

World War Memorial Stadium circa 1929

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

SKA CONSULTING ENGINEERS, INC.

TEAGUE FREYALDENHOVEN FREYALDENHOVEN ARCHITECTS & PLANNERS, LLP

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

For

The City of Greensboro
Department of Parks and Recreation
300 West Washington Street
Greensboro, NC 27401

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Seal Page for the
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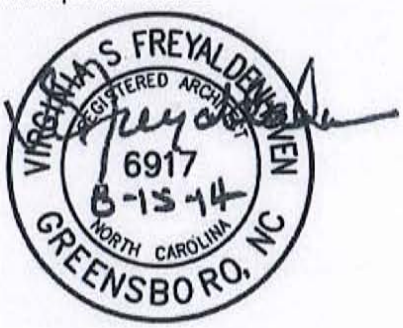


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Part 1- Executive Summary

I. Statement of Purpose



World War Memorial Stadium (WWMS), was built in 1926 as an outdoor sports venue and gifted to the City of Greensboro by the American Legion. In addition to being a stadium, WWMS serves as a memorial dedicated to the Veterans who lost their lives fighting in what is now known as World War I.

Constructed primarily of reinforced concrete in a simple neo-classical style with an inverted "J" shaped grandstand, WWMS stadium has an existing estimated capacity of 8,500 people. In its earliest years, WWMS stadium's, primary function was to serve local amateur school athletics teams in track and field, football and baseball competitions. North Carolina A&T State University's semi-professional football club first used WWMS for games as early as 1927. In 1930, WWMS was renovated with lights and a steel grandstand canopy in order to serve as the home field to Greensboro's professional minor league baseball team; a role it would continue to maintain on and off until Newbridge Bank Ballpark opened in 2004. At the time of its closing to professional baseball, WWMS was believed to be the oldest minor league ballpark still in use in the country.

Over the course of 7 decades, WWMS has undergone a series of upgrades, re-configurations and renovations. However the original fabric of the historic stadium has never been altered significantly from the 1926 design making it unique from other buildings of its type. At the time of initial development for the new Downtown Baseball Park, several interested parties felt that due to the historical and cultural significance of WWMS to the City and the Aycock Historic District, the structure would meet eligibility requirements for listing in the National Register of Historic Places. Subsequently, the property was successfully nominated and listed by the National Register of Historic Places in 2001. This listing now compels the City of Greensboro to look thoughtfully at WWMS not only as a public facility but also as a significant historic resource. The City of Greensboro has taken an active role in working with the Engineer/ Architect team as well as the North Carolina State Historic Preservation Office to review and recommend preservation treatments in order to best maintain the facility as well as its listing on the National Register of Historic Places.

WWMS is again being considered for restoration and rehabilitation to become the permanent home for baseball by North Carolina A&T State University. In order to fully accomplish this goal, a comprehensive planning document has been commissioned by the City of Greensboro with the help of funding provided by the North Carolina State Historic Preservation Office and the US National Park Service. The original goal of this study was to provide an assessment of conditions and to provide preliminary recommendations to rehabilitate WWMS into a modern facility that is also sympathetic to the

historically significant role it has played in the community for nearly 90 years. After a series of meetings and conversations, the City of Greensboro, North Carolina A&T, and the Engineer/ Architect team have determined that this report shall be completed with following primary objectives.

1. Determine the Overall physical condition of WWMS by completing a thorough assessment of all structural components, exterior walls, plumbing mechanical and electrical building systems, fire/ life safety and building code compliance. Once evaluation is complete, provide repair recommendations in accordance with proper historic preservation techniques.
2. Determine those components of the stadium that have the greatest Historical Significance and Establish a Period of Historic Interpretation/Period of Restoration for WWMS. Utilizing the established Period of Restoration, compile a preservation plan assigning all building components an appropriate preservation treatment; restoration, preservation, rehabilitation, renovation and selective removal.
3. Complete a facility needs assessment for a rehabilitation of WWMS into a 1500 seat college baseball facility for North Carolina A&T State University.
4. Complete a Preliminary Opinion of Probable costs for the conceptual scope of work listed in the objectives listed above.

Based on our historical research and study of the original facility design, we have determined that an appropriate period of historic interpretation/restoration should be the years of 1926-1929. Establishing this date allows the proper preservation of the most significant architectural elements including the original seating deck, entry portals, arches and towers to resemble the originally designed amateur sports venue. Much of the original exterior walls, arches and towers will be restored and preserved while most of the deteriorated concrete seating deck and underutilized areas under the seating will be rehabilitated. Some of the seating deck areas will be rehabilitated by converting the seating area from concrete to earth berm lawn seating. Because the existing steel canopy was installed after the period of restoration, we are proposing a full removal of this structure along with all other non-historic buildings

Physically, WWMS's structural system is in poor condition and in desperate need of repair. Significant removal, repair and/or replacement of much of the concrete components will be required to properly preserve the original appearance. In addition to deteriorated structural systems, much of the under deck plumbing mechanical and electrical systems at WWMS are out of date and not compliant with current building codes requiring removal and replacement with new code complaint systems

The facility space needs assessment completed in this study has determined that the existing structure could adequately accommodate a modern, code compliant 1500 seat baseball facility with accompanying public restrooms, concessions, and player/umpire areas adequate for use by North Carolina A&T State University. The lawn seating areas mentioned above would provide additional seating that shall be considered as a future amenity and not part of this study. A successful project will require significant reductions in seating capacity along with complete upgrades to all building components, life safety and handicapped accessible features. These efforts are necessary to facilitate acquisition by North Carolina A&T State University and the North Carolina State Construction Office.

To achieve the work outlined above we have completed a preliminary Opinion of Probable Costs and estimate the total construction cost to be in the range of **$4.7 to 5.3 million dollars**

This Engineer/ Architect consulting team led by SKA Consulting Engineers and Preservation Architects, TFF Architects & Planners, LLP understands the architectural and cultural significance of WWMS and we present this Preservation Plan and Conditions Assessment for your consideration. We feel that proper preservation planning of our historic structures results in successful community-engaged projects that look optimistically forward to the future while at the same time being respectful of the past.

Submitted August 2014

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II. Report Objectives

Since its construction in 1926, WWMS has been owned and operated by the City of Greensboro, North Carolina. The facility has always been in use by either an amateur or professional sports team and the management of the stadium has been administered through the City's Parks and Recreation Department.

North Carolina A&T State University (NC A&T) has been the primary building occupant since 2004 and it is their intention to obtain state ownership of the stadium from the City of Greensboro thus making it a part of their campus physical plant. However, prior to transferring ownership of the facility, a Phase I structural assessment and this Phase II preservation plan are being undertaken by the City of Greensboro to accomplish 4 primary objectives:

1. Determine the Overall physical condition of WWMS. This includes the structural system, Plumbing, Mechanical, and Electrical systems, Building Code Compliance for fire/life safety and Compliance with the North Carolina Accessibility Code.

2. Determine those components of the stadium that have the greatest Historical Significance and Establish a Period of Historic Interpretation/Period of Restoration for WWMS.

3. Undergo a space needs analysis and an initial code compliance review for a comprehensive rehabilitation to serve as the home baseball park for NC A&T. Provide a conceptual building design responding to the space needs assessment that includes basic preservation treatments and necessary infrastructure repairs/replacements to achieve code compliance.

4. Develop a conceptual plan to complete the required work and to establish a preliminary opinion of probable construction costs based upon the concept design and preservation plan.

A brief summary of each of these objectives is listed below and discussed in greater detail in the subsequent sections of this this document.



Griffin panel detail at World War Memorial Stadium, 2014.

Objective 1: Physical Condition

Based on our observations made over a number of site visits, the WWMS has been determined to be in Fair to Poor Condition. Decades of deferred maintenance as well as no significant upgrades to the infrastructure have resulted in a facility that is in a severely diminished state of utility. Below is a condensed list of items based on the standard conventions of condition assessment; "Good", "Fair" and "Poor". A detailed description of WWMS's physical condition is included in the Conditions Assessment portion of this document.

1. We do not believe there are any elements within WWMS that are to be considered in "Good" condition.

2. The following is a list of items that are observed to be fair condition:

a. The Ball Field playing surface and the associated fences/ walls
b. Stadium Lighting
c. Outfield Scoreboard
d. Parking and Sidewalk areas directly to the west of the main entry gate.

3. The following is a list of items that are observed to be poor condition and/or are non-compliant with current building codes at the time this report was assembled.

a. The Entire Reinforced Concrete seating platform Structure (See Phase I report)
b. The Decorative Stucco Exterior walls and memorial structure.
c. The Steel Grandstand Canopy
d. All seating in the main grandstands including safety devices such as guardrails at entries and exits
e. All Public Restrooms due to their non-compliance with current Accessibility Codes
f. All concessions areas due to their non-conformance with current health codes
g. Home and Visitor clubhouses as well as Umpire facilities
h. All Plumbing Mechanical and Electrical Systems.
j. All parking areas directly to the south of the right field foul pole and extending east towards center field.

Objective 2: Period of Historic Interpretation and Preservation Treatments



World War Memorial Stadium, circa 1929. This photo is the basis for the period of significance for restoration

Based on our research and analysis of WWMS, we believe there is a significant amount of historical fabric that should remain within the ball park and is therefore worthy of historic preservation. As a building listed on the National Register of Historic Places, recognizing these elements and undergoing the proper historic preservation measures will ensure that the facility remains listed after rehabilitations are complete.

Equally important to identifying historic fabric is determining a period of historic interpretation for the structure. A period of interpretation is a historic date or era that guides all decisions related to the proper preservation treatments to be undertaken. One may not always assume that a building or site will be preserved back to the date of original construction. Often times a buildings “history” comes at a later time based on a modification, significant event or some other milestone.

For WWMS we propose that the period of historic interpretation should be established with a date range of 1926-1929 for the following reasons:

1. We believe that the style, purity of form and simple classical architecture of the original stadium is best realized when those elements added to WWMS after 1930 are removed from the original structure. The original inverted "J" shape of the seating bowl and the presence of the monumental towers have been obscured by the canopy and press box when these later alterations were complete. Furthermore, the later additions have altered the originally intended axial symmetry that is similar to many memorial stadiums built during the same time period

2. This period of Interpretation falls within the date that NC A&T first started using WWMS for athletic facilities. This is a significant date for the University as it relates directly to the early establishment of an organized athletics program. If restored/ rehabilitated to this period significance NC A&T will be able to tell alumni and donors that this was what the stadium would have looked like when the first football game was played here in 1927

3. From 1926-1930 WWMS operated as a stadium owned by a public entity for amateur sporting events. From 1930 to 2004 the facility was primarily a professional baseball park. Since NC A&T will again be using WWMS primarily for local amateur sporting events we believe all restoration/rehabilitation should be undertaken to retain the building's original historic use.

Based on the existing physical conditions completed in the Phase I Conditions Assessment, and the proposed period of historic interpretation, we recommend the following preservation treatments for WWMS:

1. **Preservation/ Restoration:** The proper retention and careful restoration of most or all of the original components, features, materials from the period of significance in Accordance with *The Secretary of the Interior Standards for the Treatment of Historic Properties* shall be as follows:

a. **The Original 1926 monumental pylons (towers), flagpoles and entry arches that face Yanceyville Street.** *The Pylons and arches shall be restored to their historic condition. In addition we feel that the original design intent by which the pylons and flag poles should prominent and visible from both the interior and the exterior of WWMS.*

b. The Original 1926 exterior walls that form the Inverted "J" shaped on the West and North Elevations of the Structure. *The Exterior masonry concrete and stucco walls shall be restored to their original condition including the re-installation of the original cast iron windows clearly present in 1926 era photos. As restored, the exterior views of the stadium from Lindsay and Yanceyville Streets will be consistent with the exterior during the period of significance.*

c. The original ground level entrance portals and the primary arched entrance between the pylons directly out to the ball field. *Future designs and planning will be undertaken so as to preserve the original view and materials from the entry points directly onto the field as this is a very distinctive feature of WWMS.*



World War Memorial Stadium, 2014. The ground level entry portal with pylons and triumphal arches is the most distinctive architectural feature of the stadium.

d. Ball Field arrangement and Layout. *Ideally the orientation of the diamond and the outfield walls should be re-aligned to restore WWMS's playing field to the period of significance. Originally home plate and second base would have been aligned with the main Yanceyville street entrance. However, that arrangement would not be permitted under current NCAA regulations due to the short distance from home plate to the left field foul pole and home run wall. Compliance would require that a very tall wall (similar to Boston's Fenway Park) would need to be built to accommodate the required home run distance and would detract from the original form of the ball park. Therefore we feel that the current rotated configuration is the best option for WWMS.*

2. Rehabilitation: The proper selective removal and careful replacement of any historic components, features, materials and shall be compatible with those items to be preserved. All items to be rehabilitated shall be carefully designed and integrated into the structure so as to not have an adverse effect on the period of significance. Those items are as follows:

a. **All Parking areas, site entries and amenities associated with arrival to WWMS:** *Historic photography indicated that the area surrounding the site had very little improvements during the period of significance. We believe that a thorough rehabilitation of the parking lots, sidewalks and stadium entry points may be rehabilitated but done in such a way that maintains the simplicity and austerity that categorizes ball barks of this era.*

b. **All concourse circulation below the seating decks:** *A proper rehabilitation and selective preservation must be undertaken to modernize the existing concourse area to meet current ADA accessibility standards, and building code regulations. Rehabilitation to the concourse shall include changing the slope and grading and several surfaces in order to provide barrier free design not currently achieved.*

Rehabilitation shall be undertaken in such a way that the look and feel of the original walkways will be preserved in conjunction with providing amenities that are modern and up to date. All rehabilitation work in these areas will include the complete removal and replacement of new plumbing, mechanical and electrical systems that are compliant with current building codes yet compliment the historic look and feel of the historic structure.

c. **All Stadium Seating and the Concrete Seating Deck.** *Repairing and replacing the damaged/deteriorated concrete seating deck to be exactly like the original is impractical and would not conform to current structural building codes. In addition, NC A&T does not require all of the original seating area to be rehabilitated in concrete with bleachers. Therefore we propose the following treatments:*

1. *Rehabilitate the primary seating area (approximately 1500 seats) directly behind home plate and up the first base line with new concrete structure and/or structural repairs. The rehabilitated concrete deck shall match the materials and slope of the original deck exactly. Upon completion of repairs, the seating deck shall be protected with a modern concrete coating system similar to those systems used to protect parking deck surfaces in order to prevent future deterioration.*



World War Memorial Stadium, circa 2010. The existing grandstand seating is varied a collection of original benches and seats acquired from other ballparks, including most recently Fulton County Stadium(extant) in Atlanta, GA

2. *Remove all other concrete seating decks outside this 1500 seat area and replace the concrete with a filled earth berm that will match the slope of the historic concrete seating deck exactly. Doing so will preserve the original form of the seating bowl but will be doing so with a different material than the original concrete. When complete, these areas will be used as lawn seating and will be located along the Third base/ left field grandstand as well as a small portion.*

3. Replace all non-historic seating in the rehabilitated 1500 seat area with new coated aluminum seating systems that replicate historic painted wood bleachers.

4. Replace and install new railings at walkways, entrances, etc. with code compliant components that replicate historic railing systems.

3. Renovation: The proper selective removal and careful replacement of any ***non-historic or non-compliant*** *building* components, features, or materials with new in order to achieve a greater level of utility or enhanced code compliance. Renovation areas are typically support/ utility spaces and would not require a design that is compatible with the period of significance. Items that shall be considered for renovation are as follows:

a. Home and Visitor Clubhouses (Including all HVAC, plumbing and electrical systems)
b. Umpire Areas
c. Offices, Storage, Custodial and other support spaces
d. Public Restrooms
e. Concession Areas

4. Selective Removal: The proper selective removal and disposal of any non-historic components, features, or materials that detract from the structures designated period of significance. Removal items that shall be considered for this project are as follows:

a. 1930's Steel Canopy Addition*
b. All non-historic accessory buildings or other structures around the facility.
c. All press boxes built on top of the existing seating deck outside the period of significance

**The conditions assessment compiled by SKA Engineers does provide potential options for retaining and restoring the steel canopy structure however, preservation of such would exist outside the established period of Interpretation.*

Objective 3: Space needs Assessment, Code Compliance Check and Concept Design

1. Space Needs Analysis: A space needs analysis was completed for WWMS based on NC A&T's desired goal to provide the Athletic Department with a baseball venue that can host baseball games with an anticipated seating capacity of 1500 patrons. It is our opinion that once WWMS is rehabilitated, it can provide the University and the Community a baseball experience that is modern, convenient, accessible and still will retain the ambiance of the desired period of significance.

A detailed breakdown of the space needs is included in Part 3 of this report

2. Code Compliance Check: An important component to a successful rehabilitation project will be conceptual code compliance with the 2012 North Carolina Building code. Code compliance will be essential to acceptance by the North Carolina Office of State Construction (SCO). Until detailed schematic design is complete and further existing conditions surveys confirm existing conditions

As an outdoor sporting venue WWMS stadium is classified as an A-5 Assembly Occupancy. Despite its age, most of the basic components of the seating areas, walkways and exits are either code compliant or can be made code compliant with minimal alteration to the existing

structure. However, all of the support spaces, public restrooms, concourse areas are currently not code compliant and must be upgraded before SCO acceptance. Despite these non-compliant items we feel that the structure, in its present condition meet code compliance following a comprehensive rehabilitation.

A detailed Code Summary is included in Part 3 of this Report.

3. Conceptual Design and Rehabilitation Plans
Refer to Appendix A in this document for Conceptual Rehabilitation Plans.

Objective 4: Preliminary Opinion of Probable costs
Refer to Part 4 in this document for more detailed cost data.

Opinion of Probable Costs by Scope of Work*

OPTION A

Phase I – Preservation and Stabilization: $3,220,000

Phase II – Renovation and Amenities: $2,055,000

Total of Phases I and II: $5,275,000

OPTION B

Limited Phase I - Grids 5 thru 20 only – Preservation and Stabilization: (with partial removal of existing stucco on Tower and Archways)	$3,033,000
Limited Phase II – Grids 5 thru 20 only - Renovation and Amenities:	$1,650,000
Total of Limited Phases I and II:	$4,683,000

Note: The above preliminary opinions of probable cost are based on the drawings and documents provided in the Phase 1 and Phase 2 reports. All probable costs shall be assumed to use construction cost data compiled for the year 2014 .* ***This is not an estimate or a final budget* *and may not include all owner costs as all "Other Project Costs" are assumed percentages of the construction costs that are used as allowances. Note that there is no allowance for inflation, interest, or other legal fees in these preliminary projections. This is to serve only as a planning tool in order to provide an "order of magnitude of project costs."*

Part 2 - Preservation Plan

I. Introduction

Preservation planning is a process by which the general and specific needs of a cultural resource are determined, priorities are established, and strategies for implementation are identified. Its primary goal is to define a realistic course of action based on established parameters that will allow an institution to set its present and future preservation agendas. In addition, it identifies the actions an institution will take and those it probably will never take so that resources can be allocated appropriately. In the case WWMS there are 3 primary working parameters that shall serve as the basis for the development of the preservation plan

First, WWMS is listed on the National Register of Historic Places which deems it necessary to comply with the Secretary if the Interior's Standards as it relates to all technical work that may involve preservation, restoration or rehabilitation. A preservation plan for a National Register listed building or site should exist in order to build a consensus with local and state preservation agencies to ensure the listing will be maintained post-restoration and the treatments that are completed follow established preservation procedures.

Second, WWMS has been dedicated as a War Memorial in perpetuity and we are compelled to maintain this important designation now and in the future. At the stadium's dedication in 1926, Greensboro Mayor Edwin Jeffress said, "The soldier boys said they wanted no hollow granite, no useless monument to decorate our street corners, even no statuary or brass to remind us of those who have passed along after doing life's full duty. But they wanted something that would be useful; that would help develop mind and body; that would in this way be a perpetual memorial to those who have passed." Equally important is WWMS's historic role as a baseball facility. Perhaps no other American sport has more nostalgia and reverence for the past as baseball. In order to maintain these two vital links to the past we must continue to keep them in mind for future planning.

Third, WWMS as an important cultural resource and its current and future value to the community at large should always be considered. It is here therefore, one should take into consideration that the past is not always helpful to sustaining cultural resources, particularly buildings. It may be the reason a site gets listed in the National Register in the first place as well as being the basis for treatment and rehabilitation plans. Additionally our memories, respect for our ancestors, and nostalgia compel many to join the cause for historic preservation. However, a historic building's past is often irrelevant when it comes to its long term sustainability. We often need to stop trying to convince people that a building should be saved because it was important in the past and spend more time helping owners and community leaders to define new roles for their buildings now and into the future. Helping property owners and the public think about historic buildings as "legacy assets" reframes the conversation from the start. Preservationists know that historic resources have intrinsic value, but the reality is, if that the building we are trying to save doesn't have a role to play or a good job to perform in a future reuse strategy, its state of utility is likely to diminish quickly and return it to a cycle of underutilization and obsolescence.

So as we move forward in the development of a preservation plan for WWMS, our goal shall be to balance the three ideals of appropriate physical treatment, respect for the past and sustainability for the future in all aspects of the decision making process.

II. Nomenclature

Proper use of terminology as it relates to preservation is an essential component to planning activities. Incorrect or misleading use of terminology can often times communicate the wrong message to building owners, designers, preservation officers and the general public. It is therefore paramount to set forth the correct nomenclature in order to properly convey the intentions of the preservation team and the goals of the preservation plan for the historic resource.

Additionally, experience has taught us that there is often no single comprehensive word to describe a preservation treatment for a historic resource. Often times there are as many as 5 different treatments within a single property. To account for this variance we present here the following nomenclature that will serve as the basis for our plan.

Note: some definitions are excerpted from the National Park Service's website

1. Preservation is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.

2. Restoration is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.

3. Rehabilitation: is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

5. Renovation is defined as the act or process of removing and constructing spaces, features or structures within a historic property with entirely new components as if to appear completely new. Retention of some historical components may occur but complete modernization is typically the primary objective in renovation projects. When renovations border other preservation treatments, designs must clearly differentiate those items which are new from those that are historic without adverse effects to the latter.

6. Selective Removal: is defined as the act or process of carefully removing non-historic materials, finishes, assemblies or structures as an aid to preservation, restoration or rehabilitation. Unlike

demolition, selective removal minimizes the unnecessary removal and discarding of items and places a strong emphasis on retention of historic fabric. Retention may occur *in-situ* or through careful disassembly, cataloging and storage at another location so that items may be protected and re-assembled in the future.



World War Memorial Stadium, circa 1926. It is believed that this photo was taken on the dedication for the stadium. Note that there are no sidewalks or other site developments in front of the entrance.

III. Outline Building History

Detailed building history is typically not included within a preservation plan but rather provided in a comprehensive Historic Structure Report. However, we feel that it is impossible to tell the entire story a historic resource without, at the very least, a basic history of the building, its significant historic precedents, its various uses, as well as its recent past. So we have included this condensed building timeline as a reference document so that application of preservation treatments can be connected to a particular era of WWMS's overall history.

a. Time Line History

1925- Local American Legion Post decides to build a monument that should be useful to the citizens of North Carolina and Greensboro. Building was not originally intended to be a baseball park

1925- Original plan was to be a stadium to seat 25,000 and was quickly deemed too expensive and too ambitious. Original form as designed by Greensboro Architects Barton and White was to

be a "horseshoe" configuration with the primary sport to be American Football. Designs were scaled back to existing inverted "J" shape with the opportunity to expand in the future

1926- Stadium opens on Armistice Day 1926 with a finished seating capacity about 8,500

1926-1930 Early years served as a local football and track stadium. Summer amateur leagues played baseball on the field. Home plate and second base were aligned with the main entry which made for a very short left field foul line and an immense left and right field foul areas. Professional Baseball is still played at Cone Park

1927- NC A&T State University's semi-professional team uses field for Football for the first time and would continue to play football games at WWMS through 1980.



World War Memorial Stadium, circa 2008. WWMS has appeared in 2 feature length films. As seen here WWMS is being "portrayed" as a 1920's football stadium in the Movie "Leatherheads", directed by George Clooney.

1930- WWMS is retrofitted with a steel truss covered seating and lights. The monumental entry towers were in-filled with a press box and permanent dugouts were constructed into the field walls. It is believed that the field was rotated off axis at this time aligning the left field foul pole with far Northeast corner of the long grandstands. Use of Cone park ceased and the Greensboro Patriots (St. Louis Cardinals Affiliate) moved operations into the renovated stadium

1935- Greensboro Patriots leave and move to Asheville to become the "Tourists"

1941- 1942 Home to the Patriot League Greensboro Red Sox

1943-1945 No professional men's baseball played due to World War II

1946-1968 WWMS is home to various teams in the Carolina league.

1978-1984 Minor League baseball returns to WWMS. Several Upgrades to the stadium to meet more stringent minor league guidelines. Upgrades include

1. Constructed walkways at field level in front of seating deck
2. Press Box was re-built behind home plate and the area behind the original towers was converted to a "V.I.P" space
3. Updated seating, concessions and restrooms under seating deck and outside stadium

4. Moved Dugouts closer to the field
5. Improved Home and Visitor clubhouses

1987 Exterior of stadium was featured in the "Road Trip" scene in the movie *Bull Durham*

1990 Various upgrades to concessions including wood concession area in far left field.

2004- Present Exclusive home ballpark for North Carolina A&T. Several advertisements and displays have been removed from the outfield walls.

2008 Exterior of stadium was again featured in the movie *Leatherheads*. For this movie, the stadium was portrayed as a football venue.

2012- Left field concessions area is removed restoring conditions of the original seating area.

IV. Architectural Form and Design

The form of WWMS as designed and constructed originally in 1926 is best characterized as a "Parade Ground" style stadium characterized by the following architectural features:



World War Memorial Stadium, circa 2008. Despite several alterations to WWMS, the distinctive inverted "J" and entry towers are still present from the original 1926 design. The field was rotated off center early in the stadium's history in order to increase the field depth along the left field foul line.

1. **Symmetrical shape** (although never fully realized) seating bowl with proportions adequate to serve track and field sports.

2. **A clearly defined entry portal with highly stylized architectural features**. Classically designed pylons, towers or colonnades visible from both the interior and the exterior of the stadium introduce a strong architectural influence to the structure.

3. **A strong axial component to layout and configuration of the stadium elements**. Again, this was never fully realized but the intent was that the playing field and track surfaces were

to be centered upon a horseshoe stadium configuration. Teams would enter through the main portal and onto the field.

4. **The field Level is at or near the same level as the street.** This would allow for full military parades, marching bands, and teams to enter "triumphally" onto the field directly from the street through the main arches. This stadium form was also very popular for events such as automobile races, equestrian shows because cars or horse can enter directly onto the field from street level. This type stadium form differs from "bowl" shaped stadiums that are dug or carved into flat land or from hills making events such as a parade marching formation or automobile race difficult to conduct.

b. Style and Precedent

WWMS can best be characterized architecturally as a simplified classical style. The rise of neo-classicism starting at the turn of the century and continuing until the great depression is often referred to as the "gilded age" or American architecture. The era represented the rise of America's first generation of domestically trained architects and engineers. Most all architectural training in America was in the Ecole Des Beaux Arts method which educated architects in the elements of classicism. Greensboro architect Harry Barton was trained in this manner and many of his buildings around North Carolina display his knowledge of classicism.



Doughboy Memorial Stadium, Ft. Benning Georgia, 1925. A good precedent example of a small World War I memorial stadium built at the time as WWMS in Greensboro. Note the use of entry arches and towers as a defining architectural feature that can be viewed from the interior and exterior.

Classical architecture is an obvious choice for civic stadiums and war memorials as its connection to the civilizations of Rome and Greece in many ways served as the basis of American democracy. The oval or horseshoe stadium form originates in ancient Greece and Rome and their engineering serves as the basis of design in early 20th century stadium structures utilizing similar structural design elements including concrete and masonry. Likewise, the triumphal arch and pylon form are equally important to war monuments as it was these arches in ancient Rome that soldiers would pass through marking their symbolic transformation from warrior back to civilian life.

The precedent of WWMS can be theorized into to two primary cultural movements present in the mid-1920's. First is the cultural significance of Stadia and other athletic facilities as War memorials. The veterans group, American Legion, was instrumental in promoting memorials that would have a lasting use to their communities most importantly being and aid to assist in the

physical fitness and health of youth so that the future generations may be ready to step up and fight. War memorial projects that Legion posts were designed and completing during this time period were frequently published in their membership periodicals and would have certainly contained several other similar structures built before the start of planning for WWMS. Several similar venues were constructed and widely published before or at the same time WWMS was being planned.



Los Angeles Memorial Coliseum, Los Angeles, built 1923. A pre-eminent example of a mid-1920's memorial stadium. Note the similar use of simplified classical architecture. This stadium was published nationally and most likely served as a precedent for the Greensboro American Legion Post as they commenced planning for WWMS.

A few of stadia displaying the similar architectural features and forms most certainly provided precedent for WWMS

1. Los Angeles Memorial Coliseum- Completed 1923

2. Soldier Field- Chicago, IL-Completed 1924.

3. Doughboy Memorial Stadium- Ft. Benning, GA- completed 1925

4. Memorial Stadium, University of Illinois, Champaign, IL - Completed 1925

In each of these precedent facilities, the same architectural features as WWMS are expressed: **symmetry, purity of form, use of towers, triumphal arches or other classical architectural feature visible from the interior and exterior, and in many cases a ground level entry or other type of formal entry onto the stadium field reminiscent of a parade ground facility**.

The second cultural precedent is the strong paradigm of the athletic playing field to the battlefield persisted particularly in track and field and American Football. Other similar events that fall into this pattern include use of civic venues for paramilitary events such as marching bands, flag corps, scout jamborees, ROTC, etc. gained mass popularity during the 1910's through the 1920's. The 1924 Summer Olympics in Paris was widely publicized in the United States for their dominance in athletic competitions. The success of the Olympics coupled with the profound popularity of baseball and boxing saw an exponential rise in sports entertainment throughout the 1920's as America became evolved into a middle class society with more people than ever before with free time on the weekends and spare cash to spend.

c. Later Renovations

Starting in 1930 and continuing on until the 1990's several renovations and additions occurred that detract from the original 1926 architectural design and form of WWMS, and they are as follows:

1. The addition of a roof structure and infilling for the 1930's press box has almost fully obscured the architectural significance of the pylons and flag poles that were originally designed to be viewed from both the interior and the exterior. This we feel the expression of the pylon and the flag poles is the most significant architectural feature of the structure and efforts to restore this feature should be undertaken.

2. The canopy structure as well as the press box completed in the 1970's obstructs the geometrically pure form of the inverted "J" seating bowl.

3. Infilling the historic windows on the exterior stadium walls have been done in a way that detracts from the original architectural expression

4. Several Auxiliary structures, most notably, a non-historic concession area along the left field foul line detracts from the historic ball park appearance and aesthetic. This structure has recently been removed by the City of Greensboro, however there is another located along the right field foul line that should also be removed. 5. Concessions areas within the concourse areas under the grandstand seating deck behind home plate. These concessions areas are constructed with non-historic materials and aluminum doors that are not accurate to the original construction date of the stadium.

5. Multi-colored seats detract from the seating deck area that would have originally been simple wood bleachers left natural or painted a single color.

V. Period of Historic Interpretation for Preservation and Rehabilitation



World War Memorial Stadium, circa 1929. This photo was taken just prior to the renovations in 1930 that converted WWMS for use as a minor league ball park. Not the field orientation aligns with the main entry portal and what appears to be a decorative plaza in front of the arches.

Based on our study of the 1925-1926 Henry Barton Stadium design, similar precedents projects, the later renovations and the current Future by NC A&T we feel that the period of significance for WWMS should be the date of the facility's original date of construction up until those initial conversions into a professional baseball park. Therefore

we propose a period of significance of 1926-1929. As stated in the Executive summary we feel there are three primary goals that assist in establishing this date and they are as follows:

1. We believe that the style, purity of form and simple classical architecture of the original stadium is best realized when those elements added to WWMS after 1930 are removed from the original structure. The original inverted "J" shape of the seating bowl and the presence of the symmetrically placed monumental towers have been lost when these later alterations were complete.

2. This period of Interpretation falls within the date that NC A&T first started using WWMS for athletic facilities. This is a significant date for the University as it relates directly to the early establishment of an organized athletics program. If restored/ rehabilitated to this period significance NC A&T will be able to tell alumni and donors that this was what the stadium would have looked like when the first football game was played here in 1927

3. From 1926-1930 WWMS operated as a stadium owned by a public entity for amateur sporting events. From 1930 to 2004 the facility was primarily a professional baseball park. Since NC A&T will again be using WWMS primarily for local amateur sporting events we believe all restoration/rehabilitation should be undertaken to retain the building's original historic use.

VI. Preservation Treatment Plan

In order to establish a preservation treatment plan for any historic resource, we feel it is necessary to employ a 4-step methodology that aids in identification of historic significance and application of treatments to both the context and architecture of that resource. For WWMS we provide this methodology below as well as preservation treatment conceptual drawings located in Appendix A of this report.

- **Step 1: Identify the historically significant role of the Historic Resource in the Community**
  - A War Memorial
  - A significant piece of Civic Architecture
  - A public facility for the Betterment of the community
  - Role in the History of Professional Baseball
  - Role in the development of Collegiate Athletics at NC A&T

- **Step 2: Identify those Architectural Features that best exemplify its role as a historical resource and Preserve/ Restore those Features to the greatest extent possible**
  - Triumphal Arches/ Front Entry with direct site lines to the playing field from Yanceyville street
  - The original concrete, masonry and stucco finishes that comprise the structure, the exterior walls, the seating deck and the vomitories and concourses
  - The central pylons and flagpoles that are intended to be viewed from the interior and exterior
  - Exterior Curved wall that forms the street view of the entire stadium
  - The form of the seating bowl from the interior.
  - The Baseball field, diamond, dugouts, etc.. Maintain facility as a baseball park or other athletics facility intended for amateur sports.

- **Step 3: Identify those Architectural Features that are of secondary importance and Rehabilitate those features with respect to the original architecture/form**
    - Seating Deck surfaces and substructure
    - Spaces under the seating deck including the concourse circulation areas
    - Parking Areas

- **Step 4: Identify those Architectural Features that are non-historic, are outside the period of significance or detract from the original architecture and remove those elements and restore those features effected by their removal. Areas that are non-historic shall also be considered for renovation if they do not detract from the historic areas once renovations are complete.**
    - Steel covered canopy over seating
    - Existing auxiliary structures/ sheds/ clubhouse, etc.
    - Press Box Structures located on seating deck and between the pylons.
    - Locker Rooms, public restrooms offices, concessions, storage areas,

Part 3- Space Needs Analysis and Building Code Compliance

The completion of a space needs analysis for an existing historic resource goes beyond what would be prepared if considering a program for a new building. Not only do the needs of the users need to be considered, the needs of the historic resource should always be taken into account in order to ensure that proper historic preservation procedures are maintained. In addition, if items of historical significance are to remain, we must ensure that these items are first, able to be adapted to meet the space needs and second, can be adapted to comply with current building codes.

For WWMS we have divided the facility into 4 major components for purposes of facility needs planning:

1. Site and entry points into WWMS
2. The seating deck area including all field level walkways
3. Public concourse areas including: Restrooms, concessions areas, and circulation areas under the seating deck.
4. Team/ Umpire areas including: Home and Visitor Clubhouses, umpire areas, offices, ticket areas.

Within each of these components we have:

1. Studied those existing features and components that will require work
2. Developed, as required, space needs, occupancy counts, and conceptual materials designations
3. Determined the preservation treatment for each components that is most appropriate based on our preservation plan
4. Verified conceptual recommendations to achieve building code compliance

For purposes of this report, at the Conceptual/ Planning Phase, we have had to make several assumptions that are subject to change as further study will be required to complete a full design and construction project.

1. This study assumes that this facility will be used primarily by North Carolina A&T State University for a 1500 seat baseball stadium. Existing seating areas not part of the 1500 seating arrangement are not being considered at his time.

2. All code compliance is being reviewed under the *2012 North Carolina Commercial Building Code*. Code compliance is theoretical and conceptual and will require significant study during subsequent phases of a design and construction project. It is anticipated that there will be a 2015 revision to the NC Commercial Building Code. If design does not commence before adoption of the new codes this time additional study will be required. In addition to compliance with current building codes, all future work may be afforded certain latitude and interpretation due to its historic designation.

3. The North Carolina Office of State Construction (SCO) was not contacted as part of this study. Once the study is complete, we recommend that the final document be reviewed with SCO to confirm if any other additional compliance measure will be required.

Based on the Facility Needs Assessment that follows and the assumptions provided above, we have also completed conceptual rehabilitation drawings located in Appendix B of this report. Exterior cladding, materials and structure preservation recommendations is included in the Conditions Assessment.

Area 1- Site and Entry/Exit Points

Conceptual Stadium Occupancy:

Patrons	1500 persons
Baseball Teams:	75 Persons
Workers, Support, Etc	25 Persons
Total	**1600 persons**

Exit/ Entry Points Building Code Requirements:

1. Per Table 1021.1, 4 Exits are required based on the Conceptual Stadium Occupancy.

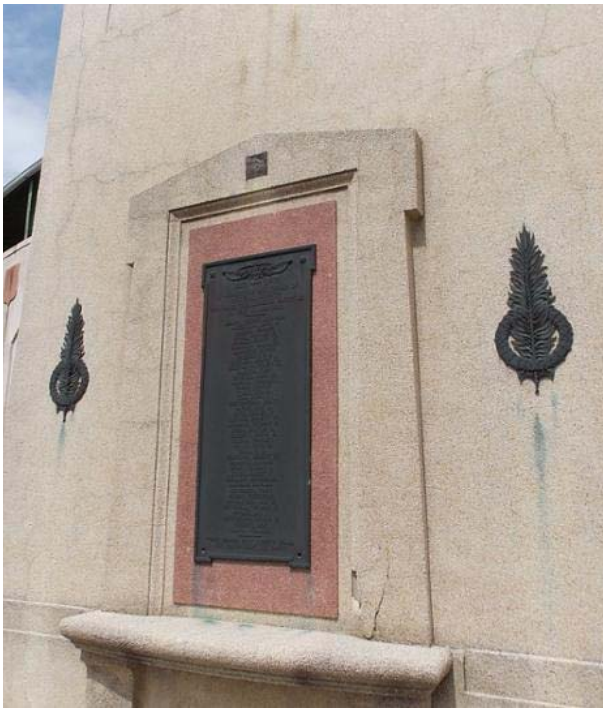
   Comments: 4 exits may be achieved based on current stadium layout. This includes 3 portal entry points in addition to a ground level entry/ exit at the southwest right field foul pole

2. Required Total Exit Egress Width: Per 1005.1 1600 Occupants x .3 inches per occupant = 480 Inches or 40 Feet

   Comments: Based on current Designs there appears to be 55 to 60 feet of egress width.

3. Per 1105.1 60% of all entries must be accessible.

   Comments: Based on current Designs all entry and exit points can achieve accessibility



World War Memorial Stadium, 2014. Bronze Plaques flank the entry arches and list all of the local soldiers who died in World War I.

4. Per Table 1106.1 Required Handicapped parking spaces required: 26 Spaces

   Comments: There is enough existing parking area to properly accommodate this amount of handicapped parking spaces

5. The accessible routes from handicapped parking to Entry/ Arrival Points shall be accessible by compliant surfaces with slope no greater than 1 unit for every 20 units or with complaint ramps with slope no greater than 1 unit for every 12 units

   Comments: Additional ramp and slope studies will need to be completed by a civil engineer to confirm that all entry and exit points meet accessibility standards.

6. Entry/ Exit Gates: 1008.2.1 Stadiums. Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be
located less than 50 feet.

Comments: Panic hardware on all entry/exit gates are recommended if gates will not be supervised at all times during games.

Site- Exit/ Entry Points Other Requirements and Recommendations

1. Each Entry and Exit point at WWMS should be restored and/or rehabilitated to their original 1926 condition. The existing gates at the main entry should be removed and replaced with new gates compliant with the current building codes. All gates should be designed to have a historic appearance compatible with the building exterior. As stated above, we recommend that gates should be equipped with panic devices.

2. Each entry point should be clearly indicated with proper signage and safety/emergency lighting in order to endure safe ingress and egress. We recommend that signage and lighting be designed to have a historic appearance.



World War Memorial Stadium, 2014. Creating an enhanced entry and exit sequence along the right field line (shown here) at WWMS will provide a better connection to the North Carolina A&T Campus and future development along the Lindsay Street corridor

3. A rehabilitated primary entry site area should be designed to provide an enhanced stadium entry experience. There are 26 required parking spaces that should be incorporated into this design along with the possibility of constructing an entry plaza. Connectivity to the other 3 entry/exit gates should be completed with new or improved sidewalks.

4. Rehabilitate all existing parking areas with new surfacing and striping as required in order to achieve the required accessible parking spaces. Parking areas should designed

to enhance the streetscape along Lindsay and Yanceyville Streets, improve storm water management issues and provide opportunities for enhanced utilization such as farmer's markets, football tailgating and other university public events.

5. Construct new ticket booth structures as required at site entry/exit points of similar architecture as shown in historic photographs.

6. Remove the existing concrete auxiliary structure at the right field foul pole. Consider future improvements at right field foul pole entrance including additional amenities areas. This entry exit point should be considered as part of the comprehensive campus planning efforts along the Lindsay Street Corridor.

7. Provide a designated player entrance with a team bus loading and unloading area. Bus parking may be achieved at a different location on the site.

8. All landscaping work between the parking areas and the stadium exterior walls should be minimal in order to maintain the period of significance. Minimal landscaping should be used to screen mechanical equipment and as a means to improve the streetscape at Yanceyville Street entrances.

Area 2- Seating Deck and Field Level Walkways

Proposed Seating Deck Occupancy:

Patrons	1500 persons
Workers, Support, Etc	10 Persons
Total	**1510 persons**

Seating Deck Occupancy type: *A-5- Assembly uses intended for participation in or viewing outdoor activities*

Seating Deck and Field Level Walkway Building Code Requirements:

1. Per Table1108.2.2.1 Handicapped Viewing areas are required in stadiums. For a stadium capacity of 1500 patrons WWMS is required to have: 6+(1500/150) = 16 spaces

Comments: Handicapped viewing areas must be placed along an accessible route.

2. Each handicapped seating area shall have a clear area of 30" x 48" and per 1108.2.3 be equipped with at least one companion seat for each space provided.

Comments: Handicapped viewing areas should accommodate 16-30" x 48" spaces plus 8 additional 30" x 48" spaces for companions. Companion seating can be accommodated with either a bench or folding chairs.



World War Memorial Stadium, circa 2002. The left field seating deck in use for a Greensboro Bats game. As configured here, WWMS could seat up to 7,500 people. However, the poor condition of the deck coupled with little need for this much seating for college baseball is motivating the planning for a reduction to a 1500 seat stadium

3. Per 1108.2.2.4 At least one wheel-chair space shall be provided in team or player seating areas serving areas of sport activity.

Comments: An accessible route and seating space shall be provided to each baseball dugout.

4. 1108.2.6 Lawn seating. Lawn seating areas and exterior overflow seating areas, where fixed seats are not provided, shall connect to an accessible route

Comments: If lawn seating is incorporated into the design, then the route leading to those areas shall be accessible. This will require additional clarification from SCO.

5. 1004.7 Fixed seating. For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. The occupant load for areas in which
fixed seating is not installed, such as waiting spaces and wheel- chair spaces, shall be determined in accordance with Section 1004.1.1 and added to the number of fixed seats. For areas having fixed seating without dividing arms, the occupant load shall not be less than the number of seats based on one person for each 18 inches of seating length.

Comments: Based on this ratio of seat width, WWMS will need to have 2,250 linear feet of bench style seating to accommodate 1500 patrons. The proposed seating deck area to be preserved is approximately 3,750 linear feet with an approximate capacity of 2,500 patrons. It is unlikely that SCO will allow a posted occupancy count, therefore seating reductions will need to be made. We suggest the following reductions to achieve 2,250 linear feet of seating:

1. Eliminate the top 4 rows of seating. This will reduce the seating length by about 840 linear feet. If the top 4 rows are eliminated, the seating deck can remain however a railing will most likely need to be installed to prevent this area from being an occupied assembly space.

2. Widen Aisles approximately 2 feet. This will reduce the seating length by about 160 linear feet. Since the seating deck is shallow enough to not require intermediate steps between the rows, this change is a simple way to reduce seating capacity and increase circulation throughout the stadium.

3. Eliminate the bottom 3 rows of seating to accommodate the required wheel chair seating and companion seating. This will reduce the seating length by about 500 linear feet. Placing the accessible seating in this area is the best solution for both capacity reduction and meeting accessibility requirements.

*****NOTE** The computations provided in this study are preliminary and should be studied in detail as part of a design and construction project.***

6. 1028.7 Travel distance- open-air seating exception 2: The travel distance from each seat
to the building exterior shall not exceed 400 feet. The travel distance shall not be limited in facilities of Type I or II construction.

Comments: All Seating areas at WWMS have a travel distance less than 400 feet.

7. 1028.8 Common path of egress travel. The common path of egress travel shall not exceed 30 feet (9144 mm) from any seat to a point where an occupant has a choice of two paths of egress travel to two exits

Comments: All Seating rows at WWMS have an aisle at both ends and at no location is the length of a row between aisles more than 60 linear feet.

8. 1028.13 Handrails. Aisle stairs shall be provided with handrails located either at the side or within the aisle width

Comments: Since there will be significant revisions/ reductions to the seating deck area to achieve a capacity of 1500 patrons, code compliant aisle railings not currently in place will need to be installed. Below are the additional railing requirements:

1. Where there is seating on both sides of the aisle, the handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other

2. Where handrails are provided in the middle of aisle stairs, there shall be an additional intermediate handrail located approximately 12 inches below the main handrail

9. 1028.14.2 Sightline-constrained guard heights. Unless subject to the requirements of Section 1028.14.3, a fascia or railing system in accordance with the guard requirements of Section 1013 and having a minimum height of 26 inches shall be provided where the floor or footboard elevation is more than 30 inches above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating.

Comments: The locations where this occurs are minimal and are mostly contained to the seating areas directly adjacent to the vomitory portals. The side and top walls of the vomitory are not tall enough to comply with the current standards listed above. To correct this, a common retrofit should be done involving the installation of a supplemental railing on top of the existing concrete wall

Seating Deck and Field Level Walkways- Other Requirements and Recommendations

1. All existing seating on the seating deck should be removed and discarded. Proper repairs and replacement of the seating deck shall be made based on the conditions assessment by SKA Consulting engineers. Once complete a top protective coating should be installed to preserve the existing and new structure.

2. New Aluminum bleacher system shall be installed on the repaired concrete seating deck. The new bleacher system should have powder coated aluminum bleachers to replicate the look of the historic painted wood bleachers. Each bleacher will have aluminum seating backs for increased comfort.

3. All site walls and vomitory walls should be cleaned, repaired/ replaced and re-coated with a protective coating similar to the seating deck. The paints and coating should be pigmented to closely match the original concrete color of WWMS

4. All new railings and guards installed at WWMS should be carefully designed to have a historic appearance. There are several companies who specialize in the manufacture of railing systems that are appropriate to the period of significance.

5. The field level walkway at WWMS should be rehabilitated as required to accommodate the new accessible seating areas. In addition, it is recommended that wider areas of this walkway be considered for in-park concessions, press seating and public address announcement. Further study of these individual needs will be required as part of a design and construction project.



Lawn Seating has again become a popular choice for ball parks of all sizes. Note that the slope of the lawn area is the same as the concrete seating deck. This is a simple way to make the stadium larger without the expense of a concrete structure.

6. As stated earlier, we recommend the removal of the 1930 steel canopy and both press boxes in order to restore the appearance of WWMS back to the period of 1926-1929. Once complete this will improve site lines and make the pylons and flag poles a very prominent component of the stadium. We recommend that after removal of the press boxes the area between the pylons be considered for a special area of interest to be determined.

7. As stated in the occupancy requirements, the seating area/ grandstand along the left field line all the way to the foul pole is not required for the facility needs of NC A&T. We recommend that this seating area with the exception of the portals and the walls be removed and the area contained within this zone be in filled with natural earth berms that replicate the slope and form of the original seating deck. Initially, this area will be closed to the public. However, in the future the earth berms may become a lawn seating area. Lawn seating areas are very popular in smaller ball parks because they allow for more seating options and accommodate families. It should be noted here that when the lawn seating becomes available, increased stadium capacity, additional patron amenities (restrooms), ingress and egress and accessibility will all need to be conserved for the lawn seating area. As currently proposed, the existing facilities will not accommodate the lawn seating.



Signage appropriate to the period of significance should be incorporated into rehabilitation designs for WWMS. In this example, the sign uses traditional fonts and colors along with a historic graphic frame and is applied directly to the building wall without back lighting or electronics.

8 . The seating deck area and walkways should be upfit with a new way finding signage, aisle/row designations, exit signs and perhaps other graphics enhancements. Because WWMS is a historic property we feel that the graphics should be minimal and any signage that is installed should be appropriate to the 1926-1929 period of significance. Introduction of bright colors, LED displays, large graphic banners or other "modern" treatments applied directly to the historic concrete seating structure should be avoided. Installation of flag poles on the historic exterior wall signifying Southern Conference baseball teams and/or flags signifying NC A&T baseball championships would teams would be an example of a proper rehabilitation method that is appropriate to the period of significance.

Product advertisements, if any, should be limited to the outfield "home run" walls as this would be the historically accurate location for such graphics

Area 3- Public Concourses

Proposed Use:

The public concourse areas are defined as those areas for patron use located below the rehabilitated 1500 seat seating deck. The items to be included within this Area include:

1. Public Restrooms and Family Restrooms to accommodate 1500 patrons
2. Circulation/ Egress Corridors
3. Primary Arched Entry Portal
4. Concessions



World War Memorial stadium, south concourse, 2014. Various renovations and upgrades to infrastructure have created concourses that are dark, non-compliant and aesthetically undesirable. We propose removing the interior non-historic walls and concessions doors (seen here) in order to open the space up as it would have been in 1926.

Public Concourse Building Code Requirements:

1. Occupancy Type: Accessory/ Circulation to accommodate the A-5 Occupancy at seating deck. We anticipate that based on construction type and all occupied areas under the seating deck portion of the stadium will require an approved automatic sprinkler system.

2. Plumbing Fixture Calculations- 2012 North Carolina Plumbing Code Table 403.1

Requirements for Female Patrons, A-5

Minimum Water Closets: 1 per 75 for first 1500: 751/75 = 11 Water Closets/ Urinals

Minimum Lavatories: 1 per 250: 751/250 = 4 Lavatories

Requirements for Female Patrons, A-5

Minimum Water Closets: 1 per 40 for first 1520: 751/40 = 19 Water Closets/ Urinals

Minimum Lavatories: 1 per 200: 751/200 = 4 Lavatories

Required Drinking Fountains: 2 “hi-lo ADA accessible fixture”

Comments: IBC Minimum requirements for plumbing fixtures in arenas and stadiums do not always accurately accommodate the specific event as well as accurate gender

proportions at the event. For WWMS which will be used primarily as a baseball facility, we propose the following increased plumbing fixtures based on the sport (baseball) and the gender distribution (predominantly male)

Men
Toilets: 1 toilet for every 2 urinals = 5 Toilets
Urinals: 1 Urinal for every 90 people = 9 Urinals
Lavatories: 1 Lavatory for every 125 People = 6 lavatories

Women
Toilets: 1 Toilet for every 40 people = 19 Toilets
Lavatories: ***1 Lavatory for every 125 People = 6 lavatories***

3. Family Toilets: 1109.2.1 Family or assisted-use toilet and bathing rooms. In assembly and mercantile occupancies, an accessible family or assisted-use toilet room shall be provided where an aggregate of six or more male and female water closets is required. Family restrooms shall have one water closet and one lavatory.

Comments: Aggregate fixture counts for WWMS far exceed 6 so a family restroom is required.

4. Concourse Circulation Requirements:

a. 1003.2 Ceiling height. The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm).

Comments: At many locations in the concourse there are concrete structural members that go below 7'-6". These will be considered protruding objects. At many locations there are also conduits and wiring that extend below the 7'-6" height requirement. To achieve compliance these will need to be relocated.

b. 1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 provided a minimum headroom of 80 inches
shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50 percent of the ceiling area of a means of egress shall be reduced in height by protruding objects.

c. A barrier in a means of egress shall be provided where the vertical clearance is less than 80 inches high. The leading edge of such a barrier shall be located 27 inches maximum above the floor.

Comments: At any location where the structure goes below 6'-8", a barrier will need to be constructed to a point where 6'-8" tall will be achieved

D. Accessible means of egress. Per Section 1007, a means of egress and all points connecting to the means of egress shall be accessible.

Public Concourse Building Program Requirements:

1. Men's Restroom to Serve 751 male patrons

a. Proposed Area: 375 Square Feet

b. Fixtures: 3 Toilets, 1 ADA Toilet, 1 Ambulatory Toilet, 9 Urinals, 6 Lavatories

c. Preservation Treatment: Renovation. Note: wall shared between restrooms and concourse shall be a wall built to replicate the historic concourses.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU or brick masonry painted or with glazed finish
2. Ceilings- Moisture Resistant Gypsum board and paint
3. Floors- New polished concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Urinals- Wall Hung low volume or flushless style
3. Lavatories- Wall Hung

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split Heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls.
3. Trash Cans

2. Women's Restroom to Serve 751 female patrons

a. Proposed Area: 740 Square Feet

b. Fixtures: 16 Toilets, 2 ADA Toilets , 2 Ambulatory Toilets, 6 Lavatories

c. Preservation Treatment: Renovation. Note: wall shared between restrooms and concourse shall be a wall built to replicate the historic concourses.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU or brick masonry painted or with glazed finish
2. Ceilings- Moisture Resistant Gypsum board and paint
3. Floors- New polished concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Lavatories- Wall Hung

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split Heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. Trash Cans

3. Family Restroom

a. Proposed Area: 65 Square Feet

b. Fixtures: 1 ADA Toilet, 1 Lavatory

c. Preservation Treatment: Renovation.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU or brick masonry painted or with glazed finish
2. Ceilings- Moisture Resistant Gypsum board and paint
3. Floors- New polished concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Lavatories- Wall Hung
3. Baby Changing Station

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. Provide a seat or bench for baby nursing or other family related needs
4. Trash Can

4. Custodial Closet

a. Proposed Area: 50 Square Feet

b. Fixtures: Janitorial Sink

c. Preservation Treatment: Renovation. Note: wall shared between restrooms and concourse shall be a wall built to replicate the historic concourses.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all drains within custodial closets due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU or brick masonry painted or with glazed finish
2. Ceilings- Moisture Resistant Gypsum board and paint
3. Floors- New polished concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Accessories- Stainless Steel

j. Fixtures

1. Janitorial Sink- Floor Mounted terrazzo or concrete

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. Provide electrical connections for floor cleaning machine
4. Provide shelving for custodial supplies

4. Memorial Entrance

a. Area 1550 Square Feet

b. Fixtures: 2 ADA Accessible Drinking Fountains

c. Preservation Treatment: Preservation/ Restoration

d. Energy Requirements: N/A. This area shall be considered an outdoor space

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code.

f. Mechanical Requirements: N/A

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- Brick masonry painted and exposed concrete
2. Ceilings- Exposed Structure. Wiring piping and conduits shall be visibly minimized
3. Floors- New brushed concrete. If existing floors remain, they shall be painted with a coating resembling the original concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Gates: Iron gates painted.

j. Fixtures

1. Drinking Fountains- extra heavy duty commercial grade fixtures.
2. Lighting: Fixtures in this area should be historic style fixtures that would be compatible with the period of significance. Conduits to lighting would be exposed.

k. Furnishings/ Equipment

1. Provide painted metal railings at low head height locations
2. Provide 2 benches
3. Provide Electrical rough-ins for future historical displays
4. Provide Information Display boards
5. Trash Cans and Recycling Bins
6. Game Score Card and Pencil Holder
7. Way finding Signage
8. Security/ Information stand
9. Speaker Connections to Public Address system

5. Concourses

a. Area 190 Square Feet

b. Fixtures: Hand Wash Sink

c. Preservation Treatment: Rehabilitation

d. Energy Requirements: N/A. This area shall be considered an outdoor space

e. Plumbing Requirements: N/A

f. Mechanical Requirements: N/A

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- Brick masonry painted and exposed concrete
2. Ceilings- Exposed Structure. Wiring piping and conduits shall be visibly minimized
3. Floors- New brushed concrete. If existing floors remain, they shall be painted with a coating resembling the original concrete
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Gates: Iron gates painted.

j. Fixtures

1. Fixtures in this area should be historic style fixtures that would be compatible with the period of significance. Conduits to lighting would be exposed.

k. Furnishings/ Equipment

1. Provide painted metal railings at low head height locations
2. Provide Information Display boards for home and visiting teams
3. Trash Cans and Recycling Bins
4. Way finding Signage
5. Speaker Connections to Public Address system

6. Concessions Room

a. Area 190 Square Feet

b. Fixtures: Hand Wash Sink

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all drains within this area due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- Brick masonry painted and exposed concrete

2. Ceilings- Food service approved coated ceiling tiles
3. Floors- Quarry tile
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Gates:
6. Counters- Stainless Steel

j. Fixtures

1. Fixtures in this area should be the type that will comply with current health codes

k. Furnishings/ Equipment

1. All food service equipment shall be planned for specific needs of users. It is anticipated that food to be sold will be mainly pre-packaged and minimally stored and prepared on site.

7. Concessions Kiosk/ Vending Areas

a. Concessions Kiosk Areas will be provided in various outdoor areas of WWMS. These locations will be a place where a temporary or semi-permanent point of sale will be located. Kiosks may be located in the concourse areas or on the field level walkways in the seating area and could provide any of the following items:



Portable food service Kiosks like one's seen here have become a popular alternative to portal style concessions area. Portable Kiosks would work well at WWMS, allowing the point of sale to be located at various locations depending on the size and type of event.

1. Merchandise (hats t-shirts, etc.)
2. Vending/ Drink Machines
3. Pre-Packaged Food or Food that requires minimal preparation (ice cream/ popcorn)
4. Fundraising sales
5. Publicity/ Promotions/ Public information tables.

b. Area: 60-100 Square Feet

c. Quantity: 10 dispersed throughout the stadium

d. Fixtures: Hand Wash Sink

e. Energy Requirements: N/A

f. Plumbing Requirements: N/A

g. Mechanical Requirements: N/A

h. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

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j. Finishes/design: Individual Kiosk designs may vary but all should comply with health department regulations for applicable food safety requirements and ADA requirements for accessibility.

h. Fixtures: At each concourse location provide ceiling mounted lighting

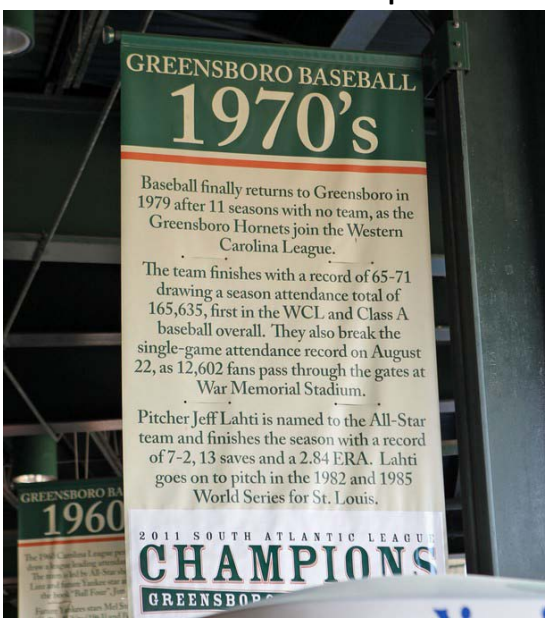
k. Furnishings/ Equipment

1. Provide painted metal railings at low head height locations to define kiosk area

2. Provide Trash Cans and Recycling Bins adjacent to kiosks

3. Provide electrical connections for specific equipment. Provide properly sized electrical wiring and circuitry to accommodate for several different types of equipment.

Concourses and Public Areas- Other Requirements and Recommendations



Banner signage, as seen in New Bridge Bank Ballpark, is simple and incorporates a historical component into the concourse. Similar treatments should be considered at WWMS.

1 . The concourse and historic entry area should be upfit with a new way finding signage. Because WWMS is a historic property we feel that the graphics should be minimal and any signage that is installed should be appropriately designed to the 1926-1929 period of significance. Introduction of bright colors, LED displays, large graphic banners or other "modern" treatments applied directly to the historic walls should be avoided.

2. Because the structure in the concourse area is very low in many areas, a method for creating the proper safety barriers will be essential. Simple painted pipe railings or some other decorative metal barrier compliant with current regulation will be most appropriate.

3. We believe the concourses and entry areas will be much more spacious and open feeling if all of the non-historic concessions walls and gates are removed and opened back up again as they would have been originally. In each of the structural bays could be a small vending/kiosk area, have trash cans and benches or have some other amenity installed for the benefit of the patrons.

4. The new restrooms and clubhouses areas adjacent to the concourses and entries should be designed and constructed to allow all PME systems to be run above the roof/ceiling and not in the concourse itself. The concourse and memorial entrance should have very minimal amounts of exposed conduit as this detracts from the space and is not compatible with the period of significance.
5. The concourse floor level will need to be renovated and changed to meet accessibility requirements. Simply raising of lowering the floor in the concourse or adjacent spaces may be appropriate. However additional study of structure heights, footing depths and headroom issues need to be confirmed in greater detail.
6. Planning for a historical display at the memorial entry should be considered for future work. Many people who visit a historic venue such as this are interested in its history and this would be the perfect location.
7. All work done to the seating deck should be completed in a way that best preserves the underside of the deck as well; particularly in the concourse and memorial entry areas.
8. All restrooms and related facilities for patrons that are to be renovated will be done so in a way that makes them efficient, economical, and easy maintain. All finishes and furnishings and equipment shall be “modern” or “contemporary” to typical commercial interiors.
9. Concessions and Vending requirements will need much more study to determine if the programmed space is adequate as shown. The inclusion of the lawn seating in the future may require additional restrooms, concessions and other patron amenities not included in this report.

Area 4- Team and Umpire Areas



WWMS- NC A&T batting practice circa 2012. Team and umpire amenities are important it is the players, coaches and umpires who use WWMS more than anyone else.

1. Home Clubhouse

a. Proposed Area: 1000 Square Feet including
   1. Locker room for 30 players: 400SF
   2. Showers and Toilets: 250 SF
   3. Training/ Taping area: 200 SF
   4. Managers/ Coaches office: 150 SF

b. Fixtures: 3 Standard Showers, 1 ADA Shower, 1 ADA Toilet, 2 urinals, 2 lavatories

c. Preservation Treatment: Renovation.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting

h. Finishes
   1. Walls- CMU or brick masonry painted or with glazed finish
   2. Ceilings- Moisture Resistant Gypsum board and paint
   3. Floors- New polished concrete, tile, polypropylene fiber carpet tiles
   4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
   5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
   6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Lavatories- Wall Hung
3. Showers: Tile Floors
4. Hand wash sink in training room

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split Heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. Wood Lockers. Note: Existing lockers may be re-used
4. Training Table and Shelves for supplies
5. Equipment storage shelving (Office).
6. Internet/ Voice/ Data Connections and WiFi router
7. Seats or benches in front of every locker
8. Drink Vending Machine/Refrigerator and/or water cooler
9. Ice Machine
10 Ceiling/ Wall mounted Television (connection)
11. Table and Chairs for 8 (coaches office).
12. Soap and Shampoo dispensers in showers
13. Hand/ Hair Dryers

2. Visitors' Clubhouse

a. Proposed Area: 725 Square Feet including

1. Locker room for 28 players: 375 SF
2. Showers and Toilets: 225 SF
3. Training/ Taping area: 125 SF

b. Fixtures: 3 Standard Showers, 1 ADA Shower, 1 ADA Toilet, 2 urinals, 2 lavatories

c. Preservation Treatment: Renovation.

Note: wall shared between restrooms and concourse shall be a wall built to replicate the historic concourses.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU painted or with glazed finish, Tile in Showers
2. Ceilings- Moisture Resistant Gypsum board and paint

3. Floors- New polished concrete, tile, polypropylene fiber carpet tiles
4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Lavatories- Wall Hung
3. Showers: Tile Floors
4. Hand wash sink in training room

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split Heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. Wood Lockers
4. Training Table
5. Internet/ Voice/ Data Connections and WiFi router
7. Seats or benches in front of every locker
8. Drink Vending Machine/Refrigerator and/or water cooler.
9. Soap and Shampoo dispensers in showers
10. Hand/ Hair Dryers

3. Umpires' Area

a. Proposed Area: 250 Square Feet including

1. Locker room/Lounge for 4 Umpires: 130 SF
2. Showers and Toilets: 120 SF

b. Fixtures: 1 ADA Shower, 1 ADA Toilet, 1 lavatory

c. Preservation Treatment: Renovation.

d. Energy Requirements: Perimeter Walls and Ceilings shall be insulated per the 2012 NC Energy Code. These will be considered interior spaces

e. Plumbing Requirements: All new plumbing fixtures to comply with the NC Plumbing code. Note: We recommend manual trap primers in all area drains within restrooms due to limited use in the off season

f. Mechanical Requirements: All new Mechanical HVAC and exhaust fans designed in accordance with the 2012 NC Mechanical code.

g. Electrical Requirements: All new electrical systems and lighting in accordance with the 2012 NC Electrical Code.

h. Finishes

1. Walls- CMU or brick masonry painted or with glazed finish, Tile in Showers
2. Ceilings- Vinyl Coated Acoustic Ceiling Tile
3. Floors- New polished concrete, tile, polypropylene fiber carpet tiles

4. Doors- Extra Heavy Duty Insulated Hollow Metal- Painted
5. Toilet Partitions- Phenolic resin, plastic, solid surface or stone.
6. Accessories- Stainless Steel

j. Fixtures

1. Toilets- Wall Hung Flash Valve commercial toilets
2. Lavatories- Wall Hung
3. Showers: Tile Floors
4. Hand wash sink in training room

k. Furnishings/ Equipment

1. Mechanical System- Independent Mini-split Heating and cooling unit.
2. Exhaust- ducted mechanical exhaust. Note- Exhaust ducts shall not extend through exterior walls
3. 4 Wood Lockers
4. Table and 4 chairs
5. Internet/ Voice/ Data Connections and WiFi router
8. Mini Refrigerator and/or water cooler.
9. Soap and Shampoo dispensers in showers
10. Hand/ Hair Dryers

Part 4- Structural Conditions Assessment and Evaluation

I. Introduction and Background Information

The War Memorial Stadium located in Greensboro, North Carolina was reportedly constructed in 1926. The structural framing system for the elevated seating sections are constructed with cast-in-place, reinforced concrete raker beams and stepped, reinforced concrete seating treads and risers. The concrete raker beams that support the stepped concrete seating treads and risers are supported on cast-in-place, reinforced concrete columns. The type of foundation system supporting the columns was not determined. The vomitory walls and guardrail walls are constructed with cast-in-place, reinforced concrete. There are sections of on grade, cast-in-place concrete seating treads and risers located adjacent to the bottom row of elevated concrete seating treads and risers.

The exterior façade and towers adjacent to each side of the façade at the main front entrance are constructed with cast-in-place, reinforced concrete walls, columns, beams and slabs. There is a direct applied portland cement stucco veneer on the exterior surfaces of the cast-in-place concrete at the front and side of this façade.

The exterior façade adjacent to each side of the façade at the main entrance and towers is comprised of cast-in-place, reinforced concrete columns, spandrel beams, upset guardrail walls and on grade foundation walls. There are masonry infill walls constructed between the sides of the concrete columns, bottom of the spandrel beams, and top of the grade wall. There is a bonded, direct applied stucco veneer on the exterior surfaces of the masonry infill walls. There is a coating system applied on the exterior surfaces of the structural concrete members and stucco veneer on the exterior façade adjacent to each side of the façade at the main entrance.

According to historical photographs provided, the roof canopy structure constructed over a partial area of the elevated seating area back of the main entrance façade was not part of the original construction in 1926. The roof canopy structure was reportedly constructed around 1931. The structural system for the roof canopy is comprised of a timber roof deck supported on structural steel purlins. The structural steel purlins are supported by structural steel trusses, beams and columns. The steel base plates on the structural steel columns that support the roof canopy structure bear directly on top of the concrete seating treads and raker beams and columns directly below. These base plates are anchored to the top of the concrete slabs and structural beams with anchor bolts. The anchor bolts extend through the treads of the seating slabs and are connected to the sides of the columns that support the concrete raker beams.

In 2003, SKA was authorized by the City of Greensboro (COG) to perform a visual condition assessment and evaluation of selected components of the existing structure. In June 2003, SKA submitted a report to the COG on the results of the visual condition assessment and evaluation of selected components of this War Memorial Stadium. The primary objectives of this visual condition assessment and evaluation were:

1. Identify potential areas of structural deficiencies, safety issues and concerns and submit our opinions on address their effects on the effective service life and use of this structure.

2. Develop an outline of a general scope of work for a comprehensive condition assessment and evaluation of any potential issues and concerns identified in the visual condition assessment and evaluation that warrant further study.

3. Submit an engineering opinion on the overall condition, safety issues and estimated useful service life of this facility.

In 2008, SKA was authorized by the COG to perform a more comprehensive condition assessment and evaluation of selected components and areas of this existing stadium. A report on the results of this more comprehensive condition assessment and evaluation of selected components of the existing War Memorial Stadium was submitted in June of 2008. This report included the results of:

1. A comprehensive visual condition assessment and evaluation of selected components and sections of the existing structural concrete members with estimates and opinions of the magnitude and extent of distress and deterioration identified.

2. Compressive strength tests on core samples extracted from the existing structural concrete members at representative areas.

3. Microscopic examination and analysis of core samples of concrete extracted from the existing concrete members at representative areas.

4. Tests to determine the depth of carbonation of the concrete.

5. Tests on powder samples extracted from the existing concrete for chlorides content.

6. Estimates of concrete cover over embedded reinforcing steel in the concrete based upon tests and invasive test cuts.

7. Excavation of soil around the base of several concrete columns to observe concealed conditions.

8. Visual condition and audible survey and invasive test cuts at direct applied stucco veneer on exterior surfaces or concrete façade at main entrance.

9. Visual condition survey of exposed surfaces of structural members on underside of existing roof structure from the ground level.

10. Development of an outline or a general scope of work for the repair/replacement of selected structural and non-structural components that would bring the structure into compliance with the requirements of the current code.

In July through October 2012, the COG authorized students and faculty from North Carolina A&T State University to conduct a pilot assessment of two (2) areas of the stadium. This assessment included the use of Ground Penetration Radar and a seismic property analyzer. These assessments were located at the left face of the left tower at the front entrance façade and a section of the elevated seating slabs and support structure for the seating slabs. The results of this limited pilot assessment by the students and faculty at North Carolina A&T confirmed the results of SKA's condition assessment and evaluation of these areas in 2008.

The results of the SKA condition assessment and evaluation of this facility in 2008 determined:

1. *Exterior Façade The exposed aggregate direct applied stucco finish on the exterior façade at the front entrance is delaminated, cracked and spalled in several areas, most prominently on the left tower. Test cuts revealed that delaminations have occurred in the parent concrete and at bond lines between the stucco and parent concrete and pose potential safety issues from spalling and falling concrete. This distress appears to be a result of freezing and thawing of water in the parent concrete and stucco exacerbated by water infiltration through cracks.*

2. *Stadium Seating Slabs: Samples extracted from the stadium seating slabs revealed carbonation and significant levels of chlorides at depths consistent with the observed and measured level of reinforcing steel throughout the structure. Either carbonation or high levels of chlorides or both can create corrosive environments for reinforcing steel embedded in the concrete, provided that sufficient oxygen and moisture is available to sustain corrosion.*

    a. *Stadium Seating Slab – Top: At widespread areas of spalled and delaminated concrete, there is little to no cover and visibly corroding reinforcing steel bars were observed at the surface, but to a lesser degree than observed below the slab. Many holes and patches from previously removed and/or replaced fixtures and spalls were observed in the slab surfaces. Aged sealants and patch repairs associated with joints and cracks were observed. There are widespread areas of scaling on the surfaces of the treads.*

    b. *Stadium Seating Slab – Underneath: The underside of the stadium seating slabs has widespread areas of reduced or minimal concrete cover of reinforcing steel on the underside with cracking, delaminations and spalling of the concrete cover resulting from reinforcing steel corrosion. Some bars were observed to have significantly reduced cross-sectional areas from corrosion. At several cracked or delaminated areas the impending spalls pose a safety concern from overhead falling hazards, especially in the restrooms and shower room areas. At many locations, a cementitious bonded overlay had been applied on the exposed surfaces on the underside of the seating slabs and sides and bottom of the raker beams.*

3. *Raker Beams: The sides and bottom of the raker beams appeared mostly in serviceable condition; however there were several areas identified with low cover over corroding reinforcing steel and ties. Additionally, a limited number of observed transitional areas between the raker beams and columns exhibited reinforcing steel corrosion and associated spalling of the concrete cover.*

4. *Columns: Several concrete columns exhibited spalling near their bases from reinforcing steel corrosion. These areas were primarily identified in the rooms adjacent to the walkway on the field side.*

5. *Open Roof Structure: Although only observed from the seating slabs, the exposed surfaces on the underside appear serviceable; however, the coating system on the steel is peeling and flaking. Lead was found in a sample of paint extracted from a lower portion of the truss. Any repairs may have to address the safe removal and replacement of the coating system as per local, state and federal regulations. During investigation of the column anchorages, severe corrosion was observed on the anchor bolts that secured the steel base plate to the structural concrete raker beams that significantly reduced the wind uplift capacity of the roof structure.*

6. *Infill Walls: Infill masonry walls are not structural, but are exhibiting large scale differential settlement of the foundation system. It is unknown if the walls are still settling.*

II. Scope of Work and Objectives of 2014 Study

In 2014, SKA was authorized by the COG to re-examine and evaluate selected components of the existing structural system in this stadium, that, based on the results of the 2008 condition assessment and evaluation and subsequent information provided by COG, could be satisfactorily repaired, strengthened and brought to the standards requested by COG and meet the intent of the life safety and durability requirements of the current North Carolina State Building Code (NCSBC).

In April of 2014, SKA submitted a proposed scope of work to the COG for these additional engineering studies and evaluation of selected components and the development of an outline of a conceptual scope of work that would satisfactorily repair and/or replace selected structural and non-structural components of the existing War Memorial Stadium and bring this facility to acceptable, code compliant standards. The primary objectives of these additional engineering studies and the development of an outline of a conceptual scope of work were to:

1. Bring this existing facility to standards that are acceptable to the COG and that meet the intent of the live safety and durability requirements of the current NCSBC.

2. To develop an outline of a general scope of work that would restore this facility to acceptable, code compliant standards and extend its useful service life.

3. To develop a conceptual scope of work that would restore this facility to standards required by the State Historic Preservation Office and US National Park Service for a historically significant structure.

In meetings with the COG, SKA was informed that the COG would like to repair, restore, remove and/or replace the following areas of this existing facility to meet the intent of the life safety and durability requirements of the current NC Building Code, standards acceptable to COG and standards required by the State Historic Preservation Office for the restoration of a historically, significant structure. The COG informed SKA that they would like to repair and restore the following areas:

1. Two (2) towers and exterior façade between the towers at the main entrance.

2. The existing exterior masonry in fill walls with a stucco veneer and the structural concrete frames around these walls that are adjacent to each side of the two (2) existing towers at the main entrance.

3. Develop options to both remove and not replace the existing roof canopy structure, or to repair and strengthen the existing roof canopy structure to code compliant standards.

4. Removal of the existing distressed and deteriorated cast-in-place reinforced concrete seating treads and risers and replace with new seating treads and risers that meet the requirements of the current NCSBC.

5. Develop a general scope of work to repair and strengthen the existing concrete raker beams and columns or to remove the existing raker beams and columns and construct new raker beams and columns.

6. Develop an outline of the scope of work required for the removal of existing elevated seating sections and raker beams on each side of the existing seating sections that are located back of the entrance façade and exterior walls adjacent to the entrance façade that are to be restored and install a lateral bracing system to laterally support the existing exterior concrete frames and masonry infill walls.

7. Develop a general scope of work to repair and restore the concrete columns, spandrel beams and upset guardrail walls located adjacent to the elevated seating slabs and raker beams that will be removed and not replaced.

Based on the results of the condition assessment in 2008 and 2014, develop an outline of the general scope of work to repair and restore areas of this existing stadium that the COG wants to retain to standards required by the current building code, standards required by the COG and standards required by the State Historic Preservation Offices for the restoration of historically significant structures. The following is an outline of the original scope of work proposed to meet these requirements:

1. Perform a visual condition survey of the current condition of the exposed surfaces of existing cast-in-place concrete raker beams and columns and concrete members on the exterior façade in the areas that COG wants to retain that can be satisfactorily repaired. These components are the existing concrete raker beams and columns, concrete towers and façade between the towers at the main entrance, exterior masonry infill walls and concrete frames around these walls that are located adjacent to each side of the main entrance and exterior masonry infill walls and concrete frames back of seating sections that will be removed and not replaced.

2. Develop an outline of a general scope of work to restore the exterior walls adjacent to each side of the front entrance façade to acceptable standards.

3. Develop conceptual requirements for constructing a lateral bracing system for the exterior masonry infill walls and concrete frames located back of the elevated concrete seating sections that will be removed and not replaced.

4. Develop an outline of a general scope of work to repair and restore to acceptable standards the distressed and delaminated surfaces of the exterior stucco veneer on the existing concrete towers and façade between the towers at the front entrance and the tops of the two (2) towers that support the flag pole.

5. Develop a conceptual scope of work for constructing a temporary support and lateral bracing system for the existing steel columns that support the existing canopy roof if it is decided to retain the existing roof canopy structure. The conceptual study for the temporary support and lateral bracing system for the existing roof structure will consider two options.

    a. The first option is based on the existing concrete seating treads and risers between each side of the existing concrete raker beams being completely removed and replaced with new seating treads and risers. The raker beams and columns that support the seating treads and risers that are removed will be repaired and strengthened.

    b. The second option is based on the existing concrete seating slabs and concrete raker beams and columns that support the raker beams and steel columns that support the roof canopy being completely removed. This option will require a temporary system for the existing roof canopy columns that can support both gravity and live loads and lateral wind loads at the base of the existing steel columns if the roof structure is retained.

6. Develop an outline of a general scope of work to repair and bring the roof canopy to acceptable standards, or to remove and not replace the existing roof canopy. The scope of work for a third option would be to remove and replace the existing roof canopy with a new roof canopy structure.

7. Develop an outline of a general scope of work for the removal of components of the structural and non-structural members of this existing facility that will not be retained.

8. Develop conceptual systems to replace the existing seating slabs that will be removed.

9. Assist TFF Architects & Planners, LLP in developing an outline of a scope of work to restore areas of this facility to standards that meet the requirements for historical structures and proposed future uses of spaces below and adjacent to the elevated seating sections that will be repaired or replaced.

10. Develop a broad range, preliminary estimate of the probable construction cost of the conceptual scope of work developed to repair and restore this structure to standards required by the current codes and by the COG that meet the requirements the agencies have set for restoring historical structures.

11. Prepare a final draft of a report for review with the COG with an outline of the general scope of work required to bring this facility to meet the intent of the standards of the NCSBC, the requirements for restoration of historical structures, and the requirements of the COG.

12. Incorporate any comments and requirements requested by the COG and State Historic Preservation Office in a final report. The final report will include an outline of a general scope of work and schematic drawings of the proposed scope of work to repair and restore segments of this facility that the COG would like to retain and bring to acceptable standards and the requirements for the restoration of the historical structures and the broad range estimate of the probable cost.

III. Structural Engineer's Executive Summary

SKA submitted a report on the results of a visual condition assessment and evaluation of the existing structural system for the War Memorial Stadium in Greensboro, NC in 2003. In 2008, SKA performed a comprehensive condition assessment and evaluation of the existing exterior façade and structural framing for the elevated reinforced concrete seating sections. The condition assessment and evaluation in 2008 included tests on core samples extracted from the existing concrete members, microscopic tests on core samples, tests for depth of carbonation of the concrete, measurements of concrete cover over reinforcing and tests for chloride content in the concrete. The condition assessment in 2008 also included invasive test cuts and audible surveys on the two (2) towers and façade between the towers to detect potential delaminations at the areas sounded.

In 2014, SKA was authorized, by the COG, to visually examine and evaluate the current condition of structural members at this stadium that the COG wanted to retain, that, based upon the results of the condition assessment in 2008 and 2014, could be satisfactorily repaired and brought to acceptable code compliant standards. This scope of work authorized by the COG for this evaluation also included the development of conceptual measures to repair and restore and/or to remove and replace components of this facility that the COG would like to retain to acceptable code compliant and broad range estimates of the probable cost of the measures required to restore the structural members in the area that the COG wants to retain.

The results of the visual examination and evaluation of the existing structural framing members and exterior façade back of the elevated seating and exterior façade at the main entrance in 2014 found that there was some additional distress and deterioration of the structural members and exterior façade that, in 2008, were found to be repairable. The extent of this distress and deterioration though was not significantly greater.

Concrete used in the 1920's was of a lower quality and compressive strength than concrete used today. Most notably, concrete used in the 1920's did not contain purposeful additions of air-entraining admixtures that were developed in the 1930s to provide resistance to distress from freezing and thawing cycles of water when the concrete was critically saturated. Concrete samples from the slabs extracted and tested during the 2008 assessment confirmed the lack of entrained air at those locations, and by extension, almost assuredly at other locations. Compressive strengths on core samples extracted from the existing concrete members were approximately one-half of the compressive strength required by the current codes for concrete exposed to an exterior environment in this area.

This report outlines the results of a condition assessment and evaluation of the current condition of selected components of the existing structures that the COG want to retain and based upon the condition assessment in 2008 and 2014 can be repaired and restored to acceptable, code compliant standards. The report also includes broad range estimates of the probable cost of these repairs. Options are provided that address a proposed scope of work for repairing and restoring the exterior façade, roof canopy, seating slabs, vomitory and guardrail walls, raker beams and columns. This Executive Summary provides a brief synopsis.

Exterior Façade at Entrance

The exterior façade at the main entrance, including the towers and archways between the towers have delaminations and loose concrete that are a current overhead falling safety hazards. Measures should be taken immediately to make the areas around these towers and entrance façade safe. Corrosion stains and

delaminations were identified at flag pole bases at the tops of towers. The integrity of the flagpole anchorage system is unknown. SKA recommends that the flagpole anchorages be evaluated. Pedestrians should be restricted from this area until this condition can be further reviewed, the flagpoles removed, or measures to assure that the existing anchors are safe are completed.

The visual and audible delamination survey revealed a significant number of cracks and delaminations. It is estimated that 20 to 30 percent or more of the exposed bonded stucco on the façade (and portions of the underlying substrate concrete) will require removal and replacement. Cracked and delaminated areas should be repaired to acceptable standards. A breathable, penetrating sealer should be considered to reduce water intrusion to areas that are repaired and the inherently non-durable concrete substrate that were not repaired. Areas that currently are believed to be sound can, with continued exposure to the exterior, become delaminated. Larger portions or the entire exposed topping on the façade could be removed and replaced at this time, if it is desired to minimize future repairs, or, if conditions reveal that additional distress is present.

Exterior Façade Adjacent to the Main Entrance

The exposed surfaces of the existing concrete columns, spandrel beams, foundation grade walls and upset guardrail walls that comprise the façade extending from each side of the main entrance generally appear to be in fair condition. If conditions on the concealed, inside surfaces of existing concrete members in the portion of the exterior façade are confirmed to be satisfactory, these structural concrete members could be satisfactorily repaired and their useful service-life extended.

Concrete Seating Treads and Risers, Raker Beams and Columns

One or more areas on the underside of the concrete seating slabs and raker beams at the main entrance hallway were cracking and the concrete cover over the steel appeared to be delaminating. These areas pose overhead falling hazards. Measures should be taken to immediately make conditions safe by removing the cracked and delaminated concrete cover and, if these areas are not restricted for use, safety netting installed until more permanent measures are taken.

Inadequate concrete cover over the reinforcing steel in the seating treads and risers and the use of a low compressive strength concrete mix which is normally more permeable to water absorption has led to widespread and extensive corrosion of the reinforcing steel in these members. At many locations, the reinforcing steel had lost a significant amount of the original sound metal. Standards for the repair of concrete members where the reinforcing steel has corroded, requires the removal of the concrete from around the entire perimeter of the corroded steel. For these thin members, the removal of the concrete from around the perimeter will remove the entire depth or width of the member. For these reasons, the concrete seating tread and risers in this facility cannot be satisfactorily repaired. Replacement is the only option.

The existing reinforced concrete raker beams that are constructed monolithically with the concrete seating treads and risers have not experienced significant distress and corrosion of the reinforcing steel. Areas that were examined where the concrete cover over corroded steel had occurred were small and not widespread. Based on our evaluation of these members, it is our opinion that they can be satisfactorily repaired and strengthened to meet the current requirements of the ACI Building Code by satisfactorily repairing the spalls and enclosing the beam with a bonded reinforced concrete overlay.

Temporary bracing may be required during repair when seating slabs are removed. If it is demonstrated that it is more feasible to replace raker beams rather than repairing them, they could be replaced with either a cast-in-place concrete system or structural steel system. Vomitory and guardrail walls could either be repaired or replaced depending on costs and feasibility.

Columns can be satisfactorily repaired by encasing the entire perimeter with a reinforced concrete overlay bonded to sound surfaces of the original concrete. The type of existing foundations will have to be determined and evaluated to confirm that additional loads from repairs or new seating slabs and occupancy requirements can be supported by the current system.

Vomitory and Guardrail Walls

Reinforced concrete vomitory and guardrail walls generally appear to be in fair condition and can be satisfactorily repaired. The concrete vomitory and guardrail walls are constructed contiguously with the concrete seating tread and risers. When the existing concrete seating slabs are removed and replaced with new seating slabs, provisions for a temporary support and a temporary lateral bracing will be required for these walls. In our opinion, the removal and replacement of the vomitory walls with new concrete walls meeting the durability requirements of the current Building Code could be more economical and feasible and provide a longer service life for these walls than installing temporary shoring, repairing and applying a water repellent coating system on the existing concrete vomitory walls.

Roof Canopy Structure and Press Box

The roof canopy structure is comprised of a tongue and groove or wood spline timber deck and roofing membrane, supported by structural steel purlins and beams, and steel trusses. There are four (4) steel columns that bear directly in top of the concrete seating slab over raker beams below at the end of the canopy adjacent to the field. The roof canopy was reportedly added in 1931. It is unknown if dead, live and wind loads associated with the roof canopy that are supported by the original columns and foundation were considered when the addition was constructed. During the 2008 assessment, severely corroded anchor bolts were identified at the column bases adjacent to the playing field that were subsequently repaired. Lead was identified in the paint applied on the structural steel.

Although there are no obvious deformations or deflections of the roof canopy observed during this condition assessment, a closer visual inspection from a lift would be required to determine if there is any significant corrosion or distress. If it is decided to retain the roof structure, a close visual examination should be made of the existing structure. A structural analysis should also be made to verify whether or not the roof structure and supporting columns and foundations meet the current requirements of the NCSBC.

Several options could be entertained regarding the roof structure, including complete removal, retaining with repair, and replacement with new. Regardless of the choice, lead abatement may be required (due to the condition of the paint). Retaining the roof structure, if desired, would include: need for temporary support while the repair and/or replacement of the seating slabs, beams and columns are addressed. Restoration of the press box, and installation of new electrical systems will be required if the roof structure is maintained. Removal and replacement with a new roof structure would require demolition, design of a new roof system, construction of a new press box and electrical systems.

IV. Results of Visual Condition Assessment and Evaluation of Selected Structural and Non-Structural Components

A. Exterior Façade at Entrance

1. Description

The façade at the main entrance for this stadium is comprised of two reinforced concrete towers with three connected reinforced concrete arched entrances between the two towers. A cementitious architectural topping with exposed aggregate is bonded to the surfaces of the base concrete. This bonded concrete topping includes multiple layers of cementitious material (as observed during the 2008 assessment). The embedded, exposed aggregate in the exterior surface is typically about 1/8 to 3/16 inches.

The total thickness of the bonded topping (as observed in representative test cut excavations during the 2008 assessment) varies from approximately 3/4" inch to 1 inch. This includes an intermediate coat and architectural top coat of nominally equivalent thicknesses. The top of the towers have a stepped architectural feature with flag poles anchored to the concrete at the each tower.

Accessible exterior areas of the façade at the towers and arches were visually reviewed from ground and from a lift provided by others during the middle of June 2014. This review included the inside face of the arch entry and accessible portions of the façade facing the stands, but did not include portions of the façade concealed at the interior adjacent to the elevated seats.

An audible delamination survey to detect debonded material or material with cracking subparallel to the surface, was conducted using a hammer and rotary percussion tool at accessible locations. In general, the audible survey was conducted at all of the visually reviewed areas except for some locations at the tops of the towers where access was not possible with the lift.

2. Results of Visual Observation

Map cracking was observed on the surfaces of the architectural topping. Though map type cracking is characteristic in many areas on both towers and the central arch entranceway and can be considered typical of most of the areas, it appears to be more prevalent on the northern tower when compared to the southern tower and more prevalent on the northern portion of the arched entranceway when compared to the southern portion of the entranceway. Observed surface crack widths ranged from hairline to greater than 1/16 inch with much of the cracking appearing to be on the order of about 5 to 15 mils (0.005 to 0.015 inches). Efflorescence and water staining, suggesting water movement, was observed on the surface and in cracks, particularly at the north east face (face adjacent to the seating slabs) and northwest face (side face on exterior of the stadium) of the north tower (left tower when looking from outside). Many, but not all of the observed cracks at the stepped upper portions of both towers had been previously sealed. A gutter was on the roof that had apparently been installed to redirect water from flowing to the north tower.

Some sections of architectural topping, and in some cases part of the substrate concrete with it, have spalled (detached from the structure). This is most prevalent on the north tower, but some spalling was also

observed in the arched entranceways and south tower. Corrosion of embedded steel was observed at a subset of the spalls.

Wide cracking and distress was observed at areas on the stepped upper portions of the towers. Corrosion stains and cracking were observed on the concrete at the flag poles bases where they were supported and anchored to the top of the towers.

3. Results of Audible Survey

The audible survey in 2014 revealed multiple areas with delaminations. This included half or more on the northwest face of the north tower and nearly all of the accessible exposed areas on the north east side of the north tower above the level of the seating slabs. Delaminations were also identified at a number of locations on the southwest (main) face of the north tower, the central archways and the upper stepped portions of the towers, including some areas near the flagpole anchorages). Though present, delaminations on the south tower were less extensive. Delaminations ranged in size from less than 1/4 square foot to greater than 100 square feet. Some areas, including a 20 to 40 square foot area on the south tower, with wide cracks did not appear to be fully delaminated, but had questionable characteristics indicating some compromised bond of the topping to the concrete substrate.

Based on the results of this audible survey, it is estimated that about 20 to 30 percent of the accessible surface area of the main entrance arches and towers is either currently delaminated or currently cracked and spalled. This is comparable, but somewhat higher than the 5 to 15 percent estimate made during the 2008 assessment that was based on a reduced area that was tested

4. Evaluation of Observations and Audible Survey

Delaminations were detected at the towers and central archway entrances at overhead areas that are currently an overhead spalling hazard. Delaminated or debonded material can detach from the substrate and fall, potentially injuring or killing pedestrians. Loose material should be removed or secured, protective structures or netting should be erected and/or areas around the towers and central archways should be closed to pedestrians. Several delaminations were identified at the arch entrance areas, including the south arch that functions as the main entranceway into the building. Delaminations were also observed at other entrance arches adjacent to the north and south towers.

Corrosion stains and delaminations were detected at the tops of the façades, near the flag pole anchorage points. The structural integrity of the flagpole anchorage is unknown. It is possible that anchorages may be currently unsafe. SKA recommends that the flagpole anchorages be evaluated or pedestrians be restricted from the area until this condition can be further reviewed or the flagpoles removed.

The characteristics of delaminations and spalls were evaluated during the 2008 assessment. That assessment revealed that failure planes sub-parallel to the surface (collectively referred to as delaminations for the purposes of the audible survey) sometimes occurred at the bond-line between the topping and the base (parent) substrate concrete and sometimes within the substrate concrete. Disbondment or reduced bond at the bond-line is often associated with poor surface preparation during installation, inadequate placement procedures, adverse environmental conditions during or shortly after construction, differential

shrinkage, or inappropriate materials. This type of distress is likely more prevalent at the arch portions, though this has not been verified at typical delaminations identified in those areas.

The base concrete is not air-entrained and has limited inherent resistance to distress from freezing and thawing cycles when critically saturated (refer to the 2008 report for additional discussion). Therefore, exposure to moisture prior to freezing has compromised the base concrete in some areas. It is possible that other materials-related distress issues are contributing, but this has not been confirmed. This type of distress is highly prevalent on the north tower where there is visual evidence of heavy exposure to moisture on the faces of the tower. Thus, repair of the area must not only include removal of the topping material, but the distressed or otherwise compromised base material as well to get to a sound concrete substrate. Additionally, any repair and preservation measures must include provisions to protect the finish material from water absorption. Clear, penetrating, breathable water repellant sealers can provide a level of protection. Even with repair of areas currently deteriorated and provisions to aid in re-directing water and reducing absorption into the concrete and topping, additional delaminated areas could occur in the future where base concrete has become partially compromised at this time, but not so distressed as to lead to delamination.

Surface map cracking is relatively typical of the architectural façade at the towers and arch entryways. Much of the cracking appears to be about 5 to 15 mils in depth. Cracking of this nature is typically associated with the restraint of drying or thermal shrinkage of the finish topping. Larger cracks and, potentially, some of the smaller cracks could also be from stresses imparted due to delamination or disbondment of the topping or substrate concrete. Cracking less than about 7 to 10 mils is typically not detrimental to vertical concrete members, provided that they are otherwise sound, durable and protected from moisture. Larger cracks should be sealed to reduce water intrusion. Installation of a clear, penetrating sealer on the surface may provide some additional benefit for reducing water absorption in existing narrow cracks by wetting out the surfaces of the cracks.

5. Conclusions

A substantial portion of the Architectural finish cementitious topping on the façade is currently debonded or delaminated. This will have to be addressed in the repair and restoration. It is possible that additional areas have partially compromised bond or are partially delaminated (small sub-parallel cracks). It should be expected that additional material will debond in the future. It is imperative that any repair and preservation methods include measures to divert water flow and reduce absorption into the wall systems to reduce the risk of future delaminations. Delaminations pose a safety hazard for pedestrians. It is estimated that at least 20 to 30 percent of the exposed surface (or possibly more) may have to be removed and replaced at this time to address current delaminations and heavily cracked concrete and to achieve convenient appropriate patch geometries for aesthetics and function. Large cracks in areas to remain should be addressed and a clear, penetrating water repellant sealer should be considered for reducing water absorption. Hidden areas, or areas with compromised bond detected during the repairs may require that additional material be removed and replaced.

B. Exterior Façade Adjacent to the Main Entrance

1. General Description

The exterior façade adjacent to each side of the façade at the main entrance is constructed with cast-in-place, reinforced concrete frames with masonry infill walls. The frames are comprised of spandrel/guardrail beams, foundation grade walls and columns. The upset guardrail walls located back of the upper top row of seating are constructed contiguously with the spandrel beams. Structural steel columns that support the one end of the roof canopy structure, are located directly back of the inside face of the upset guardrail walls. The base plates for the steel columns that support the roof canopy bear directly on the top of the concrete seating treads and raker beams and columns directly below.

There are brick masonry infill walls constructed between the concrete columns, and the top and bottom of the spandrel beams and foundation grade walls. There is a direct applied portland cement stucco veneer on the exterior surfaces of these brick masonry infill walls. These infill walls with a stucco veneer are constructed directly against the surfaces of the concrete spandrel beams and columns. It was not determined whether or not the masonry in these infill walls was mechanically connected to the columns and beams. There is a coating system applied on the exterior surfaces of the concrete members and stucco veneer. The outside face of the stucco veneer is offset approximately 2 inches back of the exterior face of the concrete columns and spandrel beams.

There are currently masonry infill walls in openings where there were windows in these exterior walls in the original construction.

2. Condition Assessment

A visual condition survey of the exposed surfaces of the exterior façade directly adjacent to each side of the façade at the main entrance was performed from the ground level and seating treads at the top. The results of this visual condition survey did not observe any significant distress and deterioration on the exposed, exterior surfaces of the columns, spandrel beams, guardrail walls, foundation grade walls and stucco veneer.

There was minor crazing and cracking of the coating system on the exposed surfaces of the concrete columns and spandrel/guardrails walls at some locations. The exposed surfaces of the direct applied stucco on the exterior brick masonry walls generally appeared to be satisfactory. At the locations visually examined, the stucco veneer appeared to be well bonded to the surfaces of the masonry. A coating system had been applied on the exposed exterior surfaces of the concrete columns, spandrel beams, guardrail walls and stucco veneer. It was not determined if this coating system was part of the original construction or was applied later.

The exterior surfaces of the concrete members and exterior masonry infill walls with the stucco veneer were concealed by the coating system. The coating system on the concrete columns and spandrel beams and direct applied stucco on the exterior surfaces of the masonry walls has provided additional cover and protection for the embedded reinforcing steel, structural concrete beams, columns and guardrail wall.

Based on the requirements of the Building Codes and Industry Standards that were current when these reinforced concrete structures were constructed around 1926 and the results of compressive strength tests and microscopic examination of core samples and carbonation tests made on samples of concrete extracted from the existing structure at other areas in 2008, it is very likely that the compressive strengths of the concrete mix used to construct the columns, spandrel/guardrail beam and grade walls in this exterior façade do not meet the durability and compressive strength requirements of the current NCSBC and ACI 318 for concrete exposed to an exterior environment in Greensboro, NC. Since the benefits of air entrainment in concrete were unknown in 1926 and air entrainment admixtures had not been developed, the concrete mix used for this structure was not intentionally air entrained. Air entrainment of concrete exposed to an exterior environment is required by the current ACI Code. The current ACI Building Code also requires a minimum 28 day compressive strength of 4500 psi for concrete exposed to an exterior environment. It is also likely that the depth of carbonation of the concrete in the concrete member may have reached the level of the reinforcing steel at some locations

There was no visual evidence of any significant distress and displacement of the brick masonry infill walls with the direct applied stucco veneer that would suggest that there had been differential settlement of the foundation system supporting these infill walls. At a few locations, where the inside surfaces of these exterior concrete beams and columns were accessible, minor spalling and cracking of the concrete cover over the reinforcing steel in the concrete columns and beams was observed. The extent and magnitude of the spalling at these locations did not, though, appear to be widespread and severe. Based on the age and exposure and compressive strength of the concrete mixture and concrete cover over reinforcing steel at other areas of that structure, it is likely that there is some corrosion activity of the reinforcing steel in these members.

3. Evaluation of Condition Assessment

The exposed surfaces of the existing concrete columns, spandrel beams, grade walls and upset guardrail walls on the exterior façade generally appear to be in fair condition. There was no visual evidence of any significant cracking and spalling of the concrete cover over reinforcing steel on the exposed exterior surfaces of the members that were visually examined. Based on the conditions visually observed, it is our opinion the existing concrete members could be satisfactorily repaired and restored to meet the intent of the requirements of the current NCSBC and ACI 318. Considering the age of this structure and its exposure to an exterior environment, some distress and deterioration of the concrete cover from corrosion of reinforcing steel is likely and should be expected to have occurred on the concrete members in this façade. However, based on a visual examination of the accessible surfaces, there does not appear to be any widespread area of significant distress and corrosion of reinforcing steel.

Based upon a visual examination of these exposed surfaces, it appears that the extent of any corrosion activity of the reinforcing steel and distress in the concrete cover over the steel is not so severe that these members cannot be satisfactorily repaired and brought to standards that meet the intent of the current requirements of the NCSBC.

C. Concrete Seating Treads and Risers

1. Description

The seating treads and risers are constructed with cast-in-place, reinforced concrete. The seating treads and risers are constructed monolithically with the concrete raker beams. The vertical height of the seating risers varies from approximately 7-inches up to 12-inches. The width of the seating treads is typically approximately 2'-4". The field measured thickness of the treads varies from 2 ½ to 4 inches. The risers are constructed monolithically with the treads. The treads span between the risers and the risers span between the concrete raker beams.

2. Condition Assessment

a. The results of a condition assessment of the seating treads and risers performed by SKA in 2008 on the exposed underside of the concrete seating treads and risers identified widespread distress, deterioration and delamination of the concrete cover over corroded reinforcing steel on the underside of the seating treads and risers. The 2008 report identified the primary cause of the distress and spalling to be the result of corrosion of the reinforcing steel. There was also less concrete cover over the embedded reinforcing steel at many locations than was required by the Building Code that was current when this facility was constructed or the current code. The reinforcing steel exposed at many locations was severely corroded. There were locations where the cross-sectional area of sound metal in the reinforcing steel had been significantly reduced by corrosion of the steel. There were also locations where electrical conduit embedded in the bottom of the concrete risers was exposed and corroded. The primary cause of the spalling and delamination of the concrete cover and corrosion of the reinforcing steel was inadequate concrete cover over the steel, chlorides in the concrete and carbonation of the concrete cover over the reinforcing steel. The use of the concrete mix with significantly lower compressive strengths that were more permeable also contributed to the causes of the corrosion of the reinforcing steel. There were many areas on the underside of the seating treads and risers where a cementitious repair mortar had been applied on the surfaces on the sides and bottom of the seating treads and risers as well as the raker beams. It is our understanding that this cementitious repair mortar was applied by the COG in the 1980's to repair areas where the concrete cover over corroding steel was cracked and delaminated. This bonded repair mortar has apparently provided additional coverage and protection of the steel in the bottom of these seating treads and risers. However some cracking and delaminations were detected in many areas where the bonded cementitious overlay had been applied during the 2014 review.

b. The results of a condition assessment of the top exposed surfaces of the seating treads and risers in 2008 identified widespread areas where there was scaling and delamination of the concrete and spalling of the concrete cover over corroded reinforcing steel. The areas with more significant scaling of the concrete on the surfaces were located outside of the existing roof canopy structure where there is more exposure to rainwater. There was also random cracking observed at many locations.

3. Evaluation of Condition Assessment

a. The depth of carbonation of the concrete, lack of adequate concrete cover, and quality of the concrete cover has resulted in widespread and extensive spalling, cracking and delamination of the concrete cover over reinforcing steel and corrosion and loss of sound metal in the reinforcing steel, to the extent

that the thin sections of the cast-in-place concrete in the seating treads and risers cannot be feasibly repaired and brought to the minimum safety and durability standards required by the current NCSBC.

b. In summary, the results of tests and microscopic examinations of samples of concrete extracted from the concrete mixture used to construct the raker beams in 1926 found that the concrete mixture was not an air entrained mix and the comprehensive strengths of the concrete determined by test core samples extracted from the concrete also did not meet the strength requirement of the current code. Also, it was found that the concrete cover over the steel was carbonated. Based on these conditions, it was determined that these seating sections could not be satisfactorily repaired to acceptable standards.

D. Concrete Raker Beams and Columns

1. Description

The existing cast-in-place, reinforced concrete raker beams and columns are constructed monolithically with the cast-in-place, reinforced concrete seating slabs. The raker beams are typically 10-inches wide and approximately 20 inches deep. The top of the raker beams are stepped to match the profile of the concrete seating treads and risers. The reinforced concrete columns that support the raker beams are typically 14 inches wide by 16 inches deep.

There are sixteen (16) sloped concrete raker beams directly back of and adjoining the concrete structures at the main entrance façade and the exterior concrete frames with masonry infill walls adjacent to each side of the entrance façade. Each raker beam is supported by four (4) reinforced concrete columns. The columns supporting the raker beams are typically spaced at approximately 18'-6" o.c. The raker beams on each side of the main entrance are typically spaced at approximately 15'-6" o.c. The raker beams directly adjacent to the back of the main entrance façade are spaced approximately at 17'-4", 14'-6" and 17'-4" and are approximately 12” wide.

2. Condition Assessment

A visual condition assessment and evaluation and tests were performed on representative locations of the existing concrete raker beams and columns in 2008. Core samples were removed for compressive strength tests. Core samples were also removed for microscopic examinations and tests to determine the depth of carbonation of the concrete and the presence of any chloride in the concrete.

The results of the tests and microscopic examination of the core samples extracted from the concrete found that the concrete mixture did not meet the strength and durability requirements of the current Building Code for concrete exposed to an exterior environment in this area. These tests found that the concrete cover over the reinforcing steel was carbonated. At several locations tested, the depth of carbonation had reached the level of the reinforcing steel.

In June and July of 2014, SKA performed a comprehensive, visual examination and condition assessment on both sides and the bottom of each of the sixteen (16) raker beams that were accessible. An audible survey

was also performed on the exposed surfaces of the sides and bottom of raker beams that were accessible from the ground level and on the raker beams back of the main entrance.

The results of the visual condition and audible survey and condition assessment of the exposed sides and bottom of each of the sixteen (16) raker beams back of the main entrance and adjoining exterior façade found that the general overall condition of these members was fair. At many locations a cementitious parge coat of mortar had been applied on the sides and bottom of the concrete raker beams. There were some locations where the partial surfaces of the existing reinforcing steel in both the raker beam and columns were exposed. The exposed surfaces of the reinforcing steel at these locations were corroded. There were also a number of locations where the concrete cover over the reinforcing steel was cracked and spalled, leaving exposed surfaces of reinforcing steel that were corroded. The extent of corrosion and loss of gross sectional area of the reinforcing steel in the raker beams at the locations where the steel was exposed did not appear to be significant. Delamination and spalling of concrete cover over reinforcing steel was observed at several columns. This distress was found primarily near the base of the columns, near the concrete slab on grade.

The sides and bottom of the raker beams exposed in the lobby adjacent to the main entrance and the corridors on each side of the main entrance had a cementitious parge coat applied on these surfaces. This parge coat was not part of the original construction. It was applied by the COG in the 1980's to repair spalls and to provide additional cover and protection of the reinforcing steel.

The magnitude and extent of any corrosion of the reinforcing steel in the concrete raker beams that had occurred prior to applying a cementitious parge coat of material on the surfaces on each side and bottom of the raker beam is unknown. There is currently some cracking in the bonded cementitious overlay on the sides and bottom of these beams at several locations. This cracking suggests that there is some ongoing corrosion activity of the reinforcing steel in these members. Cracks will eventually lead to delamination and falling of large pieces of concrete.

At the raker beams where the cementitious overlay was applied, the cementitious overlay would have to be removed in order to visually examine and evaluate the conditions of the concrete concealed by the cementitious parge coat. Since the reason for applying the bonded cementitious overlay was to repair spalls and delaminations caused by the corrosion of the embedded reinforcing steel, removal of this overlay, in our opinion, would not be required to confirm that there was corrosion of the reinforcing steel and cracking and delamination of the concrete cover over the steel when this bonded cementitious overlay was applied. Removal though is required for any satisfactorily measures to repair these members and extend their service life.

3. Evaluation of Condition Assessment

There were a number of localized areas found on the sides and bottom of the concrete raker beams where the concrete cover over the reinforcing steel had cracked and spalled, exposing corroded reinforcing steel. These localized areas of spalls and delamination were not widespread. There were several locations where the stirrups in the concrete raker beams had minimal, if any, concrete cover and protection. At the areas

where spalls and delamination of the concrete cover over reinforcing steel were visually examined, there was no visual evidence of any significant loss of sound metal of the reinforcing steel.

The bottom and sides of these concrete raker beams are covered and protected from direct rainfall and water by the concrete seating treads and risers constructed monolithically with the top of the concrete raker beams. This has minimized the exposure of these surfaces to water absorption which has reduced the risk and rate of corrosion.

Based on the results of the condition assessment of these members in 2008, and a visual examination and audible soundings of accessible surface on the bottom and sides of these raker beams, there appears to have been minimal additional distress and corrosion of the reinforcing steel since these members were visually examined in 2008.

Based on our observations and evaluation of the current magnitude of distress and corrosion of reinforcing steel, it is our opinion that the sides and bottoms of these raker beams can be satisfactorily repaired and restored to meet the intent of the strength and durability requirements of the current ACI Building Code.

The top of these concrete raker beams are constructed contiguously with the concrete seating treads and risers. This has provided some additional concrete cover over the top reinforcing steel in the raker beams. As noted, the concrete seating treads and risers constructed monolithically with the top of the raker beams have experienced significant distress, deterioration and loss of sound metal in the reinforcing steel, and cannot be satisfactorily repaired. Restoration of the seating treads and risers will require complete removal and replacement.

When the existing concrete seating treads and risers are removed and replaced with new precast as cast-in-place seating treads and risers, a significant amount of the concrete will have to be removed from the top of the existing raker beams. This removal will exposed any reinforcing steel in the top of these beams that has experienced significant corrosion and loss of sound metal. Since the reinforcing steel in the top of these raker beams had additional concrete cover over most of the steel in the top of the raker beams, any significant area where there is corrosion of the top steel should, in our opinion, should be minimal and repairable. The concrete in the top of these existing raker beams that has to be removed to construct new precast or cast-in-place seating treads and risers should also remove the majority of any distressed concrete in the top of these raker beams. Sections that are removed can be satisfactorily replaced to acceptable code compliant standards when the new precast or cast-in-place seating sections are constructed.

There were a number of columns supporting the raker beams where the concrete cover over the reinforcing steel had cracked and spalled, exposing corroded steel. These locations were primarily near the bottom of the columns near the concrete slab on grade. At the locations where hand excavations were made attempting to expose the top of the existing foundation system, the foundation system was not exposed. It is apparent that the foundation system at this location and likely at other locations as several feet below the grade and concrete slabs. The conditions of the concrete columns that extended below the grade and were enclosed with a soil fill are unknown. Any corrective measures on the columns will require excavation of the soil fill around the columns and repair, the full height of these columns. These columns can, in our opinion,

be satisfactorily repaired and strengthened by encasing the perimeter of the full height of the column with a code compliant concrete mix and new reinforcing steel.

E. Vomitory and Guardrail Walls

1. Description

The existing vomitory and guardrail walls are constructed with cast-in-place, reinforced concrete. The vomitory and guardrail walls are constructed monolithically with both the elevated and on-grade concrete seating treads and risers. The guardrail walls are located directly back of the last upper row of seating adjacent to the exterior façade.

Guardrail walls are also located above at the openings between the ends of vomitory walls. There are three (3) vomitories that are within or adjacent to the seating sections that the COG wants to retain. These vomitories provide access to the elevated and on-grade seating sections that will be repaired/replaced.

2. Condition Assessment

The results of a visual condition assessment and evaluation of the existing vomitory and guardrail walls performed by SKA in 2008 and 2014 identified the following:

a. Localized areas of spalling of the concrete cover over reinforcing steel.

b. Minor, random cracking on the exposed surfaces of the concrete.

c. Minor scaling and pitting on the exposed surfaces of the concrete.

d. Inadequate concrete cover over reinforcing steel at some locations.

e. There was no visible evidence of distress from differential settlement of the existing foundation system supporting the concrete vomitory walls. There was, though, significant visual distress and displacement observed in the masonry infill walls adjoining these concrete vomitory walls. This suggests that the foundation system supporting the masonry infill walls, if any, is not the same foundation system supporting the concrete raker beams and vomitory walls.

f. There were no core samples extracted from the vomitory and guardrail walls for tests and microscopic examination. These walls were constructed monolithically with the cast-in-place concrete seating slabs, raker beams and columns where core samples were extracted. The results of tests and microscopic examination on samples extracted from the raker beams found that the concrete mix was not air entrained and that the compressive strengths of the concrete mix was significantly less than required by the current Building Codes. It is very likely that the concrete mixture placed in this vomitory wall was the same mix and was not air entrained and does not meet the strength and durability requirements of the current ACI Building Code for structures exposed to an exterior environment in this area.

3. Evaluation of Condition Assessment

The condition of the surfaces of the vomitory and guardrail walls that were exposed generally appears to be fair. The minor distress and deteriorated conditions observed at localized areas can, in our opinion, be satisfactorily repaired. If these members are repaired, in order to bring them members into compliance with the intent of the durability requirements of the current NCSBC, a water repellent coating system that would significantly reduce or eliminate the risk of water absorption into the concrete and distress from cycles of freezing and thawing of moisture in the concrete should be applied and maintained after any repairs to the surfaces are satisfactorily completed.

The concrete vomitory and guardrail walls are constructed contiguously with the concrete seating tread and risers. When the existing concrete seating slabs are removed and replaced with new seating slabs, provisions for a temporary support and a temporary lateral bracing will be required for these walls. If these are to be retained, in our opinion, the removal and replacement of the vomitory walls with new walls meeting the durability and compressive strength requirements of the current NCSBC would be more economical and feasible and provide a longer service life than installing temporary shoring, repairing and applying a water repellent coating system on the existing concrete vomitory walls.

F. Roof Canopy Structure and Press Box

1. Description

The roof canopy structure is located over a partial section of the elevated seating. This roof canopy structure is directly back of the façade at the main entrance and the exterior concrete beams and columns with masonry infill walls at the front of the stadium that are adjacent to each side of the façade at the main entrance.

Photographs provided show that the roof canopy structure was not part of the original 1926 construction. The roof canopy was reportedly constructed in 1931, five years after the construction of the stadium in 1926. An undated photograph, that was made available, shows the front façade of the stadium with no roof canopy structure over the seating bowl.

The roof canopy structure is comprised of a tongue and groove or wood spline timber deck, roofing membrane, structural steel purlins and beams, and structural steel trusses and steel columns. There are four (4) steel columns located in the seating bowl that support one end of cantilevered steel trusses. These columns are located directly over concrete columns that support concrete raker beams. The base plates for these columns bear directly on the top of the concrete seating treads. There are steel columns that support the steel trusses directly back of the guardrail walls. These steel columns bear directly on top of the concrete seating slabs with the raker beams and concrete columns located directly below.

There was insufficient information on the documents available to determine whether or not the concrete raker beams and columns and foundation system below the steel columns that support the roof canopy that was designed and constructed in 1926 were designed to support the additional gravity and live load of the

roof canopy structure, as well as the lateral wind and uplift loads at the bottom of the steel columns that support the canopy roof. Although an analysis was not made to evaluate the adequacy of this roof canopy to solely resist the requirements of the current Building Code for wind uplifts, based on our experience with similar structures, the adequacy of the anchorage assembly at the base of these columns to resist the current wind uplift requirements appears to be marginal.

2. Condition Assessment

A cursory visual examination was performed of the exposed surfaces on the underside of the wood deck and the exposed surfaces of the structural steel members in the roof canopy structure. This visual examination was made from the top of the existing concrete seating sections.

The results of this visual examination did not detect any areas with significant and/or abnormal deflection and deformation of the exposed structural members. There was minor corrosion observed on the surfaces of the steel members at a number of locations. More substantial corrosion distress was observed at column bases, including full cross-sectional loss through a portion of web at several columns. Reports submitted to the COG in 2008 brought to their attention that there was severe corrosion and loss of sound metal on the anchor bolts that connected the steel base plates at the column bases to the supporting raker beams and columns. The COG has installed new anchor bolts to replace the original anchor bolts at these locations.

A sample of the paint on the structural steel members was removed and submitted for a chemical analysis. This sample tested positive for lead.

In order to determine whether or not there has been any significant distress and deterioration of the members in the roof structure, a close visual examination from a lift would be required. If the decision is made to retain and repair the existing roof structure to standard required by the current NCSBC, a more comprehensive visual condition survey should be made and a structural analysis should also be performed to verify that the roof structure and columns and foundation system supporting the roof structure meet the requirements of the current NCSBC for gravity live and wind loads.

G. Exterior Façade Adjacent to Existing Elevated Seating Sections that will be Removed

1. Description

The existing structural system that supports the elevated structural system for the seats that will be removed is very similar to the structural system or the seats that the COG wants to retain. This structural system is comprised of cast-in-place reinforced concrete seating slabs, raker beams, columns and walls.

The exterior façade directly back of these elevated seating slabs is comprised of cast-in-place, reinforced concrete columns, spandrel beams and upset guardrail walls. There are concrete corbels constructed monolithically with the outside face of the columns that were apparently intended for future expansion of the seating section.

There are masonry infill walls between the concrete columns and the bottom of the concrete spandrel and guardrail walls at the top of the seating. These walls are constructed with several types of masonry. There appears to have been modifications made to these walls from the original construction.

2. Condition Assessment

A limited visual condition assessment and evaluation was made of the exposed surfaces of the structural concrete members in the exterior façade located directly back of the elevated concrete raker beams that support the concrete seating treads and risers. This limited visual condition assessment did not include a detail and comprehensive visual examination of each of the concrete members in the exterior façade, compressive strength tests and microscopic examination of core samples extracted from the construction tests to determine the depth of carbonation of magnitude of any chlorides. Since the COG intends to remove and not replace the cast-in-place, reinforced concrete structural members that support the concrete seating treads and risers, a visual condition assessment and evaluation of the structural system back of the exterior façade were not made in 2014.

The results of the limited visual condition assessment and evaluation of the exposed surfaces of the members in this exterior façade in 2008 and 2014 identified a number of areas where there was localized spalls and delamination of the concrete cover over corroded reinforcing steel. The extent of the spalling and delamination at the location visually examined was not extensive and widespread. There were only a few locations in the inside of the exterior façade when the surface of the concrete was accessible. There was not significant spalling and delamination of the concrete cover over corroded steel in the limited number of areas that were visually examined.

The masonry infill walls between the concrete columns and spandrel beams generally appeared to be in fair condition. There was no significant visual evidence of distress or displacement.

3. Evaluation

Based upon the results of a visual condition assessment and evaluation of the exposed surfaces of the cast-in-place reinforced concrete members in this exterior façade, it is our opinion that these members can be repaired and restored to acceptable standards.

The COG has informed SKA that they would like to retain and restore the exterior façade to acceptable standards and remove the elevated structural beams, columns and seating treads and riser back of the exterior façade. The COG would like to construct earth berms back of the exterior façade for on grade seating.

The existing exterior façade and masonry infill walls will not resist the code design lateral wind loads applied on the exterior façade when the elevated seating structure is removed. The existing masonry infill walls will also not safely resist the lateral pressures from an earth fill placed against the existing masonry walls and un-braced exterior concrete frames.

In order for the exterior façade to safely resist the lateral wind pressure required by the code as well as the lateral pressure from a soil fill placed against the inside face of the exterior walls and facades the exterior concrete frame will have to be strengthened and the masonry infill walls removed and replaced with reinforced masonry infill walls.

V. Discussion on Durability of Reinforced Concrete

The durability of a reinforced concrete structure is defined as the ability of the concrete to resist weathering action, chemical attack, distress associated with corrosion of reinforcing steel and other constituents of service.

A concrete mixture used in a reinforced concrete structure that is exposed to an exterior environment in cold, freezing temperatures should be relatively impermeable and intentionally entrained with air. Permeability is the ability of concrete to resist penetration of water and other substances. Concrete mixtures with reduced permeability are generally more resistant to freeze/thaw cycles of water in the pore structure. Concrete mixtures that are less permeable also are more resistant to carbonation of the hardened concrete cover over reinforcing steel and generally provide better protection of the reinforcing steel.

The resistance of hardened concrete from internal pressures produced by water in the root structure as it expands during freezing is significantly improved by the use of intentionally entrained air in a concrete mixture. Entrained air voids act as empty chambers in the paste where migrating water that is expanding during freezing can enter, thereby relieving the internal pressure that could be generated as water freezes and expands. Upon thawing, most of the water returns to the root structure as a result of capillary action and pressure from compressed air in the entrained air lines.

The current NCSBC and ACI 318 requires for a reinforced concrete structure that is exposed to an exterior environment and temperatures that are below freezing to have a concrete mixture that is intentionally entrained with air and that has a minimum 28 day compressive strength of 4500 psi.

The standard regulations and building code published by the American Concrete Institute for reinforced concrete structures that was current when this stadium was constructed in 1926 did not require a concrete mixture that was intentionally entrained with air or that had the minimum compressive strength required by the current NCSBC for concrete structures exposed to an exterior environment. In fact, in 1926, the benefits of entrained air were unknown and admixtures that intentionally entrained air in concrete were not available. In 1926, the compressive strengths of a concrete mixture were generally based on proportions of cement to aggregate and not water cement ratios. Published values of compressive strengths in the code that were current in 1926 were based on proportion of cement to aggregate. They varied from 1300 psi to a maximum of 3000 psi.

The results of compressive strength tests on core samples extracted from the hardened concrete estimated that the compressive strength of the concrete mixture in this stadium was approximately 2000 psi. This is less than one-half the 28 day compressive strength required by the current NCSBC and ACI 318 for concrete exposed to an exterior environment and cycles of freezing and thawing of water in the root structure.

The results of microscopic examination of core samples extracted from the hardened concrete also confirmed that the concrete mix was not intentionally entrained with air.

The current NCSBC and ACI 318 have specific requirements for a concrete mixture exposed to an exterior environment in cold climate that address durability. In order for repairs of this existing structure to be successful and extend the useful service life, measures that address the durability should be considered.

The results of tests on core samples extracted from the existing structural concrete in 2008 found that the depth of carbonation of the concrete was significant. In some samples, the carbonation front had reached the level of the steel.

Carbonation occurs when carbon dioxide in the atmosphere penetrates into the concrete and reacts with the products of cement hydration. This reaction reduces the alkalinity of the concrete. When the depth of carbonation reaches the level of the reinforcing steel, the protective, passivating layer around the steel becomes unstable and the steel begins to corrode.

Carbonation occurs more rapidly in concrete mixes with higher water cement ratios. Compressive strength tests and microscopic examination of concrete samples extracted from the original concrete indicate that the concrete mix used in this structure had a higher water cement ratio and significantly lower compressive strength than concrete mixtures meeting the durability requirements of the current ACI Code and NCSBC.

Carbonation also occurs more rapidly in concrete with relative humidity levels around 50%. Relative humidities in this area during the summer months are normally higher than 50%.

The ACI Building Code for Concrete Structures that was current when this stadium was constructed required that reinforcing steel in columns and girders be protected with a minimum thickness of concrete cover of 2 inches and that the reinforcing steel in beams and walls be protected with a minimum thickness of concrete cover of 1 ½ inch. These cover requirements are generally consistent with the requirements of the current ACI Building Code.

The results of a visual condition survey of the existing concrete members found widespread locations where the concrete cover over reinforcing steel was less than the cover required by building code that was current when this structure was constructed or the current building code. At some locations, surfaces of the reinforcing bars at the form face of the concrete members were exposed.

Corrosion of reinforcing steel in concrete structures occurs more rapidly when there is insufficient concrete cover over the steel and the concrete cover is less dense and more permeable. These conditions exist throughout this existing reinforced concrete structure.

In order for existing reinforced concrete members in structures that are exposed to an exterior environment to be satisfactorily repaired and to meet the intent of the durability requirements of the current ACI Building Code, the following measures should be considered:

a. Repair distressed and deteriorated areas in all the concrete members that are repairable.

b. Provide a protective encasement by overcladding the existing members with a durable, air entrained concrete mix that is bonded to the existing concrete around the perimeter of the existing structural members that meets the durability and strength requirements of the current Building Code.

c. Design and construct the bonded encasement to strengthen the existing concrete members.

In addition, the following measures could be considered:

a. Divert direct moisture and provide a coating system that significantly minimizes water absorption in the concrete members.

b. Concrete members that cannot be encased in a durable bonded overlay that meets the durability requirements of the Building Code should be protected with a breathable, water repellent coating system that minimizes water absorption into the concrete members.

VI. Outline on General Scope of Work for Repairs and Restoration

The following is an outline of a general scope of work recommended for the repairs and strengthening of the existing structural and non-structural members that will restore this facility to the standards required by the current Building Code and meet the intent of the requirements of COG and Historical Society.

A. Existing Concrete Seating Slabs, Raker Beams and Columns

Option 1 – Repair and Strengthening

1. Remove the existing concrete seating slabs between the vertical face of each side of each existing raker beam. Remove sections of the existing concrete seating treads and risers that are monolithic with the top of each concrete raker beam. Remove the existing vomitory walls. Remove the existing concrete guardrail walls.

2. Expose and identify the type of the existing foundation system and evaluate the adequacy of the existing foundation system to support any additional loads of materials used to repair and strengthen the existing raker beams and columns, new seating treads and risers, and the live and wind loads required by the current NCSBC for bleacher type seats.

3. Perform a comprehensive visual and audible survey of the top, sides and bottom of each concrete raker beam. Remove distressed and delaminated areas of concrete cover over corroded reinforcing steel. Prepare and clean surfaces of existing and excavated concrete and reinforcing steel with a dry abrasive blast.

4. Expose the full length of the column from the top of the foundation system to the raker beam. Perform a comprehensive visual and audible survey of the surfaces of each column supporting the raker beams. Remove cracked, distressed and delaminated sections of concrete. Prepare and clean surfaces of existing and excavated concrete and exposed reinforcing steel with a dry abrasive blast.

5. Install galvanic anodes at interface of original and new concrete encasement at raker beams and columns.

6. Place new reinforcing steel and formwork around each side and the bottom of each raker beam and around the perimeter of each column. Design the concrete encasement and new reinforcing steel to support the entire dead and live load on the seating structure that is replaced.

7. Construct formwork on the bottom and each side of each existing raker beam and all four (4) sides of each existing column.

8. Place a low shrinkage, bonded concrete mixture that meets the durability and strength requirements of the current NCSBC and ACI Code that is bonded to the prepared surfaces of the existing raker beams and columns.

9. Construct a new lateral bracing system between existing and strengthened concrete columns that is located directly below the new precast concrete seating slabs that will satisfactorily brace the raker beams and columns.

10. Construct new cast-in-place vomitory walls and guardrail walls.

11. Install new precast concrete seating treads and risers.

Option 2 – Remove and Replace with New Seating Slabs, Raker Beams and Columns

This option is applicable if it is determined that it is more feasible to remove and replace rather than repair and strengthen the existing raker beams and columns.

1. Completely remove the existing seating slabs, vomitory walls, raker beams and columns, except the columns adjacent to the façades at the main entrance and the concrete columns at the exterior walls located directly adjacent to each side of the façade at the main entrance.

2. Expose the existing foundation system and verify its adequacy to support any additional dead load of the new structural system and the live and wind load required by the current NCSBC for bleacher type seating.

3. Construct new cast-in-place columns on the existing foundation system.

4. Construct new cast-in-place concrete raker beams.

5. Construct new precast concrete seating slabs and bracing members for concrete frames.

6. Construct new vomitory walls, guardrails walls and lateral bracing members.

Option 3 – Remove and Replace with New Seating Sections, Structural Steel Raker Beams and Columns

This option is applicable if it is determined that it is more feasible to remove and replaced the existing concrete raker beams and columns with structural steel raker beams and columns.

1. Remove the existing seating slabs, vomitory walls, guardrail walls, raker beams and columns, except the columns in the façades at the main entrance and the concrete columns at the exterior walls directly adjacent to the façade at the main entrance.

2. Expose the existing foundation system and verify it's adequacy to support the dead load of a new structural system and the live and wind loads required by the current NCSBC for bleacher type seating.

3. Construct new structural steel raker beams and columns on the existing foundation system.

4. Construct new precast concrete seating members supported by the new steel raker beams.

5. Construct new concrete vomitory walls, guardrail walls and lateral bracing members for raker beams.

B. Exterior Façade and Structure Adjacent to Main Entrance

Option #1

1. Remove the existing masonry infill walls with the direct applied stucco veneer.

2. Remove the existing concrete spandrel beam and upset guardrail walls that span between the exterior concrete columns.

3. Perform a comprehensive condition assessment and evaluation of the existing concrete columns and concrete grade walls between the columns. Remove distressed and delaminated areas of concrete cover over reinforcing steel. Prepare and clean existing and excavated surfaces of the concrete columns with a dry abrasive blast.

4. Install galvanic anodes at the interface between the original concrete and repair concrete at excavated areas.

5. Place new vertical reinforcing and ties around the perimeter of each existing column. Construct formwork around the new reinforcing steel and place a low shrinkage concrete mix into the forms. Design reinforced concrete encasement to support the dead load and live load required by the current Building Code.

6. Construction formwork and place new reinforcing steel for new concrete spandrel beams and guardrail walls to replace the original concrete spandrel beams and guardrail walls.

7. Replace existing masonry infill walls that were removed with new concrete masonry block walls with a direct applied stucco veneer.

8. Install new windows similar to the original windows in the opening in the new masonry infill walls.

9. Apply an elastomeric coating system on the exterior surface of the concrete members and direct applied stucco veneer.

Option #2

1. Remove section of the existing masonry infill walls with the direct applied stucco veneer as required to access and repair the existing concrete column.

2. Perform a detailed visual and audible survey on the surfaces of the existing concrete columns, spandrel beams and upset guardrail walls.

3. Remove distressed and delaminated areas of concrete cover over corroded reinforcing steel in the columns, spandrel beams and guardrail walls. Clean the excavated surface of the concrete and reinforcing steel with a dry abrasive blast.

4. Install galvanic anodes in all the repair areas.

5. Place a compatible repair mortar in all the repair areas.

6. Clean and prepare the surfaces of the original concrete and the repairs with a dry abrasive blast.

7. Install stainless steel metal lath around the perimeter of the existing columns, spandrel beams, and guardrail walls that were repaired. Connect the stainless steel lath to the surface of the existing and repaired concrete with stainless steel pins. Place a consolidated 5/8” portland cement stucco mix.

8. Replace sections of the masonry infill walls with the direct applied stucco veneer that was removed with new concrete masonry block with a direct applied stucco veneer.

9. Apply an elastomeric coating on the surface of the stucco veneer.

C. Façade at Main Entrance

Option #1

1. Perform a detailed audible and visual condition survey and examination of the exterior surface of the direct applied stucco veneer on the two (2) concrete towers and the arched façade between the two (2) towers.

2. Remove the existing direct applied stucco veneer at areas where the audible and visual condition survey determines that the existing stucco is delaminated and cracked.

3. Remove any unsound substrate materials back of the direct applied stucco that were removed where the concrete substrate material is distressed, cracked and delaminated.

4. Repair areas back of the direct applied stucco that was removed where the concrete substrate was cracked and delaminated.

5. Clean excavated surfaces with a dry abrasive blast.

6. Install a stainless steel metal lath on the excavated surfaces. Connect the stainless steel metal lath to the concrete substrate with stainless steel pins.

7. Place and consolidate a new portland cement stucco with a gap graded course aggregate that closely matches the size, shape, type and distribution of the existing course aggregate. Mockups of the new direct applied stucco with a gap graded course aggregate shall be made and approved prior to beginning the placement of the stucco mix on the areas being repaired.

8. As soon as the stucco mix hardens, was the surface with a mild acid that removes the portland cement stucco from the surface and cleaves the coarse aggregate exposed. As soon as the coarse aggregate is exposed, wash the surface with clean water.

9. Apply a clear, penetrating water repellent coating to the exposed surfaces that were replaced with a new stucco and the original surfaces.

Option #2

1. Remove all the direct applied portland cement stucco with the exposed, gap graded coarse aggregate. Remove in a manner that will not damage sound substrate materials.

2. Remove any unsound substrate materials back of the direct applied stucco that was removed where the concrete substrate materials are cracked or disturbed.

3. Clean the excavated surface with a dry abrasive blast.

4. Install a stainless steel metal lath on the excavated surfaces. Connect the stainless steel metal lath to sound substrate surfaces with stainless steel pins.

5. Place and consolidate a new Portland cement stucco with a gap graded aggregate that closely matches the size, shape, type and distribution of the course aggregate in the stucco mix that was removed. Make mockups of the proposed stucco mix with the gap graded course aggregate prior to beginning the work for approval.

6. As soon as the stucco mix hardens, wash the surfaces with a mild acid that will remove the portland cement mix from the surface, leaving the gap graded coarse aggregate exposed.

7. Apply a clear, penetrating water repellent coating onto the exposed surfaces of the new gap graded stucco mix.

D. Exterior Façade Adjacent to Existing Seats that will be Removed

1. Remove the existing concrete seating treads and risers and the concrete raker beams that support the seating treads and risers. Remove the existing concrete columns and walls adjacent to the playing field. Do not remove or damage the existing concrete columns, spandrel beams, and upset guardrails walls in the exterior façade.

2. Remove the existing masonry infill walls that are located between the existing concrete members in the exterior façade.

3. Perform a detailed, comprehensive, visual and audible survey of the existing concrete columns, spandrel beams and upset guardrail beams in the exterior façade that will be restored.

4. Remove distressed and delaminate concrete and repair these areas in accordance with standards published by the ACI and ICRI.

5. Determine and evaluate the existing foundation system supporting the columns and masonry infill walls in the exterior façade. Modify and strengthen as required to support new reinforced concrete counterforts adjacent to the inside face of each existing concrete column.

6. Construct new reinforced concrete counterfort walls adjacent to the inside face of each existing concrete column. Connect new concrete counterfort walls to the inside face of the existing concrete columns that were repaired.

7. Clean and prepare surfaces of existing concrete columns, spandrel beams and upset guardrails walls with a dry abrasive blast. Apply a migrating corrosion inhibitor to the clean and prepared surfaces.

8. Wrap clean and prepared surfaces of existing concrete columns, spandrel beams and upset guardrail beams with an expanded metal lath. Mechanically connect the metal lath to the existing concrete surfaces.

9. Apply a two (2) coat portland cement stucco veneer onto the exposed surface of the concrete columns, spandrel beam and upset guardrail beam.

10. Construct reinforced concrete masonry block infill walls between the repaired concrete columns and spandrel beams. Mechanically connect the reinforced masonry infill walls to the existing repaired concrete columns and spandrel beams.

11. Apply a direct applied portland cement stucco veneer onto the exterior surface of the reinforced concrete masonry block infill walls.

12. Waterproof the inside surface of the concrete masonry block infill walls.

13. Construct each of the beams against the reinforced concrete masonry block infill walls, the existing concrete spandrel and around the new concrete counterforts.

E. Existing Roof Canopy Structure

The following is an outline of a general conceptual scope of work developed for three (3) options addressing the existing roof canopy structure over a partial section of the existing seats.

Option #1 – Remove and Not Replace the Exterior Roof Canopy Structure

1. Remove existing roofing membrane, wood decking, electrical fixtures, conduit, screens, etc.

2. Remove the existing structural steel purlins, beams, columns, base plates, bracing members, etc. Abate lead paint on structural steel members.

3. Remove existing press box structure, roof, walls and floors.

4. Abate lead paint in accordance with the requirements for abating lead.

Option #2 – Repair Existing Roof Canopy Structure

1. Construct a temporary structural system to support the gravity, live and wind loads at the bottom of the existing steel columns supporting the existing roof canopy structure.

2. Abate lead paint on existing structural steel members.

3. Examine surfaces of existing steel after abatement of lead paint and repair/strengthen any member and member connections damaged by corrosion.

4. Clean existing steel members with a dry abrasive blast and apply a corrosive protective coating system.

5. Perform a structural load study on typical structural members to verify the adequacy of the as built existing roof canopy structure columns and foundation system to support gravity, live and wind loads required by the current building code.

6. Strengthen/replace existing base plates and anchors at columns as required to resist the lateral and wind uplift loads required by the current building code.

7. Perform a condition assessment of the existing roofing membrane.

8. Visually examine existing wood roof deck. Repair/replace any members that have experienced decay and clean and paint exposed surfaces.

9. Repair and restore the existing press box.

10. Install new lighting fixtures and electrical system.

Option #3 – Remove and Replace Existing Roof Canopy with a New Roof Canopy Structure

1. Remove the existing roofing membrane, wood decking, electrical fixtures and conduit, screens, etc.

2. Remove the existing structural steel purlins, beams, columns, base plates, bracing members, etc. Abate lead paint on existing structural members.

3. Remove existing press box.

4. Design and construct a new roof canopy structure. The new canopy roof structure could be extended to cover all the seats back of the front walls directly adjacent to the main entrance.

5. Construct new press box.

6. New lighting, electrical and sound system.

VII. Photographs

Overview



Exterior Façade Adjacent to Main Entrance



Exterior Façade at Main Entrance

Façade



North Tower of Exterior Façade



Base of North Tower



Exposed Aggregate Finish on Entrance Façade



Spalled Concrete Cover over Corroded Reinforcing



Spalled and Delaminate Stucco with Exposed Aggregate Fins



Top of Tower



Distress and Delamination of Stucco on Tower



Distress and Delamination of Stucco at Top of Tower



Distress and Delamination of Sloped Surface at Tower



Cracking and Distress of Stucco at Main Entry Column

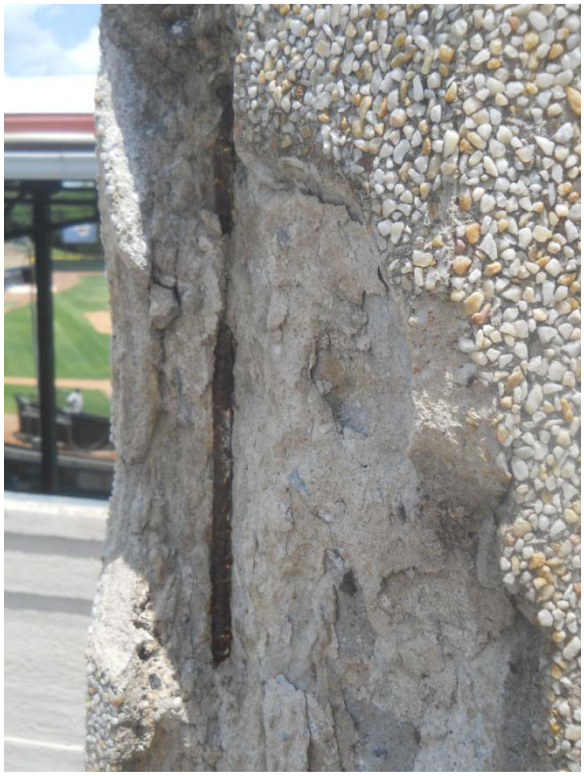


Spalling of Concrete and Reinforcing Steel at Arch



Distress and Cracking of Stucco at Top of Tower





Concrete



Concrete Seating Slabs and Raker Beams - Main Entrance



Spalled Concrete over Corroded Reinforcing Steel



Spalled Concrete over Corroded Reinforcing



Exposed Reinforcing Steel in Raker Beam



Spalled Concrete and Corroded Steel – Seating Slab

Concrete Columns 2008



Corroded Steel in Haunch at Raker Beam



Spalled Concrete over Corroded Steel in Column



Cracking and Spalled Concrete and Corroded Steel in Column



Spalled Concrete and Corroded Reinforcing



Spalled Concrete and Corroded Reinforcing

Canopy



Underside of Roof Canopy



Roof Canopy above Press Box



Corrosion of Steel Column Supporting Roof Canopy



Corrosion of Steel Connection



World War Memorial Stadium circa 1929

Appendix A – Preservation Treatment Drawings

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

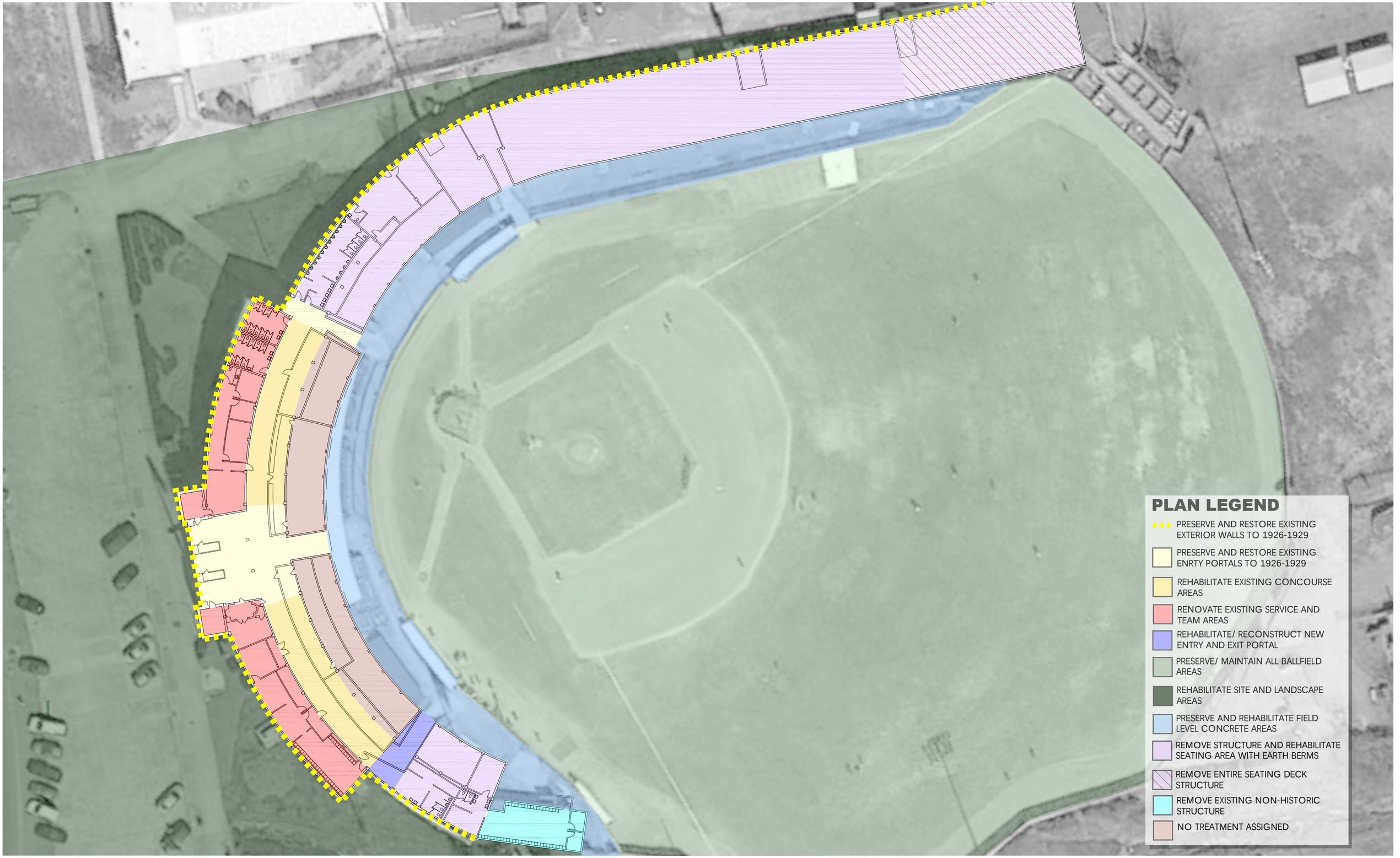
GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

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TEAGUE FREYALDENHOVEN FREYALDENHOVEN ARCHITECTS & PLANNERS, LLP



WORLD WAR MEMORIAL STADIUM GREENSBORO, NC
PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

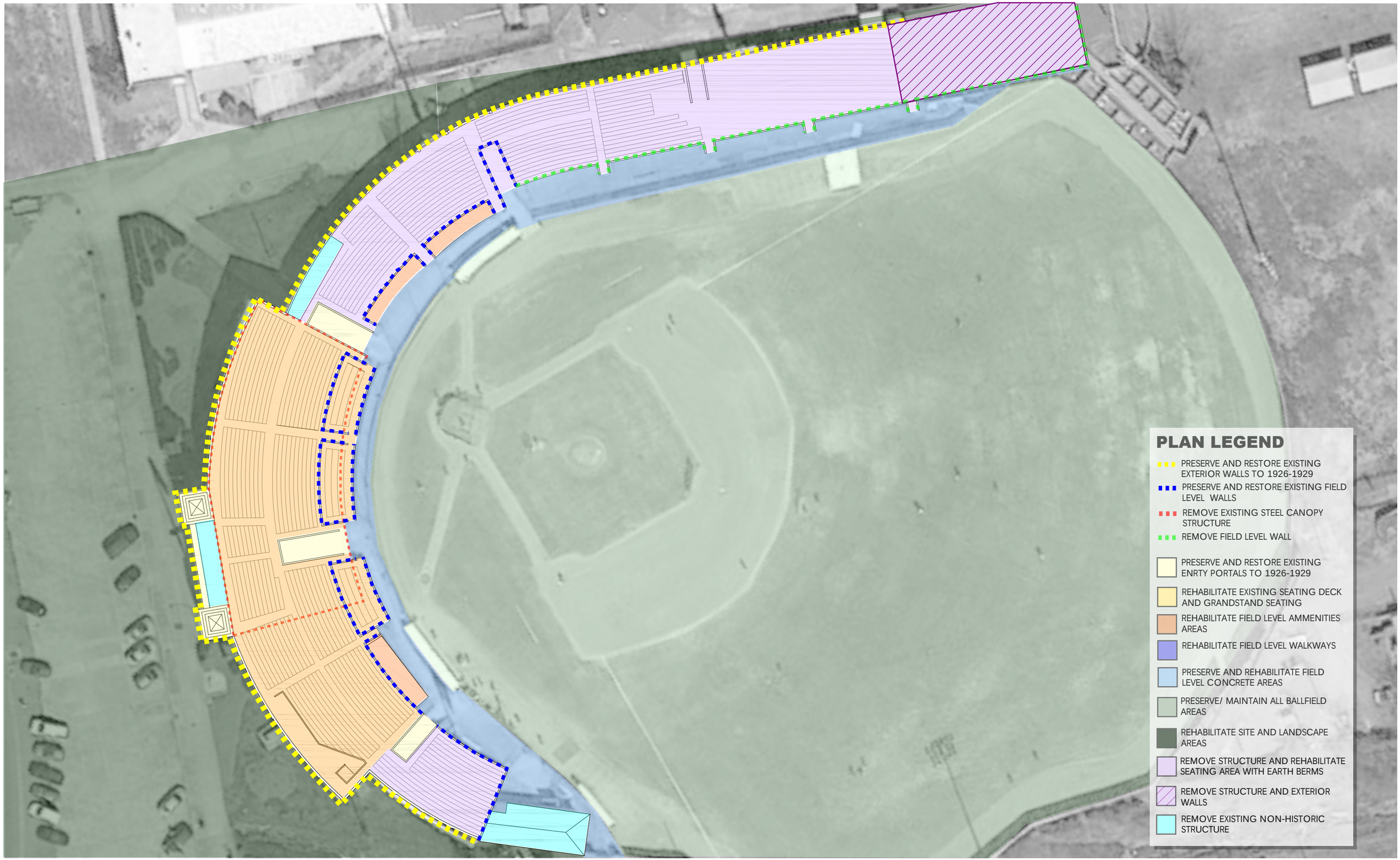
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PRESERVATION TREATMENTS PLAN
SEATING DECK AREAS

FINAL REPORT
DATE: 08.15.14
NOT FOR CONSTRUCTION
APPROXIMATE SCALE: 1" = 40'
0 10' 20' 40'

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1



WORLD WAR MEMORIAL STADIUM GREENSBORO, NC
PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

NORTH

PRESERVATION TREATMENTS PLAN
SEATING DECK

FINAL REPORT
DATE: 08.15.14
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APPROXIMATE SCALE: 1" = 40'
0 10' 20' 40'

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2



World War Memorial Stadium circa 1929

Appendix B – Conceptual Rehabilitation Drawings

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

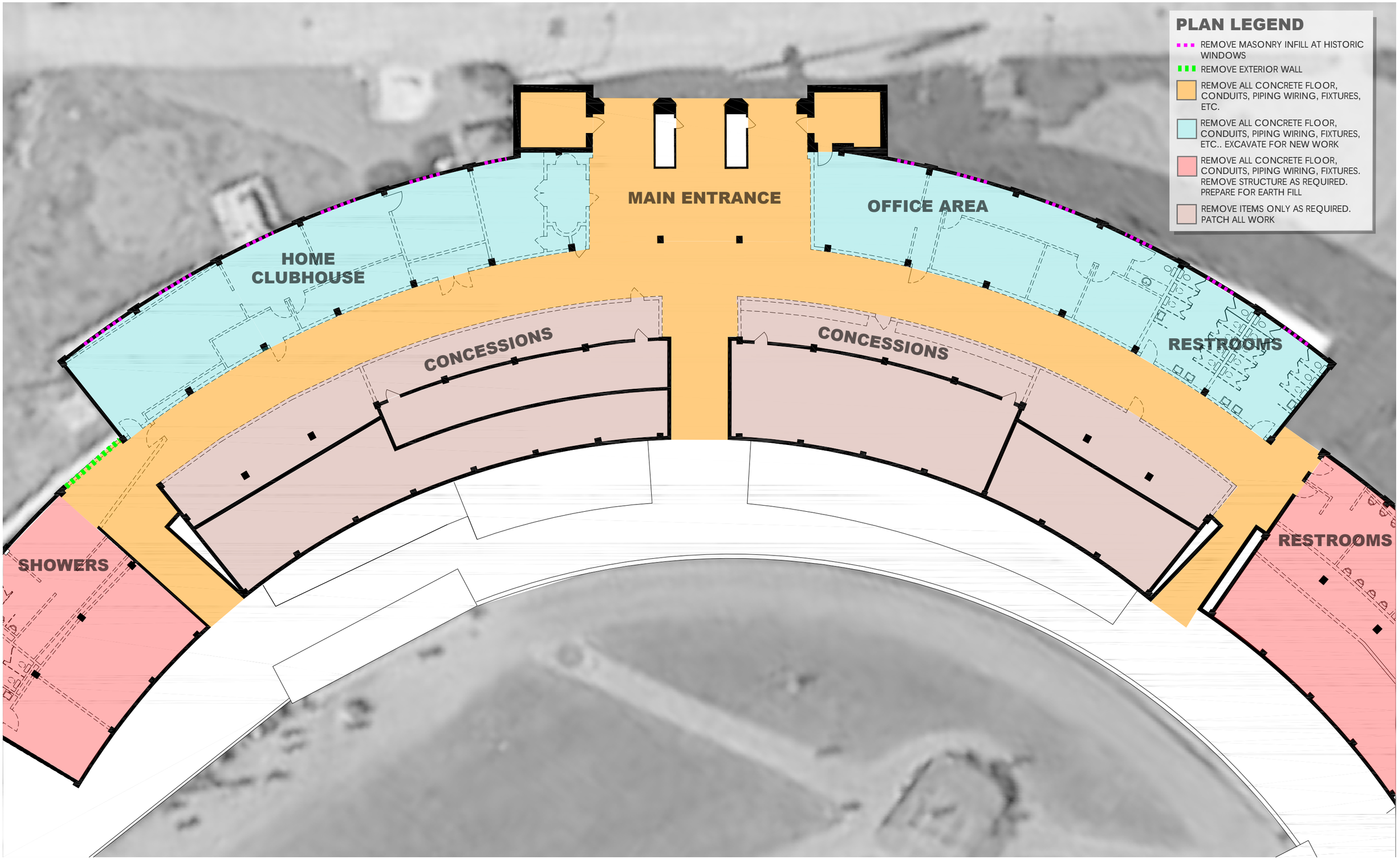
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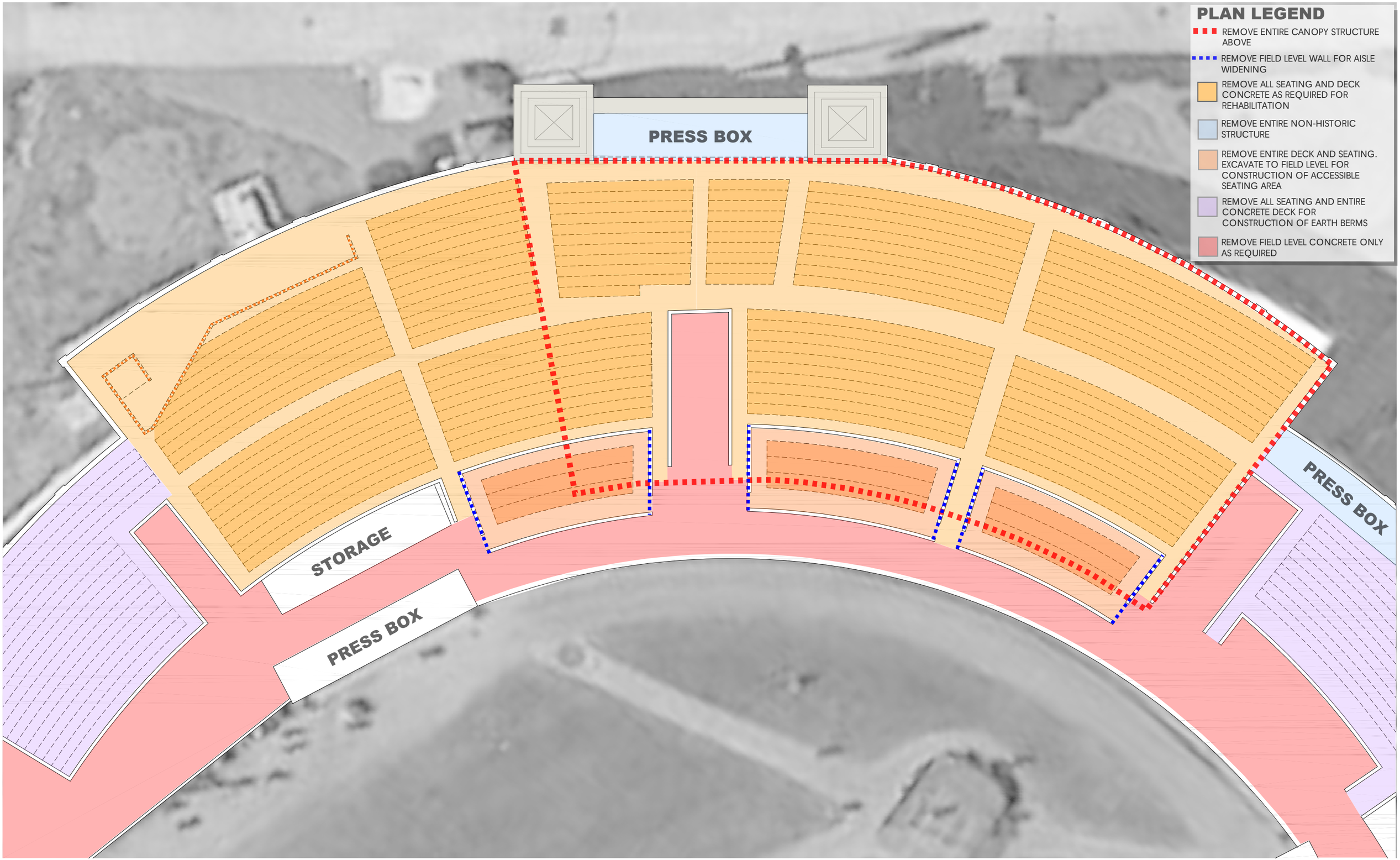
WORLD WAR MEMORIAL STADIUM GREENSBORO, NC
PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

NORTH

ENLARGED CONCEPTUAL REMOVAL PLAN
LOWER LEVEL

FINAL REPORT
DATE: 08.15.14
NOT FOR CONSTRUCTION
APPROXIMATE SCALE: 1/16"=1-0"
0 4' 8' 16'

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PLAN LEGEND

- REMOVE ENTIRE CANOPY STRUCTURE ABOVE
- REMOVE FIELD LEVEL WALL FOR AISLE WIDENING
- REMOVE ALL SEATING AND DECK CONCRETE AS REQUIRED FOR REHABILITATION
- REMOVE ENTIRE NON-HISTORIC STRUCTURE
- REMOVE ENTIRE DECK AND SEATING. EXCAVATE TO FIELD LEVEL FOR CONSTRUCTION OF ACCESSIBLE SEATING AREA
- REMOVE ALL SEATING AND ENTIRE CONCRETE DECK FOR CONSTRUCTION OF EARTH BERMS
- REMOVE FIELD LEVEL CONCRETE ONLY AS REQUIRED

WORLD WAR MEMORIAL STADIUM GREENSBORO, NC
PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

NORTH

ENLARGED CONCEPTUAL REMOVAL PLAN
SEATING DECK

FINAL REPORT
DATE: 08.15.14
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APPROXIMATE SCALE: 1/16"=1'-0"
0 4' 8' 16'

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3

PLAN LEGEND

- NEW/RESTORED WINDOW IN EXTERIOR WALL
- RESTORED EXTERIOR WALLS
- RESTORED/PRESERVED ENTRY PORTALS
- RENOVATED TEAM AND UMPIRE AREAS
- UNOCCUPIED/UNEXCAVATED AREA
- NEW GATE/RAIL

NOTE:
ALL WALLS IN CONCOURSE ARE NEW

- RESTORED ENTRY/ EXIT PORTAL AND SIDEWALK TO PARKING
- PUBLIC RESTROOMS, CONCESSIONS AND MISC.
- REHABILITATED CONCOURSES

MANAGER'S OFFICE
TRAINING
HOME CLUBHOUSE
MEMORIAL ENTRANCE
UMPIRE LOUNGE
FAMILY RESTROOM
CUST.
MEN'S
WOMEN'S RESTROOM
CONCESSIONS
NORTH CONCOURSE
VISITORS' CLUBHOUSE
TRAINING
ELEC.
SOUTH CONCOURSE
TO EXIT
SOUTH MAIN GATE
TO EXIT
EQUIPMENT
FIELD LEVEL CONCOURSE
NORTH MAIN GATE
TO EXIT
HOME DUGOUT
FUTURE CONCOURSE
TO EXIT AT LINDSAY ST.

WORLD WAR MEMORIAL STADIUM GREENSBORO, NC

PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

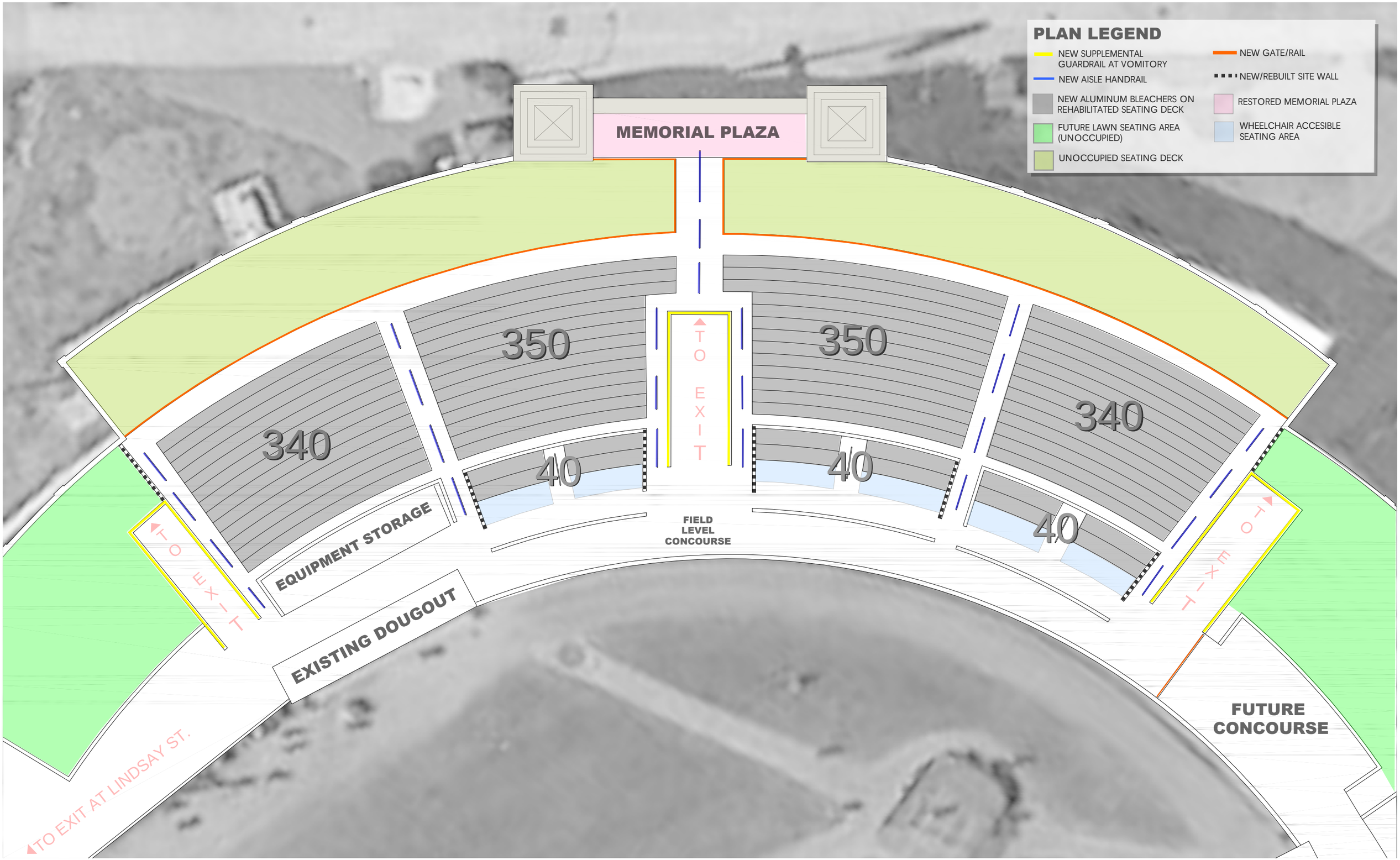
NORTH

CONCEPTUAL REHABILITATION PLAN

LOWER LEVEL

FINAL REPORT
DATE: 08.15.14
NOT FOR CONSTRUCTION
APPROXIMATE SCALE: 1/16"=1'-0"
0 4' 8' 16'

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PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

NORTH

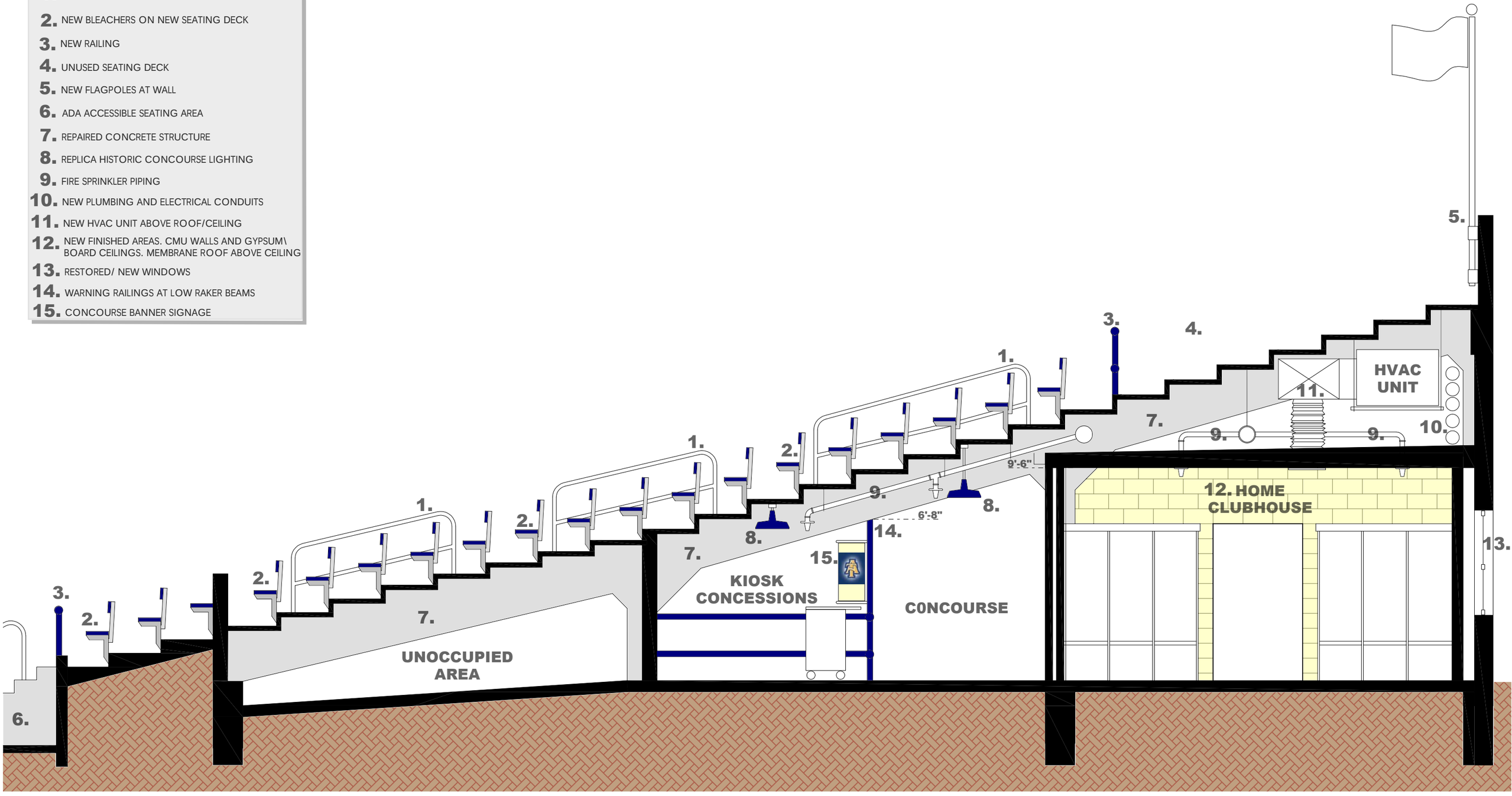
CONCEPTUAL REHABILITATION PLAN
SEATING DECK

FINAL REPORT
DATE: 08.15.14
NOT FOR CONSTRUCTION
APPROXIMATE SCALE: 1/16"=1'-0"
0 4' 8' 16'

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SECTION NOTES

1. NEW RAILING AT AISLES
2. NEW BLEACHERS ON NEW SEATING DECK
3. NEW RAILING
4. UNUSED SEATING DECK
5. NEW FLAGPOLES AT WALL
6. ADA ACCESSIBLE SEATING AREA
7. REPAIRED CONCRETE STRUCTURE
8. REPLICA HISTORIC CONCOURSE LIGHTING
9. FIRE SPRINKLER PIPING
10. NEW PLUMBING AND ELECTRICAL CONDUITS
11. NEW HVAC UNIT ABOVE ROOF/CEILING
12. NEW FINISHED AREAS. CMU WALLS AND GYPSUM\ BOARD CEILINGS. MEMBRANE ROOF ABOVE CEILING
13. RESTORED/ NEW WINDOWS
14. WARNING RAILINGS AT LOW RAKER BEAMS
15. CONCOURSE BANNER SIGNAGE



WORLD WAR MEMORIAL STADIUM GREENSBORO, NC
PRESERVATION PLAN AND FACILITY NEEDS ASSESSMENT

CONCEPTUAL REHABILITATION PLAN
SECTION THRU SEATING DECK

FINAL REPORT
DATE: 08.15.14
NOT FOR CONSTRUCTION
APPROXIMATE SCALE: 1/4"= 1'-0"
0 4' 8' 16'

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World War Memorial Stadium circa 1929

Appendix C – Conceptual Structural Repair Drawings

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

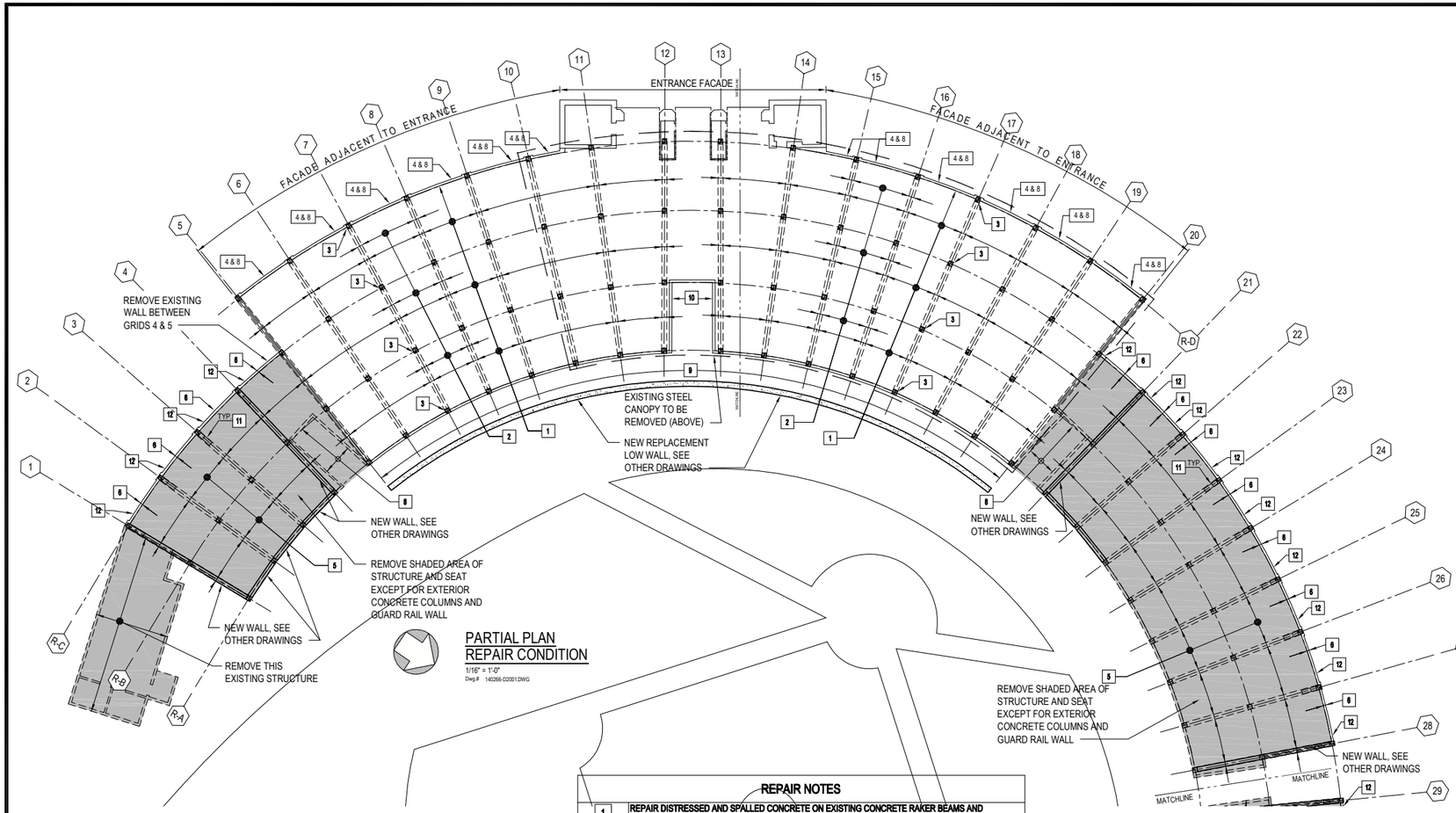
GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

SKA CONSULTING ENGINEERS, INC.

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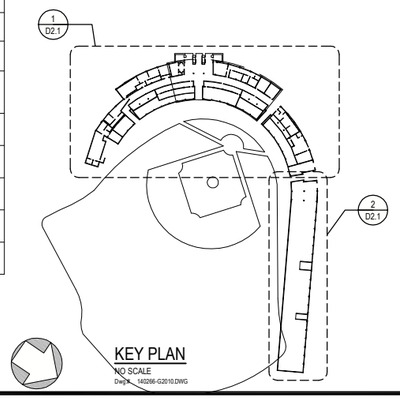
PARTIAL PLAN REPAIR CONDITION

1/16" = 1'-0"

Dwg.# 140266-D2001.DWG

REPAIR NOTES

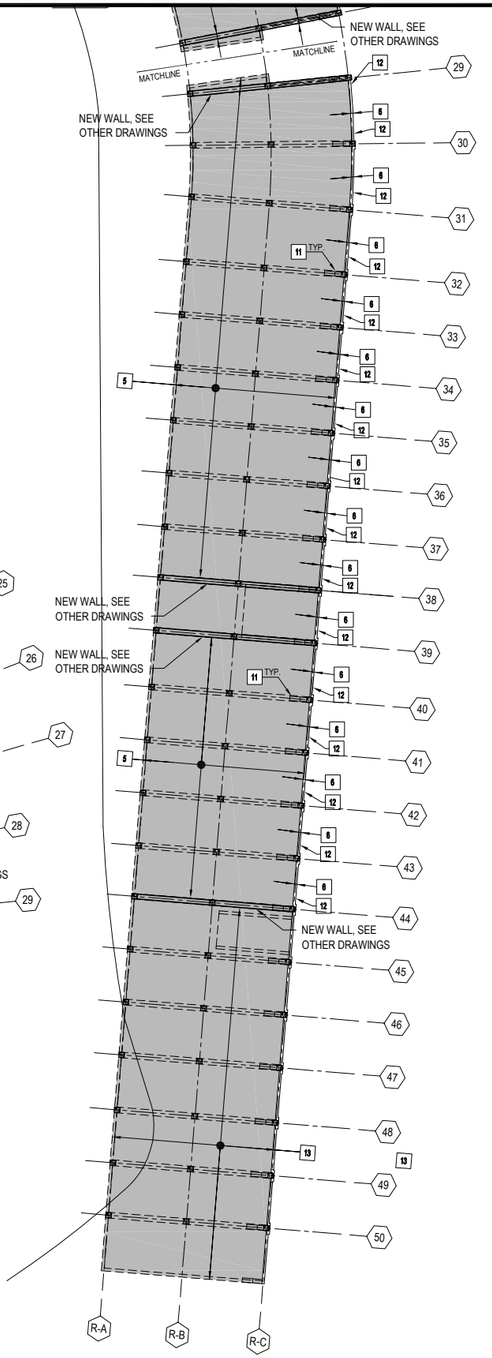
1 OPTION #1	REPAIR DISTRESSED AND SPALLED CONCRETE ON EXISTING CONCRETE RAKER BEAMS AND STRENGTHEN WITH A NEW CAST IN PLACE, REINFORCED CONCRETE ENCASEMENT BONDED TO THE CLEANED AND PREPARED SURFACES OF THE EXISTING CONCRETE RAKER BEAMS.
1 OPTION #2	REMOVE AND REPLACE EXISTING CONCRETE RAKER BEAMS WITH NEW, CAST IN PLACE OR PRECAST CONCRETE BEAMS OR NEW STRUCTURAL STEEL RAKER BEAMS.
2	SAWCUT JOINTS THROUGH THE EXISTING CONCRETE SEATING TREADS AND RISERS AT EACH FACE OF THE EXISTING CONCRETE RAKER BEAMS AND REMOVE EXISTING CAST IN PLACE CONCRETE SEATS. REPLACE WITH NEW PRECAST CONCRETE SEATING SECTIONS.
3 OPTION #1	REPAIR DISTRESSED AREAS ON EXISTING CONCRETE COLUMNS AND STRENGTHEN THE EXISTING CONCRETE COLUMNS WITH A BONDED CONCRETE ENCASEMENT AROUND THE FULL PERIMETER OF THE EXISTING CONCRETE COLUMNS.
3 OPTION #2	REMOVE AND REPLACE EXISTING CONCRETE COLUMNS WITH NEW CAST IN PLACE, REINFORCED, CONCRETE COLUMNS OR STRUCTURAL STEEL COLUMN.
4	REMOVE AND REPLACE EXISTING CONCRETE GUARDRAIL WALLS AND SPANDREL BEAMS WITH NEW, CAST IN PLACE, REINFORCED, CONCRETE SPANDREL BEAMS AND GUARDRAIL WALLS.
5	REMOVE EXISTING CONCRETE SEATING TREADS AND RISERS AND RAKER BEAMS AND COLUMNS, AND CONCRETE SLABS ON GRADE IN THIS AREA.
6	REPAIR AREAS OF DISTRESSED AND SPALLED CONCRETE ON EXISTING COLUMNS, GUARDRAIL WALLS AND SPANDREL BEAMS AND APPLY A DURABLE WATER REPELLANT COATING SYSTEM.
7	REMOVE EXISTING CONCRETE VOMITORY WALLS.
8	REMOVE AND REPLACE EXISTING MASONRY WALLS WITH A DIRECT-APPLIED STUCCO VENEER AND REPLACE WITH NEW REINFORCED, CONCRETE MASONRY BLOCK WALLS WITH A DIRECT APPLIED STUCCO VENEER.
9	REMOVE AND REPLACE EXISTING CAST IN PLACE, ON GRADE, CONCRETE SEATING TREADS AND RISERS, AND KNEE WALLS.
10	REMOVE AND REPLACE EXISTING CAST IN PLACE, REINFORCED, CONCRETE VOMITORY WALLS.
11	NEW CAST IN PLACE, REINFORCED CONCRETE COUNTERFORT WALLS MECHANICALLY ANCHORED TO BACK OF EXISTING COLUMNS.
12	REMOVE AND REPLACE EXISTING MASONRY INFILL WALLS WITH NEW REINFORCED, CONCRETE MASONRY BLOCK WALLS WITH WATER REPELLENT COATING.
13	REMOVE ALL STRUCTURE AND REPAIR GRADE AS REQUIRED.



KEY PLAN

NO SCALE

Dwg.# 140266-G2010.DWG



PARTIAL PLAN REPAIR CONDITION

1/16" = 1'-0"

Dwg.# 140266-D2001.DWG

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Project Number: 140266 File Name: 140266-X2001.rtvmod 8/15/2014 11:03 AM

Revision

Mark | Date

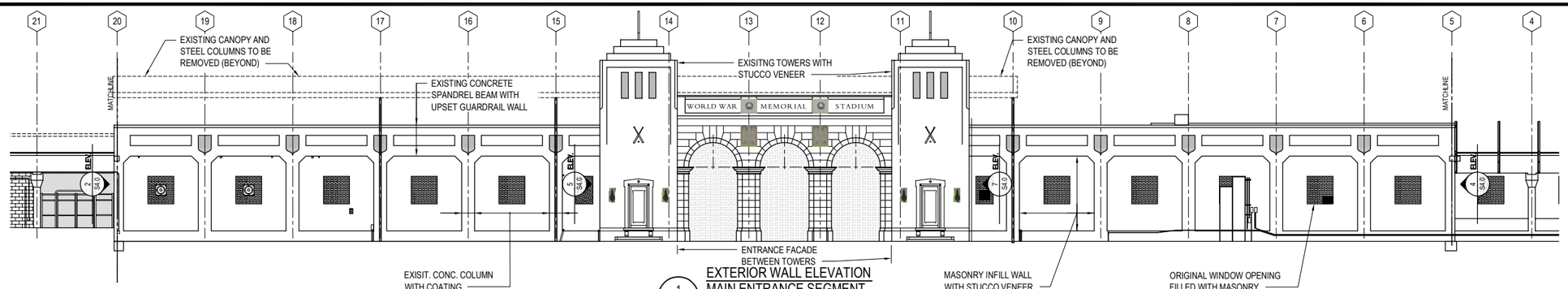
PRELIMINARY: NOT FOR CONSTRUCTION

War Memorial Stadium Study & Development
FOR
City of Greensboro, NC

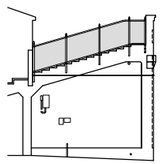
OVERALL PLAN - REPAIR CONDITION

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Drawn By: APJ
Checked By: ----
Date: __-__-__

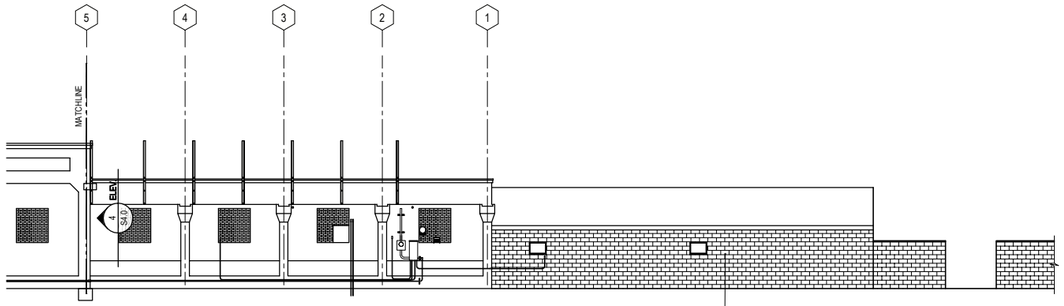
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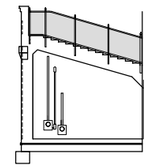
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3/32" = 1'-0"
Dwg.# 140266-S4001-A.DWG



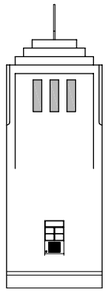
2 S4.0 EXTERIOR WALL ELEVATION NORTH SEGMENT
3/32" = 1'-0"
Dwg.# 140266-S4001.DWG



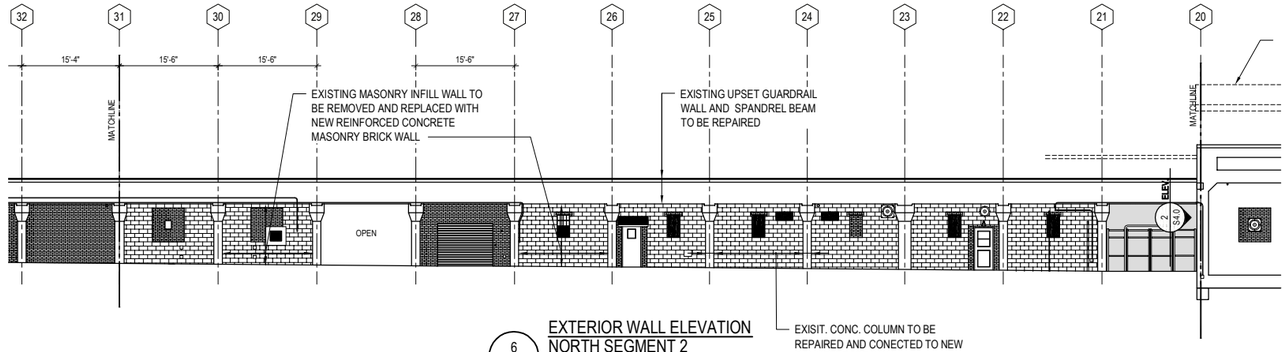
3 S4.0 EXTERIOR WALL ELEVATION SOUTH SEGMENT
3/32" = 1'-0"
Dwg.# 140266-S4001-A.DWG



2 S4.0 EXTERIOR WALL ELEVATION SOUTH SEGMENT
3/32" = 1'-0"
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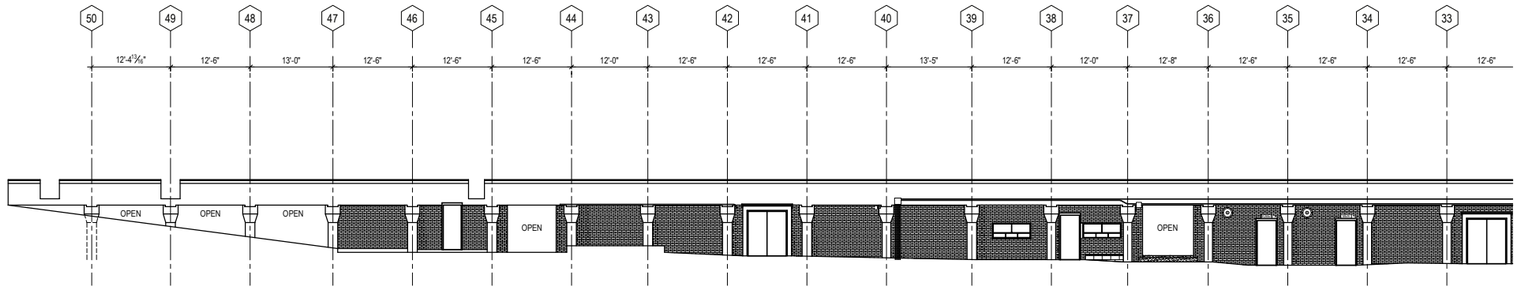


5 S4.0 NORTH TOWER NORTH WALL ELEVATION
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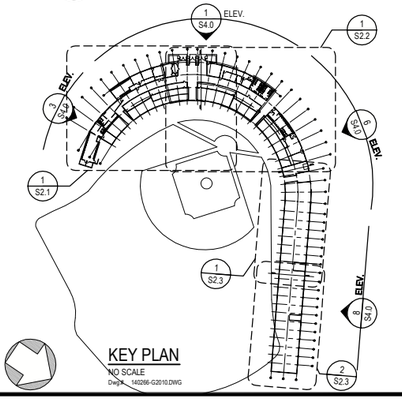


6 S4.0 EXTERIOR WALL ELEVATION NORTH SEGMENT 2
3/32" = 1'-0"
Dwg.# 140266-S4001-A.DWG

5 S4.0 SOUTH TOWER SOUTH WALL ELEVATION
3/32" = 1'-0"
Dwg.# 140266-S4001.DWG



8 S4.0 EXTERIOR WALL ELEVATION NORTH SEGMENT 1
3/32" = 1'-0"
Dwg.# 140266-S4001-A.DWG



KEY PLAN
NO SCALE
Dwg.# 140266-G2010.DWG

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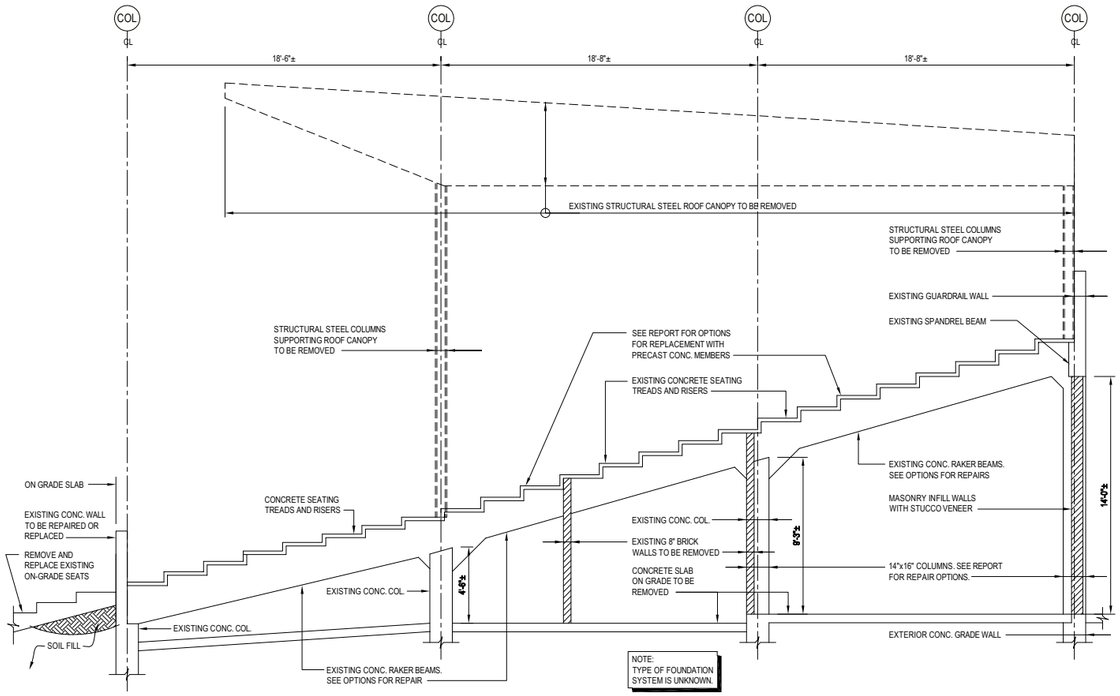
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FOR
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EXTERIOR ELEVATIONS

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Checked By:	---
Date:	---

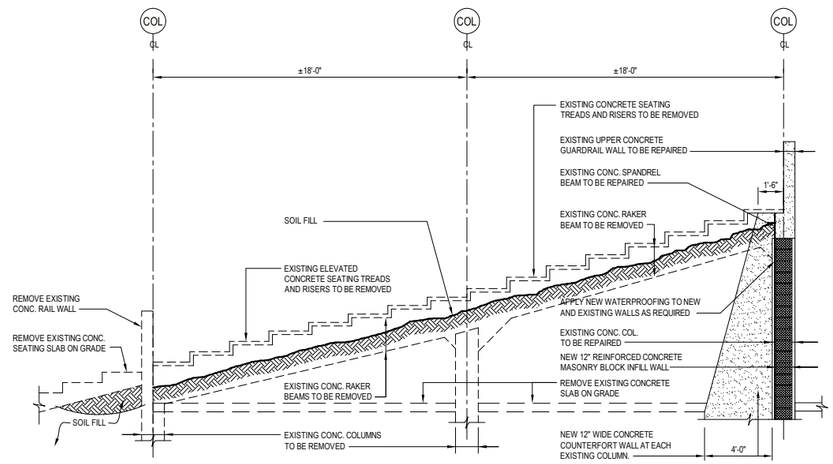
S4.0



1 S5.1 ELEVATION OF EXISTING TYPICAL RAKER BEAMS AND COLUMNS TO BE REPAIRED

1/4" = 1'-0"

Dwg.# 140266-S7001.DWG



2 S5.1 ELEVATION OF EXISTING RAKER BEAMS AND SEATING SLABS TO BE REMOVED

1/4" = 1'-0"

Dwg.# 140266-S7002.DWG

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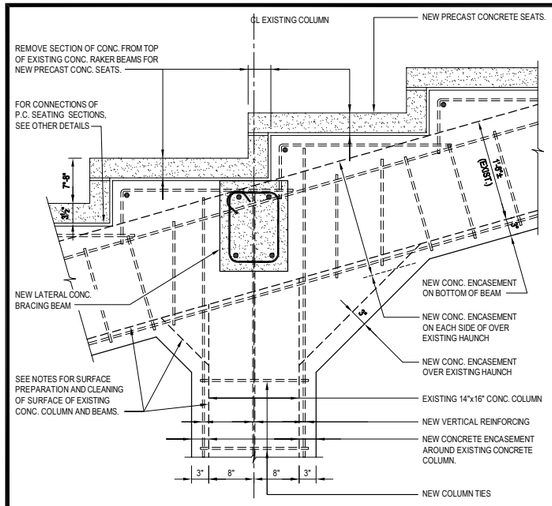
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SECTION

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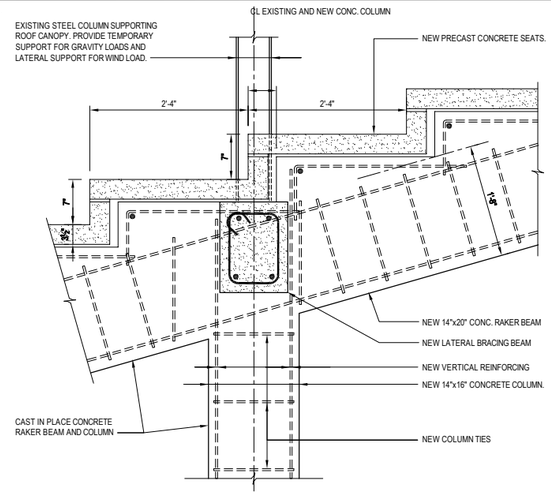
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REPAIRED EXISTING RAKER BEAM TYPICAL DETAIL - OPTION 1

1" = 1'-0"

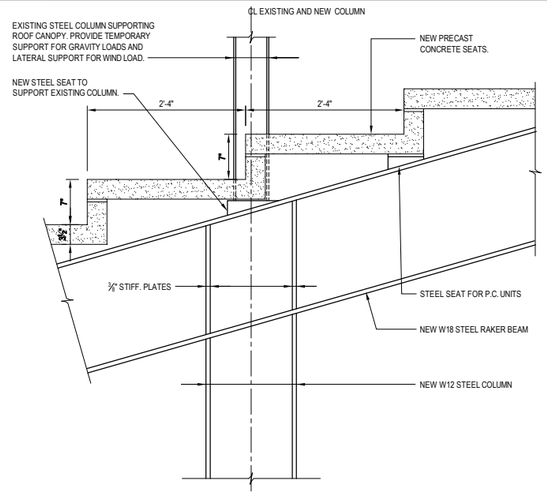
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REPLACED EXISTING RAKER BEAM TYPICAL DETAIL - OPTION 2

1" = 1'-0"

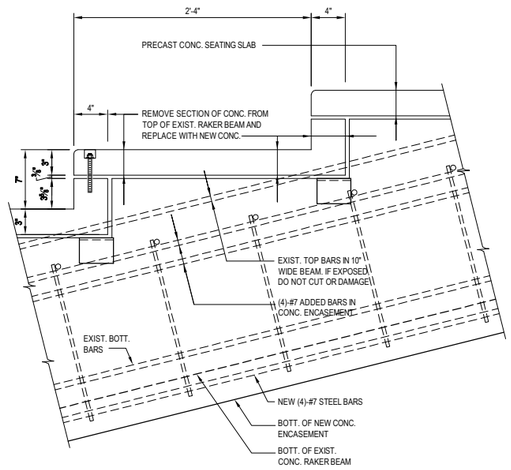
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REPLACED EXISTING RAKER BEAM TYPICAL DETAIL - OPTION 3

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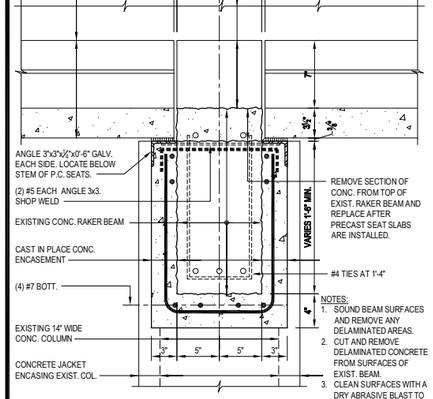
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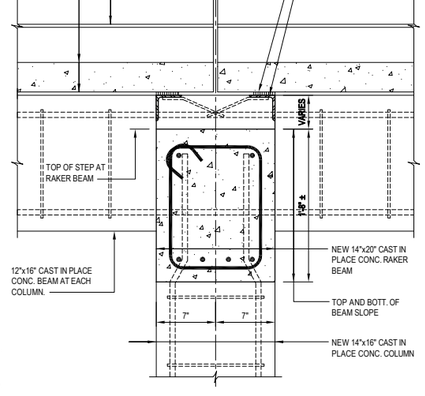
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SECTION THROUGH RAKER BEAM - OPTION 1

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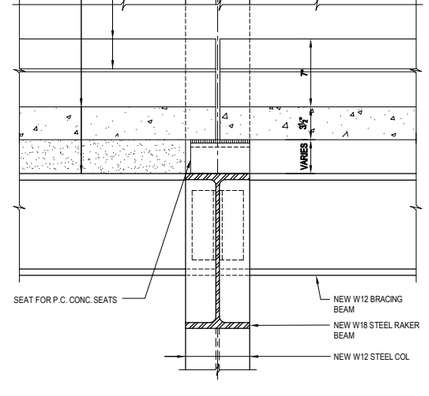
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SECTION THROUGH RAKER BEAM - OPTION 2

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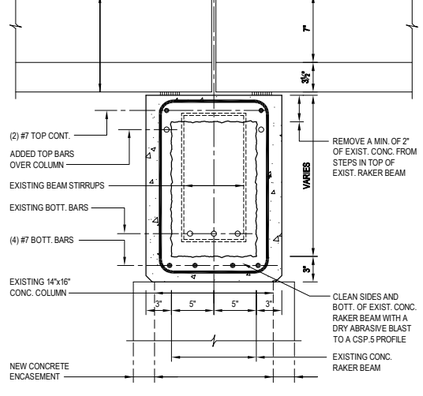
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SECTION THROUGH RAKER BEAM - OPTION 3

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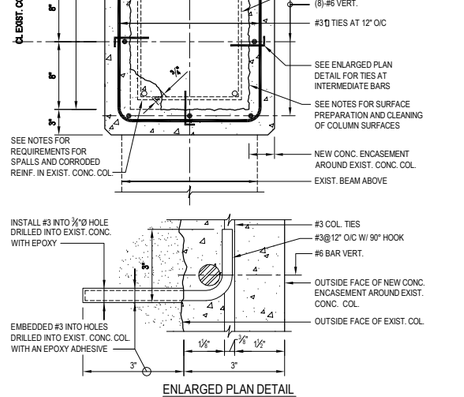
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SECTION THROUGH RAKER BEAM

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PLAN DETAIL THROUGH COLUMN

1 1/2" = 1'-0"

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ENLARGED PLAN DETAIL

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PRELIMINARY: NOT FOR CONSTRUCTION

War Memorial Stadium Study & Development
FOR:
City of Greensboro, NC

DETAILS

Designed By: ---
Drawn By: RRJ
Checked By: ---
Date: --/--/--

S6.1



World War Memorial Stadium circa 1929

Appendix D – The Preservation and Repair of Historic Stucco

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

GREENSBORO PARKS AND RECREATION

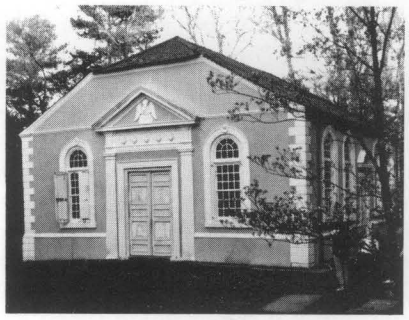
The City of Greensboro, North Carolina

August 2014

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22 PRESERVATION BRIEFS



The Preservation and Repair of Historic Stucco

Anne Grimmer

U.S. Department of the Interior
National Park Service
Preservation Assistance Division

The term "stucco" is used here to describe a type of exterior plaster applied as a two-or-three part coating directly onto masonry, or applied over wood or metal lath to a log or wood frame structure. Stucco is found in many forms on historic structures throughout the United States. It is so common, in fact, that it frequently goes unnoticed, and is often disguised or used to imitate another material. Historic stucco is also sometimes incorrectly viewed as a sacrificial coating, and consequently removed to reveal stone, brick or logs that historically were never intended to be exposed. Age and lack of maintenance hasten the deterioration of many historic stucco buildings. Like most historic building materials, stucco is at the mercy of the elements, and even though it is a protective coating, it is particularly susceptible to water damage.

Stucco is a material of deceptive simplicity: in most cases its repair should not be undertaken by a property owner unfamiliar with the art of plastering. Successful stucco repair requires the skill and experience of a professional plasterer. Therefore, this Brief has been prepared to provide background information on the nature and components of traditional stucco, as well as offer guidance on proper maintenance and repairs. The Brief will outline the requirements for stucco repair, and, when necessary, replacement. Although several stucco mixes representative of different periods are provided here for reference, this Brief does not include specifications for carrying out repair projects. Each project is unique, with its own set of problems that require individual solutions.

Historical Background

Stucco has been used since ancient times. Still widely used throughout the world, it is one of the most common of traditional building materials (Fig. 1). Up until

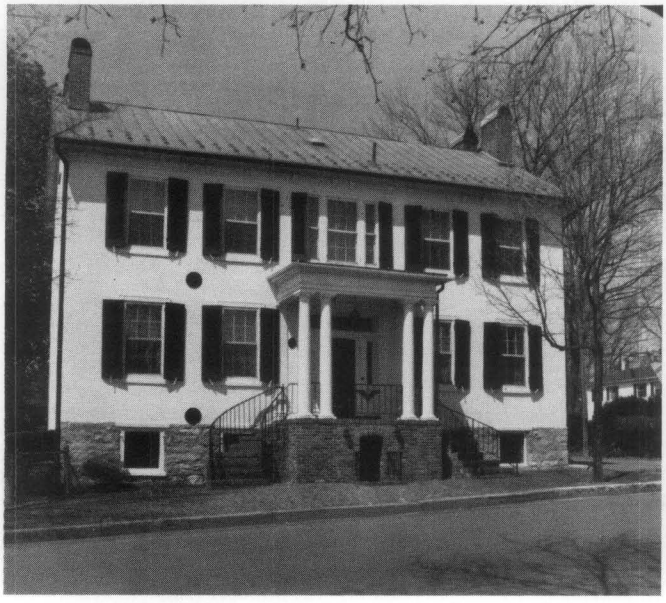




Fig. 1. These two houses in a residential section of Winchester, Virginia, illustrate the continuing popularity of stucco (a) from this early 19th century, Federal style house on the left, (b) to the English Cotswold style cottage that was built across the street in the 1930's. Photos: Anne Grimmer.

the late 1800's, stucco, like mortar, was primarily lime-based, but the popularization of portland cement changed the composition of stucco, as well as mortar, to a harder material. Historically, the term "plaster" has often been interchangeable with "stucco"; the term is still favored by many, particularly when referring to the traditional lime-based coating. By the nineteenth century "stucco," although originally denoting fine interior ornamental plasterwork, had gained wide acceptance in the United States to describe exterior plastering. "Render" and "rendering" are also terms used to describe stucco, especially in Great Britain. Other historic treatments and coatings related to stucco in that they consist at least in part of a similarly plastic or malleable material include: parging and pargeting, wattle and daub, "cob" or chalk mud, pisé de terre, rammed earth, briqueté entre poteaux or bousillage, half-timbering, and adobe. All of these are regional variations on traditional mixtures of mud, clay, lime, chalk, cement, gravel or straw. Many are still used today.

The Stucco Tradition in the United States

Stucco is primarily used on residential buildings and relatively small-scale commercial structures. Some of the earliest stucco buildings in the United States include examples of the Federal, Greek and Gothic Revival styles of the eighteenth and the nineteenth centuries that emulated European architectural fashions. Benjamin Henry Latrobe, appointed by Thomas Jefferson as Surveyor of Public Buildings of the United States in 1803, was responsible for the design of a number of important stucco buildings, including St. John's Church (1816), in Washington, D.C. (Fig. 2). Nearly half a century later Andrew Jackson Downing also advocated the use of stucco in his influential book *The Architecture of Country Houses,* published in 1850. In Downing's opinion, stucco was superior in many respects to plain brick or stone because it was cheaper, warmer and dryer, and could be "agreeably" tinted. As a result of his advice, stuccoed Italianate style urban and suburban villas proliferated in many parts of the country during the third quarter of the nineteenth century.

Revival Styles Promote Use of Stucco

The introduction of the many revival styles of architecture around the turn of the twentieth century, combined with the improvement and increased availability of portland cement resulted in a "craze" for stucco as a building material in the United States. Beginning about 1890 and gaining momentum into the 1930's and 1940's, stucco was associated with certain historic architectural styles, including: Prairie; Art Deco, and Art Moderne; Spanish Colonial, Mission, Pueblo, Mediterranean, English Cotswold Cottage, and Tudor Revival styles; as well as the ubiquitous bungalow and "four-square" house (Fig. 3). The fad for Spanish Colonial Revival, and other variations on this theme, was especially important in furthering stucco as a building material in the United States during this period, since stucco clearly looked like adobe (Fig. 4).

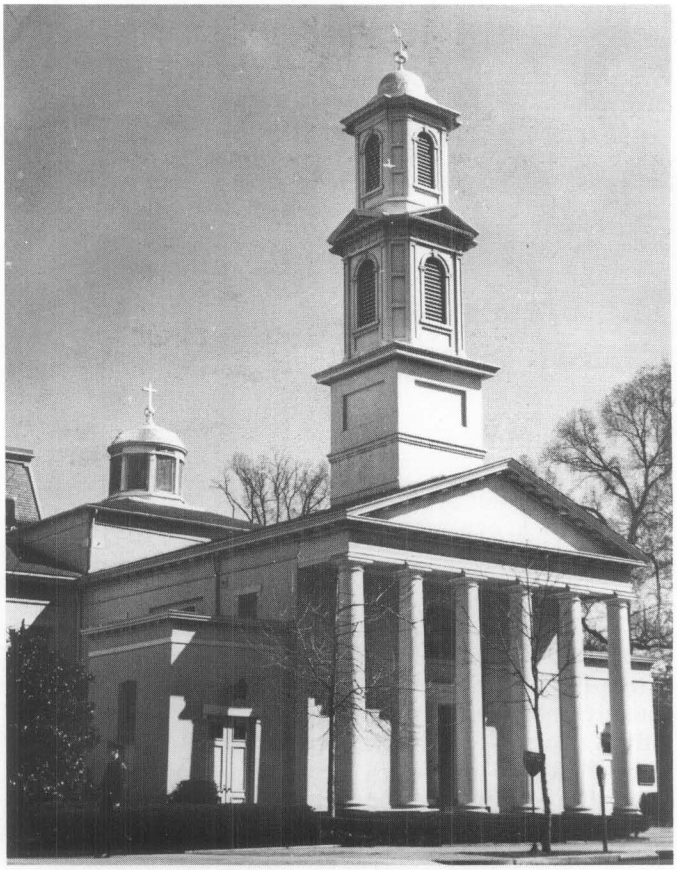


Fig. 2. St. John's Church, Washington, D.C., constructed of brick and stuccoed immediately upon completion in 1816, reflects the influence of European, and specifically English, architectural styles. Photo: Russell Jones, HABS Collection.

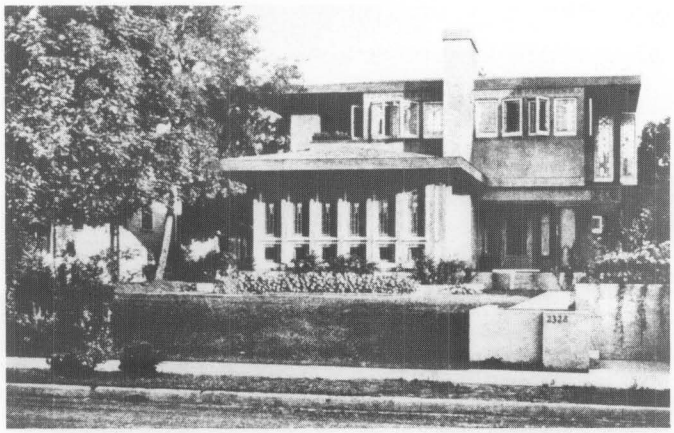


Fig. 3. The William Gray and Edna S. Purcell House, Minneapolis, Minnesota, was designed in 1913 by the architects Purcell and Elmslie in the Prairie style. Stuccoed in a salmon-pink, sand (float) finish, it is unusual in that it featured a 3-color geometric frieze stencilled below the eaves of the 2nd story. The Minneapolis Institute of Art has removed the cream-colored paint added at a later date, and restored the original color and texture of the stucco. Photo: Courtesy MacDonald and Mack Partnership.

Although stucco buildings were especially prevalent in California, the Southwest and Florida, ostensibly because of their Spanish heritage, this period also spawned stucco-coated, revival-style buildings all over the United States and Canada. The popularity of stucco as a cheap, and readily available material meant that by the 1920's, it was used for an increasing variety of building types. Resort hotels, apartment buildings, private mansions and movie theaters, railroad stations, and even gas stations and tourist courts took advantage of the "romance" of period styles, and adopted the stucco construction that had become synonymous with these styles (Fig. 5).



Fig. 4. The elaborate Spanish Colonial Revival style of this building designed by Bertram Goodhue for the 1915 Panama California Exposition held in San Diego's Balboa Park emphasizes the sculptural possibilities of stucco. Photo: C.W. Snell, National Historic Landmark Files.

A Practical Building Material

Stucco has traditionally been popular for a variety of reasons. It was an inexpensive material that could simulate finely dressed stonework, especially when "scored" or "lined" in the European tradition. A stucco coating over a less finished and less costly substrate such as rubblestone, fieldstone, brick, log or wood frame, gave the building the appearance of being a more expensive and important structure. As a weather-repellent coating, stucco protected the building from wind and rain penetration, and also offered a certain amount of fire protection. While stucco was usually applied during construction as part of the building design, particularly over rubblestone or fieldstone, in some instances it was added later to protect the structure, or when a rise in the owner's social status demanded a comparable rise in his standard of living.

Composition of Historic Stucco

Before the mid-to-late nineteenth century, stucco consisted primarily of hydrated or slaked lime, water and sand, with straw or animal hair included as a binder. Natural cements were frequently used in stucco mixes after their discovery in the United States during the 1820's. Portland cement was first manufactured in the United States in 1871, and it gradually replaced natural cement. After about 1900, most stucco was composed primarily of portland cement, mixed with some lime. With the addition of portland cement, stucco became even more versatile and durable. No longer used just as a coating for a substantial material like masonry or log, stucco could now be applied over wood or metal lath attached to a light wood frame. With this increased strength, stucco ceased to be just a veneer and became a more integral part of the building structure.

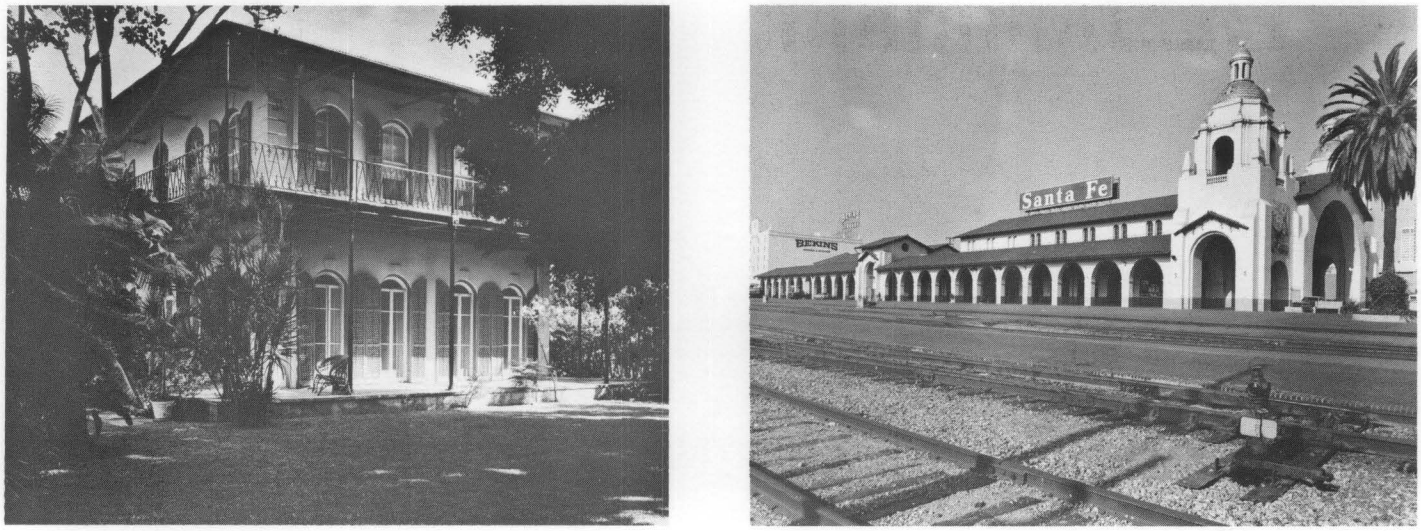


Fig. 5. During the 19th and 20th centuries stucco has been a popular material not only for residential, but also for commercial buildings in the Spanish style. Two such examples are (a) the 1851 Ernest Hemingway House, Key West, Florida, built of stuccoed limestone in a Spanish Caribbean style; and (b) the Santa Fe Depot (Union Station), San Diego, California, designed by the architects Bakewell and Brown in 1914 in a Spanish Colonial Revival style, and constructed of stucco over brick and hollow tile. Photos: (a) J.F. Brooks, HABS Collection, (b) Marvin Rand, HABS Collection.

Today, gypsum, which is hydrated calcium sulfate or sulfate of lime, has to a great extent replaced lime. Gypsum is preferred because it hardens faster and has less shrinkage than lime. Lime is generally used only in the finish coat in contemporary stucco work.

The composition of stucco depended on local custom and available materials. Stucco often contained substantial amounts of mud or clay, marble or brick dust, or even sawdust, and an array of additives ranging from animal blood or urine, to eggs, keratin or gluesize (animal hooves and horns), varnish, wheat paste, sugar, salt, sodium silicate, alum, tallow, linseed oil, beeswax, and wine, beer, or rye whiskey. Waxes, fats and oils were included to introduce water-repellent properties, sugary materials reduced the amount of water needed and slowed down the setting time, and alcohol acted as an air entrainer. All of these additives contributed to the strength and durability of the stucco.

The appearance of much stucco was determined by the color of the sand—or sometimes burnt clay, used in the mix, but often stucco was also tinted with natural pigments, or the surface whitewashed or colorwashed after stuccoing was completed. Brick dust could provide color, and other coloring materials that were not affected by lime, mostly mineral pigments, could be added to the mix for the final finish coat. Stucco was also marbled or marbleized—stained to look like stone by diluting oil of vitriol (sulfuric acid) with water, and mixing this with a yellow ochre, or another color (Fig. 6). As the twentieth century progressed, manufactured or synthetic pigments were added at the factory to some prepared stucco mixes.

Methods of Application

Stucco is applied directly, without lath, to masonry substrates such as brick, stone, concrete or hollow tile (Fig. 7). But on wood structures, stucco, like its interior counterpart plaster, must be applied over lath in order to obtain an adequate key to hold the stucco. Thus, when applied over a log structure, stucco is laid on horizontal wood lath that has been nailed on vertical wood furring strips attached to the logs (Fig. 8). If it is applied over a wood frame structure, stucco may be applied to wood or metal lath nailed directly to the wood frame; it may also be placed on lath that has been attached to furring strips. The furring strips are themselves laid over building paper covering the wood sheathing (Fig. 9). Wood lath was gradually superseded by expanded metal lath introduced in the late-nineteenth and early-twentieth century. When stuccoing over a stone or brick substrate, it was customary to cut back or rake out the mortar joints if they were not already recessed by natural weathering or

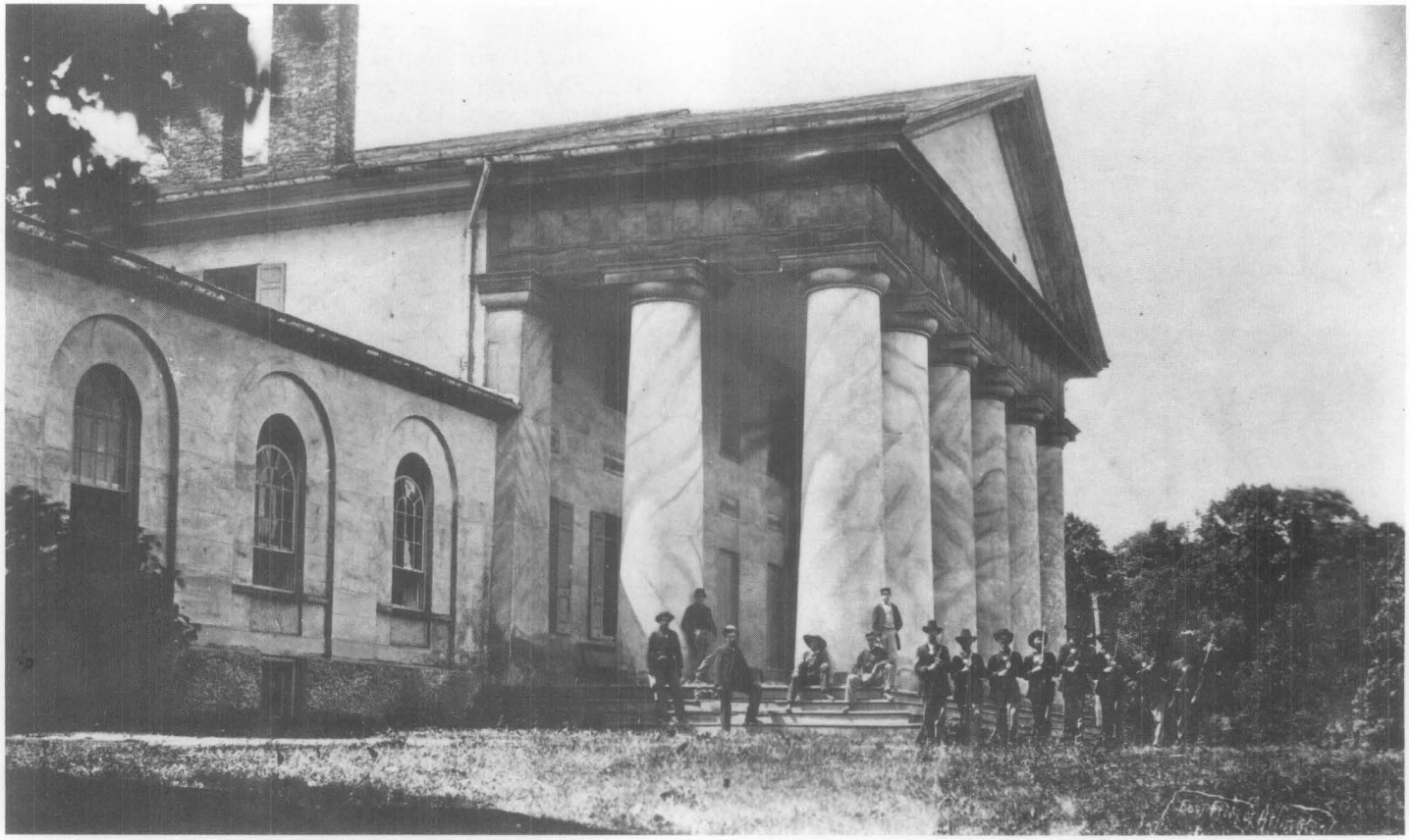


Fig. 6. Arlington House, Arlington, Virginia, was built between 1802–1818 of brick covered with stucco. It was designed by George Hadfield for George Washington Parke Custis, grandson of Martha Washington, and was later the home of Robert E. Lee. This photograph taken on June 28, 1864, by Captain Andrew J. Russell, a U.S. Signal Corps photographer, shows the stucco after it had been marbleized during the 1850's. Yellow ochre and burnt umber pigments were combined to imitate Sienna marble, and the stucco, with the exception of the roughcast foundation, was scored to heighten the illusion of stone. Photo: National Archives, Arlington House Collection, National Park Service.



Fig. 7. Patches of stucco have fallen off this derelict 19th century structure exposing the rough-cut local stone substrate. The missing wood entablature on the side and the rough wood lintel now exposed above a second-floor window, offer clues that the building was stuccoed originally. Photo: National Park Service Files.



Fig. 8. Removal of deteriorated stucco in preparation for stucco repair on this late-18th century log house in Middleway, West Virginia, reveals that the stucco was applied to hand-riven wood lath nailed over vertical wood strips attached to the logs. Photo: Anne Grimmer.

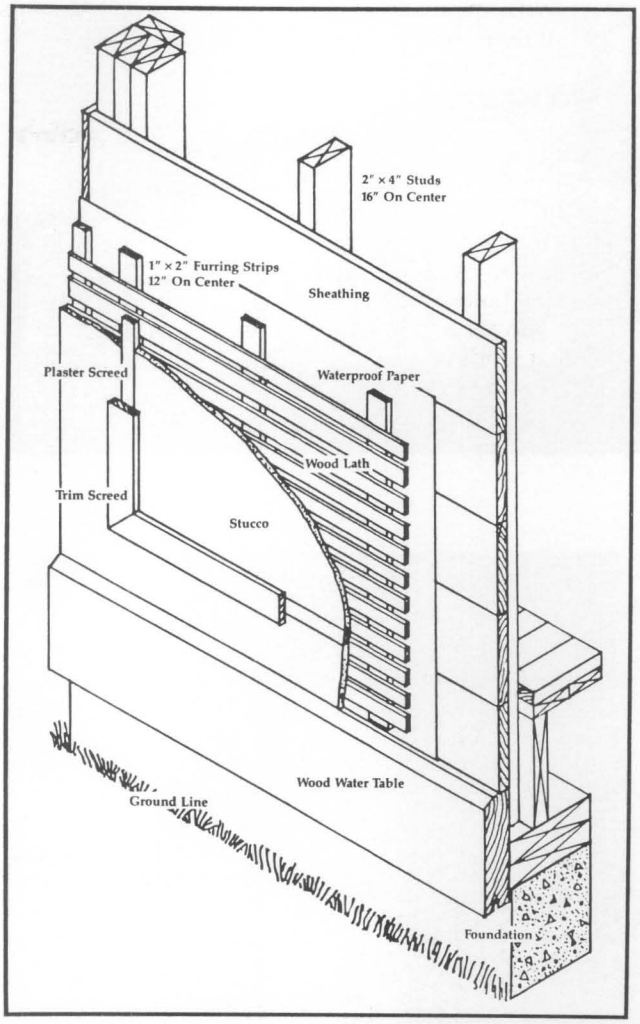


Fig. 9. This cutaway drawing shows the method of attachment for stucco commonly used on wood frame or balloon frame structures from the late-19th to the 20th century. Drawing: Brian Conway, "Illinois Preservation Series Number 2: Stucco."

erosion, and sometimes the bricks themselves were gouged to provide a key for the stucco. This helped provide the necessary bond for the stucco to remain attached to the masonry, much like the key provided by wood or metal lath on frame buildings.

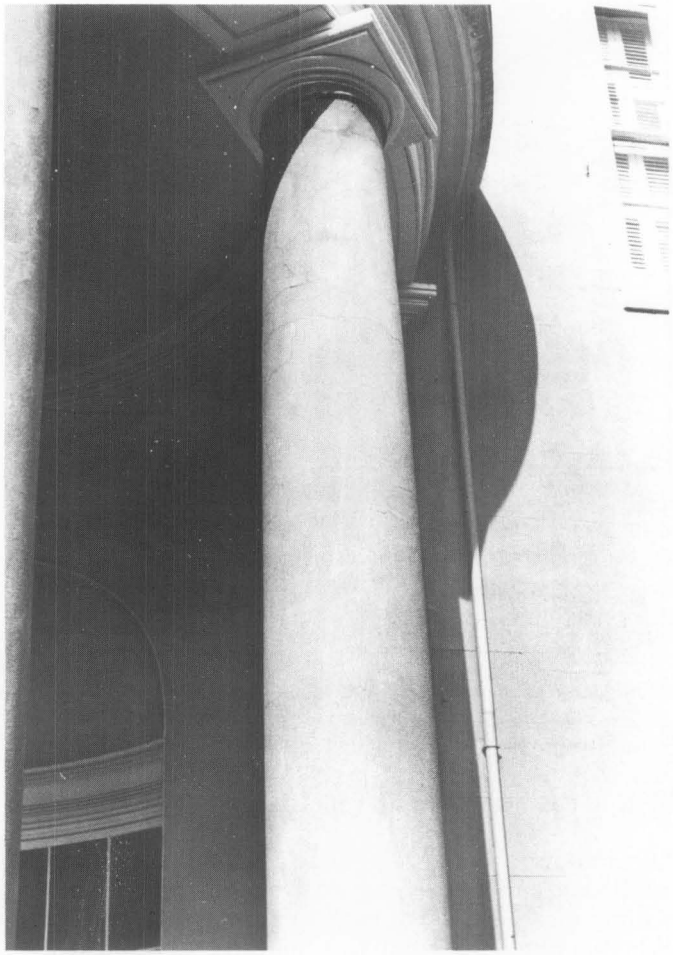
Like interior wall plaster, stucco has traditionally been applied as a multiple-layer process, sometimes consisting of two coats, but more commonly as three. Whether applied directly to a masonry substrate or onto wood or metal lath, this consists of a first "scratch" or "pricking-up" coat, followed by a second scratch coat, sometimes referred to as a "floating" or "brown" coat, followed finally by the "finishing" coat. Up until the late-nineteenth century, the first and the second coats were of much the same composition, generally consisting of lime, or natural cement, sand, perhaps clay, and one or more of the additives previously mentioned. Straw or animal hair was usually added to the first coat as a binder. The third, or finishing coat, consisted primarily of a very fine mesh grade of lime and sand, and sometimes pigment. As already noted, after the 1820's, natural cement was also a common ingredient in stucco until it was replaced by portland cement.



A



B



C



D

Fig. 10. (a) Tudor Place, Washington, D.C. (1805–1816), was designed by Dr. William Thornton. Like its contemporary, Arlington House, it is stuccoed and scored, with a roughcast base, but here the stucco is a monochromatic sandstone color tinted by sand and mineral pigments (b). Although the original stucco was replaced in the early-20th century with a portland cement-based stucco, the family, who retained ownership until 1984 when the house was opened to the public, left explicit instructions for future stucco repairs. The mix recommended for repairing hairline cracks (c), consists of sharp sand, cement and lime, burnt umber, burnt sienna, and a small amount of raw sienna. Preparation of numerous test samples, the size of "a thick griddle cake," will be necessary to match the stucco color, and when the exact color has been achieved, the mixture is to be diluted to the "consistency of cream," brushed on the wall and rubbed into the cracks with a rubber sponge or float. Note the dark color visible under the eaves intended to replicate the stronger color of the original limewashed stucco (d). Photos: Anne Grimmer.

Both masonry and wood lath must be kept wet or damp to ensure a good bond with the stucco. Wetting these materials helps to prevent them from pulling moisture out of the stucco too rapidly, which results in cracking, loss of bond, and generally poor quality stuccowork.

Traditional Stucco Finishes

Until the early-twentieth century when a variety of novelty finishes or textures were introduced, the last coat of stucco was commonly given a smooth, troweled finish, and then scored or lined in imitation of ashlar. The illusion of masonry joints was sometimes enhanced by a thin line of white lime putty, graphite, or some other pigment. Some nineteenth century buildings feature a water table or raised foundation of rough-cast stucco that differentiates it from the stucco surface above, which is smooth and scored (Fig. 10). Other novelty or textured finishes associated with the "period" or revival styles of the early-twentieth century include: the English cottage finish, adobe and Spanish, pebble-dashed or dry-dash surface, fan and sponge texture, reticulated and vermiculated, roughcast (or wet dash), and sgraffito (Fig. 11).

Repairing Deteriorated Stucco

Regular Maintenance

Although A. J. Downing alluded to stuccoed houses in Pennsylvania that had survived for over a century in relatively good condition, historic stucco is inherently not a particularly permanent or long-lasting building material. Regular maintenance is required to keep it in good condition. Unfortunately, many older or historic buildings are not always accorded this kind of care.

Because building owners knew stucco to be a protective, but also somewhat fragile coating, they employed a variety of means to prolong its usefulness. The most common treatment was to whitewash stucco, often annually. The lime in the whitewash offered protection and stability and helped to harden the stucco. Most importantly, it filled hairline cracks before they could develop into larger cracks and let in moisture. To improve water repellency, stucco buildings were also sometimes coated with paraffin, another type of wax, or other stucco-like coatings, such as oil mastics.

Assessing Damage

Most stucco deterioration is the result of water infiltration into the building structure, either through the roof, around chimneys, window and door openings, or excessive ground water or moisture penetrating through, or splashing up from the foundation. Potential causes of deterioration include: ground settlement, lintel and door frame settlement, inadequate or leaking gutters and downspouts, intrusive vegetation, moisture migration within walls due to interior condensation and humidity, vapor drive problems caused by furnace, bathroom and kitchen vents, and rising damp resulting from excessive ground water and poor drainage around the foundation. Water infiltration will cause wood lath to rot, and metal lath and nails to rust, which eventually will cause stucco to lose its bond and pull away from its substrate.



Fig. 11. The Hotel Washington, Washington, D.C. (1916–1917), is notable for its decorative ***sgraffito*** *surfaces. Stucco panels under the cornice and around the windows feature classical designs created by artists who incised the patterns in the outer layer of red-colored stucco while still soft, thereby exposing a stucco undercoat of a contrasting color. Photo: Kaye Ellen Simonson.*

After the cause of deterioration has been identified, any necessary repairs to the building should be made first before repairing the stucco. Such work is likely to include repairs designed to keep excessive water away from the stucco, such as roof, gutter, downspout and flashing repairs, improving drainage, and redirecting rainwater runoff and splash-back away from the building. Horizontal areas such as the tops of parapet walls or chimneys are particularly vulnerable to water infiltration, and may require modifications to their original design, such as the addition of flashing to correct the problem.

Previous repairs inexpertly carried out may have caused additional deterioration, particularly if executed in portland cement, which tends to be very rigid, and therefore incompatible with early, mostly soft lime-based stucco that is more "flexible." Incompatible

repairs, external vibration caused by traffic or construction, or building settlement can also result in cracks which permit the entrance of water and cause the stucco to fail (Fig. 12).

Before beginning any stucco repair, an assessment of the stucco should be undertaken to determine the extent of the damage, and how much must be replaced or repaired. Testing should be carried out systematically on all elevations of the building to determine the overall condition of the stucco. Some areas in need of repair will be clearly evidenced by missing sections of stucco or stucco layers. Bulging or cracked areas are obvious places to begin. Unsound, punky or soft areas that have lost their key will echo with a hollow sound when tapped gently with a wooden or acrylic hammer or mallet.

Identifying the Stucco Type

Analysis of the historic stucco will provide useful information on its primary ingredients and their proportions, and will help to ensure that the new replacement stucco will duplicate the old in strength, composition, color and texture as closely as possible. However, unless authentic, period restoration is required, it may not be worthwhile, nor in many instances possible, to attempt to duplicate *all* of the ingredients (particularly some of the additives), in creating the new stucco mortar. Some items are no longer available, and others, notably sand and lime—the major components of traditional stucco—have changed radically over time. For example, most sand used in contemporary masonry work is manufactured sand, because river sand, which was used historically, is difficult to obtain today in many parts of the country. The physical and visual qualities of manufactured sand versus river sand, are quite different, and this affects the way stucco works, as well as the way it looks. The same is true of lime, which is frequently replaced by gypsum in modern stucco mixes. And even if identification of all the items in the historic stucco mix were possible, the analysis would still not reveal how the original stucco was mixed and applied.

There are, however, simple tests that can be carried out on a small piece of stucco to determine its basic make-up. A dilute solution of hydrochloric (muriatic) acid will dissolve lime-based stucco, but not portland cement. Although the use of portland cement became common after 1900, there are no precise cut-off dates, as stuccoing practices varied among individual plasterers, and from region to region. Some plasterers began using portland cement in the 1880's, but others may have continued to favor lime stucco well into the early-twentieth century. While it is safe to assume that a late-eighteenth or early-nineteenth century stucco is lime-based, late-nineteenth or early-twentieth century



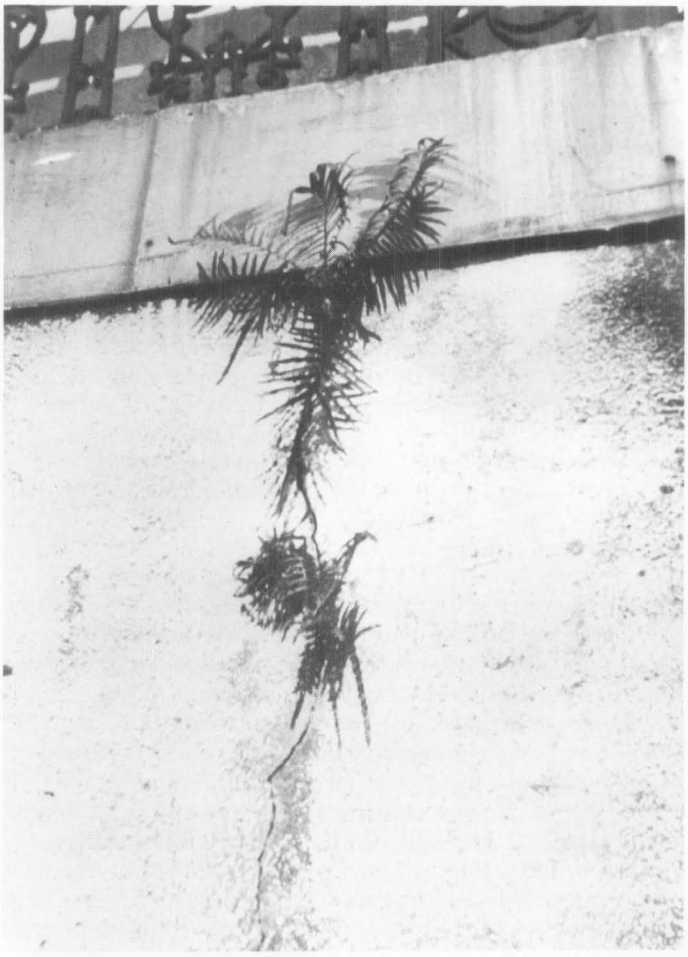


Fig. 12. (a) Water intrusion caused by rusting metal, or (b) plant growth left unattended will gradually enlarge these cracks, resulting in spalling, and eventually requiring extensive repair of the stucco. Photos: National Park Service Files.





Fig. 13. (a) In preparation for repainting, hairline cracks on this Mediterranean style stucco apartment building were filled with a commercial caulking compound; (b) dirt is attracted and adheres to the texture of the caulked areas, and a year after painting, these inappropriate repairs are highly obvious. Photos: Anne Grimmer.

stucco may be based on either lime or portland cement. Another important factor to take into consideration is that an early lime-stucco building is likely to have been repaired many times over the ensuing years, and it is probable that at least some of these patches consist of portland cement.

Planning the Repair

Once the extent of damage has been determined, a number of repair options may be considered. Small hairline cracks usually are not serious and may be sealed with a thin slurry coat consisting of the finish coat ingredients, or even with a coat of paint or whitewash. Commercially available caulking compounds are not suitable materials for patching hairline cracks. Because their consistency and texture is unlike that of stucco, they tend to weather differently, and attract more dirt; as a result, repairs made with caulking compounds may be highly visible, and unsightly (Fig. 13). Larger cracks will have to be cut out in preparation for more extensive repair. Most stucco repairs will require the skill and expertise of a professional plasterer (Fig. 14).

In the interest of saving or preserving as much as possible of the historic stucco, patching rather than wholesale replacement is preferable. When repairing heavily textured surfaces, it is not usually necessary to replace an entire wall section, as the textured finish, if well-executed, tends to conceal patches, and helps them to blend in with the existing stucco. However, because of the nature of smooth-finished stucco, patching a number of small areas scattered over one elevation may not be a successful repair approach unless the stucco has been previously painted, or is to be painted following the repair work. On unpainted stucco such patches are hard to conceal, because they may not match exactly or blend in with the rest of the historic stucco surface. For



Fig. 14. This poorly executed patch is not the work of a professional plasterer. While it may serve to keep out water, it does not match the original surface, and is not an appropriate repair for historic stucco. Photo: Betsy Chittenden.

this reason it is recommended, if possible, that stucco repair be carried out in a contained or well-defined area, or if the stucco is scored, the repair patch should be "squared-off" in such a way as to follow existing scoring. In some cases, especially in a highly visible location, it may be preferable to restucco an entire wall section or feature. In this way, any differences between the patched area and the historic surface will not be so readily apparent.

Repair of historic stucco generally follows most of the same principles used in plaster repair. First, all deteriorated, severely cracked and loose stucco should be removed down to the lath (assuming that the lath is securely attached to the substrate), or down to the masonry if the stucco is directly applied to a masonry substrate. A clean surface is necessary to obtain a good

bond between the stucco and substrate. The areas to be patched should be cleaned of all debris with a bristle brush, and all plant growth, dirt, loose paint, oil or grease should be removed (Fig. 15). If necessary, brick or stone mortar joints should then be raked out to a depth of approximately 5/8" to ensure a good bond between the substrate and the new stucco.

To obtain a neat repair, the area to be patched should be squared-off with a butt joint, using a cold chisel, a hatchet, a diamond blade saw, or a masonry bit. Sometimes it may be preferable to leave the area to be patched in an irregular shape which may result in a less conspicuous patch. Proper preparation of the area to be patched requires very sharp tools, and extreme caution on the part of the plasterer not to break keys of surrounding good stucco by "over-sounding" when removing deteriorated stucco. To ensure a firm bond, the new patch must not overlap the old stucco. If the stucco has lost its bond or key from wood lath, or the lath has deteriorated or come loose from the substrate, a decision must be made whether to try to reattach the old lath, to replace deteriorated lath with new wood lath, or to leave the historic wood lath in place and supplement it with modern expanded metal lath. Unless authenticity is important, it is generally preferable (and easier) to nail new metal lath over the old wood lath to support the patch. Metal lath that is no longer securely fastened to the substrate may be removed and replaced in kind, or left in place, and supplemented with new wire lath.

When repairing lime-based stucco applied directly to masonry, the new stucco should be applied in the same manner, directly onto the stone or brick. The stucco will bond onto the masonry itself without the addition of lath because of the irregularities in the masonry or those of its mortar joints, or because its surface has been scratched, scored or otherwise roughened to provide an additional key. Cutting out the old stucco at a diagonal angle may also help secure the bond between the new and the old stucco. For the most part it is not advisable to insert metal lath when restuccoing historic masonry in sound condition, as it can hasten deterioration of the repair work. Not only will attaching the lath damage the masonry, but the slightest moisture penetration can cause metal lath to rust. This will cause metal to expand, eventually resulting in spalling of the stucco, and possibly the masonry substrate too.

If the area to be patched is properly cleaned and prepared, a bonding agent is usually not necessary. However, a bonding agent may be useful when repairing hairline cracks, or when dealing with substrates that do not offer a good bonding surface. These may include dense stone or brick, previously painted or stuccoed



Fig. 15. (a) After reattaching any loose wood lath to the furring strips underneath, the area to be patched has been cleaned, the lath thoroughly wetted, and (b) the first coat of stucco has been applied and scratched to provide a key to hold the second layer of stucco. Photos: Betsy Chittenden.

masonry, or spalling brick substrates. A good mechanical bond is always preferable to reliance on bonding agents. Bonding agents should not be used on a wall that is likely to remain damp or where large amounts of salts are present. Many bonding agents do not survive well under such conditions, and their use could jeopardize the longevity of the stucco repair.

A stucco mix compatible with the historic stucco should be selected after analyzing the existing stucco. It can be adapted from a standard traditional mix of the period, or based on one of the mixes included here. Stucco consisting mostly of portland cement generally will not be physically compatible with the softer, more flexible lime-rich historic stuccos used throughout the eighteenth and much of the nineteenth centuries. The differing expansion and contraction rates of lime stucco and portland cement stucco will normally cause the stucco to crack. Choosing a stucco mix that is durable and compatible with the historic stucco on the building is likely to involve considerable trial and error, and probably will require a number of test samples, and even more if it is necessary to match the color. It is best to let the stucco test samples weather as long as possible—ideally one year, or at least through a change of seasons, in order to study the durability of the mix and its compatibility with the existing stucco, as well as the weathering of the tint if the building will not be painted and color match is an important factor. If the test samples are not executed on the building, they should be placed next to the stucco remaining on the building to compare the color, texture and composition of the samples with the original. The number and thickness of stucco coats used in the repair should also match the original.

After thoroughly dampening the masonry or wood lath, the first, scratch coat should be applied to the masonry substrate, or wood or metal lath, in a thickness that corresponds to the original if extant, or generally about 1/4" to 3/8". The scratch coat should be scratched or cross-hatched with a comb to provide a key to hold the second coat. It usually takes 24–72 hours, and longer in cold weather, for each coat to dry before the next coat can be applied. The second coat should be about the same thickness as the first, and the total thickness of the first two coats should generally not exceed about 5/8". This second or leveling coat should be roughened using a wood float with a nail protruding to provide a key for the final or finish coat. The finish coat, about 1/4" thick, is applied after the previous coat has initially set. If this is not feasible, the base coat should be thoroughly dampened when the finish coat is applied later. The finish coat should be worked to match the texture of the original stucco (Fig. 16).

Colors and Tints for Historic Stucco Repair

The color of most early stucco was supplied by the aggregate included in the mix—usually the sand. Sometimes natural pigments were added to the mix, and eighteenth and nineteenth-century scored stucco was often marbleized or painted in imitation of marble or granite. Stucco was also frequently coated with whitewash or a colorwash. This tradition later evolved into the use of paint, its popularity depending on the vagaries of fashion as much as a means of concealing repairs. Because most of the early colors were derived from nature, the resultant stucco tints tended to be mostly earth-toned. This was true until the advent of brightly colored stucco in the early decades of the twentieth century. This was the so-called "Jazz Plaster" developed by O.A. Malone, the "man who put color into California," and who founded the California Stucco Products Corporation in 1927. California Stucco was revolutionary for its time as the first stucco/plaster to contain colored pigment in its pre-packaged factory mix.

When patching or repairing a historic stucco surface known to have been tinted, it may be possible to determine through visual or microscopic analysis whether the source of the coloring is sand, cement or pigment. Although some pigments or aggregates used traditionally may no longer be available, a sufficiently close color-match can generally be approximated using sand, natural or mineral pigments, or a combination of these. Obtaining such a match will require testing and comparing the color of dried test samples with the original. Successfully combining pigments in the dry stucco mix prepared for the finish coat requires considerable skill. The amount of pigment must be carefully measured for each batch of stucco. Overworking the mix can make the pigment separate from the lime. Changing the amount of water added to the mix, or using water to apply the tinted finish coat, will also affect the color of the stucco when it dries.

Generally, the color obtained by hand-mixing these ingredients will provide a sufficiently close match to cover an entire wall or an area distinct enough from the rest of the structure that the color differences will not be obvious. However, it may not work for small patches conspicuously located on a primary elevation, where color differences will be especially noticeable. In these instances, it may be necessary to conceal the repairs by painting the entire patched elevation, or even the whole building.

Many stucco buildings have been painted over the years and will require repainting after the stucco repairs have been made. Limewash or cement-based paint, latex paint, or oil-based paint are appropriate coatings for stucco buildings. The most important factor to consider when repainting a previously painted or coated surface is that the new paint be compatible with any coating already on the surface. In preparation for repainting, all loose or peeling paint or other coating material not firmly adhered to the stucco must be removed by hand-scraping or natural bristle brushes. The surface should then be cleaned.

Cement-based paints, most of which today contain some portland cement and are really a type of limewash, have traditionally been used on stucco buildings. The ingredients were easily obtainable. Furthermore, the lime in such paints actually bonded or joined with the stucco and provided a very durable coating. In many regions, whitewash was applied annually during spring cleaning. Modern, commercially available premixed masonry and mineral-based paints may also be used on historic stucco buildings.



Fig. A

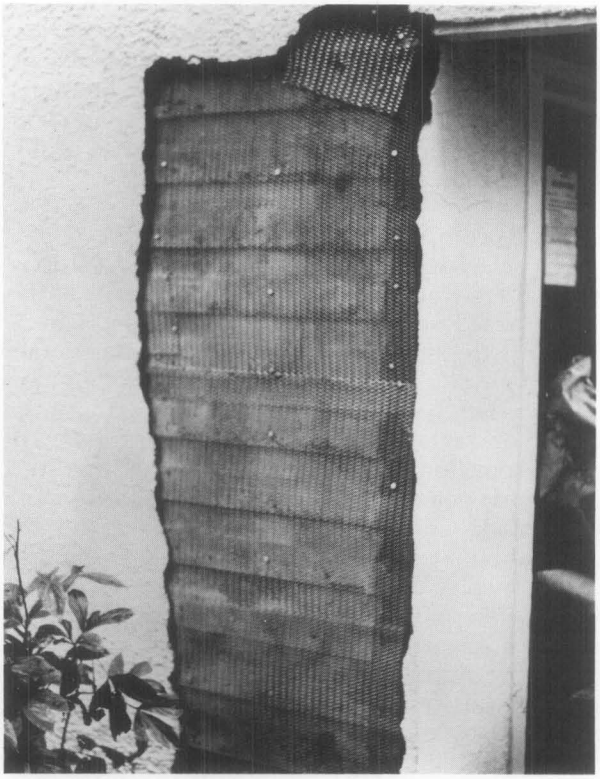


Fig. B

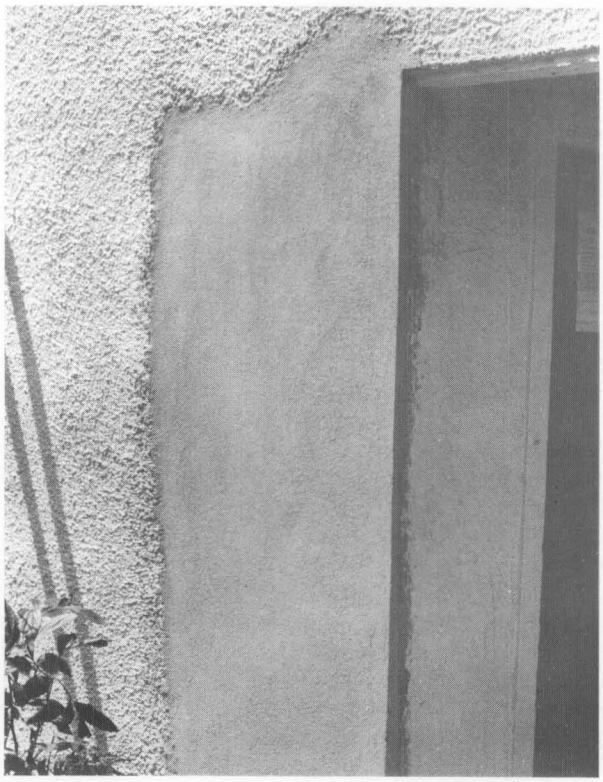


Fig. C

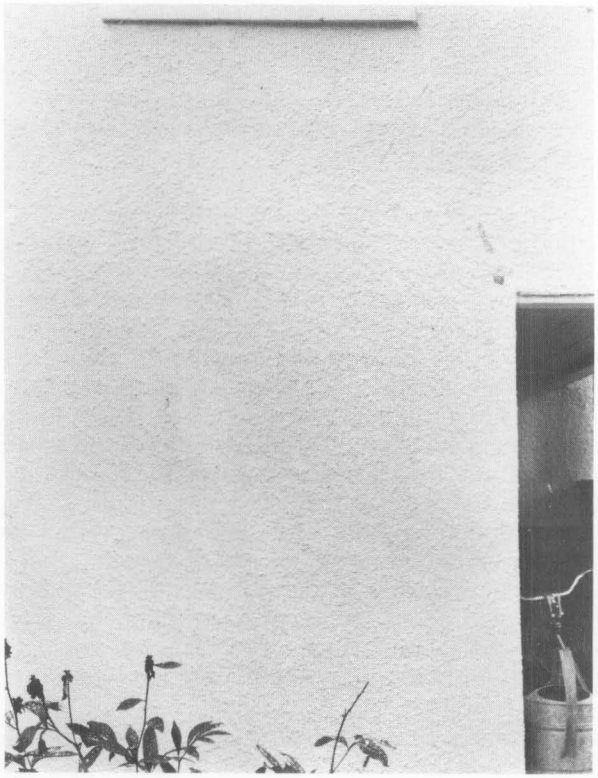


Fig. D

Fig. 16. (a) In preparation for stucco repair, this plasterer is mixing the dry materials in a mortar box with a mortar hoe (note the 2 holes in the blade), pulling it through the box using short choppy strokes. After the dry materials are thoroughly combined, water is added and mixed with them using the same choppy, but gradually lengthening stokes, making sure that the hoe cuts completely through the mix to the bottom of the box. (b) The deteriorated stucco has been cut away, and new metal lath has been nailed to the clapboarding in the area to be patched. (Although originally clapboarded when built in the 19th century, the house was stuccoed around the turn-of-the-century on metal lath nailed over the clapboard.) (c) The first, scratch coat and the second coat have been applied here, and await the spatterdash or rough-cast finish of the final coat (d) which was accomplished by the plasterer using a whisk broom to throw the stucco mortar against the wall surface. This well-executed patch is barely discernable, and lacks only a coat of paint to make it blend completely with the rest of the painted wall surface. Photos: Anne Grimmer.

If the structure must be painted for the first time to conceal repairs, almost any of these coatings may be acceptable depending on the situation. Latex paint, for example, may be applied to slightly damp walls or where there is an excess of moisture, but latex paint will not stick to chalky or powdery areas. Oil-based, or alkyd paints must be applied only to dry walls; new stucco must cure up to a year before it can be painted with oil-based paint.

Contemporary Stucco Products

There are many contemporary stucco products on the market today. Many of them are not compatible, either physically or visually, with historic stucco buildings. Such products should be considered for use only after consulting with a historic masonry specialist. However, some of these prepackaged tinted stucco coatings may be suitable for use on stucco buildings dating from the late-nineteenth or early-twentieth century, as long as the color and texture are appropriate for the period and style of the building. While some masonry contractors may, as a matter of course, suggest that a water-repellent coating be applied after repairing old stucco, in most cases this should not be necessary, since colorwashes and paints serve the same purpose, and stucco itself is a protective coating.

Cleaning Historic Stucco Surfaces

Historic stucco buildings often exhibit multiple layers of paint or limewash. Although some stucco surfaces may be cleaned by water washing, the relative success of this procedure depends on two factors: the surface texture of the stucco, and the type of dirt to be removed. If simply removing airborne dirt, **smooth unpainted stucco,** and **heavily-textured painted stucco** may sometimes be cleaned using a low-pressure water wash, supplemented by scrubbing with soft natural bristle brushes, and possibly non-ionic detergents. Organic plant material, such as algae and mold, and metallic stains may be removed from stucco using poultices and appropriate solvents. Although these same methods may be employed to clean **unpainted roughcast, pebble-dash, or any stucco surface featuring exposed aggregate,** due to the surface irregularities, it may be difficult to remove dirt, without also removing portions of the decorative textured surface. Difficulty in cleaning these surfaces may explain why so many of these textured surfaces have been painted.

When Total Replacement is Necessary

Complete replacement of the historic stucco with new stucco of either a traditional or modern mix will probably be necessary only in cases of extreme deterioration—that is, a loss of bond on over 40–50 per cent of the stucco surface. Another reason for total removal might be that the physical and visual integrity of the historic stucco has been so compromised by prior incompatible and ill-conceived repairs that patching would not be successful.

When stucco no longer exists on a building there is more flexibility in choosing a suitable mix for the replacement. Since compatibility of old and new stucco will not be an issue, the most important factors to consider are durability, color, texture and finish. Depending on the construction and substrate of the building, in some instances it may be acceptable to use a relatively strong cement-based stucco mortar. This is certainly true for many late-nineteenth and early-twentieth century buildings, and may even be appropriate to use on some stone substrates even if the original mortar would have been weaker, as long as the historic visual qualities noted above have been replicated. Generally, the best principle to follow for a masonry building is that the stucco mix, whether for repair or replacement of historic stucco, should be somewhat weaker than the masonry to which it is to be applied in order not to damage the substrate.

General Guidance for Historic Stucco Repair

A skilled professional plasterer will be familiar with the properties of materials involved in stucco repair and will be able to avoid some of the pitfalls that would hinder someone less experienced. General suggestions for successful stucco repair parallel those involving restoration and repair of historic mortar or plaster. In addition, the following principles are important to remember:

- Mix only as much stucco as can be used in one and one-half to two hours. This will depend on the weather (mortar will harden faster under hot and dry, or sunny conditions); and experience is likely to be the best guidance. Any remaining mortar should be discarded; it should not be retempered.

- Stucco mortar should not be over-mixed. (Hand mix for 10–15 minutes after adding water, or machine mix for 3–4 minutes after all ingredients are in mixer.) Over-mixing can cause crazing and discoloration, especially in tinted mortars. Over-mixing will also tend to make the mortar set too fast, which will result in cracking and poor bonding or keying to the lath or masonry substrate.

- Wood lath or a masonry substrate, but not metal lath, must be thoroughly wetted before applying stucco patches so that it does not draw moisture out of the stucco too rapidly. To a certain extent, bonding agents also serve this same purpose. Wetting the substrate helps retard drying.

- To prevent cracking, it is imperative that stucco not dry too fast. Therefore, the area to be stuccoed should be shaded, or even covered if possible, particularly in hot weather. It is also a good idea in hot weather to keep the newly stuccoed area damp, at approximately 90 per cent humidity, for a period of 48 to 72 hours.

- Stucco repairs, like most other exterior masonry work, should not be undertaken in cold weather (below 40 degrees fahrenheit, and preferably warmer), or if there is danger of frost.

Historic Stucco Textures

Most of the oldest stucco in the U.S. dating prior to the late-nineteenth century, will generally have a **smooth, troweled finish** (sometimes called a **sand** or **float finish**), possibly scored to resemble ashlar masonry units. Scoring may be incised to simulate masonry joints, the scored lines may be emphasized by black or white penciling, or the lines may simply be drawn or painted on the surface of the stucco. In some regions, at least as early as the first decades of the nineteenth century, it was not uncommon to use a **roughcast finish** on the foundation or base of an otherwise **smooth-surfaced** building (Fig. a). **Roughcast** was also used as an overall stucco finish for some outbuildings, and other less important types of structures.

A wide variety of decorative surface textures may be found on revival style stucco buildings, particularly residential architecture. These styles evolved in the late-nineteenth century and peaked in popularity in the early decades of the twentieth century. Frank Lloyd Wright favored a **smooth finish** stucco, which was imitated on much of the Prairie style architecture inspired by his work. Some of the more picturesque surface textures include: **English Cottage** or **English Cotswold finish**; **sponge finish** (Fig. b); **fan texture**; **adobe finish** (Fig. c), and **Spanish** or **Italian finish.** Many of these finishes and countless other regional and personalized variations on them are still in use.

The most common early-twentieth century stucco finishes are often found on bungalow-style houses, and include: **spatter** or **spatterdash** (sometimes called **roughcast, harling,** or **wetdash**), and **pebbledash** or **drydash.** The **spatterdash** finish is applied by throwing the stucco mortar against the wall using a whisk broom or a stiff fiber brush, and it requires considerable skill on the part of the plasterer to achieve a consistently rough wall surface. The mortar used to obtain this texture is usually composed simply of a regular sand, lime, and cement mortar, although it may sometimes contain small pebbles or crushed stone aggregate, which replaces one-half the normal sand content. The **pebbledash** or **drydash finish** is accomplished manually by the plasterer throwing or "dashing" dry pebbles (about 1/8" to 1/4" in size), onto a coat of stucco freshly applied by another plasterer. The pebbles must be thrown at the wall with a scoop with sufficient force and skill that they will stick to the stuccoed wall. A more even or uniform surface can be achieved by patting the stones down with a wooden float. This finish may also be created using a texturing machine (Figs. d–f illustrate 3 versions of this finish. Photos: National Park Service Files).

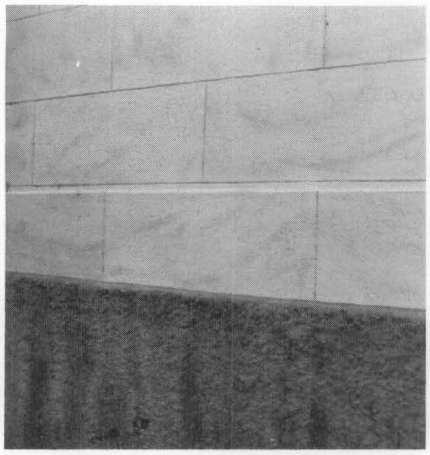


Fig. A

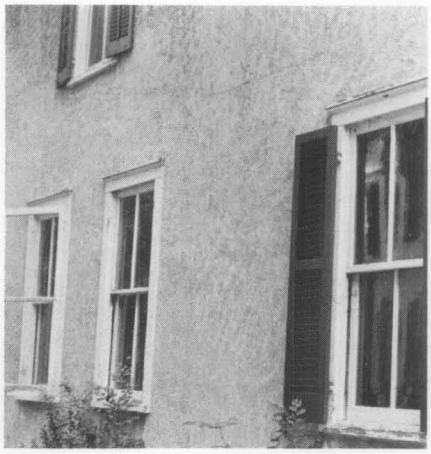


Fig. B



Fig. C

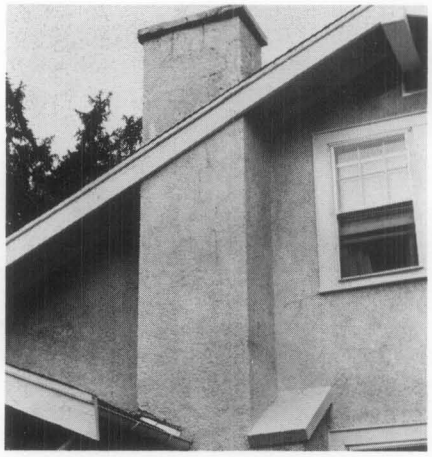


Fig. D

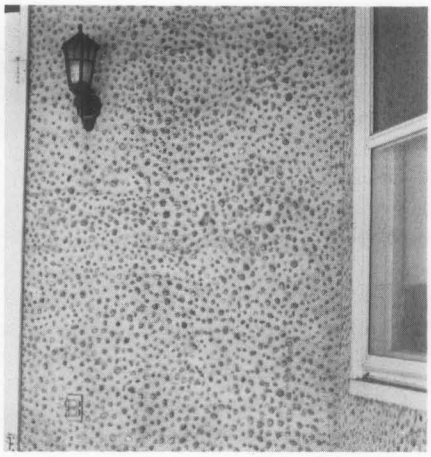


Fig. E

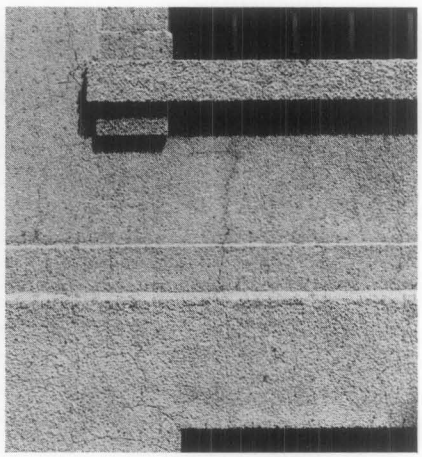


Fig. F

Summary

Stucco on historic buildings is especially vulnerable not only to the wear of time and exposure to the elements, but also at the hands of well-intentioned "restorers," who may want to remove stucco from eighteenth and nineteenth century structures, to expose what they believe to be the original or more "historic" brick, stone or log underneath. Historic stucco is a character-defining feature and should be considered an important historic building material, significant in its own right. While many eighteenth and nineteenth century buildings were stuccoed at the time of construction, others were stuccoed later for reasons of fashion or practicality. As such, it is likely that this stucco has acquired significance over time, as part of the history and evolution of a building. Thus, even later, non-historic stucco should be retained in most instances; and similar logic dictates that new stucco should not be applied to a historic building that was not stuccoed previously. When repairing historic stucco, the new stucco should duplicate the old as closely as possible in strength, composition, color and texture.

Mixes for Repair of Historic Stucco

Historic stucco mixes varied a great deal regionally, depending as they did on the availability of local materials. There are probably almost as many mixes that can be used for repair of historic stucco as there are historic stucco buildings. For this reason it is recommended that at least a rudimentary analysis of the existing historic stucco be carried out in order to determine its general proportions and primary ingredients. However, if this is not possible, or if test results are inconclusive, the following mixes are provided as reference. Many of the publications listed under "Selected Reading" include a variety of stucco mixes and should also be consulted for additional guidance.

Materials Specifications should conform to those contained in *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings,* and are as follows:

- Lime should conform to ASTM C-207, Type S, Hydrated Lime for Masonry Purposes.
- Sand should conform to ASTM C-144 to assure proper gradation and freedom from impurities. Sand, or other type of aggregate, should match the original as closely as possible.
- Cement should conform to ASTM C-150, Type II (white, non-staining), portland cement.
- Water should be fresh, clean and potable.
- If hair or fiber is used, it should be goat or cattle hair, or pure manilla fiber of good quality, 1/2" to 2" in length, clean, and free of dust, dirt, oil, grease or other impurities.
- Rules to remember: More lime will make the mixture more plastic, but stucco mortar with a very large proportion of lime to sand is more likely to crack because of greater shrinkage; it is also weaker and slower to set. More sand or aggregate, will minimize shrinkage, but make the mixture harder to trowel smooth, and will weaken the mortar.

Soft Lime Stucco (suitable for application to buildings dating from 1700–1850)

A.J. Downing's Recipe for Soft Lime Stucco

1 part lime

2 parts sand

(A.J. Downing, "The Architecture of Country Houses," 1850)

Vieux Carre Masonry Maintenance Guidelines

Base Coats (2):

1 part by volume hydrated lime

3 parts by volume aggregate [sand]—size to match original

6 pounds/cubic yards hair or fiber

Water to form a workable mix.

Finish Coat:

1 part by volume hydrated lime

3 parts aggregate [sand]—size to match original

Water to form a workable mix.

Note: No portland cement is recommended in this mix, but if it is needed to increase the workability of the mix and to decrease the setting time, the amount of portland cement added should never exceed 1 part to 12 parts lime and sand.

("Vieux Carre Masonry Maintenance Guidelines," June, 1980.)

"Materials for Soft Brick Mortar and for Soft Stucco"

5 gallons hydrated lime

10 gallons sand

1 quart white, non-staining portland cement (1 cup only for pointing)

Water to form a workable mix.

(Koch and Wilson, Architects, New Orleans, Louisiana, February, 1980)

Mix for Repair of Traditional Natural Cement or Hydraulic Lime Stucco

1 part by volume hydrated lime

2 parts by volume white portland cement

3 parts by volume fine mason's sand

If hydraulic lime is available, it may be used instead of lime-cement blends.

("Conservation Techniques for the Repair of Historical Ornamental Exterior Stucco, January, 1990)

Early-twentieth century Portland Cement Stucco

1 part portland cement

2 1/2 parts sand

Hydrated lime = to not more than 15% of the cement's volume

Water to form a workable mix.

The same basic mix was used for all coats, but the finish coat generally contained more lime than the undercoats. ("Illinois Preservation Series No. 2: Stucco," January, 1980)

American Portland Cement Stucco Specifications (c. 1929)

Base Coats:

5 pounds, dry, hydrated lime

1 bag portland cement (94 lbs.)

Not less than 3 cubic feet (3 bags) sand (passed through a #8 screen)

Water to make a workable mix.

Finish Coat:

Use WHITE portland cement in the mix in the same proportions as above.

To color the stucco add not more than 10 pounds pigment for each bag of cement contained in the mix.

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Acknowledgements

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October 1990

Cover Photograph: St. James Church, Goose Creek, Berkeley County, South Carolina (1713–1719), is constructed of brick covered with stucco. Although much restored, it is notable for its ornamental stucco detailing, including rusticated quoins, cherub head "keystones" above the windows, flaming hearts, and a pelican in piety—symbol of the sacrament, in the pediment over the front door. Photo: Gary Hume.



World War Memorial Stadium circa 1929

Appendix E – The Preservation of Historic Concrete

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

SKA CONSULTING ENGINEERS, INC.

TEAGUE FREYALDENHOVEN FREYALDENHOVEN ARCHITECTS & PLANNERS, LLP

15 PRESERVATION BRIEFS



Preservation of Historic Concrete

Paul Gaudette and Deborah Slaton

National Park Service
U.S. Department of the Interior
Heritage Preservation Services

Introduction to Historic Concrete

Concrete is an extraordinarily versatile building material used for utilitarian, ornamental, and monumental structures since ancient times. Composed of a mixture of sand, gravel, crushed stone, or other coarse material, bound together with lime or cement, concrete undergoes a chemical reaction and hardens when water is added. Inserting reinforcement adds tensile strength to structural concrete elements. The use of reinforcement contributes significantly to the range and size of building and structure types that can be constructed with concrete.

While early twentieth century proponents of modern concrete often considered it to be permanent, it is, like all materials, subject to deterioration. This Brief provides an overview of the history of concrete and its popularization in the United States, surveys the principal causes and modes of concrete deterioration, and outlines approaches to repair and protection that are appropriate to historic concrete. In the context of this Brief, historic concrete is considered to be concrete used in construction of structures of historical, architectural, or engineering interest, whether those structures are old or relatively new.

Brief History of Use and Manufacture

The ancient Romans found that a mixture of lime putty and pozzolana, a fine volcanic ash, would harden under water. The resulting hydraulic cement became a major feature of Roman building practice, and was used in many buildings and engineering projects such as bridges and aqueducts. Concrete technology was kept alive during the Middle Ages in Spain and Africa. The Spanish introduced a form of concrete to the New World in the first decades of the sixteenth century, referred to as "tapia" or "tabby." This material, a mixture of lime, sand, and shell or stone aggregate mixed with water, was placed between wooden forms, tamped, and allowed to dry in successive layers. Tabby was later used by the English settlers in the coastal southeastern United States.

The early history of concrete was fragmented, with developments in materials and construction techniques occurring on different continents and in various countries. In the United States, concrete was slow in achieving widespread acceptance in building construction and did not begin to gain popularity until the late nineteenth century. It was more readily accepted for use in transportation and infrastructure systems.

The Erie Canal in New York is an example of the early use of concrete in transportation in the United States. The natural hydraulic cement used in the canal construction was processed from a deposit of limestone found in 1818 near Chittenango, southeast of Syracuse. The use of concrete in residential construction was



Figure 1. The Sebastopol House in Seguin, Texas, is an 1856 Greek Revival-style house constructed of lime concrete. Lime concrete or "limecrete" was a popular construction material, as it could be made inexpensively from local materials. By 1900, the town had approximately ninety limecrete structures, twenty of which remain. Photo: Texas Parks and Wildlife Department.



Figure 2. Chatterton House was the home of the post trader at Fort Fred Steel in Wyoming, one of several forts established in the 1860s to protect the Union Pacific Railroad. The walls of the post trader's house were built using stone aggregate and lime, without cement. The use of this material presents special preservation challenges.

publicized in the second edition of Orson S. Fowler's *A Home for All* (1853) which described the advantages of "gravel wall" construction to a wide audience. The town of Seguin, Texas, thirty-five miles east of San Antonio, already had a number of concrete buildings by the 1850s and came to be called "The Mother of Concrete Cities," with approximately ninety concrete buildings made from local "lime water" and gravel (Fig. 1).

Impressed by the economic advantages of poured gravel wall or "lime-grout" construction, the Quartermaster General's Office of the War Department embarked on a campaign to improve the quality of building for frontier military posts. As a result, lime-grout structures were constructed at several western posts soon after the Civil War, including Fort Fred Steele and Fort Laramie, both in Wyoming (Fig. 2). By the 1880s, sufficient experience had been gained with unreinforced concrete to permit construction of much larger buildings. A notable example from this period is the Ponce de Leon Hotel in St. Augustine, Florida.

Extensive construction in concrete also occurred through the system of coastal fortifications commissioned by the federal government in the 1890s for the Atlantic, Pacific, and Gulf coasts. Unlike most concrete construction to that time, the special requirements of coastal fortifications called for concrete walls as much as 20 feet thick, often at sites that were difficult to access. Major structures in the coastal defenses of the 1890s were built of mass concrete with no internal reinforcing, a practice that was replaced by the use of reinforcing bars in fortifications constructed after about 1905.

The use of reinforced concrete in the United States dates from 1860, when S.T. Fowler obtained a patent for a reinforced concrete wall. In the early 1870s, William E. Ward built his own house in Port Chester, New York, using concrete reinforced with iron rods for all structural elements. Despite these developments, such construction remained a novelty until after 1880, when innovations introduced by Ernest L. Ransome made the use of reinforced concrete more practicable. Ransome made many contributions to the development of concrete construction technology, including the use of twisted reinforcing bars to improve bond between the concrete and the steel, which he patented in 1884. Two years later, Ransome introduced the rotary kiln to United States cement production. The new kiln had greater capacity and burned more thoroughly and uniformly, allowing development of a less expensive, more uniform, and more reliable manufactured cement. Improvements in concrete production initiated by Ransom led to a much greater acceptance of concrete after 1900.

The Lincoln Highway Association, incorporated in 1913, promoted the use of concrete in construction of a coast-to-coast roadway system. The goal of the Lincoln Highway Association and highway advocate Henry B. Joy was to educate the country in the need for good roads made of concrete, with an improved Lincoln



Figure 3. The Lincoln Highway Association promoted construction of a high quality continuous hard surface roadway across the country. The Boys Scouts of America installed concrete road markers along the Lincoln Highway in 1928.

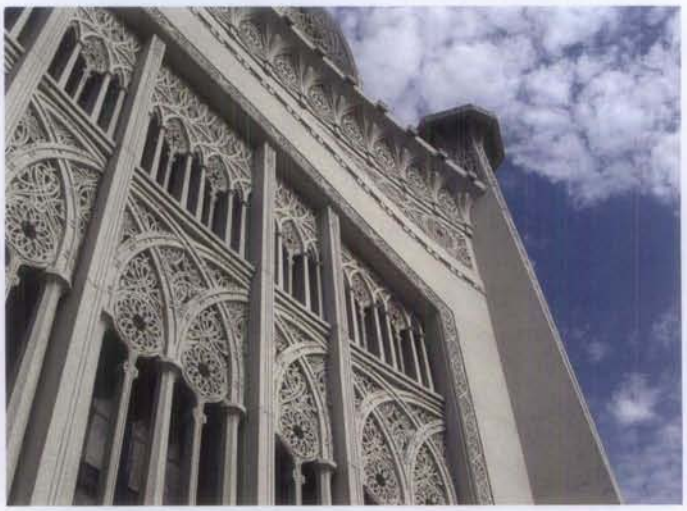


Figure 4. The highly ornamental concrete panels on the exterior facade of the Baha'i House of Worship in Wilmette, Illinois, illustrate the work of fabricator John J. Earley, known as "the man who made concrete beautiful."



Figure 5. Following World War II, architects and engineers took advantage of improvements in concrete production, quality control, and advances in precast concrete to design structures such as the Police Headquarters building in Philadelphia, Pennsylvania, constructed in 1961. Photo: Courtesy of the Philadelphia Police Department.



Figure 6. The Bailey Magnet School in Jackson, Mississippi, was designed as the Jackson Junior High School by the firm of N.W. Overstreet & Town in 1936. The streamlined building exemplifies the applicability of concrete to creating a modern architectural aesthetic. Photo: Bill Burris, Burris/Wagnon Architects, P.A.

Highway as an example. Concrete "seedling miles" were constructed in remote areas to emphasize the superiority of concrete over unimproved dirt. The Association believed that as people learned about concrete, they would press the government to construct good roads throughout their states. Americans' enthusiasm for good roads led to the involvement of the federal government in road-building and the creation of numbered U.S. routes in the 1920s (Fig. 3).

During the early twentieth century, Ernest Ransome in Beverly, Massachusetts, Albert Kahn in Detroit, and Richard E. Schmidt in Chicago, promoted concrete for use in "Factory Style" utilitarian buildings with an exposed concrete frame infilled with expanses of glass. Thomas Edison's cast-in-place reinforced concrete homes in Union Township, New Jersey (1908), proclaimed a similarly functional emphasis in residential construction. From the 1920s onward, concrete began to be used with spectacular design results: examples include John J. Earley's Meridian Hill Park in Washington, D.C.; Louis Bourgeois' exuberant, graceful Baha'i Temple in Wilmette, Illinois (1920–1953), for which Earley fabricated the concrete (Fig. 4); and Frank Lloyd Wright's Fallingwater near Bear Run, Pennsylvania (1934). Continuing improvements in quality control and development of innovative fabrication processes, such as the Shockbeton method for precast concrete, provided increasing opportunities for architects and engineers. Wright's Guggenheim Museum in New York City (1959); Geddes Brecher Qualls & Cunningham's Police Headquarters building in Philadelphia, Pennsylvania (1961); and Eero Saarinen's soaring terminal building at Dulles International Airport outside Washington, D.C., and the TWA terminal at Kennedy Airport in New York (1962), exemplify the masterful use of concrete achieved in the modern era (Fig. 5).



Figure 7. Detailed bas reliefs as well as sculptures, such as this lion at the Bailey Magnet School, could be used as ornamentation on concrete buildings. Sculptural concrete elements were typically cast in molds.

Throughout the twentieth century, a wide range of architectural and engineering structures were built using concrete as a practical and cost-effective choice—and concrete also became valued for its aesthetic qualities. Cast in place and precast concrete were readily adapted to the Streamlined Moderne style, as exemplified by the Bailey Magnet School in Jackson, Mississippi, designed as the Jackson Junior High School by N.W. Overstreet & Town in 1936 (Figs. 6 and 7). The school is one of many concrete buildings designed and constructed under the auspices of the Public Works Administration. Recreational structures and landscape features also utilized the structural range and unique character of exposed concrete to advantage, as seen in Chicago's Lincoln Park Chess Pavilion, designed by Morris Webster in 1956 (Fig. 8), and the Ira C. Keller Fountain in Portland Oregon, designed by Lawrence Halprin in 1969 (Fig. 9). Concrete was also popular for building interiors, with ornamental features and exposed structural elements recognized as part of the design aesthetic (See Figs. 10 and 11 in sidebar).

Historic Interiors

The expanded use of concrete provided new opportunities to create dramatic spaces and ornate architectural detail on the interiors of buildings, at a significant cost savings over traditional construction practices. The architectural design of the Berkeley City Club in Berkeley, California, expressed Moorish and Gothic elements in concrete on the interior of the building (Fig. 10). Used as a woman's social club, the building was designed by noted California architect Julia Morgan and constructed in 1929. The vaulted ceilings, columns, and ornamental capitals of the lobby and the ornamental arches and beamed ceiling of the "plunge" are all constructed of concrete.





Figure 10. The Berkeley City Club has significant interior spaces and features of concrete construction, including the lobby and pool. Photos: Una Gilmartin (left) and Brian Kehoe (right), Wiss, Janney, Elstner Associates, Inc.

The historic character of a building's interior can also be conveyed in a more utilitarian manner in terms of concrete features and finishes (Fig. 11). The exposed concrete structure—columns, capitals, and drop panels—is an integral part of the character of this old commercial building in Minneapolis. In concrete warehouse and factory buildings of the early twentieth century, exposed concrete columns and formboard finish concrete slab ceilings are common features as seen in this warehouse, now converted for use as a parking garage and shops.





Figure 11. Whether in a circa 1925 office (left) or in a parking garage and retail facility (right), exposed concrete structures help characterize these building interiors. Photo: Minnesota Historical Society (left).

Concrete Characteristics

Concrete is composed of fine (sand) and coarse (crushed stone or gravel) aggregates and paste made of portland cement and water. The predominant material in terms of bulk is the aggregate. Portland cement is the binder most commonly used in modern concrete. It is commercially manufactured by blending limestone or chalk with clays that contain alumina, silica, lime, iron oxide and magnesia, and heating the compounds together to high temperatures. The hydration process that occurs between the portland cement and water results in formation of an alkali paste that surrounds and binds the aggregate together as a solid mass.

The quality of the concrete is dependent on the ratio of water to the binder; binder content; sound, durable, and well-graded aggregates; compaction during placement; and proper curing. The amount of water used in the mix affects the concrete permeability and strength. The use of excess water beyond that required in the hydration process results in more permeable concrete, which is more susceptible to weathering and deterioration. Admixtures are commonly added to concrete to adjust concrete properties such as setting or hardening time, requirements for water, workability, and other characteristics. For example, the advent of air entraining agents in the 1930s provided enhanced durability for concrete.

During the twentieth century, there was a steady rise in the strength of ordinary concrete as chemical processes became better understood and quality control measures improved. In addition, the need to protect embedded reinforcement against corrosion was acknowledged. Requirements for concrete cover over reinforcing steel, increased cement content, decreased water-cement ratio, and air entrainment all contributed to greater concrete strength and improved durability.

Mechanisms and Modes of Deterioration

Causes of Deterioration

Concrete deterioration occurs primarily because of corrosion of the embedded steel, degradation of the concrete itself, use of improper techniques or materials in construction, or structural problems. The causes of concrete deterioration must be understood in order to select an appropriate repair and protection system.

While reinforcing steel has played a pivotal role in expanding the applications of concrete in twentieth century architecture, corrosion of this steel has also caused deterioration in many historic structures. Reinforcing steel embedded in the concrete is normally surrounded by a passivating oxide layer that, when present, protects the steel from corrosion and aids in bonding the steel and concrete. When the concrete's normal alkaline environment (above a pH of 10) is compromised and the steel is exposed to water, water vapor, or high relative humidity, corrosion of the steel reinforcing takes place. A reduction in alkalinity results from carbonation, a process that occurs when the carbon dioxide in the atmosphere reacts with calcium hydroxide and moisture in the concrete. Carbonation starts at the concrete's exposed surface but may extend to the reinforcing steel over time. When carbonation reaches the metal reinforcement, the concrete no longer protects the steel from corrosion.



Figure 8. The Chess Pavilion in Chicago's Lincoln Park was designed by architect Morris Webster and constructed in 1956. The pavilion is a distinctive landscape feature, with its reinforced concrete cantilevered slab that provides cover for chess players.



Figure 9. The Ira C. Keller Fountain in Portland, Oregon, was designed by Lawrence Halprin and constructed in 1969. The fountain is constructed primarily of concrete pillars with formboard textures and surrounding elements, patterned with geometric lines, which facilitate the path of water. Photo: Anita Washko, Wiss, Janney, Elstner Associates, Inc.

Corrosion of embedded reinforcing steel may be initiated and accelerated if calcium chloride was added to the concrete as a set accelerator during original construction to promote more rapid curing. It may also take place if the concrete is later exposed to deicing salts, as may occur during the winter in northern climates. Seawater or other marine environments can also provide large amounts of chloride, either from inadequately washed original aggregate or from exposure of the concrete to seawater.

Corrosion-related damage to reinforced concrete is the result of rust, a product of the corrosion process of steel, which expands and thus requires more space in the concrete than the steel did at the time of installation. This change in volume of the steel results in expansive forces, which cause cracking and spalling of the adjacent concrete (Fig. 12). Other signs of corrosion of embedded steel include delamination of the concrete (planar separations parallel to the surface) and rust staining (often a precursor to spalling) on the concrete near the steel.

Lack of proper maintenance of building elements such as roofs and drainage systems can contribute to water-related deterioration of the adjacent concrete, particularly when concrete is saturated with water and then exposed to freezing temperatures. As water within the concrete freezes, it expands and exerts forces on the adjacent concrete. Repeated freezing and thawing can result in the concrete cracking and delaminating. Such damage appears as surface degradation, including severe scaling and micro-cracking that extends into the concrete. The condition is most often observed near the surface of the concrete but can also eventually occur deep within the concrete. This type of deterioration is usually most severe at joints, architectural details, and other areas with more surface exposure to weather. In the second half of the twentieth century, concrete has utilized entrained air (the incorporation of microscopic air bubbles) to provide enhanced protection against damage due to cyclic freezing of saturated concrete.

The use of certain aggregates can also result in deterioration of the concrete. Alkali-aggregate reactions—in some cases alkali-silica reaction (ASR)—occur when alkalis normally present in cement react with certain aggregates, leading to the development of an expansive crystalline gel. When this gel is exposed to moisture, it expands and causes cracking of the aggregate and concrete matrix. Deleterious aggregates are typically found only in certain areas of the country and can be detected through analysis by an experienced petrographer. Low-alkali cements as well as fly ash are used today in new construction to prevent such reactions where this problem may occur.

Problems Specifically Encountered with Historic Concrete

Materials and workmanship used in the construction of historic concrete structures, particularly those built before the First World War, sometimes present potential sources of problems. For example, where the aggregate consisted of cinder from burned coal or crushed brick,



Figure 12. The concrete lighthouse at the Kilauea Point Light Station, Kilauea, Kauai, Hawaii, was constructed circa 1913. The concrete, which was a good quality, high strength mix for its day, is in good condition after almost one hundred years in service. Deterioration in the form of spalling related to corrosion of embedded reinforcing steel has occurred primarily in areas of higher ornamentation such as projecting bands and brackets (see close-up photo).

the concrete tends to be weak and porous because these aggregates absorb water. Some of these aggregates can be extremely susceptible to deterioration when exposed to moisture and cyclic freezing and thawing. Concrete was sometimes compromised by inclusion of seawater or beach sand that was not thoroughly washed with fresh water, a condition more common with coastal fortifications built prior to 1900. The sodium chloride present in seawater and beach sand accelerates the rate of corrosion of the reinforced concrete.

Another problem encountered with historic concrete is related to poor consolidation of the concrete during its placement in forms, or in molds in the case of precasting. This problem is especially prevalent in highly ornamental units. Early twentieth century concrete was often tamped or rodded into place, similar to techniques used in forming cast stone. Poorly consolidated concrete often contains voids ("bugholes" or "honeycombs"), which can reduce the protective concrete cover over the embedded reinforcing bars, entrap water, and, if sufficiently large and strategically numerous, reduce localized concrete strength. Vibration technology has improved over time and flowability agents are also used today to address this problem.

A common type of deterioration observed in concrete is the effect of weathering from exposure to wind, rain, snow, and salt water or spray. Weathering appears as erosion of the cement paste, a condition more prevalent in northern regions where precipitation can be highly acidic. This results in the exposure of the aggregate particles on the exposed concrete surface. Variations may occur in the aggregate exposure due to differential erosion or dissolution of exposed cement paste. Erosion can also be caused by the mechanical action of water channeled over concrete, such as by the lack of drip grooves in belt courses and sills, and by inadequate drainage. In addition, high-pressure water when used for cleaning can also erode the concrete surface.

In concrete structures built prior to the First World War, concrete was often placed into forms in relatively short vertical lifts due to limitations in lifting and pouring techniques available at the time. Joints between different concrete placements (often termed cold joints or lift lines) may sometimes be considered an important part of the character of a concrete element (Fig. 13). However, wide joints may permit water to infiltrate the concrete, resulting in more rapid paste erosion or freeze-thaw deterioration of adjacent concrete in cold climates.

In the early twentieth century, concrete was sometimes placed in several layers parallel to the exterior surface. A base concrete was first created with formwork and then a more cement rich mortar layer was applied to the exposed vertical face of the



Figure 13. Fort Casey on Admiralty Head, Fort Casey, Washington, was constructed in 1898. The lift lines from placement of concrete are clearly visible on the exterior walls and characterize the finished appearance.

base concrete. The higher cement content in the facing concrete provided a more water-resistant outer layer and finished surface. The application of a cement-rich top layer, referred to in some early concrete publications as "waterproofing," was also used on top surfaces of concrete walls, or as the top layer in sidewalks. With this type of concrete construction, deterioration can occur over time as a result of debonding between layers, and can proceed very rapidly once the protective cement-rich layer begins to break down.

It is common for historic concrete to have a highly variable appearance, including color and finish texture. Different levels of aggregate exposure due to paste erosion are often found in exposed aggregate concrete. This variability in the appearance of historic concrete increases the level of difficulty in assessing and repairing weathered concrete.

Signs of Distress and Deterioration

Characteristic signs of failure in concrete include cracking, spalling, staining, and deflection. Cracking occurs in most concrete but will vary in depth, width, direction, pattern, and location, and can be either active or dormant (inactive). Active cracks can widen, deepen, or migrate through the concrete, while dormant cracks remain relatively unchanged in size. Some dormant cracks, such as those caused by early age shrinkage of the concrete during curing, are not a structural concern but when left unrepaired, can provide convenient channels for moisture penetration and subsequent damage. Random surface cracks, also called map cracks due to their resemblance to lines on a map, are usually related to early-age shrinkage but may also indicate other types of deterioration such as alkali-silica reaction.

Structural cracks can be caused by temporary or continued overloads, uneven foundation settling, seismic forces, or original design inadequacies. Structural cracks are active if excessive loads are applied to a structure, if the overload is continuing, or if settlement is ongoing. These cracks are dormant if the temporary overloads have been removed or if differential settlement has stabilized. Thermally-induced cracks result from stresses produced by the expansion and contraction of the concrete during temperature changes. These cracks frequently occur at the ends or re-entrant corners of older concrete structures that were built without expansion joints to relieve such stress.

Spalling (the loss of surface material) is often associated with freezing and thawing as well as cracking and delamination of the concrete cover over embedded reinforcing steel. Spalling occurs when reinforcing bars corrode and the corrosion by-products expand, creating high stresses on the adjacent concrete, which cracks and is displaced. Spalling can also occur when water absorbed by the concrete freezes and thaws (Fig. 14). In addition, surface spalling or scaling may result from the improper finishing, forming, or other surface



Figures 14. Layers of architectural concrete that have debonded (spalled) from the surface were removed from a historic water tank during the investigation performed to assess existing conditions. Photos: Anita Washko, Wiss, Janney, Elstner Associates, Inc.

phenomena when water-rich cement paste (laitance) rises to the surface. The resulting weak material is vulnerable to spalling of thin layers, or scaling. In some cases, spalling of the concrete can diminish the load-carrying capacity of the structure.

Deflection is the bending or sagging of structural beams, joists, or slabs, and can be an indication of deficiencies in the strength and structural soundness of concrete. This condition can be produced by overloading, corrosion of embedded reinforcing, or inadequate design or construction, such as use of low-strength concrete or undersized reinforcing bars.

Staining of the concrete surface can be related to soiling from atmospheric pollutants or other contaminants, dirt accumulation, and the presence of organic growth. However, stains can also indicate more serious underlying problems, such as corrosion of embedded reinforcing steel, improper previous surface treatments, alkali-aggregate reaction, or efflorescence, the deposition of soluble salts on the surface of the concrete as a result of water migration (Fig. 15).

Planning for Concrete Preservation

The significance of a historic concrete building or structure—including whether it is important for its architectural or engineering design, for its materials and construction techniques, or both—guides decision making about repair and, if needed, replacement methods. Determining the causes of deterioration is also central to the development of a conservation and repair plan. With historic concrete buildings, one of the more difficult challenges is allowing for sufficient time during the planning phase to analyze the concrete, develop mixes, and provide time for adequate aging of mock-ups for matching to the original concrete.

An understanding of the original construction techniques (cement characteristics, mix design, original intent of assembly, type of placement, precast versus cast in place, etc.) and previous repair work performed on the concrete is important in determining causes of existing deterioration and the susceptibility of the structure to potential other types of deterioration. For example, concrete placed in short lifts (individual concrete placements) or constructed in precast segments will have numerous joints that can provide entry points for water infiltration. Inappropriate prior repairs, such as installation of patches using an incompatible material, can affect the future performance of the concrete. Such prior repairs may require corrective work.

As with other preservation projects, three primary approaches are usually considered for historic concrete structures: ***maintenance***, ***repair***, or ***replacement***. Maintenance and repair best achieve the preservation goal of minimal intervention and the greatest retention of existing historic fabric. However, where elements of the building are severely deteriorated or where inherent problems with the material lead to ongoing failures, replacement may be necessary.

During planning, information is gathered through research, visual survey, inspection openings, and laboratory studies. The material should then be reviewed by professionals experienced in concrete deterioration to help evaluate the nature and causes of the concrete problems, to assess both the short-term and long-term effects of the deterioration, and to formulate proper repair approaches.

Condition Assessment

A condition assessment of a concrete building or structure should begin with a review of all available documents related to original construction and prior repairs. While plans and specifications for older concrete buildings are not always available, they can be an invaluable resource and every attempt should be made to find them. They may provide information on the composition of the concrete mix or on the type and location of reinforcing bars. If available, documents related to past repairs should also be reviewed to understand how the repairs were made and to help evaluate their anticipated performance and service life. Archival photographs can also provide a valuable source of information about original construction.



Figure 15. Evidence of moisture movement through concrete is apparent in the form of mineral deposits on the concrete surface. Cyclic freezing and thawing of entrapped moisture, and corrosion of embedded reinforcement, have also contributed to deterioration of the concrete column on this fence at Crocker Field in Fitchburg, Massachusetts, designed by the Olmsted Brothers.

A visual condition survey will help identify and evaluate the extent, types, and patterns of distress and deterioration. The American Concrete Institute offers several useful guides on how to perform a visual condition survey of concrete. Generally, the condition assessment begins with an overall visual survey, followed by a close-up investigation of representative areas to obtain more detailed information about modes of deterioration.

A number of nondestructive testing methods can be used in the field to evaluate concealed conditions. Basic techniques include sounding with a hand-held hammer (or for horizontal surfaces, a chain) to help identify areas of delamination. More sophisticated techniques include impact-echo testing (Fig. 16), ground penetrating radar, pulse velocity, and other methods that characterize concrete thickness and locate voids or delaminations. Magnetic detection instruments are used to locate embedded reinforcing steel and can be calibrated to identify the size and depth of reinforcement. Corrosion measurements can be taken using copper-copper sulfate half-cell tests or linear polarization techniques to determine the probability or rate of active corrosion of the reinforcing steel.

To further evaluate the condition of the concrete, samples may be removed for laboratory study to determine material components and composition, and causes of deterioration. Samples need to be representative of existing conditions but should be taken from unobtrusive locations. Laboratory studies of the concrete may include petrographic evaluation following ASTM C856, *Practice for Petrographic Examination of Hardened Concrete*. Petrographic examination, consisting of microscopical studies performed by a geologist specializing in the evaluation of construction materials, is performed to determine air content, water-cement ratio, cement content, and general aggregate characteristics. Laboratory studies can also include

chemical analyses to determine chloride content, sulfate content, and alkali levels of the concrete; identification of deleterious aggregates; and determination of depth of carbonation. Compressive strength studies can be conducted to evaluate the strength of the existing concrete and provide information for repair work. The laboratory studies provide a general identification of the original concrete's components and aggregates, and evidence of damage due to various mechanisms including cyclic freezing and thawing, alkali-aggregate reactivity, or sulfate attack. Information gathered through laboratory studies can also be used to help develop a mix design for the repair concrete.

Cleaning

As with other historic structures, concrete structures are cleaned for several reasons: to improve the appearance of the concrete, as a cyclical maintenance measure, or in preparation for repairs. Consideration should first be given to whether the historic concrete structure needs to be cleaned at all. If cleaning is required, then the gentlest system that will be effective should be selected.

Three primary methods are used for cleaning concrete: water methods, abrasive surface treatments, and chemical surface treatments. Low-pressure water (less than 200 psi) or steam cleaning can effectively remove surface soiling from sound concrete; however, care is required on fragile or deteriorated surfaces. In addition, water and steam methods are typically not effective in removing staining or severe soiling. Power washing with high-pressure water is sometimes used to clean or remove coatings from sound, high-strength concrete, but high-pressure water washing is generally damaging to and not appropriate for concrete on historic structures.

When used with proper controls and at very low pressures (typically 35 to 75 psi), microabrasive surface treatments using very fine particulates, such as dolomitic limestone powder, can sometimes clean effectively. However, microabrasive cleaning may alter the texture and surface reflectivity of concrete. Some concrete can be damaged even by fine particulates applied at very low pressures.



Figure 16. Impact echo testing is performed on a concrete structural slab to help determine depth of deterioration. In this method, a short pulse of energy is introduced into the structure and a transducer mounted on the impacted surface of the structure receives the reflected input waves or echoes. These waves are analyzed to help identify flaws and deterioration within the concrete.

Chemical surface treatments can clean effectively but may also alter the appearance of the concrete by bleaching the concrete, removing the paste, etching the aggregate, or otherwise altering the surface. Detergent cleaners or mild, diluted acid cleaners may be appropriate for removal of staining or severe soiling. Cleaning products that contain strong acids such as hydrochloric (muriatic) or hydrofluoric acid, which will damage concrete and are harmful to persons, animals, site features, and the environment, should not be used.

For any cleaning process, trial samples should be performed prior to full-scale implementation. The intent of the cleaning program should not be to return the structure to a like new appearance. Concrete can age gracefully, and as long as soiling is not severe or deleterious, many structures can still be appreciated without extensive cleaning.

Methods of Maintenance and Repair

The maintenance of historic concrete often is thought of in terms of appropriate cleaning to remove unattractive dirt or soiling materials. However, the implementation of an overall maintenance plan for a historic structure is the most effective way to help protect historic concrete. For examples, the lack of maintenance to roofs and drainage systems can promote water related damage to adjacent concrete features. The repeated use of deicing salts in winter climates can pit the surface of old concrete and also may promote decay in embedded steel reinforcements. Inadequate protection of concrete walls adjacent to driveways and parking areas can result in the need for repair work later on.

The maintenance of historic concrete involves the regular inspection of concrete to establish baseline conditions and identify needed repairs. Inspection tasks involve monitoring protection systems, including sealant joints, expansion joints, and protective coatings; reviewing existing conditions for development of distress such as cracking and delaminations; documenting conditions observed; and developing and implementing a cyclical repair program.

Sealants are an important part of maintenance of historic concrete structures. Elastomeric sealants, which have replaced traditional oil-resin based caulks for many applications, are used to seal cracks and joints to keep out moisture and reduce air infiltration. Sealants are commonly used at windows and door perimeters, at interfaces between concrete and other materials, and at attachments to or through walls or roofs, such as with lamps, signs, or exterior plumbing fixtures.

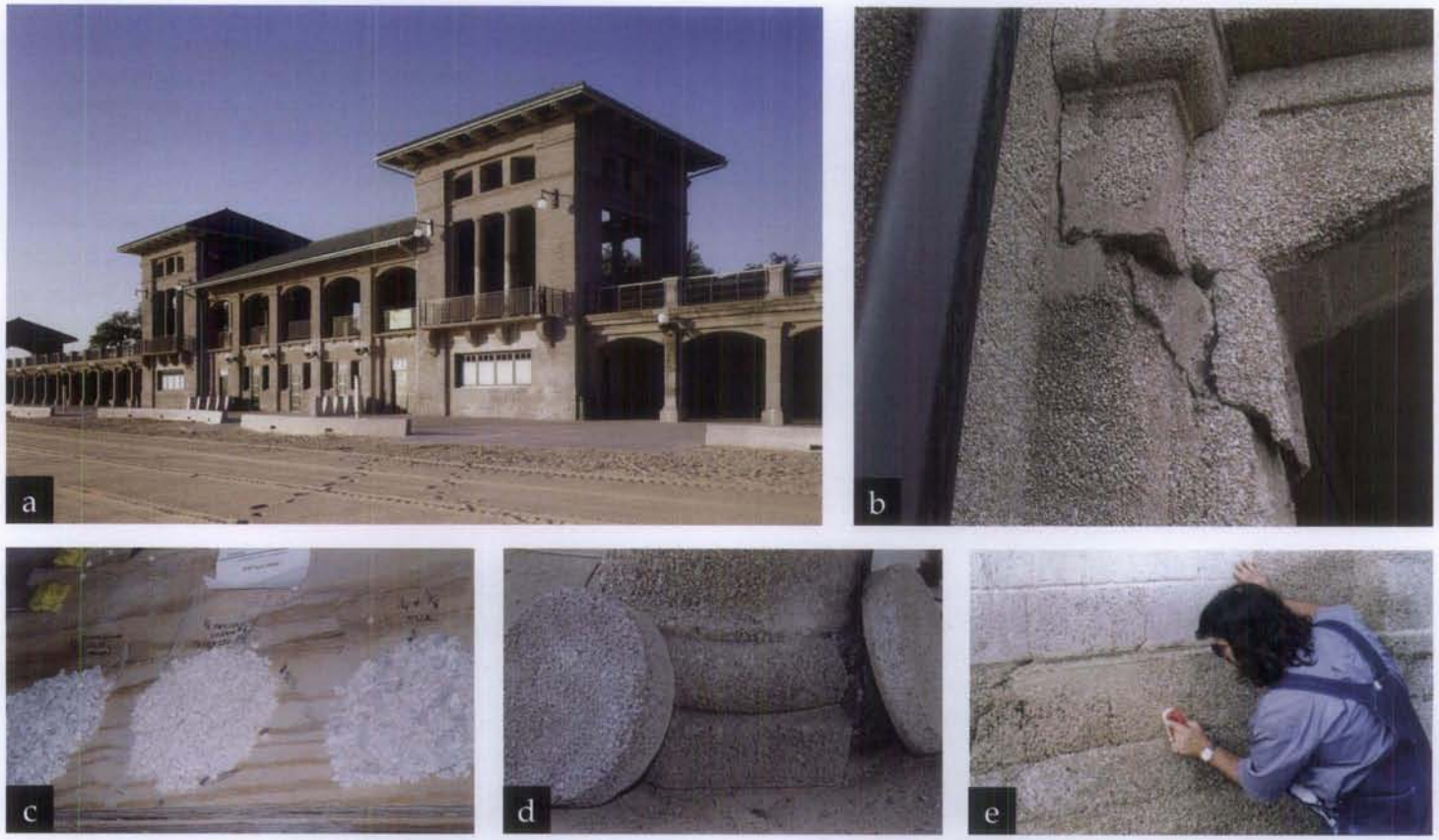


Figure 17. (a) The 63rd Street Beach House was constructed on the shoreline of Chicago in 1919. The highly exposed aggregate concrete of the exterior walls of the beach house was used for many buildings in the Chicago parks as an alternative to more expensive stone construction. Photo: Leslie Schwartz Photography. (b) Concrete deterioration included cracking, spalling, and delamination caused by corrosion of embedded reinforcing steel and concrete damage due to cyclic freezing and thawing. (c) Various sizes and types of aggregates were reviewed for matching to the original concrete materials. (d) Mock-ups of the concrete repair mix were prepared for comparison to the original concrete. Considerations included aggregate type and size, cement color, proportions, aggregate exposure, and surface finish. (e) The craftsman finished the surface to replicate the original appearance in a mock-up on the structure. Here, he used a nylon bristle brush to remove loose paste and expose the aggregate, creating a variable surface to match the adjacent original concrete.

Where used for crack repairs on historic facades, the finished appearance of the sealant application must be considered, as it may be visually intrusive. In some cases, sand can be broadcast onto the surface of the sealant to help conceal the repair.

Urethane and polyurethane sealants are often used to seal joints and cracks in concrete structures, paving, and walkways; these sealants provide a service life of up to ten years. High-performance silicone sealants also are often used with concrete, as they provide a range of movement capabilities and a service life of twenty years or more. Some silicone sealants may stain adjacent materials, which may be a problem with more porous concrete, and may also tend to accumulate dust and dirt. The effectiveness of sealants for sealing joints and cracks depends on numerous factors including proper surface preparation and application. Sealants should be examined as part of routine maintenance inspections, as these materials deteriorate faster than their substrates and must be replaced periodically as a part of cyclical maintenance.

Repair of historic concrete may be required to address deterioration because the original design and construction did not provide for long-term durability, or to facilitate a change in use of the structure. Examples include increasing concrete cover to protect reinforcing steel and reducing water infiltration into the structure by repair of joints. Any such improvements must be thoroughly evaluated for compatibility with the original design and appearance. Care is required in all aspects of historic concrete repair, including surface preparation; installation of formwork; development of the concrete mix design; and concrete placement, consolidation, and curing.

An appropriate repair program addresses existing distress and reduces the rate of future deterioration, which in many cases involves moisture-related issues. The repair program should incorporate materials and methods that are sympathetic to the existing materials in character and appearance, and which provide good long-term performance. In addition, repair materials should age and weather similarly to the original materials. In order to best achieve these goals, concrete repair projects should be divided into three phases: development of trial repair procedures, trial repairs and evaluation, and production repair work.

For any concrete repair project, the process of investigation, laboratory analysis, trial samples, mock-ups, and full-scale repairs allows ongoing refinement of the repair work as well as implementation of quality-control measures. The trial repair process provides an opportunity for the owner, architect, engineer, and contractor to evaluate the concrete mix design and the installation and finishing techniques for the repairs from both technical and aesthetic standpoints. The final repair materials and procedures should match the original concrete in appearance while meeting the established criteria for durability. Information gathered through trial repairs and mock-ups is invaluable in refining the construction documents prior to the start of the overall repair project (Fig. 17).

Surface Preparation

In undertaking surface preparation for historic concrete repair, care must be taken to limit removal of existing material while still providing an appropriate substrate for repairs. This is particularly important where ornamentation and fine details are involved. Preparation for localized repairs usually begins with removal of the loose concrete to determine the general extent of the repair, followed by saw-cutting the perimeter of the repair area. The repair area should extend beyond the area of concrete deterioration to a sufficient extent to provide a sound substrate. When repairing concrete with an exposed aggregate or other special surface texture, a sawcut edge may be too visually evident. To hide the repair edge, techniques such as lightly hand-chipping the edge of the patch may be used to conceal the joint between the original concrete and the new repair material. The depth to which the concrete needs to be removed may be difficult to determine without invasive probing in the repair area. Removal of concrete should typically extend beyond the level of the reinforcing steel, if present, so that the patch encapsulates the reinforcing steel, which provides mechanical attachment for the repair.

If the concrete was originally of lower strength and quality, the assessment of present soundness is more difficult. Deteriorated and unsound concrete is typically removed using pneumatic chipping hammers. Removal of concrete in historic structures is better controlled by using smaller chipping hammers or hand tools. The area of the concrete to be repaired and the exposed reinforcing steel are then cleaned, usually by careful sandblast and air blast procedures applied only within the repair area. Adjacent original concrete surfaces should be protected during this work. In some cases, project constraints such as dust control may limit the ability to thoroughly clean the concrete and steel. For example, it may be necessary to use needle scaling (a small pneumatic impact device) and wire brushing instead of sandblasting.

Supplemental steel may be needed when existing reinforcing steel is severely deteriorated, or if reinforcing steel is not present in repair areas. Exposed existing reinforcing and other embedded steel elements can be cleaned, primed, and painted with a corrosion-inhibiting coating. The patching material should be reinforced and mechanically attached to the existing concrete. Reinforcement materials used in repairs most often include mild steel, epoxy-coated steel, or stainless steel, depending on existing conditions.

Formwork and Molds

Special formwork is needed to recreate ornamental concrete features—which may be complex, in high relief, or architecturally detailed—and to provide special surface finishes such as wood form board textures. Construction of the formwork itself requires particular skill and craftsmanship. Reusable forms can be used for concrete ornamentation that is repeated across a building facade, or precast concrete elements may be used to replace missing or unrepairable architectural features. Formwork for ornamental concrete is often created using a four-step process: a casting of the original concrete is taken; a plaster replica of the unit is prepared; a mold or form is made from the plaster replica; and a new concrete unit is cast. Custom formwork and molds are often the work of specialty companies, such as precasters and cast stone fabricators.

The process of forming architectural features or special surface textures is particularly challenging if early age stripping (removal of formwork early in the concrete curing process) is needed to perform surface treatment on the concrete. Timing for formwork removal is related to strength gain, which in turn is partly dependent on temperature and weather conditions. Early age removal of formwork in highly detailed concrete can lead to damage of the new concrete that has not yet gained sufficient strength through curing.

Selection of Repair Materials and Mix Design

Selection and design of proper repair materials is a critical component of the repair project. This process requires evaluation of the performance, characteristics, and limitations of the repair materials, and may involve laboratory testing of proposed materials and trial repairs. The materials should be selected to address the specific type of repair required and to be compatible with special characteristics of the original concrete. Some modern repair materials are designed to have a high compressive strength and to be impermeable. Even though inherently durable, these newer materials may not be appropriate for use in repairing a low strength historic concrete.

The concrete's durability, or resistance to deterioration, and the materials and methods selected for repair depend on its composition, design, and quality of workmanship. In most cases, a mix design for durable replacement concrete should use materials similar to those of the original concrete mix. Prepackaged materials are often not appropriate for repair of historic concrete. The concrete patching material can be air entrained or polymer-modified if subject to exterior exposure, and should incorporate an appropriate selection of aggregate and cement type, and proper water content and water

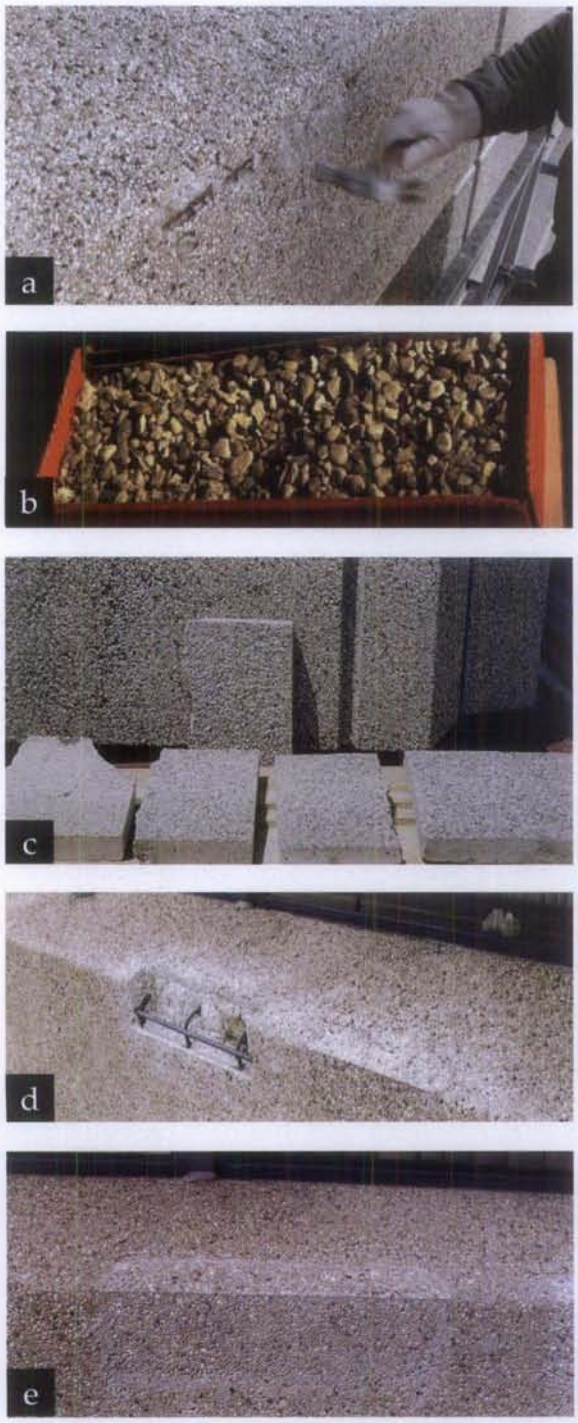


Figure 18. (a) Exposed aggregate precast concrete is sounded with a hammer to detect areas of deterioration. Corrosion of the exposed reinforcing steel bar has led to spalling of the adjacent concrete. (b) Samples of aggregate considered for use in repair concrete are compared to the original concrete materials in terms of size, color, texture, and reflectance. (c) Various sample panels are made using the selected concrete repair mix design for comparison to the original concrete on the building, and the mix design is adjusted based on review of the samples. (d) After removal of the spall, the concrete surface is prepared for installation of a formed patch. (e) Prior to placement of the concrete, a retarding agent is brush-applied to the inside face of the formwork to slow curing at the surface. After the concrete is partially cured, the forms are removed and the surface of the concrete is rubbed to remove some of the paste and expose the aggregate to match the original concrete.

to cement ratio. Some admixtures, including polymer modifiers, may change the appearance of the concrete mix. Design of the concrete patching material should address characteristics required for durability, workability, strength gain, compressive strength, and other performance attributes. During installation of the repair, skilled workmanship is required to ensure proper mixing procedures, placement, consolidation, and curing.

Matching and Repair Techniques for Historic Concrete

Repair measures should be selected that retain as much of the original material as possible, while providing for removal of an adequate amount of deteriorated concrete to provide a sound substrate for a durable repair. The installed repair must visually match the existing concrete as closely as possible and should be similar in other aspects such as compressive strength, permeability, and other characteristics important in the mix design of the concrete (Fig. 18).

Understanding the original construction techniques often provides opportunities in the design of repairs. For example, joints between the new and old concrete can be hidden in changes in surface profile and cold joints. The required patching mix for the concrete to be used in the repair will likely need to be specially designed to replicate the appearance of the adjacent historic concrete. A high level of craftsmanship is required for finishing of historic concrete, in particular to create the sometimes inconsistent finish and variation in the original concrete in contrast to the more even appearance required for most non-historic repairs.

To match the various characteristics of the original concrete, trial mixes should be developed. These mixes need to take into account the types and colors of aggregates and paste present in the original concrete. Different mixes may be needed because of variations in the appearance and composition of the historic concrete. The trials should utilize different forming and finishing techniques to achieve the best possible match to the original concrete. Initial trials should first take place on site but off the structure. The mix designs providing the best match are then installed as trial repairs on the structure, and assessed after they have cured.

Achieving compatibility between repair work and original concrete may be difficult, especially given the variability often present in historic concrete materials and finishes. Formed rather than trowel-applied patch repairs are recommended for durability, as forming permits better ranges of mix ingredients (such as coarse aggregates) and improved consolidation as compared to trowel-applied repairs. Parge coatings usually are not recommended as they do not provide as durable repair as formed concrete. However, in some cases parge coatings may be appropriate to match an original parged surface treatment. Proper placement and finishing of the repair are important to obtain a match with the original concrete. To minimize problems associated with rapid curing of concrete, such as surface cracking, it is important to use proper curing methods and to allow for sufficient time.

Hairline cracks that show no sign of increasing in size may often be left unrepaired. The width of the crack and the amount of movement usually limits the selection of crack repair techniques that are available. Although it is difficult to determine whether cracks are moving or non-moving, and therefore most cracks

should be assumed to be moving, it is possible to repair non-moving cracks by installation of a cementitious repair mortar matching the adjacent concrete. It is generally desirable not to widen cracks prior to the mortar application. Repair mortar containing sand in the mix may be used for wider cracks; unsanded repair mortar may be used for narrower cracks.

When it is desirable to re-establish the structural integrity of a concrete structure involving dormant cracks, epoxy injection repair has proven to be an effective procedure. Such a repair is made by first sealing the crack on both sides of a wall or structural member with epoxy, polyester, wax, tape, or cement slurry, and then injecting epoxy through small holes or ports drilled in the concrete. Once the epoxy in the crack has hardened, the surface sealing material may be removed; however, this type of repair is usually quite apparent. Although it may be possible to inject epoxy without leaving noticeable residue, this process is difficult and, in general, the use of epoxy repairs in visible areas of concrete on historic structures is not recommended.

Active structural cracks (which move as loads are added or removed) and thermal cracks (which move as temperatures fluctuate) must be repaired in a manner that will accommodate the anticipated movement. In some more extreme cases, expansion joints may have to be introduced before crack repairs are undertaken. Active cracks may be filled with sealants that will adhere to the sides of the cracks and will compress or expand during crack movement. The design, detailing, and execution of sealant repairs require considerable attention, or they will detract from the appearance of the historic building. The routing and cleaning of a crack, and installation of an elastomeric sealant to prevent water penetration, is used to address cracks where movement is anticipated. However, unless located in a concealed area of the concrete, this technique is often not acceptable for historic structures because the repair will be visually intrusive (Fig. 19). Other approaches, such as installation of a cementitious crack repair, may need to be considered even though this type of repair may be less effective or have a shorter service life than a sealant repair.

Replacement

If specific components of historic concrete structures are beyond repair, replacement components can be cast to match historic ones. Replacement of original concrete should be carefully considered and viewed as a method of last resort. In some cases, such as for repeated ornamental units, it may be more cost-effective to fabricate precast concrete units to replace missing elements. The forms created for precast or cast-in-place units can then be used again during future repair projects.

Careful mix formulation, placement, and finishing are required to ensure that replacement concrete units will match the historic concrete. There is often a tendency to make replacement concrete more consistent in appearance than the original concrete. The consistency can be in stark contrast with the variability of the original concrete



Figure 19. A high-speed grinder ia used to widen a crack in preparation for installation of a sealant. This process is called "routing." After the crack is prepared, the sealant is installed to prevent moisture infiltration through the crack. Although sealant repairs can provide a durable, watertight repair for moving cracks, they tend to be very visible.

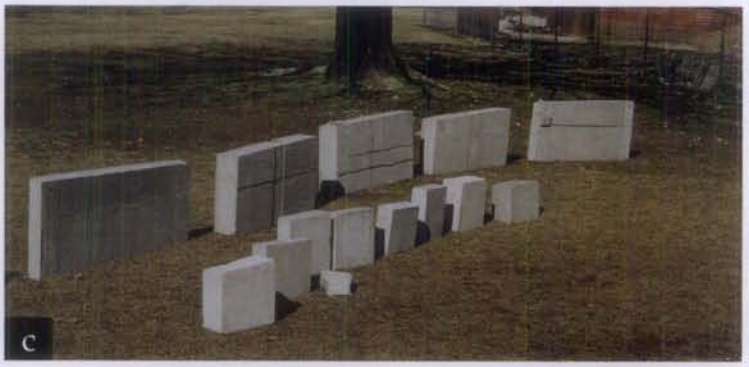
due to original construction techniques, architectural design, or differential exposure to weather. Trial repairs and mock-ups are used to evaluate the proposed replacement concrete work and to refine construction techniques (Fig 20).

Protection Systems

Coatings and Penetrating Sealers. Protection systems such as a penetrating sealers or film forming coating are often used with non-historic structures to protect the concrete and increase the length of the service life of concrete repairs. However, film-forming coatings are often inappropriate for use on a historic structure, unless the structure was coated historically. Film-forming coatings will often change the color and appearance of a surface, and higher build coatings can also mask architectural finishes and ornamental details. For example, the application of a coating on concrete having a formboard finish may hide the wood texture of the surface. Pigmented film-forming coatings are also typically not appropriate for use over exposed aggregate concrete, where the uncoated exposed surface contributes significantly to the historic character of









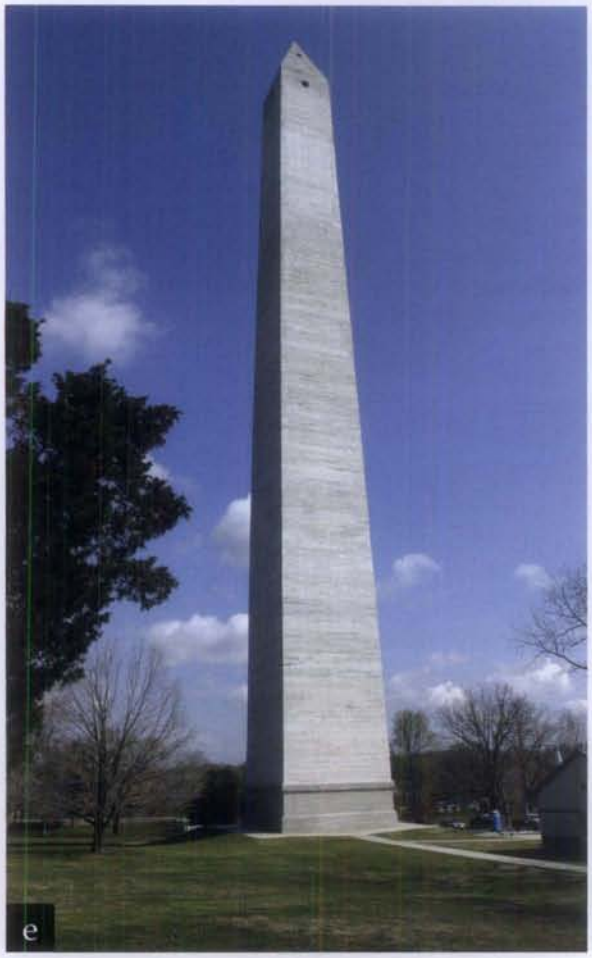


Figure 20. (a) The Jefferson Davis Memorial in Fairview, Kentucky, constructed from 1917–1924, is 351 feet tall and constructed of unreinforced concrete. The walls of the memorial are 8 feet thick at the base and 2 feet thick at the top of the wall. Access to the monument for investigation was provided by rappelling techniques, while ground supported and suspended scaffolding was used to access the exterior during repairs. (b) The concrete was severely deteriorated at isolated locations, with spalling and damage from cyclic freezing and thawing of entrapped water. In addition, previous repairs were at the end of their service life and removal of deteriorated concrete and failed previous repairs was required. Light duty chipping hammers were used to avoid damage to adjacent material when removing deteriorated concrete to the level of sound concrete. (c) Field samples were performed to match the color, finish, and texture of the original concrete. A challenge in matching of historic concrete is achieving variability of appearance. (d) The completed surface after repairs exhibits intentional variability of the concrete surface to match the appearance of the original concrete. Some formwork imperfections that would normally be removed by finishing were intentionally left in place, to replicate the highly variable finish of the original concrete. (e) The Jefferson Davis Memorial after completion of repairs in 2004. Photo e: Joseph Lenzi, Senler, Campbell & Associates, Inc.

concrete. In cases where the color of a substrate needs to be changed, such as to modify the appearance of existing repairs, an alternative to pigmented film-forming coatings is the use of pigmented stains.

Many proprietary clear, penetrating sealers are currently available to protect concrete substrates. These products render fine cracks and pores within the concrete hydrophobic; however, they do not bridge or fill cracks. Clear sealers may change the appearance of the concrete in that treated areas become more visible after rain in contrast to the more absorptive areas of original concrete. Once applied, penetrating sealers cannot be effectively removed and are therefore considered irreversible. They should not be used on historic concrete without thorough prior consideration. However, clear penetrating sealers provide an important means of protection for historic concrete that is not of good quality and can help to avoid more extensive future repairs or replacement. Thus they are sometimes appropriate for use on historic concrete. Once applied, these sealers will require periodic re-application.

Waterproofing membranes are systems used to protect concrete surfaces such as roofs, terraces, plazas, or balconies, as well as surfaces below grade. Systems range from coal tar pitch membranes used on older buildings, to asphalt or urethane-based systems. On historic buildings, membrane systems are typically used only on surfaces that were originally protected by a similar system and surfaces that are not visible from grade. Waterproofing membranes may be covered by roofing, paving, or other architectural finishes.

Laboratory and field testing is recommended prior to application of a protection system or treatment on any concrete structure; testing is even more critical for historic structures because many such treatments are not reversible. As with other repairs, trial samples are important to evaluate the effectiveness of the treatment and to determine whether it will harm the concrete or affect its appearance.

Cathodic Protection. Corrosion is an electrochemical process in which electrons flow between cathodic (positively charged) and anodic (negatively charged) areas on a metal surface; corrosion occurs at the anodes. Cathodic protection is a technique used to control the corrosion of metal by making the whole metal surface the cathode of an electrochemical cell. This technique is used to protect metal structures from corrosion and is also sometimes used to protect steel reinforcement embedded in concrete. For reinforced concrete, cathodic protection is typically accomplished by connecting an auxiliary anode to the reinforcing so that the entire reinforcing bar becomes a cathode. In sacrificial anode (passive) systems, current flows naturally by galvanic action between the less noble anode (such as zinc) and the cathode. In impressed-current (active) systems, current is impressed between an inert anode (such as titanium) and the cathode. Cathodic protection is intended to reduce the rate of corrosion of embedded steel in concrete, which in turn reduces overall deterioration. Protecting embedded steel from corrosion helps to prevent concrete cracking and spalling.

Impressed-current cathodic protection is the most effective means of mitigating steel corrosion and has been used in practical structural applications since the 1970s. However, impressed-current cathodic protection systems are typically the most costly to install and require substantial ongoing monitoring, adjustment, and maintenance to ensure a proper voltage output (protection current) over time. Sacrificial anode cathodic protection dates back to the 1800s, when the hulls of ships were protected using this technology. Today many industries utilize the concept of sacrificial anode cathodic protection for the protection of steel exposed to corrosive environments. It is less costly than an impressed-current system, but is somewhat less effective and requires reapplication of the anode when it becomes depleted.

Re-alkalization. Another technique currently available to protect concrete is realkalization, which is a process to restore the alkalinity of carbonated concrete. The treatment involves soaking the concrete with an alkaline solution, in some cases forcing it into the concrete to the level of the reinforcing steel by passage of direct current. These actions increase the alkalinity of the concrete around the reinforcement, thus restoring the protective alkaline environment for the reinforcement. Like impressed-current cathodic protection methods, it is costly. Other corrosion methods are also available but have a somewhat shorter history of use.

Careful evaluation of existing conditions, the causes and nature of distress, and environmental factors is essential before a protection method is selected and implemented. Not every protection system will be effective on each structure. In addition, the level of intrusion caused by the protection system must be carefully evaluated before it is used on a historic concrete structure.

Summary

In the United States, concrete has been a popular construction material since the late nineteenth century and recently has gained greater recognition as a historic material. Preservation of historic concrete requires a thorough understanding of the causes and types of deterioration, as well as of repair and replacement materials and methods. It is important that adequate time is allotted during the planning phase of a project to provide for trial repairs and mock-ups in order to evaluate the effectiveness and aesthetics of the repairs. Careful design is essential and, as with other preservation efforts, the skill of those performing the work is critical to the success of the repairs. The successful repair of many historic concrete structures in recent years demonstrates that the techniques and materials now available can extend the life of such structures and help ensure their preservation.

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World War Memorial Stadium circa 1929

Appendix F – The National Register of Historic Places

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

SKA CONSULTING ENGINEERS, INC.

TEAGUE FREYALDENHOVEN FREYALDENHOVEN ARCHITECTS & PLANNERS, LLP

NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name World War Memorial Stadium

other names/site number

2. Location

street & number 510 Yanceyville Street N/A ☐ not for publication

city or town Greensboro N/A ☐ vicinity

state North Carolina code NC county Guilford code 081 zip code 27405

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☒ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

Jeffrey F. Crow SHPO 2/20/01

Signature of certifying official/Title Date

North Carolina Department of Cultural Resources

State of Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is: Signature of the Keeper Date of Action

☐ entered in the National Register.
☐ See continuation sheet.

☐ determined eligible for the National Register
☐ See continuation sheet.

☐ determined not eligible for the National Register.

☐ removed from the National Register.

☐ other, (explain:) _____

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☒ public-local
- ☐ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☒ building(s)
- ☐ district
- ☐ site
- ☐ structure
- ☐ object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
1	4	buildings
		sites
	2	structures
		objects
1	6	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

-0-

6. Function or Use

Historic Functions
(Enter categories from instructions)

OTHER/World War I Memorial
RECREATION AND CULTURE/Sports facility

Current Functions
(Enter categories from instructions)

OTHER/World War I Memorial
RECREATION AND CULTURE/Sports facility

7. Description

Architectural Classification
(Enter categories from instructions)

Other: Modern Classicism

Materials
(Enter categories from instructions)

foundation Concrete
walls Concrete
Stucco
roof Asphalt
other Wood
Iron

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

See continuation sheet

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [X] **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] **B** Property is associated with the lives of persons significant in our past.
- [X] **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

- [ ] **A** owned by a religious institution or used for religious purposes.
- [ ] **B** removed from its original location.
- [ ] **C** a birthplace or grave.
- [ ] **D** a cemetery.
- [ ] **E** a reconstructed building, object, or structure.
- [XX] **F** a commemorative property.
- [ ] **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

Architecture
Entertainment/Recreation
Politics/Government
Social History

Period of Significance

1926-1950

Significant Dates

1926
1930

Significant Person
(Complete if Criterion B is marked above)

Cultural Affiliation

N/A

Architect/Builder

White, Leonard, Jr.--architect
Barton, Harry--architect
Carolina Contracting Company--builder

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

Bibliography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey # _____
- [ ] recorded by Historic American Engineering Record # _____

Primary location of additional data:

- [X] State Historic Preservation Office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Name of repository:

_____

World War Memorial Stadium — Guilford County, North Carolina

Name of Property — County and State

10. Geographical Data

Acreage of Property Approximately 14 acres

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing
1	17	609915	3993550
2	17	610295	3993525
3	17	610270	3993045
4	17	609890	3993060

☐ See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Davyd Foard Hood

organization _____ date 28 April 2000

street & number 6907 Old Shelby Road telephone 704/462-4331

city or town Vale state N.C. zip code 28168

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name The City of Greensboro, The Honorable Carolyn Allen, Mayor

street & number Post Office Box 3136 telephone _____

city or town Greensboro state NC zip code 27402-3136

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C. 470 *et seq.*).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 18.1 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, P.O. Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reductions Projects (1024-0018), Washington, DC 20503.

NARRATIVE DESCRIPTION

The World War Memorial Stadium, designed by Leonard White, Jr., and Harry Barton and erected by the Carolina Contracting Company, is an imposing Modern Classical masonry athletic facility which was built in 1926 and dedicated on Armistice Day of that year. The building occupies a fourteen-acre site, donated by the Cone family, in the cityscape of Greensboro and stands about nine blocks northeast of the crossing of Elm and Market Streets, the city's principal north/south and east/west streets, respectively. The stadium stands in an area that in the 1920s was nearly entirely residential, with fashionable Summit Avenue to the northwest and somewhat lower-income housing, also developed by the Cone family's Summit Avenue Development Company, to the northeast and southeast. During the last-third of the twentieth century, Summit Avenue virtually ceased to be a residential street and is now a commercial artery; the area immediately surrounding the stadium has seen less decline in residential fabric but a general transition to mixed uses. The lot on which the stadium stands is a six-sided polygon. The southwest front of the lot is bound by Yanceyville Street which intersects with Lindsay Street at the extreme south corner of the lot; Lindsay Street forms the long southeast boundary of the property. The two-sided, angular northeast boundary of the stadium tract is defined by Boyd and Dewey Streets for nearly equal distances. The five aforementioned boundaries are all straight lines; however, the lot's northwest boundary is in the shape of a gentle arc carrying from Dewey Street and toward Yanceyville Street and along the rear lot lines of houses facing onto the parallel path of Park Avenue. (This curved boundary line alters course as it approaches Yanceyville Street to eliminate inclusion of some city-owned and other noncontributing service buildings that were erected over and inside the boundary of the Cone family's 1926 gift.) The Summit Avenue Historic District (NR, 1993) abuts the stadium property on the northwest side. Muddy Creek flows through the southeast edge of the stadium lot, in a path generally parallel with Lindsay Street, and underground in a culvert for most of its course except for a short stretch; the underground and visible portions are the reverse of their demarcation on the enclosed tax map.

Architectural Background and Physical Development

The stadium, its improvements, and its landscape all reflect the facility's long use as a municipal athletic field and minor league baseball park. The essential masonry fabric of the stadium, standing today largely as it did in 1926, follows a reverse "J" in plan and represents about one-third of the proposed original stadium, a U-shaped facility that would have seated 25,000. The

northeast ends of the parallel sides of the "U" were never extended to their full length, despite the optimism of its sponsors at the time; features positioned along the back edges of some lower tiers of open seating and designed to receive structural steel for upper tiers remain visible and unused. The first changes in the appearance of the stadium came in 1930 when the minor league Greensboro Patriots occupied it as their home field; the elevated roof was added over the center tiers of seating, a press box, and dugouts were added for the 24 April 1930 opening game, and lights were installed that summer. The surprisingly intact fabric of the stadium indicates little physical change in its appearance and facilities from 1930 until the later 1970s; during these years the stadium was used by local high school, college, and community teams and as a minor-league ballpark for periods (1930-1934, 1941-1968).

The arrival of the Greensboro Hornets (now the Bats) in 1978 initiated a series of additions to the facility which made it more agreeable for players and more comfortable for spectators. Most of these were relatively low-cost and altogether utilitarian in appearance and materials except for the steel-frame light towers (#7). The two freestanding wood ticket kiosks (#2-3) at the front of the stadium were added in the 1970s as were food concession areas overlooking the field. The dugouts were rebuilt about 1978-1979. The 1930 press box (behind the entrance portal) was converted to a VIP suite in the late 1980s and a new press box built behind seating to the west where it remains today after some reworking in 1992. A one-story cement block dressing room for visiting teams was added onto the end of the southeast stands in the mid-1980s. (A freestanding kitchen was built about 1990; it stands on adjoining city-owned property which is not included in this nomination.) In 1993 a section of wood frame seating and a bar called the "Grand Stand" was added onto and over the end of the northwest stands, and a picnic area containing about two dozen tables was located to the north. A smaller wood bar called the "Baby Grand" was simply added in the upper corner of the southeast stands.

During the last two decades of the twentieth century some repositioning of offices and facilities occurred within the original spaces enclosed under the stands. The only significant visible alterations effected by these reallocated functions was the infill of windows centered in the symmetrical bays of the stadium walls flanking the entrance portal. Some of the openings were infilled with brick and stuccoed/painted over and at others the brick is visible. During the course of this infilling, in several instances brick was added on the outside of the opening only, leaving the original casement windows and transoms intact and visible inside. Metal ventilators and air conditioners are set in some of these former openings, and these, too, are of different dates. During its long life and active use, a period of nearly three-quarters of a century, the essential fabric of the stadium has survived intact, if slightly worn-looking at its edges. The

relative low-cost improvements for player and spectator comfort over the last three decades have been made over, around, and at the edges of the original 1926 fabric, and they could be removed and replaced in better materials should funding be secured for a restoration and rehabilitation of the stadium.

The landscape development of the stadium lot is simple and informal, and whatever Mr. Cridland, the original landscape architect, might have installed is long lost. Today a cement-paved parking lot carries fully across the Yanceyville Street front of the stadium. The effect of so much cement is partially mitigated by paired Bradford pear trees planted to either side of the portal and enclosed with barberry hedging. In the south corner of the lot the cement paving gives way to a larger gravel-covered, generally rectangular parking lot along the Lindsay Street boundary; it extends back to the grouped, fenced tennis courts standing along the rear Dewey Street boundary. The only other landscape feature outside the stadium is a cement walk, lined with Bradford pear trees which carries from the "Grand Stand" picnic area around and behind the backfield fencing to the tennis courts. The polygonal playing field has a smooth dense grass cover with a border of reddish gravel.

Note: The main grandstand, the southeast and northwest stands, their later twentieth century extensions, and the fencing are linked together and form a single entity which will be described herein as one contributing building. In the last quarter of the twentieth century a group of small unobtrusive buildings (#2-5) was added on the grounds and they will be described herein as noncontributing buildings. The stadium and the playing field are illuminated by a series of lights mounted on eight tall metal towers and two secondary poles. They (#7) constitute a single noncontributing resource as does the group of fenced tennis courts (#6) along the Dewey Street boundary of the stadium lot.

Description

1. World War Memorial Stadium
   1926
   Contributing building

The World War Memorial Stadium is an imposing sand-finished cement and brick masonry athletic facility consisting of a grandstand, being a reverse "J" in plan, which embraces a baseball playing field enclosed on the northeast and southeast sides with backfield billboard and security fencing of wood frame and plywood, cement block, and woven wire in an informal manner.

The stadium grandstand, forming the arc-shaped bowl of the reverse "J," is a symmetrical masonry building dominated by the classical portal facing southwest to Yanceyville Street. The portal is comprised of tall, square-in-plan pylons, with stepped tops supporting flag poles, which flank the entrance. The entrance has the form of a classical triumphal arch with paired five sided pilasters and two octagonal piers supporting the three arched openings which are shaded by canvas awnings. Terracotta eagles in the form of rectangular plaques are positioned above the piers and below a frieze which carries across the top of the bays and links the pylons. The three recessed panels in the frieze bear the name "WORLD WAR MEMORIAL STADIUM" in bronze letters; bronze laurel wreaths are mounted in the frieze in positions above the eagle plaques. The front southwest faces of the pylons have surface treatments at three levels. At the base of each pylon classical masonry tablets are mounted with rectangular bronze plaques on which are inscribed the names of eighty Guilford County men who died in the World War. These tables are flanked by bronze wreath and palm-leaf ornaments. Paired bronze baseball bats and balls are placed in the near center of the pylon faces. The upper faces of the pylons gradually recess inside self frames and hold trios of tall narrow window openings. The exposed outer sides of the pylons have window openings in positions corresponding with the façade tablets which hold paired eight-pane metal casement windows below four-pane transoms. The tops of these sides are finished in the same fashion as the upper front.

The portal is flanked by tall side walls, forming the back of the stadium grandstand, which extend for five-and-one-half bays to each side; the half bays abut the pylons on each side. These bays are simply finished with paired recessed panels per bay. The large, square lower panels were centered with window openings which have since been infilled with brick or masonry. Corresponding panels in the frieze above alternate with shield-shaped ornaments. The elevations of the stadium extending beyond the above-described symmetrical composition are asymmetrical in appearance and reflect the plan and form of the reverse "J." On the southeast side the additional stadium seating, built to only one-half the depth of the bays flanking the pylons, extends for three bays beyond a bay-width walkway which has been infilled. The faces of these three bays have recessed panels holding centered openings which have been infilled with masonry. Board and plywood walling carries across the top of this recessed section. A one-story hip-roof cement-block dressing room with blind walls stands at the northeast end of the seating, and its southeast elevation continues as a cement block security wall down the southeast side of the playing field to where it abuts the backfield wall.

The northwest stand of seating, also erected only one-half the depth of the main grandstand, forms the long stem of the reverse "J" and is about five times (twenty-plus bays) the length of the

southeast stands and includes three passageways providing access to the stands. These passages open off a fenced cement paved service area, behind the northwest stands (where the kitchen and a smaller frame concession stand are located). The area under the multiple bays nearest the main grandstand was originally enclosed and provided visiting team dressing room, restroom, and service areas. They house related functions today. The area under the remaining bays appears to have originally been open and sections of it were enclosed at varying times with masonry (brick or cement block) to provide office, restroom, storage, service, and related spaces. The "Grand Stand," forming the northeast end of the northwest stands, is an open, unpainted frame two-part angled span of informal boxes, deck seating, and an angle-shaped bar protected by a shed roof. A wood deck ramp extends north off the "Grand Stand" to a picnic area with some twenty-five tables partially enclosed by a wood picket fence. A cement walk, lined with Bradford pear trees loops broadly from the picnic area behind the backfield fencing to a restroom building (#4) and a series of fenced, paved tennis courts (#6) positioned at the northeast boundary of the stadium lot along Dewey Street.

At the front of the stadium the three arched openings give into a rectangular lobby with a stepped ceiling reflecting the tiered seating of the grandstand. A passage to the stands and field is on direct axis with the center arch while curving corridors lead off the sides to the southeast and northwest. The cement and exposed brick surfaces of the lobby, the passage, and corridors are painted. The Bats gift shop and their dressing rooms are located along the southeast corridor which terminates with a passage from the dressing room onto the field. On the northwest side of the lobby and along the northwest corridor are located the Bats team offices, a women's restroom, and food concession booths. The finishes of these spaces are mostly utilitarian and modern, dating to the last decades of the twentieth century, when some of the areas were put to different uses; however, a number of original doors, windows, and other significant features survive to indicate the original appearance which, when new in 1926, was very plain and simply fashioned.

The design and appearance of the main covered grandstand and the uncovered southeast and northwest stands is quite simple. Passageways, including the one on axis with the center entrance bay, provide access from the two corridors and the ground level exterior on the northwest (behind the stem of the reverse "J") to the stands. Simple inset masonry staircases link these passages with the tiered sections of seating which ascend from the front to the back. When the stadium was dedicated in 1926, the seating consisted of wood benches mounted on iron brackets; important sections of this original seating type survive in the rear third of the stadium; however, the wood slats have been replaced with metal on the original iron brackets. Most of the

seating in the front two-thirds of the stadium has been replaced during the last three decades of the twentieth century with modern seats reused here from other facilities including the Greensboro Coliseum, after it was reseated in the mid 1990s, and stadiums in New York and Philadelphia (via Spartanburg). Some individual seating, installed in the grandstand after 1926, was relocated to the "Grand Stand" when it was built. The seating in the main grandstand behind the portal and the fully-developed area to the northwest is covered by the 1930 metal frame roof supported by slender metal piers. This asymmetrical arrangement reflects the off-axis positioning of home plate and the playing field that was necessary to provide the appropriate/required distances from baselines to the backfield. Behind the portal the stadium's original press box was refashioned as a VIP suite. The new 1980s press box is located at the rear of the northwest stands. The area immediately in front of the stands, between them and the woven metal fence enclosing the playing field, is cement-paved and used by spectators for access between sections of seating and to reach concession areas including one, named "Joanne's Dugout," which is immediately behind one of two simple modern dugouts inset in the fence enclosing the field.

The grass-covered playing field of the World War Memorial Stadium is generally oval in shape, defined by the arc of the grandstand on the southwest, the straight line of the northwest stands on the northwest, a corresponding arc on the northeast, and an irregular boundary on the southeast caused by the necessary projection of the right field line. The field is enclosed on the northeast and southeast with wood frame advertising billboards. Because of the reverse "J" shape of the stands, originally conceived for football and track events and amateur/scholastic baseball, the home plate is not (and cannot be) on axis with the center of the stadium, but it is located slightly to the north. The left field line, from home plate through third base to the wall at the end of the northwest stands, is 327 feet. Center field is 401 feet. The right field line, from home plate through first base and to the angular projection in the southeast wall, is 327 feet. The playing field was laser-graded and replanted with grass for the opening home game of the Greensboro Bats' 2000 season on 6 April. Home plate, the base paths, the infield, and the perimeter of the playing field are covered with packed red clay.

Modern Support Facilities

These simple free standing buildings were erected in the last decades of the twentieth century for spectator convenience. While all of them are noncontributing, they are unobtrusive and do not affect the integrity of the stadium.

2. South Ticket Kiosk
ca. 1979
Noncontributing building

This small simple frame building is one of a pair standing on brick foundations on cement pads, sheathed with exterior wood paneling, and covered with shed roofs. This one, standing to the right (south) of the portal, has an opening protected by plexiglass on its southwest front and a door on the rear for worker access.

3. West Ticket Kiosk
ca. 1979
Noncontributing building

This ticket booth is located in a pendant position to the above booth and to the west side of the portal. It is identical in appearance except that the opening on its front is protected by a woven wire screen.

4. Restroom Pavilion
ca. 1975-1990
Noncontributing building

This rectangular frame and masonry building is covered with a side-gable asphalt shingle roof and was erected principally for the convenience of those using the adjoining tennis courts.

5. Maintenance Building
ca. 1975
Noncontributing building

This rectangular building, covered with a side-gable asphalt shingle roof, and the adjoining fenced yard, is used by the grounds crew as a rest and recreational area during the baseball season when they have to be on site for extended hours.

6. Tennis Courts
ca. 1975-1985
Noncontributing structures

This small group of fenced and paved tennis courts was erected by the parks and recreation department of Greensboro at the extreme northeast edge of the stadium lot at its boundary along Dewey Street.

7. Light Towers
ca. 1978-1985
Noncontributing structure

The playing field is illuminated at night by a group of eight principal light towers and two secondary towers. The eight principal towers are metal frame and rise from poured cement bases. The light boards have four rows with seven lights in each row. The secondary light standards have two rows with eight lights each with two in a third row at their base.

SUMMARY

The Greensboro World War Memorial Stadium, an imposing Modern Classical building dedicated on Armistice Day 1926, holds unusual significance in the history of Greensboro, Guilford County, and the state of North Carolina. It satisfies National Register Criteria A and C and holds statewide significance in the areas of architecture, entertainment/recreation, politics/government, and social history, as a unique embodiment of civic sympathy and responsibility, respectively, for those citizens of Guilford County who gave their lives during World War I and for its sons (and daughters) who would participate in athletic contests in the stadium for a period now approaching three-quarters of a century. Criteria Consideration F is superseded by the historical significance of the stadium. It stands today as the largest and costliest such memorial erected by a community in North Carolina honoring those who died in the World War. While a memorial honoring the sons of Guilford County who died in the war had been espoused by civic leaders and members of the Harry K. Burtner Post #53 of the American Legion from the close of the war, it was not until fall 1921 that the American Legion post voted to support a memorial in the form of an athletic facility that could be used by local public schools, colleges, and amateur sports associations. However noble the proposal, the effort stalled until 1925: on 12 February the North Carolina Legislature authorized the creation of the Greensboro World War Memorial Commission; and nine months later a large and influential group of three hundred citizens staged a three-day drive which raised some $105,000 by its close on Armistice Day (11 November). The stadium, originally ambitiously designed in the shape of a "U" by Greensboro architects Leonard White, Jr. and Harry Barton, would have seated 25,000. Even with the appropriation of $50,000 by the city of Greensboro that project was beyond reach, and in 1926 the Carolina Contracting Company erected a portion of the design, essentially a reverse "J" in shape, which would seat approximately 8,500. That facility, with its handsome classical entrance flanked by pylons bearing bronze tablets inscribed with the names of eighty fallen heroes, was dedicated on Armistice Day 1926. The use of the stadium as an athletic facility, inaugurated that afternoon by a football game between Guilford and High Point Colleges, has continued to the present. Beginning in 1930 the stadium became the home field of the Greensboro Patriots, an affiliate of the St. Louis Cardinals, and it survives as the oldest minor-league ball park in North Carolina (and possibly the nation). Except for several years in the late 1930s, the stadium continued to be used for minor league baseball until 1968. The stadium's period of significance begins in 1926 and ends in 1950 because it has not been shown that the property has the exceptional significance required to extend the period to within the last fifty years.

HISTORICAL BACKGROUND, ARCHITECTURE, ENTERTAINMENT/RECREATION, POLITICS AND GOVERNMENT, AND SOCIAL HISTORY CONTEXTS

The tremendous loss of life experienced in the World War--subsequently and hereinafter called World War I--occasioned many forms of remembrance and commemoration. The Tomb of the Unknown Soldier in Arlington National Cemetery, completed in 1931, is the best known of a series of monuments and memorials erected throughout the United States, which suffered casualties of 307,092 persons including 81,553 deaths. Built memorials were of two principal types: either a commemorative memorial, like the Tomb of the Unknown Soldier, which was monumental in form and setting and embellished with sculptural enrichments; or architectural, being a public building such as a library, auditorium, or stadium erected in memory of those who had died and for the use of the citizenry. Some 86,457 North Carolina men and women served in World War I; of that number 2,927 service people were from Guilford County, with about 1,400 of that total being citizens of Greensboro (Arnett, 320). Henry K. Burtner (death date unconfirmed) became the first of at least 138 persons from Guilford County who died in the war. In 1919 his death was memorialized in Greensboro through the organization of the Henry K. Burtner Post #53 of the American Legion, one of the first posts organized in North Carolina under the auspices of the national organization chartered by Congress in September 1919. Through the course of the early 1920s, members of the Henry K. Burtner Post championed the erection of a memorial; their efforts and those of others active in the fund raising campaign in the fall of 1925 saw success in the dedication of the World War Memorial Stadium on Armistice Day (November 11) in 1926.[1]

A memorial to Guilford's fallen sons became a topic of conversations among private individuals and in the meetings of various civic organizations in Greensboro as soon as the war ended. However, it was not until 17 October 1921 that the members of the Henry K. Burtner Post met expressly for the purpose of discussing a memorial and what form it should take. J. F. Stevens and McDaniel Lewis advocated an athletic field, and Mr. Stevens made a motion to that effect which was passed by the post (Greensboro Record, 16 November 1940). For reasons that are not now clear, the proposal lagged until 1925. In retrospect this delay appears inexplicable given the tenor of the times and the fact that scions of at least two of Greensboro's most prominent families died during the war in 1918.[2]

Plans for the World War memorial advanced quickly in 1925. On 12 February 1925 "An Act to Authorize the City of Greensboro to Hold and Own Property for a Memorial Park, and to

Provide for the Control and Management of Same" was passed in the North Carolina Legislature. The act also named members of the Greensboro World War Memorial Commission to hold office until their successors were elected: Herman Cone; Allen T. Preyer; Alfred Moore Scales; John N. Wilson; and Mrs. Harry R. Bush. The wording of the act suggests that the site of the memorial had been determined, although the property would not actually be conveyed to the city of Greensboro until May 1926. The design of this important new civic building was a commission with sure appeal to members of the Greensboro architectural profession, including Harry Barton, Wells L. Brewer, Charles C. Hartmann, Raleigh James Hughes, and Christopher Gadsen Sayre. The honor, however, went to members of the profession with an inside track. Leonard White, Jr., a veteran of the World War and member of the Henry K. Burtner Post, was an associate architect in the office of Harry Barton. Messrs. Barton and White received the commission for the building and appear to have resolved the general design scheme during the fall of 1925. Both their names appear on the presentation drawing which was sent to the editor of the American Legion Weekly on 5 December for publication. The extent to which the design reflected ideas earlier put forth by landscape architect Robert B. Cridland, who had been engaged by the American Legion in the early 1920s, is not known; Cridland continued his involvement with the project and prepared a landscape plan for the facility. Meanwhile, a highly organized fund-raising campaign opened in Greensboro on Monday, 9 November, with some 300 volunteers seeking donations from citizens, businesses, and the Guilford County schoolchildren. By the close of the drive, on Armistice Day (11 November), some $105,000 had been pledged.

The final working drawings for the World War Memorial Stadium were probably completed in the winter of 1926 as the financial details of the building's construction were being resolved. The city of Greensboro committed an additional $50,000 to the project. On 17 May 1926 the Summit Avenue Building Company, through its president Herman Cone, conveyed the fourteen-acre site of the memorial stadium to the city of Greensboro (Guilford County Deeds, 517/580-581). The contract for the building was awarded to the Carolina Contracting Company of Greensboro, whose office was located in the city's Jefferson Standard Building on the floor above that of the architects.

Construction on the stadium is said to have begun in April, before the property was formally conveyed to the city. The stadium design was in the form of a "U" with the entrance, offices, and guest and player facilities located in and adjoining a handsome arched portal, flanked by pylons, at the base of the "U." The long sides of the "U" provided stepped banks of seating overlooking the elongated oval field which was well suited for football and tract events; however, its principal use came to be for baseball. The original design provided seating for

25,000; the population of Greensboro in 1920 was 34,163 and that of Guilford County was 45,109. The stadium sponsors and city fathers quickly realized the plan was too ambitious. How the decision on how much of the building to erect was reached is now unknown; however, the costs and funds at hand were surely the principal factors affecting the decision. In the end, the decision was made to erect the entrance portal and to erect permanent seating for some 8,500 persons; the building readied for dedication on Armistice Day 1926 was in the form of a reverse "J." Provision was also made for portable bleacher seating for about 4,000 more. While there have been some improvements to the facility, principally the addition of a canopy, improvements to the dressing rooms, and the erection of a press box and dugouts in 1930 for the benefit of the Greensboro Patriots baseball team, the World War Memorial Stadium survives essentially as completed in the fall of 1926.

The dedication of the World War Memorial Stadium on Armistice Day (Thursday, 11 November) 1926 was much heralded in the Greensboro Daily News. Long articles published on 10-11 November celebrated the completion of the building and outlined the program of the dedicatory ceremonies. The front page article in the Friday edition of the Greensboro Daily News provided lavish coverage of the dedication. The ceremonies began at 10:30 a.m. at the entrance portal with the dedication and unveiling of the two bronze plaques, mounted on the faces of the pylons, which bore the names of eighty men who had died in the war. (Even before the building was dedicated, the total number of local deaths in the World War increased; however, the additional names were never added on plaques or visibly placed on the building.) The assembly then moved inside the stadium, took seats, and listened to speeches by Mayor Edwin B. Jeffress, president of the stadium commission, on the history of the stadium, and Alfred Lee Bulwinkle (1883-1950), Congressman for the state's Tenth District and a veteran of the world war. The athletic field was christened at 2:30 p.m. in a football game between teams from two of the county's colleges; High Point College defeated Guilford College by a score of 7 to 3.

When the World War Memorial Stadium was dedicated in 1926 it became the first major memorial in North Carolina dedicated to those "who made the supreme sacrifice in the World War" and it placed in service a building which has remained central in the civic and athletic life of the city to the present. As events came to prove, it survives as one of the two impressive memorials erected in the state to those who died in World War I. On 23 January 1919 the North Carolina Legislature had enacted a bill to "Appoint a North Carolina Memorial Building Commission and to Provide for the Erection of a Suitable Memorial Building in Honor and to the Memory of all North Carolina Citizens Who Gave Their Lives, Services, or Property to the End

that the War with Germany and Her Allies Might Be Won." That twelve-member commission, headed by the governor, did not succeed in raising the money for a memorial building; however, its adjunct responsibility to collect records relating to the war and the services of North Carolina was fulfilled in part by a "Collector of War Records" established by the North Carolina Historical Commission and the acquisition of artifacts by the Hall of History (now the Museum of History).

Four years after the dedication of the Greensboro memorial, Raleigh's municipal building and auditorium was destroyed in a fire on 24 October 1930. When the decision was made to rebuild the auditorium, it was also to be erected as a memorial to the war dead of Raleigh, but with no specific reference to a particular war. The Raleigh Memorial Auditorium, a Classical Revival-style limestone-sheathed building, was dedicated on 19 January 1932. In 1919 a committee at North Carolina State College had been appointed also to arrange for a memorial honoring its thirty-three students who had died in the world war. That project also languished, largely because of inadequate funding, until the mid-1930s when Works Progress Administration funds were appropriated for the construction of Memorial Tower in a prominent location near the Hillsborough Street edge of the campus. Designed by William Henry Deacy, the Mt. Airy granite bell tower was completed in 1937. In the years following the close of World War II, in which more than 7,000 North Carolinians lost their lives, memorials were raised in counties throughout the state to those who had died in both wars. These mostly took the form of bronze tablets mounted on the walls of court houses or monuments on their grounds.

While the Memorial Tower on the campus of North Carolina State University continues to be a handsome landmark in the capital, the World War Memorial Stadium in Greensboro continues to serve the larger purpose for which it was erected. Standing inside the stadium on Armistice Day 1926, Mr. Jeffress, mayor of Greensboro, concluded his speech with a focus on the promise the stadium held for the citizens of Greensboro and Guilford County.

> And so the stadium has been built by children's and widows' wives' and rich men's wealth. It is here for the use of the coming generations; the soldier boys said they wanted no hollow of granite, no useless monument to decorate our street corners, even no statuary or brass to remind us of those who have passed along after doing life's full duty, but they wanted something that would be useful; that would help develop mind and body; that would in this way be a perpetual memorial to those who have passed . . ., that those of us who follow after should use our best efforts to make ourselves physically fit to

answer any emergency; . . .; and when the call to duty comes, answer with a clear, strong voice, "We are ready to do our bit" (Greensboro Record, 16 November 1940)."

In 1926 good athletic facilities, particularly playing fields, for the city and county's high school students were much needed. In 1922-1923 when the city built four new graded schools, including the Charles B. Aycock School near the stadium site and off Summit Avenue, their modern plants included gymnasiums and dressing rooms; however, the provisions for outdoor sports were few and increasingly inadequate as the city's population increased. Those four graded school buildings were advanced for their time, and an early municipal expression of the statewide school consolidation movement; however, educational innovation moved rapidly in the 1920s. In 1929 when Greensboro erected new separate high schools for its white and black citizens, Greensboro (now Grimsley) and James B. Dudley High Schools, respectively, their physical plants provided larger offerings, particularly for the sciences and athletics (Brown, 76).

The football game played between High Point and Guilford Colleges as a part of the dedicatory ceremonies inaugurated the stadium as a site for collegiate athletics; from that day to the present the World War Memorial Stadium has fulfilled the role of an athletic facility envisioned by its supporters and articulated by Mr. Jeffress. In the fall of 1926 the Greensboro Chamber of Commerce circulated an attractive four-page brochure encouraging the use of the facility which it described as "North Carolina's Amateur Sports Center." For its first four years the stadium served as the site of local high school, collegiate, community, and American-Legion-associated amateur sports events; these were coordinated under the Stadium Games Committee first, long-chaired by J. D. Wilkins. In 1930 the Stadium Commission entered into an agreement with the St. Louis Cardinals whereby the stadium became the home field of its minor-league affiliate team, the Greensboro Patriots; from 1908 to 1930, the Patriots had played at the city's Cone Park under a series of league associations.

The decision to accommodate the Greensboro Patriots in the stadium, and the continued, although sometimes interrupted, use of the stadium as a minor-league baseball park, has earned it an important distinction and significance in the history of sports in Greensboro, North Carolina, and the nation. The World War Memorial Stadium is believed to be the oldest active minor-league stadium in the United States. This supposition, advanced locally and by the office of the Greensboro Bats, the current resident minor-league team, has not been researched for this nomination; however, the stadium is certainly the oldest intact minor-league stadium in North Carolina. The stadium is included in Fodor's Ballpark Vacations published in 1997. A stadium built in 1924 in Asheville was partially destroyed by fire in 1934 and rebuilt; the Kinston

Stadium, built in 1949, is the next oldest stadium in North Carolina. The Greensboro Patriots played in World War Memorial Stadium into 1934; after a six-year break from 1935 to 1940, minor-league baseball returned to the stadium and teams played here under a succession of names and affiliations until 1968. A second, ten-year absence of minor-league baseball existed until 1978 when a team in Shelby was acquired, moved to Greensboro and renamed the Greensboro Hornets. In 1994 the Hornets were renamed the Greensboro Bats, and the Bats, an affiliate of the New York Yankees, continue to use World War Memorial Stadium as their home field. The larger community use of the stadium also continues to the present; the baseball team of North Carolina A & T State University plays its home games in World War Memorial Stadium.

While the stadium has remained in use to the present, investment in its maintenance and repairs have not kept apace of general upkeep or the extensive mechanical systems updating that it requires to continue in use as a viable facility. The future use of the building is also threatened by the possible, long-sought construction of a new state-of-the-art facility advocated by the management of the Greensboro Bats and some local sports enthusiasts. Other leaders in Greensboro, including the Charles B. Aycock Neighborhood Association which sponsored this nomination, are advocating a new life for the stadium through rehabilitation, restoring its fabric and improving its facilities so that it might again, in new circumstances, live up to its 1925 description as "North Carolina's Amateur Sports Center." In 1940 J. D. Wilkins, who had been a leader in the fall 1925 fund drive and who retained an active role in the operation of the stadium for many years, wrote a sketch of the stadium published in the Greensboro Record on 16 November. Couched in the narrative outlining the building's history and operation up to 1940, he expressed a poignant regret, "It is not with pride that we recall delay in getting the project under way." Perhaps a parallel feeling, experienced by many now, sixty years later, will galvanize Greensboro citizens to renew and restore the World War Memorial Stadium in honor of those who died near the beginning of the twentieth century and those who excelled here in the years afterward to the present.

Endnotes

1. Published sources, including books and newspaper articles, used in the preparation of this nomination are included in the bibliography and where appropriate noted internally in the text.

2. Edward Latham (1894-1918) was the son of James Edwin Latham (1866-1946), a prominent cotton broker and capitalist, and his wife Maude Moore Latham (1871-1951): Mrs. Latham would become the principal donor for the restoration of Tryon Palace in New Bern, and her philanthropy would be continued by her daughter, May Gordon Latham Kellenberger (1893-1978), who became her parents' heir after the death of her only sibling. Alfred Moore Scales IV (1898-1918) was the son of Alfred Moore Scales (1870-1940), a principal developer of Greensboro's Irving Park (NR, 1995), the city's premiere residential suburban park, (and Hamilton Lakes,) and Bessie Taylor Scales (1870-1912); he was the grandson of North Carolina Governor Alfred Moore Scales (1827-1892) and the great-grandson of John A. Taylor whose marble-fronted house remains one of the finest residences ever built in Wilmington.

Bibliography

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Greensboro News & Record: 21 January 1970; 18 December 1994; 25 January, 7 February 1999.

Greensboro Record: 16 November 1940; 13, 26 February 1941.

"The Greensboro World War Memorial Stadium." Greensboro: Greensboro Chamber of Commerce, 1926.

Guilford County Deeds, Office of the Register of Deeds, Guilford County Court House, Greensboro, North Carolina.

Public Laws of North Carolina, 1919, c. 3.

Public Laws of North Carolina, 1921, c. 31.

George Stevenson, letter to author, 14 April 2000.

Geographical Data

Verbal Boundary Description: The property included in this nomination is delineated by the bold line on the accompanying copy of the northern portion of Guilford County Tax Map, sheet 46. The nominated property is described in the deed of conveyance, dated 17 May 1926, and recorded in Guilford County Deed Book 517, pages 580-581, except for the west corner of that parcel where a group of city-owned and noncontributing service buildings stand astride the boundary. The bold line on the accompanying map encompasses the vast majority of the parcel described in the deed (identified in the Guilford County tax mapping system as 00-00-0046-0-0001-00-016), but it excludes the strip of land containing the service buildings along the northwest edge of the 1926 boundary.

Boundary Justification: The property included in this nomination is the parcel conveyed as a gift by the Summit Avenue Building Company to the City of Greensboro on 17 May 1926, except for a small rectangular area at the parcel's west corner where a group of city-owned and noncontributing service buildings have been erected astride and without respect for the 1926 boundary. Otherwise, the boundary of the parcel has remained intact to the present, and the approximately fourteen-acre tract serves as the site and setting of the World War Memorial Stadium. The parcel is outlined in pencil on the enclosed Guilford County Tax Map, Sheet no. 46.

Photographic Schedule

1. Name of property: World War Memorial Stadium
2. Location: Guilford County, North Carolina
3. Name of photographer: Davyd Foard Hood
4. Date of photographs: 9 February 1999
5. Location of original negatives: Division of Archives and History, Raleigh, N. C.

Photographs

A. Overall view looking east from a position on the southwest side of Yanceyville Street.

B. Portal on the southwest façade, looking northeast.

C. Playing field, looking east.

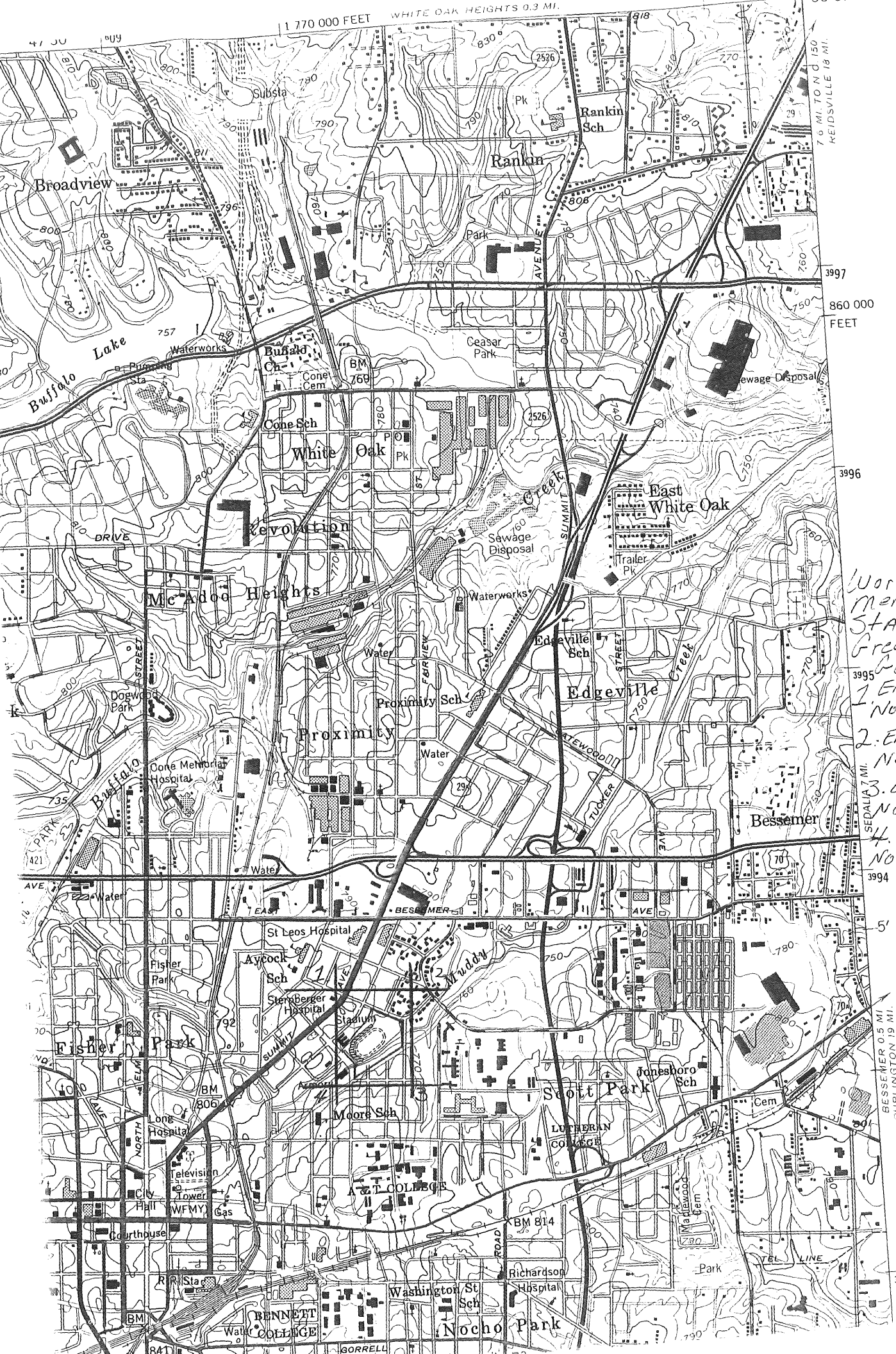
D. Grandstand seating with VIP suite, looking west/northwest.

E. Grandstand seating and roof, looking southwest.

F. View of the northwest stands, looking north with press box on the left and "Grand Stand" on the near right.

G. Lobby immediatley inside the portal, looking north with opening on the northwest corridor in the center and main axial passage to the grandstand and field on right.

H. Interior, looking northeast from lobby into northwest corridor.



World War Memorial Stadium Greensboro, Guilford Co.
1. Easting 609915
Northing 3993550
2. Easting 610295
Northing 3993520
3. Easting 610270
Northing 3993040
4. Easting 609990
Northing 3993060
Zone 17


STOP



World War Memorial Stadium circa 1929

Appendix G – Opinion of Probable Costs

for

Preservation Plan and Conditions Assessment

for

WORLD WAR MEMORIAL STADIUM

Greensboro, North Carolina

GREENSBORO PARKS AND RECREATION

The City of Greensboro, North Carolina

August 2014

SKA CONSULTING ENGINEERS, INC.

TEAGUE FREYALDENHOVEN FREYALDENHOVEN ARCHITECTS & PLANNERS, LLP

Appendix G - Opinion of Probable Costs

An Opinion of Probable Costs has been prepared based on the results of the current condition review completed by SKA, schematic design options to address stabilization requirements and the proposed amenities to restore functionality to the stadium. The Opinion of Probable Cost has been divided, for convenience, into two categories – Stabilization and Amenities.

Stabilization generally includes the required demolition of select components, required temporary bracing of remaining elements, replacement and/or preservation of historically significant components, replacement and/or strengthening of critical structural components, and basic temporary securement of the facility in a safe condition.

Amenities include those basic items necessary for the facility to be functional as a sports/event venue, such as, bench seating for 1500 persons, interior signage, locker rooms, public restrooms, support spaces (umpires and grounds offices, etc.), seating and accessible routing to meet ADA Requirements and concessions space. Electrical, Mechanical and Plumbing as required to service these amenities are included in the current probable cost estimates. No revisions to the field lighting are included in the current probable cost estimates.

In summary, the Opinion of Probable Costs is as follows:

OPTION A

Phase I – Preservation and Stabilization: $3,220,000

Phase II – Renovation and Amenities: $2,055,000

Total of Phases I and II: $5,275,000

OPTION B

Limited Phase I - Grids 5 thru 20 only – Preservation and Stabilization: $3,033,000
(with partial removal of existing stucco on Tower and Archways)

Limited Phase II – Grids 5 thru 20 only - Renovation and Amenities: $1,650,000

Total of Limited Phases I and II: $4,683,000

*See following attached summary information for specifics.

CAPITAL BUILDING CONSULTANTS
11040 OLD US HIGHWAY 52
WINSTON-SALEM, NC 27107
PHONE: (336) 775-1904
FAX: (336) 775-1905

ESTIMATE OF PROBABLE COST

PROJECT: WAR MEMORIAL STADIUM - 1
PHASE I
GREENSBORO, NC
ESTIMATOR: EJB
JOB DESCRIPTION: SCHEMATIC-STABILIZATION

BUILDING SPACE: 1 S.F.
ARCH. FIRM: SKA CONSULTING ENG.
CONTACT: BRAD EHRHARDT, PE
ESTIMATE NO: 0-536-14

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
A. GENERAL CONDITIONS							
PROJ. PERSONNEL	PROJ. MNGR./FIELD SUPT. ETC.,	48	WKS	1,500	$72,000	$72,000	2.24%
PROJ. LABOR	DAILY CLEAN-UP/GEN. LABOR	420	CHRS	55	$23,100	$23,100	0.72%
PROJ. MATERIAL	MISC. SUPPLIES	1	LS	1,500	$1,500	$1,500	0.05%
PROJ. TRANSPORTATION	PU TRK/DUMP/FUEL/ETC.	12	MO	1,500	$18,000	$18,000	0.56%
CONSTRUCTION AIDS	OSHA	1	LS	15,000	$15,000	$15,000	0.47%
TEMP UTILITIES	WATER/POWER/PHONE, ETC.	1	LS	2,500	$2,500	$2,500	0.08%
PROJECT CONDITIONS	TRASH REMOVAL/DUMP FEES	1	LS	50,000	$50,000	$50,000	1.55%
EQUIPMENT	SMALL TOOLS/SCAFFOLDS/RENTALS	1	LS	20,000	$20,000	$20,000	0.62%
					$202,100	$202,100	6.28%
B. SITE CONDITIONS							
EARTH WORK	GEN GRADING/BACKFILL/RESEED	1	ALLOW	100,000	$100,000	100,000	3.11%
SITE SPECIALTIES	DRAINAGE SYSTEM @ EARTH BERMS	1	ALLOW	25,000	$25,000	25,000	0.78%
					$125,000	125,000	3.88%
C. STRUCTURAL CONCRETE							
a. RAILS/BEAMS	CIP REINF. CONC.	55	CY	975	$53,625	$53,625	1.67%
a. SEATS/RISERS	CIP REINF. CONC.	125	CY	1000	$125,000	$125,000	3.88%
a. VOMITORY WALLS	CIP REINF. CONC.	63	CY	780	$49,140	$49,140	1.53%
a. WALLS	CIP" KNEE	52	CY	700	$36,400	$36,400	1.13%
a. SEATS/RISERS	PRECAST	16531	SF	9.50	$157,045	$157,045	4.88%
a. CONCRETE REPAIR (RB)	REINF/CONC/ENCASEMENT, ETC.	5744	CSF	25	$143,600	$143,600	4.46%
a. CONCRETE REPAIR (COLS)	REINF/CONC/ENCASEMENT, ETC.	470	CSF	30	$14,100	$14,100	0.44%
b. WALLS	CIP" COUNTERFORT	81	CY	795	$64,395	$64,395	2.00%
b. WALLS	CIP" SIDE	26	CY	780	$20,280	$20,280	0.63%
b. WALLS	CIP" VOMITORY	28	CY	780	$21,840	$21,840	0.68%
b. WALLS	CIP KNEE	78	CY	700	$54,600	$54,600	1.70%
b. REFURBISH SURFACES	PATCH & SEAL SPOILED CONC. SURFACES	3852	SF	10	$38,520	$38,520	1.20%
					$778,545	$778,545	24.17%
E. EXTERIOR WALLS							
a. MASONRY	REINF./CMU W/STUCCO	2640	SF	35	$92,400	$92,400	2.87%
a. STUCCO	MECH. FASTENED SYSTEM	3960	SF	45	$178,200	$178,200	5.53%
a. MASONRY	RESTORATION	3960	SF	6.50	$25,740	$25,740	0.80%
b. MASONRY	REINF./CMU W/WATER REP.	5004	SF	20	$100,080	$100,080	3.11%
b. MASONRY	REINF./CMU/STUCCO	1650	SF	45	$74,250	$74,250	2.31%
b. WATERPROOFING	MASTIC/DRAIN BOARD/PIERS, ETC.	4870	SF	6	$29,220	$29,220	0.91%
b. SHORING	TEMPORARY	8150	SF	3	$24,450	$24,450	0.76%
					$524,340	$524,340	16.28%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
Y. SPECIAL CONSTRUCTION							
a. DEMOLITION	CONC. SEATING/RISERS	1654	SF	20	$33,080	33,080	1.03%
a. DEMOLITION	CONC. GUARD RAIL/SPANDREL BEAM	1155	SF	15	$17,325	17,325	0.54%
a. DEMOLITION	VOMITORY WALLS	1100	CF	15	$16,500	16,500	0.51%
a. DEMOLITION	CONC. SOG	13453	SF	2	$26,906	$26,906	0.84%
a. DEMOLITION	REMOVE STUCCO FINISH	3960	SF	1.50	$5,940	$5,940	0.18%
a. DEMOLITION	MASONRY INFILL	3060	CF	8	$24,480	24,480	0.76%
a. DEMOLITION	CIP SEATING/RSRS/KNEEWALLS, ETC.	1130	SF	5	$5,650	5,650	0.18%
a. DEMOLITION	REMOVE CANOPY	8765	SF	2.50	$21,913	$21,913	0.68%
a. DEMOLITION	INTERIOR INFASTRUCTURE	13400	SF	1.50	$20,100	$20,100	0.62%
a. DEMOLITION	TOWER ROOFS & ACCESSORIES	1	LS	3,500	$3,500	$3,500	0.11%
a. DEMOLITION	RMV/DISPOSE METAL SEATING	1	LS	15,000	$15,000	$15,000	0.47%
a. SPECIALTIES	NEW "PERIOD" TYPE WINDOW	360	SF	125	$45,000	$45,000	1.40%
a. SPECIALTIES	REWORK ENTRIES & ACCENTS	1	LS	25,000	$25,000	$25,000	0.78%
a. SPECIALTIES	REWORK "TIERED" TOWER CAPS	1	LS	20,000	$20,000	$20,000	0.62%
a. SPECIALTIES	NEW FLAG POLE ASSEMBLIES	1	LS	5,000	$5,000	$5,000	0.16%
a. SPECIALTIES	RMV/REFURBISH EXT. SIGNAGE	1	LS	10,000	$10,000	$10,000	0.31%
a. SPECIALTIES	FENCING & GATES	1	LS	35,000	$35,000	$35,000	1.09%
a. SPECIALTIES	MISC. PAINT & FINISHES	1	LS	15,000	$15,000	$15,000	0.47%
b. DEMOLITION	EXISTING STRUCTURE	923	SF	15	$13,845	13,845	0.43%
b. DEMOLITION	MASONRY INFILL	4318	CF	8	$34,544	34,544	1.07%
b. DEMOLITION	CONC. STNG./RSRS./RAKER BEAMS	20994	SF	5	$104,970	104,970	3.26%
b. DEMOLITION	CONC. RAILS	1120	SF	15	$16,800	16,800	0.52%
b. DEMOLITION	CONC. SOG	13950	SF	2	$27,900	27,900	0.87%
b. DEMOLITION	CMU @ VOMITORY WALLS	1656	CF	8	$13,248	13,248	0.41%
b. DEMOLITION	INTERIOR INFASTRUCTURE	13900	SF	3.50	$48,650	$48,650	1.51%
b. SPECIALTIES	FENCING & GATES	1	LS	45,000	$45,000	$45,000	1.40%
b. SPECIALTIES	MISC. PAINT & FINISHES	1	LS	20,000	$20,000	$20,000	0.62%
					$670,351	670,351	20.82%
	BUILDING SUBTOTAL				$2,300,335	$2,300,335	71.43%
	BONDS/PERMITS/FEES/INS/ETC.	5 %			$115,017	$115,017	3.57%
	CONTRACTORS OVERHEAD	5 %			$115,017	$115,017	3.57%
	CONTRACTORS FEE	10 %			$230,034	$230,034	7.14%
	CONTINGENCY	20 %			$460,067	$460,067	14.29%
	ESTIMATED CURRENT DAY BUILDING COST				$3,220,469	$3,220,469	100.00%

CAPITAL BUILDING CONSULTANTS
11040 OLD US HIGHWAY 52
WINSTON-SALEM, NC 27107
PHONE: (336) 775-1904
FAX: (336) 775-1905

ESTIMATE OF PROBABLE COST

PROJECT: WAR MEMORIAL STADIUM - 2
PHASE II
GREENSBORO, NC
ESTIMATOR: EJB
JOB DESCRIPTION: SCHEMATIC-RENOVATIONS

BUILDING SPACE: 13,195 S.F.
ARCH. FIRM: SKA CONSULTING ENG.
CONTACT: BRAD EHRHARDT, PE
ESTIMATE NO: 0-536-14

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
A. GENERAL CONDITIONS							
PROJ. PERSONNEL	PROJ. MNGR./FIELD SUPT. ETC.,	32	WKS	1,500	$48,000	$3.64	2.34%
PROJ. LABOR	DAILY CLEAN-UP/GEN. LABOR	380	CHRS	55	$20,900	$1.58	1.02%
PROJ. MATERIAL	MISC. SUPPLIES	1	LS	1,500	$1,500	$0.11	0.07%
PROJ. TRANSPORTATION	PU TRK/DUMP/FUEL/ETC.	8	MO	1,500	$12,000	$0.91	0.58%
CONSTRUCTION AIDS	OSHA	1	LS	15,000	$15,000	$1.14	0.73%
TEMP UTILITIES	WATER/POWER/PHONE, ETC.	1	LS	2,500	$2,500	$0.19	0.12%
PROJECT CONDITIONS	TRASH REMOVAL/DUMP FEES	1	LS	75,000	$75,000	$5.68	3.65%
EQUIPMENT	SMALL TOOLS/SCAFFOLDS/RENTALS	1	LS	20,000	$20,000	$1.52	0.97%
					$194,900	$14.77	9.49%
B. SITE CONDITIONS							
WALL FOOTINGS	CONC/RBR/EXCVT/BKFILL	88	CY	325	$28,600	$2.17	1.39%
SLAB ON GRADE	CONC/WWF/VB/STONE, SP, ETC.	13195	SF	5.25	$69,274	$5.25	3.37%
FOUNDATION WALLS	CMU/REINF/CONC/ETC.	2214	FSF	11.50	$25,461	$1.93	1.24%
					$123,335	$9.35	6.00%
C. STRUCTURAL SYSTEM							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
D. ROOFING SYSTEM							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
E. EXTERIOR WALL							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
F. EXTERIOR DOORS & OPENINGS							
ENTRY DOORS	MTL. FRAME/MTL. DOOR/HARDWARE	16	EA	850	$13,600	$1.03	0.66%
PASS WINDOWS	TICKETING BOOTHS	1	ALLOW	4,000	$4,000	$0.30	0.19%
					$17,600	$1.33	0.86%
G. INTERIOR DOORS & OPENINGS							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
H. INTERIOR PARTITIONS							
MASONRY	CMU/REINF/ETC.	19850	FSF	5.50	$109,175	$8.27	5.31%
					$0	$0.00	0.00%
					$109,175	$8.27	5.31%
I. WALL FINISHES							
PAINTING	WALLS/DRS/FRMS, ETC.	13195	SF	3.50	$46,183	$3.50	2.25%
SPECIAL FINISHES	SHOWER UNITS	8	EA	2000	$16,000	$1.21	0.78%
					$62,183	$4.71	3.03%
J. FLOOR FINISHES & BASE							
SOFT FINISH	TILE/BASE, ETC.	4214	SF	4.50	$18,963	$1.44	0.92%
SPECIAL SURFACES	SEALED/STAINED CONCRETE/BASE	8991	SF	2	$17,982	$1.36	0.88%
					$36,945	$2.80	1.80%
K. CEILINGS & SOFFITS							
HARD CEILINGS	GYP/MTL. FRAMING/WP SYSTEM, ETC.	4214	SF	12.00	$50,568	$3.83	2.46%
					$0	$0.00	0.00%
					$50,568	$3.83	2.46%
M. ACCCESSORIES & SPECIALTIES							
TOILET ACCESSORIES	HC/PT/TP/WASTE, ETC.	1	LS	16,000	$16,000	$1.21	0.78%
TOILET PARTITIONS	STALLS/SCREENS/ETC.	1	LS	32,500	$32,500	$2.46	1.58%
INTERIOR SPECIALTIES	SIGNAGE	1	ALLOW	25,000	$25,000	$1.89	1.22%
INTERIOR SPECIALTIES	FIRE EXT./CABINETS	1	EA	375	$375	$0.03	0.02%
INTERIOR SPECIALTIES	LOCKERS	60	EA	150	$9,000	$0.68	0.44%
INTERIOR SPECIALTIES	LOCKER ROOM BENCHES	1	LS	5,000	$5,000	$0.38	0.24%
INTERIOR SPECIALTIES	INTERIOR RAILINGS	1	ALLOW	25,000	$25,000	$1.89	1.22%
					$112,875	$8.55	5.49%
N. FIXED EQUIPMENT							
SEATING	STADIUM BENCH SEATING	1500	EA	125	$187,500	$14.21	9.12%
					$0	$0.00	0.00%
					$187,500	$14.21	9.12%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
O. CASE & MILLWORK							
CABINETS & COUNTERS	CONCESSION & TICKETING AREA	1	ALLOW	35,000	$35,000	$2.65	1.70%
					$0	$0.00	0.00%
					$35,000	$2.65	1.70%
P. LOOSE EQUIPMENT & FURNISHINGS							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
Q. MECHANICAL CONVEYANCES							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
T. PLUMBING							
PLUMBING	WST/SPLY/FXTR/PIPE/ETC.	72	EA	2,500	$180,000	$13.64	8.76%
PLUMBING	SHOWER UNITS	8	EA	3,500	$28,000	$2.12	1.36%
DOMESTIC WATER/SEWER	WATER HEATERS	2	EA	2,000	$4,000	$0.30	0.19%
DOMESTIC WATER/SEWER	WATER COOLERS	3	EA	1,500	$4,500	$0.00	0.22%
					$216,500	$16.07	10.54%
U. FIRE PROTECTION							
SPRINKLERS	PRE-ACTION SYSTEM	13195	SF	5	$65,975	$5.00	3.21%
					$0	$0.00	0.00%
					$65,975	$5.00	3.21%
V. HVAC							
HEAT & AIR	EQUIP/PIPING/DUCT WORK	4214	SF	15.00	$63,210	$4.79	3.08%
VENTILATION	FANS/DUCT/GRILLS/CONTROLS, ETC.	8991	SF	5.00	$44,955	$3.41	2.19%
					$108,165	$8.20	5.26%
W. ELECTRIC POWER							
SERVICE/DISTRIBUTION	WIRING/OUTLET/LIGHT FIXTURES, ETC.	4214	SF	12.50	$52,675	$3.99	2.56%
SERVICE/DISTRIBUTION	WIRING/OUTLET/LIGHT FIXTURES, ETC.	8991	SF	6.00	$53,946	$4.09	2.63%
					$106,621	$8.08	5.19%
X. SPECIAL SYSTEMS							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%
Y. SPECIAL CONSTRUCTION							
					$0	$0.00	0.00%
					$0	$0.00	0.00%
					$0	$0.00	0.00%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
Z. EXTERIOR WORK							
SITE IMPROVEMENTS	GEN. GRADING/FIND GRADING, ETC.	1	LS	5000	$5,000	$0.38	0.24%
SITE IMPROVEMENTS	EXT. CONCRETE WALKS	895	SF	6.00	$5,370	$0.41	0.26%
SITE SPECIALTIES	LANDSCAPE & SEEDING	1	ALLOW	5000	$5,000	$0.38	0.24%
SITE SPECIALATIES	FENCING & GATES	1	LS	25000	$25,000	$1.89	1.22%
					$40,370	$3.06	1.96%
	BUILDING SUBTOTAL				$1,467,711	$88.13	71.43%
	BONDS/PERMITS/FEES/INS./ETC.	5 %			$73,386	$5.56	3.57%
	CONTRACTORS OVERHEAD	5 %			$73,386	$5.56	3.57%
	CONTRACTORS FEE	10 %			$146,771	$11.12	7.14%
	CONTINGENCY	20 %			$293,542	$22.25	14.29%
	ESTIMATED CURRENT DAY BUILDING COST				$2,054,796	$132.62	100.00%

SKA CONSULTING ENGINEERS, INC.

MEMORANDUM

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Groups

Structural

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Birmingham, AL

To: Butch Shumate butch.shumate@greensboro-nc.gov

From: Robert G. Kennerly, Sr., P.E. rgkennerly@skaeng.com

Date: September 12, 2014

Re: Estimate of Probable Cost
War Memorial Stadium – City of Greensboro
Preservation Plan and Condition Assessments
SKA Project No. 140266.0

The original estimate of probable cost prepared for SKA by Capital Building Consultants included the removal of all the bonded and un-bonded direct applied stucco finish from the cast-in-place towers and façade between the towers at the main entrance. Capital Building Consultants' estimate of probable cost for this phase of the work was approximately $184,000.00.

Assuming that only 30% of the total area of the direct applied stucco on the two (2) towers and façade between the two (2) towers is removed and replaced, this would reduce the cost of this phase of the work by approximately $125,000.00

Based upon the cost of furnishing and installing special debris netting on a project of SKA's at UNC-G, the estimated probable cost of furnishing and installing debris netting only under the existing concrete seating slabs in the main lobby adjacent to the main entrance façade will be approximately $29,000.00

The net reduction on the approximately $1.6M estimate of the probable cost for the repairs and restoration of the two (2) towers and façade between the two (2) towers and the exterior walls adjacent to the two (2) towers will be approximately $96,000.00 ($125,000 - $29,000).

cc: SKA - File

CAPITAL BUILDING CONSULTANTS
11040 OLD US HIGHWAY 52
WINSTON-SALEM, NC 27107
PHONE: (336) 775-1904
FAX: (336) 775-1905

ESTIMATE OF PROBABLE COST

PROJECT: WAR MEMORIAL STADIUM - 1-A
GREENSBORO, NC
ESTIMATOR: EJB
JOB DESCRIPTION: SCHEMATIC-STABILIZATION
MAIN ENTRY FACADE, COLS. 5-20
REFURBISH STRUCT & SEATING COLS. 5-20

BUILDING SPACE: 13,195 S.F.
ARCH. FIRM: SKA CONSULTING ENG.
CONTACT: BRAD EHRHARDT, PE
ESTIMATE NO: 0-536-14

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
A. GENERAL CONDITIONS							
PROJ. PERSONNEL	PROJ. MNGR./FIELD SUPT. ETC.,	24	WKS	1,500	$36,000	$2.73	1.15%
PROJ. LABOR	DAILY CLEAN-UP/GEN. LABOR	480	CHRS	55	$26,400	$2.00	0.84%
PROJ. MATERIAL	MISC. SUPPLIES	1	LS	1,500	$1,500	$0.11	0.05%
PROJ. TRANSPORTATION	PU TRK/DUMP/FUEL/ETC.	6	MO	1,500	$9,000	$0.68	0.29%
CONSTRUCTION AIDS	OSHA	1	LS	10,000	$10,000	$0.76	0.32%
TEMP UTILITIES	WATER/POWER/PHONE, ETC.	1	LS	2,500	$2,500	$0.19	0.08%
PROJECT CONDITIONS	TRASH REMOVAL/DUMP FEES	1	LS	75,000	$75,000	$5.68	2.40%
EQUIPMENT	SMALL TOOLS/SCAFFOLDS/RENTALS	1	LS	20,000	$20,000	$1.52	0.64%
					$180,400	$13.67	5.77%
B. SITE CONDITIONS							
SECURITY	TEMPORARY FENCING	1	LS	7,500	$7,500	$0.57	0.24%
SAFETY	METAL GUARD RAIL	280	LF	150	$42,000	$3.18	1.34%
					$49,500	$3.75	1.58%
C. STRUCTURAL CONCRETE							
a. RAILS/BEAMS	CIP REINF. CONC.	105	CY	2000	$210,000	$15.92	6.71%
a. CONCRETE REPAIR (COLS)	REINF/CONC/ENCASEMENT, ETC.	1920	CSF	35	$67,200	$5.09	2.15%
a. REFURBISH SURFACES	PATCH & SEAL SPOILED CONC. SURFACES	2360	SF	20	$47,200	$3.58	1.51%
a. SEAT/RISERS	CIP REINF. CONC.	185	CY	1000	$185,000	$14.02	5.91%
a. VOMITORY WALLS	CIP REINF. CONC.	63	SF	780	$49,140	$3.72	1.57%
a. WALLS	CIP" KNEE	52	CY	700	$36,400	$2.76	1.16%
a. SEATS/RISERS	PRECAST	16531	SF	9.5	$157,045	$11.90	5.02%
a. CONCRETE REPAIR (RB)	REINF/CONC/ENCASEMENT, ETC.	5744	CSF	25	$143,600	$10.88	4.59%
a. CONCRETE REPAIR (COLS	REINF/CONC/ENCASEMENT, ETC.	470	CSF	30	$14,100	$1.07	0.45%
					$909,685	$68.94	29.07%
E. EXTERIOR WALLS							
a. STUCCO	MECH. FASTENED SYSTEM	5920	SF	45	$266,400	$20.19	8.51%
a. MASONRY	REINF./CMU/STUCCO	2436	SF	35	$85,260	$6.46	2.72%
a. SHORING	TEMPORARY	1	LS	25,000	$25,000	$1.89	0.80%
					$376,660	$28.55	12.04%
N. FIXED EQUIPMENT							
SEATING	STADIUM BENCH SEATING	1500	EA	125	$187,500	$14.21	5.99%
					$0	$0.00	0.00%
					$187,500	$14.21	5.99%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
Y. SPECIAL CONSTRUCTION							
a. DEMOLITION	CONC. GUARD RAIL/SPANDREL BEAM	1155	SF	15	$17,325	$1.31	0.55%
a. DEMOLITION	CONC. SEATING/RISERS	3304	SF	20	$66,080	$5.01	2.11%
a. DEMOLITION	REMOVE STUCCO FINISH	5920	SF	1.50	$8,880	$0.67	0.28%
a. DEMOLITION	MASONRY INFILL	3060	CF	8	$24,480	$1.86	0.78%
a. DEMOLITION	REMOVE CANOPY	8765	SF	2.50	$21,913	$1.66	0.70%
a. DEMOLITION	TOWER ROOFS & ACCESSORIES	1	LS	7,000	$7,000	$0.53	0.22%
a. DEMOLITION	VOMITORY WALLS	1100	CF	15	$16,500	$1.25	0.53%
a. SPECIALTIES	NEW "PERIOD" TYPE WINDOW	225	SF	125	$28,125	$2.13	0.90%
a. SPECIALTIES	REWORK ENTRIES & ACCENTS	1	LS	35,000	$35,000	$2.65	1.12%
a. SPECIALTIES	REWORK "TIERED" TOWER CAPS	1	LS	30,000	$30,000	$2.27	0.96%
a. SPECIALTIES	NEW FLAG POLE ASSEMBLIES	1	LS	7,000	$7,000	$0.53	0.22%
a. SPECIALTIES	RMV/REFURBISH EXT. SIGNAGE	1	ALLOW	15,000	$15,000	$1.14	0.48%
a. SPECIALTIES	FENCING & GATES	1	LS	15,000	$15,000	$1.14	0.48%
a. SPECIALTIES	MISC. PAINT & FINISHES	1	LS	15,000	$15,000	$1.14	0.48%
a. DEMOLITION	CONC. STNG/RSRS/RAKER BEAMS	20994	SF	5	$104,970	$7.96	3.35%
a. DEMOLITION	CONC. RAILS	1120	SF	15	$16,800	$1.27	0.54%
a. DEMOLITION	CMU @ VOMITORY WALLS	1656	CF	8	$13,248	$1.00	0.42%
a. DEMOLITION	INTERIOR INFASTRUCTURE	13900	SF	3.50	$48,650	$3.69	1.55%
					$490,971	$37.21	15.69%
Z. EXTERIOR WORK							
SITE IMPROVEMENTS	GEN. GRADING/FINE GRADING, ETC.	1	LS	5,000	$5,000	$0.06	0.16%
SITE IMPROVEMENTS	EXT. CONCRETE WALKS	895	SF	6	$5,370	$0.06	0.17%
SITE SPECIALTIES	LANDSCAPE & SEEDING	1	ALLOW	5,000	$5,000	$0.06	0.16%
SITE SPECIALTIES	FENCHBING & GATES	1	LS	25,000	$25,000	$1.00	0.80%
					$40,370	$1.18	1.29%
	BUILDING SUBTOTAL				$2,235,085	$167.51	71.43%
	BONDS/PERMITS/FEES/INS/ETC.	5 %			$111,754	$8.47	3.57%
	CONTRACTORS OVERHEAD	5 %			$111,754	$8.47	3.57%
	CONTRACTORS FEE	10 %			$223,509	$16.94	7.14%
	CONTINGENCY	20 %			$447,017	$33.88	14.29%
	ESTIMATED CURRENT DAY BUILDING COST				$3,129,119	$235.27	100.00%

CAPITAL BUILDING CONSULTANTS
11040 OLD US HIGHWAY 52
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PHONE: (336) 775-1904
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ESTIMATE OF PROBABLE COST

PROJECT: WAR MEMORIAL STADIUM - 2-A
GREENSBORO, N C
ESTIMATOR: EJB
JOB DESCRIPTION: SCHEMATIC-RENOVATIONS
COLUMNS 5-20

BUILDING SPACE: 13,195 S.F.
ARCH. FIRM: SKA CONSULTING ENG.
CONTACT: BRAD EHRHARDT, PE
ESTIMATE NO: 0-536-14

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
A. GENERAL CONDITIONS							
PROJ. PERSONNEL	PROJ. MNGR./FIELD SUPT. ETC.,	32	WKS	1,500	$48,000	$3.64	2.91%
PROJ. LABOR	DAILY CLEAN-UP/GEN. LABOR	380	CHRS	55	$20,900	$1.58	1.27%
PROJ. MATERIAL	MISC. SUPPLIES	1	LS	1,500	$1,500	$0.11	0.09%
PROJ. TRANSPORTATION	PU TRK/DUMP/FUEL/ETC.	8	MO	1,500	$12,000	$0.91	0.73%
CONSTRUCTION AIDS	OSHA	1	LS	15,000	$15,000	$1.14	0.91%
TEMP UTILITIES	WATER/POWER/PHONE, ETC.	1	LS	2,500	$2,500	$0.19	0.15%
PROJECT CONDITIONS	TRASH REMOVAL/DUMP FEES	1	LS	25,000	$25,000	$1.89	1.51%
EQUIPMENT	SMALL TOOLS/SCAFFOLDS/RENTALS	1	LS	10,000	$10,000	$0.76	0.61%
					$134,900	$10.22	8.17%
B. SITE CONDITIONS							
WALL FOOTINGS	CONC/RBR/EXCVT/BKFILL	88	CY	325	$28,600	$2.17	1.73%
SLAB ON GRADE	CONC/WWF/VB/STONE, SP, ETC.	13195	SF	5.25	$69,274	$5.25	4.19%
FOUNDATION WALLS	CMU/REINF/CONC/ETC.	2214	FSF	11.50	$25,461	$1.93	1.54%
					$123,335	$9.35	7.47%
F. EXTERIOR DOORS & OPENINGS							
PASS WINDOWS	TICKETING BOOTHS	1	ALLOW	4,000	$4,000	$0.30	0.24%
					$0	$0.00	0.00%
					$4,000	$0.30	0.24%
G. INTERIOR DOORS & OPENINGS							
ENTRY DOORS	MTL. FRAME/MTL. DOOR/HARDWARE	16	EA	850	$13,600	$1.03	0.82%
					$0	$0.00	0.00%
					$13,600	$1.03	0.82%
H. INTERIOR PARTITIONS							
MASONRY	CMU/REINF/ETC.	19850	FSF	5.50	$109,175	$8.27	6.61%
					$0	$0.00	0.00%
					$109,175	$8.27	6.61%
I. WALL FINISHES							
PAINTING	WALLS/DRS/FRMS, ETC.	13195	SF	3.50	$46,183	$3.50	2.80%
SPECIAL FINISHES	SHOWER UNITS	8	EA	2000	$16,000	$1.21	0.97%
					$62,183	$4.71	3.76%
J. FLOOR FINISHES & BASE							
SOFT FINISH	TILE/BASE, ETC.	4214	SF	4.50	$18,963	$1.44	1.15%
SPECIAL SURFACES	SEALED/STAINED CONCRETE/BASE	8991	SF	2	$17,982	$1.36	1.09%
					$36,945	$2.80	2.24%

SYSTEM/COMPONENT	SPECIFICATION	QUANTITY	UNIT	UNIT COST	SYSTEMS COST	COST/SF	% OF JOB
K. CEILINGS & SOFFITS							
HARD CEILINGS	GYP/MTL. FRAMING/WP SYSTEM, ETC.	4214	SF	12.00	$50,568	$3.83	3.06%
					$0	$0.00	0.00%
					$50,568	$3.83	3.06%
M. ACCCESSORIES & SPECIALTIES							
TOILET ACCESSORIES	HC/PT/TP/WASTE, ETC.	1	LS	16,000	$16,000	$1.21	0.97%
TOILET PARTITIONS	STALLS/SCREENS/ETC.	1	LS	32,500	$32,500	$2.46	1.97%
INTERIOR SPECIALTIES	SIGNAGE	1	ALLOW	25,000	$25,000	$1.89	1.51%
INTERIOR SPECIALTIES	FIRE EXT./CABINETS	1	EA	375	$375	$0.03	0.02%
INTERIOR SPECIALTIES	LOCKERS	60	EA	150	$9,000	$0.68	0.54%
INTERIOR SPECIALTIES	LOCKER ROOM BENCHES	1	LS	5,000	$5,000	$0.38	0.30%
INTERIOR SPECIALTIES	INTERIOR RAILINGS	1	ALLOW	25,000	$25,000	$1.89	1.51%
					$112,875	$8.55	6.83%
O. CASE & MILLWORK							
CABINETS & COUNTERS	CONCESSION & TICKETING AREA	1	ALLOW	35,000	$35,000	$2.65	2.12%
					$0	$0.00	0.00%
					$35,000	$2.65	2.12%
T. PLUMBING							
PLUMBING	WST/SPLY/FXTR/PIPE/ETC.	72	EA	2,500	$180,000	$13.64	10.90%
PLUMBING	SHOWER UNITS	8	EA	3,500	$28,000	$2.12	1.70%
DOMESTIC WATER/SEWER	WATER HEATERS	2	EA	2,000	$4,000	$0.30	0.24%
DOMESTIC WATER/SEWER	WATER COOLERS	3	EA	1,500	$4,500	$0.00	0.27%
					$216,500	$16.07	13.11%
U. FIRE PROTECTION							
SPRINKLERS	PRE-ACTION SYSTEM	13195	SF	5.00	$65,975	$5.00	3.99%
					$0	$0.00	0.00%
					$65,975	$5.00	3.99%
V. HVAC							
HEAT & AIR	EQUIP/PIPING/DUCT WORK	4214	SF	15.00	$63,210	$4.79	3.83%
VENTILATION	FANS/DUCT/GRILLS/CONTROLS, ETC.	8991	SF	5.00	$44,955	$3.41	2.72%
					$108,165	$8.20	6.55%
W. ELECTRIC POWER							
SERVICE/DISTRIBUTION	WIRING/OUTLET/LIGHT FIXTURES, ETC.	4214	SF	12.50	$52,675	$3.99	3.19%
SERVICE/DISTRIBUTION	WIRING/OUTLET/LIGHT FIXTURES, ETC.	8991	SF	6.00	$53,946	$4.09	3.27%
					$106,621	$8.08	6.45%
	BUILDING SUBTOTAL				$1,179,841	$80.52	71.43%
	BONDS/PERMITS/FEES/INS./ETC.	5 %			$58,992	$4.47	3.57%
	CONTRACTORS OVERHEAD	5 %			$58,992	$4.47	3.57%
	CONTRACTORS FEE	10 %			$117,984	$8.94	7.14%
	CONTINGENCY	20 %			$235,968	$17.88	14.29%
	ESTIMATED CURRENT DAY BUILDING COST				$1,651,778	$116.29	100.00%