City of Miami

Marine Stadium

At

Virginia Key

Existing Building Condition Assessment

Project No.: F008449.00
July 21st, 2008

Prepared by:

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ASTORINO
Architecture Engineering Interior Design Design/Build

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Structural Condition Assessment Report by Bliss & Nyitray, Inc.

MEP Condition Assessment Report by L.D. Astorino Architects, Inc.

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1. Introduction

The City of Miami Department of Capital Improvements approached L.D. Astorino Architects, Inc. to perform a visual conditions assessment of the existing Marine Stadium building located at 3501 Rickenbaker Causway, Virginia Key. The objective of this assessment is to provide the Capital Improvements Department a tool with which to evaluate the feasibility of renovating the existing facility for reuse. This assessment will evaluate the facility to determine if it meets, or does not meet, the requirements of the latest revision of the 2004 edition of the Florida Building Code, Life Safety Code, ADA, and all other applicable codes and City Ordinances. The assessment report will evaluate the site, structural system, mechanical system (HVAC), electrical system, plumbing system, fire suppression system, accessibility for the disabled (ADA)] and life safety of the facility. The assessment includes reviews by L.D. Astorino Architects, Inc. for architectural, mechanical, electrical and plumbing and Bliss & Nyitray, Inc. for structural.

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2. Scope of Work

The scope of the work includes a complete visual conditions assessment report of the existing facility with some limited destructive exploratory structural investigation. This has been accomplished by evaluating the following:

a) The extent of damage caused by abandonment and/or lack of maintenance of all architectural, structural, mechanical, electrical, fire suppression and plumbing systems.

b) The extent of upgrades necessary for the existing facility to meet the requirements of the current Florida Building Code, Life Safety, ADA and all other applicable codes and ordinances requirements.

c) A visual and minor destructive investigation and examination of all available record documents provided by the City of Miami.

d) A statement of probable cost of construction for the proposed repairs and/or renovations.

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3. General Building Description

The Marine Stadium, built in 1963, was designed by Miami architect Hilario Candela. At that time, it was the first structure of its kind built for the sole purpose to host powerboat races. The stadium site is approximately 16 acres with the building totaling approximately 67,560 square feet in area. It is a 6,600-seat reinforced concrete structure where the shell-like roof structure cantilevers over the grandstand overlooking Biscayne Bay.

Numerous reports dating from 1969 through 1989 indicate moderate to severe cases of structural deterioration of floor slabs, beams and columns, spalled concrete, corrosion of steel reinforcing bars and ties, severe cracking at cantilevered slabs, large pieces of concrete falling off the structure and water seepage through roof slab cracks.

The earliest report of structural deterioration found on record dated is November 3, 1969. (See Exhibit 01.) This report described a concern of serious concrete spalling and rusting steel and questioned if the steel was placed appropriately during construction.

Reports dated September 13 and November 22, 1972 described severe deterioration of concrete columns and beams under the intermediate crosswalk at the water edge. (See Exhibit 02.)

A letter dated December 5, 1972 (See Exhibit 03.) from the Assistant City Manager at that time, stated that the building was supposed to have been built for a minimum life span of 30 years and held the building's design engineers responsible to explain the reasons for the severe deterioration of the concrete structure at such early age.

Subsequent response letters from the design engineers dated January 15, 1973 (see Exhibit 04.) pointed out several probable causes for the rapid deterioration of the structure to the following:

1) Intrusion of salt water into the forms during concrete placement.
2) Concrete columns placed without proper vibration to insure consolidation and density.
3) Inadequate concrete cover over reinforcing steel and in some cases inadequate steel reinforcing.
4) Improper placement methods to avoid areas of honeycomb and porous concrete.
5) Exposure to the bay water and moist salt air.
6) Corrosion of exposed steel bar supports provided a path for moisture to reach steel reinforcing in concrete slabs and beams.

A memorandum dated June 22, 1973 (See Exhibit 05.) focused on the water seepage stains that were showing through the Marine Stadium roof deck. It was determined that the roofing

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material originally applied to the concrete roof deck had outlived its life span and needed a new sealant coating.
A report dated October 18, 1984 (See Exhibit 06.) described additional deterioration where the reinforcing steel was exposed at the supporting beams and cracking was found at the mezzanine slab. The report also stated that most of the previous repairs to the beams and columns adjacent to the walkway made from 1973 and 1979 had held up, but major spalling had appeared in other areas. Concrete piles and beams at the front of the stadium (water side) were found cracked and spalling. Concrete had spalled off the underside of the front cantilever slab exposing the reinforcing steel.

Another report dated March 20, 1986 (See exhibit 07.) made note of serious and extensive deterioration found in the substructure columns and beams on the water side of the Dressing Room Passageway and stated that moderate to extensive cracking and spalling had been found on the underside of the projecting front slab of the grandstand. The report recommended that the slab be removed if no repair work was provided soon.

The memorandum from August 30, 1988 (See Exhibit 08.) strongly pointed out the urgent need to fix the severely deteriorated cantilever slab on the water side at the earliest possible date. It was advised that failure would be a sudden event with no initial cracking and deflection warnings. The memorandum also noted that since the 1984 inspection, the conditions of the piles supporting the front portion of the structure had considerably worsened. Considerable cracking was noted at the mezzanine slab and moderate rusting at the steel supporting the overhead control room.

The last memorandum available on record, dated May 4, 1989 (See Exhibit 09.) reported large pieces of concrete falling from the structure that could be potentially dangerous to spectators. All reports called for remedial work to be performed at the time in order to prevent future additional structural deterioration.

The building was closed and deemed unsafe by the City of Miami after the devastation of Hurricane Andrew on August 24, 1992. In the course of nearly 16 years after its closure, the stadium sits blighted, unsafe and in desperate need of repair. It has also been the target of extreme vandalism.

The building's actual overall general structural condition goes from bad to better in the horizontal and vertical directions as one moves away from the water side. The cantilevered concrete slab at the front of the grandstand is deflecting and some parts of the structural concrete has fallen exposing the steel reinforcement. Approximately 50% of the substructure, columns and beams that support the front portion of the grandstand, are severely damaged. Large amounts of concrete have crumbled, exposing heavily corroded reinforcing steel bars. The seawall is in bad condition as parts of the concrete slab along the corridor adjacent to the

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Dressing Rooms have spalled, exposing the rusted steel reinforcement. The steel structure supporting the overhead control booth and the access bridge are severely corroded and unstable. The mezzanine concrete slab shows several cracks while the supporting steel connections and posts that hold the slab are severely corroded. There are numerous cracks in the cantilever concrete roof slab which need immediate repair. Most of the roof drains are clogged allowing rain water to collect and seep through the concrete cracks. Numerous diagonal columns, which hold the cantilevered roof structure, show corrosion signs and require repair. A thorough structural analysis will be required to determine if the roof structure meets the requirements for High-Velocity Hurricane Zones of chapter 16 (Structural Design) of the latest revision of the 2004 Florida Building Code. Additional information on the structure's conditions is provided in the Bliss & Nyitray evaluation report.

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4. Field Observations

Site Condition Assessment:

Parking Area Overview: Since the facility was closed, approximately sixteen years ago, the existing parking lot area has not been maintained. The entire parking area is in a state of deterioration due to areas of standing water and intrusion of vegetative material. Areas of landscape have migrated into the paving and appear to have damaged the base material as well as the asphalt top coat. The typical parking configuration including the driveways, required landscape separation and landscape aisles do not meet the minimum zoning code landscape requirements. The entire parking area will have to be reconstructed to meet the current City of Miami Off-street Parking Design Guides and Standards.

Site Striping: The existing parking area and directional striping have degraded to the point they are almost nonexistent. The parking area also lacks directional traffic arrows, stop bars and required markings for crosswalks.

Site Signage: No existing site signage was observed. Site signage for traffic control and designation of disabled parking will be required by code. No existing venue advertisement signage was observed; although not a code required item venue advertisement signage to announce events is a standard design program requirement for current facilities of this type.

Site Lighting: Existing site lighting was observed, however, the placement of the existing site lighting fixtures does not appear to meet the requirements of the current code. In order to assess the adequacy of the site lighting system, photometric modeling should be performed. The existing fixtures, wire and associated conduits, are nearing the end of the normal expected life in optimum conditions. Due to the harsh conditions associated with the site location and intrusion of salt water from several storm flooding cycles the conditions of the wire and conduit are likely to have been compromised and require replacement. Additional landscape that will be required should the facility be renovated will also most likely conflict with existing raceway routing and will be damaged during the reconstruction process.

Sidewalks: No sidewalks from the parking area to the stadium facility exist at this time. Designated walking areas will need to be incorporated to separate the pedestrian and vehicular traffic. Areas from handicapped accessible parking to the stadium facility will need to be designated and an assessable rout to the facility must be provided.

Waste Receptacles: No existing dumpster area was observed. An enclosed area per the waste management requirements will need to be provided to house the required dumpsters and recycle bins for the facility.

Landscape: All landscape observed was in poor condition due to lack of maintenance and irrigation. Some areas of landscape have been over taken by exotic plant species. None of the observed areas meet the requirements of the current zoning code. All landscape areas will require the removal of existing material and installation of new vegetation in accordance with current zoning and building department requirements.

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No area for the retention of storm water runoff was observed. Per the requirements of current water management regulations, storm water must be retained on site and must be filtered in order to control water quantity and quality prior release.

Site Clean-up: The existing site has been abandoned since the facility was deemed unsafe and closed in 1992. T he site has been severely vandalized, used as a dumping area and the building appears to have been occupied by vagrants. Extensive exterior and interior clean-up will be required.

Architectural Condition Assessment:

- **Handicap Accessibility**-

Accessible entrance: The existing facility is lacking code compliant disabled access as required by 2004 FBC 11-4.6 for parking and accessible loading zones. The south entry area from the existing parking lot to the facility lacks curb ramps as well as entry ramps. The main entrance to the facility can be accessed via stairs only. Per 2004 Florida Building Code (FBC) (11-4.14), accessible entrances shall be connected by an accessible route to public transportation stops, to accessible parking and passenger loading zones, and to public streets or sidewalks if available.

A ramp at the east side of the facility does provide access to the lower facility level. However, the existing ramp exceeds the maximum allowable slope for accessible ramps required by the 2004 FBC (11-4.8).

Accessible parking: Per the current zoning code and land use designation, the 6,600-seat stadium is required to provide approximately 1,320 parking spaces (I space per 5 seats) and 24 handicap accessible spaces per 2004 FBC (11-4.1.2(5)(a)). Due to abandonment and disrepair, it is difficult to verify the actual parking count and if an adequate amount of parking spaces for the disabled were provided.

Accessible ramps: In the building, the two central ramps, that are the only way to access and egress, the mezzanine level and grandstand upper levels, have a slope that doubles the maximum allowable required by the 2004 FBC (11-4.8) In addition, there are no accessible routes to the lower section of the grandstand on the water side. Stairs to the lower level have been covered with wood boards to provide a ramped access, but the slope almost triples the maximum code allowed. None of the ramps in the facility provide proper guardrails and handrails. See the life safety section below for an expanded cover of the ramps.

Wheelchair areas location: No clear space has been provided at the grandstands to accommodate disabled spectators in wheelchairs. Per the 2004 FBC (11-4.33.2 and 11-4.33.3), wheelchair areas shall be an integral part of any fixed seating plan and shall be provided so as to provide people with physical disabilities a choice of admission prices and lines of sight comparable to those for members of the general public. They shall adjoin an accessible route that also serves as a means of egress in case of emergency.

Accessible restrooms: None of the restrooms provide accessible stalls, toilets, grab bars, urinals or lavatories. Shower stalls in the dressing rooms are not accessible. All drinking fountains have been removed. Originally mounted on a concrete stoop, the drinking fountains were inaccessible for the disabled.

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Performance areas access: Per the 2004 FBC (11-4.33.5), an accessible route shall connect wheelchair seating locations with performing areas, including stages, arena floors, dressing rooms, locker rooms, and other spaces used by performers. In their current configuration, the dressing rooms are not accessible.

Doors: Most door swings do not meet the minimum pull and/or push side clearances. The door access to the dressing rooms does not allow appropriate clear turning space for a wheelchair in accordance with the 2004 FBC (11-4.13) requirements.

Counters and Bars: Countertops at the concessions and the ticket booths do not provide adequate height for disabled access reach as required by the 2004 FBC (11-5.2 and 11-7.2).

Stairs: Risers at the grandstand aisle stairs do not have a constant dimension. In some instances they measure from just over 5 inches to 7 inches in height. Per the 2004 FBC (11-4.9.2), on any given flight of stairs, all steps shall have uniform riser heights and uniform tread widths. Stair treads shall be no less than 11 inches wide, measured from riser to riser.

- **Life Safety**-

  Width of means of egress: The existing building provides only two ramps approximately 7'-6" feet wide each (total 180 inches of exit width) for access and egress from the middle and upper levels of the grandstand and two stairs 6 feet wide each (total 144 inches of exit width) to access and egress the lower levels by the water side. The exit width provided is not sufficient for the actual number of seats.

  Per the 2004 FBC (1024.6), the minimum required egress width equals the number of occupants x 0.3 inches for stairs having riser heights 7 inches or less and tread depths 11 inches or greater. For ramps where slopes are steeper than one unit vertical in 12 units horizontal, the number of occupants x 0.22 inches. The total minimum width required for the stadium upper level is (3,864x0.22) = 850 inches, while the total minimum width required for the stadium lower level is (2,736x0.3) = 821 inches. The total width of means of egress provided is 324 inches, versus 1671 inches required.

  Assembly main entrance/exit: Per the 2004 FBC (1024.2), the minimum width of the main entrance shall be sufficient to accommodate 50% of the occupant load, while other additional exits (FBC 1024.3) of sufficient width shall accommodate the remainder 50% of the total occupant load and shall be located as far from the main entrance/exit as practicable. Per the 2004 FBC (1018.1), for facilities with more than 1,000 occupants, a minimum of 4 exits are required. The facility only provides exit access through the two main ramps area creating a bottle-neck effect when both upper and lower level occupants merge from either side of the grandstands while exiting the building. During an emergency evacuation, this condition could cause serious consequences. Additional exits with adequate exit widths shall be provided to properly accommodate the evacuation of 6,600 occupants.

  Ramps as means of egress: Per the 2004 FBC (1010.2), ramps that are part of the means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal. Other ramps shall not exceed one unit vertical in 8 units horizontal. In addition, the 2004 FBC (11-4.8) requires that ramps, which are part of an accessible route, shall not exceed one unit vertical in

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12 units horizontal. The existing slope of the ramps is two units vertical in 12 units horizontal, which exceeds all maximum requirements. It should be noted that if the ramp slope is changed in the future to meet code requirements, there may not be enough minimum clear headroom left.

Minimum aisle width: Per 2004 FBC (1024.9.1 (1) and (2)) the minimum aisle stair width of 48 inches when having seating on each side and 36 inches when aisle stairs are having seating on only one side. The stadium's typical aisle stair width is 48 inches; however at the upper level seating where the diagonal columns pass through the grandstand structure, the width of the stairs is reduced to 24 inches where only one side is served.

Exit signs: All existing exit signs and electrical connections need to be replaced throughout the facility. Per the 2004 FBC (1006.3), all exit signs shall be readily visible from any direction of the exit access. Per the 2004 FBC (1006.3.2), signs shall be placed in such a manner that no point in an exit access corridor is in excess of the rated view distance or 100 feet, whichever is less from the nearest sign.

Dead ends: The north and south dead ends of the mezzanine level corridor on the land side which provides access to the concessions and public restrooms, measure approximately 54 feet, exceeding the 20 feet maximum distance allowed by the 2004 FBC (1016.3) for a non-sprinklered facility.

Handrail and Guardrails: Throughout the facility, the guardrails measure typically 2" in diameter and are about 32 to 34 inches high. The existing guardrails consist of three horizontal bars approximately 14 inches apart with vertical posts at approximately 4 to 5 feet. Vertical posts are either embedded in a 3 inch high concrete curb at the mezzanine or are directly embedded on the concrete slab at the ramps. In several sections, the curbs are broken, exposing the rusted or corroded steel reinforcement. At some instances, the vertical steel post has been completely corroded at the embedment. No guardrails/handrails were f at the main entrance stairs and first floor level, where the difference in height to the grade below is approximately 36 inches (2004 FBC, 1012). Guardrails at the access ramp on the southeast end of the building have been removed.

Guards: Per the 2004 FBC (1012), guards shall form a protective barrier no less than 42 inches high, measured vertically above the leading edge of the tread, adjacent walking surface or adjacent seat board. Guards shall have balusters or ornamental patterns such that a 4-inch-diameter sphere cannot pass through any opening up to a height of 34 inches. From 34 inches to 42 inches, a sphere 8 inches in diameter shall not pass through.

Handrails: Per the 2004 FBC (1010.8), handrails shall be provided along both sides of a ramp run with a rise greater than 6 inches and shall conform to the requirements in section 1009.11.

Handrail height, measured from the stair tread nosing or finish surface of ramp slope shall be uniform, no less than 34 inches and no more than 38 inches.

Seating and Equipment: The existing grand stand seating appears to be the original seating installed. The condition of the seating deteriorates as one progress away from the water. The seats and supports have been vandalized and have corroded due to many years of exposure in the salt environment and cannot be reused. The seating configuration does not meet applicable

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code for handicap accessibility and portions would need to be reconfigured if the seating was able to be reused. The control booth area structure, during several site observations, was found to be in very poor condition. All lighting and sound equipment was deteriorated or vandalized and no equipment was found that could be reused.

It is recommended that due to the condition of the control booth area, the City of Miami should take immediate action to have the access way removed in order to keep anyone from wandering into this area as sections of the floor system have rusted through and fallen.

Finishes: Due to the nature of the existing facility, finishes are limited to the few occupied spaces primarily on the first and second floors. The extended period of time that the facility has been vacant has subjected the facility to a great deal of vandalism and deterioration from storm flooding. The attached photographs in the photographic survey document the typical condition of the existing facility. The Dressing Room areas include furred drywall finishes and lay-in acoustical ceilings. Both of these finish systems are susceptible to damage from moisture and with no operable doors or dehumidification these areas have deteriorated extensively. In the restroom areas glazed tile was observed that could contain lead in quantities significant enough to require abatement. It is recommended that the City of Miami retain the services of a testing laboratory experienced in the testing of this type of material to confirm what is contained in this product prior to removal of any of this material.

Mechanical Assessment- HVAC and Exhaust Systems:

Air Conditioning System: The existing facility has limited air conditioning provided by the original design. Conditioned air is provided to the dressing room areas of the first floor only. Some remnants of the original system exist but the majority of the existing split unit air conditioning system has been vandalized or stolen. The remaining pieces of the condensing units and air handling units are rusted, disassembled and cannot be reused. Some sections of the existing air distribution system were observed. The existing duct is foil faced fiberglass duct and has deteriorated beyond its usable life, has been vandalized and cannot be reused.

Several areas of the existing facility including the restrooms and concession areas, are included in the original design ventilation systems. Review of the existing exhaust system finds all existing equipment rusted and, in most cases, partly disassembled. None of the existing ventilation equipment is acceptable for reuse.

It should be noted that due to the original locations of areas requiring exhaust venting exhaust is now released into occupied areas. Exhaust venting of the restroom spaces and the concession area will need to be designed to avoid venting these areas into occupied spaces.

Mechanical Assessment- Plumbing piping and Fixtures:

The existing potable water supply system and the existing sanitary piping system were observed. The existing sanitary system is a mix of cast iron piping and PVC. The facility appears to have experienced issues with the deterioration of the cast iron pipes in the past and sections of the original cast iron piping were replaced. The remaining portions of the cast iron sanitary piping

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appear to be in poor condition, exhibiting severe surface corrosion. Supports for the sanitary piping have corroded and in some cases failed, leaving sections of the sanitary piping unsupported. Due to the fact that the existing water service to the building is not functioning, leak testing/pressure testing cannot be performed. The sanitary system is not functioning due in part to the fact that the lift station located on the south side of the facility has been vandalized and components required for its operation have been stolen. Also, trash and debris have migrated into the system from open drain lines. Most of the existing fixtures in the restroom areas have been vandalized or stolen. The remaining fixtures do not meet the requirements for handicap accessibility. Sections of the potable water system were observed. The areas that were observed are steel pipe and appear to be severely rusted. The hot water side of the potable water system is insulated and the condition of this piping could not be observed. The water heater located on the first floor mechanical space is rusted due to the location of its installation and also has been vandalized. It should be assumed that because of the period of the construction of the existing facility, the insulation installed on the hot water piping would most likely contain asbestos and would need to be abated.

Per the 2004 FBC Plumbing, section 403, the minimum number of plumbing fixtures for stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities is as follows:

- Water Closets: a) Men: 1 per 75 occupants for the first 1,500 and 1 per 120 for the remainder exceeding 1,500.
  b) Women: 1 per 40 occupants for the first 1,500 and 1 per 60 for the remainder exceeding 1,500.
- Lavatories: a) Men: 1 per every 200 occupants.
  b) Women: 1 per every 150 occupants.
- Drinking Fountains: 1 per every 1,000 occupants.
- Service Sink: 1 Service sink.

The minimum required fixture count for the 6,600 seat stadium (3,300 men & 3,300 women) is as follows:

- Water Closets: a) Men: 35
  b) Women: 68
- Lavatories: a) Men: 17
  b) Women: 22
- Drinking Fountains: 7

The minimum number of urinals required has to comply with section 419.2 of the 2004 FBC Plumbing. In each toilet room, urinals shall not be substituted for more than 67% of the required water closets. This may allow for approximately 22 urinals and 14 water closets for men.

Where toilet stalls are provided, at least one shall be an accessible. In rooms where six or more stalls are provided, in addition to the standard accessible stall, at least one stall 36 inches wide with and outward swinging, self-closing door and parallel grab bars shall be provided as required by 2004 FBC section 11-4.22.4.

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The facility only provides the following number of toilet fixtures in the main public restrooms:

- Water Closets: a) Men: 8
  b) Women: 14
- Urinals: 16
- Lavatories: a) Men: 10
  b) Women: 10

None of the restrooms comply with the minimum ADA and chapter 11 of the 2004 FBC requirements.

- Roof Drains and Overflow Scuppers:

There are a total of eight 5" diameter roof drains located at each main diagonal column, from which only two are in working condition. The remainder of clogged roof drains have allowed several inches of water to accumulate over the roof deck. The emergency overflow scuppers, sized 9"x3", are located approximately 18 inches above the roof drain elevation; typically emergency overflow scuppers are located no higher than 4 inches above the main roof drain elevation. Note that the overflow scuppers are located in such a way that the excess rain water discharges over seating areas. Also, the overflow scuppers should not be less than 4 inches in height per chapter 11 of the 2004 FBC Plumbing.

Fire Suppression Systems Assessment:

The existing facility is not sprinklered. Fire protection is provided for the facility via one single point connection fire department connection in the parking area directly east of the main building entrance and two fire hoses located in fire hose cabinets at the second level egress ramps.

The existing recessed fire hose cabinets are rusted and cannot be reused. All internal working portions of the hose cabinet assemblies are missing.

No fire suppression system was observed for the concession area. The concession area, located under the upper level grandstands, does not appear to have been designed to facilitate the preparation of food. No Ansul system was identified during the observation. Exhaust hoods over all cooking equipment with an NFPA approved fire suppression system are required by the 2004 FBC.

No hand held fire extinguishers or provisions for the installation of required hand held fire extinguishers were observed. Fire extinguisher cabinets are required to be installed along the path of egress at a distance not exceeding seventy five feet in conformance with the latest edition of the 2004 Florida Fire Prevention Code. Due to the existing building construction, the ability to recess the required fire extinguisher cabinets may be unlikely and surface mounting of the cabinets may further restrict the existing inadequate egress routes.

No fire alarm system was observed. Per the 2004 FBC (907.2.1), a manual fire alarm system shall be installed in accordance with NFPA 72 in Group "A" occupancies having an occupant load of 300 or more.

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Electrical Systems Assessment:

The existing electrical system main panels, distribution panels, electrical raceway, and fixtures were observed. From the visual observation performed it is unlikely that any portions of the existing electrical systems and raceways can be reused.

The existing electrical panels were observed to be in very poor condition and the majority of the internal components of the electrical distribution system have been stolen or disassembled. The remaining electrical cabinets and raceways have been corroded due to the proximity of the equipment to the salt air and also several storm events.

Salt water and salt laden air have infiltrated the raceways and corroded the conduits from the interior. A significant amount of the electrical raceways is encapsulated in the concrete structure and is also causing areas of damage to the existing concrete structure.

The remaining few lighting fixtures existing have been vandalized or have deteriorated due to exposure and cannot be reused.

In some cases electrical fixtures and some surface mounted raceways have deteriorated to the extent that they have fallen or are in the process of falling from overhead locations and pose a safety concern. It is recommended the City take steps to remove these hazards no matter what the determination is for the removal or reuse of the existing facility as soon as possible.

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5. Conclusions and Recommendations

L.D. Astorino Architects Inc. and our consultants have investigated the existing City of Miami Marine Stadium facility and found it to be in a grave state of deterioration.

The primary causes of the observed deterioration date back to the original construction and the lack of maintenance has allowed the inherent spalling deterioration expected in this type of structure to progress to the point where we are today. In addition to the damage caused to the structure from the salt environment and the lack of maintenance, the extended period of time that the facility has sat vacant has also allowed for extensive damage to have been caused by vandals and vagrants. While the structure is an exquisite example of reinforced concrete architecture, the building is not designated as a historic structure and has lasted past the original intended minimum life expectancy.

In order for the City of Miami to utilize the existing venue to hold events open to the general public, it is the opinion of Astorino that minimum life safety requirements, accessibility requirements, and other items listed in the attached report will need to be met.

Even with all remediation to the structure and upgrades to the facility completed, the structure will still most likely not meet the requirements of the current code with respect to wind load. It should also be noted that due to the migration of salt laden moisture into the concrete structure, no one can determine the future deterioration that can be expected. This deterioration and the additional deterioration that can be expected from the placement of the existing reinforcing steel leads one to believe that the structure will most likely continue to require extensive maintenance.

This condition assessment report and associated statement of probable cost have been provided to the City for review and comment as well as to assist the City in determining the viability of reuse or redevelopment of the existing facility.

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6. Statement of Probable Cost of Construction

The scope of work of the project will consist of renovations to the referenced existing 6,600-seat Marine Stadium including administration offices, rest rooms, ticket booths, concession areas, dressing rooms, maintenance and storage rooms.

The work shall be in conformance with the 2004 Florida Building Code, requiring extensive repairs of the existing supporting structure, replacing all electric, phone/data, plumbing, HVAC, and fire suppression systems in addition to meet all ADA, Life Safety and Fire Prevention Code requirements.

General Conditions	
General Contractor's Project General Conditions	$ 1,360,000
Site Development	
Demo Existing Parking	821,333
New Parking, Landscape, Irrigation, Curbing, Grading Lighting, Sidewalks, Signage & Stripping	2,450,000
Structural Renovation	
Structural Preservations Cost Estimate (BNI Report Page 99)	$5,500,000*
Building Renovation Code	
New Egress Ramps, New Restrooms, Stair Remediation, New Railings	1,581,900
Building Renovation Finishes	
Demo Existing Finishes & Clean Up Build for Installation of New Finishes	530,000
New Finishes	
New Finishes in Restrooms, Concession, Offices, Dressing Rooms, Storages Areas	1,300,000
New Seating	
New Grandstand Seating	1,300,000
New HVAC System	
New HVAC System for Restrooms, Concession Areas, Offices, Dressing Rooms, Storage Areas	220,000
New Potable Water and Sanitary Services	
New Potable Water Supply Piping Valves and Fixture; New Sanitary Pipe, Venting and Fixtures	750,000
Electrical System	
New Electrical Service Raceway, Wire and Fixtures	1,875,000
Fire Suppression	
New Ansul System for Concession Area, New Fire Line From Existing Hydrant, Check Valve Assembly Riser & Valves, Hose Cabinet Assembly	550,000

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Subtotal	$ 17,738,233	
Contractor's Fee – 7%		1,241,676
Subtotal		$ 18,979,909
Construction Contingency – 10%		1,897,990
Subtotal		$ 20,877,900
Estimated One Year Inflation to the Start of Construction		2,100,000
Total Budget		$22,977,900

---

*Additional Construction Cost Estimate Based on BNI Report (Page 20)

Structural Renovation	
BNI Report (Page 20)	9,500,000
Subtotal	$27,238,233
Contractor's Fee – 7%	1,906,676
Subtotal	$ 29,144,909
Construction Contingency – 10%	2,914,490
Subtotal	$ 32,059,400
Estimated One Year Inflation to the Start of Construction	2,100,000
Total Budget	$34,159,400

This analysis has been prepared solely for the Client's benefit, and no other entity shall have any rights or claim against the design professionals as part of this report for performance or non-performance of the observations, opinions, conclusions or recommendations contained herein.

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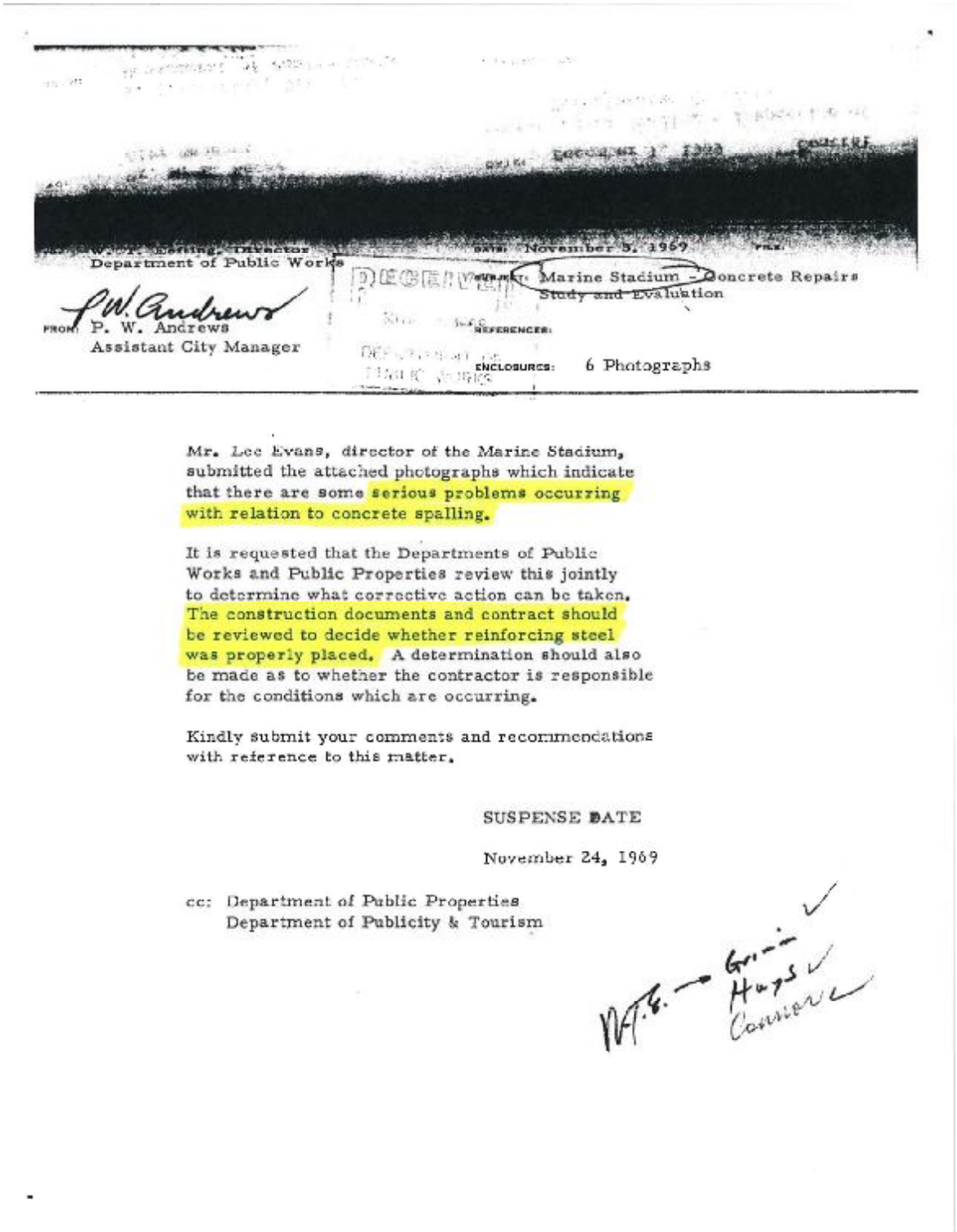
7. Exhibits

Exhibit 1



Department of Public Works

DATE: November 5, 1969

SUBJECT: Marine Stadium - Concrete Repairs Study and Evaluation

FROM: P. W. Andrews
Assistant City Manager

REFERENCES:

ENCLOSURES: 6 Photographs

Mr. Lee Evans, director of the Marine Stadium, submitted the attached photographs which indicate that there are some serious problems occurring with relation to concrete spalling.

It is requested that the Departments of Public Works and Public Properties review this jointly to determine what corrective action can be taken. The construction documents and contract should be reviewed to decide whether reinforcing steel was properly placed. A determination should also be made as to whether the contractor is responsible for the conditions which are occurring.

Kindly submit your comments and recommendations with reference to this matter.

SUSPENSE DATE

November 24, 1969

cc: Department of Public Properties
Department of Publicity & Tourism

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Exhibit 2

TO: Vincent E. Grimm, Jr., Director
Department of Public Works

DATE: September 13, 1972

FILE: Central

SUBJECT: Structural Deterioration
Marine Stadium

FROM: Edmund A. Connor
Assistant Engineer of Design
Design Division

REFERENCES:

ENCLOSURES:

A field investigation was made at the Marine Stadium this afternoon to examine some of the specific areas in which improvements have been requested. While there my attention was directed to an area of severely deteriorated concrete. This is in the area lying under the intermediate cross walkway. It may be examined most expeditiously at the extreme southeast end of the stadium structure, at the water's edge.

Splitting of the concrete may be noted in some of the beams, from rusting reinforcement. However, the most serious deterioration that was noted in the brief inspection was in the columns. In one, the only fully visible vertical bar appeared to be completely rusted away, and two of the lateral ties were rusted through. An examination back in the office shows that these columns were constructed with vertical bars only at the four corners, so there are no interior bars to help out.

A full inspection of these areas should be made, and all the deteriorated concrete repaired. I am sure this would be beyond the scope of Property Maintenance, and should be done under contract.

While the deterioration appeared to be as bad as any observed at the Orange Bowl, the situation here does not seem so dangerous. The ratio of live to dead load at the Marine Stadium is so much less than at the Orange Bowl, and also the continuous concrete deck would probably show severe cracking before failure was imminent.

EAC:sw

VIRGINIA KEY

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INTER-OFFICE MEMORANDUM

TO: [redacted] L. Reese
City Manager

DATE: November 22, 1972 FILE: Central

SUBJECT: Marine Stadium Structural Deterioration

REFERENCES:

FROM: Clifton C. Hays
Acting Director
Department of Public Works

ENCLOSURES:

Personnel from Public Properties earlier this month investigated the reported structural deterioration at the Marine Stadium. Last week Mr. Crouch told us that the repair work would be beyond the scope of their normal maintenance activities.

Members of this department yesterday made an inspection to determine the extent of the deterioration. Referring to the attached drawing showing a section thru the stadium, the following was found:-

16 of the 17 columns on column line "A" show vertical cracking, rusting of steel, and spalling concrete, all moderate to severe.

12 of the 16 beams designated "X" show generally moderate cracking, rusting of steel and spalling concrete.

12 of the 17 beams designated as "Y" show similar signs of deterioration.

In addition to the above, 7 other deteriorated members were noted in the same general area.

While in some cases there is insufficient concrete cover over the reinforcing, this is by no means true throughout. It is not fully apparent why these members have deteriorated so, but, apparently, the concrete in these areas was deficient in some way permitting the ready access of moisture and salt to the steel.

Preliminary thinking envisions repairs consisting of removing loose concrete and rust, applying wire mesh or short reinforcing bars, and guniting the members back to at least their original size. Some thought should be given to following this with a coating to decrease

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Exhibit 3

[redacted]

TO: V. E. Grimm, Jr., Director
Department of Public Works
Attn: C. Hays, Assistant Director

DATE: DEC 5 1972

FILE:

SUBJECT: Marine Stadium Structural Deterioration

FROM: P. W. Andrews P.W. Andrews
Assistant City Manager

REFERENCES:

ENCLOSURES:

The City Manager has reviewed your memorandum of November 22, 1972, and requests that you prepare a letter for his signature which would be sent to the engineers who originally designed the Marine Stadium structure, placing the burden on them to supply the City with an evaluation as to why the concrete is cracking and spalling, and other matters relating to structural deficiency. The structure was supposed to have been designed and constructed for a minimum 30 year life.

Hays → Stadium ✓
Center ✓

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CONSULTING ENGINEERS
CIVIL - STRUCTURAL - MECHANICAL - ELECTRICAL
760 PALERMO AVENUE, CORAL GABLES
MIAMI, FLORIDA 33134
444-7178 CABLE DIGNAS

NORMAN J. DIGNUM, P. E.
R. L. O'DONOVAN, P. E.
GEORGE D. GUNN, R. A.
WILLIAM E. MILLS, P. E.
MARION K. COX, P. E.

December 5, 1972

RECEIVED DEC 7 3:28

Mr. Edward Connor
City of Miami Public Works Dept.
Miami, Florida.

Re: Marine Stadium Grandstand.

Dear Mr. Connor:

After your telephone call my former partner, James Owen Power and I visited the Grandstand. There we saw the condition you described where some spalling has occurred in members exposed to frequent wetting by sea water.

It would appear that this condition has resulted from corrosion of the reinforcing steel.

We urge that corrective measures be undertaken at the earliest possible moment so that further deterioration may be avoided.

Very truly yours,

Norman J. Dignum
NORMAN J. DIGNUM

NJD/d

cc: James Owen Power.

Norman Connor

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RECEIVED
1972 DEC 18 PM 3:30

Wigham Associates
260 Palermo Avenue
Coral Gables, Florida 33134

Gentlemen:

Marine Stadium

The Department of Public Works has notified me that there is an area of moderate to severe concrete deterioration at the City's Marine Stadium. While confined to one region of the stadium structure, it occurs across the width of the stadium at nearly every member in that region. This is at a location near the water, both in the horizontal and vertical planes.

When the stadium was built, the City had anticipated 30 years or so of use without major maintenance. Needless to say, we are disturbed by the discovery of this deterioration less than ten years after the stadium's construction.

While I am aware that the City provided inspection during construction, it appears to me that, as designing engineers, your firm is best able to answer the following two questions:

1. Why has the steel rusted so in this one portion of the structure?

2. On the basis of your design and your observations at the site, is it necessary to restore all the deteriorated members to approximately their original capacity, or could repairs consist of halting further attack?

Your attention in this matter will be appreciated.

Sincerely,

M. L. Reese
City Manager

cc: City Manager
bc: Structures
Central

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Exhibit 4

[redacted]

NUM ASSOCIATES
NSULTING ENGINEERS
IL - STRUCTURAL - MECHANICAL - ELECTRICAL
200 PALERMO AVENUE, CORAL GABLES
M I A M I, FLORIDA 33134
444-7178 CABLE DIGNAS

NORMAN J. DIGNUM, P. E.
R. L. O'DONOVAN, P. E.
GEORGE D. GUNN, R. A.
WILLIAM E. MILLS, P. E.
MARION K. COX, P. E.

January 15, 1973

Mr. Melvin L. Reese
City Manager, Miami
Dinner Key, Miami, Fla.

Ref: Marine Stadium.

Dear Sir:

In order to answer your questions concerning the captioned project I have proceeded as follows:

1. Made inspections of the structure with my former partner, Mr. James Owen Power, P.E.

2. Retained the services of the firm of Mueser, Rutledge, Wentworth and Johnson, Consulting Engineers, to review plans and specifications as well as to make field inspection.

3. Retained Pittsburg Testing Laboratory to make tests of concrete samples taken from the job site.

4. Researched the journal of the City's field inspectors who were on the site during construction.

The reports of Mr. Power and the laboratory are enclosed. From these sources I have reached the following observations:

1. The deteriorated concrete in question lies along column line "E" from columns number "1" thru number "17" and in some adjacent grade beams above and below.

2. Except in honey-combed areas the concrete appears to meet specifications and Building Codes.

3. The specifications call for honey-combed concrete to be repaired by the Gunite method at the discretion of the Engineer. It is apparent that no attempt to repair honey-combed column bases has been made.

4. Concrete cover over reinforcing bars is inconsistant; Sometimes the steel is exposed, sometimes according to plans and specifications and sometimes exceeding the minimums. It is to be noted that concrete slabs in the same area with one inch of concrete cover are not deteriorating.

1.

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5. One apparent cause of concrete cracking in grade beam soffits was observed to be rusting of rebar chair legs. This rusting migrated to the principal reinforcement and split the concrete cover.

6. From the Journal of the City's field inspectors, from personal inspection of honey-combed bases of columns concerned and from the pattern of vertical steel (there is no evidence of cracks following the steel closest to the concrete surface, namely stirrups and ties) I have reached the following conclusions:

   (a) Columns in line "E" may have been poured in tidal water. (Inspection reports indicate that some concrete was placed when there was tidal water in the forms, although this was contrary to the specifications which required that all concrete be placed in the dry).

   (b) Concrete in these columns was placed without proper vibration to insure consolidation and density. The honey-comb is obvious.

   (c) In my opinion salt water entered the bases of the columns in line "E", possibly by mixture during placing, causing a loss of fines and resultant honey-comb. The honey-combed concrete has permitted water to seep into the columns causing the vertical steel to corrode thereby cracking the concrete and permitting more water to enter. This migratory corrosion extends from the pile cap upwards some five feet to the soffit of adjacent grade beams.

In answer to your other question I feel that repairs should entail more than halting further deterioration. Cracked concrete should be removed, rebars cleaned and corroded areas restored and the column re-built with concrete.

Sincerely,

Norman J. Dignum

NORMAN J. DIGNUM

NJD/d

2.

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JAMES OWEN POWER
CONSULTING ENGINEER
SO. MIAMI, FLA. 33143

[illegible] RED ROAD, SUITE N
[illegible]LEPHONE (305) 665-6964

JAMES OWEN POWER PE
LAWRENCE J. ESSMAN PE

January 15, 1973

City of Miami, Florida
City Hall, Dinner Key
Miami, Florida 33133

Attn: Mr. W. L. Reese, City Manager

Re: Marine Stadium Grandstand

Dear Mr. Reese:

As a result of my investigation with Messrs. Dignum and Wentworth and a careful study of their reports I have independently reached the following conclusions which I consider to be in substantial agreement with theirs.

First, I believe the severe deterioration along Column Line E is the result of four major factors acting together in various combinations.

1. Exposure. The area in which the deterioration in question has occurred is the area most subject to exposure from bay water and moist salt laden air. But this fact alone does not explain the condition which exists since adjacent areas where the exposure is comparable exhibit no significant deterioration.

2. Inadequate Cover. There are a number of places where spalling has revealed that the specified cover was not provided. In many places this lack of protective cover, in my judgement, triggered the corrosion which then became progressive. However, this alone does not explain all the conditions observed. For example, there are also places where spalling has occurred although cover appears to be as much as 4 inches. Furthermore, the pattern of spalling reflects the location of the main steel in the members rather than the ties and stirups which are closest to the surface.

3. Defects in Concrete. There is no evidence to suggest that the concrete itself was not of good quality. However, it is evident that placement methods were not successful in avoiding a number of areas of honeycomb and porus concrete nor were such areas properly repaired. In particular this condition is typical of the columns on Line E just above the pile cap. In my judgement, the porus concrete at this critical point permitted moisture to reach the vertical steel. Corrosion beginning at this point then, I believe, migrated along the bars resulting in the spalling which is typical of those columns.

-1-

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4. Corrosion of Accessories. There are a number of places where rust stains indicate the corrosion of form ties and, more important, of bar supports used to support bottom reinforcing in grade beams. The corrosion of these bar supports is significant because it provides a path for moisture to reach the bottom bars and a starting point for migration of the corrosion.

Finally, I fully concur with Mr. Dignum and Mr. Wentworth that it is necessary to restore the deteriorated members to their original intended condition taking care to assure that these problems will not recur in the future.

Truly yours,

James Owen Power

JOP:rcp

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Exhibit 5

CITY OF MIAMI, FLORIDA

INTER-OFFICE MEMORANDUM

'73 JUN 22 PM 2:03

Mr. Vince Grimm, Director
Public Works Department

Andrew P. Crouch, Director
Public Properties Department

DATE: June 22, 1973

FILE:

SUBJECT: Marine Stadium Roof Coating

REFERENCES:

ENCLOSURES:

A recent inspection was made of the Marine Stadium's roof to determine the cause of seepage stains that are showing through the Marine Stadium roof deck. It is apparent that the roof coating is in need of replacement.

The product used on the original coating was recommended by your department and installed by Property Maintenance forces. We feel this coating has done a satisfactory job, and has proven its expected life. This coating was applied in February 1965. The product used was V.I.P. Buttering Grade Roof Sealing Compound.

Since it is possible that other methods or products may now be available for this type construction, I am requesting that you research and recommend to me any changes that you feel would be beneficial to this application.

The re-coating has been scheduled to be accomplished within the next 90 days. I would appreciate an early reply on your recommendation.

APG:CEC:bf

File: Marine Stadium

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Exhibit 6

Walter E. Colby
Stadium Manager

October 18, 1984

Marine Stadium
Structure

Donald W. Cather
Director of Public Works

Sketch

As requested, members of this department inspected the Marine Stadium grandstand structure. Their findings are reported as follows:

In the superstructure, where the mezzanine slabs are supported by steel rod hangers, moderate cracking was found in the slabs, and, at two locations, reinforcing is exposed in the supporting beams.

Also in the superstructure, moderate cracking was noted [redacted] the bottom of column A-2 (See attached sketch), and one [redacted] where concrete has spalled, exposing reinforcing steel.

In the substructure, considerable deterioration was noted near, and forward of, the underdeck crosswalk. This area is over water, and is continually exposed to salt spray as wake from boats rolls the water. The specific problem areas are as follows:

1. In the beams and columns adjacent to the walkway, which were previously repaired (1973 and 1979). While the greater part of the repair work has held up, some areas of major spalling have appeared.

2. About 18 of the concrete piles supporting the front portion of the structure have cracked, or otherwise show signs of deterioration.

3. At many locations, the beams near the front of the stadium (Col. line J) are cracked and spalling.

At staff meeting 6-12-85 DWC said to write Colby again about this.

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Walter E. Bolby October 18, 1984

4. Concrete has spalled off the underside of the front, cantilever concrete slab, exposing reinforcing steel. This occurs over an estimated 10% of the area of this slab. The spalling here is particularly significant, as it is occurring on the slabs compression face, and thereby directly reduces its moment-carrying capacity.

It is this department's recommendation that all of the noted defects be repaired at an early date. The several problem areas in the superstructure could probably be repaired by City forces in a period of several days however, the work on the substructure would be more complicated, and on a much larger scale, and would have to be done by contract. A preliminary estimate of the cost of this work is $200,000.

I reiterate that we believe these repairs should be accomplished at an early date. While what we have seen would not be termed life threatening, these are defects which will soon become major problems if not remedied now. As an example, the deterioration in column A-2 occurs at a highly stressed section of a primary, non-redundant structural member. In the case of the cantilevered front slab, again there is no redundancy. If the present deterioration is allowed to continue, we expect that within two years it will have reached a point where conservative judgment will dictate that the slab should be cut off, or otherwise removed from public access.

another copy to Eads 3-21-85, by DWC

cc: J. Eads
Bldg. & Veh. Maintenance

bc: Structure(2) FOR
Central

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Exhibit 7

CITY OF MIAMI, FLORIDA

INTER-OFFICE MEMORANDUM

TO: Walter E. Golby
Director
Department of Public Facilities

DATE: March 20, 1986

FILE:

SUBJECT: Marine Stadium - Structural Deterioration

FROM: Donald W. Gather
Director of Public Works

REFERENCES:

ENCLOSURES:

Following receipt of your recent memo concerning deteriorated concrete at the Marine Stadium, an investigation was made of the grandstand structure. There was general concurrence with what you wrote in your memo, and the following was reported to me:

1. Cracks in the underside of the deck where concrete had recently fallen should be probed to dislodge any loose concrete. No serious deterioration is now apparent, but the probing could possibly reveal some. The need for this work was pointed out to Dale Sandin, who was at the stadium at the time.

2. Serious and extensive deterioration exists in the substructure columns and beams on the lagoon side of the dressing room passageway. Repairs have been made under contract twice in this area. More such work is now needed.

3. Moderate and extensive cracking and spalling may be found on the underside of the projecting front slab of the grandstand. This is rapidly approaching the point at which, if not repaired, we will be forced to recommend that the projecting slab be removed.

The full scope and method of the needed repairs is unknown. At this time we suggest you set aside at least $250,000 for the purpose.

EAC:mw

cc: E. Cox

bc: Structures
Central

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Exhibit 8

CITY OF MIAMI, FLORIDA

INTER-OFFICE MEMORANDUM

TO: Aurora Badia
Assistant Director

FROM: Edmund Connor
Structures Engineer

DATE: August 30, 1988

FILE:

SUBJECT: Marina Stadium

REFERENCES:

ENCLOSURES:

In accordance with your recent request, this week George Picard and I inspected the Marine Stadium structure. While not a detailed, member-by-member inspection, it was I believe sufficient to allow a general assessment of this 25-year-old reinforced concrete structure. Our findings are as follows:

1. Many of the piles supporting the front (waterward) portion of the structure are showing signs of severe deterioration. This situation has appreciably worsened since our last inspection, in 1984.

2. Deterioration is continuing on the underside of the front, cantilevered slab.

3. Deterioration is likewise continuing on the underdeck beams and associated framing members extending over the water.

4. On the elevated walkway on the back side of the stadium, considerable cracking may be noted, especially near the supporting hangers.

5. Some isolated, relatively minor defects may be seen in the main columns near the back edge of the stands.

6. The rooftop steel beam supporting the control room shows signs of moderate rusting.

7. The concrete folded - plate roof and the seating area slabs generally show only minor defects.

8. We were not prepared to inspect the steel barge, but it is certainly in need of being hauled, scraped and painted.

Page 1 of 2

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Based on these observations, my recommendations are as follows:

- Address the problem of the cantilevered slab (Item 2) at the earliest possible date. A failure here would most likely be a sudden event, with no initial cracking and deflection to serve as a warning.
- Repair the piles and underdeck beams (Items 1 & 3) in the near future.
- Have maintenance forces address the matters covered in Items 4,5,6 & 7.
- If the City wishes to keep the barge, we will make a general inspection of its interior, and if no major problems are evident, it should be hauled and painted. (Jones Boatyard expects to have a drydock in operation around the beginning of next year which could handle the barge).

A preliminary estimate of the costs of these items is as follows:

Front slab repairs	$100,000
pile repairs	50,000
underdeck beams	75,000
haul and paint barge	50,000
	$275,000
Engineering & Contingencies	75,000
TOTAL	$350,000

To this should be added an allowance for a two man maintenance crew, and necessary materials, for about a four-month period to do the relatively minor, miscellaneous work.

EC:tmk

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Exhibit 9

CITY OF MIAMI, FLORIDA

INTER-OFFICE MEMORANDUM

TO: Luis Prieto
Director,
Public Works

DATE: May 4, 1989 FILE:

SUBJECT: Marine Stadium
Structural Deficiencies

FROM: Max L. Cruz
Assistant Director,
Parks, Recreation &
Public Facilities

REFERENCES:

ENCLOSURES:

A recent inspection of the Miami Marine Stadium revealed certain structural safety deficiencies. Please consider this a request to remedy the below listed items before the Budweiser Hydroplane Regatta on the weekend of June 2-4, 1989.

1) Falling chunks of concrete that could be potentially dangerous to spectators.

2) Cracked concrete on sidewalks in front of stadium. See Victor Kahill for exact location.

Your attention in this matter is greatly appreciated.

Max showed me area this came from - on bottom, easterly edge of main frame on col (2) line, between (C) & (E)

EC - 5-9-89

RECEIVED
89 MAY 4 PM 2:45
DEPT. OF PARKS, RECREATION AND PUBLIC FACILITIES
THE CITY OF MIAMI, FLA.

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Site

8. Photographic Survey

1- Fire Department Connection

2- Parking Area Paving Deterioration

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Site

3- Landscape Area Encroaching Into Parking Area

4- Site Lighting Typical Condition

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5- Parking Area Deterioration

6- Typical Condition of Site Curbing

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7- Equipment Box Equipment Stolen

8- Water Service Enclosure

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9- Ramp Area Egress with No Handicap Access

10- Stair Riser 7" High

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11- Stair Riser 5" High

12- Railing and Imbed Condition

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13- Typical Building Entry Access

14- Ramp Access at Ground Level – No Guardrails and Handrails

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15- Imbed Spalling

16- Typical Building Condition

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17- Typical Building Condition

18- Area with Fire Damage

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Mechanical

19- Area with Fire Damage

20- Typical Building Condition

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21- Ramp to Lower Level

22- Ramp to Lower Level – No Guardrails and Handrails

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Mechanical

23- Rest Room Stalls, No Handicap Accessibility

24- Tile with Possible Lead Content May Need to be Abated

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25- Hazardous Material Battery Back Up System

26- Dressing Room Area General Building Condition

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27- Lower Level Seating Access

28- Concession Area

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29- Water Fountain Area with No Handicap Accessibility

30- Typical Condition Grand Stand Seating Area

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31- Railing Spacing at Grand Stand Seating Area

32- Access to Control Booth

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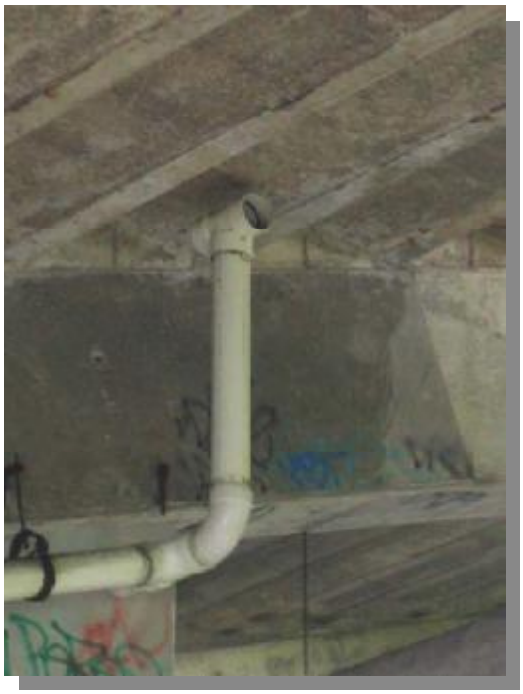

33- Sanitary System Vented Below Grand Stand Seating

34- Sanitary Piping PVC Retro Fit and Missing Pipe Supports

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35- Air Handling Units in Crawl Space

36- Fire Hose Riser

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37- Cast Iron Sanitary Line Deterioration

38- Plumbing Fixture Damage

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39- Plumbing Fixtures with Debris

40- Cast Iron Sanitary Piping Deterioration

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41- Disassembled Fire Hose Cabinet

42- Disassembled Fire Hose Cabinet

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43- Water Heater and Cast Iron Piping

44- Potable Water Cold Supply

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45- Exhaust Fan

46- Restroom with All Fixtures Stolen

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47- PVC Sanitary Pipe Retro Fit

48- Plumbing Fixtures with Debris

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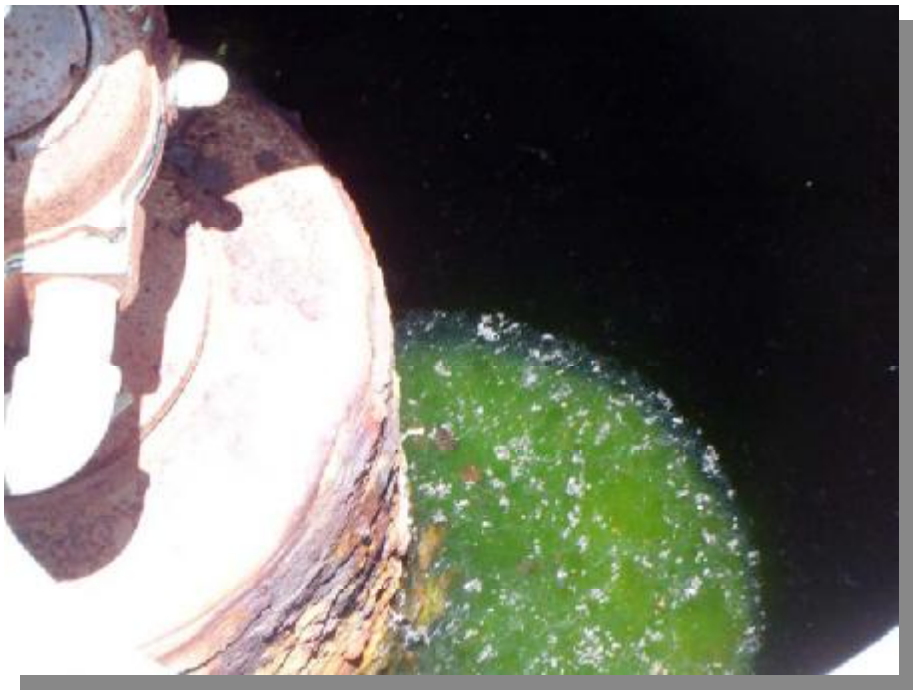

49- Lift Station

50- Lift Station Equipment Damage

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51- Conduit and Fixture Deterioration

52- Fixture Deterioration

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53- Phone System

54- Open Junction Box and Disassembled Disconnect

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55- Disassembled Electrical Panel

56- Lighting Fixture Hanging by Wire

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57- Disassembled and Deteriorated Electrical Panels

58- Lighting and Sound System Typical Condition

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Electrical

59- Electrical Disconnect Typical Deterioration

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60– Lower Level Walkway Slab Deterioration

61- Lower Level Slab Deterioration

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62- Concrete Beam Damage

63- Column and Beam Damage

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64- Column Damage

65- Main Support Beam Deterioration

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66- Main Ramp Support Beam Deterioration

67- Over Head Concrete Structure with Water Seepage

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68- Main Column Deterioration

69- Over Head Canopy with Water Seepage

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70- Over Head Control Booth with Steel Structural Beam Penetrating Concrete Structure

71- Control Booth Structure Deterioration

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72- Control Booth Structure Deterioration

73- Control Booth Support Structure Deterioration

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74- Over Head Concrete Structure with Water Seepage

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BLISS & NYITRAY, INC.
STRUCTURAL
ENGINEERS

Structural Condition Assessment

of the

Miami Marine Stadium

Miami, Florida

BNI Project No. 08M21

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July 18, 2008

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1 INTRODUCTION

The Miami Marine Stadium is a concrete structure that was built along Biscayne Bay 44 years ago and has been closed and abandoned for the past 16 years. The stadium is owned by the City of Miami and is located on Virginia Key at 3501 Rickenbacker Causeway, Miami, Florida. The stadium reportedly has various amounts of deterioration in the structure and the City of Miami requires a condition assessment of the facility to assist them in determining the future use of the stadium.

The City of Miami has engaged Astorino along with Bliss & Nyitray, Inc. (BNI) to perform a condition assessment of the Miami Marine Stadium. Astorino is the prime consultant to the City. BNI will provide the structural condition assessment while Astorino addresses other assessment concerns such as architectural, mechanical, electrical, etc.

1.1 Purpose

The purpose of the structural assessment is to identify the extent of the deterioration of the structure and to provide a repair cost estimate. A cost estimate is provided by our sub-consultant; Structural Preservations Systems (SPS), who is a nationally known specialty repair contractor with 32 years of experience in structural repair, strengthening and waterproofing and protection projects. The purpose of the assessment and cost estimate is to provide the City with information to be used in their decision for the future use of the stadium. The cost estimate represents an opinion of the cost to repair the visible deterioration.

1.2 Scope of Work

Our scope of work is to provide a structural condition assessment of the present condition of the stadium and to provide a written assessment report summarizing our findings. Our assessment is based on a review of available record documents, performing on-site visual observations to determine the present condition and to identify visible deterioration of the

structural frame. Our assessment was structured to correspond to the limited budget provided by the Owner. The assessment does not include a structural analysis of the existing building and it includes only limited destructive observations.

1.3 Documents used in review

The City of Miami did not have any record architectural or structural drawings to provide for use in this condition assessment, until several days before the date of this report, the City provided the following sheets from the original structural drawings prepared by Dignum Associates, dated April 24, 1963; S-1, S-2, S-3, S-5, S-8, S-9, S-14, S-16, S-17 and S-18. Eight of the eighteen sheets were missing from the set of drawings.

Other record documents the City provided consisted of several boxes containing correspondence concerning the stadium after it was built and a previous structural condition assessment report that was prepared by Simpson Gumpertz & Heger, Inc. who are located in Arlington, Massachusetts. The report was dated May 1993 and it consisted of only Volume 1 out of 3 volumes.

1.4 History of Structure

The stadium known as the Ralph Munroe Miami Marine Stadium was built in 1964 (Photo 1, 2) as a venue for power boat races and other water events. The stadium has also been used for concerts and other community events. Based on various articles written on the stadium, the stadium's use began to decline during the late 80's and early 90's until the stadium was closed after Hurricane Andrew in 1992. The stadium has been abandoned for the past 16 years since 1992.

Corrosion resulting in the deterioration of the structure is not a recent problem at the stadium. There is a history of corrosion and deterioration dating back to 1969. The following is a summary of the history based on the City's correspondence contained in

their records. The summary includes the date of correspondence and a paraphrased summary of the subject.

- November 1969 – The letter states that some serious problems are occurring in relation to concrete spalling.

- December 1969 – An inspection found rusting steel and spalled concrete in various concrete members.

- September 1972 – An inspection found severe deterioration of beams and columns at the water's edge. The most serious deterioration was in the columns, where reinforcing was completely rusted away. Beams were split from corroding reinforcement. It was noted that it appeared to be as bad as any deterioration observed at the Orange Bowl.

- November 1972 – An inspection found that three quarters of the columns and beams along grid line E have moderate to severe deterioration.

- December 1972 – The City contacts the original structural engineer concerning moderate to severe deterioration in nearly every concrete member near the water. The original engineers conclude the following; this area has the worse exposure to the bay water, placement of concrete occurred with tidal water in the forms, inadequate concrete cover and inadequate vibration of concrete resulting in honey-combed concrete.

- June 1973 – An inspection observed staining on the roof due to water leakage.

- October 1984 – An inspection found moderate cracking and exposed reinforcing in the mezzanine slab. Considerable deterioration in the beams and columns adjacent to the walkway near the water which were previously repaired in 1973 and 1979. About 18 of the piles supporting the lower seating have cracked and show signs of

deterioration. The beams on grid line J are cracked and spalling. If the deterioration continues in the first row slab that is cantilevered over the water it will need to be cut off.

- March 1986 – An investigation was conducted which found serious and extensive deterioration in the columns and beams on the water side. Moderate and extensive cracking and spalling in the slab in front of the lower bleachers and again warning that it may need to be cut off.

- August 1988 – An inspection found many piles supporting the lower seating have severe deterioration and have worsened. Deterioration at beams, columns, walkway, steel beams at the press box, and minor defects in main roof columns and folded roof plate.

- May 1989 – An inspection noted falling chunks of concrete which could be potentially dangerous to spectators and cracks in walks.

2 DESCRIPTION OF STRUCTURE

The Marine Stadium was constructed along the shoreline of a basin located off Biscayne Bay and Florida's Intracoastal Waterway. The stadium is a reinforced, cast-in-place concrete structure that seats approximately 7,000 in the lower and upper seating areas. The lower seating area was constructed over the water. The stadium has a roof that covers three quarters of the seating. (Photo 3, 4, 5, 6)

The stadium consists of the following primary components; ground floor level (Page 25), mezzanine level (Page 26), grandstand level consisting of lower and upper seating (Page 26, 27), and the roof structure (Page 28, 29, 30).

The building is supported on a concrete pile foundation, with the ground floor level (Page 25) consisting of a structural slab on grade supported by grade beams. There is a concrete retaining

wall that runs along the shoreline that forms the sea wall separating the 10 foot difference in elevation between the ground floor and the water.

The first elevated floor is the mezzanine level (Page 26) that is accessible by two ramps centered on grid lines 5 and 13. The ramp slabs are cantilevered from the concrete walls on grid line 5 and 13. The mezzanine floor is framed by a 3 1/2" concrete slab supported by 12" deep pan joists in the center areas of the level, and by two-way slabs on the east and west ends of the stadium. The slabs are supported by concrete beams, or by 8" load bearing masonry walls along grid line B.

The grandstands are 326 feet x 126 feet in size constructed as two separate structures consisting of the lower seating and the upper seating (Page 26, 27). The lower seating is framed with cast-in-place concrete bleachers supported by concrete raker beams. The lower seating structure is built over the water and the raker beams are supported by concrete piles driven into the bay bottom, and the column at grid line E. The upper seating is also framed with cast-in-place concrete bleachers supported by concrete raker beams. The raker beams are supported by concrete columns at grid lines A, C and D.

The roof framing (Page 28, 29, 30) consists of eight V-shaped, thin-shell reinforced concrete elements that are hyperbolic paraboloid shape and supported by three columns. The roof is 326 feet x 108 feet in size, with a 65 foot cantilever. The three columns consist of a single main interior column from which the roof cantilevers from and two diagonal columns that resist the uplift. All three columns spring from the same pile cap foundation on grid line A. The V-shaped thin-shell roof is 3" thick between a thickened valley and ridge areas. This 3" thick area of the roof slab is referred to as "the web" by this report.

3 FIELD OBSERVATIONS

For the purpose of our observations that make reference to compass directions, North is towards the water area in front of the grandstands of the stadium. Refer to the plans on pages 25, 26 and 27 for grid line references.

The following terms; Mild, Moderate and Severe, are terms that have been used in this report to describe the degree of deterioration observed in the structure. Below are definitions of these terms.

- Mild – When the deterioration of the element has damaged 10% or less of the cross sectional area of the member.

- Moderate – When the deterioration of the element has damaged more than 10% and less than 50% of the cross sectional area of the member.

- Severe – When the deterioration of the element has damaged more than 50% of the cross sectional area of the member.

Damage to the cross sectional area of a member includes the loss of concrete and the reinforcing steel. When the degree of deterioration is referring to a floor slab, it is referring to the percentage of the floor area that is damaged, as well as the cross sectional area in the effected area.

3.1 Ground Floor Level

3.1.1 Piles and Grade Beams

Observations of the piles and grade beams below grade are outside of the scope of this assessment since it would require excavations and an expanded assessment budget to expose these elements to view.

3.1.2 Floor Slabs

The ground floor consists of a structural slab on grade supported by grade beams. There is mild deterioration through out the entire ground floor consisting of spalled

concrete and exposed corroded rebar (Photo 7, 8, 9, 10, 11, 12, 17). Each of the deteriorated areas requires repair to prevent further deterioration and to eliminate the many tripping hazards to the occupants.

The elevated slab for the corridor between grid lines D and E that runs the full length of the stadium below the lower seating has severe deterioration and requires replacement (Photo 24, 25, 26, 28, 43, 44).

3.1.3 Ramps

The ramps centered on grid lines 5 and 13 have mild deterioration, with areas of spalled concrete and exposed corroded rebar requiring repair (Photo 15, 16).

The ramp on the east side of the stadium is severely deteriorated and requires replacement (Photo 13, 14).

3.1.4 Beams

The line of beams supporting the elevated corridor slab on grid line E have severe deterioration and require replacement. There is severe deterioration in the horizontal beam that is directly below the lower seating raker beam on each numbered grid line which requires replacement. The beams on grid lines 1, 17, C and D in the open areas on the east and west ends of the stadium require replacement due to the severe deterioration (Photo 22, 23, 36).

The corrosion is so severe at most of the beams described above that 50% or more of the beam's cross section has spalled away and is missing, and very little is left of the beam's reinforcing steel cross sectional area (Photo 27, 29, 30, 32, 33, 36, 43, 44, 45, 46, 48, 49).

3.1.5 Columns

Columns C-1 and C-17 have severe deterioration where 50% of the column cross section has spalled away. There is severe deterioration in columns D-1 and D-17 which require replacement of the column (Photo 22, 23, 38, 40, 47).

There appears to have been a fire on ground level in the room between grid lines 2 and 4 which may have caused the damage to the mezzanine slab above and adjacent columns. Columns C-3 and D-3 have mild deterioration which may have been caused by a fire and then subsequent corrosion require repair (Photo 18, 19, 20).

3.1.6 Retaining Walls / Seawalls

The retaining wall that runs along grid line D and wraps around the open areas on the east and west ends of the stadium on grid lines 2 and 16 (Page 25) has deterioration ranging from moderate to severe. There are sections of the wall where large areas of corroded reinforcing steel have caused concrete spalls up to 10 feet wide which may require the replacement of sections of the wall (Photo 37).

3.1.7 Masonry Walls

There was no visible deterioration observed in the masonry walls on this level.

3.2 Mezzanine Level

3.2.1 Floor Slabs

The slab area surrounding the ramps between grid lines 4 and 6, and between grids 12 and 14, have moderate to local severe deterioration, with many areas of spalled concrete and exposed corroded rebar that require repair (Photo 51, 52, 53, 54, 57, 63, 64). There are also many cracks up to 0.060” in width that require repair.

The slab areas which cantilever from the face of the concessions and the rest rooms have mild deterioration (Photo 55, 56, 58). There are multiple cracks that are perpendicular to the long direction, and there is a 0.025" wide crack in the top of the slab running parallel to and located over the support for the cantilevered slab. These cracks require repair.

The slab area between grid lines 2 and 3 is severely deteriorated where the bottom portion of the slab spalled away and the reinforcing is exposed and corroded. This area of slab may have been damaged by a fire on the ground level below between grid lines 2 and 4, and then the subsequent corrosion.

All of the curbs at the slab edge in which the railings are anchored to are severely damaged from corroded railings and rebar (Photo 55, 56, 58, 59). In many areas the curb has broken apart and fallen to the ground level below. All of the curbs require replacement. The slab edges also require repair.

All of the hand railings are severely corroded at the base, and many are broken away from the structure (Photo 68). All railings require replacement.

3.2.2 Beams

The beams on grid line C and D, between grids 2 and 3, have moderate deterioration and require repair. These beams may have been damaged by a fire on the ground level below between grid lines 2 and 4, and the subsequent corrosion.

3.2.3 Columns

There are no indications of deterioration in the columns at this level except there is moderate deterioration in four columns next to the open areas on the east and west

ends of the stadium on grid lines 1, 2, 16 and 17, and on grids C and D. All of these columns require repair (Photo 50).

3.2.4 Hanger Rods

All of the hanger rod connections to the slab are severely corroded and require replacement (Photo 59, 60, 61). At some locations there is very little remaining of the embed that the hanger rod bolts to, and as precaution to prevent failure it's recommended that the slab edge be shored immediately. The repair may consist of installing new columns below to support the slab edges which are supported on new grade beams.

3.2.5 Masonry Walls

There was no visible deterioration observed in the masonry walls on this level.

3.3 Lower Seating Level

3.3.1 Piles

Approximately 40% of the piles supporting the lower bleacher seating area require repair. Their conditions range from piles that have vertical cracks which are consistent with the presence of corroding rebar in the pile, to a number of piles where the corrosion damage has caused 50% of the pile cross section to break away (Photo 32, 33, 34, 35, 42). There is one pile that is totally missing on grid line 2.

3.3.2 Bleachers

The Bleacher slabs have mild deterioration present, with local areas of moderate deterioration. Bleacher slabs were cast in 2-bay segments with a construction joint

occurring over the raker beams on the odd-numbered grid lines. There is a regularly occurring crack over continuous support at the raker beams on even grid lines that requires repair. The crack widths range up to 0.025” wide.

The lower walkway along the water has many cracks that run both across the width and along the length of the slab. The crack widths range from 0.013” to 0.025”. At many locations the slab is damaged with missing portions of the slab and exposed rebar (Photo 65, 66, 67). It appears that the slab edge may have been struck, causing the damage. At other areas along the slab edge there is spalled concrete and exposed corroded rebar.

3.3.3 Raker Beams

The condition of the raker beams vary from mild to moderate deterioration, with the visible spalling and exposed corroding rebar occurring at the lower elevations of the beam over the water.

3.3.4 Beams

The beam on grid line J is moderately deteriorated with corroding rebar and spalling concrete requiring repair and 30% replacement (Photo 35).

3.3.5 Columns

The columns on grid line E supporting the corridor slab and the lower seating raker beams are severely deteriorated and require replacement (Photo 36, 39, 41, 43, 47). Many of the columns appeared to have been previously repaired, however, there are cracked and spalled portions of the column that are nearly 8” deep into the column.

Immediate shoring of these columns is recommended as a precaution against a collapse of the lower seating structure.

3.3.6 Vomitory Walls

The vomitory walls require repair for the spalling and corroding rebar below the floor slab, and also at the top of the wall where the railing is embedded in the wall and corroding.

3.4 Upper Seating Level

3.4.1 Bleachers

The bleachers have mild deterioration with many areas of spalled concrete and exposed corroded rebar along the edge of the bleacher step (Photo 93).

Bleacher slabs were cast in 2-bay segments, with a construction joint occurring over the raker beams on the odd-numbered grid lines. There is a reoccurring crack over continuous support at the raker beams on even grid lines. The crack widths range up to 0.025” wide.

The upper 41” wide row has moderate deterioration with many areas of spalled concrete and exposed, corroded rebar (Photo 92).

3.4.2 Raker Beams

There was no visible deterioration observed in the raker beams at this level, except where the bleachers are open around the main roof columns. In these locations at the beam-to-column joint there is moderate deterioration in the beams (Photo 94, 95).

3.4.3 Beams

The uppermost beam supporting the bleachers and the raker beams on the even grid lines has severe deterioration in the upper portion of the beam (Photo 103).

There is moderate deterioration in the beam on grid line C directly over the ramp.

3.4.4 Vomitory Walls

There was no visible deterioration observed in the wall and beam on this level, except at each railing post which has corroded and caused the concrete to spall and rebar to corrode.

The concrete walls around the bleacher openings for the main roof columns are severely deteriorated and required 30% replacement (Photo 90, 91).

3.5 Roof Level

3.5.1 Roof Slab

There is very little remaining of a roofing membrane on the topside of the roof slab, which has left the concrete surface exposed in most of the roof area (Photo 111, 112, 113, 114, 116, 118). The roofing membrane requires replacement.

The valleys appear to be drained by a roof drain located over the main interior column. Only 2 of the 8 drains are operable and there is standing water approximately 16” high, which is up to the overflow scuppers in 6 of the valleys (Photo 114, 115).

There is extensive cracking in the cantilevered portion of the roof structure. There is diagonal cracking in each web of the V-shaped cantilever (Photo 69, 70, 71, 72,

73, 75, 76, 77, 78, 79, 80, 81, 84, 86, 87). The diagonal cracking originates from approximately 2 to 3 feet above the bottom of the valley and extends to the top of the ridge. At the point where the cracks start at the valley there is a horizontal crack that runs parallel to the valley for the length of the cantilever (Photo 72, 75, 78, 79, 89). The cracking is visible from both the underside and topside the roof slab. Crack widths in the topside of the roof slab were 0.040" wide, with some wider cracks. The diagonal cracks are spaced between 2 to 3 feet on center and in many cases the spacing is smaller, with smaller cracks branching off the larger ones. Illustrations of the typical cracking pattern are shown on pages 31 and 32.

There are indications that water has been leaking through the cracks because of the staining on the underside of the roof slab. The staining consists of dark stains (Photo 71, 72, 73, 75, 76, 78, 79, 80, 84) and white efflorescence (Photo 72, 84, 85, 86, 87, 89). In many locations the white efflorescence is built up, forming stalactite-shaped deposits hanging from the underside of the roof slab (Photo 85). The locations of the dark staining seem to correlate with the locations where the roof drains are inoperable and there is dark colored standing water. The dark water color appears to be the result of the sediment and debris that has accumulated in the valleys.

In some areas there was little or no concrete cover over reinforcing steel and, without the presence of a roofing membrane, the rebar has corroded and the concrete has spalled, exposing the bars.

There is minor cracking in the 12" thick wall that is located over the main interior columns separating the cantilever and the rear portion of the roof structure. At the east end of the wall the concrete has spalled away exposing rebar and the anchors for the post tensioning cables (Photo 117).

There is a crack in the pour strip located at the ridge of the V-shaped roof running parallel to the ridge (Photo 88, 113).

There are embedded electrical boxes located along the cantilevered edge of the roof where the box and conduit have corroded causing the surrounding concrete to spall and corrode adjacent rebar.

3.5.2 Exploratory Observations of Roof Slab

We performed three exploratory observations where concrete was removed from the top surface of the roof slab to observe the condition of reinforcing steel. The locations were selected to assess the condition of rebar in an area that contained the diagonal cracking in the web of the V-shape and to assess the main reinforcing steel for the cantilever at the ridge.

The first location was in the west side of the V-shape on grid line 6 (Photo 119). This location was chosen because of the functioning drain in this valley which would allow workman to operate their electric tools safely without being in standing water. The opening was located approximately 6 feet diagonally up from the scupper drain in an area with diagonal cracks. A 30” x 30” area of concrete was removed to expose the reinforcing bars (Photo 120). The slab is 3” thick and there was a ½” of concrete cover over the top layer of bars. We found the reinforcing to be a single layer of #4 bars at 12” centers in each direction. The direction of the bars was parallel and perpendicular to valley and ridge. The bars were galvanized. There was no visible corrosion in the rebar (Photo 121).

The second and third locations were located at different elevations on the ridge of the V-shape (Photo 122, 124) where concrete was removed to uncover a concentration of #9 bars that were contained in closed #3 ties (Photo 123, 125). There was no visible corrosion in the bars, except mild corrosion was found on some of the ties where there was little or no concrete cover.

3.5.3 Columns

Mild deterioration was visible in the main interior compression columns.

3.5.4 Tension Columns

The diagonal tension columns have moderate deterioration. There are 50% of the columns requiring repair due to corroding rebar and spalling concrete (Photo 96, 97, 98, 99, 100, 101, 102). There are cracks across the cross sections that are 0.025” in width.

The rear portion of the cantilevered roof structure is held down by the connection to the intersection of the diagonal tension columns and the upturned portion of the raker beams. There are dowels from both the tension columns and the raker beam that form the connection. In additional to the rebar dowels, there are two 18” channel embeds in the upturn portion of the raker beam that extend into the roof slab with a horizontal channel welded to them to anchor the roof.

There is a semi-circular crack in the roof slab that radiates from both sides of the upturned portion of the raker. There is also exposed, corroded rebar and spalled concrete, along with the presence of white efflorescence, indicating water is leaking into this joint (Photo 104, 105, 106, 107, 108, 109, 110). Water is most likely entering through the construction joint that is located in the ridge of the V-shaped roof and located over the support.

Before any repairs are started in the tension columns or at the intersection between the roof and the tension columns, we recommend that the cantilevered roof be shored as a precaution while work is in progress on the members that tie down the back end of the cantilever.

3.5.5 Press Box

The structural steel that frames the press box structure which is hung from the roof structure is severely corroded and unsafe (Photo 73, 74, 82, 83). All of this structure needs to be replaced.

4 CONCLUSIONS

4.1 Observations Summary

Our visual observations of the stadium's reinforced concrete structure found deterioration throughout the entire building. The deterioration is due to the corrosion of the reinforcing steel in the concrete members due to the salt laden air. The general pattern of deterioration consists of severe conditions located over and adjacent to the water due to the seawater and seawater spray, with improving conditions as you move inland and upward in the structure. The deterioration ranged from mild to severe, with some of the slabs, beams and columns damaged beyond repair and requiring complete replacement. The deterioration also included previous repairs that were falling apart.

The following table is a summary of the deterioration found in the stadium. Building elements that are colored in red indicate that the element so severely deteriorated that there is substantial structural damage which requires a total replacement. Also refer to pages 33 and 34 that illustrate which structural elements require total replacement.

Summary of Observed Deterioration		
MILD	MODERATE	SEVERE
Ground floor slab	All beams on grid line J	Piles supporting lower seating
Mezzanine floor slab	Lower seating raker beams	Ground floor level slab between grid lines D and E
Bleacher slabs	Mezzanine floor slab around the ramps	All Ground level beams on grid line E
Upper seating raker beams	Mezzanine level columns at grid lines C and D, and on grids 1, 2, 16 and 17.	Ground level beams on grid 1 and 17
Vomitory walls	Mezzanine level beams on	All beams on grid lines 1 to

Summary of Observed Deterioration		
MILD	MODERATE	SEVERE
	grid line C and D, between grids 2 and 3	17 below the raker beam that are between grid line D and the double piles
Ramps	Diagonal tension columns	Ground level beams on grid line C
	Roof structure	Seawall on grid lines D, 1 and 17
		All columns on grid line E, 1 and 17
		Mezzanine hanger rod connections
		Mezzanine slab edge curbs
		Mezzanine slab between grid lines 2 and 3
		Uppermost beam supporting upper seating and raker beams
		Beams around upper seating openings for main interior roof columns
		Uppermost row of upper seating bleachers
		All hand railings
Red indicates a member with substantial structural damage that requires total replacement		

4.2 Wind Load Comparisons

We researched the current Florida Building Code 2004 – Existing Building, and believe that it may not be required to bring the stadium's existing structural design for wind up to the current code for repairs. This will require confirmation by the building official. However, should it be necessary or desired to have the stadium roof design for wind comply with the current code, we made a comparison of the roof wind pressures required by today's building code and the code used for the original design. The building code that was in effect for the original design was the 1957 edition of the South Florida Building Code.

We calculated the following roof uplift wind pressures required by each building code.

South Florida Building Code 1957	Florida Building Code 2004
65 psf	86 psf

There is a 32% increase in roof wind loading produced by the current building code.

4.3 Description of Repairs

The repairs for the deterioration described in this report will fall into the following three categories:

- Reinforcing steel corrosion and concrete spall repairs
- Crack repairs
- Member replacement

Reinforcing steel corrosion and concrete spall repair work will consist of removing all of the spalled and loose concrete to expose the entire length of the corroded rebar, removing all of the rust from the bar, replacing or supplementing the bar if necessary, applying an anti-corrosion bonding agent and patching the repair.

Crack repairs will include surveying all of the cracks in the structure to determine a crack repair criteria that will be based on the recommendations of ACI 224R, Table 4.1 – Guide to Reasonable Crack Widths, Reinforced Concrete Under Service Loads, which is reproduced below. The crack repair will consist of epoxy injection to seal cracks from water intrusion and to restore the integrity of the member.

ACI 224R Table 4.1 Guide to reasonable crack widths, reinforced concrete under service loads	
Exposure Condition	**Crack Width**
Dry air or protective membrane	0.016 in.
Humidity, moist air, soil	0.012 in.
Deicing chemicals	0.007 in.
Seawater & seawater spray, wetting & drying	0.006 in.
Water-retaining structures	0.004 in.

Member replacement is applicable for the members identified as being substantially damaged and requiring a total replacement. This operation will require the use of temporary shoring to support column loads while they are replaced. All of the concrete in damaged slabs, beams or columns are removed along with the corroded reinforcing, and then replaced by new reinforcing and concrete.

In addition to the above repairs the roof structure requires a new roofing membrane to prevent the leakage of water through the roof slab. The cracking in the roof slab requires repair by epoxy injection to restore the slab integrity. All of the roof drains require either repair or replacement to provide rain water drainage and to prevent ponding on the roof. The hanger rods supporting the mezzanine slab require replacement which may be replaced by a new column below the slab and a foundation. All of the railings in the building require replacement, including a new railing along the water's edge at the first row of the lower seating.

4.4 Repair Cost Estimate

Our sub-consultant, Structural Preservations Systems, has prepared a cost estimate of the repairs identified in this report. The cost estimate is an opinion of the repair costs to

restore the structure to a condition that is somewhere near its original condition. The estimate is based on the assumptions that temporary shoring be installed as a precaution to support the cantilevered roof before performing repairs to the members that resist the uplift reaction of the roof, such as the diagonal tension columns and at the intersection between the roof, the tension columns and raker beam. The estimate assumes the use of a new railing that is transparent along the water's edge at the first row of the lower seating to accommodate spectator visibility.

SPS estimates the repair cost to be $5.5 million dollars (Page 99). We consider this cost estimate to be a reasonable initial or preliminary estimate. It is our experience in this type of repair work that, after removing all loose and spalled concrete to expose corroded reinforcing bars, the areas that require repair are significantly greater than those that were visible during initial observations and estimates. Many times corrosion is found on the bar extending beyond the initial visible area, where the concrete has not spalled yet indicating its presence. We have found that the actual repair areas end up between 2 to 3 times larger than the initial repair estimate. Based on our experience, our opinion is the estimated repair cost will be between $10 million and $15 million dollars.

4.5 Conclusion Summary

Deterioration exists in the majority of every visible element of the building's structural frame, ranging from mild to severe, to requiring total replacement. Our assessment could not include every element of the structural frame, such as the piles and grade beams that are below grade (See 3.1.1), and within connections like the intersection of the roof and the diagonal tension columns and upturned raker beam (See 3.5.4), which would require shoring the roof before destructive exploratory observations could be made. The above items would require the Owner expending substantial sums of money to investigate which make it beyond the scope of this assessment.

To repair the structural elements identified in this assessment as needing repair or replacement, would restore the structure to an unknown strength level, that would be

somewhere near the original condition of the building, but not equal to the original condition. It would still be a 44 year old structure located in an extreme salt laden air environment that is in contact with the seawater and seawater spray, which may be experiencing corrosion in other areas of the structure that's not yet visible. The structural restoration of the stadium structure does not necessarily bring it up to a strength level required by today's codes, or free of corrosion not yet detected.

5 RECOMMENDATIONS

This report identifies members that are severely deteriorated and have substantial structural damage. We recommend that the City of Miami immediately shores the structure at the following locations as a precaution against a failure.

- Columns on grid lines E, 1 and 17 (See 3.3.5)
- Mezzanine slab edges supported by the hanger rod (See 3.2.4)

We recommend that the piles and grade beams below grade, and the support that resists the upward reaction of the cantilevered roof at the inspection of the tension columns and upturned raker beam, are investigated further using destructive observations before any proposed use of the stadium.

If the stadium is restored, it will require a continuous maintenance program that is proactive in addressing corrosion before it reaches moderate and severe deterioration conditions. The maintenance program should include regular inspections to detect corrosion in the early stages and then implementing repair solutions.

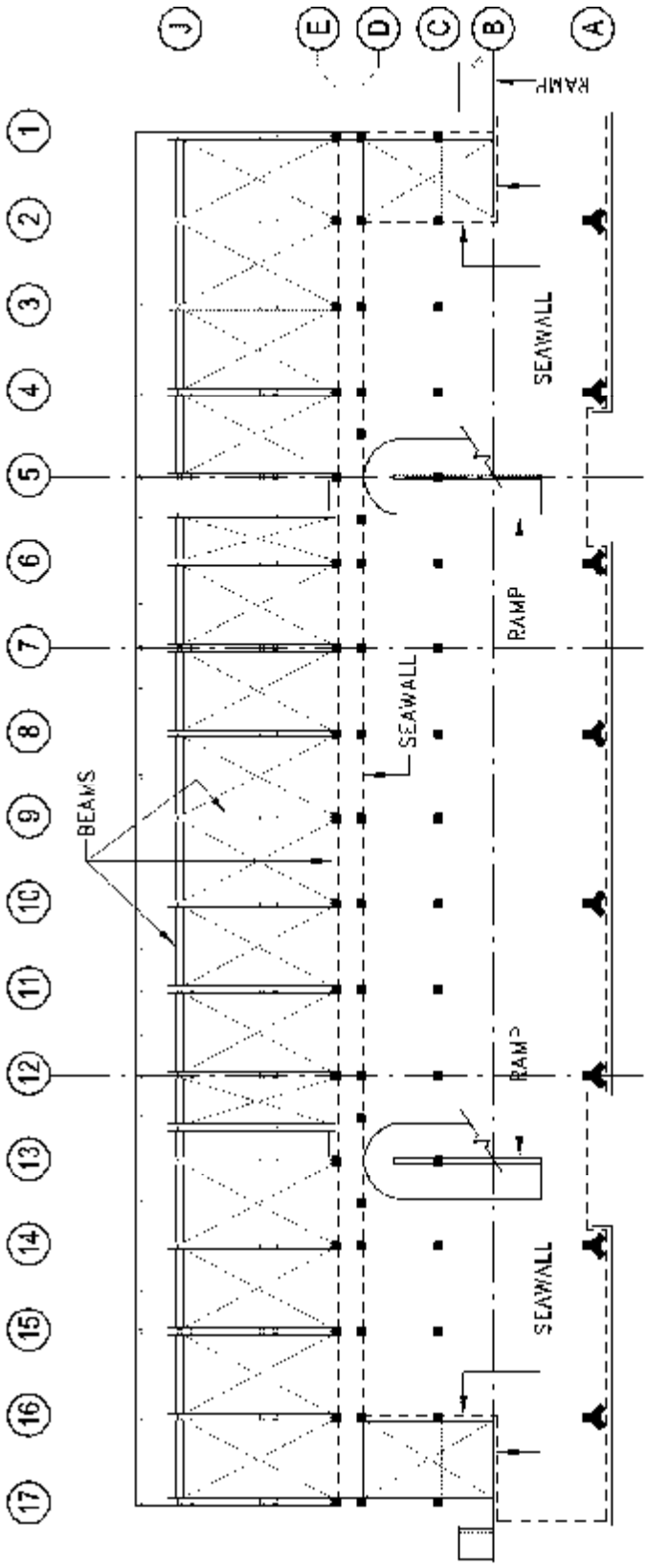
6 DISCLAIMER

The opinions and comments contained in this report are based on visual observations only and no calculations or structural analysis of the existing structure were performed to determine the adequacy of the structural system or its compliance with accepted building code requirements.

Field observations were limited to structural components that were readily accessible and observable at the time of the site visit, and there is no claim, either stated or implied, that all conditions were observed. This report does not address any other portions of the structure other than those areas mentioned, nor does it provide any warranty, either expressed or implied, for any portion of the existing structure.

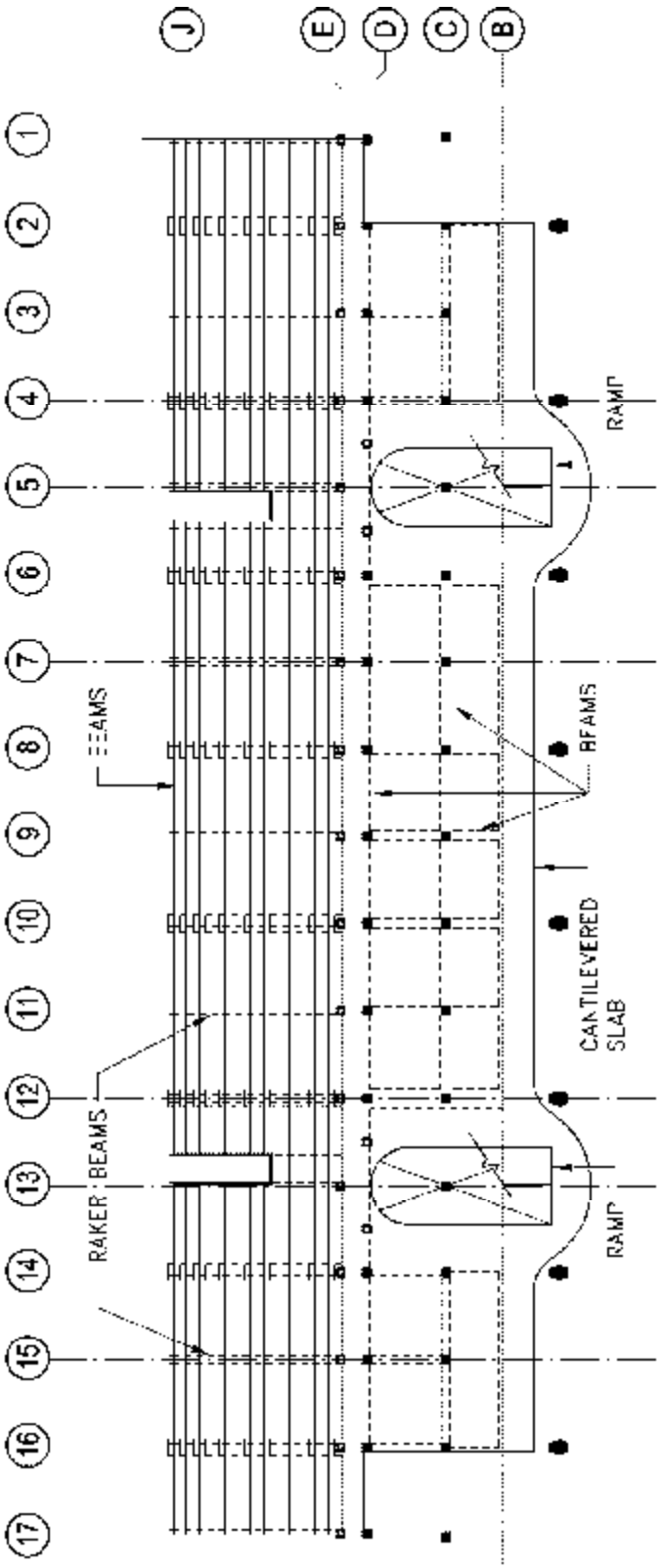
This report is created solely for the City of Miami's benefit, and no other entity shall have rights or claim against the Conditions Assessment Professional because of the performance or non-performance of the observations, opinions, conclusions or recommendations contained herein.

7 ILLUSTRATIONS



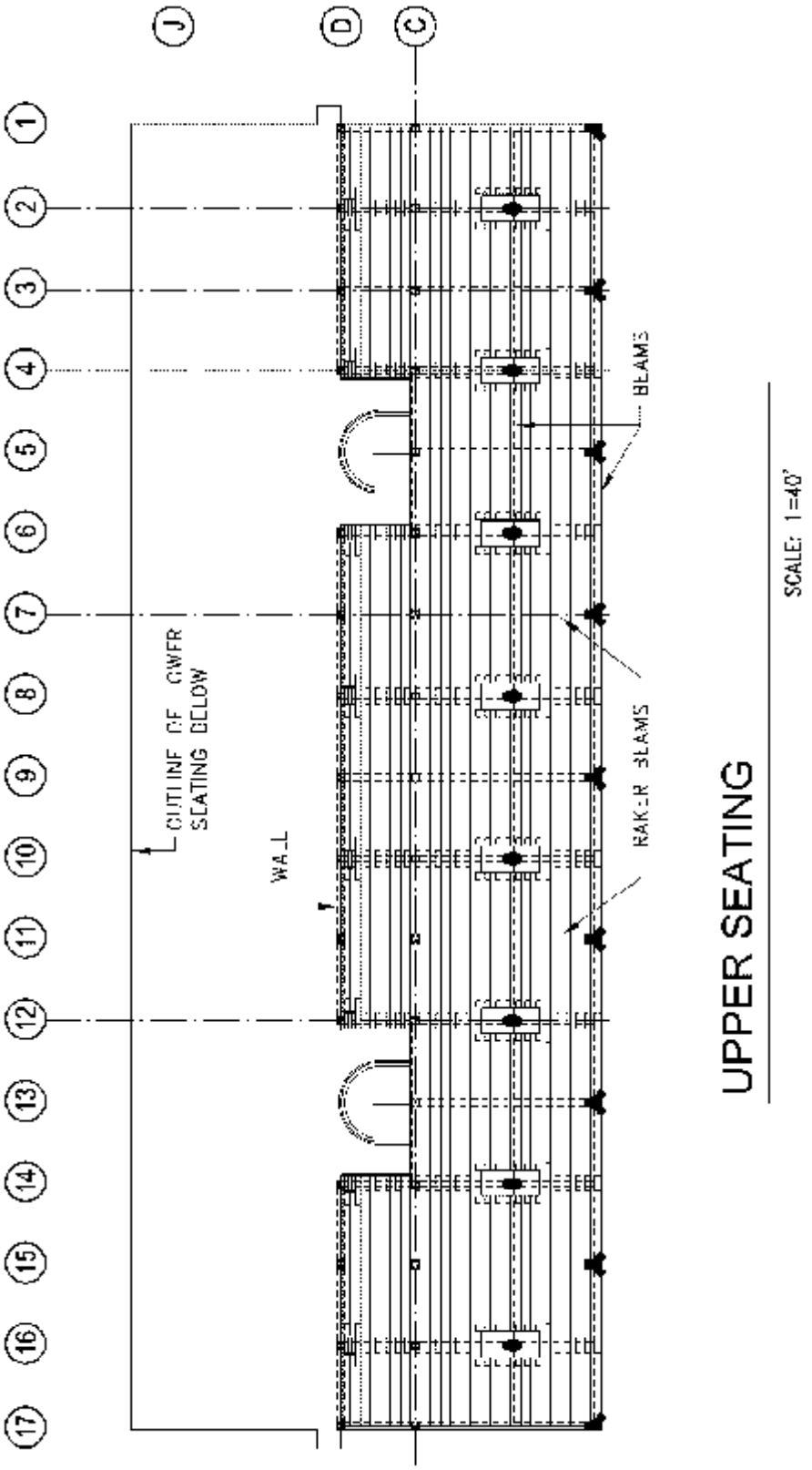
GROUND LEVEL AND FRAMING BELOW LOWER SEATING

SCALE: 1=40'



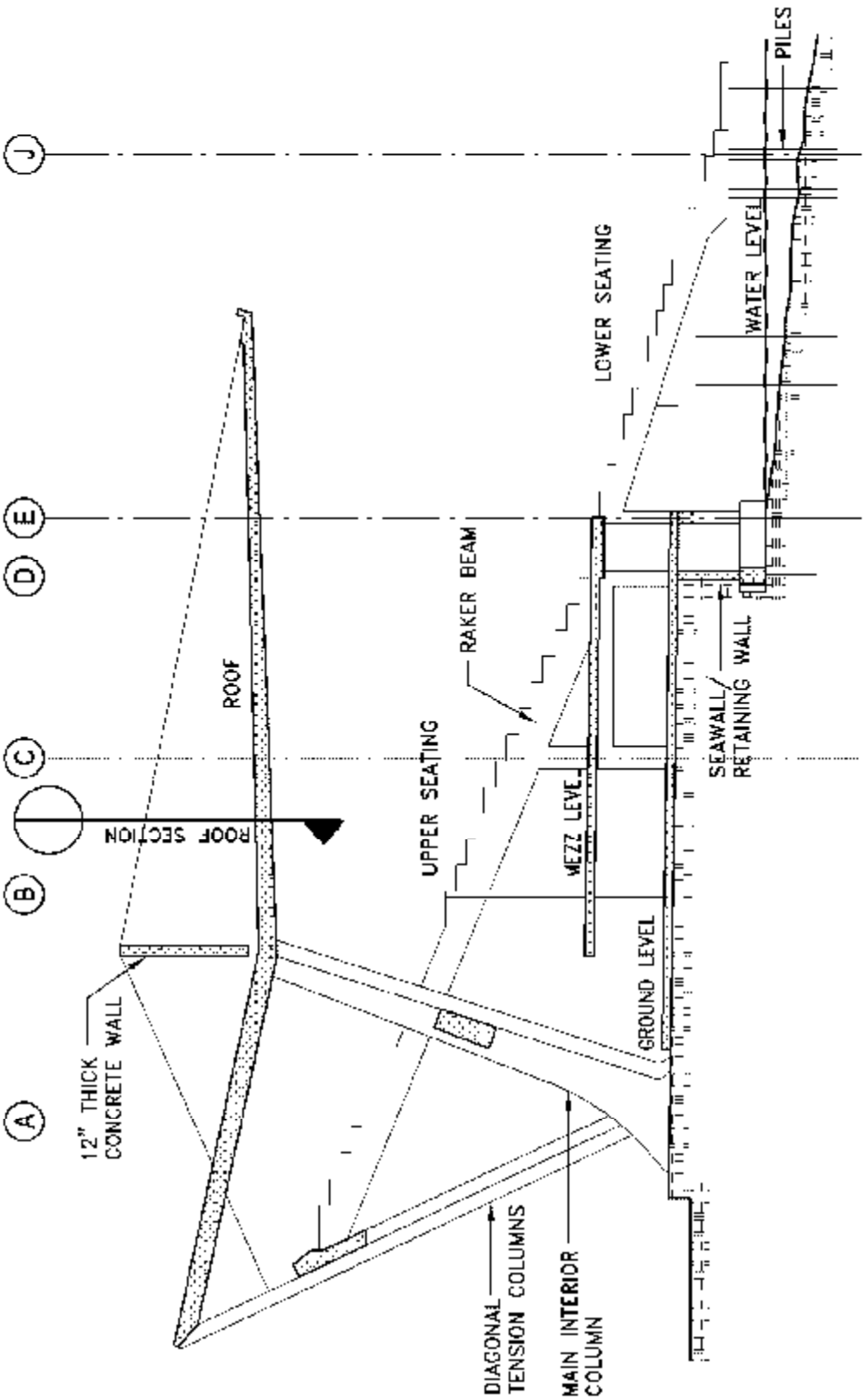
MEZZANINE LEVEL AND LOWER LEVEL SEATING

SCALE: 1"=40'



UPPER SEATING

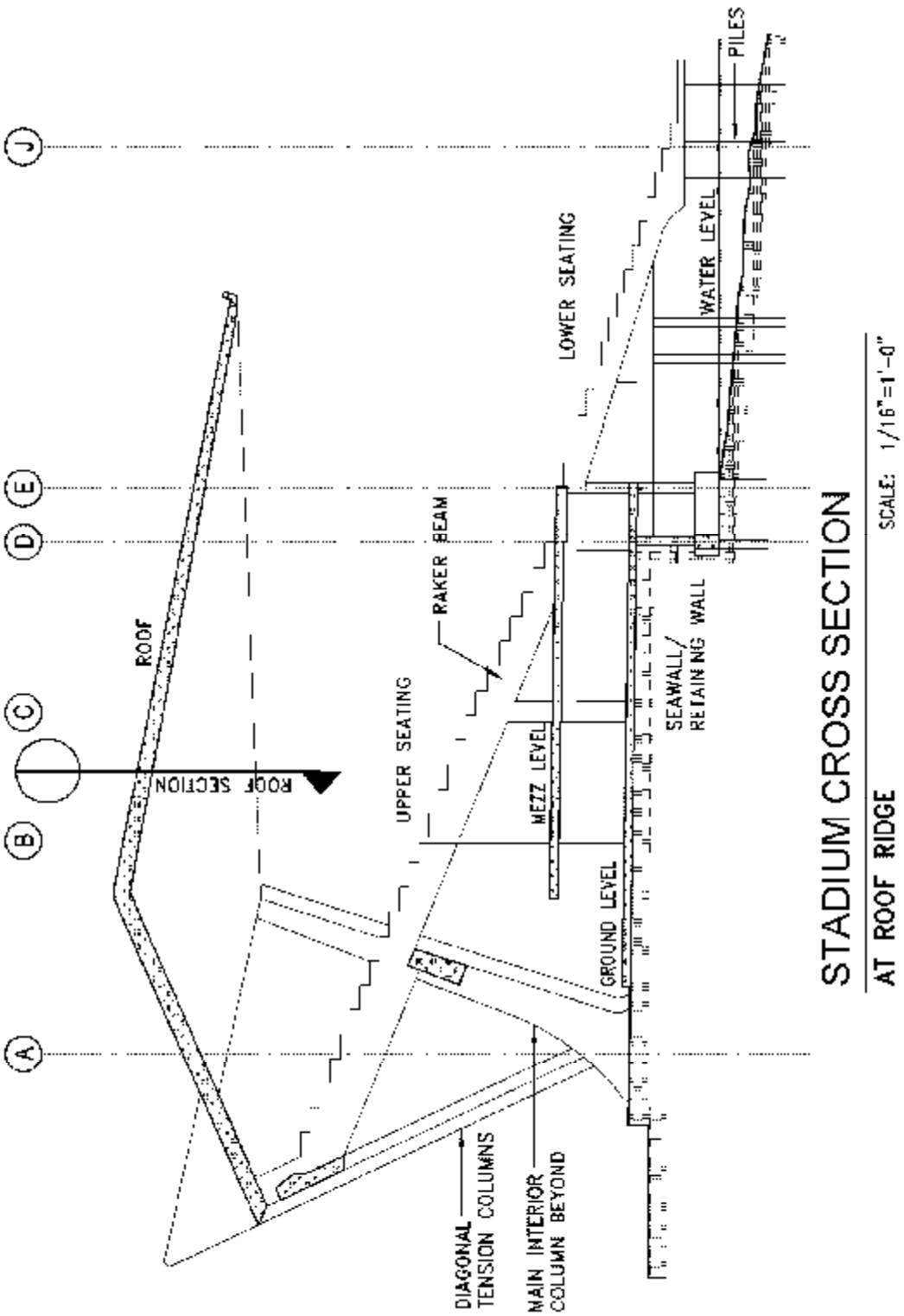
SCALE: 1=40'

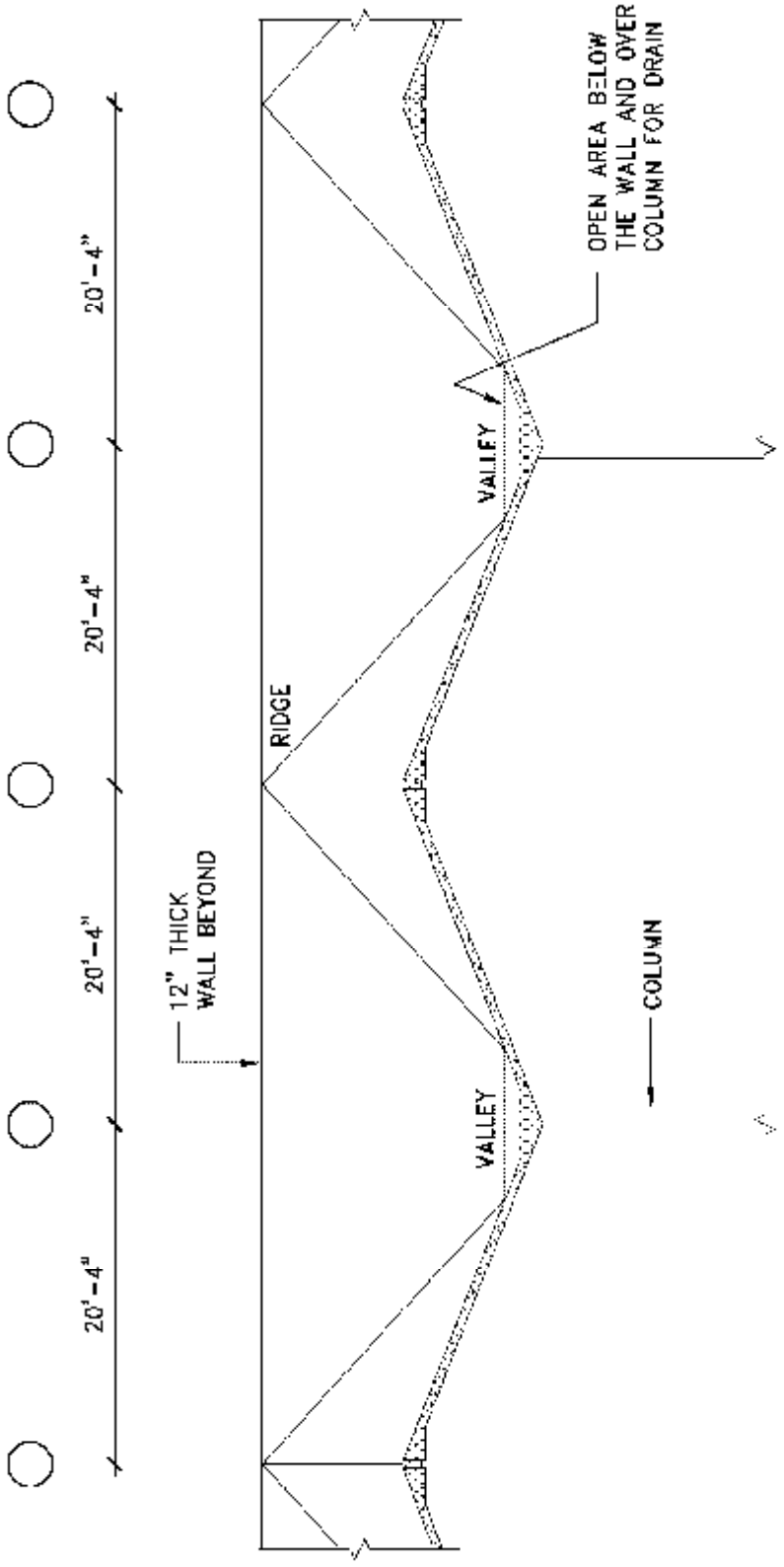


STADIUM CROSS SECTION

AT ROOF VALLEY

SCALE: 1/16"=1'-0"

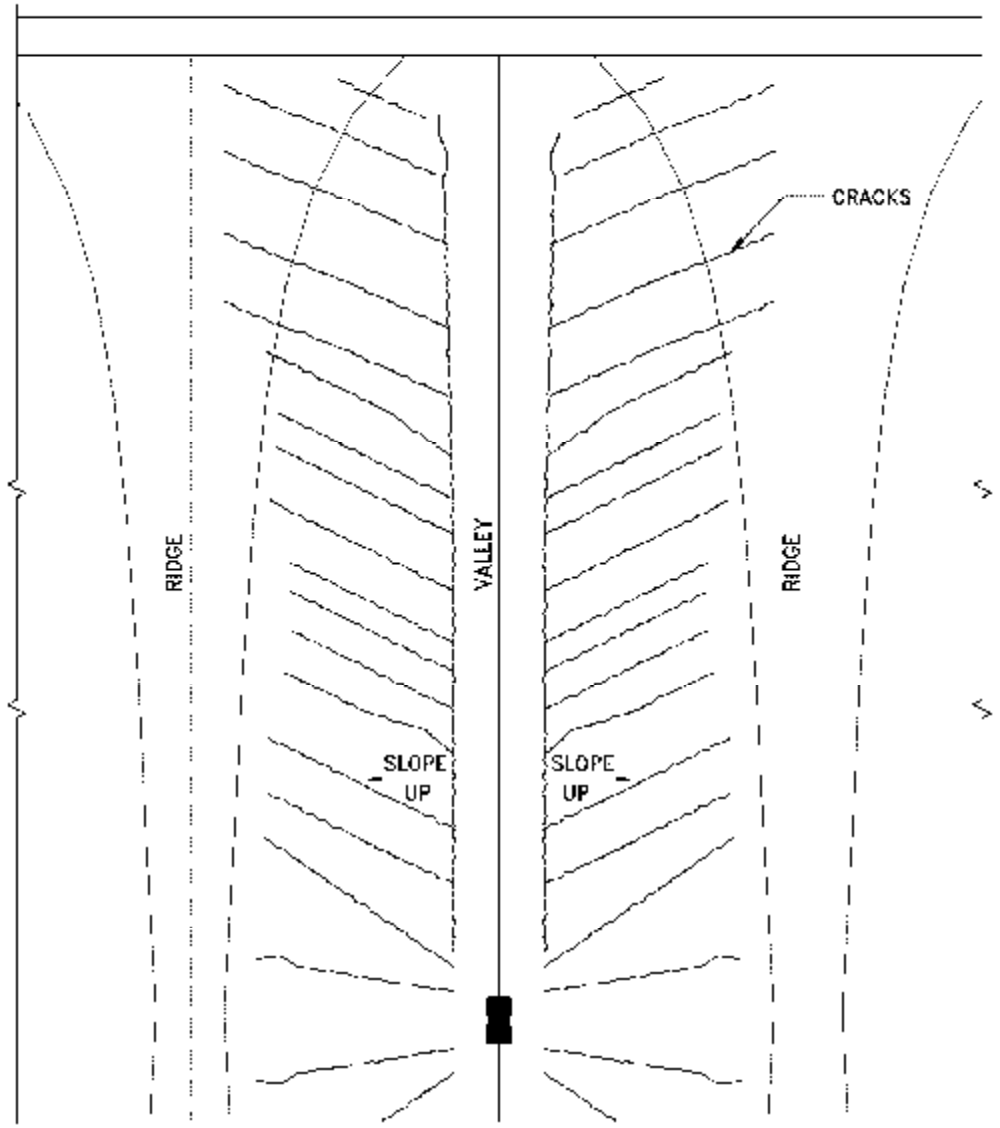

A
B
C
D
E
J
ROOF
ROOF SECTION
UPPER SEATING
RAKER BEAM
MEZZ LEVEL
GROUND LEVEL
LOWER SEATING
WATER LEVEL
PILES
SEAWALL/
RETAINING WALL
DIAGONAL
TENSION COLUMNS
MAIN INTERIOR
COLUMN BEYOND
STADIUM CROSS SECTION
AT ROOF RIDGE
SCALE: 1/16"=1'-0"



ROOF SECTION

THROUGH 65FT CANTILEVER

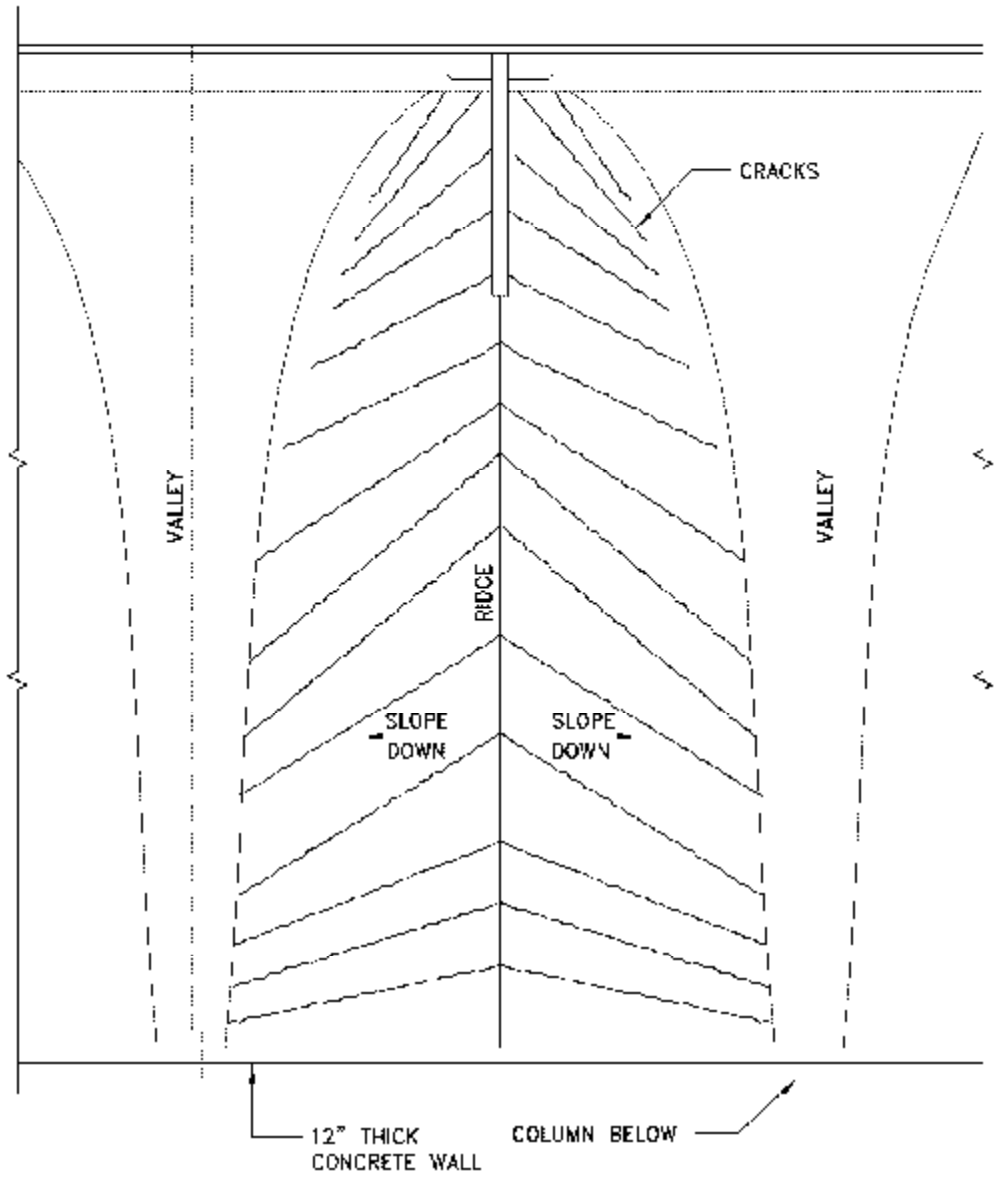
SCALE: 3/32"=1'-0"



PARTIAL ROOF PLAN OF TYPICAL CRACK PATTERN

VIEW FROM UNDERSIDE

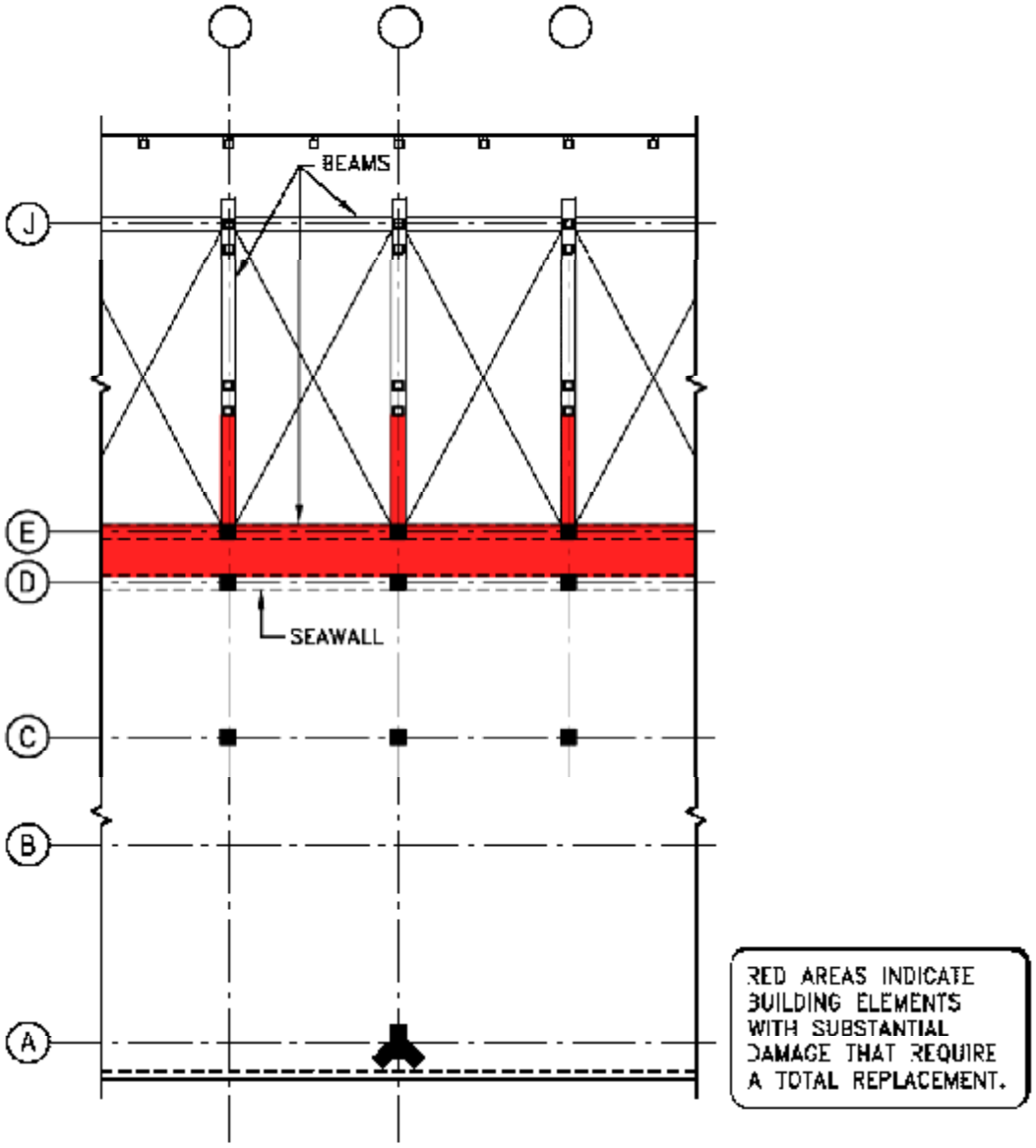
SCALE: 3/32"=1'-0"



PARTIAL ROOF PLAN OF TYPICAL CRACK PATTERN

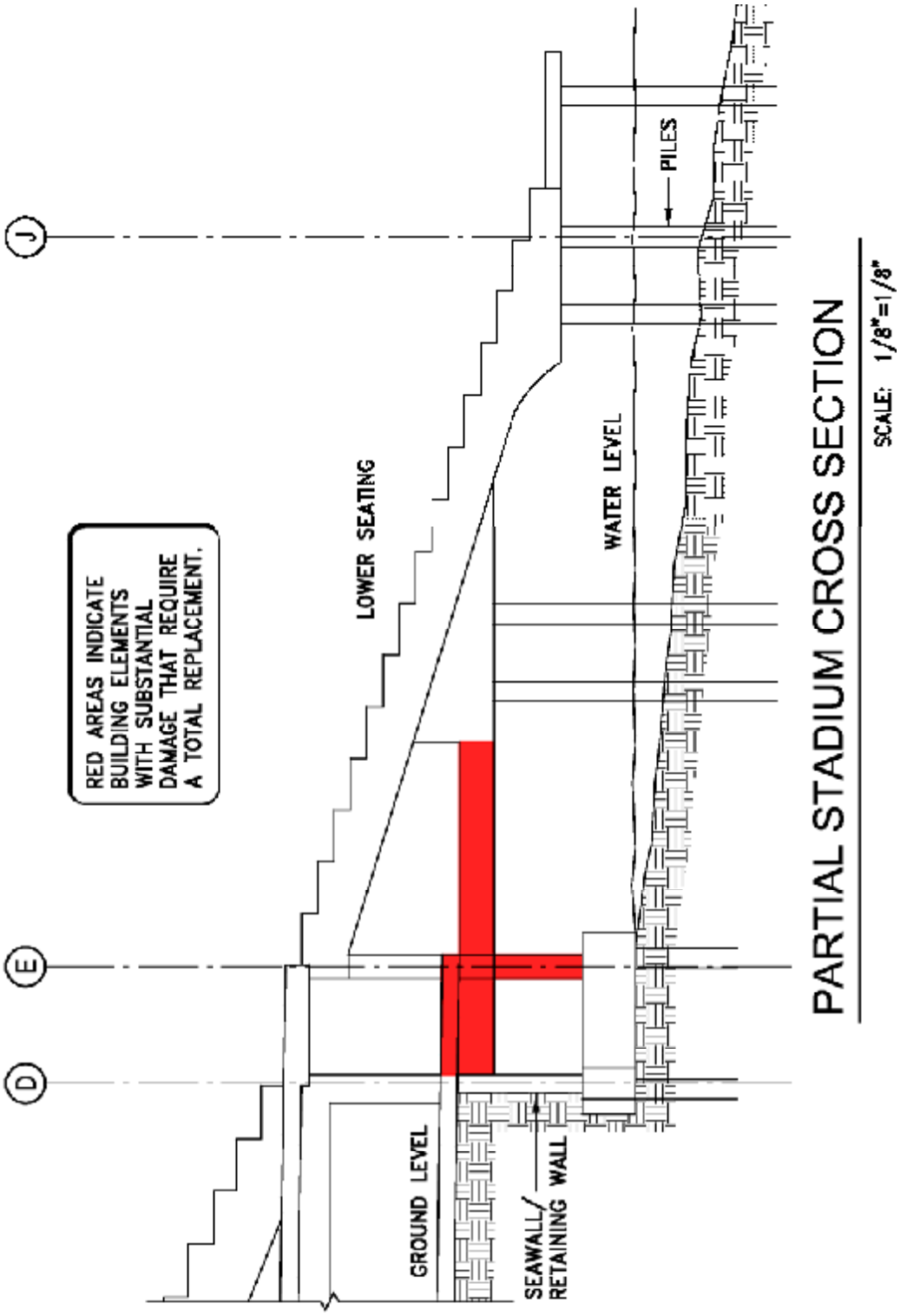
VIEW FROM TOP SIDE

SCALE: 3/32"=1'-0"



PARTIAL GROUND LEVEL

AND FRAMING BELOW LOWER SEATING SCALE: 1=20'


PARTIAL STADIUM CROSS SECTION
SCALE: 1/8"=1/8"
RED AREAS INDICATE BUILDING ELEMENTS WITH SUBSTANTIAL DAMAGE THAT REQUIRE A TOTAL REPLACEMENT.
LOWER SEATING
WATER LEVEL
PILES
GROUND LEVEL
SEAWALL/ RETAINING WALL
J
E
D

8 PHOTOGRAPHS

Photo 1 – Original Stadium

Photo 2 – Original Stadium

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

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Photo 22

Photo 23

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Photo 25

Photo 26

Photo 27

Photo 28

Photo 29

Photo 30

Photo 31

Photo 32

Photo 33

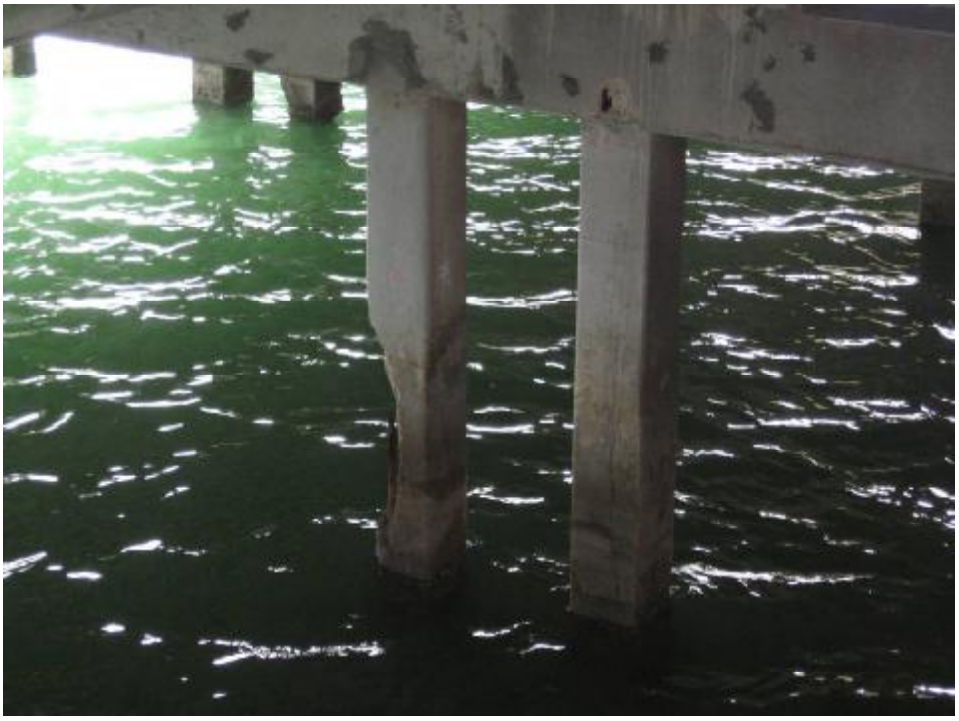

Photo 34

Photo 35

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Photo 63

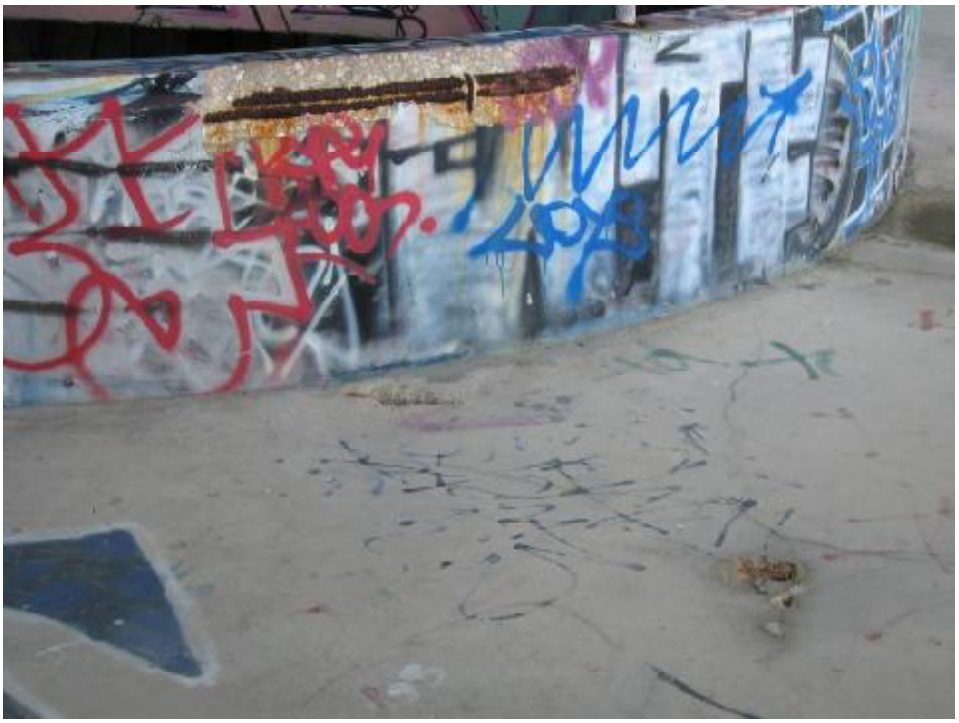

Photo 64

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Photo 112

Photo 113

Photo 114

Photo 115

Photo 116

Photo 117

Photo 118

Photo 119

Photo 120

Photo 121

Photo 122

Photo 123

Photo 124

Photo 125

9 REPAIR COST ESTIMATE DETAIL BY SPS

STRUCTURAL PRESERVATION SYSTEMS

Florida Branch
3000 SW 10th Street
Pompano Beach, FL 33069
Phone 954-984-9555
Fax 954-984-9559
www.structural.net

MIAMI MARINE STADIUM

Structural Repair Budget
7/17/2008

Structural Preservation Systems, LLC

Structural Group, Inc.

Work Item	Estimated Quantity	Unit Of Measure	Unit Price	Estimated Total
Mobilization/Demobilization	1	ls	$ 28,030.00	$ 28,030.00
Building Permit @ 3%	1	ls	$ 165,750.00	$ 165,750.00
P & P Bonds @ 2%	1	ls	$ 110,500.00	$ 110,500.00
PD Floor Spall Repair	2,500	sf	$ 95.00	$ 237,500.00
PD Overhead Spall Repair	400	sf	$ 120.00	$ 48,000.00
FD Floor Spall Repair	2,800	sf	$ 145.00	$ 406,000.00
Floor Crack Repair	2,000	lf	$ 28.00	$ 56,000.00
Pile Repair	73	ea	$ 5,400.00	$ 394,200.00
E-Line Column Replacement (Incl. shoring)	17	ea	$ 16,860.00	$ 286,620.00
Beam Replacement	1,800	cf	$ 480.00	$ 864,000.00
Beam Repair	900	cf	$ 500.00	$ 450,000.00
Seawall Repair	1,500	sf	$ 140.00	$ 210,000.00
Wall Repair	360	sf	$ 130.00	$ 46,800.00
Column Spall Repair	100	cf	$ 400.00	$ 40,000.00
Column Crack Repair	150	lf	$ 33.00	$ 4,950.00
Tension Column Repair	150	sf	$ 140.00	$ 21,000.00
Shoring of Roof Slab	1	ls	$ 238,500.00	$ 238,500.00
Roof Slab Spall Repair	200	sf	$ 135.00	$ 27,000.00
Roof Slab Crack repair	5,200	lf	$ 70.00	$ 364,000.00
Scaffold for Roof Soffit Access	35,200	sf	$ 6.00	$ 211,200.00
Roof Membrane Waterproofing	45,000	sf	$ 10.25	$ 461,250.00
Railing Pocket Repairs	400	cf	$ 400.00	$ 160,000.00
Curb Removal and Replacement	320	lf	$ 70.00	$ 22,400.00
Slab Edge Repair	280	lf	$ 165.00	$ 46,200.00
New Code Compliant 42" Railing	1,800	lf	$ 120.00	$ 216,000.00
New Code Compliant Stub Railing	1,300	lf	$ 95.00	$ 123,500.00
New Code Compliant Glass Railing	340	lf	$ 300.00	$ 102,000.00
Hanger Removal and Column Placement	12	ea	$ 2,800.00	$ 33,600.00
Grade Beams for Columns	12	ea	$ 12,500.00	$ 150,000.00
			Estimated Total	$ 5,525,000.00