

Arrowhead Stadium Assessment

JCSCA + Burns & McDonnell

This document contains information pertaining to the condition of Arrowhead Stadium as documented by the Jackson County Sports Complex Authority (JCSCA), including descriptions, conditions, and exhibits which have been reviewed by Burns & McDonnell and documented in this report.



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PURPOSE AND SCOPE

Purpose

The Kansas City Chiefs organization has a lease with the Jackson County Sports Complex Authority (JCSCA) that requires the organization to maintain Arrowhead Stadium to a level consistent with a First Class NFL Football Stadium. The purpose of this study is to report the overall condition of Arrowhead Stadium and its immediate environs to determine if the team is upholding their lease agreement.

Scope

Burns & McDonnell, in conjunction with the JCSCA, has developed a Facility Assessment Report that reviews and documents the stadium condition. During 2016, the JCSCA conducted an inspection of every space within Arrowhead Stadium. Each room was carefully examined and documented using iPad technology (Fuze Inspections mobile application by Evoco Inc.) during the walkthrough. This application allowed the JCSCA to build a database containing photos, condition ratings, and an inventory of building elements in each room. These elements included: a rating of overall room condition, electrical components, mechanical components, and various pieces of equipment, including, a listing of the type of floors, walls, and ceilings in each room. Checks of mechanical and plumbing equipment, life safety systems, including 24 hour monitored control rooms and fire suppression systems were also completed. Burns & McDonnell received the database from the JCSCA, spot-checked the database, interviewed Kansas City Chiefs staff and reviewed maintenance records. This report is based on the above review in conjunction with on-site evaluations by Burns & McDonnell engineers and architects.

Burns & McDonnell's scope is limited in nature and did not include an entire facility room-by-room inspection or evaluation. An on-site walk through of the stadium and its immediate environs was performed by Burns & McDonnell's engineers and architects to spot-check rooms and areas to compare that the overall conditions reported in the Jackson County Sports Complex Authority's condition reports align with the actual conditions as observed. Additionally, Burns & McDonnell has provided recommendations for observed maintenance issues that may need to be rectified in the near future.

EXECUTIVE SUMMARY

General Description

Arrowhead Stadium, located at One Arrowhead Drive in Kansas City, Missouri. Arrowhead Stadium was completed in 1972 with a major renovation completed in 2010 that enhanced the fan game day experience, increased revenue generation, and improved the day to day operations of the Kansas City Chiefs and its other users. The stadium holds approximately 80,000 fans and offers amenities such as club level suites, luxury suites, bars, restaurants, and other venues geared towards large scale entertainment.

General Condition

In general, Arrowhead Stadium and its immediate environs were observed to be in satisfactory condition. It is apparent that the Kansas City Chiefs have performed the ordinary cleaning and maintenance obligations consistent with a First Class NFL Football Stadium.

Minor physical deficiencies were observed throughout various locations within Arrowhead Stadium and its immediate environs. Such deficiencies are expected in such a large facility and typical of a high-use facility. These can be addressed by the Kansas City Chiefs through standard maintenance procedures.

Recommendations

The final section of this document, labeled “Summary of Recommendations” includes recommendations for the deficiencies observed for each building or site category. Most observed deficiencies are generally minor and may require attention in the near future.

KC Chiefs Response Plan

The Kansas City Chiefs have developed a response plan to rectify the deficiencies observed by Burns & McDonnell this year. This plan includes the location of each deficiency, an action to correct or maintain the item of concern, and a date for which each item is to be addressed. This report can be found as “**Exhibit A**” attached to the end of this document.



EXISTING CONDITIONS

Site Flatwork

Arrowhead holds a large amount of paved walkways surrounding and leading into the stadium. These paved areas serve as access walkways to different areas of the stadium both inside and outside the stadium fencing which is accessed by four ticketing gates. In addition to the paved walkways, several stairs, curbing, and retaining walls make up the site flatwork. Overall, the flatwork on the site was observed to be in satisfactory condition, with the exception of a few mild and moderate site defects.

The most prominent defect observed during the walkthrough was the transverse cracking, spalling, & faulting of the pavement. Cracking can be observed in several spots along the curb that surrounds the stadium, as shown in [Figure C-1](#). Additionally, corner cracking of the pavement was observed in several areas throughout the stadium concourse, as shown in [Figures C-2 and C-3](#). [Figure C-2](#) shows corner cracking leading up to a trench drain located outside the Founder's Plaza. [Figure C-3](#) shows corner cracking located outside of gate D. Cracking was observed on several of post footings the perimeter gate. Cracking that leads into the footing could hold potential for displacement of the footing during freeze/thaw conditions. Damages to the fencing were also observed near the Hy-Vee gate. Both the cracking and fence damage are shown in [Figure C-4](#).



Figure C-1: Transverse Crack along Perimeter Curb.



Figure C-2: Corner Cracking outside The Founder's Plaza.



Figure C-3: Corner Cracking outside Gate D.



Figure C-4: Fence Damage and Cracking along Footing.

The trench drains outside of the Founder's Plaza were found to be damaged in several different places and were able to be removed or displaced when stepped on. [Figure C-5](#) show a broken piece of the drain displaced from the trench located outside the Founder's Plaza.



Figure C-5: Broken Trench Drain outside The Founder's Plaza.

Damaged or deteriorating sealant was observed around the site, many cases it would also be accompanied by joint spalling. [Figure C-6](#) shows spalling occurring with a damaged joint sealant near gate D at the base of a structural column/gate post footing. Additionally, mild-moderate deterioration of joint sealant was observed throughout the site, as shown in [Figure C-7](#).



Figure C-6: Joint Spalling and Sealant Damage.



Figure C-7: Joint Sealant Deterioration.

Concourse entryways that are located beyond the ticket gates (almost directly North, South, East, and West respectively) are subject to heavy foot traffic. As a result the detectable warnings at each corner of the concourse have deteriorated and may not be ADA compliant. One observed detectable warning also showed damaged sealant and a large gap between the warning and the pavement which can be subject to damage during freeze-thaw conditions. [Figure C-8](#) shows the detectable warning near the intersection of Chiefs Way and Red Coat Lane. Cracking in the bollard footing can also be seen just past the detectable warning near the Hy-Vee gate, which is shown on [Figure C-9](#).



Figure C-8: Detectable Warning Deterioration.



Figure C-9: Cracking in the Bollard Footing.

Water meters, storm drains, & man holes all seem to be in satisfactory condition. One water meter located outside the Tower Gate seemed to have been displaced causing the lip of the casing not to stay flush with the top of the meter, as shown in [Figure C-10](#). Further investigation may be needed to evaluate whether or not this needs to be corrected.



Figure C-10: Displaced Water Meter.

Landscaping and Appurtenances

Arrowhead Stadium houses a variety of native plantings and grass between the concourse walkways. Many of which are accented with decorative rock and mulch combinations. The landscaping observed on site was shown to be in satisfactory condition overall. With regular maintenance and close regulation the site landscaping can sustain at a satisfactory level on site. Any recent improvements or repairs should be monitored closely to ensure that no deterioration is taking place.

Structure

The substructure is primarily concrete drilled piles with pile caps. Cast-in-place (CIP) grade beams are located around the perimeter and throughout the foundation system. CIP mat foundations support the stair and elevator core walls and CIP single spread footings also exist for lighter loaded structures. Floating slabs-on-grade exist throughout the facility.

No significant settlement of the structure was observed. The slab-on-grade is primarily in satisfactory condition. No major cracks or spalling of the concrete were observed. Control joints and expansion joints are in satisfactory condition.

The original superstructure is primarily cast-in-place (CIP) reinforced concrete columns and walls for the vertical support system with reinforced concrete pan joist slab system, as shown in [Figure S-1](#). During the renovations, additions were constructed which consisted primarily of CIP reinforced concrete columns. Other vertical support systems include Hollow Structural Section (HSS) columns, CIP reinforced concrete and concrete masonry (CMU) load bearing shear walls.



Figure S-1: CIP Reinforced Column with Pan Joist Slab System.

The Plaza, Club, Lower-Upper Concourse and Upper Concourse levels consist primarily of reinforced concrete pan and joist slab system as shown in [Figure S-2](#) below. The Horizon and Press level consists of light weight composite deck supported by steel wide flange beams. The roof levels primarily consist of steel roof deck supported by steel wide flange beams. Other roof systems consist of cold form metal joists with steel roof deck. The lateral resisting system consists of reinforced concrete load bearing shear walls. The scoreboard and advertising boards consists of built-up hollow steel shapes.



Figure S-2: Typical Concourse Structure.

The original reinforced concrete columns and walls are in satisfactory condition. No major cracks or spalling was observed. The vertical column and wall surfaces are flat and smooth. Concrete patchwork of the original structure is in satisfactory condition. The patchwork is typically flat and smooth, as shown in [Figure S-3](#).



Figure S-3: Concrete Patchwork in Upper Concourse.

The original reinforced concrete pan joist slab systems are in satisfactory condition. No major cracks or spalling were observed. Minor cracking and spalling exist but are not detrimental to the structure and should be expected with a structure of this age. One location of moderate spalling was visible in Concourse Section 116 adjacent to the Hall of Honor, and should be patched to avoid deterioration of the surrounding concrete and reinforcing. This is shown in [Figure S-4](#) below.



Figure S-4: Concrete Joist Spalling at Concourse Section 116.

The steel wide flange columns and beams are in satisfactory condition. No corrosion was observed. Scoreboard column base and mid-span connections are in satisfactory condition. Beam connections are in satisfactory condition. The steel decks are in satisfactory condition. No corrosion or significant deflection was observed.

Façades

Arrowhead Stadium incorporates a variety of finish materials that are used in the composition of the exterior façade, as shown in [Figure AF-1](#). The primary surface materials include structural concrete, insulated metal panel, curtainwalls, and graphic mesh fabric on galvanized steel framing.

Stone veneer and glass storefront systems are utilized extensively along the base of the stadium, in addition to miscellaneous structures such as metal entry canopy, gates, and fencing.



Figure AF-1: Arrowhead Stadium Overall Exterior.

All facades, in general, appear to be in satisfactory condition. Glass storefronts and curtainwall systems appear to be in satisfactory condition, as shown in [Figures AF-2](#). Aluminum frame and mullions were observed to be free of staining, fading, or degradation of any kind. Seals and flashing around storefronts appear to be in satisfactory condition. Glazing was observed to be free of defects, including cracking or chipping. At the time of observation, glass curtainwalls were being cleaned on the interior side of the system.

Insulated metal panel systems appear to be in satisfactory condition, as shown in [Figures AF-2](#). No oil canning, staining, or degradation of any kind was observed.



Figure AF-2: External Glass Curtainwalls and Storefronts.

Exterior doors at the exterior plaza level were observed to have minor deficiencies. The hinges on the aluminum framed storefront doors near the team store were observed to have minor rust and corrosion accumulation. Refer to [Figure AF-3](#) (left image). To avoid rust stains or streaking on the aluminum frames, consider replacing hinges with an anti-corrosive material such as stainless steel.

Also, paint applied to steel angle lintels above nearly every Plaza Level hollow metal service door was observed to be peeling and flaking. Refer to [Figure AF-3](#) (right image). To avoid exposing the steel lintels to moisture and eventual rust development, consider scraping and repainting with an appropriate paint product which is specifically formulated for this material and exterior conditions.



Figure AF-3: Rusty Hinges at Aluminum Door (left) and Flaking Paint at Exterior Lintel (right).

Stone cladding systems appear to be in satisfactory condition, as shown in [Figure AF-4](#) (left image). No chipping or staining of the stone or grout was observed.

Graphic mesh fabric systems anchored to galvanized steel framing was observed to be in satisfactory condition, typically. No signs of corrosion or rust on framing exist and fabric mesh panels appear to be free of rips, tears, or fading. Anchor bolts appeared to be missing from the galvanized support structure at the Hy-Vee Gate shown in [Figure AF-4](#) (right image). Bolts should be added as required to insure all elements of the sub-structure are adequately anchored to the concrete superstructure.



Figure AF-4: Stone Veneer Wall (left) and Graphic Fabric Mesh System (right).

Internal storefront and sliding glass wall systems appear to be in satisfactory condition, as shown in [Figures AF-5](#). Aluminum frame and mullions were observed to be free of staining, fading, or degradation of any kind. Seals and flashing around storefronts appear to be in satisfactory condition. Glazing was observed to be free of defects, including cracking or chipping.



Figures AF-5: Internal Windows, Storefront, and Sliding Glass Wall System.

Roofing

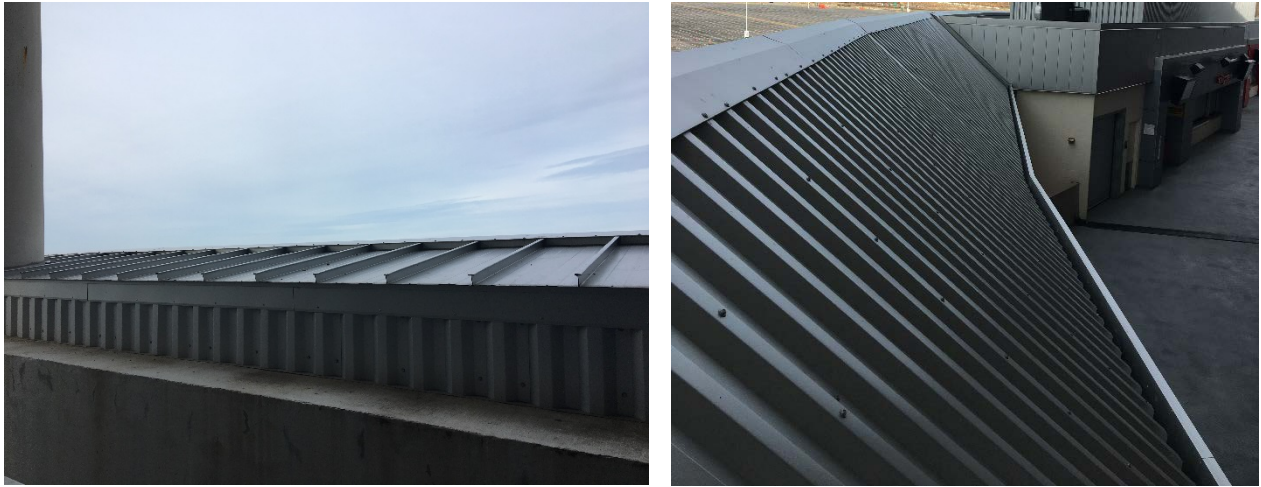
The roofing structures throughout Arrowhead Stadium vary greatly in composition. The primary roofing material utilized at the renovated office and event spaces is a Polyvinyl-Chloride (PVC) membrane on R-24 thermal insulation. Standing seam metal roof panels are also utilized at various locations around the facility.

Roofing membranes were observed to be in satisfactory condition. No rips, tears, or other failures were observed. All observed copings, flashings, and sealants appear to be in satisfactory condition, as shown in [Figure AR-1](#).



Figure AR-1: Membrane Roofing (right) and Typical Prefinished Metal Coping at Concourse (left).

Standing seam metal roof panels appear to be in satisfactory condition, as shown in [Figures AR-2](#). No signs of rust, staining, or other failures were observed.



Figures AR-2: Standing Seam Metal Roof Panels.

Miscellaneous Exterior Observations

At the field level, between sections 112 and 113, insulation applied to the underside of the concrete deck was observed to be deteriorating. The condition of such insulation may significantly affect the material's resistance to resist heat flow (r-value), thus affecting the thermal comfort of the spaces above this area. Repair or replacement of this insulation and other similar areas is suggested within the near future. Refer to [Figure AME-1](#).



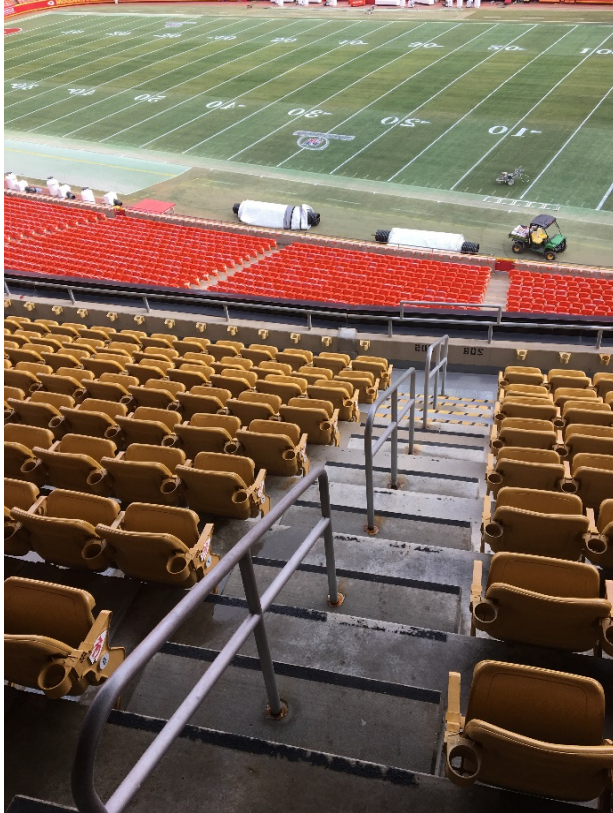
Figure AME-1: Failing Applied Insulation to underside of Concrete Deck.

At the elevated Bud Light concessions area chipped concrete was observed at several concrete stairs, as shown in [Figures AME-2](#). Failure of the concrete material may pose a serious trip hazard and should be patched and repaired immediately.



Figures AME-2: Chipped Concrete at Bud Light Concession Stairs.

At several stairs within the club level seating bowl, the nosing applied slip resistant caution tape was observed to be significantly deteriorated or missing completely. Refer to [Figures AME-3](#). The absence of the slip resistant material poses a significant slip and fall hazard and should be repaired or replaced immediately.



Figures AME-3: Deteriorated Slip Resistant Caution Tape at Club Level Stairs.

At the service level stair located in the field access tunnel, the handrail anchored to the concrete masonry unit wall was observed to be loose. An anchor bolt was missing from one of the handrail brackets, as indicated in [Figure AME-4](#). Install missing anchor to secure handrail to the wall and prevent potential future safety incidents.

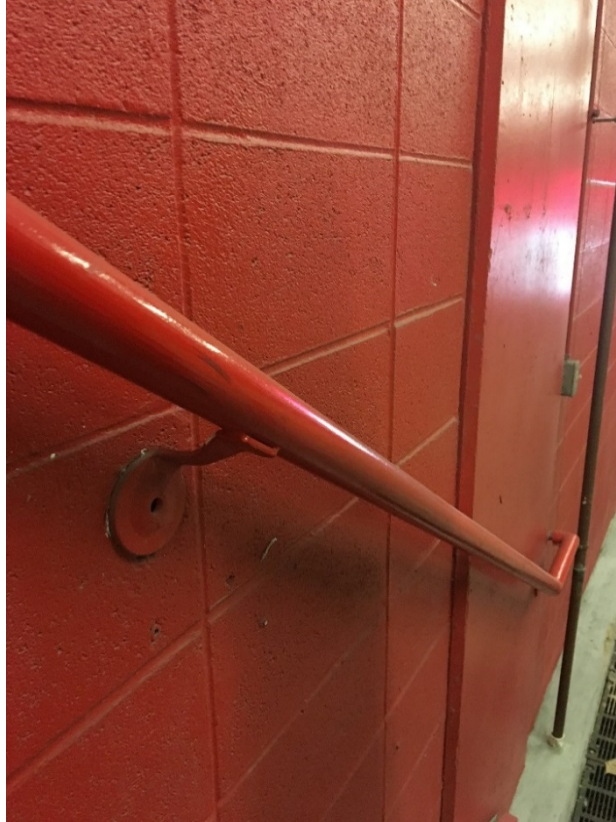


Figure AME-4: Loose Handrail at Service Level Field Access Tunnel Stair.

Interior Elements

Interior finishes within Arrowhead Stadium encompass a broad range of materials for floors, walls, and ceilings. The primary flooring systems are composed of epoxy and sealed concrete, as shown in [Figure AI-1](#).

These surfaces were observed to be in satisfactory condition, typically. Minor cracking was observed at various locations throughout the facility, which is considered normal given the expansion and contraction properties of the material and their exposure to outside air temperatures. No excessive cracking was observed during the walk-through.

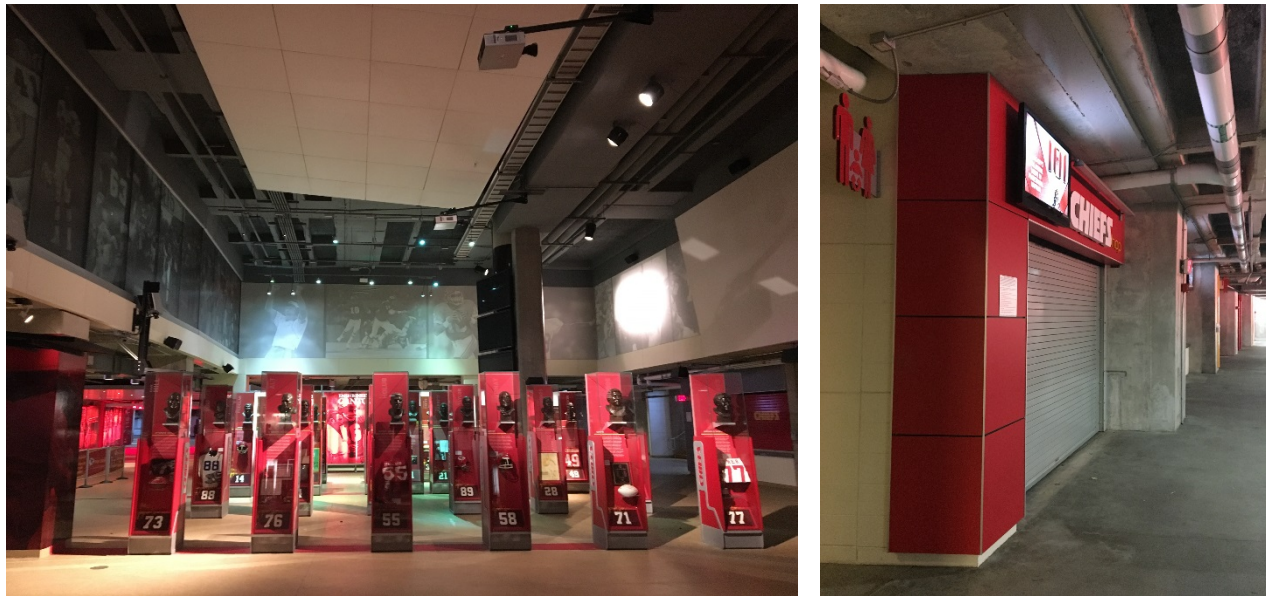


Figure AI-1: Epoxy Flooring (left) and Exposed Concrete (right) throughout Facility.

Carpet flooring was generally observed to be in satisfactory condition. No signs of rips, tears, stains, or discoloration were observed, as shown in [Figure AI-2](#) (left image). Porcelain/Ceramic tile flooring areas appear to be in satisfactory condition, as shown in [Figure AI-2](#) (right image). No signs of grout discoloration or cracking were observed, typically.



Figure AI-2: Carpet Flooring (left) and Porcelain Tile Flooring (right).

Less abundant areas of flooring materials include vinyl composition tile (VCT) and athletic rubber flooring. These materials are generally found in service areas or back-of-house type areas which are less visible to the public. All observed materials of this type were observed to be in satisfactory condition, as shown in [Figure Al-3](#).



Figure Al-3: Rubber Flooring (left) and VCT Flooring (right).

Wall materials at Arrowhead Stadium vary throughout the facility, but are primarily painted or exposed Concrete Masonry Units (CMU) at outdoor areas and painted gypsum board on metal stud framing at interior areas. Alternative wall materials include ceramic tile and wood veneer, which are generally located in bathrooms and fan suite areas, respectively.

Generally, painted CMU walls were observed to be in satisfactory condition. No signs of chipping, flaking, or cracking of the applied paint system were observed.

Painted Gypsum board walls appear to be in satisfactory condition, typically, as shown in [Figure AI-4](#). No signs of punctures or holes in the gypsum board materials were observed.



Figure AI-4: Painted Gypsum Board Walls.

Graphic applied presentation boards throughout the stadium appear to be in satisfactory condition, as shown in [Figure AI-5](#) (left image). No signs of scratching or delamination were observed. Wood veneer panel at interior walls appear to be in satisfactory condition, as shown in [Figure AI-5](#) (right image). No scratches, scuffs, or fading of any kind was observed.

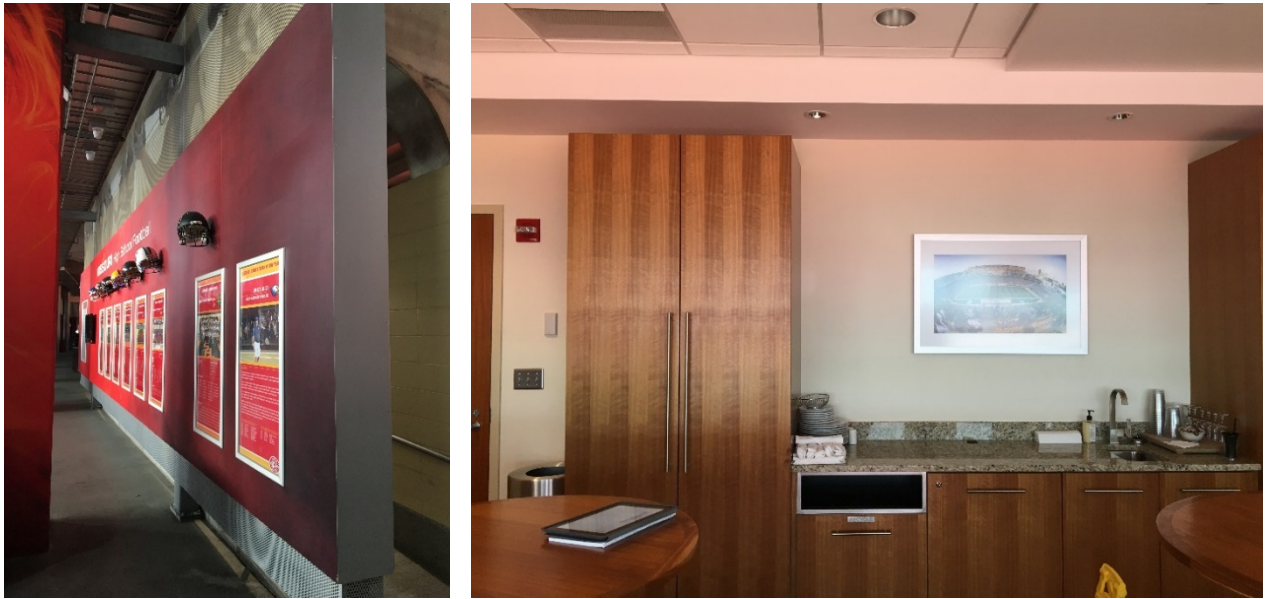


Figure AI-5: Graphic Applied Presentation Board (left) and Wood Veneer Paneling Wall (right).

Ceilings in Arrowhead stadium are typically exposed concrete around the outdoor concourse areas. Refer to the “Structure” section for observations of concrete surfaces. Other ceiling types located within the interior spaces of the stadium include gypsum board, acoustic ceiling tile, and lay-in perforated metal ceiling tiles in some cases.

Acoustic ceiling tiles appear to be in satisfactory condition, generally. A typical condition at the Club Level lounge area is shown in [Figure AI-6](#) (left image). Ceiling tile in these spaces do not show signs of stains or deterioration of any kind. However, at a few locations at the Service Level some ceiling tiles were observed to be damaged around the corners or were not properly set within the ceiling grid. One location where damaged ceilings tiles were observed was at the visiting locker observation room in the Service Level, as shown in [Figure AI-6](#) (right image). It appears that visiting teams require ceiling mounted hooks. To avoid future damage of the ceiling grid and tiles in these areas, provide permanent hook anchors to suit the needs of visiting teams.



Figure AI-6: Acoustic Ceiling Tile at Event Space (left) and at Service Level Coach Room (right).

Gypsum board ceilings appear to be in satisfactory condition, typically. No punctures, stains, scrapes, or tears were observed. Refer to [Figure AI-7](#) for typical condition.



Figure AI-7: Gypsum Board Ceiling, Painted.

Lay-in perforated metal ceiling tiles were observed to be in satisfactory condition. No signs of rust or finish deterioration was observed. Refer to [Figure AI-8](#) for typical condition at exterior concourse.

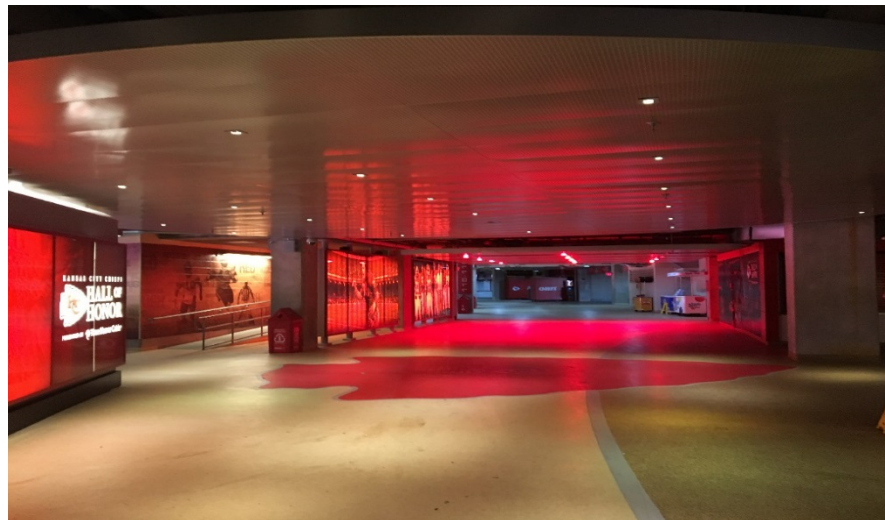


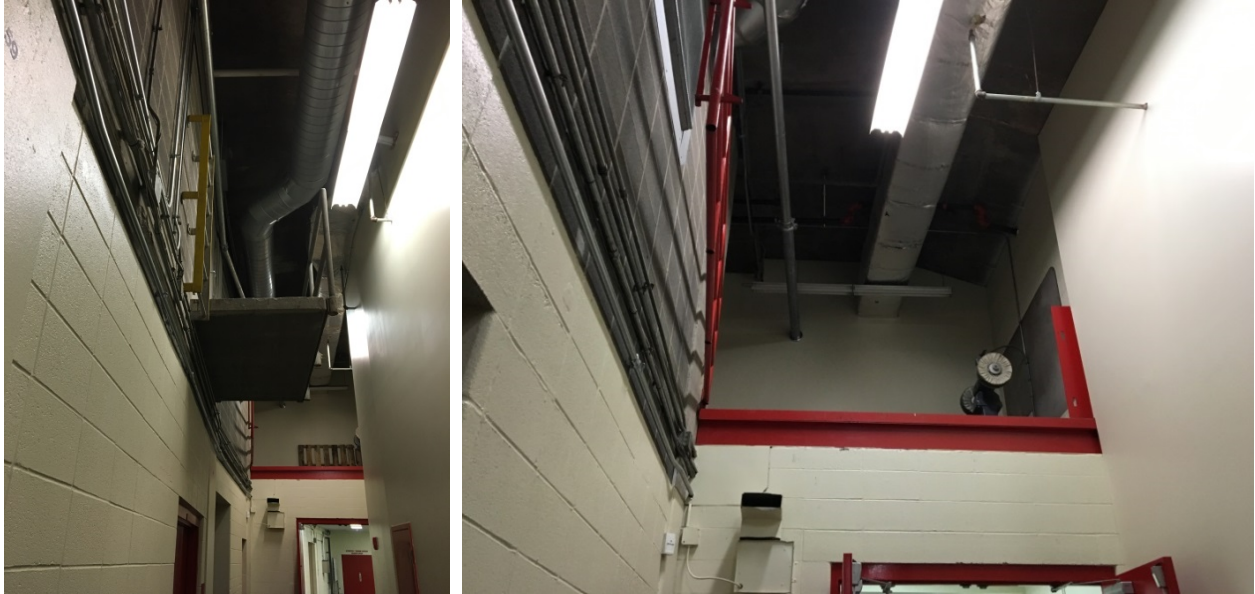
Figure AI-8: Lay-In Perforated Metal Ceiling Panels.

Door types and styles throughout Arrowhead Stadium include painted hollow metal doors and frames, flush wood doors, aluminum glazed doors, overhead coiling doors, and access doors. Generally speaking, all doors were observed to be in satisfactory condition. However, at the Field Level men's restroom, near the Bud Light concession, the hollow metal door paint was observed to be scuffed. Refer to [Figure AI-9](#). Continue routine painting as required to maintain the appearance of a world class NFL stadium.



Figure AI-9: Scuffed Hollow Metal Door at Field Level Men's Restroom.

At the Service Level, two balcony areas were observed to have inadequate fall protection as shown in [Figures AI-10](#). It is assumed that these areas are not accessible to the general public and that individuals accessing these spaces are aware of the hazard. It is also assumed that these areas are intended to allow forklift trucks to hoist and deliver items to the upper story of this space. However, failure to keep proper fall protection in place (guardrails) may present a major safety concern for individuals accessing these spaces. It is highly recommended that these balcony areas be adequately closed off with a guardrail when not required to be open for material delivery.



Figures AI-10: Balcony Areas without Proper Fall Protection.

Miscellaneous Interior Observations

Several fire extinguishers were checked for verification of updated inspection tags. All fire extinguishers observed were inspected and punched within the last year.

Mechanical

The mechanical equipment at Arrowhead Stadium is comprised of air-conditioning units that utilize electric heat and chilled water for cooling, stand-alone direct expansion (DX) units, miscellaneous electric unit heaters, roof-mounted condensing units, ceiling-mounted fan coil units, electric baseboard heaters, electric infrared heaters, pumps (fire, domestic water, and chilled water), exhaust fans, and concession stand water heaters.

Electrical rooms on the exterior of the stadium are temperature controlled by vertical air-conditioning units, as shown in [Figure M-1](#). These units appear to be in satisfactory condition.



Figure M-1: Electrical Room Vertical Air-Conditioning Unit.

Adjacent to each of these electrical rooms is a mechanical room. Within these mechanical rooms are single zone air-handling units (AHU) that use chilled water for cooling. The filters, fan motors, and belts were inspected in a variety of units. All of these components appeared to be in satisfactory condition. Additional belts were located in the mechanical room in the event of a broken or damaged belt. AHUs were also located on separate mezzanine levels within the stadium.

In general, all piping and insulation throughout the stadium appeared to be in satisfactory condition. In multiple locations, manual chilled water valves appeared to have rust and corrosion on the exterior face of the valve and on the valve handle. It is possible that this rust could continue into the valve itself, which should be verified. [Figures M-2](#) show an inline chilled water isolation valve (left) and a strainer drain valve (right) that appear to have rust and corrosion.



Figures M-2: Rust Present on Valve and Valve Handles.

There appeared to be a squeaking noise coming from the interior of cooling unit A/C 9C-02 (scoreboard control), as shown in [Figure M-3](#). This is likely due to a loose or damaged belt.



Figure M-3: Scoreboard Control Air Handling Unit.

In general, air-conditioning unit filters appeared to be in satisfactory condition. Several units throughout the stadium had filters that have not been changed since May of 2015 and appear to be dirty. This can be seen in [Figures M-4](#).



Figures M-4: Dirty Air Handling Unit Filters.

Air handling units serve conditioned spaces throughout the stadium. In some cases, the ductwork is located in the ceiling above. In other areas, such as the Founder's Club, the ductwork is exposed to the space. In the Founder's Club, it was observed that there were a few air leaks in the ductwork through small cracks and holes. A larger hole was observed as shown in [Figure M-5](#) below.



Figure M-5: Hole in Founder's Club Ductwork.

Electric unit heaters were located in various mechanical rooms and storage spaces throughout the stadium, as shown in [Figure M-6](#). All observed electric unit heaters appeared to be in satisfactory condition.



Figure M-6: Electric Unit Heaters.

In the mechanical room that contains the domestic water booster pumps, it was observed that there was a “dry fault” for the Variable Frequency Drive (VFD) on Domestic Water Booster Pump 3, as shown in [Figure M-7](#). Pump 3 was sequenced to be the first operational pump. It was noted that staff was aware of this and was in the process of correcting this fault.



Figure M-7: Domestic Water Booster Pumps.

In this same mechanical room, fire protection pumping and piping exists. It was observed that the fire protection piping contained a leaky valve, as shown in [Figures M-8](#).



Figures M-8: Leak on Fire Piping Valve.

There is a large number of hot water heaters throughout the stadium in mechanical rooms and concession areas. These hot water heaters appeared to be in working condition. Various hot water heaters throughout the facility were observed to have calcium buildup on the exterior of the heater, as shown in [Figure M-9](#) below.



Figure M-9: Hot Water Heater.

The press/media areas and the individual suites were temperature controlled via ceiling mounted fan coil units. These fan coil appeared to be in satisfactory condition.

Due to the low ambient temperatures at the time of the site visit, various equipment was not operational and unable to be observed. This includes the chillers and various rooftop cooling units. The ambient temperature was not low enough to require the electric baseboard heaters on the interior of the stadium to be operational. Exterior electric infrared heaters were not observed during this walkthrough.

Electrical Service Description

The stadium main electrical service consist of 13.2kV switchgears with integral 13.2kV to 480V transformers in each quadrant of the Plaza level. The electrical distribution also consist of (10) 4,000A 480Y/277V 3 phase, 4 wire main switchgear. The stadium electrical essential distribution service consist of (2) main 2,000A 480Y/277V, 3 phase, 4 wire switchgear power fed backed up by (2) 1250KW on-site generators. The lighting and appliance branch circuit panelboards are located throughout the stadium in each electrical closet on each stadium level.

Telecommunication Service Description

The main telecommunications service is fed from a vault on the Field level and is run to the Main Telecommunications Equipment room on the Plaza level. Backbone cabling is run throughout the stadium to various telecommunications rooms on each stadium level. Horizontal cabling is routed from each telecommunication closet to workstations, media suites, and P.O.S. stations on respective floor levels.

Electrical System Observations

The overall electrical system installation was observed to be in satisfactory condition and kept clear of debris. Panelboards, distribution boards, switchboards and switchgears observed appear to all contain a branch circuit directory and labeled branch circuit breakers.

The following elements were found to be unsatisfactory:

- The emergency bug-eyed battery units were evaluated in 2015 and observed to be non-operational. The assessment performed in 2017 observed the bug-eye emergency units be emitting a buzzing noise, which may indicate that the back-up batteries may be weak. The electrical rooms observed with bug-eyed emergency units are P252, P241, P240, P228 and P221. Refer to [Figure E-1](#).



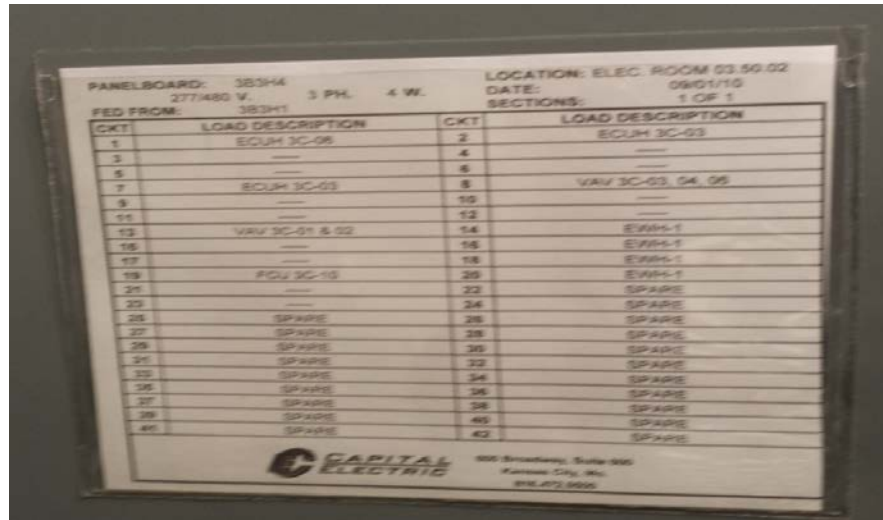
Figure E-1: Emergency Bug-Eyed Light Fixture.

- 13.2KV switchgear, FB3, was observed to be operating and functioning in fair conditions, as shown in [Figure E-2](#).



Figure E-2: 13.2KV Switchgear FB3.

- Panelboard 3B3H4 branch circuit directory do not indicate load description for 3-pole, branch circuit 38, 40 and 42. Refer to [Figures E-3](#) and [E-4](#) shown below.



PANELBOARD: 3B3H4 277/480 V. 3 PH. 4 W. LOCATION: ELEC. ROOM 03.50.02
 FED FROM: 3B3H1 DATE: 09/01/10
 SECTIONS: 1 OF 1

CKT	LOAD DESCRIPTION	CKT	LOAD DESCRIPTION
1	EQUIP 3C-06	2	EQUIP 3C-03
3	---	4	---
5	---	6	---
7	EQUIP 3C-03	8	VAR 3C-03, 04, 05
9	---	10	---
11	---	12	---
13	VAR 3C-01 & 02	14	EWH-1
15	---	16	EWH-1
17	---	18	EWH-1
19	FGU 3C-10	20	EWH-1
21	---	22	SPACE
23	---	24	SPACE
25	SPACE	26	SPACE
27	SPACE	28	SPACE
29	SPACE	30	SPACE
31	SPACE	32	SPACE
33	SPACE	34	SPACE
35	SPACE	36	SPACE
37	SPACE	38	SPACE
39	SPACE	40	SPACE
41	SPACE	42	SPACE

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Figure E-3: Panelboard 3B3H4 Branch Circuit Directory.



Figure E-4: Panelboard 3B3H4 Branch Circuit Breakers.

- Panelboard 6B3H2 branch circuits in the Fire Pump room do not have circuit numbers adjacent to the branch circuit breakers, as shown in [Figure E-5](#) below.



Figure E-5: Panelboard 3B3H4 Branch Circuit Breakers.

SUMMARY OF RECOMMENDATIONS

Site Flatwork

The majority of flatwork at Arrowhead was observed to be in satisfactory condition. Regular concourse maintenance should be continued throughout the year. Some of the following specific observations should be addressed:

- Cracking and spalling throughout the paved areas should be monitored closely or repaired to prevent further damage to the pavement and avoid pavement displacement during freeze-thaw conditions.
- Deteriorating or missing joint sealant on site will need to be repaired. Specifically on [Figure C-6](#), the damaged sealant shown is at the foot of a structural column and a fence post footing. Both of these footings could be subject to water damage.
- Several of the fence post footings show separation between the footing and the pavement, these post footings are also subject to water damage which can also lead to damage to the fence. Repairs to the fence surrounding the concourse should be made for aesthetic purposes. See [Figure C-4](#) for reference.

The following comments pertain to elements that may pose potential safety concerns and should be addressed as soon as possible.

- Repair or replace the trench drain outside the Founder's Plaza. The broken and displaced pieces of the drain can cause a tripping hazard for pedestrians entering the Stadium. Can also be used as a projectile. See [Figure C-5](#).
- Deterioration was observed on several of the detectable warnings leading into the building concourse. Damaged sealant was also seen between the detectable warning and the pavement which can be subject to displacement due to freeze-thaw conditions. Leaving these detectable warnings in an unsatisfactory can be hazardous to vision-impaired pedestrians and may also not be compliant with ADA regulation. See [Figure C-8](#).
- Any pavement faulting observed or warned of in this report will need to be addressed. Displaced pavement from freeze-thaw conditions can be a tripping hazard and is a threat to pedestrian safety.

Landscaping and Appurtenances

The landscaping and appurtenances on site were observed to be in satisfactory condition. Regular maintenance and observation should be continued year-round to sustain a satisfactory site. Any recent improvements or repaired items should be regularly observed to prevent any deterioration on site.

Structure

All observed structural elements are in satisfactory condition. One pan-joint location in Concourse Section 116, adjacent to the Hall of Honor, should be repaired with a cementitious patching material within the next year to avoid potential deterioration. Other concrete superstructure areas may require concrete patchwork within the next few years. Continue routine maintenance and inspection as required.

Façades

Rust was observed on the hinges of the aluminum framed storefront doors near the team store, as shown in [Figure AF-3](#) (left image).

- To avoid rust stains or streaking on the aluminum frames, consider replacing hinges with an anti-corrosive material such as stainless steel.

Paint applied to steel angle lintels above nearly every Plaza Level hollow metal service door was observed to be peeling and flaking. Refer to [Figure AF-3](#).

- To avoid exposing the steel lintels to moisture and eventual rust development, consider scraping and re-painting with an appropriate paint product which is specifically formulated for this material and exterior conditions.

Anchor bolts were observed to be missing from the galvanized support structure at the Hy-Vee gate fabric mesh. This was likely missed during installation of the support structure during the stadium renovation. Refer to [Figure AF-3](#) (right image).

- Consider installing bolts as required to insure all elements of the sub-structure are adequately anchored to the concrete superstructure.

Roofing

All roofing materials appear to be in satisfactory condition, no signs of deterioration were observed. Continue routine maintenance as required.

Miscellaneous Exterior Observations

Insulation applied to the underside of the concrete deck was observed to be deteriorating at the Field Level, between sections 112 and 113. Refer to [Figure AME-1](#).

- Consider repair or replacement of the damaged insulation to maintain thermal comfort conditions in the spaces above these areas.

The following comments pertain to elements that may pose potential safety concerns and should be addressed as soon as possible.

Chipped concrete was observed at several concrete stairs at the elevated Bud Light concession area on the Field Level, as shown in [Figure AME-2](#).

- Failure of the concrete material may pose a serious trip hazard and should be patched and repaired immediately.

Slip Resistant caution tape applied to the nosing of several stairs within the club level seating bowl was observed to be significantly deteriorated or missing completely. Refer to [Figure AME-3](#).

- The absence of the slip resistant material poses a significant slip and fall hazard and should be repaired or replaced immediately.

The handrail anchored to the concrete masonry unit wall, located in the field access tunnel on the Service Level, was observed to be loose. An anchor bolt was missing from one of the handrail brackets, as indicated in [Figure AME-4](#).

- Consider installing the missing anchor bolt to secure the handrail to the wall and prevent potential future safety incidents.

Interior Elements

Acoustic ceiling tiles appear to be in satisfactory condition, generally. However, at a few locations at the Service Level some ceiling tiles were observed to be damaged around the corners or were not properly set within the ceiling grid. One location where damaged ceiling tiles were observed was at the visiting locker observation room in the Service Level, as shown in [Figure AI-6](#) (right image). It appears that visiting teams require ceiling mounted hooks.

- Consider installing permanent hook anchors to suit the needs of the visiting teams to avoid future damage of the ceiling grid and tiles in this area.

Doors throughout Arrowhead were observed to be in satisfactory condition, typically. However, a hollow metal door leading into the men's restroom near the Bud Light concession was observed to be scuffed. Refer to [Figure AI-9](#).

- Continue routine painting and maintenance as required to maintain the appearance of a world class NFL stadium.

The following comments pertain to elements that may pose potential safety concerns and should be addressed as soon as possible.

At the Service Level, two balcony areas were observed to have inadequate fall protection as shown in [Figure AI-10](#). It is assumed that these areas are not accessible to the general public and that individuals accessing these spaces are aware of the hazard. It is also assumed that these areas are intended to allow forklift trucks to hoist and deliver items to the upper story of this space. However, failure to keep proper fall protection in place (guardrails) may present a major safety concern for individuals accessing these spaces.

- It is highly recommended that these balcony areas be adequately closed off with a guardrail when not required to be open for material delivery. It is also recommended that doors accessing these spaces be locked at all times and only accessible to individuals who are completely familiar with the potential hazards of these spaces. Unintentional passage through adjacent doors and onto unprotected balcony areas may cause serious injury or death should someone fall due to inadequate fall protection.

Mechanical

In general, all observed mechanical elements are in satisfactory condition. Continue routine maintenance as required.

- Filters that have not been changed in 12 months should be discarded and replaced with new filters.
- In order to ensure the appropriate distribution of air throughout the space and to minimize unnecessary noise, consider replacing ductwork containing leaks.
- All manual isolation and ball valves that have exterior rust and corrosion should be tested to ensure that the valve functions, holds, and seals properly.

Electrical

The overall electrical system installation was observed to be in satisfactory condition. However, several bug-eyed emergency light fixtures were observed to be non-operational.

- To ensure the safety of the public and workers along paths of egress and exit discharge, consider replacement of the batteries for all bug-eyed units and test to verify that the emergency battery units are functional and operational.

To ensure the safety of equipment and power reliability of the electrical service and distribution, the following is recommended:

- An infrared inspection and ultrasonic inspection be performed annually on all medium voltage switchgear, 13.2KV to make sure there are no concerns for arcing, resistive faults, insulation faults, tracking, corona and excessive heat.

In all electrical rooms the following s recommended for panelboards, distribution boards and switchboards:

- All loads are identified in the branch circuit schedule directory.
- Branch circuit breakers be provided and identified with branch circuit numbers.

2017 ARROWHEAD STADIUM ASSESSMENT - RESPONSE PLAN

ITEM DESCRIPTION	PAGE OF REPORT	DESCRIPTION OF REPAIR	DATE TO CORRECT
Flatwork	8,9,10,11,12,25	Repair Cracks & Broken Concrete (Chiefs plan to sub concrete work to contractor Western Waterproofing)	8/30/2017
Grates on Plaza	10	Replace with grates in storage and add feet.	5/31/2017
Joint Spalling	17	Repair Spalling (Chiefs plan to sub concrete work to contractor Western Waterproofing)	8/30/2017
Rusted Hinges	20	Oil Hinges to prevent future rusting due to poor stainless (No Plan to replace)	3/31/2017
Paint Door	20	Painted	3/16/2017
Mesh System	21	Add Anchor to sub structure noted in photo	3/31/2017
Bird Control	24	Re Coating and Bird Control being reviewed for Cap Ex	8/30/2017
Club Level Stairs	26	Re Paint and Re Coat nosing for visual and slip resistance	7/30/2017
Hand Rail	27	Replaced Bolt	3/16/2017
Epoxy Floor Repair	28	Recoat in flooring budget in 2017 Cap Ex spending	8/30/2017
Ceiling Tile	33	Replaced tile and installed ceiling mounted hooks.	3/16/2017
Door Cleaning	35	Daily Maintenance	8/30/2017
Guardrails not closed	36	Guardrails have been enclosed and employees coached on proper use.	3/16/2017
Filters that have not been changed in 12 months should be discarded and replaced with new filters	40	This is not unusual for areas that are only used 10 times per year. Will check to ensure filters are changed when needed.	As needed
In order to ensure the appropriate distribution of air throughout the space and to minimize unnecessary noise, consider replacing ductwork containing leaks	41	This ductwork has been sealed	3/1/2017
To ensure the safety of the public and workers along paths of egress and exit discharge, consider replacement of the batteries for all bug-eyed units and test to verify that the emergency battery units are functional and operational	47	The emergency lights have been properly re-wired, batteries replaced and replacement of non-functioning fixtures will be done as soon as the new ones arrive	5/31/2017
An infrared inspection and ultrasonic inspection be performed annually on all medium voltage switchgear, 13.2KV to make sure there are no concerns for arcing, resistive faults, insulation faults, tracking, corona and excessive heat	55	Mark One Electric completed this work in December and will be getting us the report	Report will be sent to Director of Facilities
All loads are identified in the branch circuit schedule directory.	56	We have not found any that are not identified - please provide locations.	
Branch circuit breakers be provided and identified with branch circuit numbers	56	We have not found any that are not identified - please provide locations.	
All loads are identified in the branch circuit schedule directory.	56	We have not found any that are not identified - please provide locations.	
Branch circuit breakers be provided and identified with branch circuit numbers	56	We have not found any that are not identified - please provide locations.	
Water meters, storm drains, & man holes all seem to be in satisfactory condition. One water meter located outside the Tower Gate seemed to have been displaced causing the lip of the casing not to stay flush with the top of the meter, as shown in Figure C-10. Further investigation may be needed to evaluate whether or not this needs to be corrected	13	Engineering is working with the Grounds Crew to correct this. It was either installed this way or over the years, the Ground contractor has dug the ground around it to cause the ring to settle	5/31/2017
There appeared to be a squeaking noise coming from the interior of cooling unit A/C 9C-02 (scoreboard control), as shown in Figure M-3. This is likely due to a loose or damaged belt.	39	The drive belt(s) will be replaced when the AV room equipment can be shut down. Unfortunately, the AHU was installed where the access panel for the belts is against the wall and the fan assembly may need to be disassembled to replace the belts.	5/31/2017
In this same mechanical room, fire protection pumping and piping exists. It was observed that the fire protection piping contained a leaky valve, as shown in Figures M-8.	44	We have purchased the valve and will replace it.	5/31/2017
Panel board 6B3H2 branch circuits in the Fire Pump room do not have circuit numbers adjacent to the branch circuit breakers, as shown in Figure E-5 below	49	Panel 6B3H2 must not have been labeled during the renovation. Chiefs Engineering will correct it.	5/31/2017

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