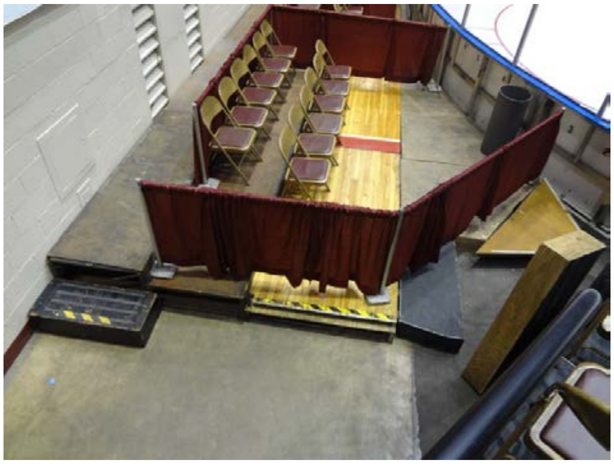
APPENDIX E:
ARCHITECTURAL AND INTERIORS ASSESSMENT

Finishes and Overall Appearance

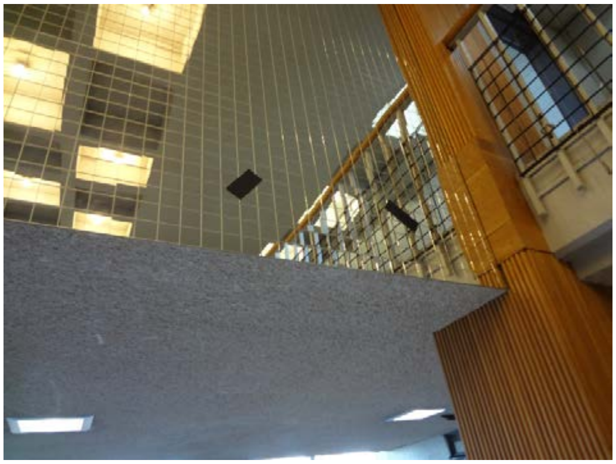
Coliseum

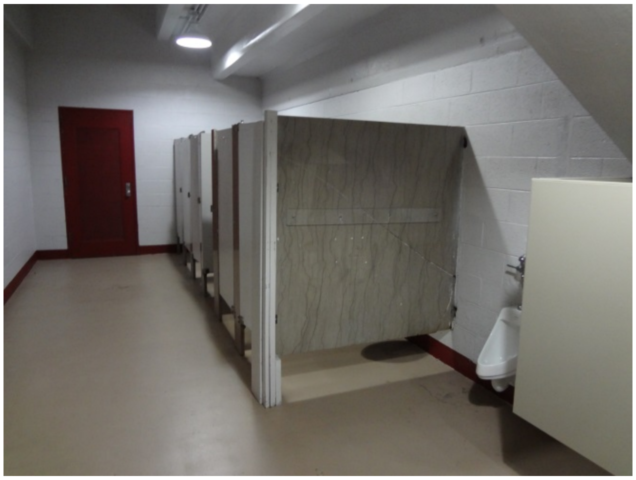
Exterior plaza, stairs and breezeway areas need patching, painting & re-finishing. Deterioration has begun in some locations.

Loge boxes and temporary seating set up for ice hockey games do not meet code and presents a safety concern. Code compliant retractable risers and seating should be provided. Also, ADA accessibility must be a priority for the seating and furniture as well.



Overall finishes are out of date for the entire Coliseum. Areas in the star dressing rooms and visitor's locker room are especially deficient. Many of the restrooms have toilet dividers that need repair/replacement. Back of house spaces include plumbing fixtures are in need of replacement. There are also areas that pose a safety concern (ex. tile in atrium hallway – taped to wall. Concern that tile could fall from wall).





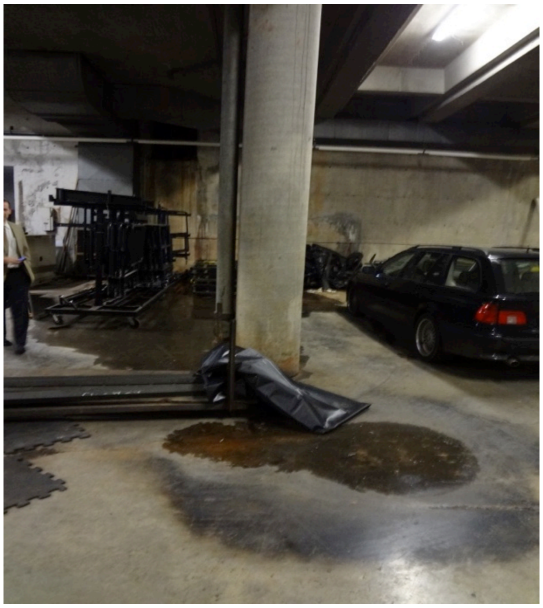
The facility needs to be upgraded from an ADA perspective. Increasing ADA toilet counts, increasing ADA concession counts, access to many of the event level areas (ex. star dressing rooms and locker rooms), access from event level to other levels – passenger elevator would be beneficial, also some of the interiors of the east and west concessions are not accessible from a disabled worker's standpoint.

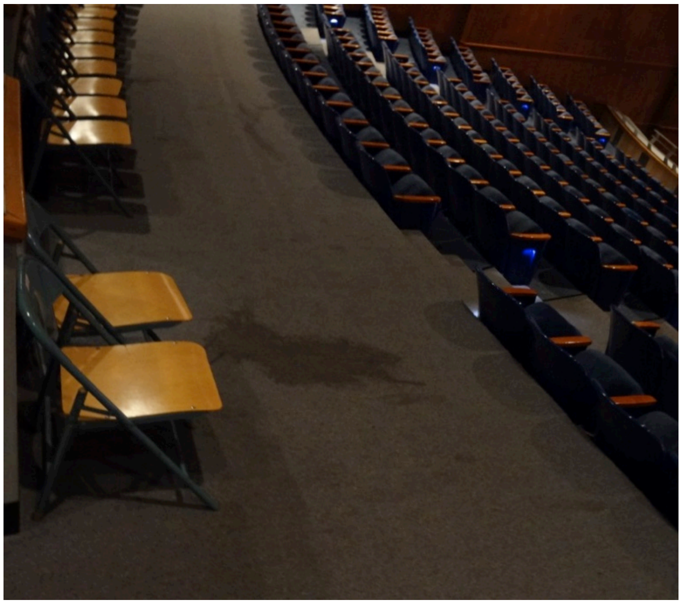
Major leaking and water infiltration on event level exterior walls. Patching has been done but water still finding its way in, so repair to areas is necessary. This leaking is also causing the nearby MEP and ductwork to deteriorate.

Recommendation for increasing HVAC ventilation – providing super heat for Ice Bears locker room – to reduce the amount of moisture and odor in locker room.

Auditorium

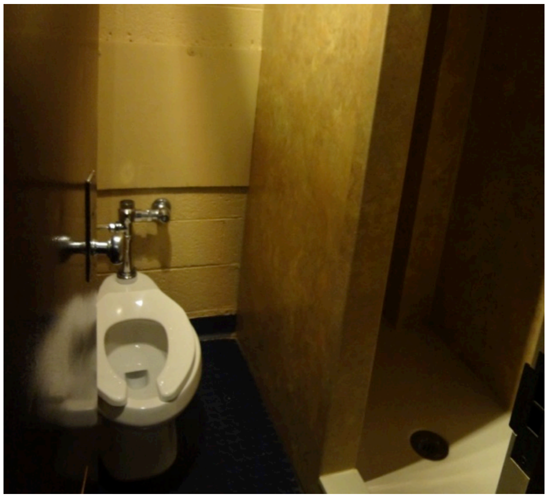
Loading dock has several large leaks and standing water. Repair to area is necessary.





Overall finishes and décor are out of date – primarily the seats and carpeting need to be replaced. Many of the seats have ripped and stained fabric. The carpeting has several stains and tears.

Green room is severely out of date from a finish standpoint and lack ADA toilet access.



Major staining showing on ceiling of Auditorium atrium – building manager indicates roof leaks have been repaired, so this is a cosmetic issue.

Exterior Enclosure

The exterior enclosure of the Knoxville Auditorium & Coliseum must remain properly maintained, water tight, and efficient if it is to be in continued service in the coming years. A number of observations are included.

- Precast joints require re-sealing and regular examination/maintenance.
- Currently the panels under the overhangs at the east & west sides are in better condition than their exposed counterparts. Exposed precast panels show fair amounts of discoloration, indicating likely moisture infiltration.

- Roofing materials are in need of cleaning and maintenance. Visible debris at a number of roof drains, including those on canopies and breezeways visible to the public. Full evaluation may be required, though most current issues appear to be aesthetic.

- Water damage throughout the ceilings of the Auditorium & Coliseum indicates history of roof infiltration/deterioration.

- Visible evidence of water infiltration at sub-grade concrete walls. Current cosmetic approach to sealing interior surface cracks & joints appears to have spread the issue. Some areas of infiltration have been handled with catchment bins.

- Curtain wall and storefront glazing are single glazed systems. The system is in need of general maintenance including re-sealing/gasketing of glazing panels in a number of locations. The curtain wall frame itself appears to be stable. Glazing is in differing amounts of disrepair, including damage in the primary Auditorium entry façade.

- The single-glazed systems are likely taxing the current MEP systems and compromising the energy efficiency of the facility as a whole. We would recommend replacing the current glass with insulated glazing units.
- Entry doors throughout the facility appear to be mostly in working condition, although each door was not individually tested. Doors and hardware are of light to medium duty, we would recommend replacing all doors particularly at primary entrances.
- Entry doors in the facility do not have vestibules. Their implementation would add to MEP efficiency and performance. Given the hot & humid climate, we would recommend providing them particularly in a facility that maintains an ice sheet.
- Clerestory windows above loading dock/back of house areas are in disrepair. Some glazing panels out of alignment. Frames need to be evaluated, re-sealed and/or replaced. Black staining on the glass itself is present throughout.

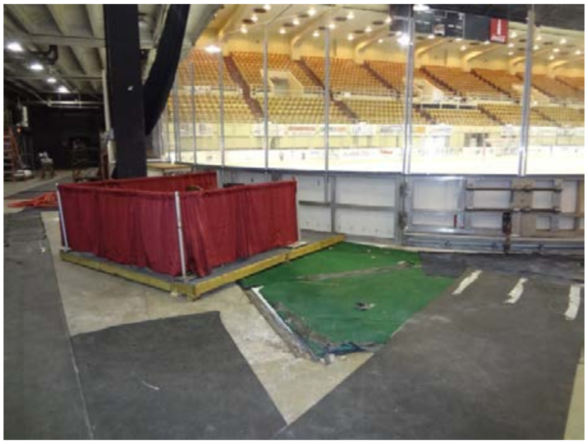
Seating Bowl

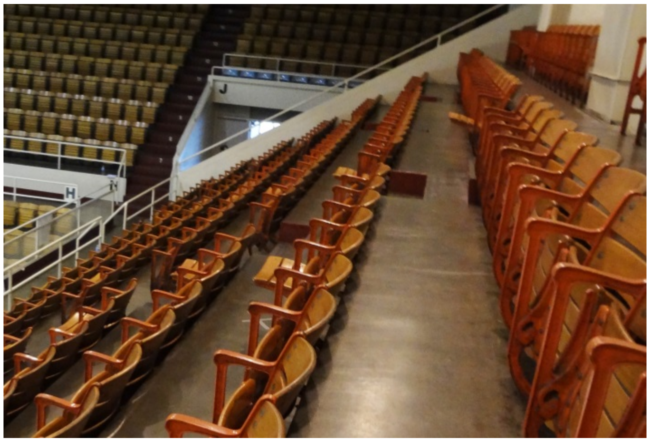
In general terms, the seating bowls in both the Coliseum & Auditorium are out of date with modern standards, with the Coliseum in a more detrimental state. Bringing the bowl up to these standards would mandate additional ADA seating and implementation of current life safety codes.

Way finding and signage overall should be more uniform and clear. Overhead signage at entries is inadequate in size & clarity to properly direct spectators to their seats. In addition signage at stair locations lacking permanent signage, as current signs are made of paper.

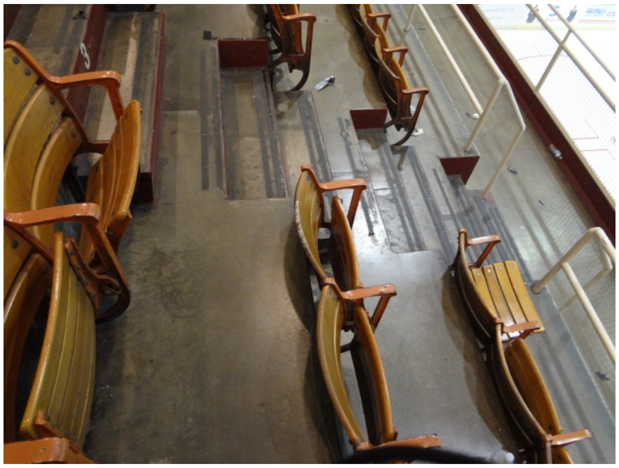
Coliseum

- Seating in (4) corner sections of the north & south seating areas have severely compromised views for many event types. This has negative impact on spectator experience and potential revenue for particular show configurations.
- The Coliseum contains no true premium seating amenities. Temporary loge style boxes at floor level are inadequate for current market standards. Lack of premium amenities represents a potential loss in revenue for the facility.



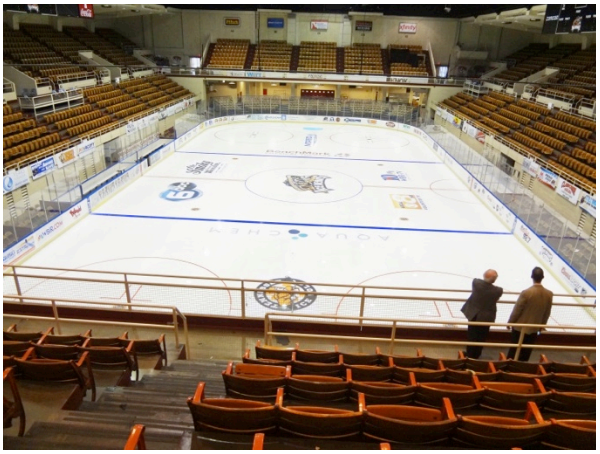


- Many of the wood slat seats are in disrepair. Self-rising mechanism have failed & material finishes are worn. This failure reduces the effective aisle with of the seating sections.
- While the seats themselves are an interesting character element for the age of the arena, they should be replaced with seats of those of modern standards & ergonomics.
- Seating aisles are narrower than current code requirements.
- Seating aisle steps have riser & tread dimensions that do not meet code. Aisle steps have tread depths of 10” at north & south sides and 8” at east & west sides.

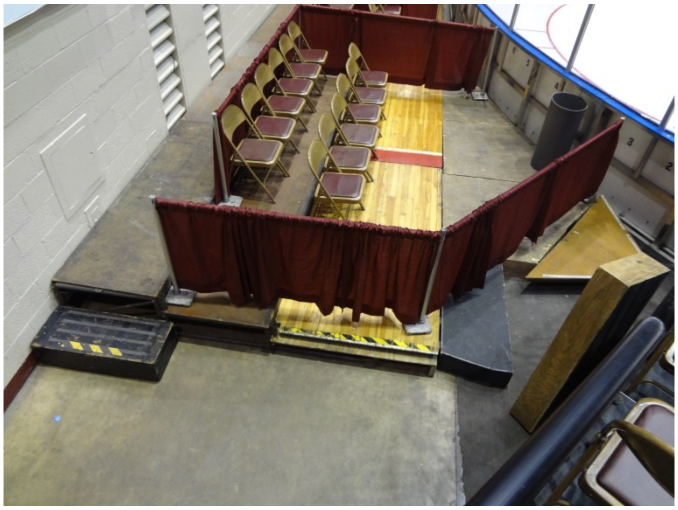


- There are no handrails in any of the seating aisles. This exacerbates the concern of inadequate tread depth of the aisle steps.
- (19) Wheelchair accessible positions are inadequate to meeting ADA design standards.
- Facility was in hockey configuration when reviewed. No ramps were in place for accommodation of ADA seating at the ice level.

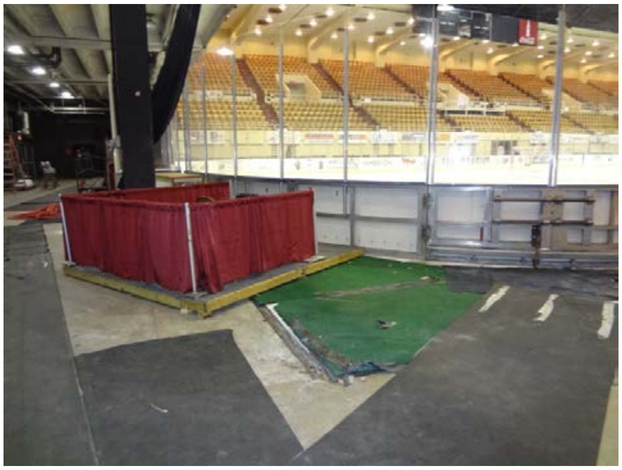
- Seating bowl sightlines are compromised for hockey, worth noting, as this is the current primary function/tenant (e.g. end zone seating does not have view to near goal).



- Portable platforms at hockey sideline are built of combustible materials & not suitable for use. Use of temporary rails in these areas is inappropriate as well.

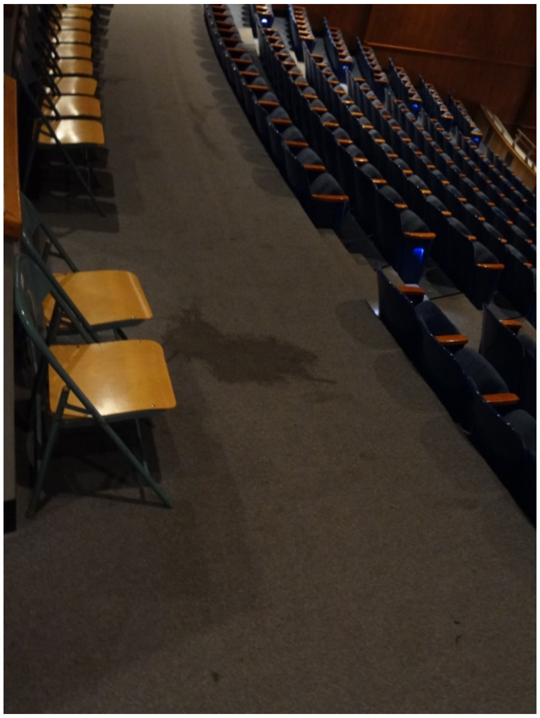


- Temporary floor coverings around floor seating need replacing and better planning. The current condition creates a number of accessibility hazards. Materials are torn, stained, & incoherently installed.



Auditorium

Seat materials have deteriorated. Many seats have torn fabric seats with exposed foam padding. Self-rising mechanisms need maintenance.



The cross aisle conditions at the upper balcony should have a rail behind last row of seats.

There is a lack of premium seating product, as this type of item was not a design trend at the time the building was constructed. Should a significant renovation occur, and with the support of market research, the addition of premium boxes should be considered.

STRUCTURAL ASSESSMENT

The Knoxville venue was originally planned in the 1950s and was completed on August 20, 1961. It was officially called the General James White Memorial Civic Auditorium and Coliseum, and is now known as the Knoxville Civic Auditorium and Coliseum (KCAC). The facility includes an auditorium with a maximum seating capacity of 2,500, a multi-purpose arena with a maximum seating capacity of 7000, an exhibition hall, and a ballroom. Each venue, the auditorium and coliseum, consists of seven (7) levels.

An engineering assessment of the KCAC was conducted between December 18-21, 2014, with Mr. Doug Simmons, operations manager of the facility, to evaluate the structural conditions and to collect field data of the existing structure components. Additional field assessments were also conducted in January 2015 to collect additional data.

A visual assessment of the three (3) parking garage structures was conducted on December 29, 2014, and January 12 -15, 2015.

Facility Structure

Foundation:

Entire facility structure is supported by several clusters of piles varying in length from approximately 30 to 55 feet. The piles are supported by very dense rock formation. The pile caps are connected with reinforced concrete grade beams. The auditorium at grade floor slab is 4 inches thick while other floor slab at grades are 5 to 6 inches thick.

Facility Exterior: (See Appendix A)

The north face of the facility, which is the main entrance and lobby of the Auditorium, is basically constructed with aluminum clad glass wall and the concrete canopy. The entrance surface is constructed with a decorative and segmented concrete pavement.

The lower part of the east face consists of a glass wall along the south side (i.e. Coliseum side) of the facility and east wall of the east promenade. Diamond shape tilt-up panels are also installed at the top of the glass wall and along the reminder of the east face. There are steel grating covered window wells providing daylight to lower level east mezzanine.

The main lobby south entrance and the entrance to the stairs leading to the ballroom are also aluminum clad glass walls. The Auditorium side recessed wall also has an exposed but covered waiting lobby along the Auditorium side of the facility. There is an exit door providing the access to the Auditorium's east exit lobby and main lobby access stair.

The service garage northwest entrance is also located at the north end of the east side along with access steps leading to the courtyard.

The south side includes the concrete retaining walls along the north, as well as south side of the south service ramp and service doors leading to the arena. An HVAC platform with plain tilt-up panels is located above the south service ramp. The remainder of the south wall is basically diamond shaped tilt-up panels supported by concrete beams and column and constructed above a cast in place concrete wall.

Similar to the east face, the lower part of the west face consists of glass wall along the south side, (i.e. Coliseum side) of the facility and west wall of the west promenade. Diamond shape tilt-up panels are also installed at the top of the glass wall and along the remainder of the west face. The west side also includes steps leading to the west promenade, main lobby and steps leading to the lower mezzanine of the Auditorium. The west side front is grassed covered ground and a paved area similar to the north side.

Coliseum: (See Appendix B)

With exception of the roof frame, the majority of the Coliseum is reinforced concrete structure. All beams and columns are cast in place reinforced concrete members. The exterior walls are a combination of plain as well as diamond pattern pre-cast tilt up, cast in place cast wall, and glass. The interior walls are cast in place concrete and CMU block walls.

All columns from the top of the Coliseum down to the foundation are cast-in-place concrete. All columns are supported over the pile caps. All connecting and inclined beams (i.e. raker beams) are also cast in place.

All Coliseum seating are precast “L” and “C” shaped concrete joists and are supported by the inclined beams. These joists are anchored in place either mechanically or by dowels. Seating steps are constructed with either precast or are cast in place. The walls of all access ways to seating area are 6 inch thick CMU blocks.

The ceilings over the seating area are constructed with double “T” precast concrete slabs. The mezzanine floors under the seating area are also constructed with double “T” precast slabs.

Auditorium: (See Appendix C)

The Auditorium rear, or the north, reinforced concrete curved wall is supported by a grade beam spanning over pile caps. The Auditorium’s curved sidewalls are constructed with hollow red clay brick blocks. Stage back and sidewalls are also constructed with reinforced concrete. The Auditorium ground sloped floor slab is 4 inch thick, reinforced concrete supported by compacted soil sub-base.

Balcony seating floors are constructed with precast “L” and “C” shape concrete joists, which are supported by the inclined beams. These joists are anchored in place either mechanically or by dowels. Seating steps are constructed with either precast and/or cast in place concrete. The balcony cross aisle is also a precast concrete joist. All joists are supported at the ends by concrete beams.

All auditorium columns from the top of the auditorium down to the foundation are cast-in-place reinforced concrete. All columns are supported over the pile caps. All connecting and inclined beams (i.e. raker beams) are also cast in place reinforced concrete.

The Auditorium’s exterior walls are a combination of plain as well as diamond pattern pre-cast tilt up, cast in place concrete walls, and glass windows. The interior walls are cast in place concrete and CMU block walls.

All access stairs are constructed with cast in place reinforced concrete.

Service Garage: (See Appendix D)

The service garage, also called “Mountain View Parking Garage”, is located along the east side of the Auditorium and is an underground concrete structure built under the east side courtyard. Access to the service garage is by a ramp from Historic Preservation Drive along the south side. There is also an exit way located at the northwest corner of the service garage.

The entire service garage structure, including the access ramp, is constructed with cast in place concrete walls, floor, and ceiling slabs. The ceiling slab also supports part of the courtyard. This "T" shape, service garage is capable of accommodating access to 18 wheel trucks. The service garage has a loading dock access to the Auditorium stage and also has a drive in access at south west corner leading to the Coliseum service area. Part of the service area is also used as a storage and staging area.

The service garage floor is 7 inch thick reinforced concrete supported by compacted sub-base and perimeter beam at the edge. The walls are 10 to 12 inches thick. The ceiling is pre-stressed, pre-cast, single, double, and triple "T" concrete joists.

HVAC Platform

The HVAC platform housing the cooling units is located along the south side of the Coliseum and above the south service ramp. The platform is enclosed with plain, 7 inch thick pre-cast concrete tilt-up panels with openings at the bottom for air circulation. This HVAC platform can only be accessed through a door located in the men's restroom located at level 4.

Assessment Approach

The assessment task is divided into the following:

1. Facility assessment of KCAC, which includes the structure housing:
    - Facility exterior
    - Coliseum
    - Auditorium
    - Ballroom/banquet room
    - Service ramps and service areas
    - Lobbies, mezzanine, mechanical rooms, etc.
    - Service garage
    - HVAC platform

The parking garages were also field visited. However, as this review was not part of the original scope, the assessment is cursory and visual in nature, without the benefit of a full plan review. Our observations include excessive cracking, exposed and rusted rebar, and water seepage. Some of the crack patterns and location of cracks were identical on all floors, and we believe something unusual is occurring to create this. We also noticed rusting of unexposed rebar at several locations. Based on our observations, we strongly recommend that a full and complete structural assessment of the three (3) garages be undertaken as soon as possible.

These assessments were conducted per requirement of 29 CFR 1926.850(a), Sub part T, and as recommended in the American National Standard for Construction and Demolition Operation-Safety Requirement for Demolition Operations ANSI A10.6-1990.

These structural assessments utilized the guidance found in the ASCE Standard: Guideline for Structural Condition Assessment of the Existing Building ANSI/ASCE 11-1990.

Assessment includes all accessible areas of the facility, and no destructive tests were conducted.

Multiple sets of drawings used as references were also analyzed to conduct the structural assessment.

Observations

Due to lack of the structural details, the material strength, concrete strength, design loads, code compliance, soil bearing and geological data were not included as a part of this assessment.

Knoxville and the surrounding areas were subjected to several minor seismic occurrences after completion of the facilities. However, no effect or failure due to the seismic activities was observed.

A. Parking Garages:
Based on a limited and cursory assessment, the parking garages structures reveal significant concern, which will require further in depth assessment along with the review of the available design data.

B. Facility Exterior: (See Appendix A)
All four sides of the facility was observed and assessed. The concerned and critical issues encountered during this observation are included in Appendix A of this report.

The following are the defects and issues observed at the facility exterior.

1. Front or West Face:
   - Spalling of the concrete at the top beam, exterior floor slab edges
   - Cracks at the exterior concrete floor
   - Exposed rebar at the edge of the concrete slab and beam supporting the slab and at the overhead ceiling of the exterior lobby
   - Rebar rusting
   - CMU block wall settlement and separation gaps
   - Corroded and fragmented concrete at the support beam and under the steps
   - Cracks at the exposed surfaces of the west concrete wall of the lower level mezzanine
   - Rusting at the railing base connections

2. North Face:
   - Cracks at the canopy
   - Cracks at the pavement
   - Water infiltration thru gap
   - Cracks at knee wall

3. East Face:
   - Spalling and water penetration at the column base
   - Deformed grating
   - Exposed and rusted rebar at the column
   - Patch repair
   - Cracked patches
   - Damaged and fragmented concrete curb
   - Repaired side walk pavement
   - Sub surface erosion, sink hole, tunneling due to water intrusion
   - Pavement caving due to sub strata erosion
   - Restored cracks
   - Spalling and cracks at the steps and landing
   - Cracked curb wall

4. South Face:

- Concrete spalling
- Separation
- Surface crack at tilt-up panels
- Dented and separated aluminum panel siding under the HVAC platform
- Cracks at the retaining wall
- Water infiltration
- Separation at the lintel
- Cracks, separation exposed rebar at column base
- Excessive gap at the joint

C. Coliseum and Auditorium Interior (see Appendix B and D)

- Detached ceiling tile above arena seating area
- Floor and ceiling cracks
- Exposed and rusted rebar
- Rusted floor supporting steel beam
- Seepage through cracks
- Fragmented concrete
- Abandoned equipment
- Asbestos at the pipe insulation and tile mastic
- Joint separation
- Unsecured but stable CMU block
- Mineral deposit at ceiling
- Shaky walkway
- Concrete deterioration
- Seepage at cracks and construction joints
- Water leaks
- Repaired and restored floor cracks
- Repair patches
- Spalling
- Rusted pipes and HVAC unit base
- CMU block wall settlement and separation gap
- Cracked granite partition at restroom

D. Service Garage (See Appendix D)

- Cracks at the floor and ceiling
- Honey combing
- Spalling
- Exposed and rusted rebar
- Water seepage thru cracks and joints
- Mineral deposit
- Concrete fragmentation and deterioration
- Surface peeling
- Surface run off through abandoned exhaust fan opening
- Seepage at electrical junction box
- Excessive gap at expansion joint

Assessment and Analysis

Based on the conducted assessment, and in spite of observations listed above, this half century old facility is found to be very well maintained and in excellent condition. It has withstood several seismic events, thermal cycles, and weather exposure.

Based on the history of available material, structural design requirements, code compliance, and construction approach when this facility was design and constructed, the concrete structure is in remarkably structurally sound condition.

The observed cracks at the horizontal structural members like floor slabs are very common for the concrete structure. All observed cracks at various floors and ceilings may be result of shrinkage during the initial concrete curing stage, stress relief, floor loading, weather exposures, wear and tear, etc.

Cracks at the ground floor slab

Generally, sub base strata failure due to cavity or tunneling formation, which can be caused due to erosion generated by water infiltration, may result in localized failure of the ground floor concrete slab. Such localized failure can cause either permanent cracks at the ground floor slab, depression, or visible vertical displacement at the crack.

In addition, failure to achieve required design compaction of the sub base may result in less than designed soil bearing capacity which may generate the localized vertical displacement/ depression due to load application thus resulting in the crack at the ground floor concrete slab.

A majority of the Coliseum’s ground floor slabs are subjected to applications of constantly moving loads, which over the elongated period of exposure may result in stress induced cracks.

Ground floor slab cracks initiated from the corners of the chimney or columns may be due to provisions of inadequate corner reinforcement rebar or lack of base support at opening edges.

All observed cracks appear to be aged and stabilized cracks without any sign of further or ongoing separation. The maximum observed separation at the ground floor crack is no more than 1/8 inch wide at the top surface.

There was no vertical displacement observed at any of these ground floor slab cracks. There were no sign of ground water upward seepage through any of the observed cracks at the ground floor slab. Several cracks at the ground floor slab have been restored/ repaired by grouting.

Crack at the elevated floor slab

All elevated slabs are precast concrete single, double “T” shape, or checker box shaped which can permit a thinner floor slab with a thickness ranging from 3 inches. However, crack formations at the thin slab section resulted as a relief of load induced stress. Most of such stress relief cracks are observed parallel to the adjacent deeper section. Lack of quality control measures at the construction phase of precast concrete floor can also result in either shrinkage cracks, which may expand, or elongate due to load application.

The observed problem with such cracks is the seepage of water or floor cleaning chemicals. Such seepage may initiate corrosion of the steel reinforcement. If not prevented it may result in localized failure.

Observed mineral deposit (i.e. efflorescence) is due to crystalline mineral salt left behind as moistures comes thru the concrete wall or slab and evaporates into the building interior. Primary efflorescence typically occurs during the initial cure of a cementitious product. Primary efflorescence brings out salts that are not ordinarily part of the cement components; it is not a structural, but rather an aesthetic concern.

Secondary efflorescence causing concrete stalactites is due to the external influence of concrete poisons such as chlorides. A very common example of where secondary efflorescence occurs when there is a presence of salt when steel-reinforced concrete floor are subjected to saline solutions. This saline solution is absorbed into the concrete where it can begin to dissolve cement stone, which is of primary structural importance. Virtual stalactites can be formed in some cases as a result of dissolved cement stone, hanging off cracks in concrete structures. Where this process has taken hold, the structural integrity of a concrete element is at risk. This is a common infrastructure and building maintenance concern. Excessive secondary efflorescence is akin to osteoporosis of the concrete.

Efflorescence observed at the crack with presence of rust is indication of rebar corrosion. Such rebar corrosion due to efflorescence can be stop by restoring the cracks to prevent further water or chemical seepage.

Water seepage at the service garage walls through the cracks or foam inserted into holes can cause corrosion of the rebar.

Spalling and Separation

Spalling of the concrete is caused due to lack or loss of cohesiveness or due to accidental impact. Water penetration resulting from the freezing and thawing cycle can also cause spalling or separation. Construction deficiencies can also result in localized spalling. Rusted rebar will also spall the concrete cover.

Exposed and rusted rebar

The cause of exposed rebar is either due to the shift of rebar during concrete placement or water penetration rebar rusting and resulting in spalling of the concrete and loss of concrete cover. Observed exposed rebar are rusted, however the initiation of rusting prior to or after exposure is difficult to determine.

Rusted rebar can also result in further failure of the surrounding concrete either by spalling, fragmenting, or cracking of the concrete.

With exception of the exposed rebar at the service garage’s northwest entrance, all other encountered rebar at the vertical structural members are stirrups.

Rusted rebar at the exterior can deteriorate at an accelerated rate. If not repaired in a timely manner, it may initiate deterioration of structural integrity.

Seepage and water leaks

Most of the observed seepages are through cracks, joints, the forming hole left in place, at penetrations, etc., and with exception of seepage through cracks, all other seepage resulted due to failure or lack of the sealing provided. These seepages are a result of direct path or due to capillary movement of the liquid.

The observed seepage of floor cleaning chemical and water through cracks shows sign of the reinforcement rusting. Efflorescence is also observed at the ceiling cracks.

Fragmented and deteriorated concrete

Weathering, expansion, and contraction due to the thermal cycle, construction deficiencies, water penetration, localized failure, weak concrete, etc. are the probable causes of the fragmented and deteriorated concrete. If not restored in a timely manner, this type of failure may result in localized but progressive failure.

Fragmented or deteriorated concrete was observed along the west side exposed lobby slab, corner columns at the coliseum entrance, and northwest entrance from the service garage.

Localized settlement and excessive gap at the joint of the CMU block wall:

The observed settlement and gap maybe a cause of poor bearing support. At present, the observed settlement and gap at the joint are stable and do not impose any immediate threat.

Asbestos and Lead contaminant

Based on the asbestos abatement report, asbestos materials were found at the pipe insulation and tile mastic. Currently, the asbestos containing tile mastic is capsulated by application of additional tile floor covering.

The initial application of paint may be lead base paint. However, the initial coat may be concealed by additional paint coat application. Unless exposed, the capsulated lead base paint coat does not impose any immediate harm or threat.

Recommendations

Remediation and required restoration works are categorized and prioritized per the guideline outlined at the work scope:

a. Areas where structural framing requires priority remediation

Upon initial inspection, three issues were identified as requiring immediate rectifying implementation. Subsequently, facility management has addressed or is addressing each of the following issues:

1. Loose ceiling tile found at the arena east seating area must be secured in place immediately to prevent accidental injury to audience.
2. Removal of the cracked granite partitions in the restrooms.
3. All encountered asbestos does not impose any immediate threat to the public. However, exposure of pipe insulation asbestos to the maintenance staff is a concern. Until abated completely, the maintenance staff must be trained to avoid pipe insulation asbestos exposure.

b. Structural items requiring regular or routine maintenance:

The following encountered issues are prioritized based on the level of concerns and criticality.

1. Restoration of fragmented and deteriorated concrete, exposed rebar and spalling encountered at service garage
2. Restoration of exposed and rusted rebar which are at the exterior of the facility (West and East Side)
3. Restoration of cracks found at the north entrance canopy (At north side, See Appendix A)
4. Restoration of the cracks, joint gaps, spalling, fragmented and deteriorated concrete at the exterior of the facility (East, West and South side See Appendix A)
5. Restoration of the cracks and failed seal at the penetration showing seepage and mineral deposit (Coliseum, See Appendix B)
6. Restoration of the spalling, exposed, and rusted rebar, seepage, water infiltration (Coliseum-See Appendix B and Auditorium-See Appendix C)
7. Restorations of the floor slab crack (in both Auditorium and Coliseum)

c. Ability of main building systems to carry initial design loads

Due to the lack of availability of the initial design data, it is difficult to accurately evaluate the capability of current structure. However, considering the applicable code requirement of the 1960s and based on the conducted assessment, the entire structural skeleton is capable of carrying the initial code compliance design loads. As stated before, the facility structure has withstood the load and forces induced during the seismic occurrences.

d. The ability of the main building systems to carry loads is based on our current understanding of loads, including latest equipment and environmental conditions.

Based on the conducted assessment and known fact of concrete gaining the strength over the period, the main building is capable of accommodating the load imposed based on the current and intended use of the facility.

With adequate routine maintenance and timely implementation of restoration, the facility can withstand and adjust to the environmental conditions.

Future Services for Consideration

Following are the recommendations of future structural engineering services were noted after completion of our initial assessment. We have since been informed that building management has addressed or is currently addressing each of these items:

1. Complete and thorough assessment of the parking garages
2. Engineered remediation of the observed deficiencies
3. Engineered analysis for any modifications, alterations, improvements, or any changes in the use of the facilities
4. The upper structural components of the facilities such as roof, framing, and installations were excluded from this assessment. An in depth assessment of these areas should to conducted, and especially prior to any modifications or changes in use

Finally, it will be important that KCAC annually budgets adequate funds for repairs and maintenance to concrete/CMU elements and related joints. Once appropriate repairs have been made, the structural systems should last another 30+ years, provided cracks, water seepage, and other problems are rectified in a speedy and thorough fashion.

Coliseum Rigging

While not part of our official scope of work, Venue Solutions Group recognized the concern with the current rigging capacity of the Coliseum. The concert rigging is limited and has been identified by KCAC management as well as stagehands as a cause of not being able to book certain live entertainment events. KCAC provided VSG with a study from a licensed structural engineering firm that verifies rigging loads and beam capacities. This ensures that event producers don't overload beams and exceed the overall weight capacity of the rigging grid.

Should the market study determine that events with larger rigging requirements (in excess of the current capacity of 85,000 pounds) could play the Coliseum, and if the City desires to investigate options to accommodate such events, VSG has compiled a list of potential options that have been presented and/or implemented in other facilities. If a course of action has been determined that involves an enhanced rigging system, we recommend enlisting the services of a licensed structural engineering firm with specific experience in designing concert-rigging systems. Estimating costs at this time is difficult to ascertain due to the individual nature and existing infrastructure of a specific venue; from the strength and geometric limitations of the structure to the multiple options for providing rigging locations and capacities to the desired functionality of the facility. Currently there are too many "unknowns" to estimate costs for KCAC, however as a reference, we offer this information:

A 7,500-seat area built in 1979 was seeking to increase their rigging capacity to 80,000 lbs. In 2012 construction bids came in just under $2M. Today the venue is considering a stand-alone grid system that is cantilevered over the stage area and has a capacity of 120,000 lbs. The construction estimate is around $1.1M

In late 2015, it is expected that a new rigging grid, 300' long and 100' wide, will be installed in Atlantic City's Boardwalk Hall at a cost of $3M. The venue was built in 1929 and seats 14,000 people.

In 2008, the Scope Arena in Norfolk, VA spent approximately $2.2M to increase the rigging capacity to 145,000 lbs. This arena seats 12,600 people and opened in 1971.

Based on current design techniques, there may be multiple options to improve and increase rigging capacity at KCAC. Keep in mind these options are only possible at this point; due to the specific nature of KCAC, one or more options may not be feasible for a variety of reasons. As already recommended, the services of a licensed structural engineering firm would be necessary to determine the best option for KCAC. The "$" symbols indicate costs relative to each other; more "$" symbols means more cost.

1. Reinforce the entire roof structure with steel components. This would involve taking the arena offline for several weeks and is generally the most costly of all options. $$$$
2. Create a new grid of hanging points over the end stage location by suspending a cable system at an appropriate height. This would require an in-depth analysis of the existing roof and supporting elements, and may require strengthening of existing roof truss members and connections. Essentially, the new grid system would be supported by cables connected to multiple roof support structures around the bowl. The same concept could be utilized to add hanging points over center stage location; obviously the cost increases significantly with this option. $$$

3. The same concept with the cabling system can be used, but in this option there would be a rigid steel grid above the end stage location or both the end stage and center stage locations. With the rigid steel grid, there are more locations from which to hang equipment. $$$
4. Another option is to install a new load-carrying truss running east west along what would typically be the down stage edge. From there, a new rigid rigging grid could be installed, which would be independent from the existing roof support structure. The same concept could be applied in adding a 2nd, new truss in order to create a new rigging grid over center stage as well. $$
5. Another option for a rigging grid that would be independent of the existing structure would be to install a new grid that is supported by it's own new columns. This would not require any analysis of the roof structure, but might require new foundations, and would create some sightline issues. $
6. Similar to #5, another "column" option is to increase the size of the new columns, but place them towards the rear of the grid, which will minimize sightline issues. The grid is then cantilevered outwards. $

Auditorium Rigging

The fly system at the Auditorium is original to the building's construction, although the ropes and cabling have been replaced as needed over the years. The system is a manual, 50 line set system with cast iron arbors, and has six (6) electrics. The estimated weight per line is 750 pounds. While replacing the system in its entirety may ensure more reliable functionality, a replacement with an equivalent, but modernized system would not materially increase the number of events that the Auditorium could host. Neither would such a system reduce the labor necessary to operate it. If the current fly system were replaced with a fully automated one, and the weight per line set were increase from 750 pounds to 2000 pounds, the required operating labor could be reduced and a broader range of events might be possible. Before moving further with replacing the fly system, we recommend further investigation into the costs and ROI of the options in such a project.

Currently the stagehands inspect the fly system on a regular basis, although our recommendation is that a licensed and experienced rigging consultant be engaged once a year to perform a complete and thorough inspection. Such a firm will maintain a certain level of liability that the stagehands do not.

Mechanical, Electrical, and Plumbing

This report is a field investigation narrative describing the category and condition of various Mechanical, Electrical and Plumbing (MEP) systems serving the Knoxville Civic Auditorium and Coliseum (KCAC). Noting that the scope of this study was to be of a cursory nature, focused on HVAC systems, observations were limited to a select group of representative equipment.

The primary goal of this report is to note general conditions of primarily Mechanical HVAC systems and identify equipment that is in need of replacement or that will be within the next 20 years. Ultimately, this document will provide an engineering "high level" evaluation of existing systems and guidelines aiding in annual (and more immediate) capital expenditures for MEP systems.

Estimates of equipment life are based on both the ASHRAE 2011 Handbook – HVAC Applications and the ASHRAE Owning and Operating Cost Database. Specifically, data from the ASHRAE Handbook is from the Akalin 1978 study and, where available, from the 2005 Abramson data. The Database is an ongoing project and represents more up-to-date information, although the dataset in some cases is too small to be considered useful. Information is presented in the report as a range between the three, while in the capital expenditure table either the mean of the range or the best value from experience has been used. Access to the database is available at: http://xp20.ashrae.org/publicdatabase/

Recommendations regarding repair and replacement for existing systems are made online along with their descriptions. Recommendations regarding emerging technologies and other updates are described separately below. References made below include ASHRAE Standard 62.1 – Ventilation for Acceptable Air Quality and ASHRAE Standard 90.1 – Energy Standard for Buildings except Low Rise Residential Buildings.

The HVAC systems utilize chilled water for comfort cooling and hot water for comfort heating throughout the arena. A central chiller plant and cooling tower generate chilled water for distribution to the facility. Similarly, a central boiler plant produces steam, which is subsequently used to generate hot water for the building.

1. The Auditorium and Coliseum mechanical systems have been maintained well over their extended life span, but many are well past their serviceable life and in need of a phased replacement.

2. There has been an emphasis on upgrades to the building automation system (BAS) for increased energy efficiency and control. The existing BAS is in good condition. Some of the upgrades noticed include:
   a. Demand control ventilation (DCV) control for some air handling systems.
   b. Single zone VAV control for all constant volume single zone systems including the arena bowl air handling units.
   c. Variable Frequency Drives were added to most air handlers.

MECHANICAL

Chilled Water System

Observations:

The chiller plant is served by three (3) chillers of various ages and capacities. The primary chiller is a 430 Carrier centrifugal unit installed in 2006. The backup chiller is a 300 ton Carrier centrifugal chiller installed in the mid-1970s. The third chiller is a 60 ton reciprocating united also manufactured by Carrier, (1970s vintage); it serves the ballroom air handling unit on the third level. The chilled water distribution is via constant volume primary pumping loop and variable volume secondary loops (auditorium loop and coliseum loop). The secondary pumping system consists of three (3) pumps with one serving the auditorium loop, one serving the coliseum loop, and one standby. These secondary water pumps provided chilled water and provide heating water via 3-way switchover valves to the single coil in the facilities air handling units. Variable frequency drives have been added in approximately the last five years to serve the secondary heating and cooling pumps.

M.2 430 ton chiller

M.3 300 ton chiller

Heat rejection for the chiller plant is through a three (3) cell cooling tower located on the coliseum roof. The tower cells are connected to a remote condenser water concrete tank in the basement. The six condenser water pumps draw from this tank and pipe to their respective chiller, including two pumps to serve the ice chillers. All of these pumps are mid-1970s vintage; expect for the ice plant condenser water pumps (late 1990s vintage.)

M.4 60 ton chiller

M.5 Chilled water pumps

M.6 Cooling tower

The chillers appear to be in good to fair condition based on their respective ages. The condenser tubes are brushed every year and the machines appear to be well maintained.

The median useful life span of a chiller is between 18 and 23 years. Therefore, the 300 ton and 60 ton chillers are well past their service life and should be replaced. A proactive maintenance routine for the chillers is essential to extend their useful life; however, as time passes, the chillers will become less energy efficient even with the best of service practices.

Chilled water pumps appear to be in average condition. The median useful life of the chilled water pumps is between 20 and 21 years, the pumps have exceeded their useful life and should be replaced.

M.7 Condenser water basin

M.8 Condenser Water pump

Condenser water pumps appear to be in fair to poor condition. The median useful life of the condenser water pumps is also between 20 and 21 years and these pumps should be replaced.

The cooling tower cells are in fair condition. The indoor concrete basin is cleaned yearly and is in good condition. The median useful life of the cooling towers is between 17-1/2 and 20 years. Complete tower replacement should be considered in about 2 to 4 years. Chemical treatment for the condenser water system is good and seems to be managed effectively.

Recommendations:

Chillers are a large energy user in the chilled water systems; as such, the chillers should be a priority for preventative maintenance and service planning. However, with the age of the existing 300 ton chiller, we recommend replacement in the short term for this machine. A phased replacement of the 430 ton chiller should be planned in the next 15 years.

The age of the cooling towers will require replacement in the next 2 to 4 years. When considering replacement, we recommend sizing the cooling tower to optimize the energy efficiency of the new chillers. Condenser water pumps should also be completely replaced. The chilled water pumps should be replaced with their respective chiller replacement.

Heading Hot Water System

Observations:

The steam boilers appear to be in good working condition, and well maintained. Steam boilers consist of two (2) flexible water tube boilers, each with an output capacity of 4800 MBTUH. The condensate feed water unit for the boilers had a leaking pump and appeared to be well past its' service life. There is a steam to water heat exchanger to generate heating water and two (2) primary pumps, each an end suction type. These pumps serve the heating water primary loop that connects via 3-way mixing valves to the variable flow secondary heating/cooling loops. As noted previously, the air handling unit coils are seasonal dual function heating/cooling coils and a separate secondary variable flow loop serves the auditorium and coliseum independently.

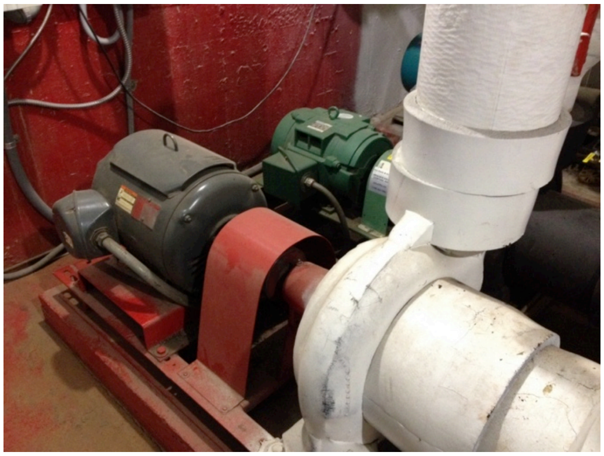
M.9 Steam boilers

M.10 Steam condensate feed water pumps

The boilers appear to be in good condition with preventative maintenance ongoing. The median useful life span of a flexible tube boiler is between 15 and 20 years. However, as time passes, the boiler inherently will become less energy efficient even with the best of service practices.

M.11 Steam condensate pumps for hot water heat exchanger Pumps

M.12 Secondary Heating/Cooling water



Hot water pumps appear to be in fair condition based upon their age. The median useful life of the hot water pumps is between 20 and 21 years. Therefore, the primary loop heating water pumps appear to be close to the end of their service life.

Recommendations:

Boilers are one of the largest energy consumers for the arena. As such, the boilers should be a priority for preventative maintenance and service planning. Heating hot water pumps should be completely replaced in 5 years.

M.13 Pump variable frequency drives

Ice Plant

Observations:

Two ice chillers provide cooling for production and maintenance of the bowl ice sheet. The primary refrigerant in each machine is R-134A with a Glycol solution for the ice floor. A steam heat exchanger can heat the Glycol solution for ice melting purposes. The condenser heat is rejected to the cooling tower system and the associated indoor basin.

M.14 Ice Chiller

The ice system equipment includes one chiller installed in the late 1990's and a redundant unit added in 2008 (one unit runs in ice production mode and one is standby). Just as with the facility HVAC system, the ice chiller and pumps appear to be well maintained. The ice system pumps appear to be in good working condition.

Three (3) reciprocating compressors serve each chiller in the ice system. Ice quality does not seem to be a concern, and we understand the indoor space conditions and ice chiller performance are adequate for the coliseum. The only noted operational concern was occasional humidity control challenges when hockey events occur on warm/humid days in fall or spring. On these occasions, fog can form above the ice surface until the air handling system can eventually lower the space moisture level.

Recommendations:

The median useful life on the ice chiller is between 17 and 20 years. The oldest chiller will most likely need to be completely replaced within the next 5 to 7 years and the second chiller should be replaced within 15 years. Although with limited use these chillers may last longer. Continue preventative maintenance of existing compressors.

Air Handling Systems

Observations:

The Auditorium and Coliseum are served by nine (9) air handling units and the Coliseum concourses are served by approximately eight (8) smaller blower coil units. The units are original to the facility, though a number of controls and motor upgrades have occurred through the years.

The seating bowl in the Coliseum is served by two (2) large built up air handling units located at the south end of the facility. These units are equipped with pre-filters (metal media washable type), cooling/heating 2-pipe coil, coil bypass dampers, and a housed centrifugal supply fan. A premium efficiency motor and VFD were added to both units in the energy retrofit project that occurred approximately 5 years ago. The coils were replaced approximately 15 years ago.

The air handling units serving the Auditorium and Coliseum include an air side economizer function which, when activated, pressurizes the respective space. Relief air is accommodated by exhaust fans on the roof in the Coliseum and by roof mounted relief hoods in the Auditorium. These relief systems are in poor condition and some of the Auditorium relief hoods are apparently closed by weights due to water leakage issues.

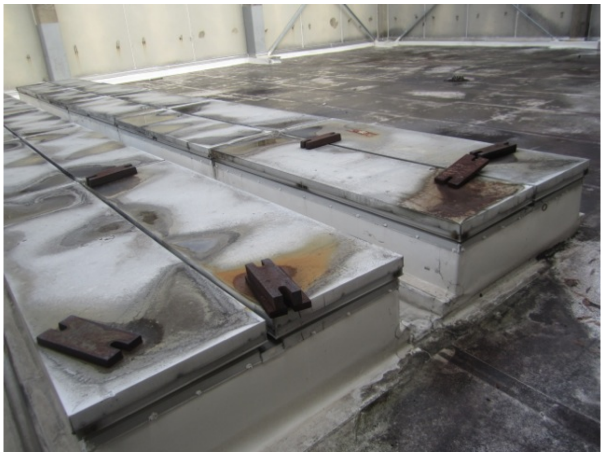
M.15 Bowl AHU Supply Fan

The air handlers and their associated components appear to be in reasonable condition considering their age and runtime. Filter media is cleaned annually, but is low filtration efficiency type. Cooling coils were relatively clean and several of the units have added UV lights to maintain coil cleanliness. Condensate drain pans were reasonable with little signs of biological growth. The motors were in good condition.

Typical life span for an air handler cooling coil will be around 20 years and fans will reach their end of life around year 25. Therefore, all of the facility's air handling units have significantly exceeded their service life and should be part of a phased replacement plan.

M.16 Auditorium stage AHU

M.17 Auditorium relief vents



The administration offices and hockey offices are each served by water source heat pump units. These units are piped to the cooling tower basin for heat rejection. Their condenser water pump is in good condition and the heat pumps are tied into the building automation system control network.

Recommendations:

We recommend that the current preventative maintenance program for air handling units continue with a focus on extending the useful life of each system. Planning and budgeting should be considered for replacement of entire air handling units beginning at present and continuing over a span of five (5) years. The new air handling systems should continue the demand control ventilation and single zone variable airflow concepts incorporated in recent energy upgrades. These strategies should be extended to the concourse blower coil unit replacements as well since the reduction of fan energy and outdoor air conditioning are a good ways to lower operating energy costs. New air handling units should also incorporate disposable filter media with higher filter efficiencies to improve indoor air quality.

Consideration should be given to the addition of a dehumidifying air handling system to serve the Coliseum. This system could incorporate a desiccant wheel and be standalone or could be part of new bowl air handling units. The benefit would be improved space humidity control during all seasons and potentially improved energy operating costs.

Building Automation System

Observations:

The Building Automation System (BAS) is an Andover system and was added in the energy upgrade project approximately five years ago. The original controls system was a pneumatic system and most actuators remain pneumatic type. The actuators' pneumatic air is provided by two (2) separate control air compressors with one system acting a standby to the primary unit. These compressor systems are in reasonable condition and in lieu of future replacement should be phased out as part of a complete system transition to electric actuators for valves and dampers.

Control panels, sensors, actuators, valves, and dampers appear to be generally in good condition and in working order.

M.18 Control Air compressor

Recommendations:

A major emphasis should be upgrades to the building automation system (BAS) for increased energy efficiency and control. The existing BAS is in good condition, but will require system upgrades or possibly replacement in 5 to 10 years to keep the system modern and properly commissioned. We would encourage immediate upgrades to some of the sequences of operation to improve energy efficiency including:

1. Chilled water pumping optimization and wire-to-water efficiency.
2. Chilled water reset controls.
3. Demand control ventilation (DCV) control for remaining air handling systems (ball room air handling unit).
4. For all single zone VAV air handling systems, provide for discharge temperature reset.
5. Add outside air flow, supply air flow, and return airflow monitoring stations.
6. Network interface cards (NICs) for all VFDs for integration into the BAS.

Along with these upgrades to the building automation system, we recommend the addition of modulating outdoor air dampers and outdoor air measurement stations to major systems such as the bowl air handlers and variable volume air systems. This serves a number of purposes: it assures proper ventilation rates as required by code, even when supply airflow has been turned down; it helps in control of building pressurization; it can save energy by preventing over-ventilation; it may be combined with the existing demand ventilation scheme for increased energy savings. Many of the air handling units are already equipped with this feature.

Maintaining building pressure is critical for a number of reasons: it helps with building indoor air quality by reducing dust and particulates drawn in through doors and gaps in the envelope; it helps with indoor comfort by reducing drafts; it is crucial for humidity control and when making and maintaining the ice sheet.

Further related to the upgrade of the BAS is the addition of an energy measurement component. By installing current sensing relays and tracking run times on critical and larger pieces of equipment, energy usage may be monitored and trended through the BAS. By making this information readily available and trended historically, baselines and goals may be set for operations and maintenance personnel. By the very fact that energy use is being watched, it will raise the awareness of the staff to energy savings and will almost naturally create energy savings. This effect may be even further magnified when coupled with an incentive-based program to further reduce energy use. In the BAS, energy use may be organized by system and by each piece of equipment individually. This will further offer a maintenance tool which will help indicate diminished performance due to bearing failures, loss of refrigerant, clogged strainers, etc. before a catastrophic failure.

Operations and Maintenance

Observations:

Pre-filters in the coliseum's bowl air handlers are cleaned annually, but there is no filter differential pressure monitoring. Therefore, there is no method to verify if additional cleaning would be beneficial for improved fan energy costs and improved air quality. Filters throughout the building are kept on a similar schedule. A performance-based schedule would help maintain filter discipline and increase the life of all units.

The ice chiller room doors appeared to remain typically closed between this room and the primary chiller room. These doors should remain open since the refrigerant leakage exhaust system is in the primary chiller room and the make-up air duct is in the ice chiller room. The refrigerant monitor is also located in the ice chiller room and this device is intended to monitor both rooms. Otherwise, the building systems seem to be well-maintained.

M.19 Ice Chiller Room doors

OTHER GENERAL RECOMMENDATIONS

All improvements listed above where motor replacements are being done should specify premium efficiency motors. With highest efficiency fan and pump motors, the benefits are not only in reduced electric cost in operating equipment, but also in reduced waste heat to space that has to be conditioned. Additionally, we recommend specifying a fan power limitation requirement of FEG (Fan Efficiency Grade) 67 or better, particularly on larger air handling systems.

We highly recommend any work that is done be fully commissioned, and that ongoing commissioning (Cx) services be contracted for at least two years thereafter. Building commissioning typically provides significant savings in operating costs with a short payback period. According to a 2009 study from Lawrence Berkeley National Lab, design and installation (new construction) commissioning provides median whole-building energy savings of 13%, a benefit ratio of 1.1, and a cash-on-cash return of 23%. Ongoing commissioning (existing building commissioning) has shown median whole-building energy savings of 16%, a benefit ratio of 4.5, and a cash-on-cash return of 91%. We recommend the renovations be commissioned during design and installation phases based on new construction commissioning practices, and ongoing commissioning based on existing building commissioning practices. We also recommend that ongoing commissioning (OCx) be implemented post-installation of the renovations.

There would be three phases to the commissioning process: first, design phase commissioning wherein the Cx provider would review the design documents for completeness, intent and adherence to owner requirements; the implementation phase in which the Cx provider would observe the construction process and review the final product for adherence to construction documents; and the ongoing commissioning process, in which the Cx provider would be present to give ongoing training to the Arena operations staff, track the operation of the building systems in all operating modes for consistency with design intent, and identify additional opportunities to improve the Arena operations.

The cost for commissioning depends a great deal on the scope of work, and a more detailed cost estimate can be prepared by SSR or by a third-party Cx provider upon request. For budgeting purposes, assume $125,000 for initial design commissioning and another $50,000 per year for two years.

ELECTRICAL

Site Electrical Distribution

Description:

Electrical service for the facility is provided by a single primary voltage service feed from Knoxville Utility Board (KUB) located inside the main primary electrical room on the event level near the loading dock as shown in photo E.1 and E.2.

Observations:

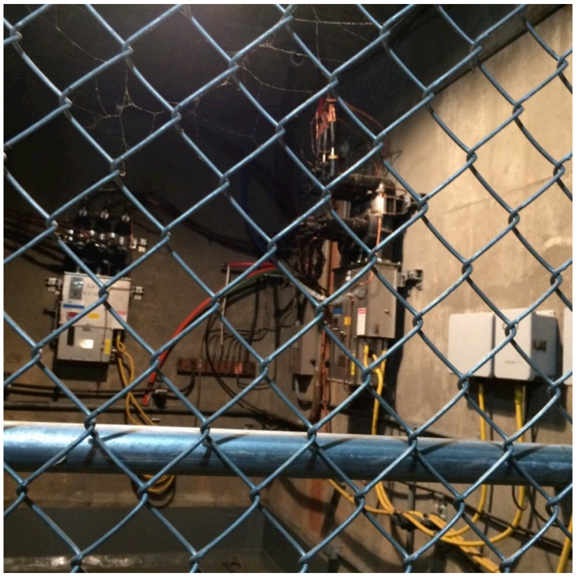
Primary electrical distribution equipment was repaired in the last few years by the local utility (KUB). Regular preventive maintenance of equipment is the responsibility of (KUB).

Recommendations:

- Upon a significant major renovation/addition, modifications to the site electrical distribution system may be required, but at this time the primary distribution is adequate to serve the building's needs during events and shows.

E.1 Electrical Utility Transformers

E.2 Electrical Utility Switches



Normal Electrical Distribution System

Description:

There is a single 3000A, 480/277V switchboard in the main electrical room on the event level. The 3000A switchboard serves the Auditorium and the Coliseum. There are numerous distribution panels and branch circuit panels for lighting and receptacles scattered throughout the facility.

Overcurrent devices in the main switchboard consist of circuit breakers.

Observations:

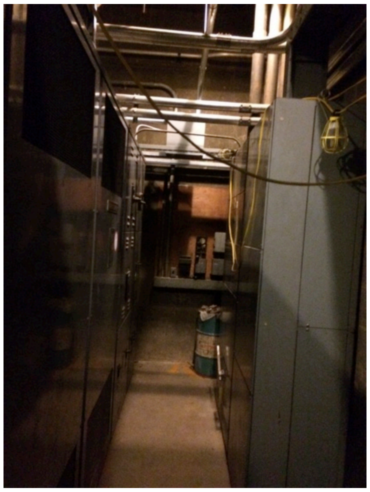
The Main switchboard appears to be in good condition considering its age. There was considerable rust on the rear of the switchboard enclosure due to a previous leak down the wall. An aluminum gutter was mounted to the wall behind the main switchboard to divert any further water leaks. There is inadequate space around the main switchboard to meet the NEC 116.26. If the switchboard failed and needed replacing, it would not be able to go back in its current location without some major modifications of the room and its current space configuration.

Many electrical panel enclosures are showing signs of fatigue after years of use and will need replacing.

Recommendations:

Upon a significant major renovation/addition, replacement of electrical distribution system may be required, but at this time the distribution is adequate to serve the building's needs during events and shows.

E.3 Main Electrical Switchboard (front)



E.4 Main Electrical Switchboard (rear)

E.5 Electrical Panel Showing Considerable Wear.

E.6 Electrical Panel cover not fitting properly and wires exposed.

E.7. Electrical Panel cover not fitting properly.

Show/Truck Power

Description:

There currently is no power in the loading dock area for broadcast trucks and various support trucks.

Show power is separated for the Auditorium and the Coliseum. Auditorium has three disconnect switches for stage power. A 200A, 208Y/120V, 3P with cam-locks and a 800A, 208Y/120V, 3P at stage right upstage and a 400A, 208Y/120V, 3P stage right downstage. This arrangement in the Auditorium has served all events adequately to date per facility personnel. Show power for event level of Coliseum consist of a 200A, 208Y/120V, 3P a 400A, 208Y/120V, 3P and a 600A, 208Y/120V,3P disconnects and is located at south end. The facility personnel stated that additional power is needed at times.

Observations:

Only one show power disconnect had cam-locks installed for easy connection, shown in E.8. The majority of the show power distribution is aged and showing wear.

Recommendations:

- Repair/replace existing show power distribution with new. New distribution should have Cam-locks for all connections typical to an E1016 series.

E.8 200A Show Power with Cam-locks (Auditorium)

E.9 400A Show Power (Auditorium)

E.10 Show Power (Coliseum)

One of our recommendations is not related to capital, but is an ongoing operating expense. Thermal scanning of electrical panels should occur annually (if not already being done) at least until the panels are replaced. Given their age and condition, panel scanning may identify issues before they become full blown failures. A budget of $3,000 per year would be a reasonable amount, with different panels scanned every year for four (4) years. If KCAC were to undertake this work all at once, we suggest a budget of $12,000.00.

Emergency Generation System

E.11 Emergency Generator

Description:

Emergency Power for the venue is provided by one KATOLIGHT 60KW 208/120V, 3P natural gas engine generator installed indoors. The generator serves basic life safety emergency lighting.

Observations:

The emergency generation system was replaced a few years ago and is in good functioning condition.

Recommendations:

Perform a monthly test of the generator using the available building power as load. Force as much load onto the emergency system as practical. Record amps, volts, oil pressure, water temperature, etc. Use NFPA 110 as a guide.

Provide 3’-0” clear working space around generator at all times.

Site Lighting

Description:

The existing site lighting systems consist of the following components:

- Exterior building lighting
- Walkways-Decorative pole with luminaries
- Building flood lights

Observations:

Maintenance personnel indicated that the some of the building lighting is still incandescent

Recommendations:

- Replace incandescent fixtures with new Fluorescent or LED fixtures

E.12 Incandescent Building Lighting

E.13 Building Flood Lighting

Building Lighting Systems

Description:

Lighting in the facility consists of a variety of types. Recessed fluorescent fixtures are used in office spaces. Surface mounted fixtures are installed in utility and storage areas. Lighting in concourses consists of incandescent fixtures with self-ballasted fluorescent lamps. The majority of the lighting is controlled via local switching, except in the Coliseum. The egress lighting for the building consists of various fixtures operated by the standby generator.

Observations:

Most of the fixtures are original to the building. Areas that have been renovated, since the facility opened, have been changed out for more energy efficient options. Linear fluorescent fixtures that have T8 lamps were installed in the office area. There was a lamp replacement project a few years ago that replaced most incandescent lamps with self-ballasted fluorescent lamps. The majority of the lighting appears to be in good condition. It was not observed if there were any areas with a high level of lamps needing to be replaced. Lighting levels in the concourses, lockers, restaurants, offices, suites, bathrooms, electrical and mechanical rooms was generally good.

Recommendations:

- Many areas still remain that would benefit from newer technology fixtures utilizing modern ballasts and lamps and even LED's in some spaces. In general, a complete lighting evaluation for the facility is in order to continue to change the building over to using more LED technology.

E.14 Incandescent lighting with Self Ballasted Fluorescent Lamps (Lobby)

E.15 Incandescent lighting (Coliseum)

E.16 Incandescent lighting with Self Ballasted Fluorescent Lamps (Concourse)

Lighting Control System

Description:

There is no building-wide lighting control system. The Coliseum uses a control console (original to building) utilizing contactors to operate lighting for events.

Observations:

Many labor hours are used in manually turning lighting on and off throughout the facility. This process is often times an inefficient way to save energy.

Recommendations:

Install a lighting control system that is capable of scheduling events and functions throughout the facility, with local area control to be by occupancy sensors.

E.17 Lighting Controls for Coliseum

Sports Lighting Systems in Coliseum

Description:

The Coliseum sports lighting system consists of 1000W metal halide fixtures. The fixtures were retrofitted with shutters for black out scenes.

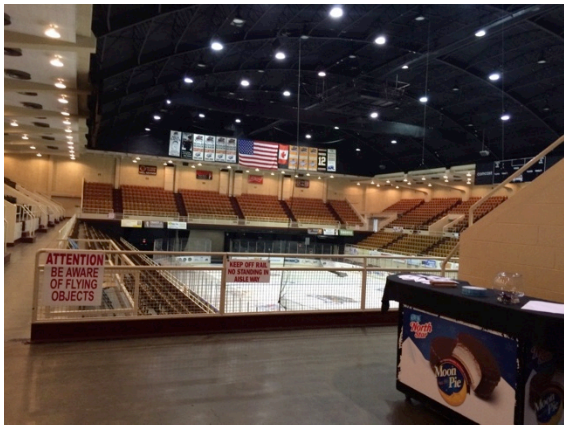
Observations:

The overall condition of the sports lighting system is fair, and the equipment appears to be operating in its current condition.

Recommendations:

Continue to maintain the sports lighting fixtures.

E.18 Sports Lighting for Coliseum



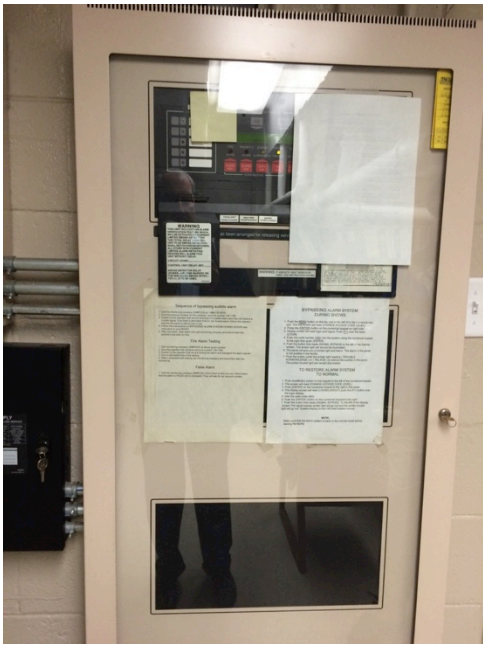
E.19 Sports Lighting for Coliseum

Fire Alarm System

Description:

A distributed fire alarm system is installed throughout the facility. The system is not original to the building and was installed a few years ago. The fire alarm system is a Simplex 4000. According to building operations, the system has had very few issues and is functioning properly. See photo E.20 and E.21.

E.20 Fire Alarm Control Panel



E.20 Fire Alarm Control Panel

Observations:

The fire alarm system appears to be in good working order

Recommendations:

- Continue to maintain fire alarm system as required.

PLUMBING

Domestic Water System

Observations:

Water service consists of a single 4" high pressure water service main with a single pressure reducing valve and reduced pressure backflow preventer located in the dirt crawl space area below level 2. It was installed in 2008 as well as a new 8" fire service main to the facility. The fire service has three entrances from the one fire main supply line into the facility. The original below floor mains located in the arena area ruptured and had to be replaced with new mains to supply the facility. Piping material consists of copper, lined cast iron water main and galvanized steel pipe. Repairs or recent construction areas are all copper pipe material. The system is operational without any leaks noted.

P.1 Piping


12/18/2014

P.2 Piping


12/18/2014

Insulation (original construction)

Insulation in some of the original construction areas possibly contains asbestos. It was reported the system has had some abatement in the past. See P.3 & P.4 below.

P.3 Insulation


12/18/2014

P.4 Insulation

12/18/2014

Waste piping

Waste and vent piping materials vary from modern piping material from galvanized schedule 40 screwed DWV, cast iron lead and oakum pipe joint, to PVC material. No leaks were noted.

P.5 Screwed galvanized waste and vent piping material

P.6 PVC waste piping

P.7 Bell and Spigot cast iron waste piping

Plumbing Fixtures

Plumbing fixtures and trim were changed out for the most part in 2010. The one exception is the freestanding urinals located in the men's rooms. These are cast into the raised floor during the original construction and were not replaced.

Flush valves have been updated in recent time to include piston type throughout the facility, with some normal diaphragm and a few photo eye flush valves intermixed. Most appear to be water saving type and all tested work properly.

Lavatories for the most part contain metering faucets with some photo eye models to conserve water. Showers located in the dressing room lower areas are gang type configured in 4 to 6 showers per room. All fixtures appeared to operate satisfactorily. Newer ADA fixtures are scattered about the facility and work as expected.

The majority of the building domestic hot water is produced by two power gas-fired hot water heaters located in the lower level boiler room. These have a capacity of 703 GPH recovery, each. These heaters were replaced in 2004, and staff reported minimal to no issues with the hot water heaters. The system does contain one hot water recirculating pump and piping from the boiler room area to serve the building. It appeared not to be very effective.

The remaining areas of the building are served by small, localized storage or instant type water heaters and in some areas booster heaters have been provided. These heaters vary in age and condition but are generally operating within expected performance for their style.

P.8a Plumbing fixtures – sinks

P.8b Plumbing fixtures - sinks

P.9 Plumbing fixtures – bathroom stall

P.10 Plumbing fixtures – women's restooms

P.10 Plumbing fixtures – urinals

P.11 Plumbing fixtures – gang showers

P.12 Plumbing fixtures – in floor urinals

P.13 Plumbing fixtures - women's restroom, below level 2

Water Heaters

P.14 Gas water heaters


12/18/2014

P.15 Hot water recirculation pump


12/18/2014

P.16 Electric water heater


12/18/2014

P.17 Booster heater


12/18/2014

P.18 Grease trap in one of the many concession stands


12/18/2014

Recommendations:

The fixtures appear to be in relatively good condition with proper operation. A concern is the floor- mounted urinals are not a good sanitary type fixture, but they do operate normally.

The condition of the galvanized screw waste and vent piping is a concern. Although the piping appears to be good condition outside, it is a known fact this type pipe reduces interior area as time goes on, leading to ongoing service calls or leaks. The galvanized pipe will corrode from the inside causing a reduced internal diameter, which then causes reduced flow issues. Eventually the corrosion will lead to leaks and pipe failure. This piping appears to be the majority of the facility piping. The piping will need to be replaced to maintain operation of the facility for the next 5 to 15 years. It could not be verified if it was installed below the floor slab but observation says it was.

The domestic water heaters are in good condition and sufficient to meet the needs of the facility presently. Equipment replacement should be planned for in the next 6 to 8 years.

The hot water recirculation pumps need to be replaced with a larger capacity pump and the system reset/ balanced to maintain hot water at the fixtures this system serves. It is believed this system only serves the lower level dressing rooms and showers at this time.

The gang showers are in need of renovating into individual compartments for occupants with separate drains for each shower stall. This would require floor removal and re-piping of the waste and vent systems in these areas at a minimum. The shower valves operated as intended.

The original in-floor urinals are in need of replacement with more modern wall hung units with separation barriers for privacy. While currently functional, these urinals are not ADA compliant, and with their age, there is always the concern of unexpected failure.

We recommend an additional reduced pressure backflow preventer be added to the cold water service main in the crawl space for operational standpoint. If the one existing unit fails during an event the facility would be out of water until it is repaired.

FIRE PROTECTION

Observations:

At best, 20% of the facility contains sprinkler coverage. The sprinkler system is limited to the Auditorium stage and lower dressing room areas. The lower boiler room also contains sprinkler coverage. The stairwells on either side the stage/auditorium main entrance do contain fire hose cabinets with fire extinguishers and hoses. This occurs at several levels. This piping was upgraded during the 2008 water main break, or shortly afterwards, and has newer piping serving these existing standpipes. The building does not contain a fire pump. It relies on the street water pressure and fire truck pumper connection at the street to supply the system under a fire condition. Water pressure is very good and in the 125 psi range in the street.

Fire extinguishers and fire department hose connections appear to be properly spaced throughout the facility to meet the requirements of the National Fire Protection Association.

Sprinkler piping, head type, and coverage are sufficient and are generally in compliance with National Fire Protection Association standards and general design practices in the areas where provided.

P.19 Fire Department backflow device and pumper location

P.20 FHC and Extinguisher

Recommendations:

The facility fire protection system is generally in good condition and meets minimal levels of coverage protection at this time.

ROOF

Our understanding is that there is currently an insurance claim with either the installer or manufacturer of the roof due to possible hail damage, and our report does not take into account any circumstances related to this issue. This is a visual inspection and our comments, recommendations and capital expense matrix are based only on what we observed.

The primary roof system of KCAC consists of three areas: the barrel roof, the flat portion of the main roof, and the roof above the fly loft. All roofs are comprised of a rubber membrane, and were installed in 2002. We noted a lack of lightening protection as well as fall protection systems. VSG cannot confirm whether the lack of these systems violates any OSHA or local building codes, however it is a best practice to include them, and during any future renovation we recommend adding these systems.

The barrel portion is approximately 67,500 ft^2 and the flat portion is approximately 29,600 ft^2. Above the fly loft, the roof membrane covers 6,050 ft^2.

Based on the observed level of dirt and grime on the membrane, as well as discussions with building management, there is no formal annual inspection or preventive maintenance being performed on the roof, and the roof has never been cleaned. While the cleaning of the roof is an aesthetic issue, the makeup of the local soil could contain elements that are damaging to the long-term viability of this, or any future roof membrane. While it is not likely there are natural elements that could cause such damage, the potential does exist. At age 12, this roof is approximately halfway through its expected usable life.

For all three roofing systems, an annual inspection by a qualified roofing consultant should be conducted. A licensed professional may spot issues before they create larger problems that can occur from water intrusion, standing water, and the growth of vegetation in gutters and drains.

Main Roof

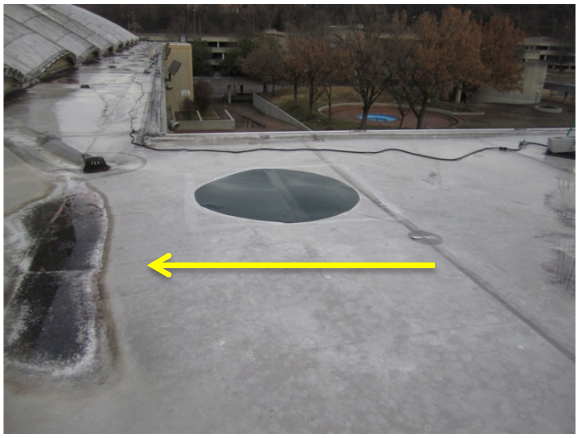
Covering strip that has lost its adherence. We observed a few instances of this condition, and recommend they be refastened.

The roof was observed to be very dirty.

Roof mounted lights should include the use of a safety cable, especially needed since the mounting bracket is showing significant oxidation. Dislodged roof drain cover. All covers should be inspected and remounted.

There is a dip in the roof membrane that may lead to standing water. Covering that has lost its adherence.

One of several instances of standing water (black spot at left). Standing water resulting in discoloration of the membrane.



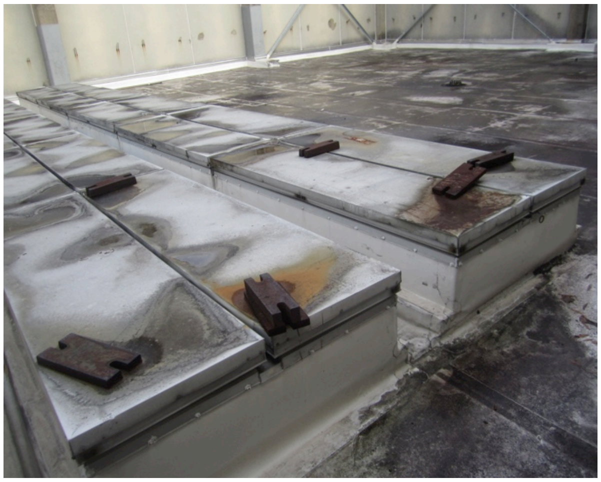
Holiday decoration weighted down with CMU blocks. If this is to be a left in place throughout the year, it should be mounted in a permanent fashion.

Fly Loft Roof

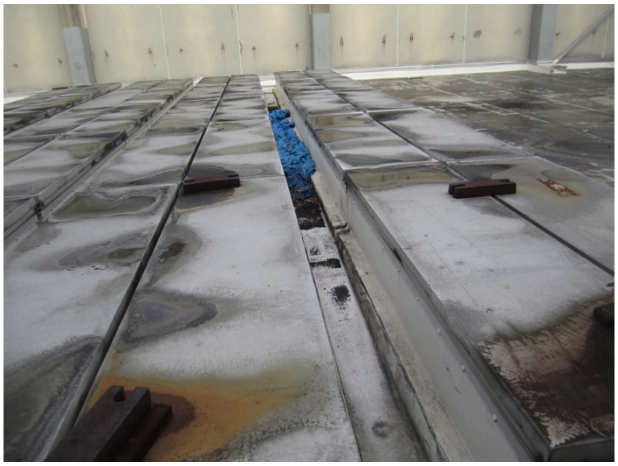
Dirty roofing membrane.

Clogged roof drain with built up organic debris. Standing water over time has resulted in discoloration of membrane.

Weights used to keep exhaust doors from allowing rain penetration. Very dirty membrane surface.



Abandoned blue tarp observed between exhaust vents.



FOODSERVICE

Foodservice for both the Coliseum and Auditorium is provided by Ovations, a nationally recognized foodservice operator. There is not a full kitchen on the property, only a warming/prep area in the Coliseum that has a small convection oven and residential-style stove/oven combo. Catering is typically provided by outside vendors who prepare food offsite and use the spaces in KCAC for warming only. The extent of the foodservice operation in the Auditorium consists of two (2) concession stands (one in main lobby and one in balcony/upper level lobby). These stands do not contain cooking equipment, and serve basic fare such as popcorn, hot dogs, pretzels, and prepackaged items such as chips and candy. For the Coliseum, concessions are served through four (4) permanent stands on the main concourse, an assortment of portables on the main concourse and just inside the seating bowl, and portables that can be placed in the exhibit hall (event level). The bulk of the fare in the Coliseum consist of hot dogs, sausages, popcorn, pizza (1 stand), nachos, pretzels, and some dessert items (1 stand). There is one cooking stand that offers hamburgers, French fries, and chicken; if the other stands were larger, additional ventless cooking equipment could be utilized in the Coliseum.

Our observation is that all the foodservice equipment is in good or very good condition. This would be expected, as we were informed that $300K worth of equipment has been added or replaced over the last 15 years. Kitchen equipment is considered to have a useful life of 7 to 10 years (depending on usage), but it appears much of this equipment has 5-10 years of useful life remaining. Items such as steel shelving and sinks will have a much longer lifespan. Ovations is responsible for maintaining the equipment, even though it is all City-owned. Based on a visual inspection, it appears proper maintenance is occurring.

The most significant shortcomings of the foodservice operation are the lack of a computerized point-of-sale (POS) system, lack of space for additional POS locations (approximately 25 POS locations service a crowd of 6,000 for a ratio of 1:240; ideally the ratio is 1:150, which for KCAC would mean 40 POS locations), lack of proper loading dock and a full service kitchen. With the exception of an available point-of-sale system, these shortcomings are all the result of the physical limitations of KCAC. While the lack of an computerized POS system does not prevent Ovations from fulfilling their obligations, it would provide for greater employee accountability, an ability to track inventory and produce useful data quickly, and minimize human error in conducting cash transactions. A computerized POS system would also allow for credit card acceptance at every location; currently the employee has to leave the register to use what might be one credit card machine for 3-4 point of sale locations.

Auditorium

Main lobby concession stand. Equipment was in very good condition and the stand was clean. The main counter is not ADA height, although there is a portion that is lower (2nd photo) to accommodate wheelchair users.

ADA counter at main lobby concession stand.

Lobby concession stand.

Balcony concession stand. Again, equipment was observed to be in very good condition.

Coliseum

This is the cleaning area in the warming kitchen on event level. The equipment was observed to be in very good condition. Convection oven and residential-style stove/oven combo, in good condition, provide the greatest cooking ability outside of the individual stands.

One of two portables inside the seating bowl. The equipment was in good condition. Typical main concourse concession stand. Rolling doors and stand graphics are in good condition.

Typical condiment stand. These were in very good condition with adequate space for products.
Interior of main concourse concession stand. Equipment was in good condition and area was clean.

Interior of pizza concession stand on main concourse. Equipment was in good condition. Pizza ovens were in good condition.

Signage for the dessert concession stand (permanent stand) on the main concourse.

Freezers were the main equipment in the dessert stand, and they were in good condition. We recommend ramping over the PVC drain that extends across the walkway in order to minimize the trip hazard as well as protect the pipe.

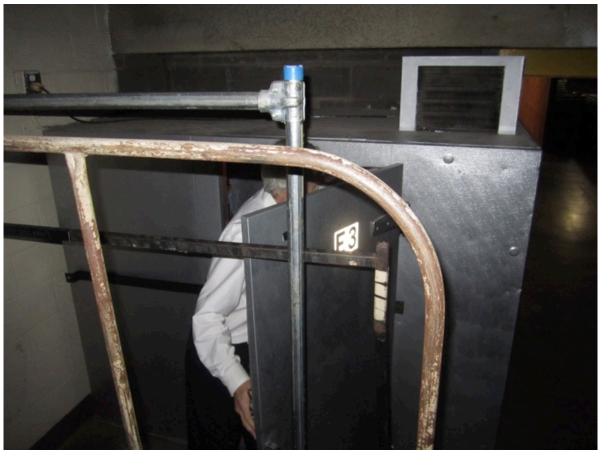
This is the only cooking (fryer and griddle) concession on the property, and it's located in the main hallway outside the Coliseum. This stand has the most appealing graphics. All the equipment observed was in good or very good condition.

Two vent less fryers were in very good condition.

Vent less griddle was in very good condition.

Refrigeration units were in very good condition. Freezer on event level was in good condition.

Walk in cooler on event level was in good condition. A second walk in cooler on event level was in good condition.



TECHNOLOGY

The technology elements included in this review include the exterior marquee, the sounds systems in both the Coliseum and Auditorium, and the scoreboards in the Coliseum. The types of systems present are very common in venues of the size, age and usage of KCAC.

Exterior marquee

The marquee housing appears to be an original structure from 1961, or constructed soon thereafter, but the video portion was installed in the fall of 2014. It measure approximately 4' tall x 21' long, and was installed by Datatronic Control, Inc. (Rowland, TX). The video board is full color with 10 mm pixel spacing. It is of a quality that is typically found in outdoor installations, and was observed to be functional and in excellent condition. While LED video boards can have a wide range of life expectancy, DCI has indicated the performance of this type of board will peak between years 5 and 7. After this time period, there can be a discernable level of brightness, and as with typical electronics, those components can start to fail. Towards the end of the warranty period for this sign we recommend compiling a list of electronic components, and for ones that can be replaced by building staff, maintaining an inventory of spares.

Exterior marquee at corner of
Howard Baker Jr. Blvd. and S Hall of Fame Drive.

Auditorium sound system

The Auditorium sound system was upgraded in 2013 and VSG believes it is adequate for its purpose.

Coliseum Scoreboard

At the base of the roof level along of each long side of the arena there are 7’10” x 10’11”, 20 mm, GalaxyPro displays from Daktronics (including Show Control software), including an adjacent hockey scoreboard system. The boards and scoring system were installed in 2008, and are in very good condition. Since the boards are located along the longs sides of the hockey floor, at the time when they are to be replaced, we recommend the City consider locating new boards on the ends of the Coliseum in order to be more player-friendly. Additionally, since the current video boards are unable to display a live feed from a camera (according to information from the manufacturer), any future replacements should include a consideration to remedy that situation, as the current or future tenant(s) may have a desire for a live feed in order to improve their fan experience.

Coliseum sound system

The PA/sound system in the Coliseum was installed in 2005 and is adequate for permanent seating, but needs upgrading in the lower floor area in order to provide coverage. This is a common problem among smaller municipal buildings, and one that can be rectified at the time when the system needs to be replaced. If the current problem in this area at KCAC is significant enough, it may be worth hiring a sound design firm to develop a solution to address floor coverage.