Building Foundation and Structure

Overview

The construction of the Hall of Waters building began in 1936, and was constructed over the original site of the Siloam and Sulpho-Saline Springs. The original structural engineer of record was Erwin Pfuhl of Kansas City, Missouri.

Following a damaging flood in 1955, an earthen levee was constructed to protect the east and south elevations, while allowing access to the Ground Floor, Loading Docks and surface parking. Most of the north and west elevations of the building are built into the existing higher-ground terrace, and provide accessible ingress/egress to the First Floor. Adjoining the north elevation is the subterranean North Terrace Well Pump Room. A detailed report of this space can be found in Appendix D.

The original building is a reinforced cast-in-place, beam-and-slab (one-way), pan joist framed concrete structure. The lowest slab-on-grade level is the Boiler Room Floor in the northeast section of the Basement Level. The building structure is supported on reinforced concrete columns and walls, that are supported by reinforced concrete piers that appear to be bearing on bedrock at approximately Elevation 52' – 0", local datum.

The building elevated/framed levels with their elevations are as follows, starting with the lowest level:

- Boiler Room Floor Elev. 59' – 8 ½"
- Basement Floor Elev. 65' – 0"
- Ground Floor Elev. 76' – 0"
- Ground Floor Mezzanine Elev. 88' – 0"
- First Floor Elev. 100' – 0"
- Second Floor Elev. 112' – 0"
- Penthouse Floor Elev. 125' – 0"
- Upper Roof Slab Elev. 134' – 7"

Extending beyond the roof structure of the Hall of Waters is the iconic Tower, which is a four-sided, stone and glass covered structure housing the original 38" diameter steel pipe that exhausts the building's boilers and other mechanical equipment. The first landing inside the tower is at Elevation 134' – 8", and the top of the flue discharge is at Elevation 197" – 2".

Interior Structural Conditions

The interior of this 75-year old structure is in need of a number of structural concrete framing repairs which have been outlined in this section. In the Treatment Recommendations, the critical life safety deficiencies have been prioritized and their repair cost estimated.

Most of the structural concrete framing elements are in generally good condition. Moisture infiltration has affected the structure, most of which is confined to the Basement and Ground Floors which is caused by flooding, sub-surface moisture infiltration, chlorides/minerals contamination from pool and spring waters.

There are a number of discrete slab, wall, beam, and soffit repairs required in the Penthouse and Upper Roof Slab spaces, as well as the Tower. During the study, the tower was assessed in a cursory manner due to the on-going bird infestation. It is recommended that during the exterior rehabilitation, the interior of the tower be assessed in greater detail.

Most of the interior structural repairs are somewhat random in location, and in most cases are fairly accessible, except where existing finishes on floors, walls, and ceilings may need to be removed to complete the repairs.

The overview and estimated repair quantities are provided in the structural repairs Cost Estimate section.

Basement/Boiler Room Structural Overview

The Boiler Room Floor is the lowest elevation of the interior space, and houses the original (now abandoned) boilers and support equipment. The slab-on-grade is at Elevation 59' – 8 ½", which is over 16'-0" below the Ground Floor. It is subject to flooding from the nearby Fishing River, and evidence remains of several past major flood events.

Refer to the Civil Engineering Assessment for information on the building's outfall pipes that flow to the Fishing River which have probably contributed to backwater conditions in the building, something that has happened even following the construction of the flood levee. Some concrete cracks and corrosion repairs are needed in the Boiler Room space, and if the boilers and other equipment are removed, then there will be some associated repairs.

The main Basement Floor, also slab-on-grade, is approximately 5' – 6" above the Boiler Room level. This level houses much of the original mechanical, electrical, and plumbing (MEP) equipment that service the building. This space consists of two principal sections, the north is the main portion of the building, while the south section contains the original swimming pool structure. The swimming pool structure is constructed of reinforced concrete, sitting on a slab-on-grade foundation.

A number of interior columns, beams, and soffits have corroded causing the concrete to delaminate. Most of the columns around the pool structure exhibit spalls from corrosion in the bottom few feet of the column (Figure S2), most likely the result of leaking chlorinated water from the swimming pool coupled with the high humidity in the space. Some of the distressed interior columns had been roped off to protect against the possibility of fall hazards from the unsound concrete. The ability of the columns, beams, and slabs to safely carry the existing loading is impacted, so these structural deficiencies should be repaired soon.

Fig. S1 Pool wall haunch damage. (SEA 2012)

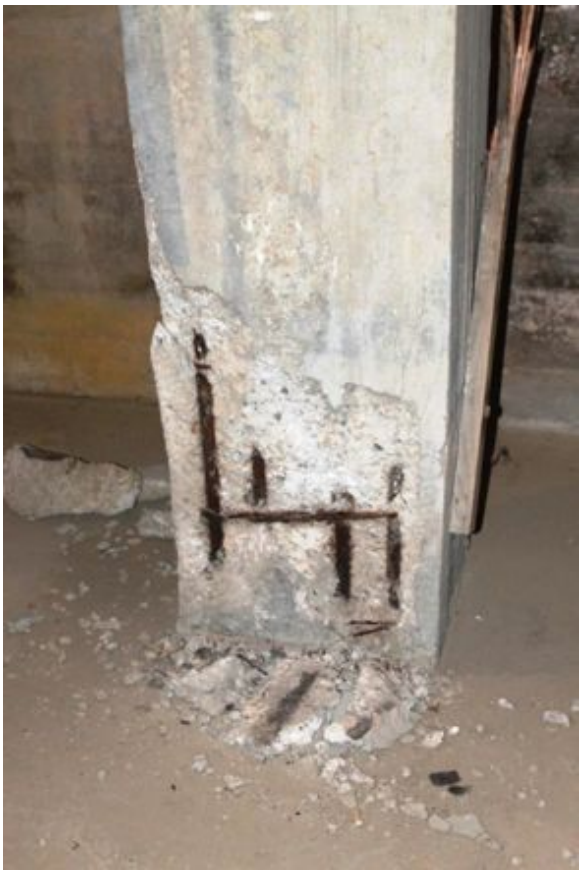

Fig. S2 Corrosion damaged column. (SEA 2012)

In some areas there is evidence of previous vertical wall penetrations (Figure S3), most notably along the west basement foundation wall. Around the penetrations, there are cracks, efflorescence, and evidence of leaks. These should also be addressed during the building restoration project.

Fig. S3 West foundation wall opening repair. (SEA 2012)

Ground Floor Structural Overview

The Ground Floor level is at Elevation 76' – 0", and is an elevated structural concrete slab. The southern portion of the building is occupied by the pool structure. Ingress and egress are provided from the interior pool space to the exterior via doors along the east, south, and west walls. The original interior southeast and southwest stairs from the Ground Floor to the Ground Floor Mezzanine in the Pool Room have been demolished, and the remaining hole is a potential fall hazard from the mezzanine level above.

Above the pool, on the supported First Floor slab, there are some large concrete soffit and beam areas that have moderate to severe delamination. This is an area of significant concern due to the severe delamination of the structural slab and the potential fall hazard as the structure continues to delaminate. In the center of the pool, there is scaffolding which appears to have been used to remove the existing ceiling tile system, thus exposing the underside of the First Floor structure. These conditions and their suggested repairs will be addressed in further detail in the First Floor Overview section.

Most of the supported slab distress through the rest of the floor is due to delaminated joists (small beams) (Figure S4) and pans (slab sections between joists) (Figure S5) which are in need of conventional partial (e.g. some of the pans/slabs) or full-depth repairs. Where some full-depth pan/slab repairs are needed, finish floor materials spaces may need to be removed and replaced.

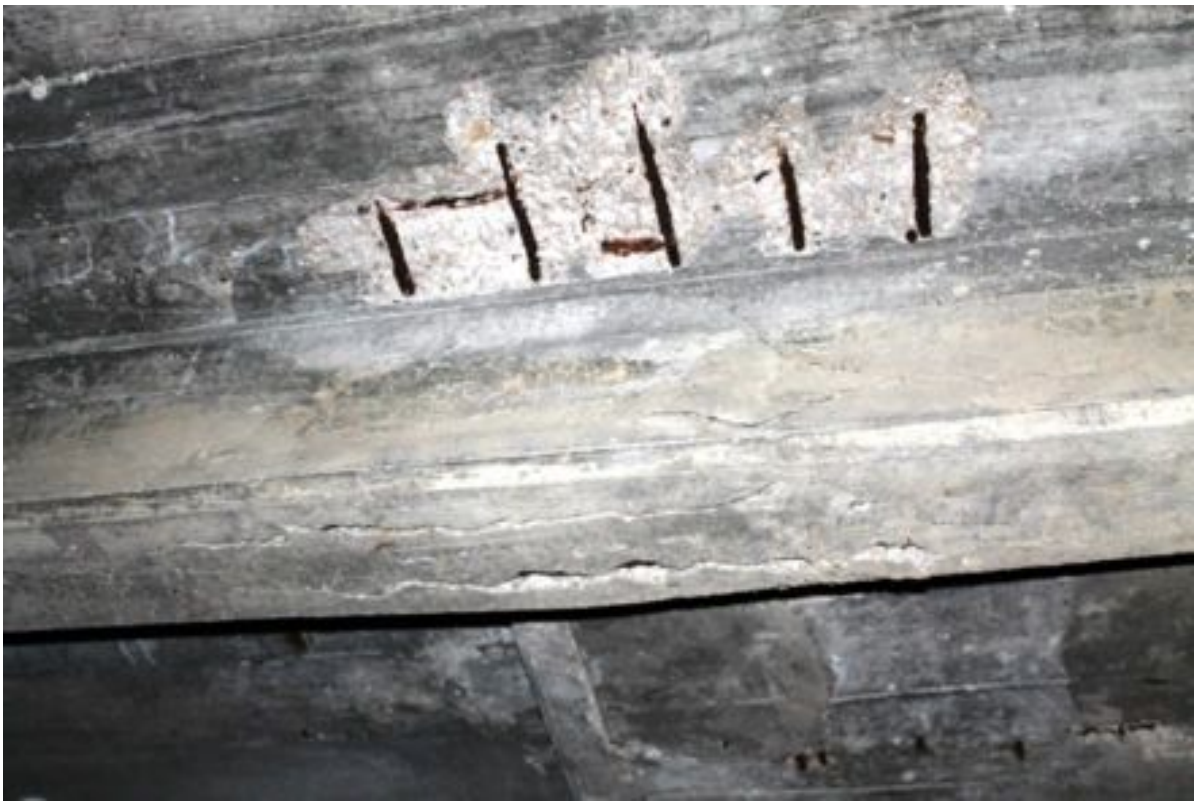

Fig. S4 Delaminated concrete joist. (SEA 2012)

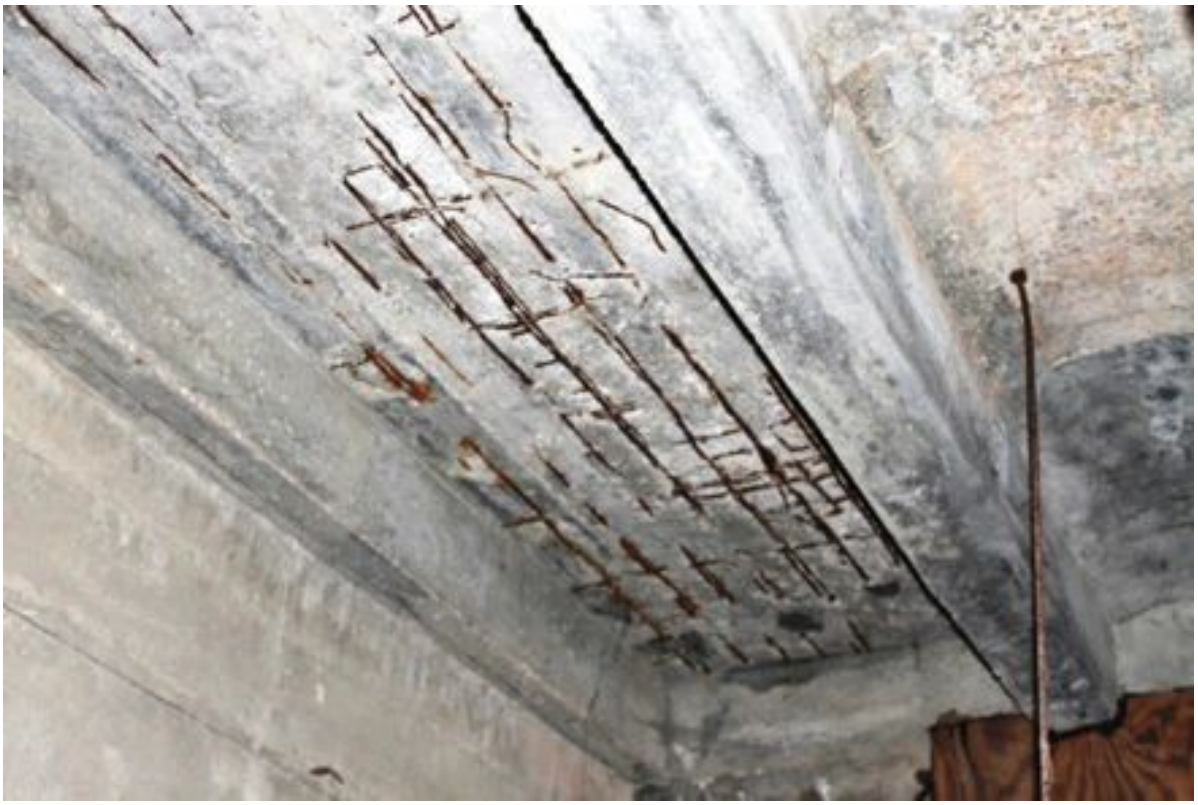

Fig. S5 Distressed pan soffit. (SEA 2012)

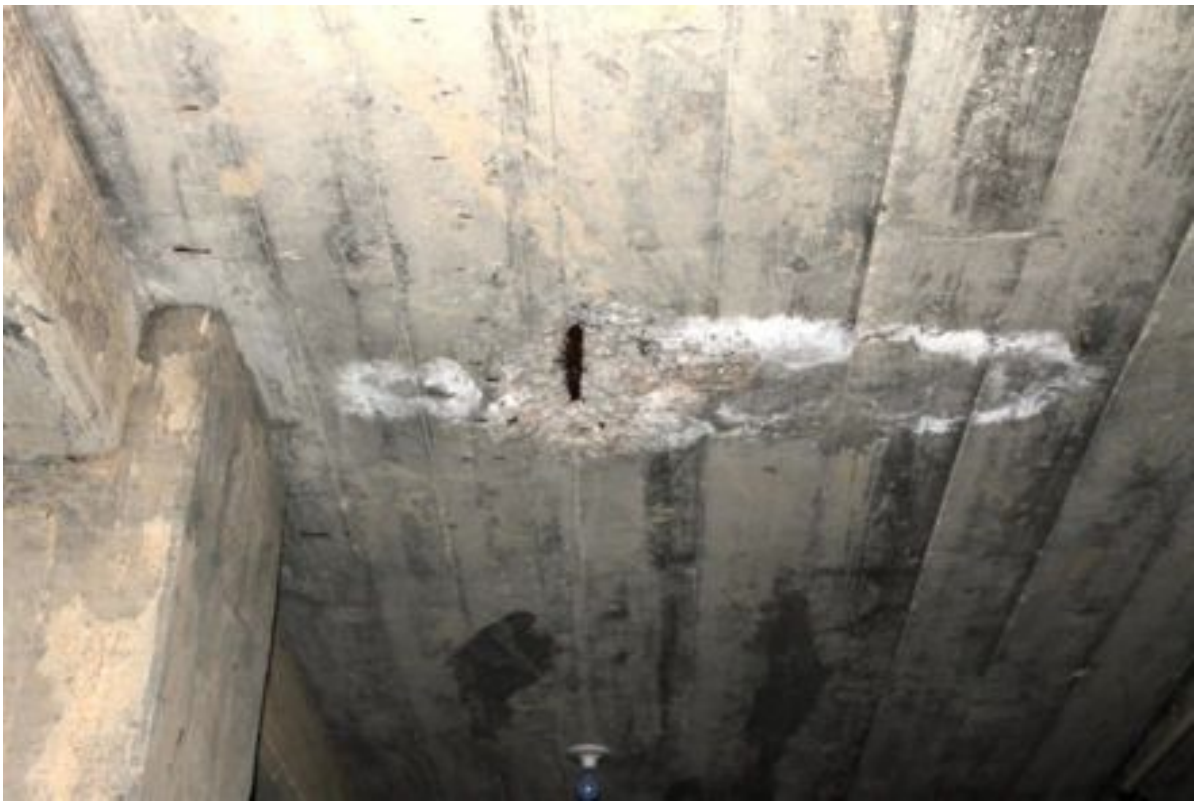

Fig. S6 Leaking Ground Floor Mezzanine slab crack. (SEA 2012)

The Loading Dock area at the northeast corner of the building is in need of a number of structural repairs to the framing elements. There are delaminated columns, beams, and soffits that must be repaired. These areas are covered in more detail within the Exterior Conditions section.

The North Terrace Well Pump Room located beneath the North Terrace lawn, is in very poor condition structurally. Recommendations for future rehabilitation work has been prioritized due to the significance deterioration. A separate study, found in Appendix D, was performed of this area detailing the existing conditions and treatment recommendations.

In general the rest of the Ground Floor structure is in good condition. There are some miscellaneous spalling and cracks below-grade on portions of the north and west exterior walls. In some of the floors, there are cracks that are reflected in the terrazzo and tile finishes. Further investigation is required, as all of the ceilings, walls, and floors could not be assessed at the time of the report.

Fig. S7 Condition of one of the demolished corner stair in the Pool Room. (SEA 2012)

Ground Floor Mezzanine Structural Overview

The Ground Floor Mezzanine level is documented at Elevation 88' – 0", making it approximately 12'– 0" above the Ground Floor, which allows for a balcony around the pool. In general this floor is in relatively good condition. In the floor slab, there are a large number of cracks (Figure S8), most of which appeared to be full-depth in nature. Most of the floor slab cracks occur at column lines, and were probably caused by shrinkage following the original construction. The full-depth slab cracks can be repaired with an epoxy crack injection, while the shallower cracks can be routed and sealed with a urethane joint sealant. These repair techniques can be used throughout the building. In addition to the floor cracks, there are some beams and columns in need of repair.

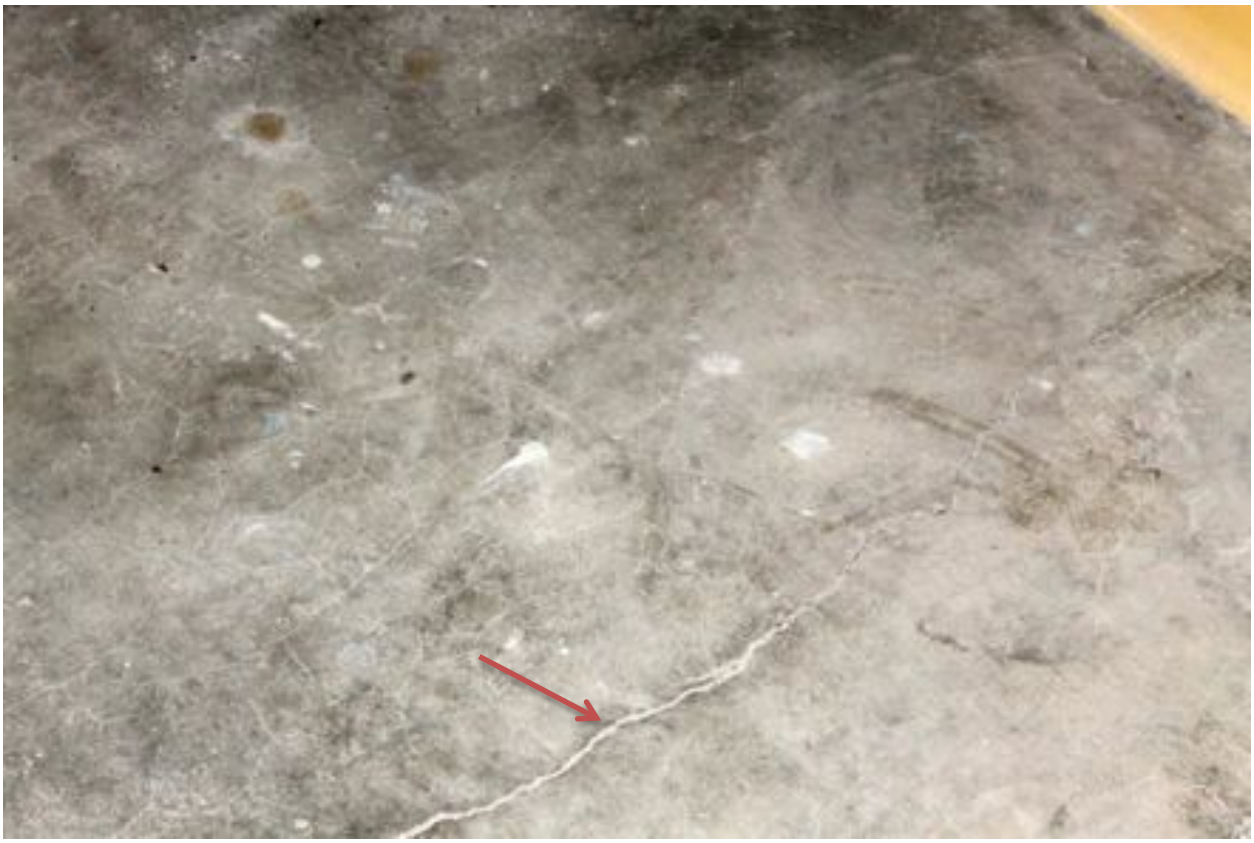

Fig. S8 Typical Ground Floor Mezzanine slab crack (red arrow). (SEA 2012)

First Floor Structural Overview

The First Floor level is the main level, and houses the historic mineral Water Bar and some offices for City Staff. It is depicted on record documents to be at Elevation 100' – 0" (project datum). Most of the structural floors, columns, walls, and ceilings are finished with the original architectural finishes.

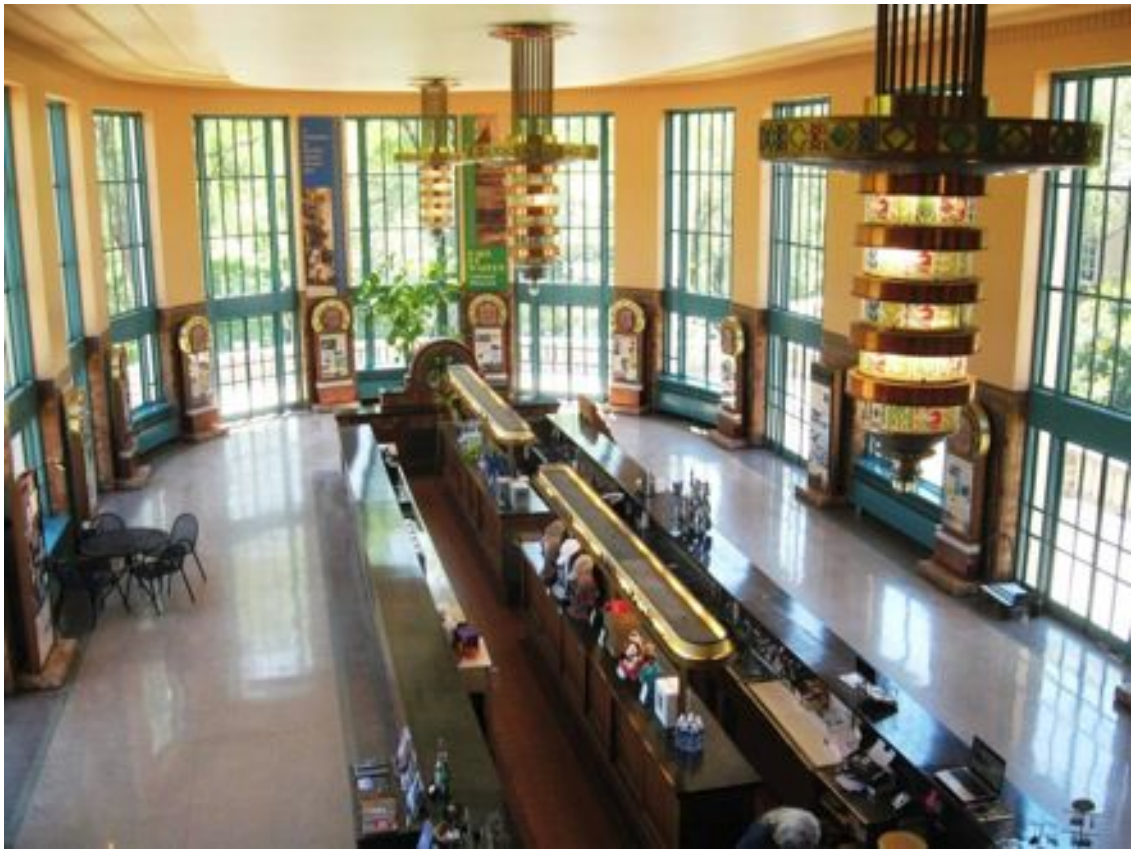

Fig. S9 View looking south in the Hall of Springs. (SEA 2012)

A Critical Repair condition exists, as noted in the Ground Floor Overview section, in the slab and beams under the historical mineral Water Bar in the Hall of Springs. The structural framing for this area consists of a one-way, beam-and-slab type construction. The slabs are approximately 4 ½" to 5" thick, according to the record documents. There are three bays in particular that exhibit moderate to severe corrosion delamination. Although an estimate has been made on the degree of delamination, further investigation is needed to determine the extent of the damage. .

Most of the slab delamination (Figure S11 and S12) appear to require full-depth repairs, while the adjacent, distressed beams (Figure S13) will only require partial-depth repairs. During the repairs, it may be necessary to partially dismantle sections of the historical mineral Water Bar and remove the abandoned piping drains and other sources of leaks, which have contributed to the corrosion process and slab degradation. These issues are critical, life-safety concerns, and their repair should be prioritized.

In addition, there is light corrosion damage and a water infiltration issues at the Pool Room patio doors. There are also some miscellaneous, non-structural cracks in the terrazzo flooring, and water infiltration at several locations through deteriorated windows and louvers.

Fig. S10 View of concrete slab and beams below First Floor Water Bar in the Hall of Springs. (SRJA 2012)

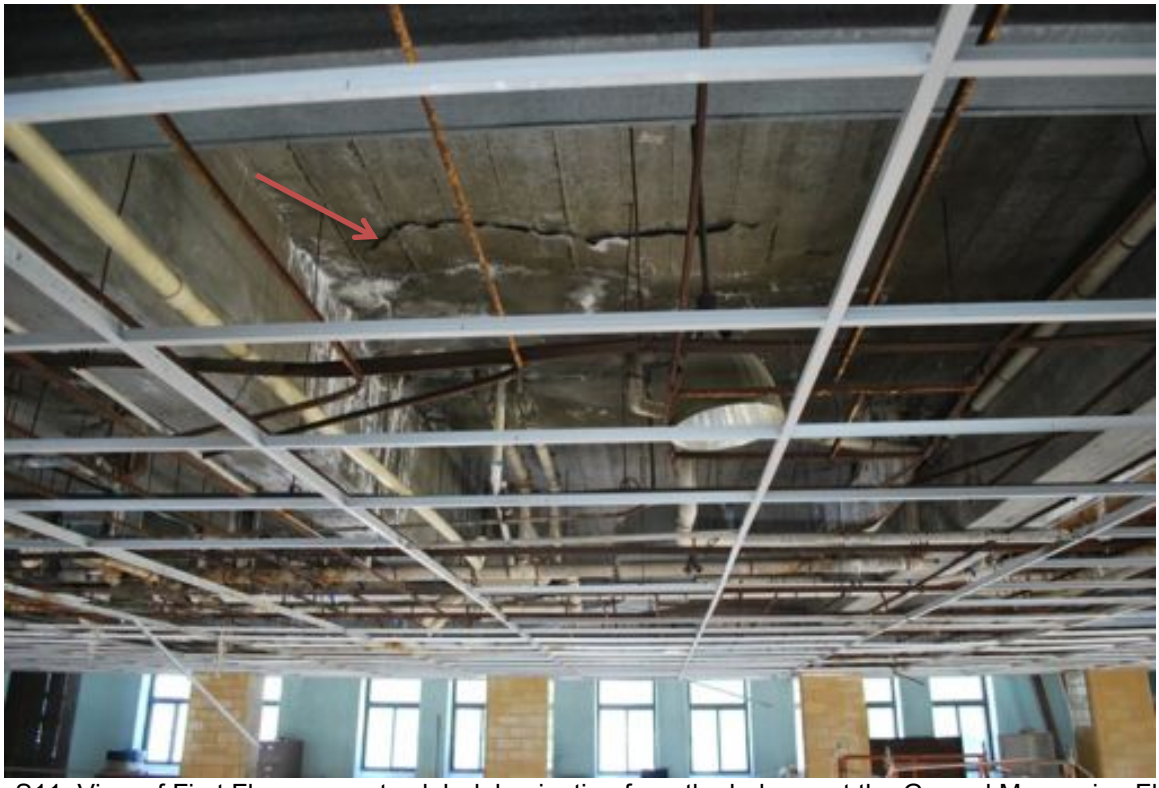

Fig. S11 View of First Floor concrete slab delamination from the balcony at the Ground Mezzanine Floor level. (SRJA 2012)

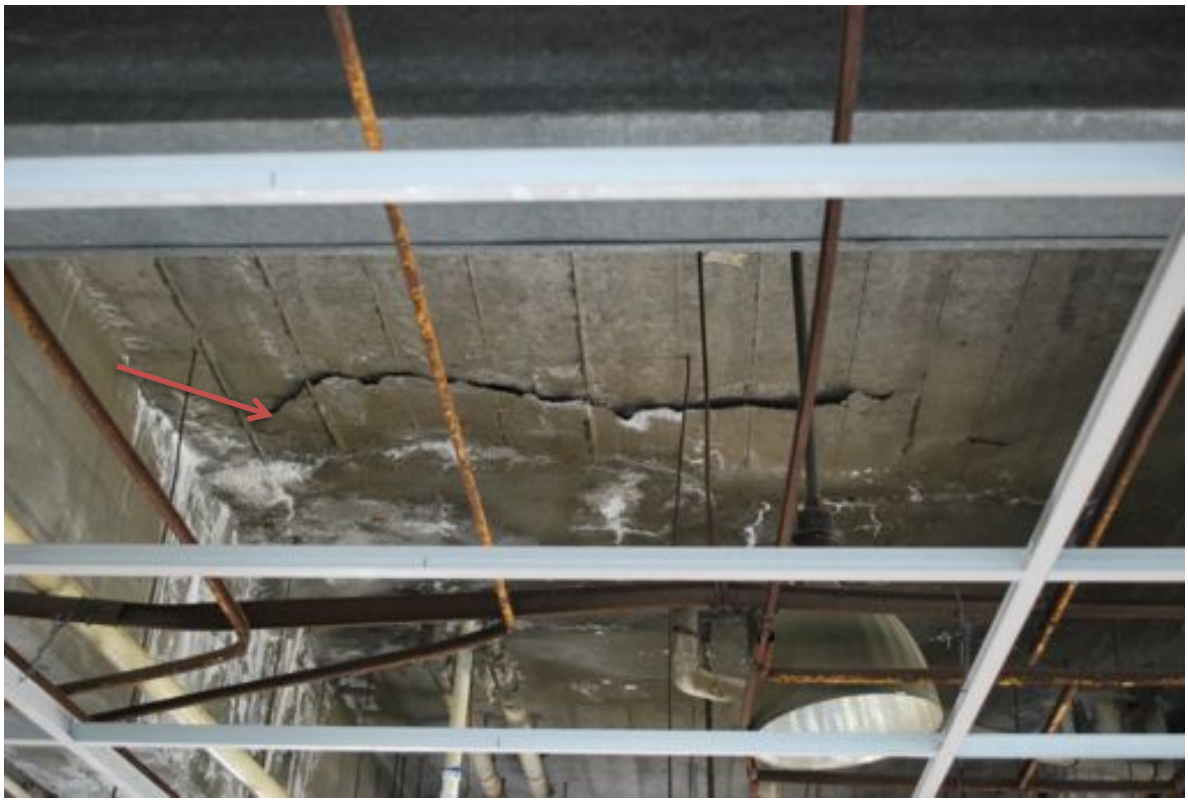

Fig. S12 Detail view of concrete delamination on the First Floor slab. (SRJA 2012)

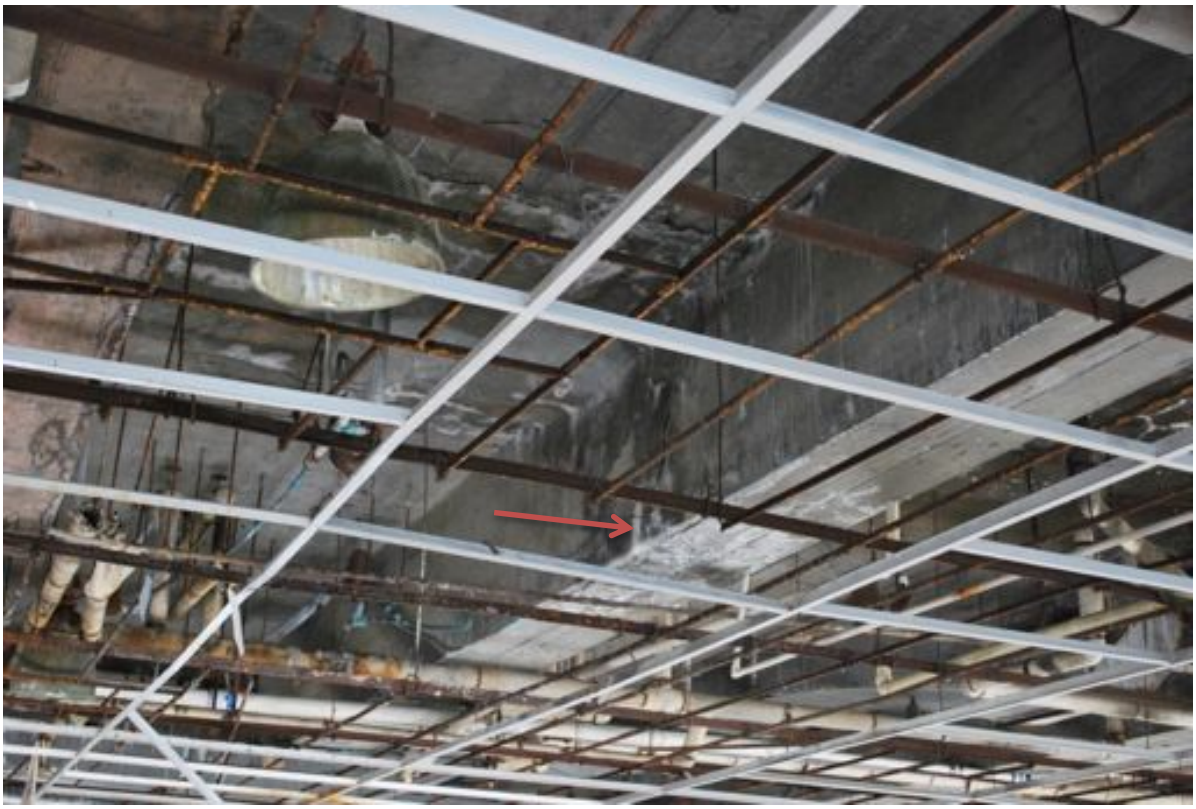

Fig. S13 Distressed concrete beam from the First Floor structure. Note the mineral water leak stains and cracks in concrete (red arrow). (SRJA 2012)

Second Floor Structural Overview

The Second Floor occupies the northern portion of the building, and is at Elevation 112' – 0". This floor houses the County Courtroom and City Council Chamber. Between the two spaces, there is a Gallery that overlooks the First Floor Entrance Foyer and Hall of Springs. Along the north and east exterior walls there are some stains caused by leaks in the windows and ceiling. Previous roof penetrations may have also contributed to these leaks. In addition several of the windows are inoperable. Of what that be seen at the time of the report, the rest of the structural framing elements appear to be in good condition.

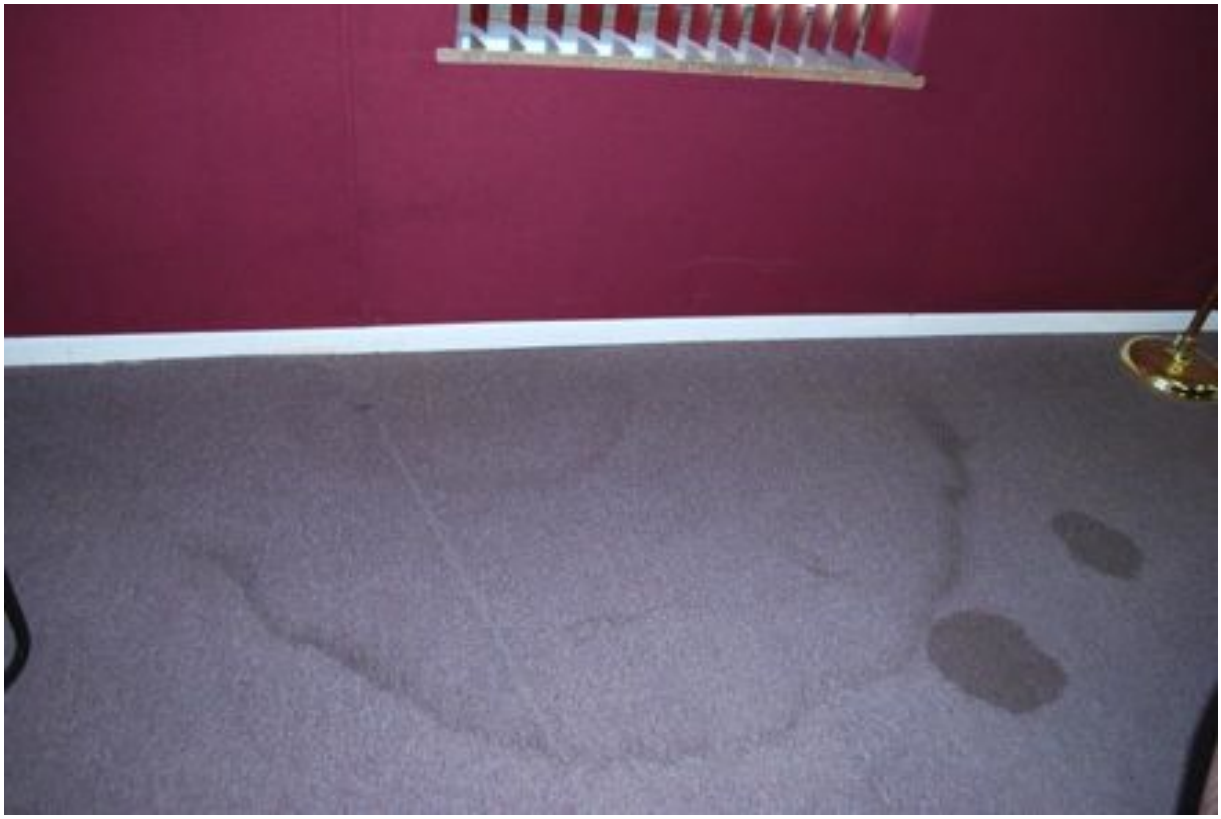

Fig. S14 Leaks in Council Chambers. (SRJA 2012)

Penthouse Floor Structural Overview
The Penthouse Floor is at Elevation 125' – 0", and houses the MEP equipment, including the existing elevator equipment (Figure S15), fire controls, air handling units, etc. Of what that is visible, there are several concrete slab repairs needed, mostly consisting of partial depth and crack injection repairs.

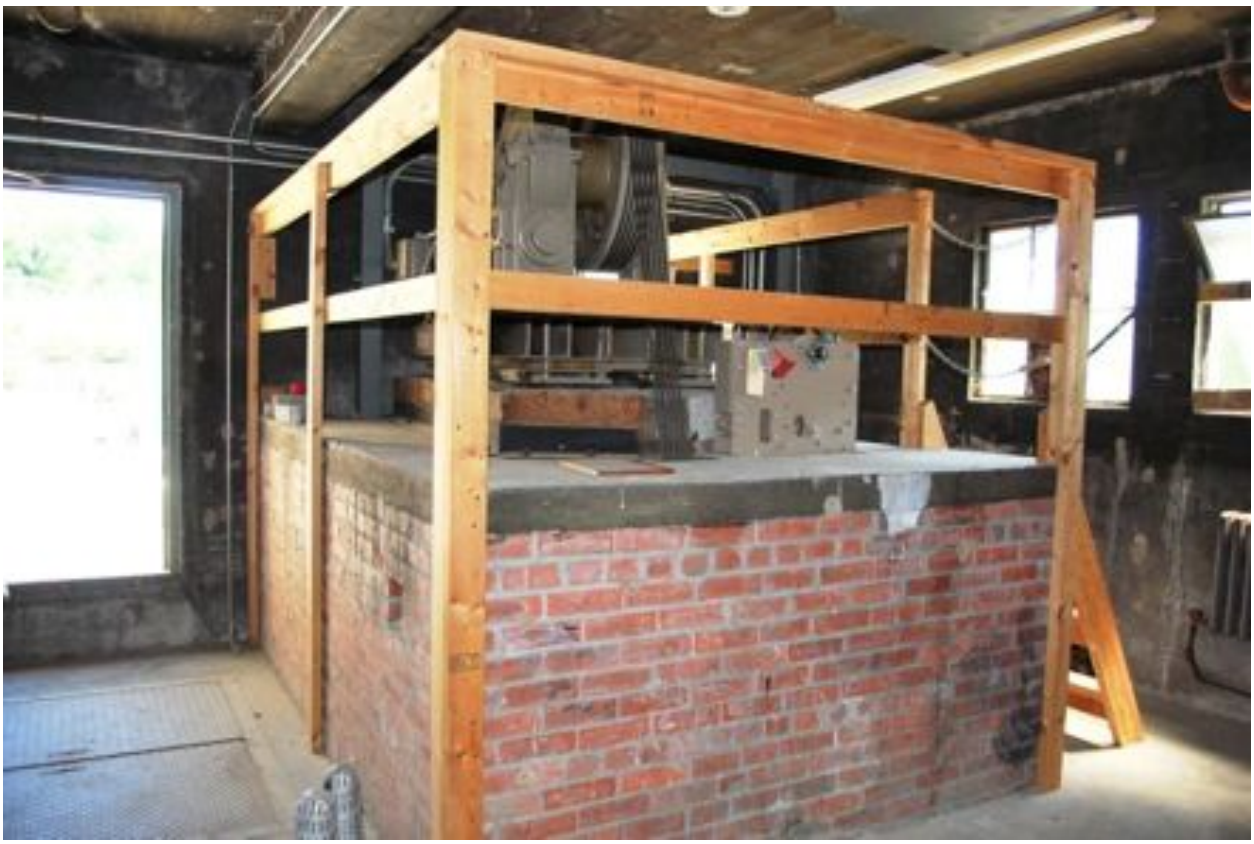

Fig. S15 View of elevator equipment and roof access door. (SEA 2012)

The existing 38" diameter steel flue pipe (Figure S16) penetrates the Penthouse floor then goes up into the Tower where it discharges at approximately Elevation 197'– 2". The Tower can be access by a narrow steel ladder in the southeast corner of the Penthouse.

The Tower façade (refer to Exterior Assessment section) has been damaged over time by hail, vandalism, wind, and general degradation. These issues have created holes that allow pigeons to enter into the tower, and deposit their droppings throughout the interior. Pigeon droppings are odorous, as well as very caustic, as they contain high percentages of nitrogen which when combined with moisture can aggressively attack concrete and structural steel. At the time of assessment, the amount of pigeon droppings made safe access beyond the Penthouse Floor problematic and thus the Tower's interior concrete structure was only reviewed in a cursory manner.

It is recommended that a future structural assessment and possibly forensics testing be done of the Tower's structural materials. Additionally, the existing steel flue pipe should be investigated for possible leaks and degradation if it is to remain, as it could cause the concrete and mortar contamination from the carbonation process.

Fig. S16 Penthouse floor access to the Tower. (SEA 2012)

Fig. S17 View up from bottom of the Tower access ladder. (SEA 2012)