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November 18, 2009

Kevin Wilson
U.S. Office of Special Counsel
1730 M Street, N.W., Suite 300
Washington, D. C. 20036-4505

Dear Kevin,

Thank you for time and effort you have put forth with the allegations I have made over mold and moisture problems and the associated health issues at Detroit Metro Airport. I would also like to thank you for the extensions to properly address these issues.

The Statement of Work, June 12, 2008, was included in tab 20 of Volume 2 from OSC and the Project Review Tracking, August 8, 2008, was included in tab 8 of Volume 2 from OSC. I will comment on the trip report due to recent findings.

The June 12, 2008 DTW Trip Report has fallacies. It is stated that no visible trace of standing water or further leaking from the precast joints. Building Science Consulting conducted a building enclosure investigation (Attachment 1) that generated an October 26, 2009 report. The investigations reports numerous issues with the precast panels and joints and are noted on pages 7, 9, 10, 11, 14, 18, 20, 22, 24 with associated pictures. Pages 15 and 18 have detailed diagrams covering water infiltration issues associated with the panels as well as other areas.

The trip report also states that there was absolutely no trace of moisture behind the plywood access panel in the old NATCA office. Page 10 of the building enclosure investigation contradicts this statement as well. The Building Science Consulting report also reports numerous other water/moisture issues with the building.

The inspector even states that the old tower storage areas were warm and stagnant. A stagnant odor is usually from standing water or without flow. With all the lack of visible water and yet the report of a stagnant odor, the inspector should have delved deeper into the investigation, but he chose not to.

The trip report goes onto state that since the upgrade project last year, no complaints or major problems. On page 4 of the BBJ Environmental Solutions report (Attachment 2) states that during the 2006 upgrade, additional unit heaters (hot water) were installed from Level 3 through 10. It appears that the intension was to control room condensation/mold problems by keeping rooms warmer. Actually this action probably produced a result opposite that desired (see discussion following). The discussion is continued on page 6 and further states that the temperature conditions in the Tower shaft lead to a high risk of moisture condensation on surfaces and this was made worse during the 2006 project by the addition of more unit heaters.

Topic 1

I find the Agency's response to be weak and not indicative of what took place during the roof project, mold inspection and the remediation plan set from the inspections. We were not even notified of the impending remediation projects and were not involved in drafting the scopes of work. Our concerns with employee health and the manner in which the roof replacement was being handled were not addressed and at times not even answered. Not one of our health concerns were addressed during the May, June or December 2008 inspections. This is far from collaborative. During the December 2008 inspection there was 11 CA1's filed. On page 12 of the Building Science Consulting (Attachment 1) report it states just how poorly the roof project was done with pictures on page 13. Page 29 states that the roof must be replaced.

These collaborative events that the Agency keeps referring to were not as collaborative as they appear. The January 2009 meeting was called only after I contacted my union president and voiced opposition on how the December 2008 invasive was being conducted. One of the attendees from the January 2009 meeting that was not listed was an aide from Congressman Dingell's office. Congressman Dingell's aide is the one who strongly suggested that a health employee survey be conducted.

The health survey being conducted by the Detroit Tower Integrated Mold Team as described in Topic 1, Health Survey is accurate on how the survey will be conducted. We are pleased with the comprehensiveness and approach of the survey. Unfortunately I was not given a copy of the survey until the Agency had it for weeks. Numerous times I requested a copy of the survey for review and it was not until I threatened congressional intervention that I received it. We should have received a copy of the survey at the same time the Agency did. We do not have any issues with the questions, but had a few concerns over anonymity. These were addressed satisfactorily. Facility employees still have concerns over the Agency interfering with the process and using the information to harass or retaliate. Given facility management conduct, I understand their concern.

The Agency has been given addresses of retirees, transferees and contractors on at least two occasions and there still seems to be confusion over what contact information was sent to whom. There was also confusion over which facility contractors would receive the survey as well. Discussions had determined employee participation to include current, retired and transferred employees and contractors. Local management seemed to have a grip on it, but Carol McCrarey of Labor Relations seemed to have forgotten about at least one of the facility contractors. This puzzles me given the fact that I was told by local management that the contact information was sent out for all the facility contractors. Setting up the survey process began in July 2009, along with other aspects of the project, and these games are only delaying the survey. To date, the survey has not been conducted. Two statements by Michael J. Rapuano of Parsons and Jamie Greene of the

FAA say it all. Mr. Greene stated at one of the kick off meetings that the FAA does not want to do the survey because they believe the controllers are going to lie because the controllers have a grudge against the FAA. Mr. Rapuano asked me if I wanted to still do the survey because it has been a stick in everyone's side. The handling of the survey does not sound too collaborative to me.

Although the project is moving forward, it must be noted that these positive steps should not over shadow the fact that the Agency was derelict in their duty up to this point. This topic response is covered in more detail in my response to OSC in July 21, 2009.

Topic 2

This is more of the same idiotic nonsense the DOT and Agency has offered as to why a health survey should not be conducted. They believe the "how the mold is not making people sick due to levels", the source of the problem is unknown, their investigation did not establish a direct link between the mold at the facility and employee health and then and that there are not standards for indoor mold levels. DOT's rationale for conducting or not a health employee survey and mold counts and employee health was also covered in the July 21, 2009 response to OSC.

The point for not doing a health survey is not moot from the stand point of the DOT's attitude and explanation for not doing one. DOT should be held accountable for not conducting a survey along with the other improprieties surrounding their investigation.

The "elevator shaft is not a conduit" comment is addressed in the BBJ Environmental Solutions (Attachment 2) report. Pages 2, 5, 7 and 9 of the report explain the stack/chimney effect of not only the shaft, but other areas of the facility that affect the cab. The report covers in great detail how the poor pressure, air flow and other HVAC issues are impacting the facility. This is why an HVAC engineer should have been hired to evaluate the facility from the start instead of the Agency's CIH making the determinations.

Topic 3

Given the information in the BBJ Environmental Solutions and Building Science Consulting reports, it is clear that the three inspections by DOT and the Agency were inadequate, deficient and incompetently performed. The DOT is trying to use current activities to muddle the issues and divert attention from their inadequacies and deceit in earlier activities. If the Agency and DOT would have conducted proper inspections by qualified individuals these problems would been identified early on and corrected sooner.

The cancelled remediation projects were just more of the same mistakes made by DOT and the Agency in earlier projects. All of the issues that were identified in the BBJ

Environmental Solutions and Building Science Consulting reports show just how inadequate, incompetent and deficient the Agency's and DOT's inspections were.

The November 10, 2009 memorandum (Attachment 3) is more support that past activities were continually conducted improperly. The memorandum discusses some of the issues from BBJ Environmental Solutions and Building Science Consulting reports, but is being conveyed from the Agency. The memorandum discusses contaminates in the tower, work performed made a situation worse and other issues with building condition and safety.

Again, all of these problems would have been identified if the Agency and DOT would have conducted proper inspections and evaluations and conducted themselves in a sympathetic, compassionate and collaborative manner from day one.

The people within the Agency and DOT who are responsible for these condemnable and reprehensible acts should be held accountable for their conduct. They should not nor every again be responsible for the health, safety and welfare of building occupants at any capacity.

I know this has been and is going to continue to be a daunting task, but I would like to thank you again for the time and effort that you have and will be putting forth. I look forward to working with you in bringing this issue to closure.

Sincerely,

Vincent M. Sugent

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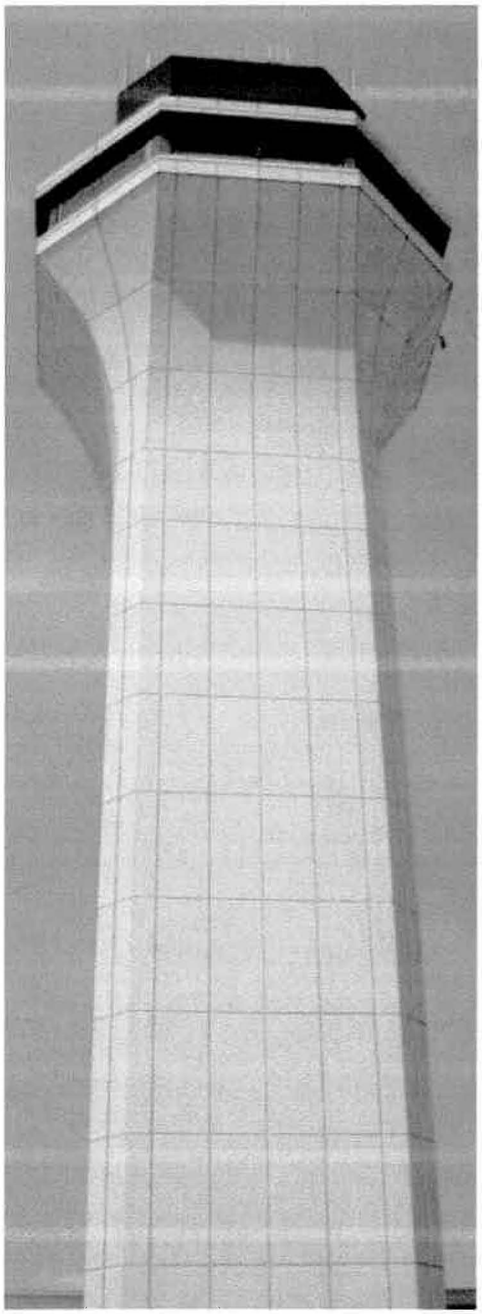
BUILDING SCIENCE CONSULTING

BUILDING ENCLOSURE INVESTIGATION: DETROIT AIR TRAFFIC CONTROL TOWER



2009.10.26

Prepared For:
Parsons – Technical Center
Michael J Rapuano

Prepared By:
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Philip Kerrigan Jr., P.E.

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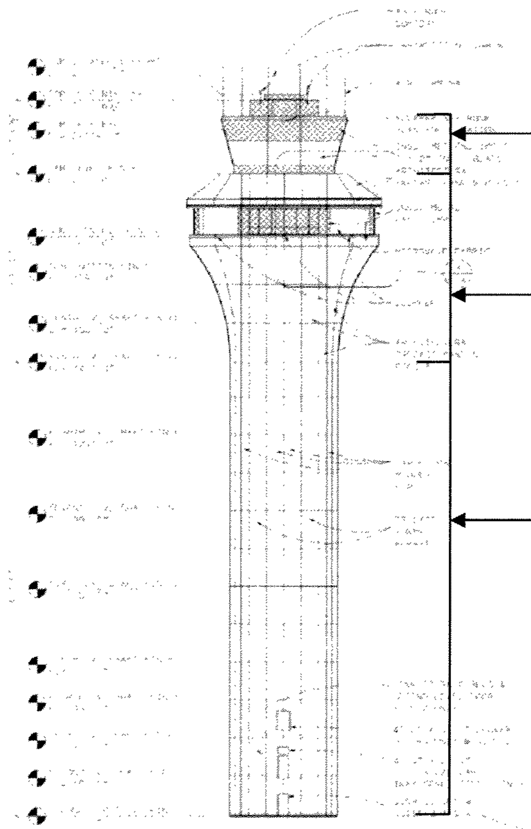
Introduction

Building Science Corporation was retained as part of an "Integrated Team" to investigate water intrusion and condensation concerns of the Air Traffic Control Tower and associated Base Building at the Detroit International Airport in Detroit MI. The review and investigation consisted of the following.

1. Discussion with the client group regarding the history of observed moisture related events.
2. Review of architectural drawings.
3. Review of structural drawings.
4. Preliminary Field Review (2009-07-23/24 – Joseph W. Lstiburek)
5. Field Investigation (2009-08-25/26 – Joseph W. Lstiburek, Peter D. Baker, Philip Kerrigan, Jr.)
6. Field Investigation (2009-08-31 – Peter D. Baker)
7. Field Investigation (2009-09-18 - Joseph W. Lstiburek, Peter D. Baker, Philip Kerrigan, Jr.)
8. Field Investigation (2009-10-09 – Peter D. Baker)

Building Description

The tower construction can be separated into three unique sections based on structural design. The cab and penthouse at the top is constructed with a steel structure and is clad with sloped glass curtainwall and insulated metal panels. Cable access level through level 9 are constructed with a steel structure and are clad with precast concrete cladding panels (with the exception of the Junction level which is clad with insulated metal panels). Below level 9 the tower the building is constructed as a form cast concrete structure. The method of construction used a combination of precast structural elements and precast exterior formwork with cast in place concrete panels in between the precast elements (The cast in place sections are used to tie the structure together). The structure also acts as the exterior enclosure.



Cab and penthouse levels – steel structure with sloped glass curtainwall and insulated metal panel cladding.

Cable access through level 9 – steel structure with exterior concrete precast panels

Level 8 and lower – form cast concrete structure using precast panels in combination with exterior precast formwork for the cast in place sections.

Figure 1: Tower elevation

Observations

The tower was investigated to examine signs of liquid rain water intrusion through the enclosure elements as well as locations of condensation accumulation within the exterior enclosure elements. Based on the results of the first field investigation several other site visits were scheduled to examine conditions in areas that were not readily accessible and to conduct some intrusive disassembly of enclosure components in order to verify construction. In addition the roof of the base building was reviewed.

The following areas were accessed and reviewed:

1. Penthouse (including investigation opening into parapet construction)
2. Cab
3. Cable Access (including interstitial space between gypsum and precast)
4. Junction (including investigation opening of insulated metal panels at the microwave balconies)
5. Sub Junction (including interstitial space between gypsum and precast)
6. Level 10 (including interstitial space between gypsum and precast)
7. Level 9 (including interstitial space between gypsum and precast)
8. Level 8 through 1
9. Elevator shaft
10. Base building roof

Penthouse

At the time of the investigation no moisture related concerns were visible in the penthouse.

Reports from staff indicated problems of condensation on the radar access hatch.

The ceiling of the penthouse has been retrofit with a layer of closed cell spray foam installed to the underside of the metal deck. It was reported to BSC that this retrofit was completed in order to address problems of condensation that had been noted on the underside of the roof assembly. The closed cell spray foam extends out to the interior face of the exterior drywall installed on the interior side of the metal stud wall at the perimeter of the penthouse.

Figure 2: Radar access hatch

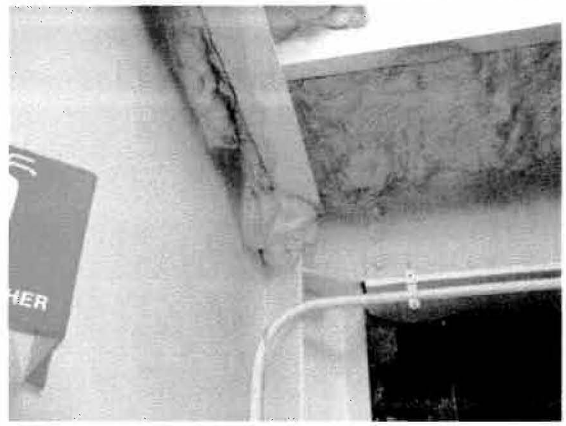


Figure 3: closed cell spray foam on underside of penthouse roof

CAB

Water stains and drips were noted on the interior face of the exterior metal cladding panel in drop ceiling area of the CAB. The water stains appear to be originating in the parapet construction of the exterior penthouse catwalk above the CAB.

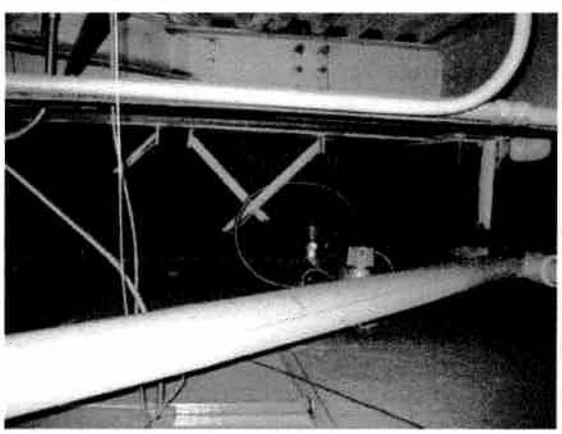


Figure 4: Dropped ceiling plenum above the CAB

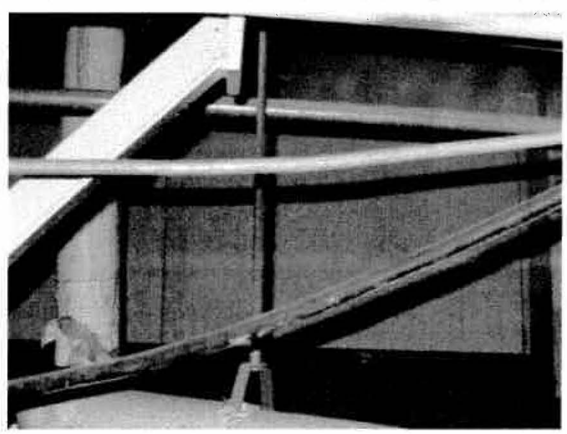


Figure 5: Water staining on exterior insulated metal panels (visible at the dropped ceiling)

Cable Access

The main area of Cable Access level did not have any obvious signs of water intrusion or condensation and accumulation.

The interstitial space between the drywall and precast concrete was accessed via an access door. Signs of water dripping were noted on the floor of the concrete slab in a regular pattern along the perimeter of the interstitial space. The location of the water dripping correlated with the bend in the exterior precast panel above. The space was used to house a supply duct for the CAB above. The duct entered into the interstitial space and wrapped approximately ½ of the length of the space.

Water staining and deterioration were also noted on the insulated drywall partition that separates the interstitial space from the main conditioned space.

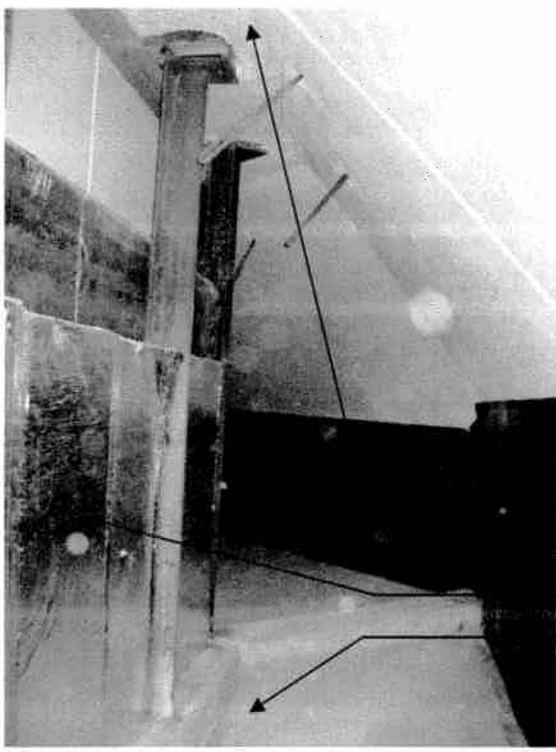


Figure 6: Interstitial space on Cable Access Level

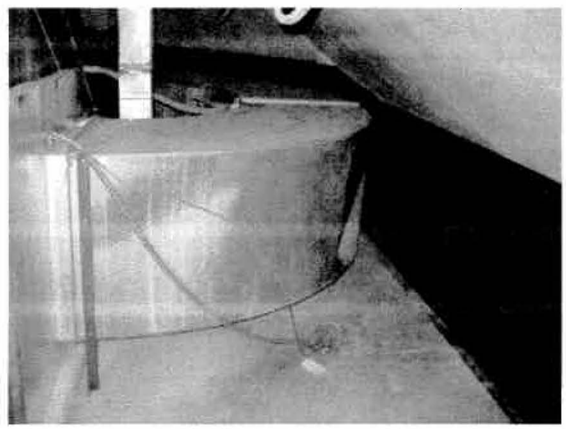


Figure 7: Supply duct located in interstitial space

Junction

The exterior catwalks and microwave balconies are designed to be exterior of the primary enclosure separation. While the microwave balconies are shielded from the elements they would be considered to be exterior spaces. Two of the microwave balconies are used for air intake for the mechanical ventilation system. The air enters the balcony through louvered doors and then passes to the intake plenum through large metal floor grates. A gutter system is installed in front of the metal grate to intercept any rainwater. The gutter does not continue around the perimeter of the grate.

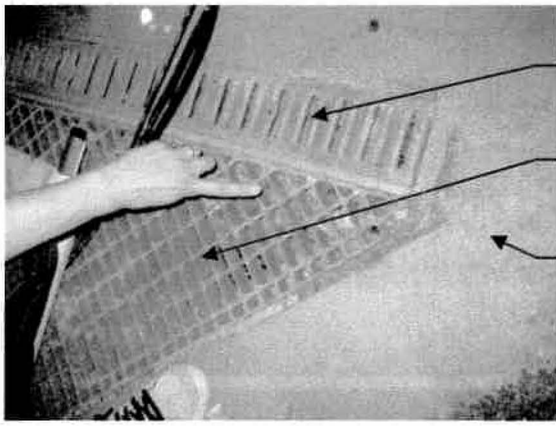


Figure 8: Air intake grate at microwave balcony

Water staining was also noted at insulated metal panel joints (and penetrations) and at soffit locations on the Junction level.

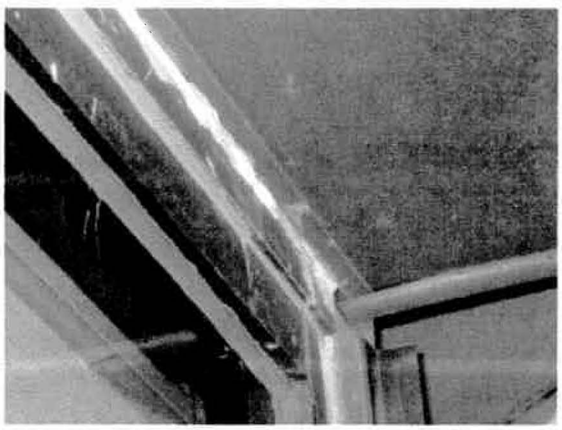


Figure 9: Condensation due to air exfiltration at exterior soffit

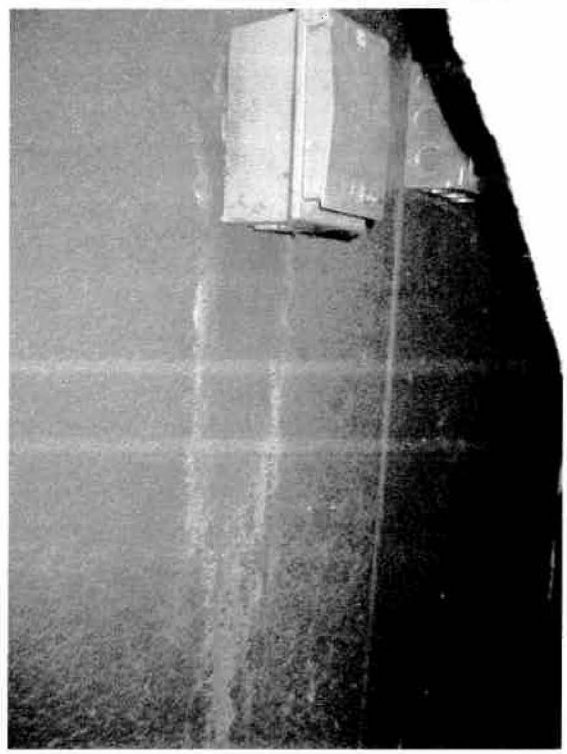


Figure 10: Condensation staining at electrical penetration

Some minor concerns were identified regarding the condition of the roof traffic coating installed on the catwalk areas. A few discontinuities were noted where anchor bolts penetrate through he concrete slab and where holes are drilled into the railing posts that are cast into the concrete slab.

Figure 11: Discontinuity of deck traffic coating

Figure 12: Hole in post railing

Sub-Junction

Water staining was noted on the sloped plywood panels in the mechanical room.

Water staining was noted on the metal structure in the air intake plenums.

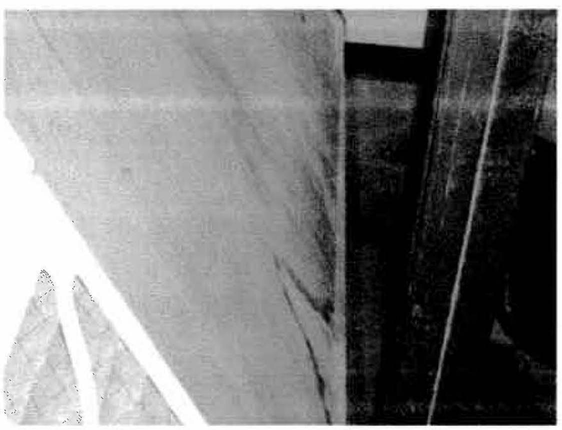


Figure 13: Water staining at base of sloped plywood wall

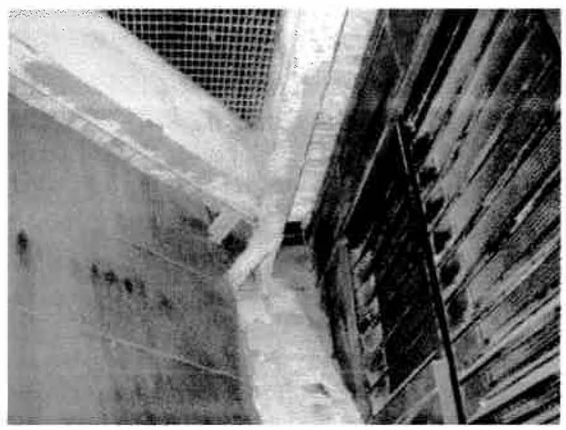


Figure 14: Water staining on sloped metal panels and structural steel at air intake plenum

In the interstitial space between the gypsum exterior wall and the precast concrete panels, significant water staining was identified on the cementitious fireproofing (covering the steel structure) and on the interior surface of the exterior precast panel. The highest concentration of staining appeared at the 45 degree bends in the precast panels. Some minor staining was noted at roof drain collars and on a few miscellaneous areas of the structural steel.

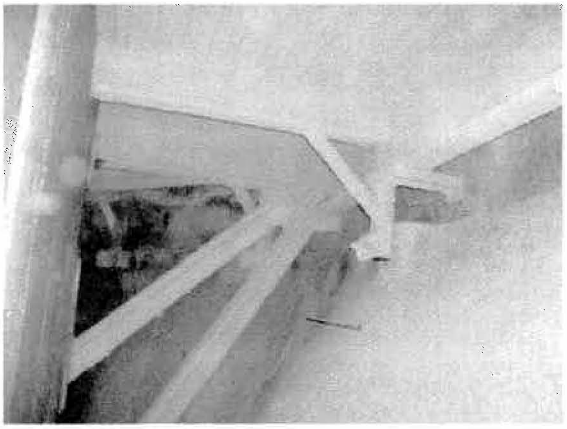


Figure 15: Staining noted in interstitial space at 45 bend in precast

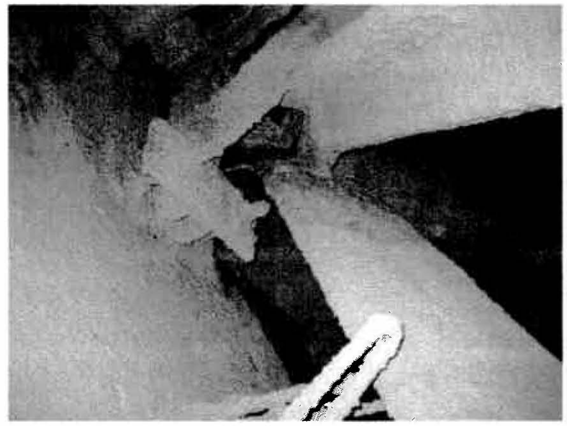


Figure 16: Staining noted in interstitial space at 45 bend in precast

Additional water staining below the bathroom plumbing on Junction level was also noted. It could not be identified at the time of the review if the water staining was from an active leak or from a past leak.

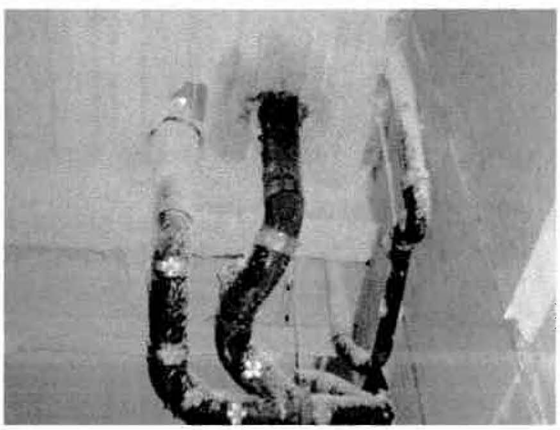


Figure 17: Staining below bathroom plumbing

Level 10

Water staining was noted along the base of the drywall in locations around the exterior perimeter of the floor. Reports from staff indicated wetting events that resulted in wet carpet.

In the interstitial space between the gypsum exterior wall and the precast concrete panels, significant water staining was identified on the cementitious fireproofing (covering the steel structure) and on the interior surface of the exterior precast panel. The highest concentration of staining appeared at the 45 degree bends in the precast panels. Some minor staining was noted on a few miscellaneous areas of the structural steel.

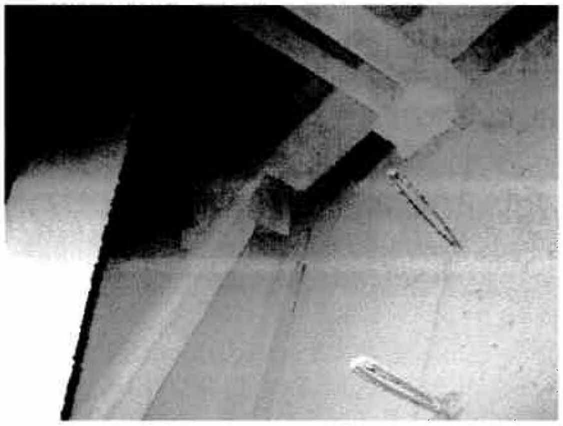


Figure 18: Water staining in interstitial space at 45 bend in precast

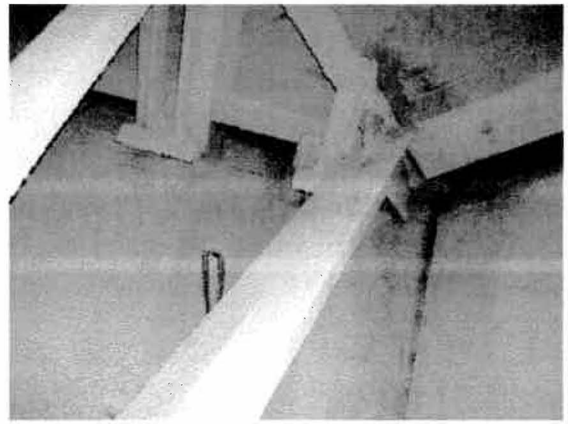


Figure 19: Water staining in interstitial space at 45 bend in precast

Level 9

Water staining was noted along the base of the drywall in locations around the exterior perimeter of the floor. Reports from staff indicated wetting events that resulted in water ponding on the concrete floor slab. Additional reports were of wet and spongy gypsum at the corners where the structural steel terminates into the concrete structure.

In the interstitial space between the gypsum exterior wall and the precast concrete panels, water staining was identified on the cementitious fireproofing (covering the steel structure), on the interior surface of the exterior precast panel, and on the concrete floor slab where the steel terminates into the concrete structure. The highest concentration of staining appeared at the 45 degree bends in the precast panels. Some minor staining was noted on a few miscellaneous areas of the structural steel.

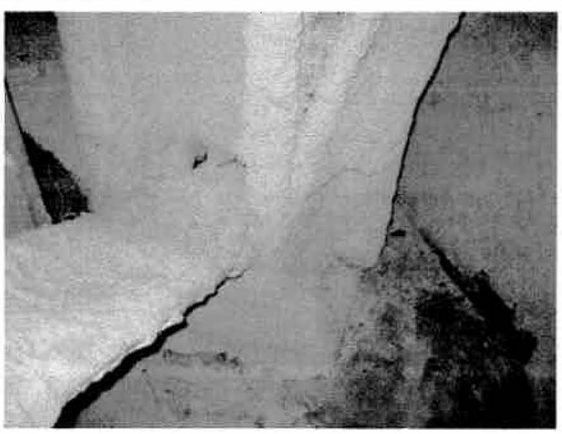


Figure 20: Staining at base of steel structure (reduced compared to floors above)

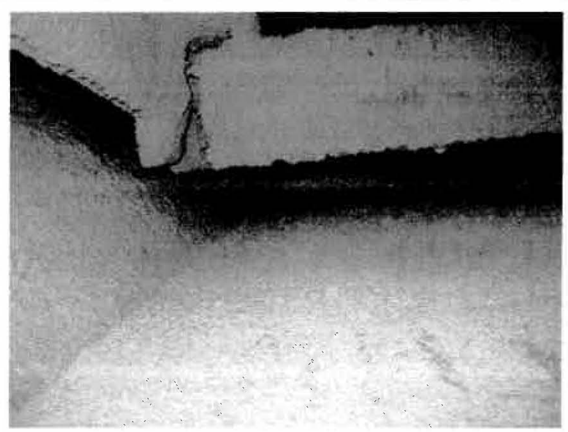


Figure 21: Staining at 45 bend in precast

Level 8 through level 1

Level 8 and below all had similar issues. Water stains were noted at cold joint locations between the precast concrete panels and the cast in place concrete.

Figure 22: Water staining at cold joint in precast panel

Elevator shaft

The interior of the elevator shaft was reviewed for signs of water staining and damage. The interior shaft liner showed signs of water staining occurring at the floor slab to wall interface. The levels of most significant staining were level 9, and level 3.

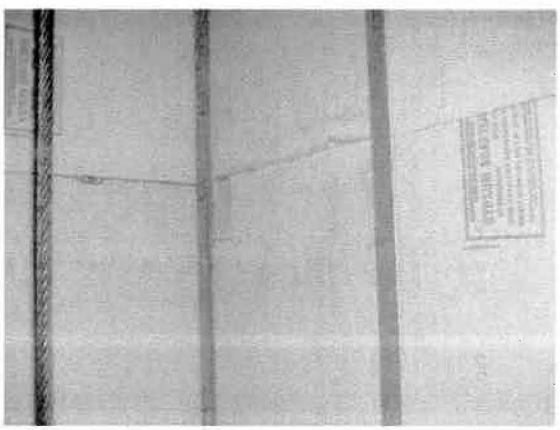


Figure 23: Stained elevator shaft liner at level 3

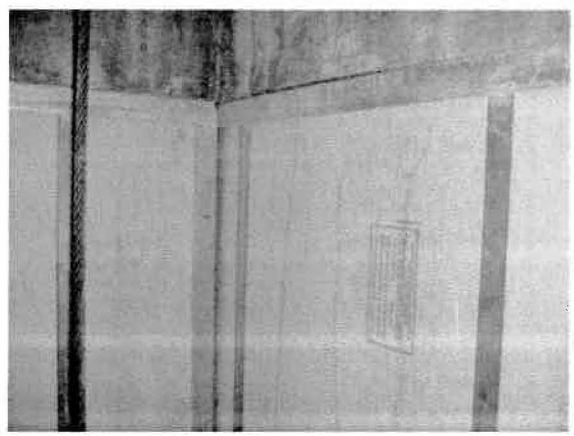


Figure 24: Stained elevator shaft liner at slab edge of level 9

Base Building Roof

The base building roof system appears to be a light weight vinyl type roof membrane that is mechanically attached at the membrane seams. The connection of the roof membrane to the parapet and other roof curbs appeared to be done by returning the membrane up the curb and clamping the top of the membrane with a retaining bar. Many of the connection details appear to be poorly done.

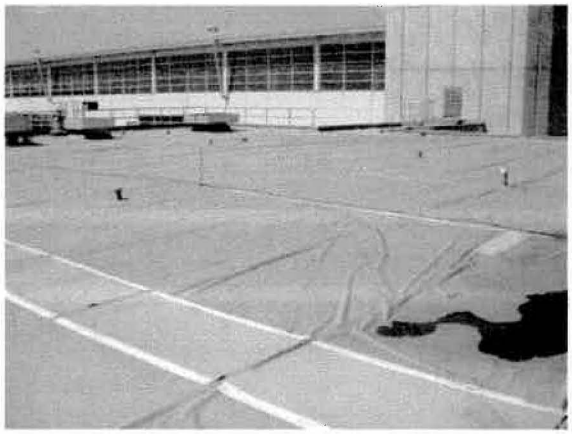


Figure 25: Overall roof

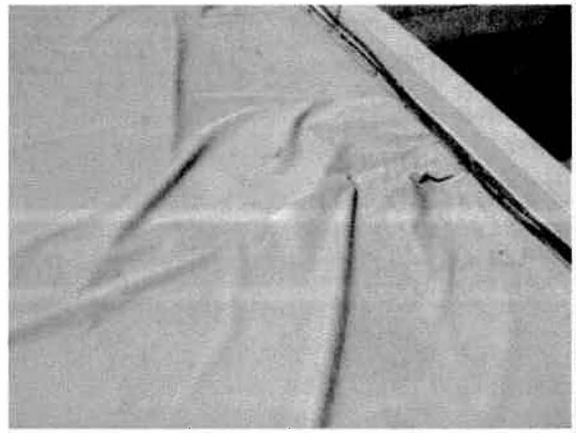


Figure 26: Roof parapet connection

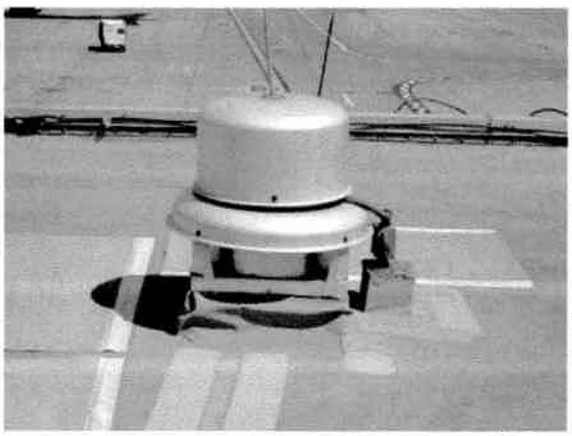


Figure 27: mechanical curb

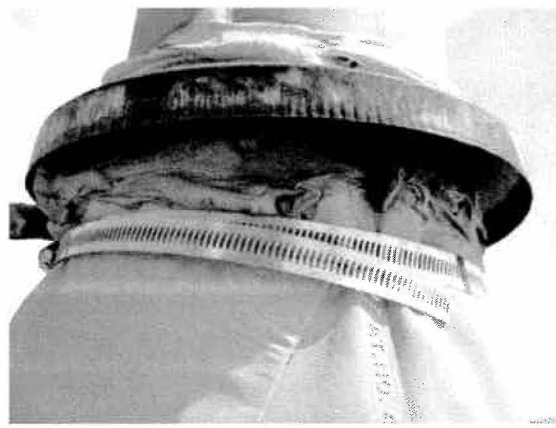


Figure 28: Plumbing vent connection

Discussion and Analysis

The building has identified issues related to both liquid water intrusion through the enclosure elements as well as condensation related water accumulation in the exterior enclosure assemblies.

The following locations of water infiltration were identified:

1. Slab to parapet interface at the base of the exterior corner metal cladding panels - microwave balconies at Junction level
2. Air intake grates - microwave balconies at Junction level
3. Precast panel joints - level 8 and below

Although only three locations of water infiltration were identified, the water infiltration at these locations migrated throughout much of the facility.

The following locations of condensation accumulation were identified.

1. Radar access hatch – penthouse level
2. Top track of metal stud wall - penthouse level
3. Interior of parapet construction - penthouse level
4. Inside surface of precast cladding - cable access level
5. Exterior soffit – junction level
6. Interior surface of precast cladding - sub-junction through level 9
7. Interior surface of form cast concrete structure - level 8 and below

In addition to the water management concerns of the structure, there are significant energy use concerns related with the current design of the building enclosure.

Liquid Water Intrusion – Slab to Parapet Interface at Microwave Balconies

Based on our observations the primary location for water infiltration is associated with the slab to parapet interface at the corners of the microwave balconies on the Junction level. Water infiltration at these locations is resulting in the significant water staining of the steel structure and precast concrete panels observed at the 45 degree corners on Sub Junction down to Level 9 of the tower due to a cascading effect of water leaking from the floor above down to the floor below. Based on the staff reports, it is also likely that this water infiltration is the primary cause of the liquid water staining in the elevator core at the Sub Junction down to Level 9 as some of the water is intercepted by structural elements and the floor slab, and is directed towards the elevator core. Correction of the infiltration at these locations will address the major source of water infiltration into the building.

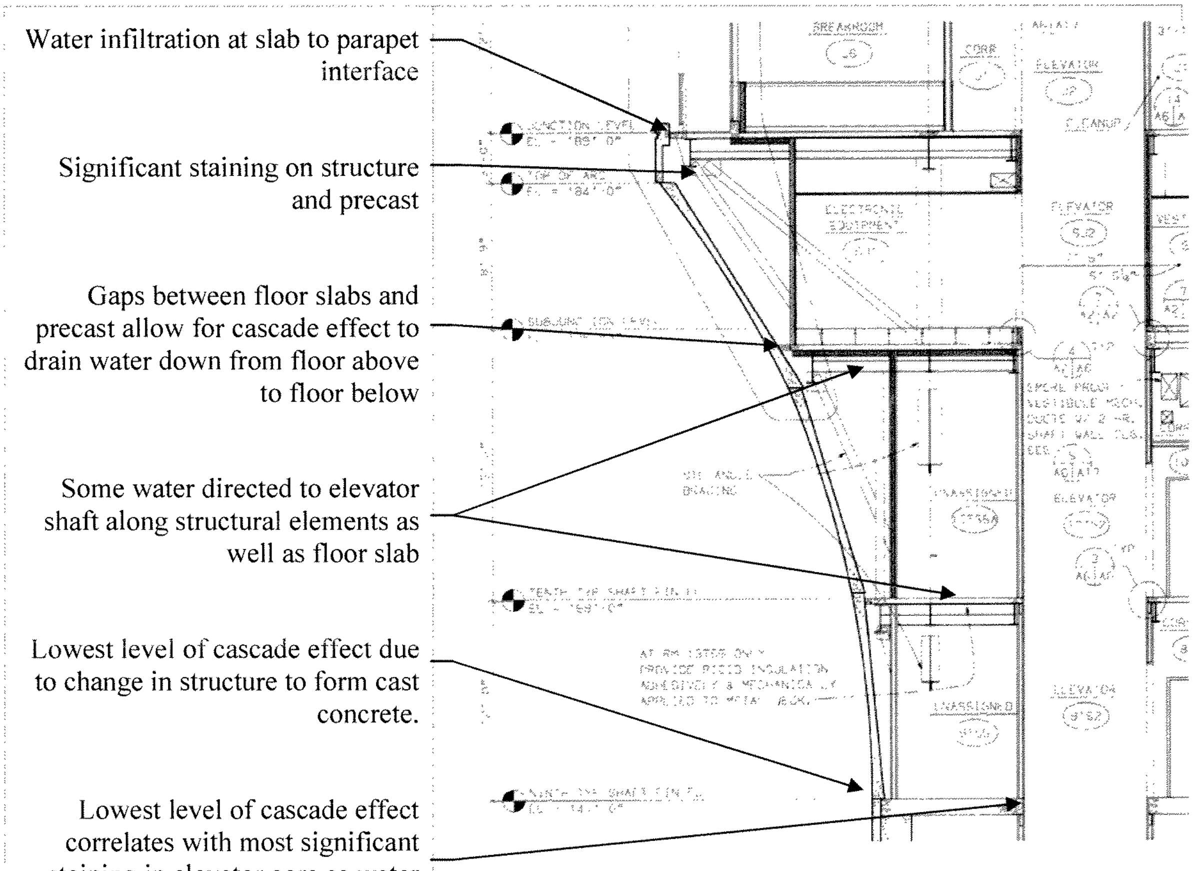


Figure 29: Cascade effect of water infiltration at microwave balcony slab to parapet interface

The architectural drawings were reviewed to examine the proposed construction of the slab to parapet interface. Based on the drawing review the waterproof traffic coating was intended to be installed prior to the installation of the insulated metal panel cladding. It was suspected based on visual review of the area, that the construction sequence had lead to the panels being installed prior to the installation of the deck waterproofing. This change in installation sequence would result in a void between the slab edge and the precast parapet and a path for water infiltration.

Given the shape of the parapet, a gutter between the metal panel to parapet interface is created, concentrating rain water at the interface. A visual inspection of the interface revealed sealant joints between the parapet flashings and the metal panels. These sealant joints had failed in some locations allowing for water to infiltrate between the panel and the parapet. In addition, the joints between the metal panels were not sealed allowing for water to infiltrate between the panels.

In order to confirm the construction, sections of the insulated metal panel at the corners of the microwave balconies were removed. The investigation openings revealed a ¼" to ½" gap between the concrete slab and the precast parapet. This confirmed the hypothesis.

Architectural drawings indicate deck waterproofing installed below metal panel

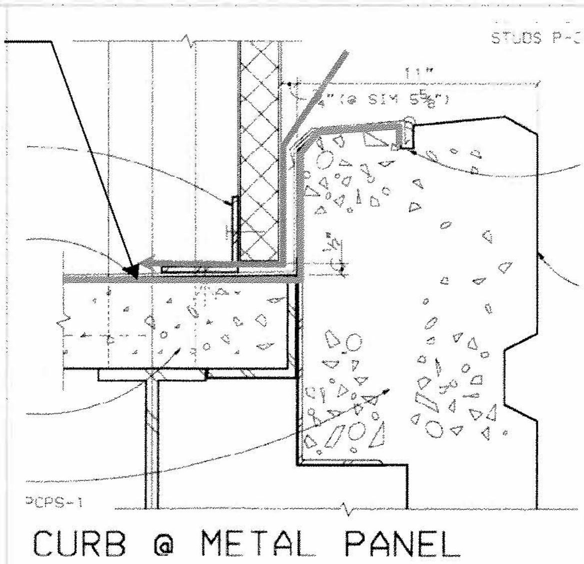


Figure 30: Slab to curb detail – as designed

Site review of conditions revealed deck water proofing installed to face of panel

Infiltration at panel to parapet interface as well as at vertical panel joint covers coupled with the lack of deck waterproofing continuity allows for water infiltration to the interior of the structure

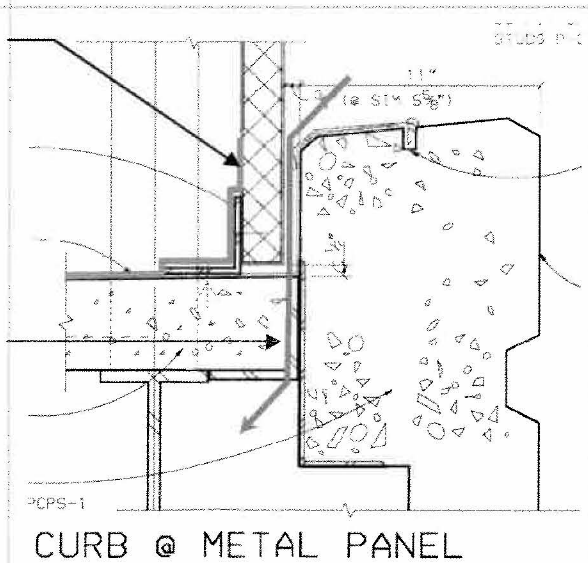


Figure 31: Slab to curb detail - as built

An investigation opening revealed the discontinuity of the deck waterproofing below the metal panels

¼" to ½" gap at slab to parapet interface

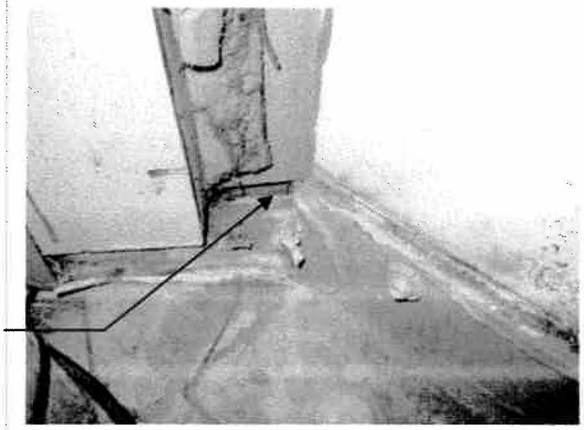


Figure 32: Investigation opening at base of metal panel

Liquid Water Intrusion – Air Intake Grates

A secondary water intrusion location was identified at the air intake grate in the microwave balconies. The grates are designed with a gutter to intercept any exterior rainwater from draining down into the air intake plenum below. The gutters are not continuous beyond the front edge of the floor grate allowing for water to by-pass the gutter on both sides, and drain down onto the structure that supports the metal floor grate. This allows for water to infiltrate into the interior by traveling along the structure to the interior.

On sides of grate, water drains onto the structure and can migrate towards the interior	On front edge of grate, water is collected and drained by a gutter system

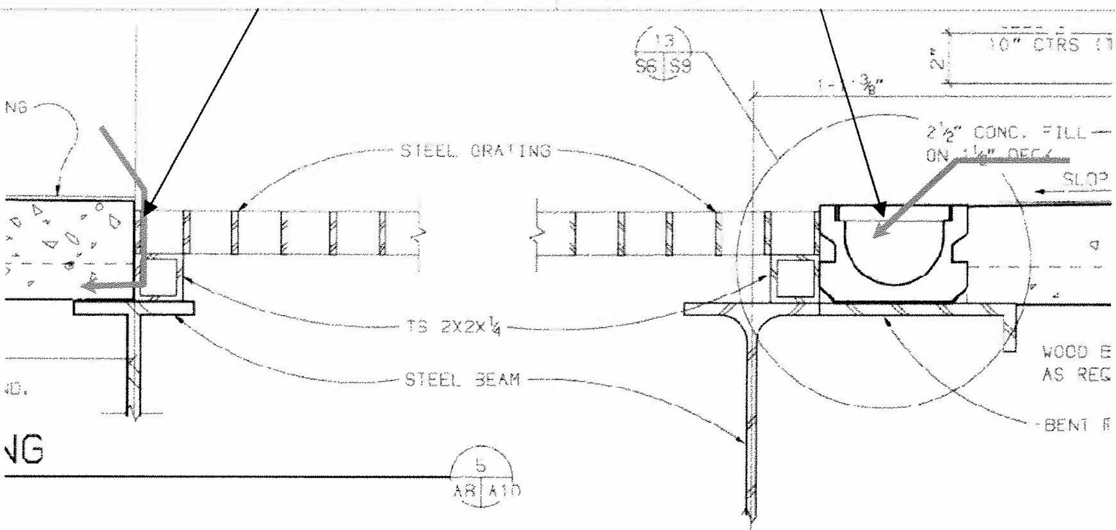


Figure 33: Floor grate detail

Liquid Water Intrusion – Precast panel joints (Level 8 and below)

Water intrusion events occurring on Level 8 and below are related to water infiltration at exterior precast joints of the concrete structure. The building was constructed by using precast concrete panels joined together with formed and cast-in-place concrete. The exterior joints are filled with a non-shrink grout. This joint is not waterproof and allows for water infiltration into the small gap behind the grout at the precast panels. Once the water penetrates past the exterior grout, it gets drawn into the cold joints of the concrete due to capillary forces. With enough water, the hydrostatic pressure created by gravity overcomes the capillary forces holding the water in the cold joint, and liquid water will flow to the interior (and exterior) resulting in water leakage through the concrete structure.

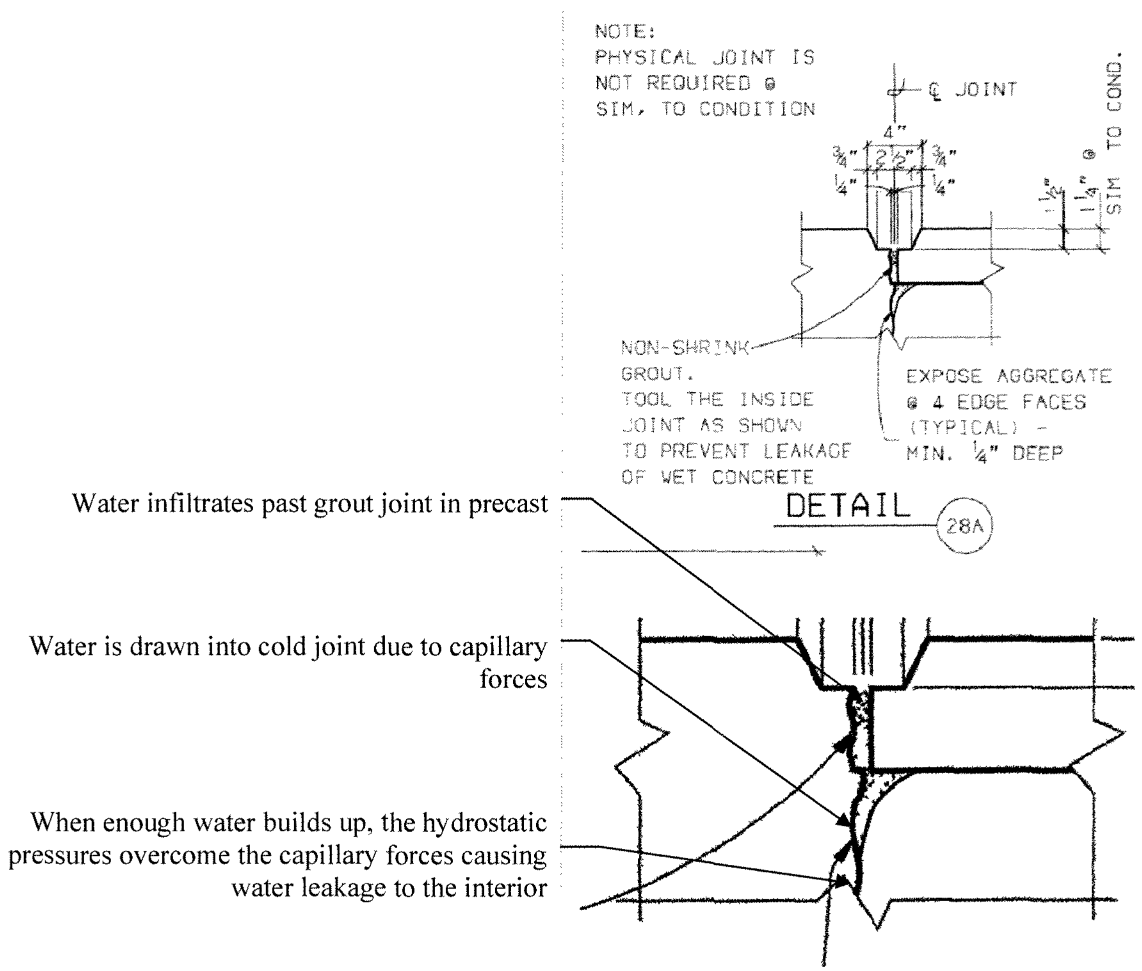


Figure 34: Precast concrete joint design

Condensation – Radar Access Hatch (Penthouse Level)

Condensation is occurring on the radar access hatch due to the highly conductive nature of the metal and glass hatch coupled with cold outside air temperatures. This condition lowers the interior surface temperature of the hatch. If the surface temperature is lower than the interior dewpoint temperature, then condensation will occur. The concern with condensation at this location is minimal due to the non-moisture sensitive materials.

Condensation – Top Track of Metal Stud Wall (Penthouse Level)

The retrofit work conducted to manage the condensation problems below the roof deck of the penthouse level was appropriate. However, the closed cell spray foam only extended to the front face of the gypsum board on the exterior steel stud framed wall. This creates a gap in the continuity of the thermal insulation between the retrofit roof insulation and the insulated metal wall panels. This gap in the thermal insulation and air barrier is at risk for condensation due to cold surfaces. This area should be addressed due to the moisture sensitive nature of the gypsum wall board.

Condensation – Interior of Parapet Construction (Penthouse Level)

The staining that was noted on the interior face of the insulated metal panels in the dropped ceiling area of the CAB was a function of condensation within the parapet construction of the penthouse catwalk.

It was suspected that no provision for air sealing had been made during the initial construction to prevent warm interior air from leaking up into the parapet construction. Air infiltration into the parapet from the space below will results in condensation accumulation due to the exposed cold surfaces of the parapet construction. If sufficient condensation builds up, it will drain back down to the interior in liquid form often being mistaken for a roof leak.

To confirm this hypothesis, an investigation opening was cut in the parapet to examine the construction and confirm the existence of an air flow pathway. The investigation opening confirmed the presence of an air flow pathway from the CAB below into the parapet construction as well as revealed signs of past condensation accumulation.

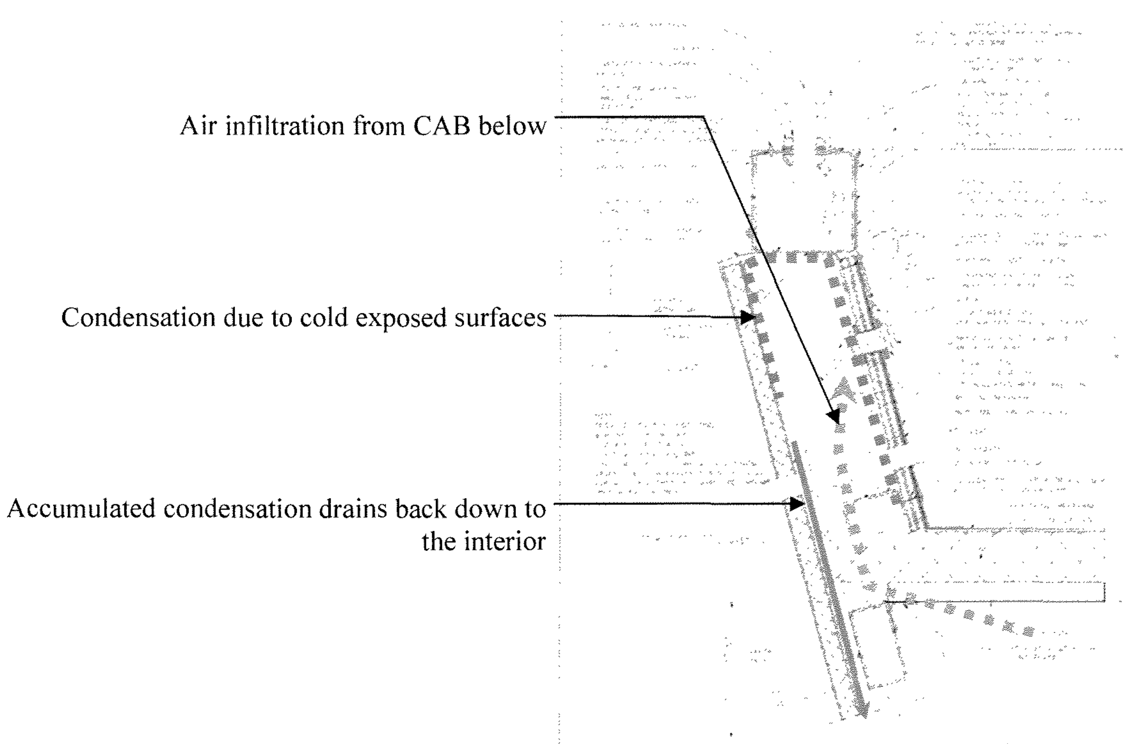


Figure 35: Parapet detail

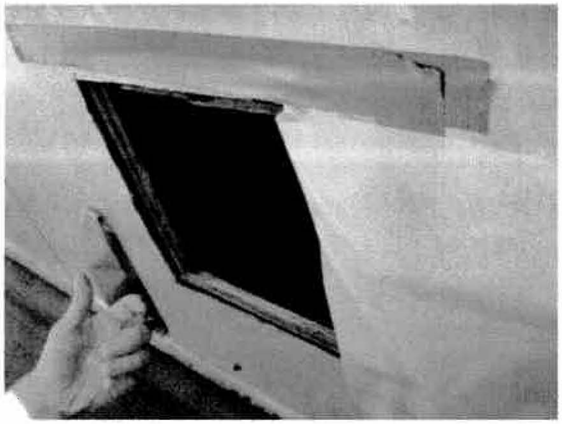


Figure 36: Parapet investigation opening

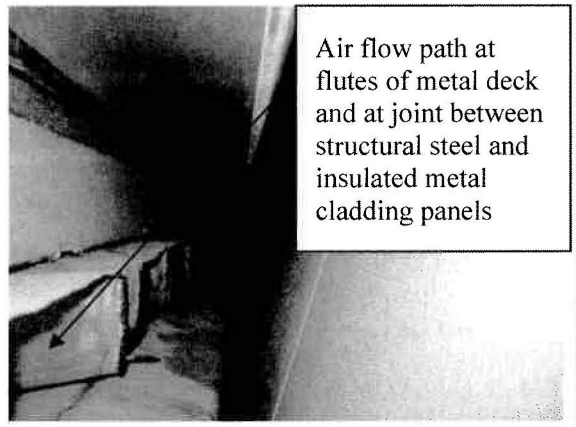


Figure 37: Interior of parapet construction demonstrating air flow path with space below

Condensation – Interior Surface of Precast Cladding (Cable Access)

The condensation noted on the surface of the exterior precast cladding panels on the cable access level is due to interior air coming in contact with the cold surfaces of the un-insulated concrete. In this location, the condensation is exacerbated due to the presence of the supply air duct that is run through approximately half of the perimeter. The pressurized supply duct leaks warm conditioned air into the space increasing the available moisture for condensation.

Condensation – Exterior Soffit (Junction)

The condensation staining noted on the exterior soffit panels on the Junction level is due to air exfiltration condensing within the soffit construction. Investigation of the area revealed a lack of air barrier continuity above the dropped ceiling installation. This issue does not pose a durability or health and safety concern as the condensation is occurring exterior of the enclosure.

Condensation – Interior Surface of Exterior Precast (Sub-Junction - Level 9)

Condensation is occurring on the interior surface of the exterior precast cladding panels from the Sub Junction Level down to Level 9. This condensation is due air exfiltration into the interstitial space between the drywall and the precast panels coupled with the cold surfaces of the concrete.

Condensation – Interior Surface of Concrete Structure (Level 8 and below)

Condensation is occurring on the interior surface of the exterior concrete structure from Level 8 down to Level 3. Below Level 3, the concrete structure enters the base building and the concrete is no longer exposed to the cold exterior air. This condensation is due to the highly conductive nature of un-insulated concrete resulting in surface temperatures of the concrete falling below the dewpoint temperature of the interior air.

Energy

The building enclosure is not energy efficient. The two aspects of the building enclosure have the greatest impact on building energy efficiency are:

1. Thermal Insulation
2. Air barrier continuity

The thermal enclosure should be integrated with or installed in direct contact with the primary air barrier of the building. The current design of the air traffic control tower has many areas where the thermal insulation and the plane of primary air tightness are at different locations. This leads to the creation of concealed interstitial spaces that are not interior of the building and also not exterior of the building. For the most part, it is at these interstitial spaces where most of the condensation problems and a significant source of energy loss for the building are occurring.

With the lack of a well identified and continuous air barrier, air exfiltration into the interstitial spaces is resulting in a by-pass of the thermal insulation (installed in some locations). This coupled with the high conductance of concrete[1] is leading to high thermal losses for the building.

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[1] The conductance of concrete is very high resulting in an average R-Value of around R-0.1/inch of thickness. This means that a 10" thick concrete wall will have a thermal resistance of approximately R-1. While mass effects of the concrete can help to buffer some of the associated affects of such a high thermal conductance, it still leaves the building being very inefficient from a space conditioning perspective.

Recommendations

The following is a list a retrofit measures recommended to address the identified water intrusion and condensation concerns identified in the building. The retrofit measures also take into account identified concerns with the performance of the thermal enclosure and air barrier for the building.

Liquid Water Intrusion – Slab to Curb Interface at Microwave Balconies

The water intrusion that is occurring at the slab to curb interface at the corners of the microwave balconies is accounting for the majority of the moisture intrusions problems for the building. The following measures are recommended to repair the source of infiltration.

1. Remove the base of the metal panels as required to expose the slab to curb interface. (The panels will need to be supported with new anchors attached to the metal columns)
2. The old panel base angle anchors are recommended to be removed.
3. A backer rod and sealant joint should be installed in the exposed gap between the concrete deck and precast curb.
4. A minimum 6" wide flexible membrane flashing (compatible with the liquid applied waterproof traffic coating) should be installed over the new sealant joint extending a minimum 6" on either end over existing deck waterproof traffic coating (at the concrete slab to curb interface).
5. A new deck waterproofing system should be installed to completely cover and embed the flexible membrane flashing.
6. The exterior of the area area should be covered with a new metal flashing to divert water out and away from the microwave balconies.

It is recommended to repair any other distressed areas identified in the waterproof traffic coating on the exposed catwalk at the same time as the retrofit work for the metal panel interface.

The hole drilled in the post holes should be covered with a membrane and the liquid applied traffic coating installed over top of the membrane patch.

Existing deck waterproof traffic coating turned up inside face of insulated metal cladding panel

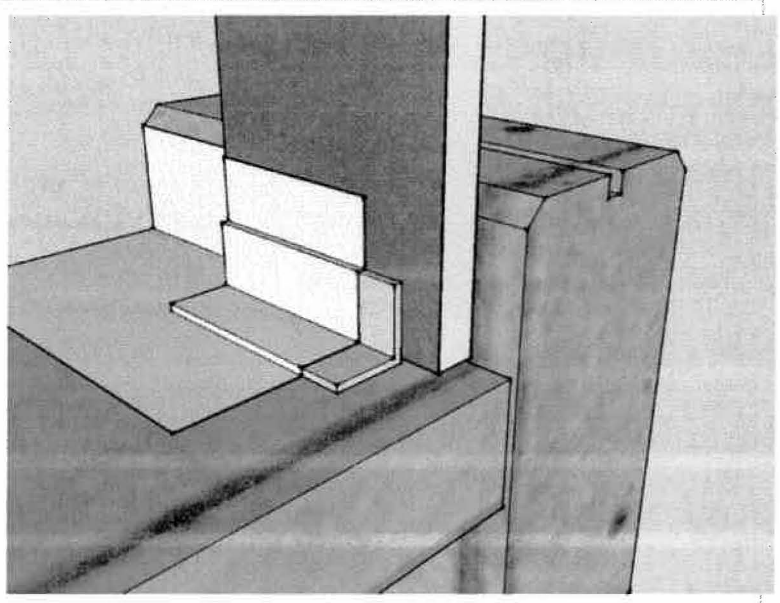

Figure 38: Slab to Curb Retrofit Detail 1

Cut bottom of metal panel to expose slab to curb joint. Remove angle bracket on slab

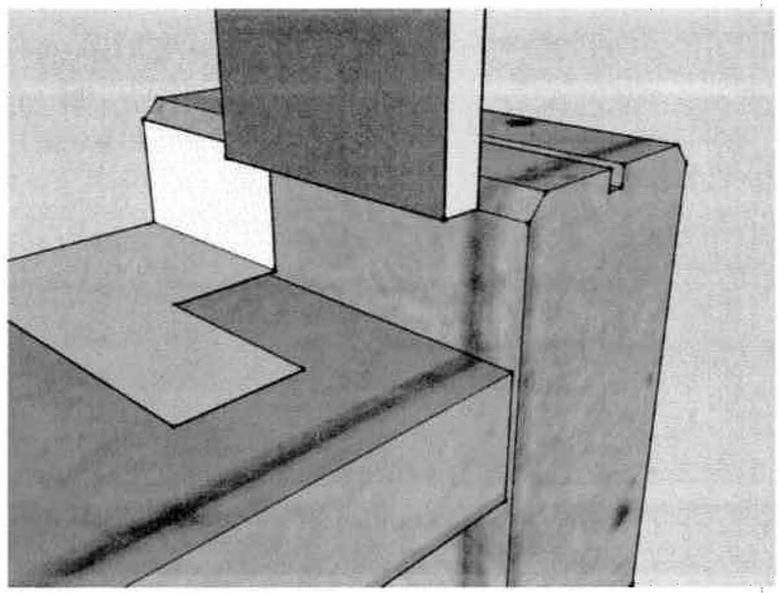

Figure 39: Slab to Curb Retrofit Detail 2

Install a backer rod and selant joint at the slab to curb interface

Cover the sealant joint with a compatible membrane flashing. Lap end of membrane flashing onto existing deck waterproof traffic coating.

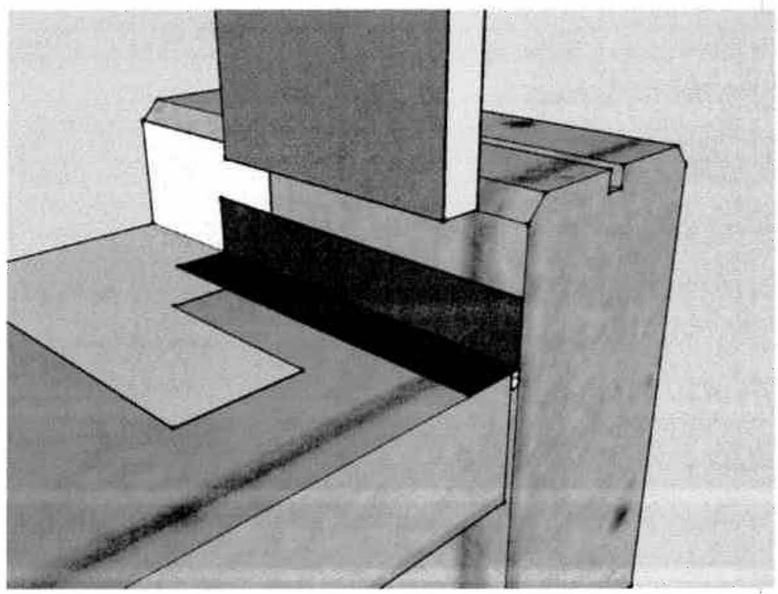

Figure 40: Slab to Curb Retrofit Detail 3

Cover area with new deck waterproof traffic coating

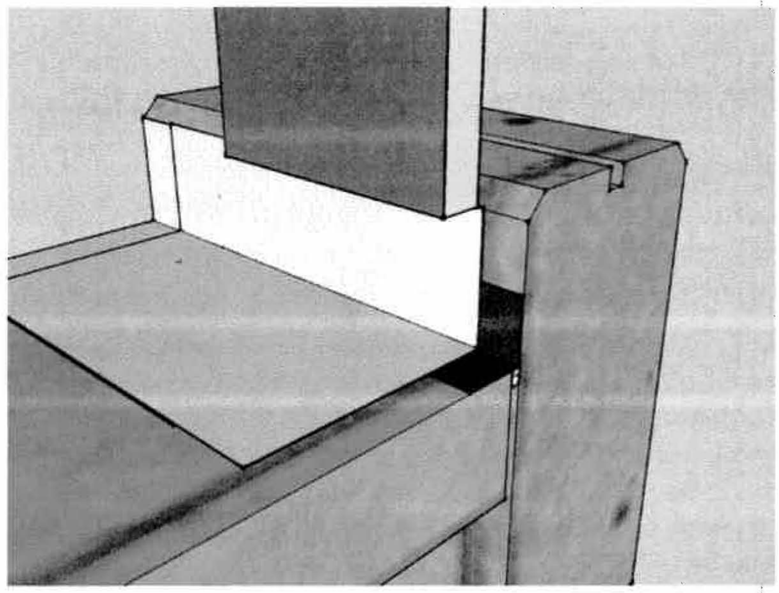

Figure 41: Slab to Curb Retrofit Detail 4

Liquid Water Intrusion – Air Intake Grates

It is recommended to install a diverter angle at the air intake grate to prevent water by-pass of the grate gutter system. In addition, the grate gutter should be re-waterproofed to ensure that no water is able to infiltrate at any joints in the gutter system. The following is recommended:

1. A 1" x 1" angle should be installed from the wall to the edge of the intake grate.
2. The existing grille cover for the gutter should be removed and the gutter cleaned.
3. Any damage noted to the gutter system or surrounding concrete should be repaired as required.
4. A new liquid applied traffic coating should be installed to completely seal the deck to the gutter as well as encapsulating the 1" x 1" diverter angel.
5. The gutter grille cover should be re-installed.

Liquid Water Intrusion – Precast panel joints (Level 8 and below)

The installation of the elastomeric coating on the exterior of the building has addressed the immediate concern relating to water infiltration for Level 8 and below. The elastomeric coating creates a flexible and waterproof film (or barrier) over the exterior concrete and associated mortar joints. This barrier prevents water penetration into the joints between the precast panels, and prevents leakage to the interior of the building. However, as with any paint or waterproof coatings, elastomeric paints are subject to temperature changes and UV radiation which will deteriorate the coating over time. Due to this, the coating must routinely inspected (once per year), and re-applied as necessary in order to maintain long term performance.

An alternate approach is to allow the joints to drain to the exterior, thereby reducing the reliance on the continuity of the elastomeric to maintain a complete barrier. To accomplish this, it is recommended to provide weep holes in the vertical joints at each horizontal joint in the exterior precast panels to relieve any water that is able to penetrate past the exterior seal.

Where the tower intersects the base building, the vertical joints are recommended to be routed out to allow for the space to be filled sealant just above the top edge of the roof membrane. Directly above the sealant, the joint is to be drained to the exterior.

Condensation – Radar Access Hatch (Penthouse Level)

It is recommended to replace the access hatch with a thermally broken and insulated hatch. The exterior curb of the access hatch should be insulated.

Condensation – Top Track of Metal Stud Wall (Penthouse Level)

It is recommended to remove the top 6" of gypsum in order to expose the stud cavity and top track of the exterior wall. The top track should be sprayed with a closed cell spray polyurethane foam in order to complete the thermal insulation and vapor control layer out to the exterior insulated metal panel.

Remove the gupsum wall board at the top of the wall to allow for the installation of closed cell spray polyurethane foam to complete the thermal isnualtion and air barrier at the top of the penthouse roof

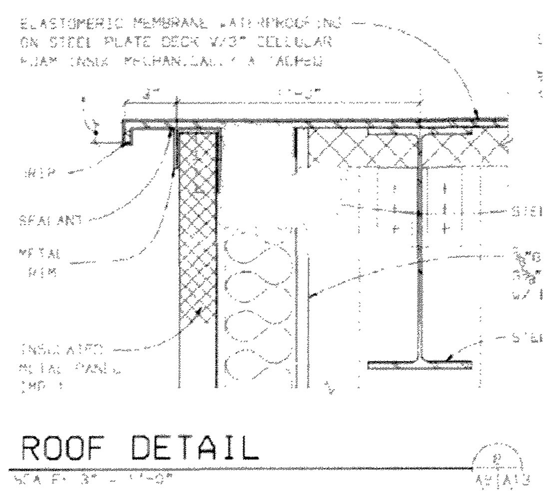

Figure 42: Top Track Retrofit Section

Condensation – Interior of Parapet Construction (Penthouse Level)

It is recommended to cut a 12" tall section of the parapet facing (on the catwalk side) around the entire perimeter of the catwalk to expose the air infiltration location at the roof deck level. The area should be blocked at the top of the roof deck in order to provide a backing for a closed cell spray foam insulation and air seal to be installed. The blocking material can be a range of products from plywood to sections rigid insulation board (such as XPS), the intent for the product is to prevent overspray of the closed cell foam into the conditioned space below. After the area is sealed, the inner face of the parapet should be covered with a sheet metal backing and a new compatible roof membrane installed to seal the opening. The roof should be properly flashed with the parapet cap flashing.

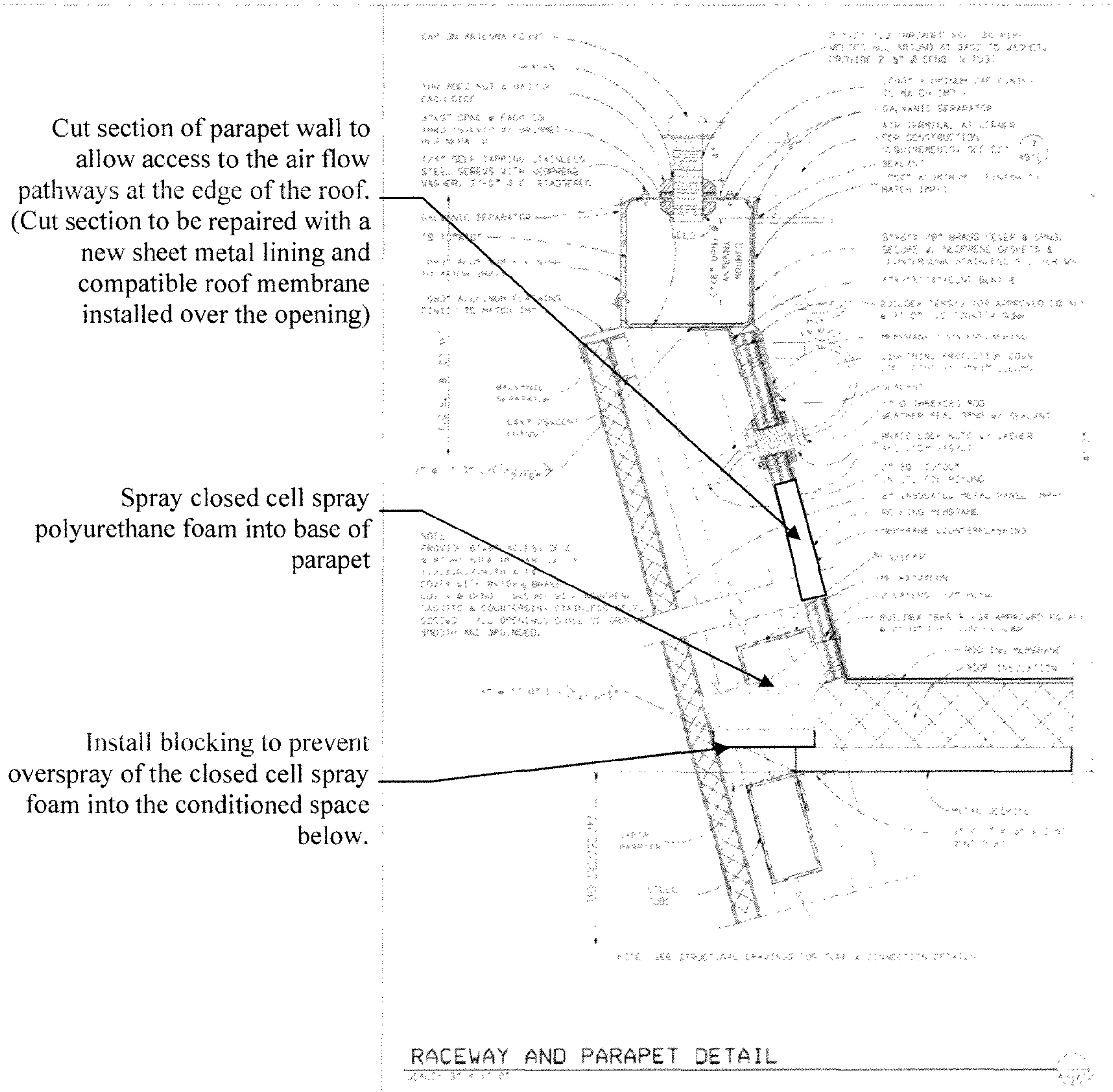

Figure 43: Parapet Retrofit Section

Condensation – Interior Surface of Precast (Cable Access through Level 9)

It is recommended to install a layer of closed cell spray polyurethane foam to interior surface of the exterior precast. Closed cell spray foam used in this location will control condensation by increasing the first condensing surface temperature (now located at the inside surface of the spray foam), and improve the overall thermal efficiency and air tightness of the building. The following sections show the intent for the locations for the closed cell spray foam.

Install closed cell spray polyurethane foam to the interior surface of the exterior precast concrete cladding panel. Closed cell spray foam must be covered with a thermal barrier.

Extend closed cell spray polyurethane foam below the catwalk slab of the CAB above

For this approach the insulated partition wall will be required to be removed

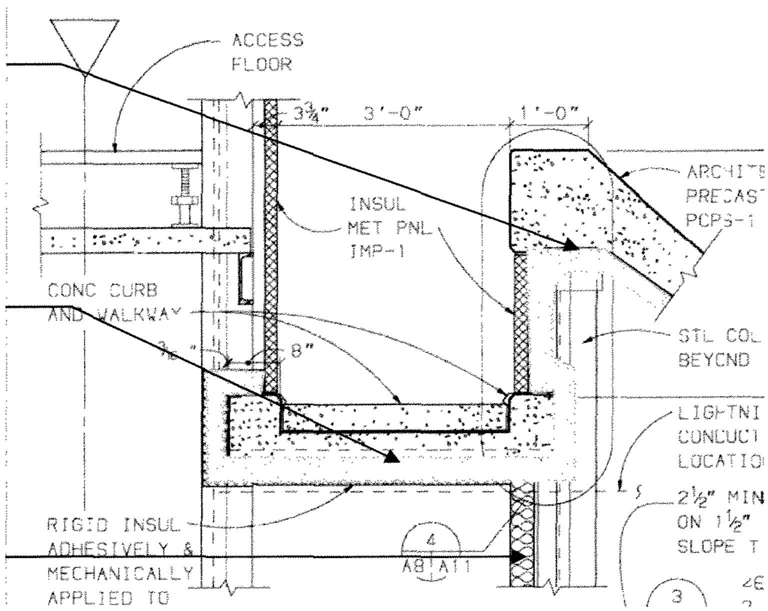

Figure 44: Cable Access Retrofit Section 1

Install closed cell spray polyurethane foam to the interior surface of the exterior precast concrete cladding panel. Closed cell spray foam must be covered with a thermal barrier.

Install concrete topped rigid insulation on top of catwalk deck

For this approach the insulated partition wall will not be required to be removed

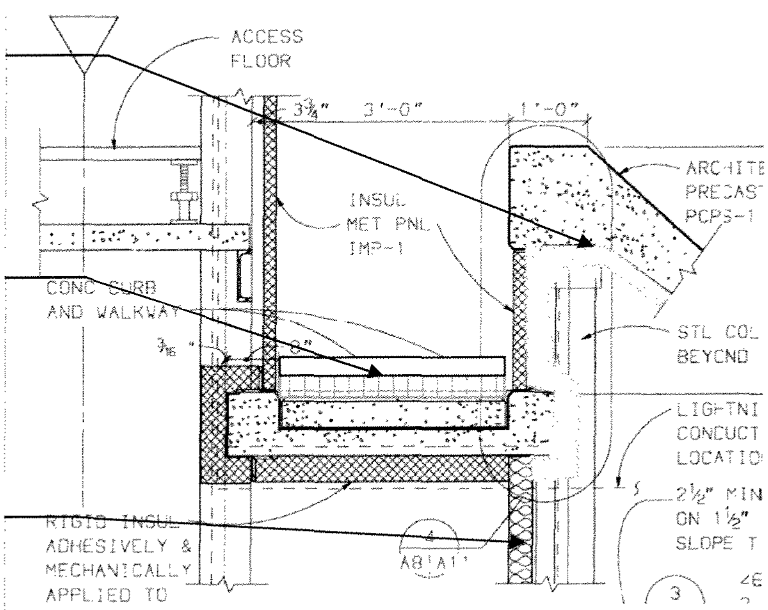

Figure 45: Cable Access Retrofit Section 1 (Alternate)

Install closed cell spray polyurethane foam to the interior surface of the exterior precast concrete cladding panel. Closed cell spray foam must be covered with a thermal barrier.

Closed cell spray polyurethane foam installed from the exterior to the outer surface of the soffit wall. The foam is to continue up to the underside of the precast panel to maintain continuity of the air seal and thermal insulation

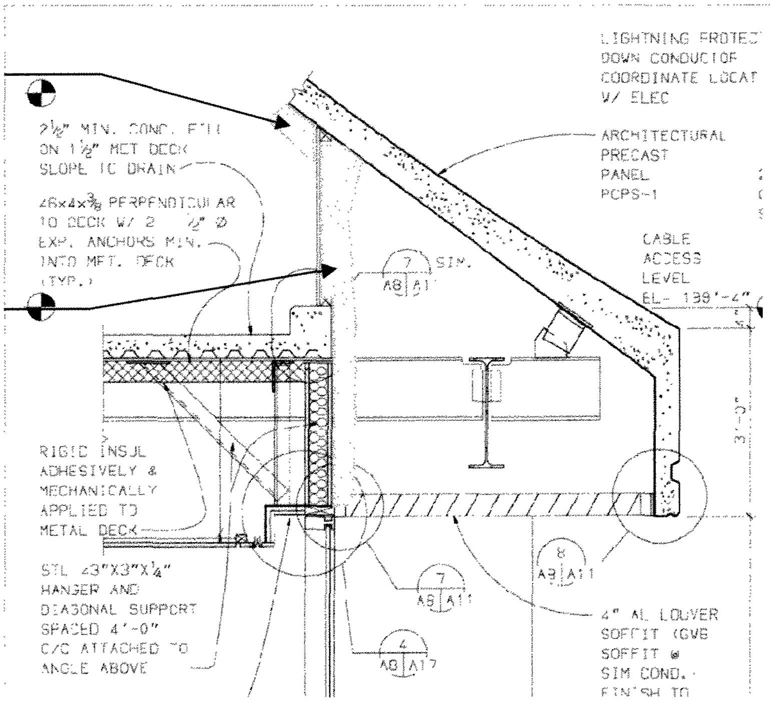

Figure 46: Cable Access Retrofit Section 2

Install closed cell spray polyurethane foam to the interior surface of the exterior precast concrete cladding panel. Closed cell spray foam must be covered with a thermal barrier.

Foam to begin below location of exterior insulated wall above

Closed cell spray polyurethane foam to continue down to t he floor slab of Level 9

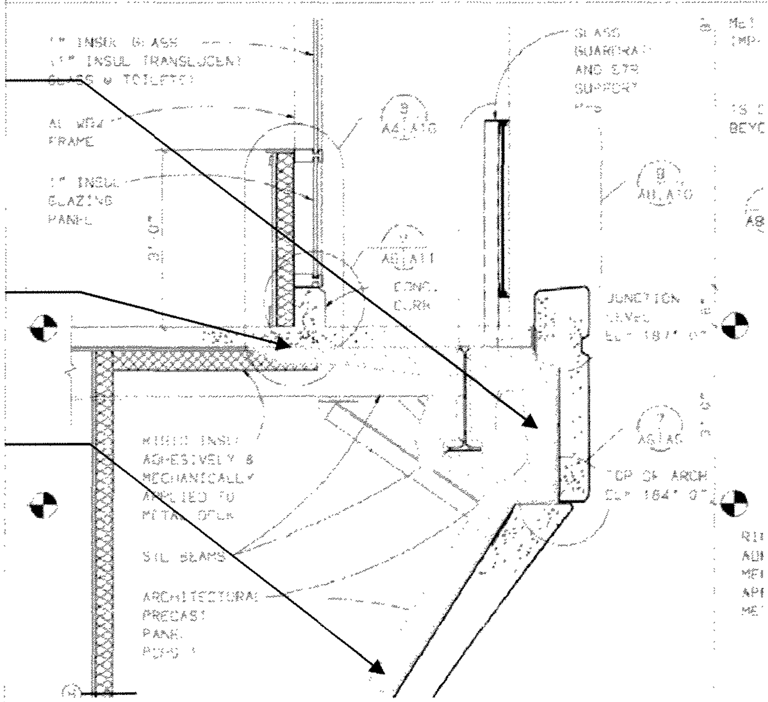

Figure 47: Sub-Junction Retrofit Section 1

Condensation – Interior Surface of Concrete Structure (Level 8 and below)

It is recommended to install a layer of closed cell spray polyurethane foam to interior surface of the concrete structure. Closed cell spray foam used in this location will control condensation by increasing the first condensing surface temperature (now located at the inside surface of the spray foam and not the concrete), and improve the overall thermal efficiency and air tightness of the building. Where closed cell spray foam is use and intended to be left exposed, it must be covered with a thermal barrier (Products such as Flame Seal TB http://www.flameseal.com/FSTB.html may be appropriate for this application).

Base Building Roof

The roof installation on the base building is recommended to be replaced with a new fully adhered compact roof assembly. The recommended assembly for this project would be:

- Existing metal deck
- Non paper faced gypsum sheathing (Dens deck or equivalent)
- Fully adhered air barrier membrane (self adhered SBS membrane or 2 layers mopped on felts and asphalt)
- Polyisocyanurate roof insulation
- Roof cover board (plywood, gypsum, or fiberboard)
- Fully adhered roof membrane system

Conclusion

The building has numerous issues related to both liquid water intrusion through the enclosure elements as well as condensation related water accumulation in the exterior enclosure assemblies.

The following locations of water infiltration were identified:

1. Slab to parapet interface at the base of the exterior corner metal cladding panels - microwave balconies at Junction level
2. Air intake grates - microwave balconies at Junction level
3. Precast panel joints - level 8 and below

The following locations of condensation accumulation were identified.

1. Radar access hatch – penthouse level
2. Top track of metal stud wall - penthouse level
3. Interior of parapet construction - penthouse level
4. Inside surface of precast cladding - cable access level
5. Exterior soffit – junction level
6. Interior surface of precast cladding - sub-junction through level 9
7. Interior surface of form cast concrete structure - level 8 and below

In addition to the water management concerns of the structure, there are significant energy use concerns related with the current design of the building enclosure.

The water intrusion concerns are categorized as sections that must be repaired prior to other retrofit work being completed. The only exception to this is any work needing to be done in Cable Access Level or higher as all of the water intrusion concerns are located on the lower floors. Condensation concerns are generally not as severe and retrofit work can be scheduled to be done concurrently with other work in the facility.

2

BBJ ENVIRONMENTAL SOLUTIONS

HVAC SYSTEMS ASSESSMENT

DETROIT AIR TRAFFIC CONTROL TOWER AND BASE BUILDING

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Introduction

BBJ Environmental Solutions was retained as part of an "Integrated Team" to investigate moisture and accompanying mold growth concerns of the Detroit Airport Air Traffic Control Center (ATC). The investigation consisted of the following:

1. Preliminary discussion with team and management of the tower and history of situation plus walk thru of facility – July 21-23, 2009
2. Review of architectural/mechanical drawings, reports and other documentation.
3. Field Investigation (August 31-September 1, 2009) R. Baker, A. Baker, Wei Sun
4. Follow-up Pressurization measurements/inspect access cuts (September 18, 2009) – R. Baker
5. Detailed Controls review (October 1-2, 2009) – Wei Sun
6. Design of Pressure monitoring system and preliminary design of control and air distribution retrofits plus cost estimates.

Description of ATC

Tower Building

The Tower Building consists of 15 levels with an overall height in excess of 230 feet. It qualifies as a 'high rise' building under building codes and this brings in wind and stack effect factors common to such buildings. The ground level (Level 1) of the Tower Building has a linked walkway to the adjacent Base Building. The floor plans of the 'shaft' portion of the tower (Level 1 though 10) are similar. Each floor has a centrally located elevator shaft, a stairwell with associated isolated vestibule and a lobby area at the elevator entrance. Two utility rooms at the right side of elevator shaft are used as mechanical/electrical spaces and one unoccupied room on the left side of elevator shaft is used as a storage space. On some floors, the lobby and the left side unoccupied rooms connect without a partition. The configuration of each of these rooms varies somewhat from floor to floor. Each level has floor area around 1,100 S.F. (34' by 34').

Each floor in he upper portion of the tower, consisting of Sub-Junction (Level 11), Junction (Level 12), Cable Access (Level 13), Cab (Level 14) and Penthouse/Catwalk (Level 15) has an area of about 2,850 S.F. The Sub-Junction level houses data communication equipment with operational personnel. The Junction level has offices, break area, lockers, rest rooms and a mechanical room. The Cab level is the operational hub for flight controllers. These three floors are major occupied areas. Cable Access and Penthouse levels house various mechanical, plumbing, electrical equipment, ductwork, cables, etc., these are congested, unoccupied floors which are not easily accessible for convenient cleaning.

Base Building

The Base Building is a two-story building with a full basement. Each of these three floors has about 11,200 S.F. (106' by 106'). The Basement Floor has a large mechanical/electrical room which houses boilers, chillers' evaporators, and other accessory equipment for heating water and chilled water production. The basement also has bulk storage, conference rooms, rest rooms, and a small telecommunication room which has heating and cooling provided by the central HVAC system. The First Floor has offices, administration area and training rooms, it also connects to a two-story "Link Building" which serves as a walkway to the Tower Building's Ground Level. The Second Floor has a large data center, a few offices, break rooms and lockers, and support for the Air Traffic Control Center (TRACON). It connects to the Link Building's second floor to walk to the Tower Building's Second Level.

Existing HVAC Units and Control System of Tower/Base Buildings

Heating and Chilled Water Systems

Two boilers and three chillers located in Based Building basement (Room B18 & on outside pad) provide heating and cooling to both Base and Tower Buildings. 3" heating hot water (HHW) and 3" chilled water (CW) supply/return pipes are extended from Base Building through the Link Building's ground level ceiling. Currently the Tower Building only uses about 34 tons of cooling at flow rate of 80 GPM, while the 3" chilled water piping ($\Delta T=10°F$ between supply and return) has spare cooling capacity which can easily carry up to 100 GPM at 40 tons cooling capacity when needed. Heating capacity in the Tower Building is adequate. Heating water and chilled water piping risers are located in the stacked mechanical rooms in each floor adjacent to elevator shaft.

HVAC Systems in Tower Building

The Tower Building has six air handling units (AHU-11, AHU-12, AHU-13, AHU-14, AHU-15 and AHU-16) which provide major heating and cooling to levels 11-15. Two fan-coil units (FCU-11 & FCU-12) provide heating and cooling to Ground Level and Level 2 respectively. One fan-coil unit (FCU-13) provides cooling only at the Ground Level. Unit heaters either direct discharge type (labeled as UH-XX) or ducted type (labeled as CUH-XX) provide heating at shaft levels 3-10. Several floors have a ducted unit heater (labeled as CUH-11, actually a 2-pipe, fan-coil unit) located in an adjacent mechanical room that provides heating air to the elevator shaft. Return air from the elevator shaft is through a transfer opening from elevator shaft to the mechanical room. Each unit's thermostat originally was intended to be installed inside the elevator shaft per drawings, but it was not observed during the site investigation. It is believed that the unit uses an integral thermostat mounted at the suction side of the unit to control shaft air temperature when heating is needed. The elevator shaft currently does not have any cooling provided except for what enters when the doors are opened.

Both AHU-11 and AHU-12 units (Each has 3,100 CFM, 82 MBH cooling, 57 MBH heating) are located on Sub-Junction level in Room SU7, and serve the Sub-Junction and portions of the Junction floors. They work in lead-lag relationship with 100% redundancy (when one unit works, the other unit is in standby). Both AHU-13 and AHU-14 units (Each has 6,970 CFM, 254 MBH cooling, plus heating coils in ducts with various capacities-both hot water and electric) are located in a mechanical room on the Junction level and serve the Cable Access, Junction level Rest Rooms, and Cab. They work in lead-lag relationship with 100% redundancy (when one unit works, another unit is in standby).

AHU-15 (2,000 CFM, 5 tons) is a DX split-system located in the Penthouse with the outdoor condensing unit (CU-15) located on the adjacent walkway. In 2006, during the minor HVAC modifications this system was replaced and a package air conditioner (AHU-16; 1,700 CFM, 4.7 tons) was added as a backup on the opposite side of the Penthouse. Also during the 2006 upgrade, additional unit heaters (hot water) were installed from Level 3 through 10. It appears that the intension was to control room condensation/mold problems by keeping rooms warmer. Actually this action probably produced a result opposite that desired (see discussion following).

HVAC Systems in Base Building

The Base Building has four air handling units (AHU-1 through 4), heating and cooling from these units are provided by hot water heating and chilled water respectively. As in the Tower Building, hot water for heating and chilled water are produced by the same boilers and chillers located in this Base Building.

AHU-1 (3,000 CFM, 168 MBH cooling, 104 MBH heating) located in Basement (Room B18) is a single zone unit with face & bypass dampers in unit, it serves part of the basement. AHU-2 (4,600 CFM, 157 MBH Cooling, 124 MBH heating) also located in the Basement (Room B18) is a three-deck, multi zone unit, it serves the rest of the spaces in the basement. AHU-3 (11,000 CFM, 346 MBH cooling, 303 MBH heating) located on the First Floor (Room 131) is a three-deck, multi zone unit, it serves the entire First Floor. AHU-4 (9,100 CFM, 303 MBH cooling, 266 MBH heating) located on the Second Floor (Room 205) is a three-deck, multi zone unit, it serves the entire Second Floor.

Each of these four AHU units has a matching return fan so that relief air can be properly exhausted from main return air prior to mixing with outside air. As the total air quantity for relieved and exhausted air streams are very close to the total outside air intake, the Base Building pressurization is essentially neutral to the outdoors. This represents a risk of possible air and moisture infiltration during windy and rainy days. "Stack effect" is not typically considered in design for this low-rise building.

Pressure drops across filter bank and cooling coils as tested in field varied somewhat from original specifications and needs to be corrected during the retrofit and subsequent commissioning. Cooling coil temperature drop in each of these units was also tested. As the outdoor temperature was relatively mild during investigation, cooling was not at its peak capacity in each unit. However, operation seemed logical.

DTW ATC Air Handlers
31-Aug-09

	AHU-1	AHU-2	AHU-3	AHU-4	AHU-11	AHU12	AHU-13	AHU-14
Return air	72	72.7	73	71.5	78.4	71.9	71.6	69.6
Discharge air	64.7	56.1	54.4	52.9	67.4	65.8	59.4	62.2
ΔT - Air								
Water In	77	46	49	44	50	NA	45	52
Water out	72	NA	52.5	47.5	57.5	59	54	49
ΔT - Water								
ΔP Filters	0.73	1.946	0.225	1.49	0.95	0.709	1.86	0.85
ΔP Cooling Coil	0.001	0.153	0.019	0.04	0.42	0.545	0.882	0.5

Since the Data Center on the Second Floor houses communication, control and radar equipment, the space has a raised floor with multiple down-flow Liebert AC units to provide cooling for IT/computer/Radar equipment and personnel in the TRACON and associated spaces.

HVAC Systems in Link Building

Two ducted fan-coil units (FCU-3) provide heating and cooling at First Floor of Link Building, two ceiling-mounted fan-coil units (FCU-2) provide heating and cooling at its Second Floor.

Observations

There were four significant areas of concern identified during the investigations:

- There is significant uncontrolled air movement throughout both the Tower and Base Building. Such airflow can move contamination generated in one part of the facility to another such as is the case with mold from the tower shaft being carried to the Junction and Cab levels and moisture and VOCs from outside into the Base Building. This is related both to structural problems and operation of the various building systems.

DTW Air Flows
31-Aug-09

Cable Access	Stairway	>	Interior	>	Cab							
Junction	Stairway	>	Vestibule	X	Hall	<	Elevator					
Sub-Junction	Stairway	>	Vestibule	>	Interior	>	Elevator	Interior	>	Mechanical		
10	Stairway	>	Vestibule	X	Hall	<	Elevator	Cable	>	Hall		
9	Stairway	>	Vestibule	X	Hall	<	Elevator	Cable	>	Hall		
8	Stairway	>	Vestibule	<	Hall	<	Elevator	Cable	<	Hall		
7	Stairway	<	Vestibule	<	Hall	<	Elevator	Cable	<	Hall		
6	Stairway	<	Vestibule	<	Hall	<	Elevator	Cable	<	Hall		
5	Stairway	<	Vestibule	<	Hall	<	Elevator	Cable	<	Hall		
4	Stairway	<	Vestibule	<	Hall	<	Elevator	Cable	>	Hall		
3	Stairway	<	Vestibule	<	Hall	<	Elevator	Cable	>	Hall		
2	Stairway	<	Vestibule	<	Hall	>	Elevator	Cable	>	Hall	>	Security
1	link	>	Stair	>	Hall	>	Elevator<	Connector	<	Base		
1	Stairway	<	Hall	<	Smoking							

< or> indicates direction of flow
X indicates balance

    - Part of this will be corrected through a planned fire-stopping project.
    - Additional improvement may be provided through changes proposed by the Building Science group.
    - Enhancements will be needed to the air distribution systems throughout the facility and associated controls.
- The temperature conditions in the Tower shaft lead to a high risk of moisture condensation on surfaces and this was made worse during the 2006 project by the addition of more unit heaters.
- There were some errors in the design of HVAC systems that have led to deterioration of air quality. Major ones include:
    - There is no return air fan to AHUs 11 &12. This causes the relief vent into the Sub Junction open space to act as an outside air intake; drawing contaminated air from this space. Since the relief duct is large (36" X 36") relative to the intended outside air inlet duct, most of the outside air is drawn through this opening and from an area of probable high contamination rather than through the cleaner source that was the intended outdoor air source.
    - Economizer cycles were incorporated into the systems resulting in the possibility of contaminated and/or moisture laden air being brought in beyond the cleaning and drying capacity of the systems.
    - There is insufficient clean outside air capacity to assure positive pressurization of the facility.
- The control system enhancements incorporated into the 2006 renovation were never completed. Thus the system does not have the capability to respond to changes in air flow due to temperature and wind variation throughout the work day and adjust systems so that air flows and pressure balance remain as desired.

Discussion and Analysis

Upper Tower , Cab, Cable Access, Junction, Sub-Junction)

A key to maintaining acceptable air quality in the upper tower is compartmentalization of this area from lower portions of the tower where contamination may orignate. At present, it is not possible to maintain a positive pressure in the Cab relative to levels below. Part of this is because of air leakage through the building enclosure. The Corps of Engineers has established a widely accepted standard for acceptable building leakage (0.25 cfm/75 ft^2 at 75 PA). Applying this standard, leakage for the cab area should be no more than about 10 cfm total. In an attempt to develop a rough estimation of the flow of air that would be needed to pressurize the cab relative to lower levels, we introduced the flow from two 500 cfm air movers while monitoring pressure differential between the cab and 10th level. At maximum flow (~1,000 cfm) the increase in pressure differential was less than 5 PA (significantly below the 50PA that is normally desired to separate clean spaces from those that are less clean). Since there is so much leakage, it is not possible to accurately quantify it. It is safe to assume that leakage is hugely is excess of the 10 cfm that would be considered optimal for the facility.

- In addition, there are penetrations between levels 10 and below and the Cab that allow airflow from below. There are two factors that are working to propel air from below into the top levels of the tower. These are wind effect (directional wind blowing against the sides of the structure) and stack effect (thermal force due to hotter air being lighter than cooler air). As building height doubles wind effect also doubles and as height quadruples, stack effect roughly doubles and the greater the temperature differential, the greater stack effect. Overcoming these forces so as to control air flow will be a significant challenge. Examples of identified conduits for air movement from lower to upper levels of the tower that have been identified include:
- Cable Access – top
  - Duct penetrations to Cab – These are difficult to access and observe. They appear to fit the slab penetrations but some do not appear to have been sealed with fire stop.
  - Cable tray to Cab – These have residual fire stopping material which has been disturbed and should be replaced.
  - Inspect conduit and service penetrations
- Cable Access – floor
  - Drain pipes from Cab Cat walk – The floor penetrations for these are much larger than the pipes and do not appear to have ever been fire stopped.
  - Cable trays from below – These have fire stopping material, however there is air flow from below so it must either be removed and replaced or supplemented.
  - Supply, return and exhaust (toilet and kitchen) ducts from Junction level – all of these show some air movement around ducts where they penetrate the floor.
- Cable Access - Other – Air ducts have never been mastic sealed. Sealing is especially important for the supply duct that runs through the non-conditioned exterior space and the relief duct from the elevator shaft to the exterior.
- Junction Level
  - Ceiling – See Cable Access floor (above)
  - Floor – Check cable tray penetrations
- Sub Junction
  - Ceiling – Cable tray penetrations
  - Floor – There is a huge (~1' X >4') unsealed penetration from the 10th floor to under the computer floor
  - Due to equipment placement, we were unable to check for other possible unsealed penetrations. The ceiling tiles above the 10th floor should all be removed and the slab between 10 and Sub-junction should be completely inspected for additional air leakage.
- Other – The 2" poly drop tubes that are no longer in use are open from the 10th floor or other levels to the Cab and allow for considerable air flow between those spaces.

Finally, there is not a sufficient supply of conditioned outside air to pressurize the Cab available from the existing air handlers. Maintaining the highest level of air quality in the Junction and Cab levels is dependent on providing a high quality of supply air to the occupied area in sufficient quantity to hold back any contaminated air stream from below. This will be attained through a combination of proper HVAC system operation, an added source from the Penthouse level and building enclosure integrity.

Shaft Levels (3-10)

Location personnel expressed a desire to utilize these levels for office and/or storage. This would require ventilation and air-conditioning for these spaces. This is technically feasible. It would require the following:

1. Install 4 pipe fan coil units, common ventilation duct and associated control points – estimated cost; $48,000
2. Convert existing heating only two pipe fan coil units to heating/cooling 4 pipe units – estimated cost $18,000
3. Replace existing chillers to assure sufficient capacity for added load – see Base Building estimates.

Although this is technically feasible, it is not recommended. Arranging occupancy for the shaft levels will complicate controlling conditions so as to maximize the potential for maintaining satisfactory air quality in the upper levels which would seem to be the primary objective of the project.

Base Building

The Base Building has been plagued with periodic water incursion events. Fortunately, these appear to have been corrected quickly enough to avoid extensive fungal growth and the associated risks. All efforts must be made to limit or eliminate these and this is being addressed by the Building Science team. However, the primary threat to air quality in this area is the poor control of building pressurization. The capacity of the existing HVAC Systems should be sufficient to establish and maintain positive pressurization of occupied spaces relative to mechanical areas and the exterior. Presently this is not being done and the building goes negative drawing in fumes and moisture laden air from time to time. In addition, it appears that VOC content of the air may on occasion exceed the capacity of the Gas Phase filters and they should be evaluated for possible breaching. Current filters have a 20# of media. Although this is adequate for the Tower where the air supply is reasonably free from VOCs or they are extremely diluted it may not be adequate for the TRACON. In comparable situations beds of up to 90# have been utilized to meet the challenges and avoid breakthrough of odors.

The control system upgrade began in 2006 needs to be completed and the full capability of the new system implemented. In addition, the entire air circulation system must be redesigned and enhanced so that airflow will be dynamically controlled through system logic rather than human intervention. Currently, the system does not have either sufficient sensors or control outputs (modulating dampers) to maintain the air flow and balance required in a critical facility.

Maintenance Contract

Maintenance of the HVAC systems in the facility is split between the Environmental Services personnel on staff and an outside maintenance contractor. This arrangement is sensible as it splits duties both on need and capability. The current contract, however, is rather general in describing the responsibilities of the outside contractor (Provide labor and materials to perform all inspections, tests, and maintenance to insure the proper operation and safety of the Heating/Ventilating/Air Conditioning system (HVAC) at the FAA ...). Considerable clarity could be added by inserting, "in conformance with ASHRAE/ACCA/ANSI Standard 180 (Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems)" to the current contract document when it is placed for renewal. This new standard which was published in September 2008 represents the consensus of leading experts in the industry as to those inspection and maintenance tasks and task frequencies that represent the most prudent approach to HVAC maintenance.

Recommendations

Upper Tower (Penthouse, Cab, Cable Access, Junction, Sub-Junction)

- Correct temperature control – Currently, temperature control is uneven. Temperature can vary 7-10 degrees F from one side of the Penthouse to the other depending on which AHU is in operation. An additional temperature sensor plus reprogramming of the control system will be required.
    - Cost estimate - < $3,000
- Install Dedicated Outdoor Air System (DOAS) on Penthouse walkway and duct to Cab ceiling (with multiple supply grills). This will add an additional source of clean/conditioned air, pressurize the Cab and help overcome the stack effect that risks introducing contamination from below to the Cab. Final design of this system cannot be completed until the building enclosure and fire stopping projects are complete as the proper size for this system cannot be determined until these tasks are complete and current leakage has been reduced.
    - Cost estimate - $78,000
- Seal Openings between each upper level as well as possible and between those levels and shaft below (fire stopping project).
    - Cost estimate – Existing estimate: separate project
- Install pressure differential monitoring/alarm system to monitor pressure differentials between Cab and Junction and Junction and level 10. Initially this will be an independent system utilized to document and quality assure engineering controls during remediation and evaluate effectiveness of air flow sealing as a design input for sizing of DOAS system. When the overall air distribution retrofits are undertaken, this system will become a key to providing the air needed to assure correct balance of air flow into the Cab.
    - Cost estimate - $5,000
- Install damper and actuator in elevator shaft pressure relief duct in Cable Access level and integrate with fire alarm system so that duct is closed except in case of fire.
    - Cost estimate - $5,000
- Seal supply duct in Cable Access level (this will not be needed if Building Science recommendation to make the area where this duct runs part of the 'interior').
    - Cost estimate - pending
- Create vestibule at Junction level elevator door. This will be done by placing a door closer on the existing door between the elevator and hallway, installing an additional door (self closing)

between the elevator and bathrooms, replacing the suspended ceiling with a hard ceiling and equipping both doors with switches that trigger alarms if the doors are open longer than a reasonable time (5 minutes suggested).
  - Cost estimate - $5,000
- Add a return air fan to AHUs 11/12 on Sub-junction level.
  - Cost estimate - $28,000
- Minimize temperature differential between ambient and surfaces on levels 3-10. Immediately we suggested changing fan coil and unit heater set points to 50^{0}F or below. This should be lowered until elevator occupants complain of cold and optimally these units should be turned off. If the Building Science recommendation to insulate the walls of the shaft is implemented, this will be less critical.
  - Cost estimate – Facility personnel
- Install relief vents with modulating damper in link and integrate with control system.
  - Cost estimate - $15,000
- Equip Link doors with closers and position switches that will activate alarm if open for more than 5 minutes.
  - Cost estimate - < $1,000
- Add VOC sensors to Base Building and integrate with control system.
  - Cost estimate - $36,000
- Rework Gas Phase filtration system for AHU-4 to increase capacity.
  - Cost estimate - $8,000
- Prepare airflow map for entire facility and retrofit air distribution and control systems to assure dynamic balance control. This will include replacement of some existing volume balancing dampers with modulating dampers, additional sensors for air and water flow and complete reprogramming of the control system both to incorporate all of the new sensors and output devices and to add logic to dynamically control system operation. Total control points are estimated to be 450. This will build on the existing system and complete the work that should have been done. It will allow for dynamic control of airflow and balance between times of day and seasons with minimal operator intervention.
  - Cost estimate - $380,000
- Replace existing chillers to recover capacity and correct current energy inefficiency.
  - Cost estimate - $218,000
- Complete specifications and plans for above additions and retrofits.
  - Cost estimate – 10%
- Project Management.
  - Cost Estimate - TBD
- Rebalance all systems.
  - Cost estimate - $25,000
- Provide Commissioning Agent to oversee project and assure completion as designed.
  - Cost estimate - $40,000
- Training for local operating personnel.

  - Cost estimate - $10,000
- Maintenance contract – Reference ASHRAE/ACCA/ANSI Standard 180 in the outside maintenance contract.
  - Cost estimate – unknown - estimated to be minor

The first priority should be to seal the upper tower from lower levels and monitor the pressure relationships. That will minimize risk for those working in the upper levels and quality control effectiveness of engineering controls utilized during remediation activities. The second priority will to begin design of the facility pressure and air flow map along with system enhancements and retrofits that will be required to maintain the desired relationships.

BBJ Environmental Solutions October 29, 2009

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11/10/09

DURING SHIFT	Tower
GIB	
Remove on	12/09/09
Originator	
Copies to	

Federal Aviation Administration

Memorandum

Date: November 10, 2009

To: Everyone

Gary Ancinen

From: Acting Staff Manager

Subject: Mold Project Update

The Mold Remediation Integrated Team met at DTW on Monday and Tuesday. The team consisted of representatives from Parsons Technology, Regency DKI, Envirotech, Wondermakers, BBJ, Building Science Corp., NATCA, PASS, and numerous people from various branches of the FAA.

The team reviewed the findings of the studies on the flaws in the building, the beginning steps of the mold remediation, and held discussions on the scope of the project and timeline.

The water intrusion problems in the building are caused by leaks in the structure near the microwave dishes, condensation due to poor insulation, and a leaky roof over the base building. Contributing to air quality problems in the building are mold contamination and other issues in the HVAC system, poor pressure control, and previous mold control efforts. In addition, the building does not provide for adequate fire/life safety.

The first part of the project is to complete fire-blocking the tower cab. This not only will improve fire safety, it will allow the cab to maintain a higher air pressure relative to the rest of the building. This will help keep odors and contaminants out of the cab. This project begins on the midnight shift on November 11 and will mostly be conducted below the cab. The technicians will need to enter the cab to cut the old drop tubes so they can be removed. This will be done by the use of a heated wire and should cause minimum disruption in the operation.

The second part of the project is the cleaning of the Liebert units that keep the equipment cool on the second floor. This will be accomplished on the midnight shift as well beginning on Monday, November 16. The ducts will be vacuumed, the insulation replaced where necessary, and the cooling units cleaned with a low odor cleaner. This should cause minimum disruption to the TRACON. We do not plan to relocate the TRACON to the tower for this project, but this can be done on short notice if the CIC deems it necessary.

The third part of the project is an interim repair of the leaks into the tower. This will be accomplished by inject foam into joints on the tower cab balcony. This will temporarily stop most of the water from getting into the tower shaft. This will be done from outside and will have no effect on operations. This repair is expected to occur sometime during the week of November 16.

The heaters in the elevator shaft were turned off today. They were installed in 2006 to warm the shaft and keep condensation from forming, but actually made it worse. This is not expected to lead to an uncomfortably cold elevator.

Pressure monitoring equipment will be installed in the cab the week of December 5. This will allow the technicians to verify that the corrective actions to increase tower cab air pressure are working. This will complete Phase 1 of the project and keep things from getting worse.

An executive summary of the findings and recommended actions to fix the problems is due to be completed by November 30. A project schedule is due to be completed by December 31. After that, the "order of battle" can be determined, the contractors can be selected, the cost estimates finalized, and then work can begin.

The actual remediation will be a huge effort that may take up to 3 years to complete. Most, if not all, of the drywall in the tower and base building will need to be replaced; the HVAC system will need to be cleaned twice, redesigned, and rebuilt; the base building roof torn off and replaced; new walls and doorways constructed; and the fire integrity restored. A temporary exterior elevator may need to be installed, we will need to utilize the "old" tower for periods of time, a temporary TRACON may be needed, offices will be displaced, and a lot of safety studies will be conducted.

The next meeting of the integrated team is scheduled for the week of January 10.

We will provide regular updates on the progress of the project. If you have any questions, please see a union representative, Project Coordinator Phil Yeldo, SSC Manager Tina Siebertz, or me.