Hoffmann Architects

Slab Moisture Investigation

Branford Police Department
Branford, CT

Architect's Project No. 220030

7 May 2020

Town of Branford
1019 Main Street
Branford, CT 06405

Hoffmann Architects, Inc.
2321 Whitney Avenue
Hamden, CT 06518
203/239-6660

Contents

Executive Summary

Constructed in 1994, the Branford Police building at 33 Laurel Street, is a single-story structure clad with brick and capped with a low-slope roof. The basement level of the building opens on grade at the north elevation and contains a garage area, holding cells, lockers, physical fitness equipment, and storage. Excessive moisture in the basement slab of the building has been an ongoing issue for many years and flooring failures throughout the basement are frequent.

Hoffmann Architects was retained by the Town of Branford to perform a slab moisture investigation and recommend repair strategies to mitigate moisture vapor transmission to the interior spaces. To assist with the investigation, Hoffmann Architects retained Independent Floor Testing & Inspection (IFTI) who performed specific ASTM tests, related to concrete slab moisture, at select locations in the basement.

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According to the IFTI test results, the moisture vapor transmission rate (MVER) through the concrete slab varies, depending on test location, from 8.6 pounds per 1,000 square feet per 24 hours, to 13.7 pounds per 1,000 square feet per 24 hours, with the relative humidity within the concrete ranging between 91% and 93%. As a comparison, sheet and tile manufacturers do not allow their materials to be placed when the MVER levels exceed 2 or 3 pounds per 1,000 square feet per 24 hours.

A typical basement slab assembly includes a vapor barrier placed on top of a compacted sub-base prior to the pouring of the concrete slab. This membrane greatly reduces the potential for moisture vapor transmission. While we cannot confirm or deny the presence of a vapor barrier, it is Hoffmann Architects' professional opinion that the slab was cast without an effective vapor barrier membrane. This failure or omission of an effective vapor barrier is the primary cause of the excessive water vapor transmission through the concrete slab.

Installation of an effective vapor barrier membrane below the slab is impractical as this would require removal and reconstruction of the slab and, by extension, the interior finishes. Moisture mitigation efforts must therefore be conducted from the surface (generally referred to as negative side waterproofing). There are coating products available for negative side waterproofing of concrete. They are formulated to resist specific rates of moisture vapor transmission and should be selected in accordance with the MVER testing results.

To mitigate the moisture vapor transmission through the basement slab at the Police building, Hoffmann Architects recommends the application of a vapor control system membrane capable of resisting approximately 14 pounds per 1,000 square feet per 24 hours. To install this system, all surface finishes must first to removed and then subsequently reinstalled or replaced. Our opinion of the probable cost of construction to implement this work is $296,000. Leveling compounds, if present below the surface finishes, must also be removed and replaced; as these compounds were not observed, the cost of this work is not included in this estimated construction cost.

Introduction

Constructed in 1994, the Branford Police building at 33 Laurel Street, is a single-story structure clad with brick and capped with a low-slope roof. The basement level of the building opens on grade at the north elevation. There are ground floor garage doors for police vehicles to directly enter into the basement. In addition to garage space, the basement includes space for holding cells, lockers, physical fitness equipment, and storage.

In February of 2019, Mr. Benjamin Robinson, Senior Architect, and Mr. Robert Delagrange, Business Development Manager, both with Hoffmann Architects met with representatives from the Town of Branford at the Police building to discuss their concerns with excessive moisture in the basement slab of the building. We were told that moisture at the basement slab has been an ongoing issue for many years and that flooring failures throughout the basement are frequent. Subsequent to this initial visit, Hoffmann Architects provided a proposal for a slab moisture investigation.

In October 2019, several months after submission of the original proposal, Mr. Brian Droney, Facilities Manager / Lead Tradesman for the Town of Branford, contacted Hoffmann Architects to request an updated proposal. Mr. Droney indicated that the Town of Branford was prepared to implement the slab moisture investigation at the Police building.

To assist with the investigation, Hoffmann Architects retained Independent Floor Testing & Inspection (IFTI). Based in Concord, California, IFTI employs teams of floor testing inspectors throughout North America. Their personnel are certified "Slab Moisture Testing Technicians" by the International Concrete Repair Institute.

The American Society for Testing and Materials (ASTM) has published standards for evaluating moisture in concrete floors. Hoffmann Architects requested that IFTI perform slab moisture testing at select, pre-determined locations, to determine the rate of moisture vapor transmission through the basement slab. The following are the applicable ASTM test methods to be performed:

- ASTM F1869-11 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

- ASTM F 2170-11 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.

On 16 April 2020, Mr. Lawrence Keenan, AIA, PE, Senior Vice President with Hoffmann Architects, met at the Police building with Mr. David Gotz, NE Regional Field Technician with IFTI. Mr. Gotz implemented the field tests at seven locations in the basement. To complete the testing process, three visits to the building were necessary. On visit No. 1, Mr. Gotz prepared each test area by removing flooring, scarifying the concrete slab, and placing relative humidity probes. On visit No. 2, the vapor emission test units were placed, and on visit No. 3, these units were collected and the previously removed flooring was reinstalled.

Observations

The basement of the Branford Police building is divided into rooms with various functions including men's and women's locker rooms, evidence storage, meeting rooms, holding cells, and a workout room. Finish flooring varies throughout. Each finish floor material is applied to the basement concrete slab. Flooring materials include, vinyl composition tile (VCT), solid vinyl tile, resilient gym flooring, and epoxy coating.

In February 2019, Hoffmann Architects made the following general observations while on site discussing the project with Branford officials. In the workout room, we lifted a loose-laid, resilient floor tile and discovered VCT underneath. On the underside of the resilient flooring (rubber), moisture was present.

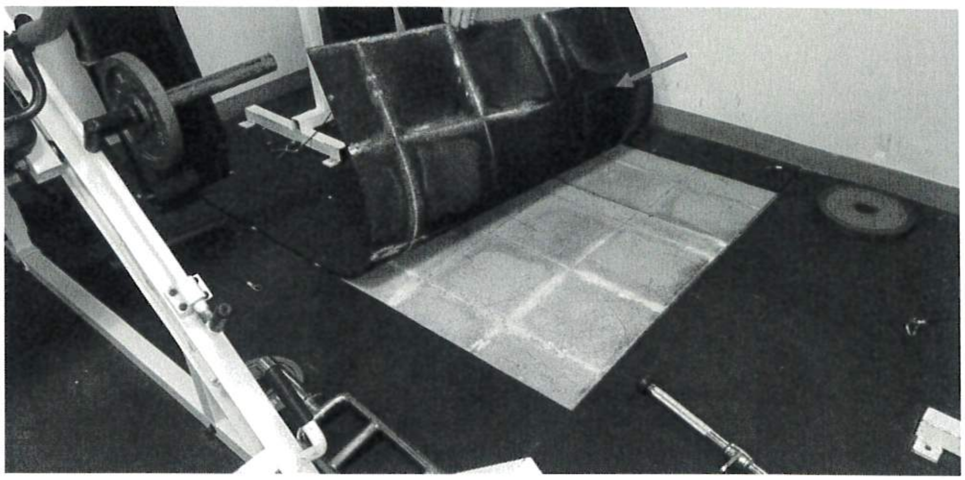


Photo 1 - View of resilient floor, lifted. Note: moisture present on underside.

In the men's locker room, the finish flooring is a gray solid vinyl tile. This tile is applied over a blue membrane material. We were able to easily remove one small tile and noticed that there was little to no adhesion of the tile to the substrate.

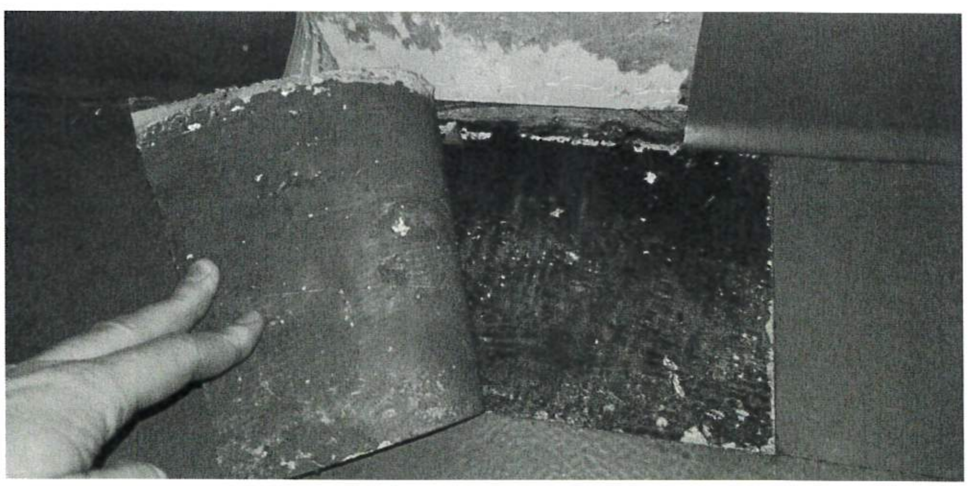


Photo 2 - View of solid vinyl tile, lifted. Note: blue membrane underneath.

In the roll-call meeting room, VCT covers the entire floor. At select locations, we observed a white powder material and brown staining collecting at tile joints.

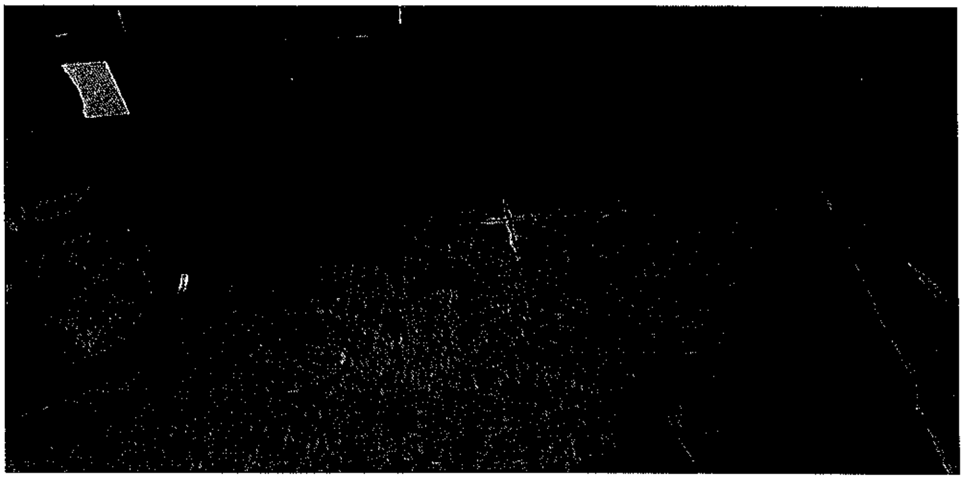


Photo 3 - View of VCT in roll call room. Note: white powder and brown staining at tile joints.

Elsewhere in the basement of the Police building, the primary floor covering is epoxy coating. Spaces with epoxy flooring include hallways, holding cells and evidence storage. Bubbles, blisters and cracks in the coating are evident throughout. The coating in some areas has been replaced.

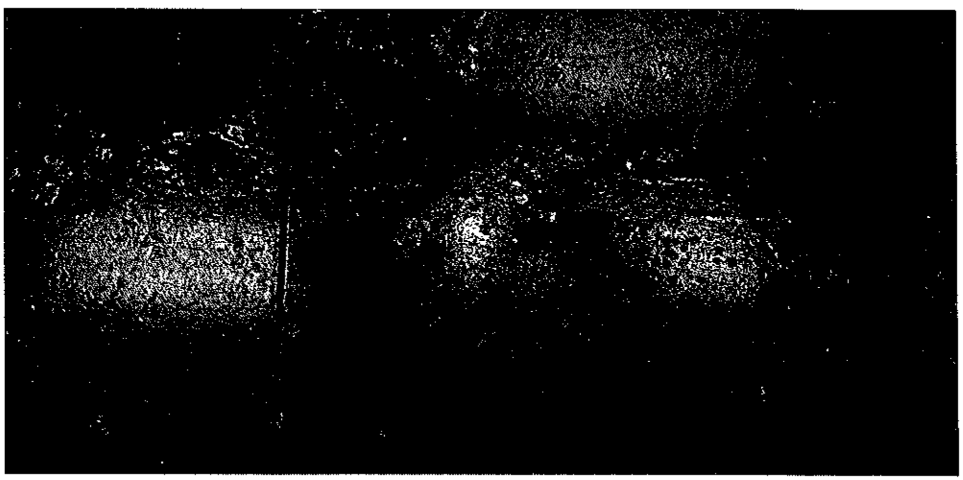


Photo 4 - View of epoxy coated floor in holding cell area. Note: blisters and defects.

The quantity of required relative humidity tests (ASTM F2170) is dictated by the total affected floor area. Based on the approximate area of 10,675 square feet, seven test sites were chosen. The test site location plan is found below, and within the test results report by IFTI in the appendix.

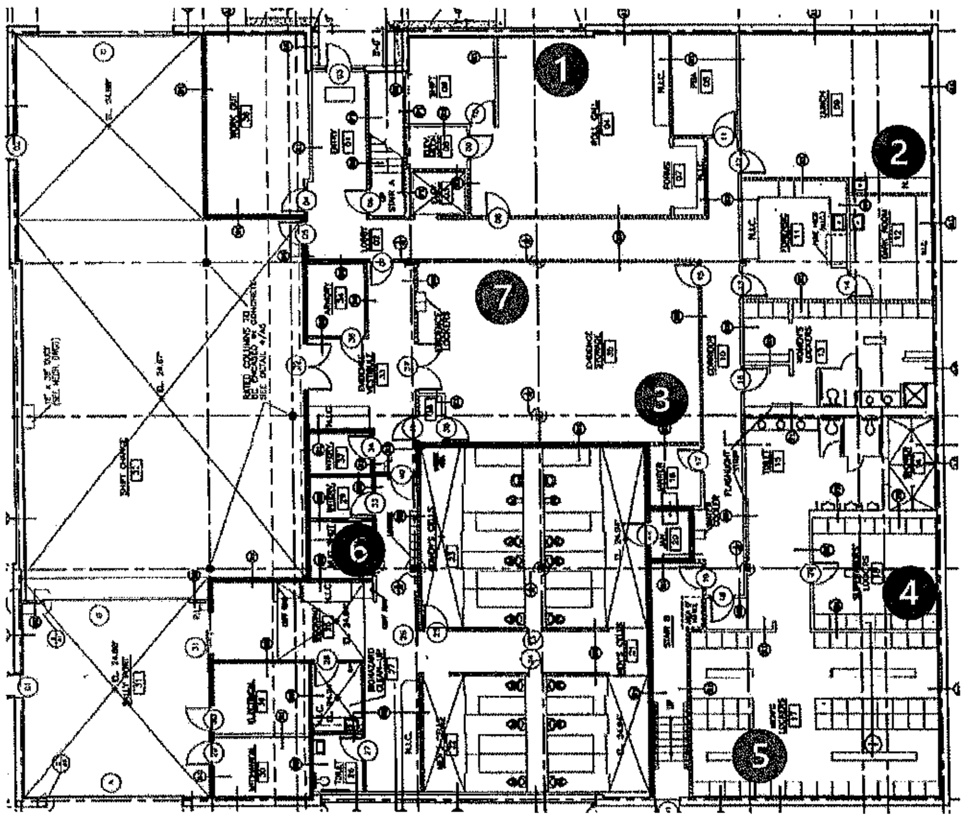


Photo 5 - Ground floor plan. Yellow shaded area is not part of test area. Red dots indicate test locations.

The following is a summary of observations at each test location.

Test #1

Location:

- Roll-call

Finish Flooring Assembly:

- VCT
- Adhesive (cream colored)
- Concrete Slab

Three vinyl composition tiles were removed by IFTI and the concrete slab was prepared for moisture testing. The adhesive that bonds the VCT to the concrete slab was wet. Tiles were not securely bonded.

Photo 6 - View of VCT flooring in roll call room.

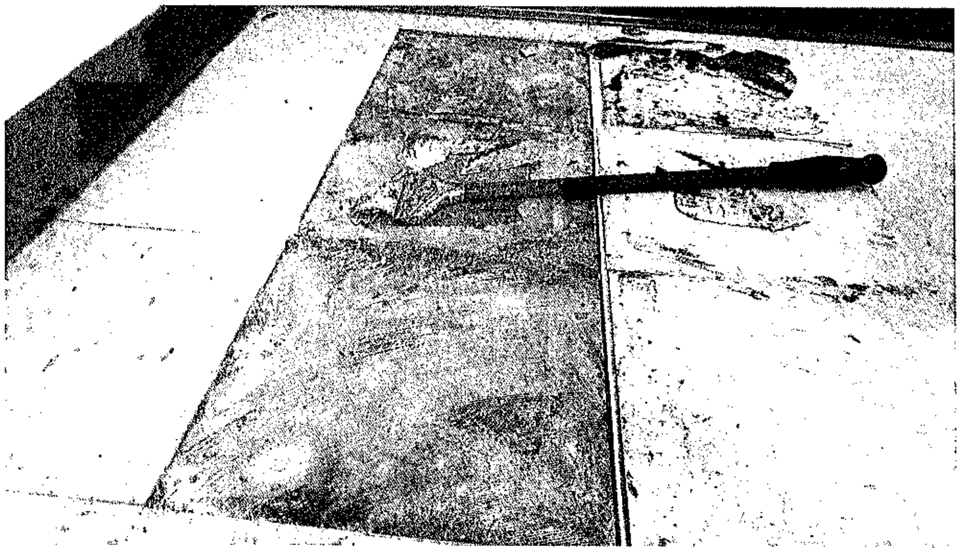


Photo 7 - Three tiles removed in roll call room. A scraper was used to remove the VCT adhesive.

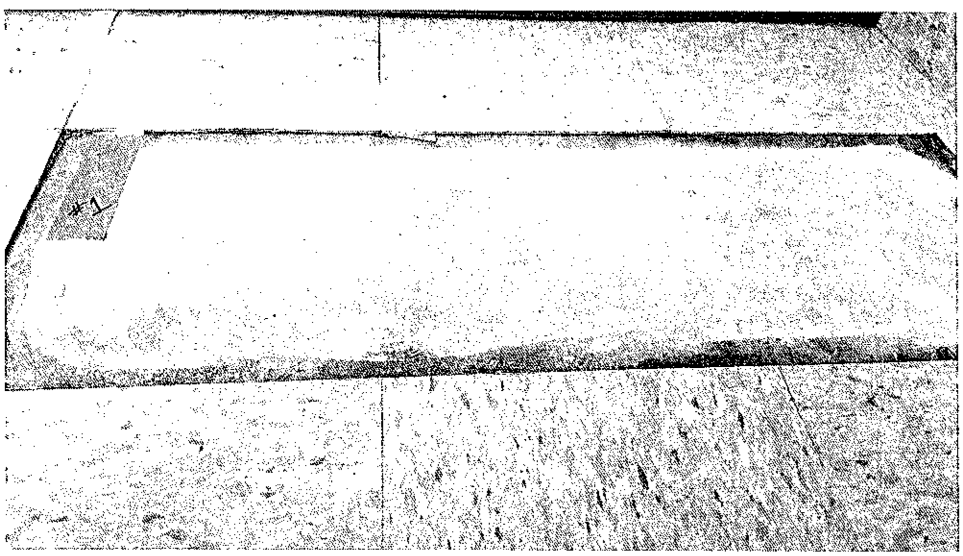


Photo 8 - The concrete was scarified with a grinding wheel to prepare for implementation of test #1.

Test #2

Location:

- Gym

Finish Flooring Assembly:

- Rubber Tile
- VCT
- Adhesive (cream colored)
- Concrete Slab

A section of resilient rubber flooring was rolled back, and eight vinyl composition tiles were removed by IFTI. The concrete slab was prepared for moisture testing. The adhesive that bonds the VCT to the concrete slab was wet. Tiles were securely bonded in this room. However, the VCT adhesive was wet and re-emulsified.

Photo 9 - View of resilient rubber flooring at gym.

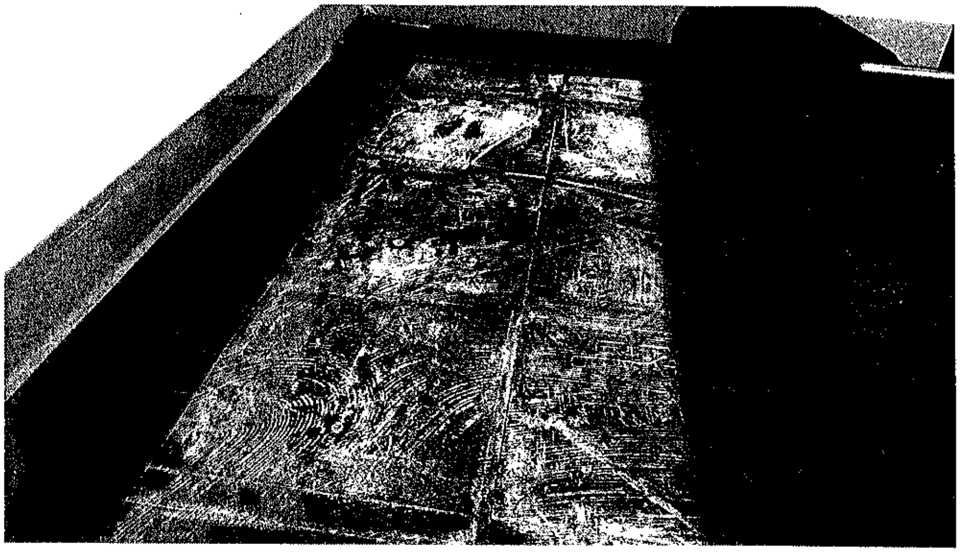


Photo 10 - View of resilient rubber floor rolled back to expose VCT.

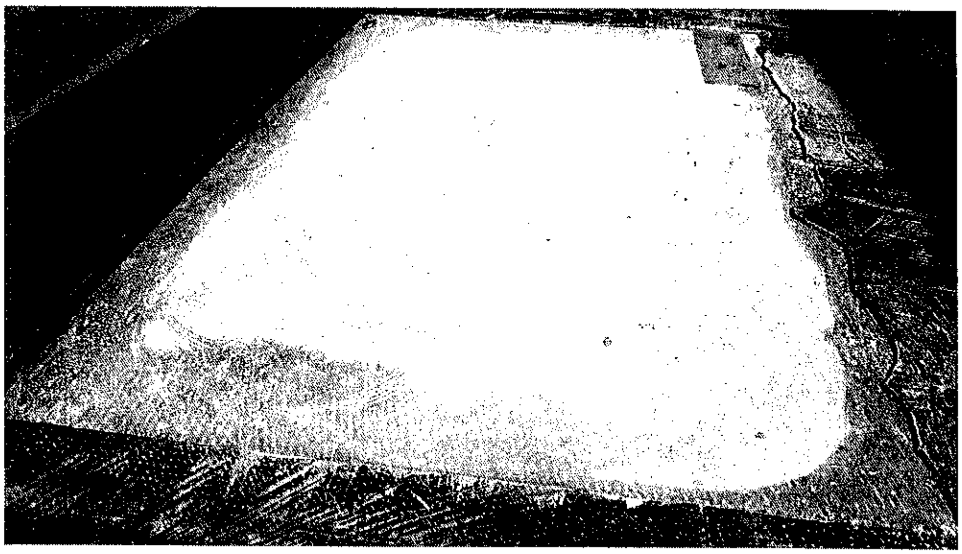


Photo 11 - The concrete was scarified with a grinding wheel to prepare for implementation of test #2.

Test #3

Location:

- Evidence Room

Finish Flooring Assembly:

- Epoxy floor coating
- Concrete Slab

A limited area of epoxy coating was removed to expose the concrete slab. The concrete was scarified, and the testing apparatus installed.

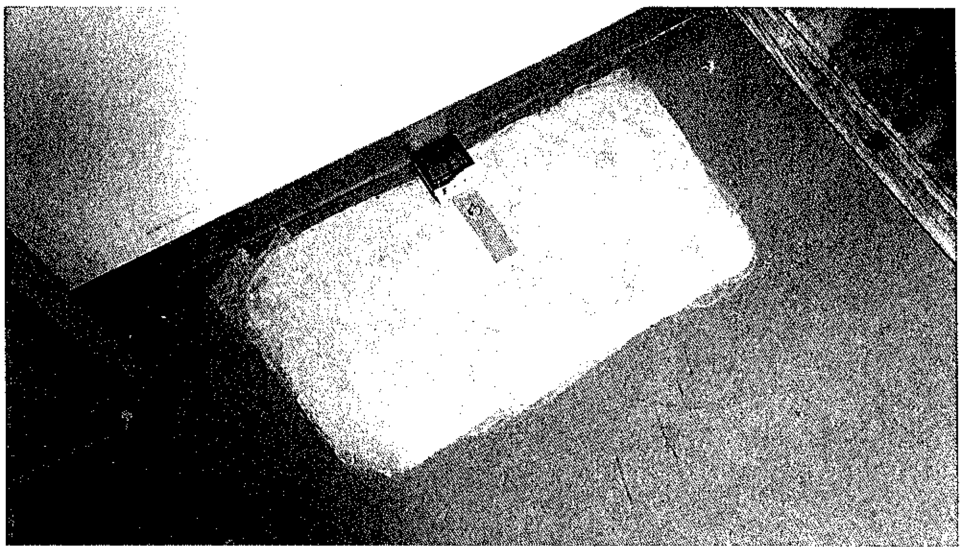


Photo 12 - View of prepared test area with Relative Humidity probe installed.

Test #4

Location:

- Supervisor's Locker Room

Finish Flooring Assembly:

- Solid Vinyl Tile
- Adhesive (cream colored)
- Blue colored coating
- Concrete Slab

Four vinyl tiles were removed by IFTI and the concrete slab was prepared for moisture testing. The adhesive that bonds the vinyl tile to the blue coating on the concrete slab was wet and re-emulsified. Tiles were not securely bonded.

Photo 13 - Vinyl tiles removed in supervisor's locker room. Note: blue coating on slab.

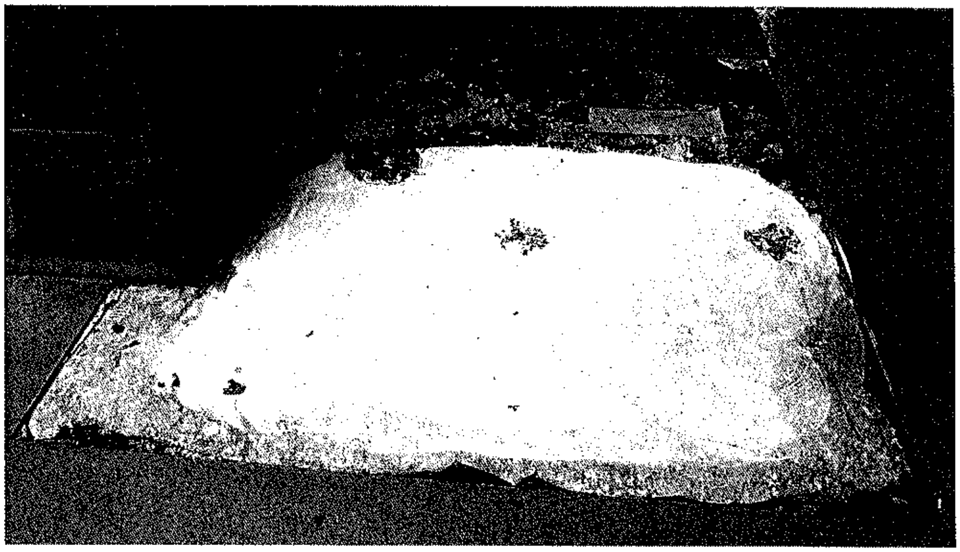


Photo 14 - Concrete slab prepared for testing in supervisor's locker room.

Test #5

Location:

- Men's Locker Room

Finish Flooring Assembly:

- Solid Vinyl Tile
- Adhesive (cream colored)
- Blue colored coating
- Concrete Slab

Four vinyl tiles were removed by IFTI and the concrete slab was prepared for moisture testing. The adhesive that bonds the vinyl tile to the blue coating on the concrete slab was wet and re-emulsified. Tiles were not securely bonded.

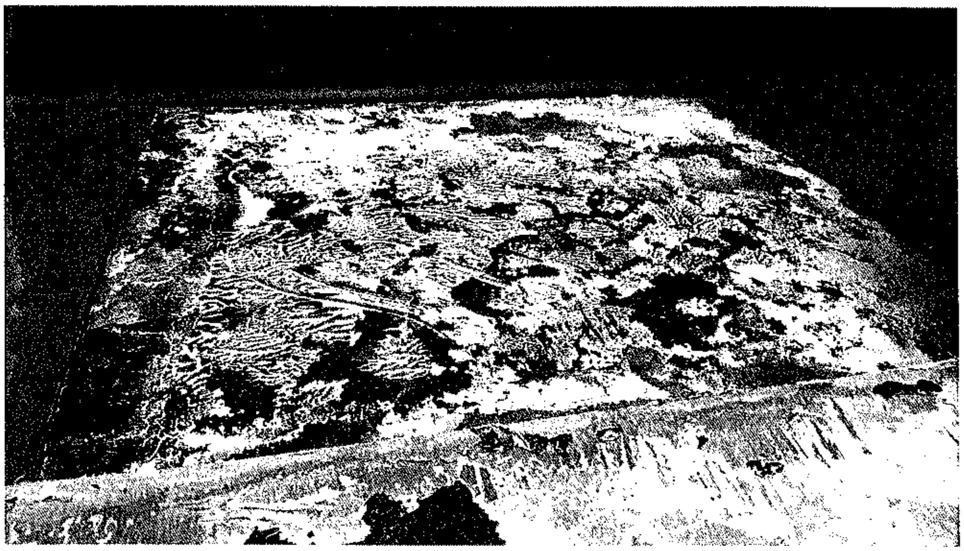


Photo 15 - View of vinyl tile removed in men's locker room.

Photo 16 - Adhesive bonding vinyl tiles to blue coating was wet, deteriorated, and paste consistency.

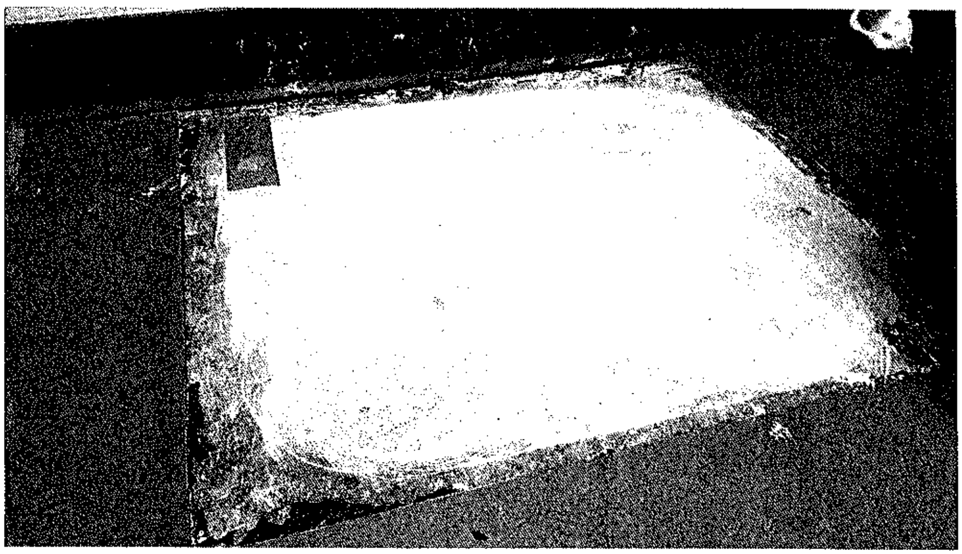


Photo 17 - View of prepared concrete slab in men's locker room.

Test #6

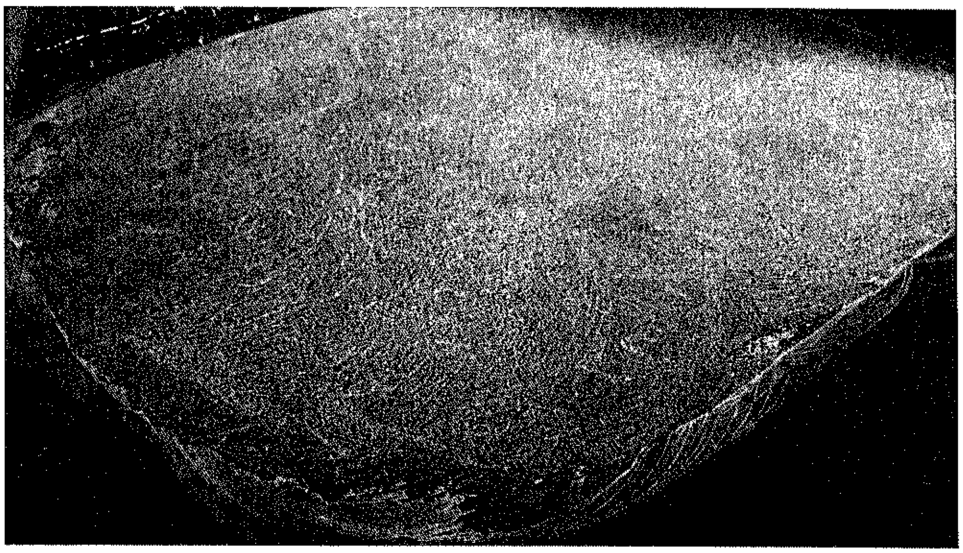
Location:

- Mug Shot Room

Finish Flooring Assembly:

- Epoxy floor coating
- Concrete Slab

A limited area of epoxy coating was removed to expose the concrete slab. The concrete was scarified, and the testing apparatus installed.



Test #7

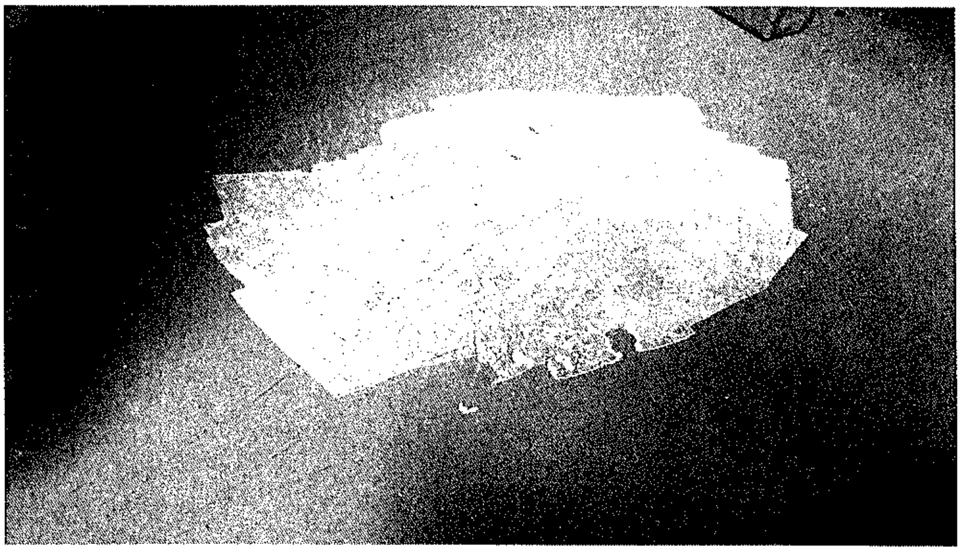
Location:

- Evidence Room

Finish Flooring Assembly:

- Epoxy floor coating
- Concrete Slab

A limited area of epoxy coating was removed to expose the concrete slab. The concrete was scarified, and a calcium chloride test was implemented.



Evaluations

Reasons

Since the Police building was constructed in 1994, moisture vapor emission through the basement concrete slab has caused numerous finished flooring failures. Flooring failures include lifting or heaving vinyl composition tiles and solid vinyl tiles, as well as blistering epoxy coating. Moisture vapor transmission through the concrete slab is attributable to the lack of an under-slab vapor barrier, a high water table and the characteristics of the concrete.

We reviewed the 1994 construction documents for the Police building which was designed by Chase and Denes Architects. Within this set of drawings, there is no detailing of the foundation or the basement slab. The cover sheet lists six S-series drawings (structural drawings) which likely contain information about the slab. However, these drawings are not included within the set.

A typical slab assembly includes a vapor barrier placed on top of a compacted sub-base prior to the pouring of the concrete slab. This membrane greatly reduces the potential for moisture vapor transmission. While we cannot confirm or deny the presence of a vapor barrier, it is Hoffmann Architects' professional opinion that the slab was without an effective vapor barrier membrane. This failure or omission of an effective vapor barrier is the primary cause of the excessive water vapor transmission through the concrete slab.

Wet soil conditions and a high water table also contribute to a high rate of moisture vapor transmission. Moisture vapor travels from a cool humid environment to a warm dry environment. In this case, the basement of the Police building is warm and dry, as it is mechanically conditioned.

Moisture vapor transmission will always occur as the exterior and interior conditions are relatively constant. Outside, or underneath the slab, the ground temperature is a constant 55 degrees with a relative humidity of 100%. These values equate to vapor pressure of .21psi. With the interior air temperature at a constant 70 degrees and a relative humidity of 20%, the vapor pressure is 0.72 psi. The difference between exterior and interior vapor pressure is 1.42psi of upward pressure.

According to the IFTI test results, the moisture vapor transmission rate (MVER) through the concrete slab varies, depending on test location, from 8.6 pounds per 1,000 square feet per 24 hours, to 13.7 pounds per 1,000 square feet per 24 hours, with the relative humidity within the concrete ranging between 91% and 93%. As a comparison, sheet and tile manufacturers do not allow their materials to be placed when the MVER levels exceed 2 or 3 pounds per 1,000 square feet per 24 hours.

The finish flooring and the adhesive that the flooring is set into is acting as a barrier on the negative side of the slab. This is problematic as these materials are not designed to resist moisture vapor transmission. On the negative side (interior), products applied to a substrate must be specified to resist moisture vapor transmission or hydrostatic pressure. While, on the positive side (exterior), vapor barriers are compressed into the substrate and do not need to resist pressure. There is likely no positive side vapor barrier under the slab or it was widely and systemically damaged or breached during construction.

Recommendations

The installation of a positive side vapor barrier (beneath the slab) would be the most effective solution to combatting the moisture vapor transmission through the concrete slab. However, the installation of this barrier involves demolishing the basement slab and casting a new slab, a project that is not practical.

Moisture mitigation efforts must therefore be conducted from the surface (generally referred to as negative side waterproofing). There are coating products available for negative side waterproofing of concrete. They are formulated to resist specific rates of moisture vapor transmission and should be selected in accordance with the MVER testing results.

To mitigate the moisture vapor transmission through the basement slab at the Police building, Hoffmann Architects recommends the application of a vapor control system membrane capable of resisting approximately 14 pounds per 1,000 square feet per 24 hours. Coating manufacturers require specific substrate preparation to ensure a successful installation of their products. Typically, surface preparation includes the complete removal of old coatings and adhesives, and the profiling of the concrete slab to a Concrete Surface Profile (CSP) #3. CSP3 is defined as a "light shot blast." After surface preparation and vapor control system application, new finish flooring products can be installed.

The finished space in the basement is approximately 11,000 square feet. To accomplish the moisture vapor mitigation project, the scope of work is as follows:

- Removal of furniture and fixtures from the affected floor areas; $
- Removal of existing flooring materials and adhesives;
- Light shot blasting of the existing concrete slab surface;
- Application of a vapor control system membrane;
- Installation of new finish flooring, and
- Miscellaneous repairs to damaged interior finishes.

Hoffmann Architects opinion of the probable cost of construction to implement this work is $296,000. Leveling compounds, if present below the surface finishes, must also be removed and replaced; as these compounds were not observed, the cost of this work is not included in this estimated construction cost.

Appendix

Slab Moisture Testing Report by Independent Floor Testing & Inspection (IFTI) – 4/23/20

IFTI THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Corporate Offices: 2300 Clayton Road, Suite 1240, Concord, CA 94520
P: (800) 490-3657 F: (877) 814-0338 E: ifti@floortest.com

EXECUTIVE SUMMARY: P-200375
Date: April 23, 2020

COMMISSIONED BY		PROJECT LOCATION	
Name:	Hoffman Architects, Inc.	**Name:**	Branford Police Department
Address:	2321 Whitney Ave.	**Address:**	33 Laurel St
City:	Hamden, CT 06518	**City:**	Branford, CT 06405
Phone:	(203) 239-6660	**Phone:**	(203) 239-6660

History:
The Commissioner stated the Police station is experiencing flooring failure throughout the basement of the building. The Commissioner has requested that IFTI perform Sample Moisture Testing (Pilot Study) and provide a Certified Moisture Test Report. Additionally, the Commissioner would like IFTI to produce a risk assessment depicting the potential of a moisture related flooring failure.

Sample Moisture Testing (Pilot Study):
As requested, we have performed Sample Moisture Testing (Pilot Study) of the concrete slab (see attached Moisture Test Report). Additionally we observe as follows (see site photos for details):

- We found Vinyl Composition Tile (VCT) installed with what appeared to be a cream colored adhesive, over a concrete substrate, with the use of a cementitious patching compound to prepare the existing substrate. We observed that the existing flooring was not securely bonded, i.e. an unusual amount of force was not required to lift it from the substrate. We also observed at test site(s) #1 the adhesive appeared wet.
- We found Rubber Tile Flooring installed over a layer of Vinyl Composition Tile (VCT) installed with what appeared to be a cream colored adhesive, over a concrete substrate. We observed that the existing flooring was somewhat securely bonded, i.e. a reasonable amount of force was somewhat required to lift it from the substrate. We also observed at test site #2 that the adhesive appeared wet and reemulsified.
- We found Solid Vinyl Tile installed with what appeared to be a cream colored adhesive, over a blue coating, over a concrete substrate. We observed that the existing flooring was not securely bonded, i.e. a reasonable amount of force was not required to lift it from the substrate. We also observed at test sites #4 and #5 that the adhesive appeared wet and reemulsified.
- At test site #3, #6, and #7 we observed a grey colored coating installed over the concrete substrate.
- See attached "(MVER) Moisture Vapor Emission Rate", "Internal Relative Humidity", and "Alkalinity - pH" Test Results Mapping Diagrams for a visual depiction of the numerical values represented over the concrete slab.

Analysis of IFTI's Risk Assessment and Repair Option Chart:
As requested, please find attached IFTI's Risk Assessment and Repair Option Chart to assist in interpreting the Test Data:

- In summary, the Risk Assessment is showing that overall; a "Moderate to High Risk Condition" exists.

Submitted by Greg Mercurio, Service Delivery Manager

IFTI THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Moisture Test Report

COMMISSIONED BY	PROJECT LOCATION	Moisture Test Report #: P-200375
Name: Hoffman Architects, Inc. Address: 2321 Whitney Ave. City: Hamden, CT 06518 Phone: (203) 239-6660	Name: Branford Police D Address: 33 Laurel St City: Branford, CT 06405 Phone: (203) 239-6660	Report Date: April 23, 2020 P.O. #: Authorized By: Robert Delagrange Terms: Net 30

TEST DEPLOYMENT PARAMETERS

	Date	Time	Temperature	Humidity	Dew Point
Start:	04/17/20	4:20 PM	68.3° F	35% RH	39.4 F
Finish:	04/20/20	3:05 PM	68.7° F	28% RH	34.1 F
		Maximum:	69.0° F	35% RH	
		Minimum:	68.1° F	24% RH	

NOTES

See Comment(s) on Last Page

The "Factor" used to calculate the actual test area of the Calcium Chloride test site: 108.74

The Concrete Slab thickness was observed during field testing to be: 5 inches

Moisture & Alkalinity (pH) Testing

Moisture conditions for concrete fall into two categories: Static & Dynamic. A Static Moisture Condition is a function of how wet the internal structure of the concrete presently is (usually expressed by percentage). A Dynamic Moisture Condition is a function of how much moisture is currently evaporating from the surface (usually expressed in pounds per 1,000 square feet per 24 hours). An Alkalinity Condition is a function of alkaline and/or other soluble salts that are at the surface of a concrete slab (expressed by pH, the degree of acidity or alkalinity measured on a scale from 0-14). Moisture testing for concrete also falls into two categories: subjective & objective. A subjective, qualitative test relies upon the person testing to make an opinion on the test result and/or condition. An objective test quantifies the result and/or condition in terms of percentage, pounds of emission and pH values. Consequently, the most meaningful tests (recognized by most flooring manufacturers and ASTM) are those that quantitatively produce an objective test result from measuring the Alkalinity, Static and Dynamic conditions of a concrete slab.

NOTE: Moisture and Alkalinity (pH) testing only reflects the condition of the concrete floor slab at the time the tests are taken.

TEST RESULTS					Alkalinity Condition	Static Moisture Condition (moisture contained in slab)						Dynamic Moisture Condition (moisture vapor reading from slab)				
					Objective Testing	Subjective Testing		Objective Testing				Subjective Testing		Objective Testing		
Test Locations		Type(s) of Existing Floor Coverings	Visual Distress Level of Existing Floor Coverings	Surface Temp of Concrete	pH Testing ASTM F 710-11	Visual Appearance of Concrete	Concrete Slab Age	Quantitative Relative Humidity In Situ Probe Test: ASTM F 2170-11			Electrical Impedance Test Readings	Plastic Sheet Test	Mat Bond Test	Quantitative Anhydrous Calcium Chloride Test: ASTM F 1869-11		
Test No.	Areas	VCT, CPT, SV	1 to 5	°F	0 to 14	Color	Years	Depth from top of Slab, in.	RH in concrete, %	Temp in concrete, °F	0 to 7	Pass/ Fail	Pass/ Fail	Weight Gain in g.	Exposure Time/hrs	MVER Pounds
1	Roll Call Room	VCT	4	65.1	9.6	Light Grey	25.00	2	92.0	64	5.0	n/a	n/a	7.4	70.50	11.4
2	Gym	RUB T/VCT	4	62.7	9.5	Light Grey	25.00	2	93.0	63	6.3	n/a	n/a	5.9	70.50	9.1
3	Evidence Room	Coating	n/a	68.5	9.9	Light Grey	25.00	2	91.0	67	5.0	n/a	n/a	7.4	70.50	11.4
3QC	Evidence Room	-	-	-	-	-	-	-	-	-	-	-	-	6.6	70.50	10.2
4	Locker Room	SVT	4	61.3	9.7	Light Grey	25.00	2	93.0	63	5.9	n/a	n/a	8.9	70.50	13.7
5	Locker Room	SVT	4	61.3	9.8	Light Grey	25.00	2	93.0	63	5.1	n/a	n/a	7.3	70.50	11.3
6	Cell Room	Coating	n/a	64.9	9.6	Light Grey	25.00	2	93.0	67	4.8	n/a	n/a	6.0	70.50	9.3
7	Evidence Room	Coating	n/a	68.5	9.8	Light Grey	25.00	2	n/a	n/a	5.6	n/a	n/a	5.6	70.50	8.6

Continues on Page 2...

Field Testing

We were commissioned to perform Field Testing to determine the following:

- Moisture Vapor Emission Rate (MVER) of the concrete subfloor.
- The pH at the surface of the concrete slab.
- The Percent of Relative Humidity in the concrete floor.

Analysis

- Dynamic Moisture Condition: Moisture vapor that is radiating from the surface of a concrete slab. Referencing ASTM Test Method F 1869-11, this test method covers the quantitative determination of the rate of moisture vapor emitted from below-grade, on-grade, and above-grade (suspended) concrete floors slabs.
- Alkalinity Condition: As moisture vapor passes through a concrete slab, it can collect and condense (turns from a gas to a liquid) beneath a floor covering, at the adhesive bond line. Osmotic forces can compel soluble salts (efflorescence, alkaline salts and/or other contaminants) to the surface from the ground or the concrete itself elevating the pH to damaging levels. Referencing ASTM F 710-11 Appendix X1. Concrete Composition and Practices X1.4 Alkalinity: As Portland cement hydrates, calcium hydroxide and other alkaline hydroxides are formed. The pH of wet concrete is extremely alkaline, typically around pH 12.0 to 13.0. The surface of a concrete slab will naturally react with atmospheric carbon dioxide to produce calcium carbonate in the hydraulic cement paste, which reduces the pH of the surface.
- Static Moisture Condition: Condense, typically non-moving moisture (Internal Relative Humidity) contained within the body of a concrete slab. Referencing ASTM Test Method F 2170-11, this test method covers the quantitative determination of percent relative humidity in concrete slabs.

Rules & Standards

Referencing the following standards (copies provided upon request):

- ASTM Designation: F 1869-11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- ASTM Designation: F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- ASTM Designation: F 2170-11 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

Application

Dynamic Moisture Condition: Most flooring product Manufacturers and Organizations recommend that the maximum emission rate considered acceptable for moisture sensitive flooring systems is 3.0 pounds per 1,000 square feet per 24 hours, although 5.0 pounds per 1,000 square feet per 24 hours is considered acceptable for some products (based on the Anhydrous Calcium Chloride Test).

Alkalinity Condition: (alkaline and/or other soluble salts that are at the surface of a concrete slab): According to ASTM F 710-11 on pH: Readings below 7.0 and in excess of 10.0 have been known to affect resilient flooring or adhesives, or both. Refer to resilient flooring manufacturer's written instructions for guidelines on acceptable testing methods and acceptable pH levels.

Static Moisture Condition: Most floor covering Manufacturers and Organizations recommend that the relative humidity in a concrete floor slab shall not exceed 75% for moisture sensitive flooring systems, although 80% is considered acceptable for some products.

NOTE: The internal building envelope / environment conditions in which the slab is located WAS at "normal service temperature and humidity" (during moisture testing). Most floor covering Manufactures and Organizations agree that moisture testing shall be conducted after the internal conditions of the building in which a slab is located has been at normal service temperature and humidity for at least 48 hours. Otherwise, results may not accurately reflect the amount of moisture which is present in the slab or would normally be emitted from or through the concrete during normal operating conditions. If the service temperature and humidity is unattainable, the internal conditions of the building in which a slab is located shall have been maintained within the following temperature and humidity range for at least 48 hours: Temperature: 65° to 85° F (18° to 29°C), and Relatively humidity: 40% to 60%.

Comments

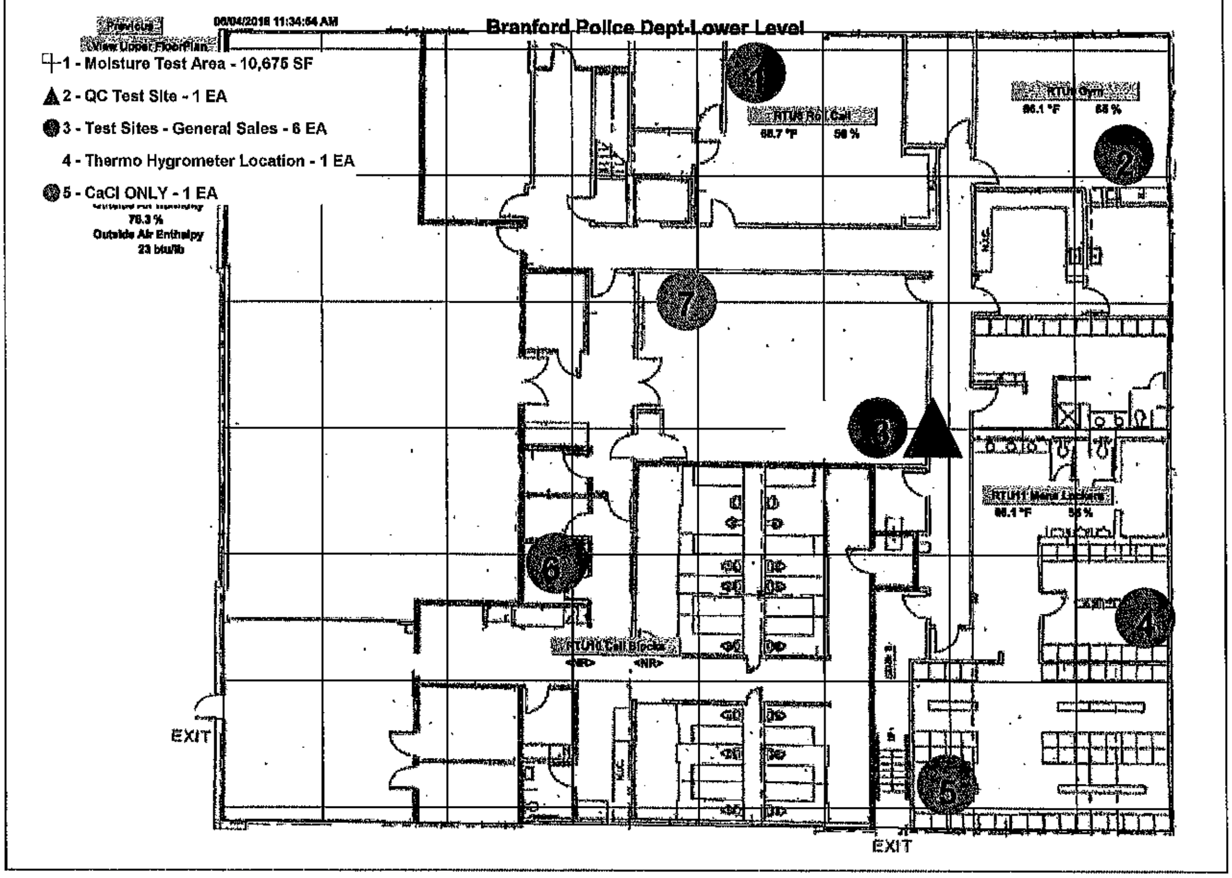
ASTM F1869 X1.2 A moisture test indicates a condition of the concrete floor slab at the time of the test, under the ambient conditions of the test, and may not predict the future moisture condition of the floor slab. This is especially true if an effective moisture vapor retarder is not present or has been compromised by damage or by improper installation. Ingress of moisture from subbase or subgrade soil can significantly increase the moisture condition of a concrete slab and potentially affect floor covering and adhesive performance when an effective vapor retarder is not present.

Please feel free to call for further detail pertaining to any information on this report.

Tested by: David Gotz
Title: Field Technician

Certified by:
Title: Certifier

Branford Police Dept.; Branford, CT



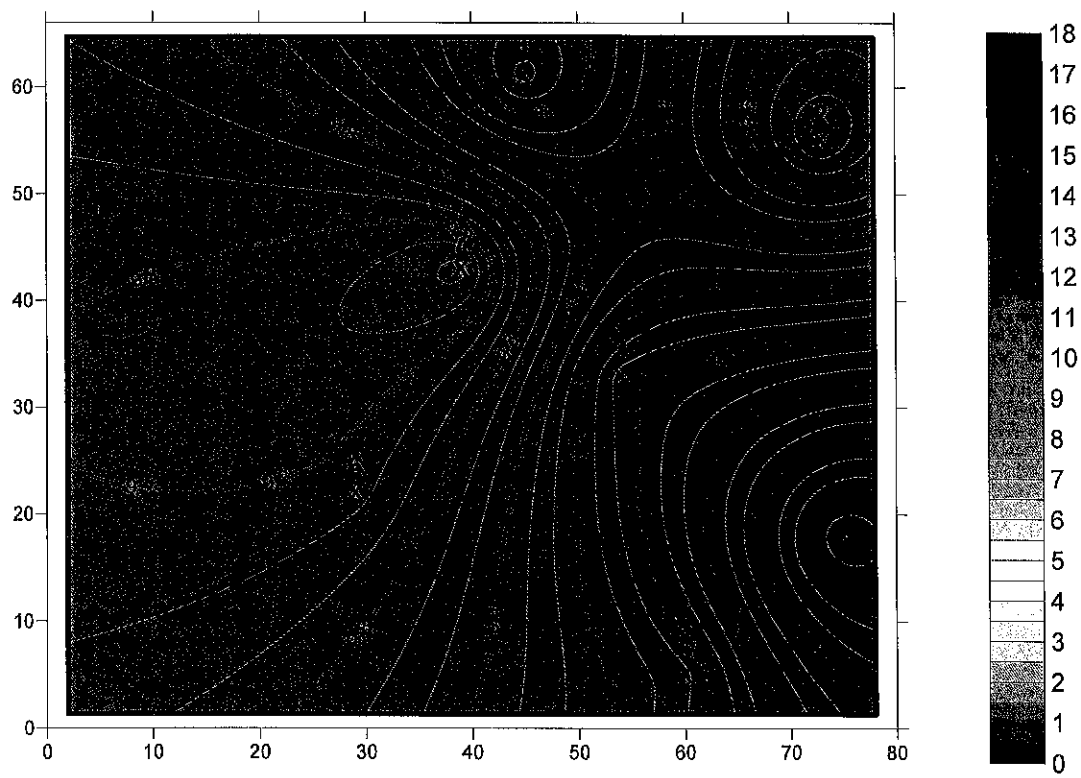
Lower Floor Plan Police Department (98% of Scale); Takeoff In Active Area: All Areas; Branford Police Dept.; OST; 4/15/2020 11:17 AM

THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Branford Police Department Branford, CT

Test Results Mapping Diagram

Moisture Vapor Emission Rate (MVER)

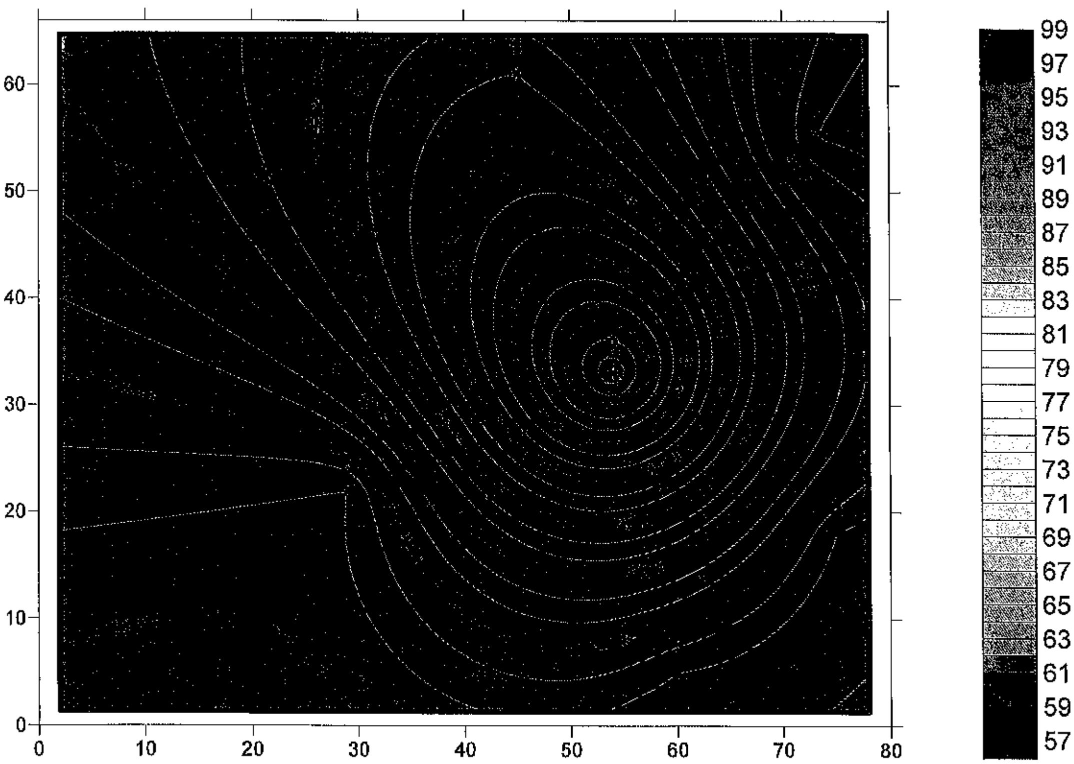


IFTI THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Branford Police Department Branford, CT

Test Results Mapping Diagram

Internal Relative Humidity

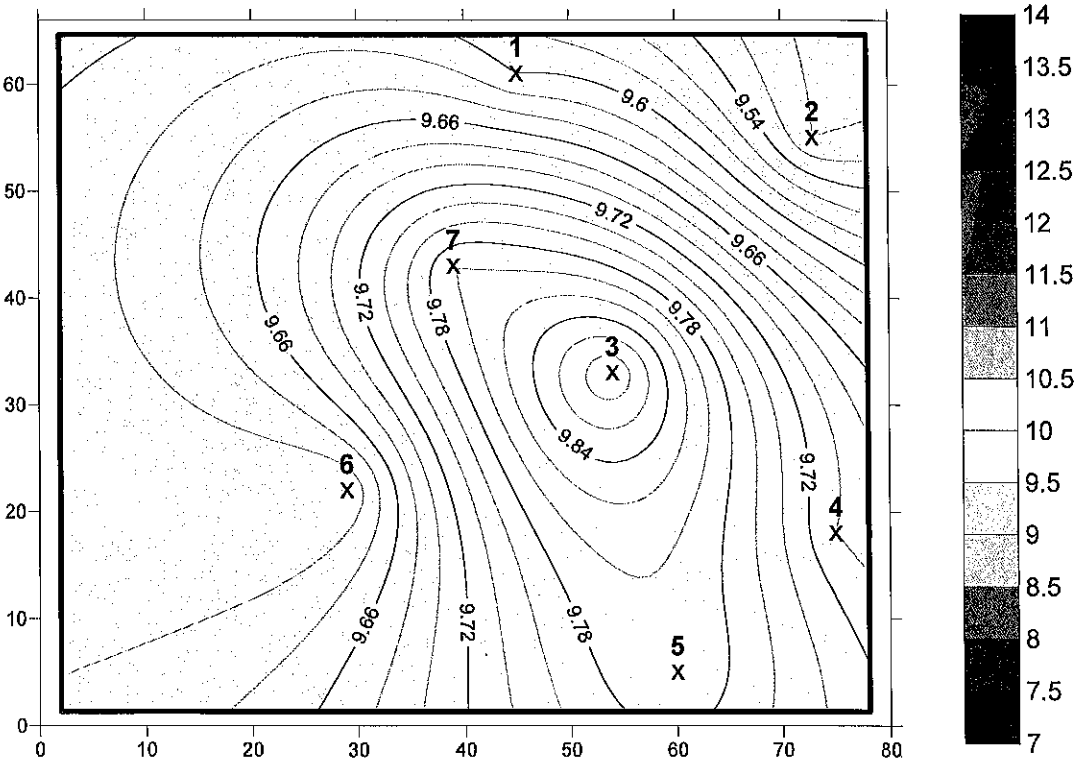


IFTI THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Branford Police Department Branford, CT

Test Results Mapping Diagram

Alkalinity - pH



IFTI's Risk Assessment & Repair Option Chart

IFTI THE NORTH AMERICAN SPECIALIST IN CONCRETE SLAB MOISTURE TESTING

Branford Police Department
Branford, CT

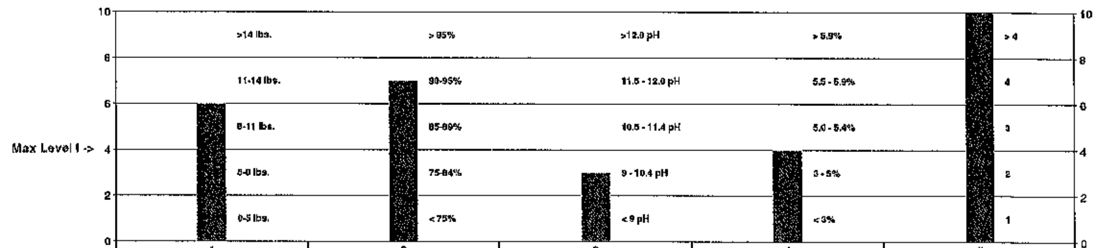
IFTI's Risk Assessment and Repair Option Chart
Based on Full Moisture Testing or Sample Moisture Testing, the Commissioner will analyze IFTI's Risk Assessment and Repair Option Chart, the costs associated with a flooring failure and considered recommended Repair Options.

P-200375

Region: Region1

Evaluation:

- Moisture Vapor Emission Rate (MVER) Evaluation
- Internal Relative Humidity Evaluation
- Alkalinity (pH) Evaluation
- Electrical Impedance (Meter) Evaluation
- Visual Distress Level of Floor Covering Evaluation



	1	2	3	4	5
Weighing Factors	37.00	43.00	7.00	5.00	8.00
Evaluation Points	6	7	3	4	10

Average Score: 64.4

Risk Range: 14.0

59.1	73.1

Risk Assessment: Low Risk | Low to Moderate Risk | Moderate | Moderate to High Risk | High Risk

Repair Options:

Low Risk	Low to Moderate Risk	Moderate	Moderate to High Risk	High Risk
i. Employ "NO" Moisture Control system (low risk of flooring failure, lowest initial cost option, no Moisture warranty)	i. Employ "NO" Moisture Control system (moderate risk of flooring failure, lowest initial cost option, no Moisture warranty), or ii. Employ a "Level I" Moisture Control system (low risk of flooring failure, low initial cost option, low risk of an invalid claim under the Moisture Control system warranty)	I. Employ a "Level I" Moisture Control system (moderate risk of flooring failure, low to moderate initial cost option, low to moderate risk of an invalid claim under the Moisture Control system warranty). Note: Core samples to evaluate the concrete slab, vapor retarder and subslab conditions at the core sites may be necessary to verify appropriateness of employing a "Level I" Moisture Control system in a Moderate Risk condition, or ii. Employ a "Level II" Moisture Control system (low risk of flooring failure, moderate initial cost option, low risk of an invalid claim under the Moisture Control system warranty)	i. Employ a "Level II" Moisture Control system (moderate risk of flooring failure, moderate initial cost option, and low to moderate risk of an invalid claim under the Moisture Control system warranty). Note: Core samples to evaluate the concrete slab, vapor retarder and subslab conditions at the core sites may be necessary to verify appropriateness of employing an "Level II" Moisture Control system in a Moderate to High Risk condition, or ii. Employ a "Level III" Moisture Control system (low risk of flooring failure, high initial cost option, low risk of an invalid claim under the Moisture Control system warranty)	I. Employ a "Level III" Moisture Control system (low to moderate risk of flooring failure, highest initial cost option, low risk of an invalid claim under the Moisture Control system warranty)

Note: The Average Risk Score is determined by weight averaging the Evaluation Points with the Weighing Factor for each condition. The Risk Range represents the variability of the average score as determined by sampling statistical methods. A smaller Risk Range represents more certainty in the Average Risk Score. In the absence of existing flooring the "Distress Level" evaluation will default to "1".

MVER AVG 10.8. MVER STDEV 1.8. RH AVG 92.5. RH STDEV 0.8. pH AVG 9.7. pH STDEV 0.1. Meter AVG 4.6. Meter STDEV 0.5. VDL AVG 4.3. VDL STDEV 0.6

Although these recommendations provided by IFTI are based on successful past experiences, they do not constitute any guarantee or the acceptance of any liability on end results.

Branford Police Department Branford, CT

Photo 1

Photo 2

Photo 3

Photo 4

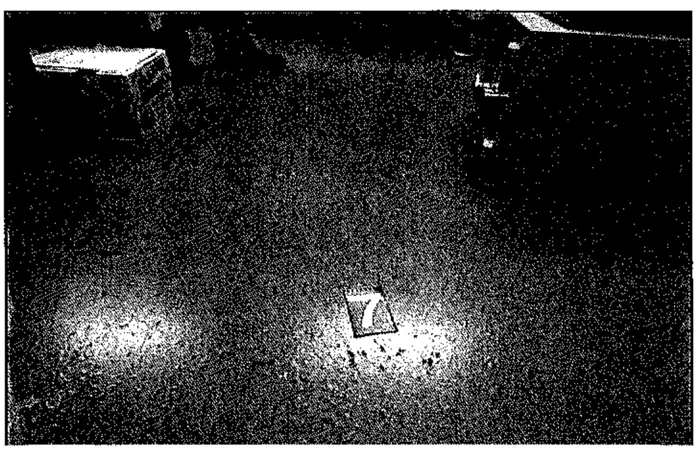


Photo 5

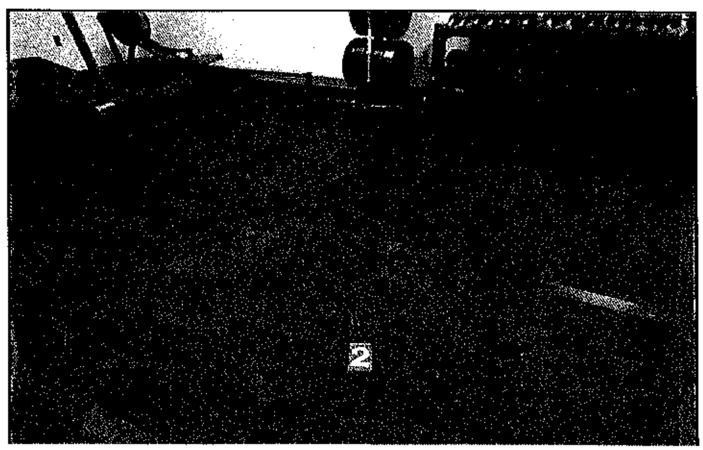


Photo 6

Branford Police Department Branford, CT

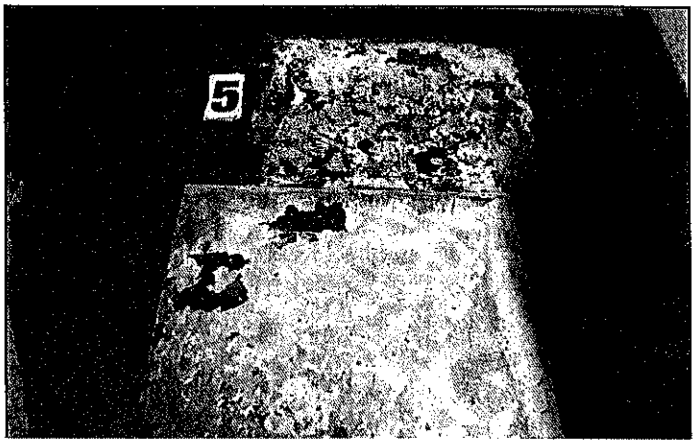


Photo 7

Photo 8

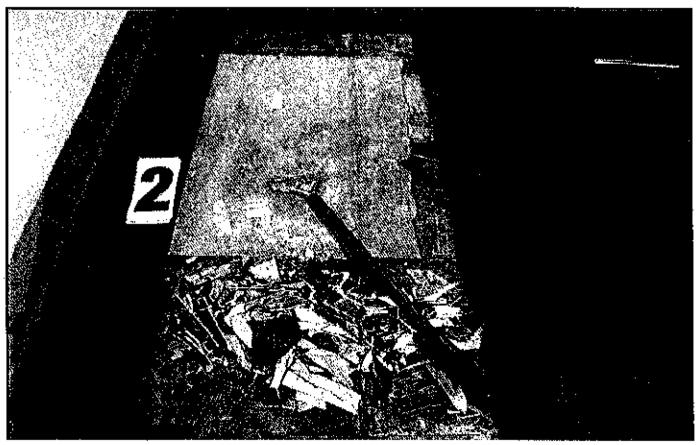


Photo 9

Photo 10

Photo 11

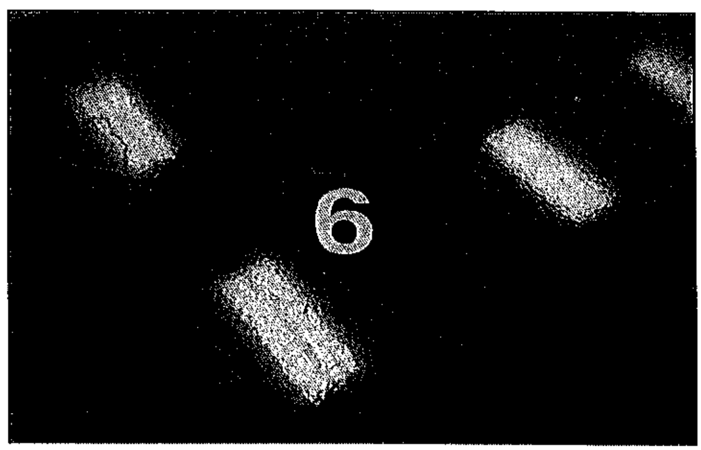


Photo 12

General Information

Construction Costs

Statements of opinion of probable construction costs given in this report do not include professional fees for consultants concerning repair procedures, preparation of construction documents, assistance with bidding, construction contract administration, or on-site observation of construction. Construction costs projected in this report represent our opinion as to what the probable costs, in today's dollars, might be to implement the recommendations. They are based on our experience supplemented by published cost estimating sources. They reflect preliminary data and have not been derived from accurate quantities, drawings, details, or specifications. Actual construction costs may therefore vary from the costs in this report.

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Construction Use Notice

This report is not intended for any purpose other than to report on conditions observed. Its language and recommendations are not sufficiently detailed or specific enough, nor have any drawings been provided, that could serve as a basis for securing proposals for or executing the recommended work. This survey does not represent that unseen problems may not exist. No representation is made or intended that implementation of our recommendations will place the property in a condition wholly free of all defects or hazards.