MINUTES

Building and Property

November 3, 2015
Land Information Conference Room
First Floor, Courthouse

MEMBERS PRESENT:	Supervisors Mike Behnke, Russ Bousley, Mike Cassidy, and Vilas Schroeder
MEMBERS EXCUSED:	Supervisor Ken Mattison
OTHERS PRESENT:	Deputy County Clerk BobbieJean Borkowski, and Facilities Director James Swanson, County Administrator Shawn Henessee, Fair Board President Dave Gross, Supervisor Kathy Just, River Cities Community Pool Executive Director DeeDee Thull, Eagle Herald, and Peshtigo Times

1. Call to order

Chair Behnke called the meeting to order at 10:00 a.m.

2. Agenda

Motion (Cassidy/Schroeder) to approve agenda. Motion carried.

3. Public Comment

None

4. Minutes

Motion (Cassidy/Bousley) to approve minutes of October 13, 2015. Motion carried.

5. Fairgrounds Annual Report – Dave Gross

Exhibit A

6. Fairgrounds update – Dave Gross

Exhibit B

7. Sheriff Department – Dispose of surplus items

Motion (Cassidy/Schroeder) to authorize the Sheriff's Department to dispose/destroy two (2) sending units bearing serial numbers S9014 & S9015, one (1) receiving unit without a serial number, and several related chargers and adaptor cords. Motion carried.

8. Preliminary Niagara Senior Center Facility Assessment

Committee reviewed preliminary draft from OHM Advisors for the Niagara Senior Center facility assessment. Facility Director will request additional insulation and add trusses when replacing the roof. Exhibit C

9. Johnson Controls Agreement – upgrading Door Access in County Buildings

Motion (Schroeder/Cassidy) to approve agreement with Johnson Controls to do a project development survey for upgrading the door access in the county buildings at a cost of $2,000. Motion carried. Exhibit D

10. UW Fieldhouse Assessment

Committee discussed the UW Fieldhouse Assessment priority list. They are looking at meeting with UW Marinette, Rivercities Pool, and Building & Property Committee to discuss the assessment further. Exhibit E

11. Pending RFP's

- Carpeting for dispatch
- Shades at Stephenson Public Library
- Plow for maintenance truck

Future RFP's:

- Plan service agreement for HVAC
- Plan service agreement for elevators

12. Facilities Director's Report

- Project updates
  - Additional work performed at HHS on Multi-zone AHU to clean ductwork. Exhibit F
  - Courtroom carpeting will be shipped November 17, 2015.
  - Received five (5) Chevy Impala vehicles on October 28, 2015
  - New truck is expected to be here in November.

- Focus on Energy Survey – addressing LEC and Courthouse buildings, these two buildings have the highest energy costs. There is discussion on having LED lighting and variable frequency drives. Dispatch now has LED lighting and lighting in the entrance way in the back of courthouse has also been replaced with LED lighting.

13. Future Agenda Items

- Approve pending RFP's

14. Adjournment

Motion (Cassidy/Schroeder) to adjourn at 11:17 a.m. Motion carried.

Next meeting date: Tuesday, December 8, 2015 at 10:00 a.m.

BobbieJean Borkowski, Deputy County Clerk
Date approved/corrected:

Exhibit A

MARINETTE COUNTY FAIR
2015 BUILDINGS AND GROUNDS EXPENSES

BUILDINGS EXPENSES

Cattle Barn - Temporary Structure		
Misc Lumber	$ 428.81	
Tent	1288.00	
Sand and Gravel	2209.55	
Total Temporary Barn		$3926.36
Bathrooms (old and new)		
Misc toilet repairs	$459.48	
Misc shower repairs	160.54	
Misc supplies	672.99	
Total Bathroom		$1293.01
Cattle Barn Project		
Misc Lumber	$7218.99	-
Misc Supports	5117.43	
Disposal	1317.68	
Rigging	1678.00	
Total Cattle Barn Project		$15332.10
Other Buildings		
Commercial Building	$203.26	
Vito's Building	130.81	
Country Visions	220.09	
Maintenance Building	91.56	
Barnstormers	272.95	
Fire Dept Stand	138.53	
Grandstand PA (TD Entertainment)	3457.47	
Alladin Fire	377.31	
Show barn (PA)	1560.00	
Misc Repairs	350.95	
Poultry Barn	517.01	
Horse Arena	1000.00	
Office	87.42	
Dorms	230.91	
Total Other Buildings		$8638.27

TOTAL BUILDINGS EXPENSES **$29189.74**

GROUNDS EXPENSES

Lawn Care		
Tractor (loan)	2974.24	
Tractor Maintenance	527.99	
Mower Maintenance(blade)	175.48	
Gas and Fuels	1740.59	
Misc Lawn Care	89.11	
Total Lawn Care Expense		$5507.41
Water System		
Misc. Water Repairs and Inspection	$ 43.35	
Winterizing	997.93	
Wausaukee Water and Sewer	2992.14	
Total Water System		$4033.42
Misc. Grounds Expense		
Repair Damaged Fence	$1450.00	
Pressure Washer	104.45	
Misc Repairs and Equipment	469.56	
Garbage Disposal (GAD)	5302.23	
Gravel - Limestone	415.00	
Campground	66.82	
Rebuild Pulling Track	1845.00	
Misc Electrical	75.81	
Winterizing	133.35	
Total Misc. Grounds Expense		$9862.22
Utilities		
Wisconsin Public Service	$5651.08	
Centurylink	1018.41	
Total Utilities		$6669.49
Insurance		$7951.00

TOTAL GROUNDS EXPENSE **$34023.54**

SUMMARY

BUILDINGS EXPENSES **$29189.74**

GROUNDS EXPENSES	**$34023.54**

TOTAL BUILDINGS AND GROUNDS	**$63213.28**
COUNTY ALLOCATED FUNDS	**$10000.00**

Note: All of the above projects were performed by volunteers and labor was not included.

Exhibit B

MARINETTE COUNTY FAIR

2016 TENTATIVE PROJECTS

1. Continue Cattle Barn project.
2. Start Replacing East Water Line.
3. Move Maintenance Building.
4. Seal coat from new bathrooms past barns.
5. Limestone road along south food stands.
6. Paint roof on Foods Building.
7. Continue painting Commercial Building and Antique Building.
8. Level northeast corner of parking lot.
9. Continue electrical upgrades and removal of old electrical.
10. Finish siding 4-H Food Stand and Barnstormers Stand.
11. Install lighting along main entrance and back fence.
12. Start rebuilding Old Bathrooms.
13. Replace siding on Vito,s Building..

MARINETTE COUNTY FAIR

2016 TENTATIVE PROJECTS
COUNTY FUNDING

1. Rebuild Cattle Barn with Milk house.
2. Insulate and replace roof on Show Barn - install gutters.
3. Replace roof on Antique Building.
4. Replace roof on FFA Food Stand.
5. Replace roof and insulate on Pig Barn.

Exhibit C

ARCHITECTS. ENGINEERS. PLANNERS.

OHM Advancing Communities℠

Niagara Senior Center Assessment

Marinette County

Niagara, Wisconsin

DRAFT

October 23, 2015

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1. Summary of Findings
2. Options and Recommendation
3. Appendix

DRAFT

1. SUMMARY OF FINDINGS

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Niagara Senior Center Assessment

OHM Advisors performed a building assessment on the Niagara Senior Center located on Washington Avenue. The purpose of the assessment was to review existing building conditions, mechanical and electrical systems, accessibility within the facility, the front entrance canopy and provide recommendations for building upgrades. The following is a summary of the items inspected and recommendations.

Masonry and Siding

The majority of the exterior of the building consists of ribbed CMU. The ribbed CMU is showing some biological growth especially in areas where it is close to grade or in contact with water from the roof structure. There are some areas in which the masonry joints are showing some deterioration.

An addition near the kitchen is constructed of smooth face CMU. There was deterioration noted at these surfaces.

The top of the wall has a metal siding system. Sections of the siding were loose in a few locations.

The piers at the front of the building are covered with a wood siding panel with a stucco finish. The siding panels are showing water damage near grade. There are also sections that have warped and pulled away from the pier.

The exterior hollow metal doors and frames are in need of coating.

Photo 1: Front Building Elevation

Photo 2: Entry Foyer

Front Entry and Aluminum Storefront

The front façade of the building consists of an aluminum framed storefront system with glazing/doors, ribbed masonry and a stucco finish panels at the pilasters (see Photo 1). There are three distinct storefront sections, each containing a bank of windows and an access door. The main entrance is a fourth section of storefront with a double door entering a foyer that is primarily enclosed by glass storefront (see Photo 2).

Currently each section of the aluminum storefront has a single glass door for accessibility. Each of these doors is permanently locked as there is not a need for multiple points of access (the front of the building contains one large assembly room). The glazing at the windows is double pane thermal glazing. The glazing at the entry door is single pane.

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Short masonry walls support roof framing between each storefront section. The walls are covered with stucco finish panels and allow for the roof to extend out over the front of the building. The roof framing in this area consists of large main glu-lam beams running north/south with smaller glu-lams framed in-between running east/west, supporting a wood tongue and groove deck. A large glu-lam beam is located above the aluminum storefront sections and a smaller glu-lam beam supports the fascia.

The glu-lam fascia beam shows signs of water damage and rot as do the ends of the main roof support glu-lams (see Photo 3). The extent of rot is unknown at this time as most of the exposed wood surfaces are covered up with temporary support members.

We would recommend removing the existing fascia siding, original fascia beam and beam repairs along the entire front of the building. The ends of the main glu-lam beams may need to be cut back to remove rotted wood and the fascia beams should be replaced. The roof area should be inspected by an engineer after the original glu-lams have been exposed, prior to final repairs being made. Finally, the ends of the main glu-lams should be treated with a borate solution (TimBor or similar) to protect against further deterioration.

Photo 3: Fascia Beam Deterioration

Accessibility

The front entry doors appear to meet the requirements for accessible access. There appeared to be adequate maneuvering space within the vestibule. A single door at the inner and outer vestibule doors are operated by an automatic operator.

The toilet rooms off of the main gathering space do not meet current accessibility requirements. There are not adequate clearances at the fixtures. Grab bars are not provided in the required locations. There is no wrap on the exposed piping below the sinks.

Door hardware does not comply with current graspability standards.

Adequate clearances were not provided at the office for wheelchair access.

An issue with the concrete slab below the vestibule flooring has the potential to present a tripping hazard.

The site is level and grades appear to comply with accessibility requirements. The striping of the parking lot is worn to the point that it is not easily visible. There are two designated accessible parking spaces. There are not any spaces designated for accessible van parking.

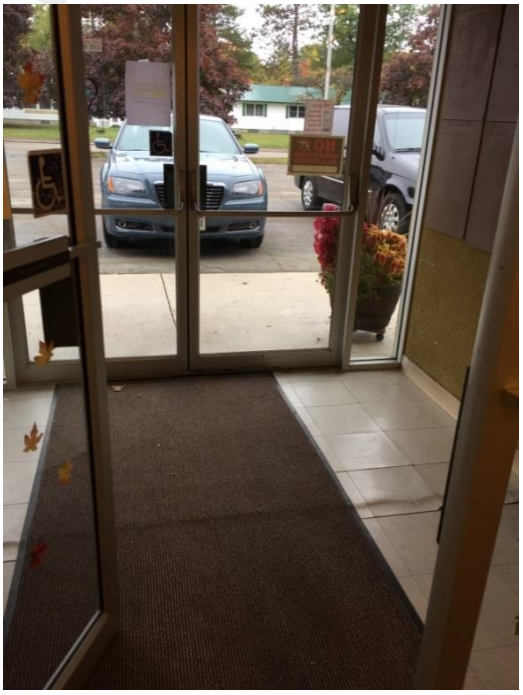

Photo 4: Vestibule Floor Condition

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Interior Finishes

The flooring in the main gathering area and vestibule was vinyl composite tile (VCT). The VCT was in good condition except at the vestibule. Cracking and separation between tiles was evident in the vestibule where the concrete surface below was uneven.

Mechanical

The building is provided heat and ventilation by two horizontal gas furnaces. The furnaces are the original units installed when the building was constructed. A fan motor has recently been replaced in one of the furnaces. Air is distributed to the building spaces by underslab ductwork. There are manual dampers that control the amount of outside air brought into the space. It was indicated that these are typically closed for winter so there is likely no fresh air delivered to the spaces during the winter months.

There is a condensing unit for each furnace to provide space cooling. The condensing units utilize R-22 refrigerant which is being phased out of production. It is currently still available for maintenance but new units cannot be manufactured with this refrigerant so it is expected that availability will go down and costs will rise significantly in the future.

A condensate collection pan below the condensing units has overflowed previously and damaged the floor and ceiling below. Water stains/damage is visible on the floor.

The kitchen has a walk in cooler that is original. The condensing unit for the cooler resides inside and sits near a window that is left open in an attempt to reject heat outside during the summer. Operating a system in this manner requires the building air conditioning to work harder to maintain temperature and also reduces efficiency of the cooler and space air conditioning.

The kitchen has an exhaust hood over a stove. The hood does not have fire suppression which is required by current codes. A convection oven sits next to the stove but is not under a hood which is required by current codes. There was no controlled makeup air identified in the kitchen space. Makeup air is required to compensate for the air exhausted from the hood.

Plumbing

The building is served hot water by a 50 gallon natural gas water heater. The water heater is an atmospheric vented unit. The water heater has been replaced within the last 3 years.

The building has a water softener that was installed within the last 6-8 years and is functioning properly.

The plumbing fixtures appear to be original except for the water cooler in the common space which has failed and is not in use. The fixtures were not low flow fixtures.

Electrical

Lighting

The interior lighting is a mixture of CFL, T-8 and T-12 linear fluorescent. Replacement of the T-12 fixtures would offer an opportunity for energy savings but there were only a few of these fixtures. The remaining fixtures are reasonably efficient.

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The exterior lighting is metal halide. Improvement in lighting levels and energy efficiency could be expected by upgrading the exterior lighting to LED.

Power Distribution

The building has an 800 Amp electrical service. Based on building size and use it appears that the service is significantly larger than necessary. The main switchgear is obsolete and spare circuit breakers would likely need to be purchased as used or after-market products. The distribution panels are Federal Pacific utilizing NA circuit breakers which have a known history of failure. Replacement of the electrical service and distribution equipment should be considered. There appeared to be an inadequate number of general use receptacles distributed around the space.

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2. OPTIONS AND RECOMMENDATIONS

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Niagara Senior Center Assessment

The table below outlines our recommendations for building modifications based on the report. All estimates are based on 2015 cost data and should be increased for inflation if desired repairs are to be completed beyond 2016.

	Opinion of Cost	Priority
MASONRY AND SIDING		
Clean masonry at areas of biological growth		
Replace siding panels at piers with simulated stone product (cultured stone).		
Patch and paint exterior hollow metal doors		
FRONT ENTRY AND ALUMINUM STOREFRONT		
Remove existing fascia beams and replace		
Remove existing aluminum storefront. Eliminate doors at front façade except for a single door for egress and the main entry doors. Infill lower portion of eliminated door openings with stud framing and simulated stone veneer. Replace windows with clad wood windows. Replace entry door with a thermal aluminum storefront framing system and doors. See attached schematic.		
ACCESSIBILITY		
Provide additional single user toilet rooms that comply with current accessibility standards.		
Replace existing knob hardware with lever handles.		
Correct issue at vestibule floor by repairing slab and replacing flooring.		
Restripe parking lot to indicate accessible parking. Provide at least one van accessible space.		
INTERIOR FINISHES		
Replace vestibule flooring (see above)		
MECHANICAL SYSTEM		
Replace 2 furnaces and condensing unit.		
Install a MUA unit and eliminate hood over convection oven.		
Replace existing walk-in cooler with unit that has outdoor condenser.		

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PLUMBING SYSTEM		
Replace plumbing fixture		
ELECTRICAL SYSTEM		
Lighting		
Upgrade exterior lighting to LED		
Replace remaining T12 fixtures		
Power Distribution		
Replace distribution panel		

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4. APPENDIX

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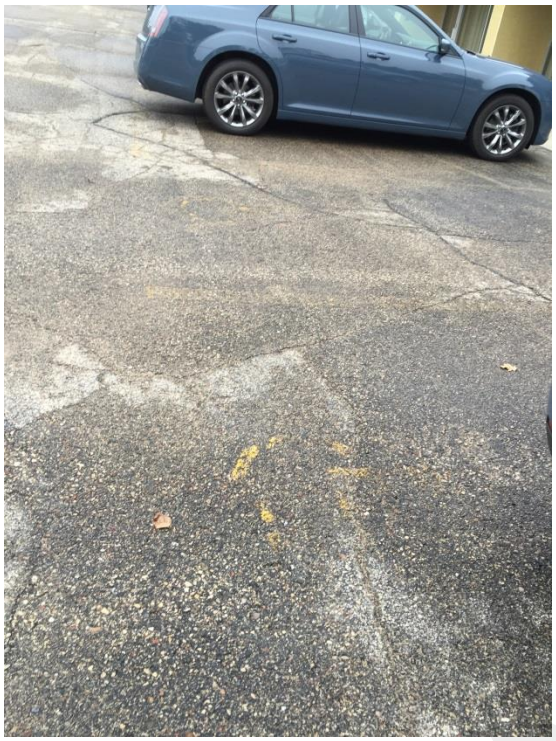
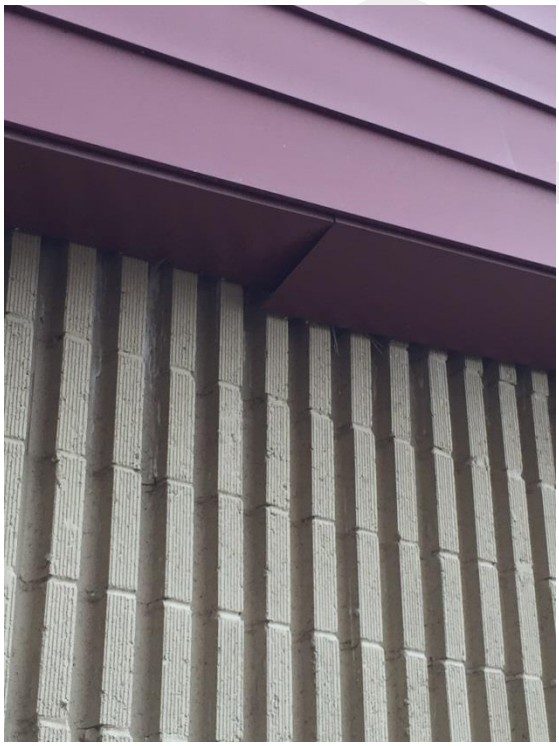


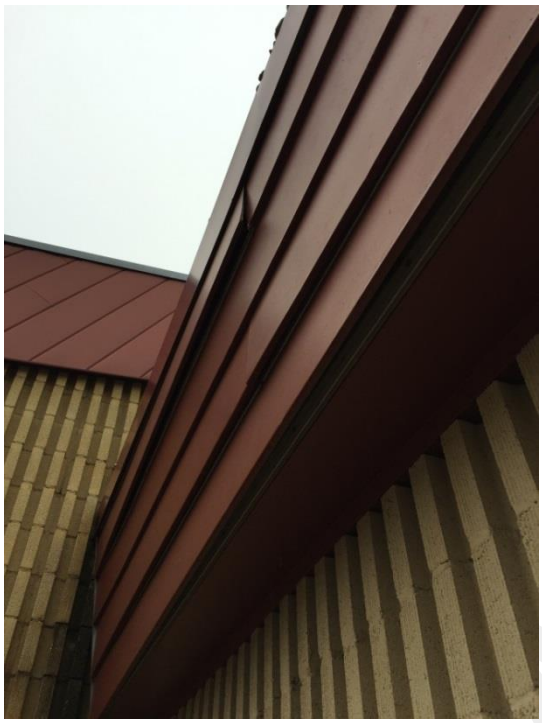
Striping at parking lot

Stucco finish panels at piers



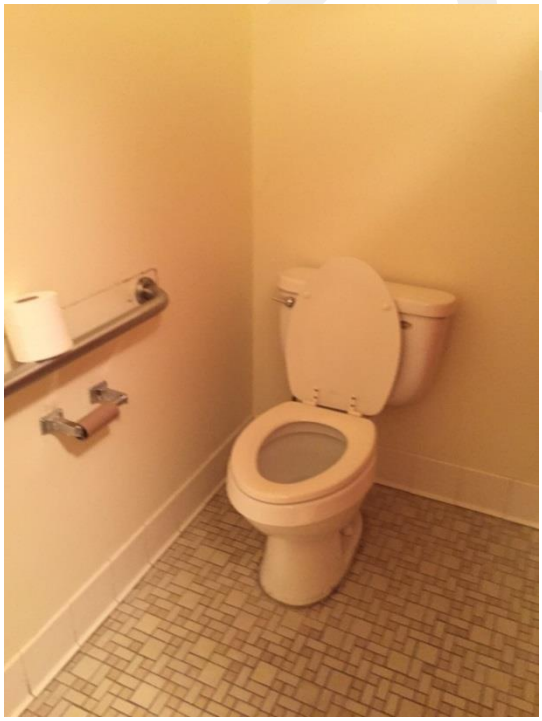
Siding repair needed

Conditions at exterior hollow metal doors

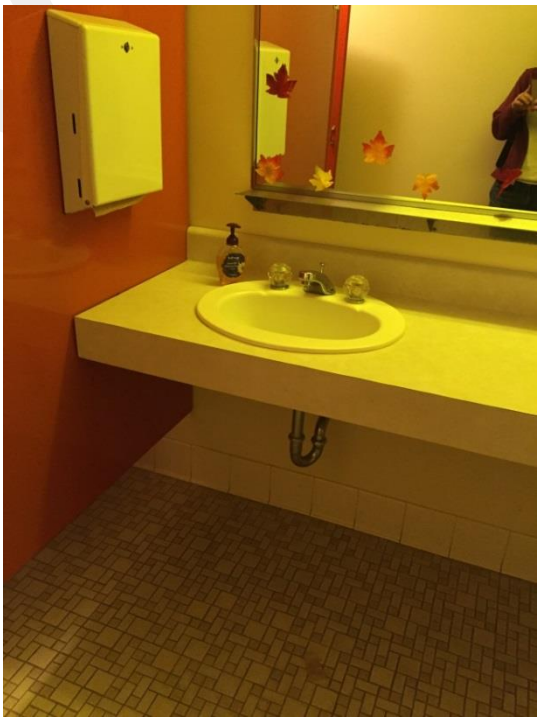


Siding repairs needed

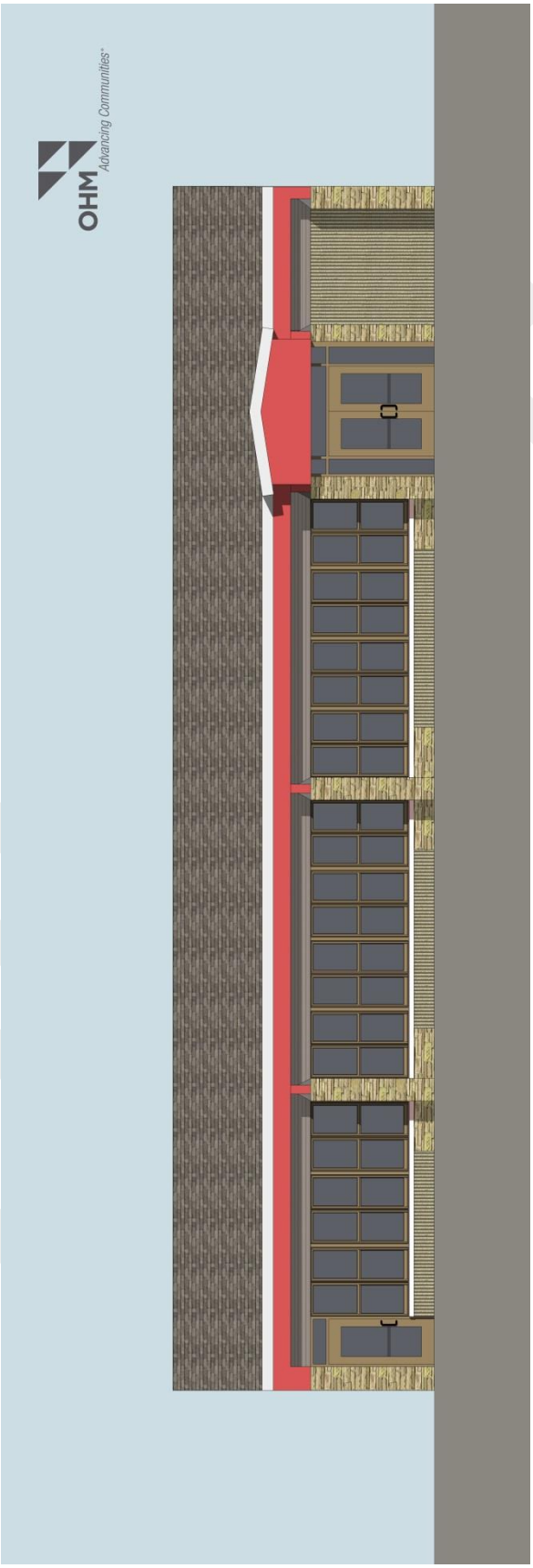
CMU discoloration and joint condition



Grab bar locations



Exposed piping at sink


OHM
Advancing Communities

This document was provided by Health and Human Services staff to indicate current issues with the building.

Niagara Improvements

The parking lot & the landscaping in front are the first impression people get when they come here. Both are bad.

Fill cracks, coat blacktop and Paint lines on parking lot as well as no parking lines in front– pressure wash first? (maybe extend the parking lot back farther back, we could use more parking.

Landscaping:

Remove Rock and weed blocker fabric – replace with new professional grade fabric
shrubs/plant something where shrubs were pulled out
Cedar mulch ($2.50 a bag @ Home Depot)
Rake & Pick up sticks and rock, maybe some weed & feed for small amount of grass

NO PARKING (LOADING ONLY) SIGNS THAT GO IN THE GROUND BY LANDSCAPING IN FRONT OF BUILDING – when people park in front of our building they cover the sidewalk and people have to walk around out in to the road to get in the door.

Spray wash side of building facing the parking lot including the lighting

Weed around the ADAPT & Public Health sides of building (wait on this if landscaping will be done)

Things we would need: Shovels, rakes, pressure washer, something to haul old rock away, mulch material to fill cracks and coat blacktop parking lot
Paint (for on blacktop) to paint parking lines in parking lot & no parking lines in front of the building
Hose & Siding wash to get cobwebs and spiders off the side of the building facing the parking lot, therapists windows face this and clients have seen spiders hanging outside the window as well as the mess when they park

Handle for outdoor water – there is no handle and I can't find one here anywhere

Fix the back door so it locks

Patch wall in Colleen Osier's office behind her desk chair & add protective strip so it will not get damaged again.

Heating & Cooling regulated if possible.

MARINETTE COUNTY AGREEMENT

THIS AGREEMENT is made by and between Marinette County, a municipality, hereinafter referred to as COUNTY, and Johnson Controls, hereinafter referred to as VENDOR, for the purpose of the Access Controls Design Development.

The parties agree as follows:

1. Contact Persons and Contract Administrators:

   COUNTY's agent and contact person is: Jim Swanson
   Whose principal business address is: Maintenance Department
   1926 Hall Avenue
   Marinette, WI 54143

   VENDOR agent and contact person is:

   Name: Brad Beyer
   Title: Account Executive
   Company: Johnson Controls, Inc.
   Address: N961 Tower Drive
   City, State: Greenville, WI 54942
   Telephone: 920.284.1007

2. VENDOR agrees the following services, as set forth in the response, dated 10/5/2015, to the Request for Proposal will be provided to Marinette County, included and incorporated by reference as attachment _A_.

3. VENDOR agrees to present manufacturer's literature regarding materials & warranty.

4. Start/Completion dates to be determined.

5. COUNTY agrees to the following:

   - Payment Terms – COUNTY will pay the VENDOR within 30 days of receipt of an invoice.

6. Both parties agree that the relationship between the parties shall be that of an independent VENDOR and shall not be construed to be an Employer-Employee relationship; specifically the parties agree that:

   - VENDOR will be responsible to pay all Federal, State and social security taxes on any income received under this Agreement.

- COUNTY will pay no fringe benefits or other compensation to VENDOR.

7. VENDOR will provide and maintain certificates of insurance with minimum limits as follows:

General liability, each occurrence	$1,000,000
Auto liability, each occurrence	$ 300,000
Workers Compensation	Statutory Requirements

Certificates of insurance indicating COUNTY as additional insured must be presented to COUNTY's agent with a signed copy of this agreement prior to commencing work. Additionally, all policies shall contain endorsements by respective insurance companies waiving all rights of subrogation, if any, against COUNTY and shall further provide that policies are not cancelable except upon thirty days written notice to COUNTY.

8. VENDOR hereby agrees to release, indemnify, defend and hold harmless Marinette County, its officials, officers, employees and agents from and against all judgments, damages, penalties, losses, costs, claims, expenses, suits, demands, debts, actions and/or causes of action of any type or nature whatsoever, including actual and reasonable attorney fees, which may be sustained or to which they may be exposed, directly or indirectly, by reason of personal injury, death, property damage, or other liability, alleged or proven, resulting from or arising out of the performance under this agreement by vendor, its officers, officials, employees, agent or assigns. Marinette County does not waive, and specifically reserves, its right to assert any and all affirmative defenses and limitations of liability as specifically set forth in Wisconsin Statutes, Chapter 893 and related statutes.

BJ BUT ONLY TO THE EXTENT DIRECTLY CAUSED BY THE NEGLIGENCE OF JCI.

9. This contract may be amended in writing by mutual agreement of both parties at any time.

10. This agreement shall be governed by the laws of the State of Wisconsin.

11. COUNTY may terminate this agreement in the event VENDOR breaches any of the terms of the agreement or for unsatisfactory performance by VENDOR. Termination shall be immediate upon written notification by the COUNTY.

VENDOR — Date: 10-27-2015

Kathy Brandt, County Clerk — Date

Project Development Agreement

THIS PROJECT DEVELOPMENT AGREEMENT (this "Agreement") is made between **Marinette County**. ("Customer"), located at **1926 Hall Avenue Marinette, WI 54143** and Johnson Controls, Inc. ("JCI"), located at **N961 Tower Drive, Greenville, WI 54942.** This Agreement shall be effective upon the date of execution of this Agreement by the parties.

RECITALS

WHEREAS, Customer desires to develop a Access Controls Design Development and Review Packet, to be located at the Marinette County facilities in Marinette, WI (the "Project"); and

WHEREAS, Customer desires to develop appropriate design development documents and final pricing for FIM's listed in Appendix A to be located at the Marinette County facility in Marinette, WI; and
WHEREAS, JCI is knowledgeable in providing the foregoing services and is prepared to perform the required services in relation to the Project, pursuant to the terms and conditions set forth in this Agreement;
NOW, THEREFORE, in consideration of the mutual promises contained herein, the sufficiency of which is hereby acknowledged, Customer Marinette County agrees to appoint JCI as the provider of the services contained herein and JCI hereby accepts such appointment upon the terms and conditions set forth in this Agreement. The parties hereby agree as follows:

1. Phases of Project

The parties agree that the Project shall be executed by JCI and Customer and completed in a total of three (3) Phases:

a) Phase I of this project provides preliminary analysis and design.
b) Phase II of this project, which will provide design development and budgeting as detailed in the sections below.
c) Phase III of this project will consist of the installation of the solutions developed in Phase II.

2. Phase I & II Scope of Services

To enable both parties to expeditiously evaluate the potential benefits of this approach without excessive speculative investment by JCI, or speculative commitment by the Customer, the parties agree to jointly undertake a Process of Design Development. This Process shall include the following:

a. Execution of this Project Development Agreement between JCI and Customer.
b. Provision of initial budgeting information based on the owner's expectations, the project budget, and schedule requirements. The initial budget and development will be a working model of the program and construction cost objectives and shall be revised, as needed.
c. Development of access controls design package. This package will contain design information to ensure that the appropriate design criteria are maintained in the development process.
d. Completion of detailed analysis, design, estimating and review with Customer.
e. The design development package will also provide the development of estimated installation pricing.

3. Deliverables

Here is a summary of what our proposed Access Control PDA would provide.

The deliverables would be:

- Selection of equipment based on documented system capabilities discussed and findings from site walk through.
- Installation costs for the proposed new system
- Initial review meeting

What's not included:

- Selected design engineering
- Plans and specifications

4. Duties of Customer

Customer will work in a diligent and timely manner with JCI to develop the aforesaid functions. The Customer shall commit to providing in a timely manner any information required to perform all relevant programming and planning, and shall also properly position JCI with the rest of its staff to insure a cooperative and successful effort.

5. Duties of JCI

JCI also commits to work in a diligent and timely manner with the Customer to deliver the aforesaid documents and materials and to complete the foregoing tasks for the purpose of meeting the project intent. JCI shall provide adequate and qualified resources to meet the project schedule, and shall work with the Customer's management in a manner that enables it to make an informed decision.

6. Phase I & II Compensation

As compensation for JCI's performance of the Phase I & II Scope of Services under and pursuant to this Agreement, the fee to JCI shall be TWO THOUSAND DOLLARS ($2,000.00).

7. Timeline

The following are approximate milestones for the development process of this Project Development Agreement and subsequent activities. Customer and JCI agree that this timeline is subject to change depending upon the mutually defined scope of the Project.

1. Execute Project Development Agreement	11/02/15
2. Conduct Site Survey & Client Meeting	11/13/15
3. Submit Initial Report for Client Review	11/20/15
4. Client Review Response	11/30/15
5. Initiate Phase II Development	12/01/15
6. Completion of Phase II Development – Proposal Submission	12/21/15
7. Initiate Phase III Start Construction	TBD
8. Installation Completion	TBD
9. Equipment Start-up	TBD
10. Begin Operations	TBD

8. Indemnity

JCI and the Customer agree that JCI shall be responsible only for such injury, loss, or damage caused by the intentional misconduct or the negligent act or omission of JCI. To the extent permitted by law, JCI and the Customer

agree to indemnify and to hold each other, including their officers, agents, directors, and employees, harmless from all claims, demands, or suits of any kind, including all legal costs and reasonable attorney's fees, resulting from the intentional misconduct of their employees or any negligent act or omission by their employees or agents. Except for a breach of Section 7 of this PDA, neither JCI nor the Customer will be responsible to the other for any special, indirect, or consequential damages.

9. Disputes

If a dispute arises under this Agreement, the parties shall promptly attempt in good faith to resolve the dispute by negotiation. All disputes not resolved by negotiation shall be resolved in accordance with the Commercial Rules of the American Arbitration Association in effect at that time, except as modified herein. A single arbitrator shall decide all disputes. The arbitrator shall render a decision no later than nine months after the demand for arbitration is filed, and the arbitrator shall state in writing the factual and legal basis for the award. No discovery shall be permitted. The arbitrator shall issue a scheduling order that shall not be modified except by the mutual agreement of the parties. Judgment may be entered upon the award in the highest state or federal court having jurisdiction over the matter. The prevailing party shall recover all costs, including attorney's fees, incurred as a result of the dispute.
All Parties are in agreement with the intent outlined by this Agreement. IN WITNESS WHEREOF, the parties have duly executed this Agreement, in duplicate, as of the date set forth below and certify they are authorized to execute this agreement.

Marinette County	**Johnson Controls, Inc.**
By: _____	By: Brad Beyer
Title: _____	Title: Account Execution
Date: _____	Date: 10/5/2015
Signature: _____	Signature: Brad Beyer

Exhibit E

ARCHITECTS. ENGINEERS. PLANNERS.

OHM Advancing Communities℠

UW Marinette Fieldhouse

Marinette County

Marinette, Wisconsin

October 2015

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1. SUMMARY OF FINDINGS

OHM Advisors performed a building assessment on September 17, 2015. The assessment was performed by one registered architect and three professional engineers. Building elements as well as systems and components were observed. Additional information regarding the function of the building was provided by facility staff and members of the RCCPA.

EXTERIOR ENVELOPE

Wall Surfaces

The exterior wall surface for the original building is a combination of brick with cast stone panels at the top of the gymnasium walls and Exterior Insulation and Finishing System (EIFS) at the top of the lower story walls. The natatorium has EIFS covering all of its exterior walls. In most areas, the brick appeared to be in good condition. These areas had little to no deterioration of mortar joints, some minor hairline cracking and brick surfaces showed no evidence of spalling. Some areas of concern were noted however:

- There is damage to some brick near the overhead door.
- Brick surfaces are showing accumulation of dirt and/or biological growth in some areas, specifically near grade or at louver openings where moisture may be present over longer periods of time. (See Figure 1).
- Cracking, spalling and efflorescense were noted near the top of the south gymnasium wall at the third pilaster from the southeast corner.
- Both small and hairline cracking was noted in both the brick and mortar joints for the north and west gymnasium walls above the lower roof. (See Figure 2). The cracking appears to be random, but spread throughout these two walls.
- No weep holes were noted near grade in most areas.

Figure 1: Brick condition at grade

Figure 2: Cracking at brick

Generally, the EIFS appeared to be in good condition for its age. In most areas, the finish coat was sound and there was no evidence of moisture intrusion based on visual and thermal imaging camera inspections. Several locations at the bottom of the wall where the EIFS terminates a few inches above grade were also checked and no soft spots or wet areas were noted.

The EIFS surfaces on the south wall and a small section of the east wall, however, have been significantly damaged. The damage appears to be the result of objects impacting the wall causing a failure of the finish coat. (See Figure 3). In several areas, large portions of the finish coat, reinforcing mesh and insulation are now absent back to the adhesive layer. (See Figure 4). One area in particular had mold/moss growing on the wall surface from prolonged moisture exposure. (See Figure 5). The EIFS surfaces have control joints located adjacent to the pilasters. These control joints do not have sealant and allow access for moisture to penetrate the system.

Figure 3: Damage at EIFS – Impact caused failure

Windows/Doors

The majority of the windows are aluminum frame with thermal glazing. Windows are in good condition.

Exterior doors and frames are primarily steel hollow metal doors and frames with aluminum doors and frames adjacent to the pool area. Hollow metal doors and frames are showing some deterioration in most locations. Hollow metal frames are rusting at grade and rust is appearing on door surfaces. The steel lintels above several doors in the pool area show signs of surface corrosion.

Figure 4: Damage at EIFS – Biological growth

Roof

Roof surfaces are a single ply EPDM fully adhered membrane. Flashings and roof edge metal are in place.

The roof, flashing and seals appear to be in good to fair condition. Minor cracking of several roof seals at seams was noted, however, the membranes appeared to have good adherence to each other when checked.

The lower roof areas are flat, have a parapet and are serviced by several roof drains which appeared to be in good to fair condition. The lower roof does not have overflow drains or scuppers which are required by current code.

The gymnasium roof has a parapet, is low-pitch, peaked at the center and sheets water to the east and west. Rain water drains through scuppers over the brick pilasters. The natatorium roof does not have a parapet, is low-pitched and drains to the south.

Figure 5: Damage at EIFS – Adhesive layer exposed

INTERIOR

Gymnasium

The athletic floor appeared to be in excellent condition. It is an Aacer Sports Flooring - Scissor Loc II system, installed in 2013. The Scissor Loc II system is a power vented system with a layer of hard maple over an air space. In 2014, the floor buckled significantly in the mid to late summer months (based on employee recollections). After dehumidification efforts, the floor settled and was refinished. There have not been any further issues with buckling, but dehumidifiers are kept running in the space. Per the floor manufacturer, the allowable humidity levels for the floor system are between 35% and 50%. Air movement is recommended by the manufacturer including the use of ceiling fans.

Spray foam was visible at the joints between the concrete masonry unit (CMU) infill and the structural steel columns. The Wisconsin Commerical Code does not permit spray foam insulation to be exposed in occupied spaces.

The existing wood bleacher system is in fair condition but does not meet current safety standards or provide accessible features.

The existing divider curtain is ripped.

The ventilation grilles on the east wall of the gymnasium have been damaged by impacts.

Door hardware at the egress doors appears to be original to the building construction. The exit devices appeared to be in fair condition. The closers were showing evidence of rust. The overhead stop at the north side of the building was damaged and the door would not close properly. The threshold at the southwest set of doors was concealed with duct tape at the door connection. Weatherstripping appeared to be new at all door openings. The weatherstripping was not continuous due to the location of the hardware.

The interior masonry walls appeared to be in good condition. Minor moisture damage to the interior paint was observed in several locations, most notable on the south wall. (See Figure 6).

Figure 6: Water damage at interior masonry

The roof consists of long span steel joists supporting metal decking. These items were visually inspected from the ground and no visible defects were observed.

Natatorium

The pool is accessed through the locker rooms or by a single door from the gymnasium. The use of the gymnasium door is discouraged in order to prevent the movement of humidity into the gymnasium space.

The pool deck, wainscot and pool surfaces are ceramic tile. The ceramic tile is in good condition with a few noted areas of damage. Significant cracking or settlement of the tile was not observed which would be an indicator of movement or cracking of the concrete underneath. The majority of doors in the pool area are

aluminum doors with aluminum frames. The aluminum doors and frames are in good condition; however, any steel hardware components are showing deterioration. The steel lintels are also showing rust.

Interior walls are painted masonry and appeared to be in good condition. One vertical crack was noted in the southwest corner above the vestibule door. (See Figure 7). The paint appeared to be intact overall, except in the southwest vestibule which had significant moisture damage. (See Figure 8). One hole through the masonry face shell was also noted in this area.

The interior roof structure consists of cambered deep glu-lam main beams supporting smaller transverse glu-lams and tongue and groove (T&G) structural deck. The following minor issues were noted from our visual inspection except for the following:

- One split in the bottom-most lamination at the second beam from the north.
- There is a slight separation between the bottom two laminations at the west wall on the fourth beam from the north.
- A few areas of minor water damage in the T&G decking were noted from past leaks and one gap between broken boards.

Negative air pressure was noted in the pool space as air could be felt entering the room when any door was opened. This was also noted at any joints that had not been previously caulked, specifically at gaps in trim, gaps between the T&G deck and trim and broken end pieces of T&G deck at the east wall. (See Figure 9).

The mechanical room off of the natatorium has gas fired equipment and also has storage of the pool chemicals. This is a code compliance issue. The chemicals for the pool need to be kept in a separate enclosure that has mechanical exhaust.

Lobby Area

This area on the interior of the building is located directly west of the gymnasium. Past leaks were noted by maintenance staff in this area in three locations directly below the west gymnasium wall. Water stained ceiling tile was noted in two areas and a third area where the tile had been replaced was indicated by maintenance staff. No visible evidence of leaks was noted above the ceiling tile. The three locations, however, were located directly underneath masonry

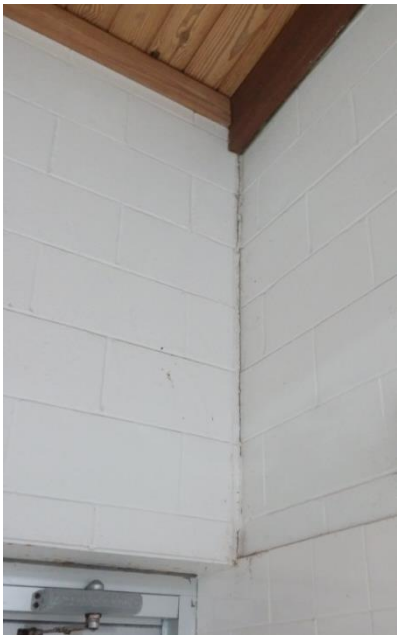


Figure 9: Vertical crack in masonry

Figure 8: Water damage at block

Figure 7: Gap at T&G decking

pilasters in the west wall. These pilasters do not extend directly to ground, but are supported off of masonry corbels. (See Figure 10).

Figure 10: Masonry corbel

The toilet rooms off the Lobby have a ceramic mosaic floor, ceramic base, and painted CMU walls. A ceramic tile wainscot exists at the lavatory wall.

Locker Rooms

Women's Locker

The Women's Locker, with the exception of the shower area, has ceramic mosaic flooring with a ceramic cove base, painted CMU walls and suspended acoustic ceiling throughout. The main shower area has ceramic tile at all wall surfaces and a gypsum board ceiling. The single shower units have a panel wall system. Several of the suspended acoustic ceiling tiles show evidence of past water damage. Countertops are plastic laminate which are showing wear.

Men's Locker

The men's locker room is similar to the women's in both layout and condition. The bases of some of the lockers are also showing signs of surface corrosion as are some of the metal bench supports and suspended ceiling grid. Fixtures and tile were in generally good condition.

Classroom/Fitness Room Area

Finishes in this area include painted CMU walls with some exposed brick in areas, vinyl composite tile flooring, vinyl base, and suspended acoustic ceiling. The fitness room has carpet flooring. The suspended acoustic ceiling throughout this area shows evidence of past water damage.

The toilet rooms off of the corridor include a ceramic mosaic tile floor with ceramic base and painted CMU walls.

Accessibility

While providing some accessible elements, the facility does not comply with current accessibility standards. Entrance doors appear to provide adequate width and clearance per accessibility requirements. The main toilet rooms located off of the Lobby area do not meet requirements for door clearances, fixture clearances, grab bars etc. The toilet rooms located off of the classroom corridor provide adequate clearances but do not meet current requirements for grab bar locations.

The locker rooms provide some accessible features including some grab bars and a hand shower at one unit in the main shower area, but do not provide an accessible private shower or a toilet stall that meets accessibility requirements. The single user toilet room closest to the pool access door may provide adequate space to meet clearance requirements, but the fixtures are not placed correctly and grab bars are not provided. Accessible

lockers were not observed. None of the locker room lavatory piping was wrapped. A pool lift was provided at the pool deck.

The bleachers at the gymnasium did not provide accessibility features such as wheelchair spaces and handrails at the stairs.

MECHANICAL SYSTEMS

Building heating is served primarily by three PK Thermic hot water boilers. Each boiler has an output of 1.6 MMBTU's. The boilers are labeled as approximately 85% efficient. The pumping arrangement is a typical primary/secondary arrangement where each boiler has a pump and then there is a second pump to deliver hot water out to the spaces.

The secondary pumps are B&G model 18501 and have 3 HP single speed motors.

The building controls are pneumatic and served by a 1 HP 3-phase air compressor. A refrigerant air dryer for the control air has failed and is no longer in service.

Building ventilation and cooling in the classroom areas is done by floor mounted unit vents with condensing units on the roof. The unit vents are in differing stages of working order.

They gymnasium is served by two ceiling hung air handling units. These units are original and have had a recent control upgrade. The units are controlled by duct mounted thermostats.

The natatorium is served by a dehumidification unit, make up air unit, exhaust fan, outside air preheater and booster coil. The following analysis was completed on the natatorium space. For the calculations the following assumptions were made after review of the existing drawings and site walk through.

- Pool Surface Area: 42'x75' = 3150 ft^2
- Volume of Pool Area: 64'x97'x15' (average)= 93,120 ft^3
- Pool temperature: 82 degrees F
- Room temperature: 82 degrees F
- 60% room relative humidity
- ASHRAE Activity factor 1.0
- No spectators

The pool loses 138.29 lb/hr to the surrounding air from evaporation and an additional 45.92 lb/hr is introduced through the make-up air. This equates to a total of approximately 184 lb/hr.

The space is served by one Dectron dehumidification unit. The unit has a dehumidification capacity of 90 lb/hr.

The resultant of the existing equipment having a capacity about 50% lower than the load provides a condition that permits elevated humidity levels.

OHM advisors recommends that a simple change be made to the pool room heating set point. We suggest that the room be kept at 84 degrees F. This provides two advantages. First, the pool occupants feel warmer

when exiting the pool as the air is warmer than their wet bodies. Second, it provides a thermal and moisture advantage where humidity will migrate less from cooler water to warmer air.

The change in the air temperature will bring the dehumidification load to 170 lb/hr which still provides a significant lack in dehumidification in the space.

Locker rooms are served by a makeup air unit that is located in the mechanical room adjacent to the pool. This unit does not have cooling or dehumidification and also compounds the pool area humidity problems. There is also an exhaust fan serving each locker space and electric heaters in the ceilings near the entry to the pool.

The classroom addition is served by unit ventilators with remote roof mounted condensing units. A number of the rooms also have hydronic finned tube radiation to provide supplemental heat for exterior wall loss.

PLUMBING SYSTEMS

The plumbing fixtures were a mix of upgraded and original fixtures. Water closets were all flush valve but many appeared to be original, urinals had been upgraded to electronic sensor type. Lavatories appeared to be original and are not low flow faucets.

There are two water heaters serving the facility. They are each 199,000 BTU's, 91 gallon capacity. They were atmospheric vented.

Locker room showers were the gang shower style. These fixtures are not low flow.

ELECTRICAL SYSTEMS

Lighting

The majority of the lighting throughout the building has been upgraded and is T-8 style linear fluorescent lighting. T-8 lighting is the industry standard and meets all energy efficiency requirements in most applications.

In most areas the exit signs were not upgraded and were still incandescent.

Most of the emergency lights were stand-alone incandescent fixtures which should be replaced with LED when they fail. It is our experience that it is very difficult to meet emergency light level requirements with the number and style of fixtures installed and suspect that emergency lighting does not meet current requirements.

Exterior wall pack lighting has all been upgraded to LED. Routine cleaning of the fixtures is the only recommendation to improve lighting.

The pool area had a number of High Pressure Sodium wall pack lights at interior doors. These lights are efficient but provide a yellow/orange light.

Power Distribution

The facility is served by two separate electrical services. One service provides power for the gym and classrooms and the second service provides power for the pool and locker room area. The main service for

the gym/classroom area has been upgraded and is fairly new and in good condition. The service equipment for the pool/locker area appears to be original and is 20+ years old.

Two of the power distribution panels for the gym area are Federal Pacific and appear to be original. These Federal Pacific distribution panels and associated circuit breakers have been known to have failures. Panel busses have been documented as faulting and circuit breakers have failed to open due to load or have not actually opened even when the lever is operated. The panels should be replaced with any building upgrades.

Mechanical Loads

Mechanical equipment with motors are provided with independent single speed motor starters. Equipment appears to be in good condition and serviceable for years to come. Energy efficiency projects may recommend upgrading motor controls to Variable Frequency Drives to improve energy efficiency.

Fire Alarm

The fire alarm system appeared to generally meet requirements except for a few spaces that were missing notification appliances (horn/strobes) such as restrooms and locker rooms.

Miscellaneous Electrical Equipment

The scoreboards in the gym are an older style that utilizes incandescent lights. Building staff has indicated that there have been problems with the scoreboard controls.

The shot clocks in the gym have malfunctioned at times and should be considered for replacement.

The building does not have a permanent sound or public address system. This should be considered as an additional amenity to promote more constant use of the space.

Exterior Sidewalk and Parking

Overall, the sidewalks are in good to fair condition while the asphalt parking is in fair condition. The sidewalks show some minor surface wear and weed growth at expansion joints, but do not exhibit signs of soil heaving or major cracking. There are areas of minor cracking and some curb damage from plowing was also noted.

The parking lot asphalt was in fair condition with moderate pavement cracking throughout. Cracks show evidence of being sealed in the past, however most have reopened and weed growth is prevalent near lawn areas. There are a few patched locations and one area of pavement failure at the drive along the front of the building. Overall, the pavement is showing signs of age as the asphalt breaks down over time.

Figure 11: Pavement Failure at Front Driveway

2. OPTIONS AND RECOMMENDATIONS

EXTERIOR ENVELOPE		
Wall Surfaces		
Brick	**Opinion of Cost**	**Priority**
Masonry Cleaning: High pressure wash and chemical, 500 sft (select areas)	$2,000	Medium
Repointing South Wall: Remove/replace ex. mortar, 150 sft	$3,000	Medium
Option 1 - Repointing North & West Walls, Replace Cracked Brick, Repair Flashing at Wall Base: Remove/replace ex. mortar, 2,000 sft, remove and replace 100 bricks, repairing 35 lft of existing flashing (total length of flashing to be repaired is unknown)	$36,000	Medium
Option 2 - Water Repellant w/ Tuck pointing & Brick Replacement, North & West Walls: Tuck point ex. mortar, 2,000 sft, remove and replace 100 bricks, repairing + 2,000 sft of sealer	$25,000	
EIFS		
Repair at Impact Damage Locations: 100 sft of patching, 250 sft of removal and replacement, 2,000 sft paint to match	$12,000	High
Sealant at Control Joints: 60 lft of sealant	$200	High
Windows/Doors		
Patching/Repair and Painting	$150/door	High
Roof		
Replacement of membrane with overflow drains	$120,000	Low
INTERIOR		
Gymnasium		
Add ceiling fans (2)	$12,000	Medium
Seal at areas with exposed spray foam	$500	High
Replace bleachers	$87,500	Low
Replace divider curtain	$50,000	Low
Replace ventilation grilles	$1,600	Low
Replace door closers and overhead stops	$400/each	High
Recoat walls at damaged areas 200 sq ft	$1,000	Low

Natatorium		
Miscellaneous tile repairs	$500	Medium
Door hardware replacement	$600/ea	High
Patch/Repair/Recoat steel lintels	$3,000	High
Add small room in mechanical room with ventilation to house pool chemicals and reroute chemical feed line to avoid all mechanical equipment.	$20,000	High
Decommissioning Option: Renovate to New Space Includes punching drain holes through concrete, grouting pipes below grade full, removing mechanical equipment, filling pool and overflow tanks with sand/concrete, new floor system, new lighting and new HVAC. Does not include anything in the locker rooms.	$490,000	Low
Lobby		
Replace damaged ceiling tile	$2.50 /sq ft	Low
Locker Rooms		
Replace damaged ceiling tile	$2.50/sq ft	Low
Classroom/Fitness Room Areas		
Replace damaged ceiling tile	$2.50/sq ft	Low
Accessibility		
Install grab bars at toilets adjacent to classrooms	$600	High
Wrap piping below lavatories at Locker Room	$600	High
Renovate single user toilet room at showers	$8,000	Medium
Renovate shower stall area	$10,000	High
MECHANICAL SYSTEM		
Option 1 Replace Dehumidification system for pool with one larger unit. Add ductwork for distribution.	$325,000	High
Option 2 Replace Dehumidification unit with two small units. Add ductwork for distribution.	$350,000	
Replace unit ventilators in classrooms	$45,000	Medium
Replace locker room MUA with energy recovery unit with heating and cooling	$38,000	High
Replace gym air handling units	$25,000	Low
Replace hot water boiler for pool	$35,000	Low

PLUMBING SYSTEM		
Replace water heaters with high efficiency units	$24,000	Low
Install low-flow fixtures	$1,500/fixture	Low
ELECTRICAL SYSTEM		
Lighting		
Upon failure replace exit signs with LED exit signs	$3,000	Low
Add emergency lighting	$20,000	High
Replace high pressure sodium wall pack lights with LED	$10,000	Low
Mechanical Loads		
Upgrade motor controls to variable frequency drives	$7,500	Low
Fire Alarm		
Replace fire alarm system with addressable system	$30,000	Low
Power Distribution		
Replace the Federal Pacific distribution panels (Quantity 2)	$10,000	Medium
Misc. Electrical Equipment		
Replace scoreboards	$12,000	Low
EXTERIOR SIDEWALKS AND PAVEMENT		
Sidewalks		
Replace the areas of the sidewalk and entry pads that are in need of repair.	$5,000	Medium
Asphalt Pavement		
Option 1 - Seal Existing: Seal cracks and apply sealer to entire surface, 5,000 lft crack sealer, 64,000 sft pavement sealer	$100,000	Medium
Option 2 - Full Replacement: Mill existing asphalt, add 3" of new pavement, 64,000 sft.	$150,000	Medium

Note:

1. Estimates are based on 2015 cost data. Inflation adjustments will need to be added based on the timing for each recommendation.

3. APPENDIX

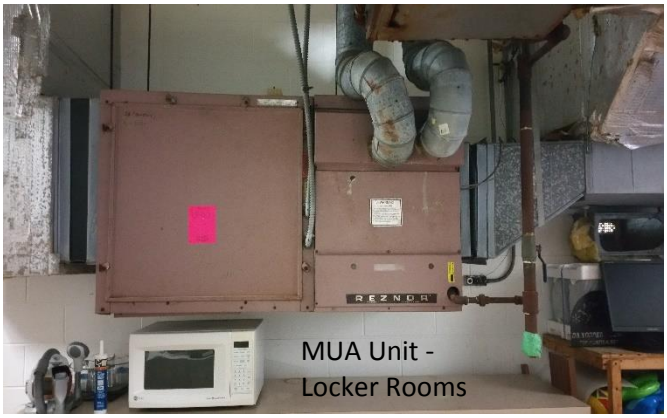
UW Marinette Fieldhouse Assessment

Ceiling Tile

Emergency Lighting

Bleachers

Gym Grille



MUA Unit -
Locker Rooms

Dehumidification Unit

Door Lintel

Door Hardware

Toilet Room

Exit Sign

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Colorless Coatings for Brick Masonry

Abstract: This *Technical Note* discusses common reasons for applying colorless coatings to above-grade brick masonry and the appropriateness of such actions. The types of products often used and the advantages and disadvantages of each are presented. Issues to consider prior to application of a clear coating to brick masonry are provided.

Key Words: clear, colorless coatings, film former, graffiti-resistant, penetrant, silane, siloxane, water penetration, water repellent.

SUMMARY OF RECOMMENDATIONS:

General

- Application of a water repellent coating is not necessary to achieve water resistance in brickwork subjected to normal exposures where proper material selection, detailing, construction and maintenance have been executed
- Application is not recommended on newly constructed brick veneer or cavity walls or on new or existing pavements using clay pavers
- Correct conditions contributing to water penetration before applying a coating to brickwork
- Consider providing vents at top of drainage spaces when a water repellent coating is applied

General Selection Criteria

- Consult the brick manufacturer prior to the selection of a coating
- Select only coatings intended for use on clay brickwork
- Consider the effects of all coating properties on brickwork, not just the desired property
- Select coatings that have demonstrated consistent performance on similar installations, materials and exposures for a minimum period of five years
- Except for anti-graffiti applications, use only breathable coatings with a water vapor permeability of 0.98 or greater as measured by ASTM E96
- Consider the use of a siloxane or siloxane/silane pre-blended coating
- Use comparative testing of treated and untreated walls using ASTM E514 or ASTM C1601 to determine coating effectiveness
- Do not apply film-forming coatings to brickwork located in freeze-thaw environments

Specific Selection Criteria

- For exterior brickwork, consider a condensation analysis to determine whether coating affects the dew point location within the wall
- For paving, consider the effects of coating on pavement slip resistance and the abrasion resistance of the coating

Application

- Use a contractor with a minimum of five years experience installing selected coating on similar installations
- Apply the coating according to the coating manufacturer directions

INTRODUCTION

Colorless coatings are available in many types and are designed for a variety of uses. When needed, colorless coatings for brick masonry should be selected based on their intended use, documented performance and chemical and physical properties [Refs. 4, 6, 10, 13]. Clear coatings formulated for use on other masonry materials may not be appropriate for brick masonry and may in fact be detrimental to brick. Clay brick masonry has physical and chemical properties that are different from stone, concrete or concrete masonry. Brick masonry has a different pore structure and is generally less absorptive, less permeable and less alkaline than concrete masonry. The recommendations included herein are applicable only to clay brick masonry.

The type of exposure the brickwork is subject to also plays an important role in coating selection. Coatings suitable for interior brick masonry may not be suitable for exterior exposures. Similarly, coatings applied to floors or pavements are subject to conditions different from those in brick walls.

Specific recommendations regarding the reasons for, selection of and use of colorless coatings are found throughout this *Technical Note*. Opaque coatings, such as damp-proofing or waterproofing coatings, are not addressed. For further information about opaque coatings, refer to *Technical Note* 6, which covers painting of brick masonry.

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REASONS FOR USE

Clear coatings may be applied to brick masonry in an effort to facilitate cleaning, to resist graffiti, to provide gloss or to reduce water absorption or penetration. Often, a single product is used to achieve several of these objectives. Selection of a coating should be based on the desired appearance, resistance to water penetration, application of brickwork, material substrate, economics, life span or other criteria set by the designer or user. The disadvantages of using colorless coatings should also be considered during selection.

Water Penetration Resistance

It is desirable to minimize the penetration and absorption of water in brickwork to avoid problems encountered in walls. Problems caused by excessive water penetration include freezing and thawing deterioration; corrosion of metal ties, metal studs and other items; rotting of wood members; mold growth; and damage to interior finishes.

The most effective means of minimizing water penetration include exercising care during material selection, designing and detailing brick masonry properly, constructing high-quality brickwork, and performing proper maintenance. Detailed discussions of these issues are provided in the *Technical Note* 7 Series. Drainage-type walls, such as brick veneer and cavity walls, are designed to accommodate water penetration of the exterior brickwork without damage to the interior components of the wall system through its drainage system.

Nonetheless, water-repellent coatings are sometimes suggested to reduce the amount of water that penetrates brickwork. Research indicates varied effectiveness of clear water repellents in reducing water leakage through a brick masonry wythe. [Refs. 3, 7, 11] Water-repellent coatings are most effective at reducing the amount of water absorbed by brick masonry. But water usually penetrates brick masonry at separations and cracks between brick and mortar or at junctures with other materials. Thus, a change in the absorption properties of brick masonry provided by a water-repellent coating may not significantly reduce water penetration through brickwork. Water-repellent coatings cannot stop water penetration caused by design or construction deficiencies such as ineffective sills, caps or copings, or incompletely filled mortar joints. Penetrating water-repellent coatings seldom stop water penetration through cracks more than 0.02 in. (0.5 mm) wide, and their effectiveness under conditions of wind-driven rain is limited. As a result, the use of water-repellent coatings to eliminate water penetration in a wall with existing defects can be futile.

Water repellents can be useful for barrier walls, chimneys, parapets and other brickwork that is particularly vulnerable to water absorption and penetration, especially in climates that receive large amounts of rain. When a water-repellent coating is considered for use on these elements, the benefits must be weighed against the possible disadvantages. Past successful performance of the proposed coating, for a number of years in the same exposure conditions and on the same type of brick and mortar, should be required. In climates that experience freezing and thawing cycles, the effect of a coating on the durability of the brickwork is of particular concern.

The age of construction and limitations of different types of water repellents are described in the sections that follow. Methods for evaluating the effectiveness of water repellents are discussed under Performance Criteria.

New Construction Use. Water repellents sometimes are specified for newly constructed brick masonry to protect against water penetration due to imperfections in construction. As discussed previously, water repellents have limited effectiveness and cannot compensate for poor construction or design. Furthermore, most brick masonry wall systems do not require a water repellent to effectively manage water and prevent water intrusion into the interior of a building. For these reasons, the use of water repellents on newly constructed drainage walls is not recommended.

Remedial Use. Water-repellent coatings most often are applied in an attempt to reduce or eliminate water penetration in existing brickwork experiencing water penetration problems. As noted previously, water repellents cannot prevent water from penetrating cracks wider than 0.02 in. (0.5 mm). Therefore, the source of water penetration should be determined and necessary repairs completed prior to the application of a water-repellent coating. Exterior walls should be inspected to determine the condition of caps and copings, flashing, weeps, sealant joints, mortar joints, brick units and general execution of details. *Technical Note* 46 provides an inspection checklist for areas of concern. Repair and replacement of missing, broken, failed or disintegrating items identified during the inspection and essential to the water resistance of the brickwork should be completed prior to

application of a water repellent. The application of a water repellent is rarely effective and is not recommended in lieu of the following common repairs:

1. Removal of failed sealant, and cleaning, priming and replacement with an appropriate grade of elastomeric sealant at all windows, copings, sills, expansion joints and between brick masonry and other materials.
2. Repointing of incompletely filled, cracked or disintegrated mortar joints.
3. Removal and replacement of brick with spalled faces or cracks extending through the face shell.
4. Surface grouting of separations between the brick units and the mortar.

These remedial measures are described in *Technical Note* 46.

Other repairs, which are generally more difficult and costly to complete, include the following:

1. Clearing of mortar blockage from weeps and the air space or cavity.
2. Removal and replacement of damaged, omitted or improperly installed flashing.

The latter repairs are considered by some to be unnecessary or uneconomical if a water repellent is applied. However, these repair techniques provide long-term solutions to water penetration problems. Not completing them may allow water within a wall to become trapped, resulting in failure of the coating or deterioration of brickwork.

After remedial repairs have been completed and inspected, it is advisable to wait a period of several months to determine whether a water repellent is necessary. Moisture penetration problems often will be corrected by these initial repairs, and further consideration of coatings can be dismissed.

If water penetration remains a problem, or long-term solutions are judged to be too costly despite their benefits, the application of a water repellent can be considered. If water absorption appears to be the problem, a water repellent can be particularly effective. However, water repellents are not a permanent solution and will require reapplication. See the discussion under Durability of Coating for further information on the life span of coatings.

Stain Resistance and Efflorescence Prevention

By reducing the amount of water absorbed by brickwork, colorless coatings may help reduce staining and efflorescence. As a result, colorless coatings are sometimes used on brickwork that is subject to severe exposures or on units that have a relatively high absorption. Brick manufacturers sometimes apply colorless coatings to units during manufacture to reduce staining or initial rate of absorption. ASTM standards for face brick require that the brick manufacturer report the presence of such coatings. Selection of a coating for any of these uses should be based on demonstrated successful performance on similar brick with comparable exposures. Staining and efflorescence may not be completely eliminated by application of a coating. If staining or efflorescence occur on masonry treated with a colorless coating, the stains and salts may be difficult or impossible to remove. Further, for film-forming coatings and water repellents with a vapor permeability less than 0.98, efflorescing salts may become trapped under the coating, causing damage to the brick.

Appearance Change

Another common reason for using a colorless coating is to achieve a darker, wet or glossy appearance. In some cases, a colorless coating may result in an undesired sheen or gloss. Such gloss may be an indication of an improperly applied coating or of poor coating selection (see Photo 1). Satisfactory appearance of a treated surface is best judged by examining a sample panel or test area of masonry before and after treatment.

Photo 1
Undesired Gloss Due to a Colorless Coating

Graffiti Resistance

Resistance to graffiti and ease of cleaning can be important attributes for public structures such as schools, government buildings, libraries and noise barrier walls, where brick masonry is chosen for its

appearance and low maintenance. Colorless coatings are sometimes applied to brick masonry to keep graffiti or dirt on the surface of the brickwork for easier removal. Glazed brick often are used in similar installations to provide the same benefits. Note that some coatings used for graffiti resistance are sacrificial, meaning that the coating itself is removed when the graffiti is removed.

TYPES OF COLORLESS COATINGS

Colorless coatings for brick masonry can be classified into two general categories: film formers and penetrants. The two types have significantly different physical properties and performance. As the name implies, film formers produce a continuous film on the surface of the masonry. Penetrants enter up to ⅜ in. (10 mm) into the brick masonry and do not form a surface film.

Colorless coatings may be either waterborne or solvent-borne. Carrier type influences permissible application conditions. Originally, better penetration and performance were attained using solvent-borne solutions. However, manufacturers are increasingly producing waterborne solutions that have lower volatile organic compound (VOC) content. Coatings with higher solids content also may have lower VOC content. VOC content is regulated by the Environmental Protection Agency nationwide because of its connection with poor air quality. In addition, many green building guidelines have limits on VOC content in coatings. Product data and test results should be examined carefully to compare performance. Temperature range, substrate moisture content, environmental regulations and effects on adjacent materials and vegetation must be considered.

Colorless coatings are discussed in the following sections according to generic chemical type. Most colorless coating manufacturers will provide information on the generic chemical composition of their products. In addition, handbooks are available that classify many proprietary coatings according to their generic chemical composition.

Film Formers

Typically, film-forming products adhere to the brick masonry and form a film on the surface. Surface preparation can be important in achieving satisfactory adhesion of a film-forming coating. Film-forming products should be applied only to dry surfaces. Film materials, continuity and product concentration determine the performance characteristics.

Film-forming products are effective at preventing water from penetrating into brick masonry. Film formers can bridge the small, hairline cracks that are commonly the source of water penetration. If the crack is active, such as one created by wind load or thermal fluctuations, a film-forming product may also crack. This obviously reduces its effectiveness. However, a film-forming product's ability to exclude water from the exterior also inhibits evaporation of water within the masonry through the exterior face and can result in clouding (see Photo 2) and spalling (see Photo 3) if the source of moisture is not addressed. The reduced water vapor transmission rate, or lack of “breathability,” is of special concern in exterior brick masonry subject to freezing and thawing cycles. Thus, film-forming products are not recommended for brick masonry in such environments.

Photo 2
Clouding of Brick Masonry Wall with a Film-Forming Coating

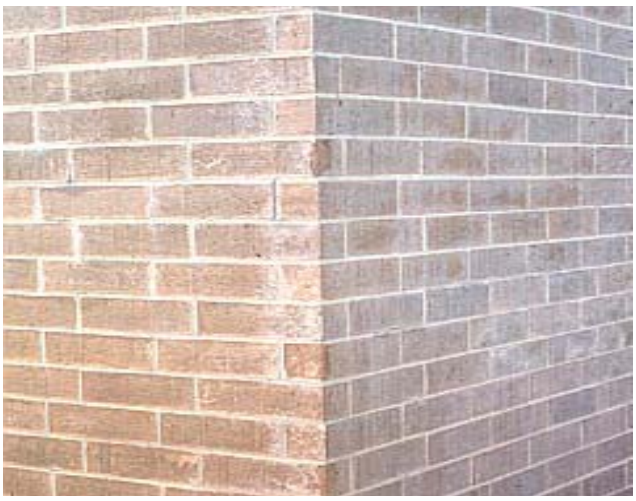

Photo 3
Spalling of Brick Masonry Wall with a Film-Forming Coating

A film on a masonry wall may facilitate cleaning by keeping surface contaminants from penetrating into the masonry. This characteristic leads to such products' use as graffiti-resistant coatings. When an appearance change is desired, film formers typically are used. Film-forming products, by their nature, tend to produce a sheen or gloss when applied. When used in high concentrations, they may darken the appearance of a wall (the “wet look”).

Acrylics, stearates, mineral gum waxes and urethanes are among the products that form a film when applied to brick masonry. The large molecular size of these products prevents them from penetrating into the masonry.

Acrylics. Acrylics can be effective as water repellents. They often are used when a high gloss is desired. Acrylics are available in two forms, waterborne and solvent-borne. Acrylic emulsions are waterborne. Acrylic solutions are solvent-borne. Because of increasing regulation of solvent-borne products, acrylic emulsions are more widely used. Coating manufacturers typically recommend that acrylics be applied to substrates that are thoroughly dry. If applied to a damp substrate, the acrylic film can separate from the masonry, giving it a cloudy, or whitened, appearance. Some acrylics can create a slippery surface, which is a concern in pavements. However, some acrylics increase slip resistance. When stabilized against degradation in ultraviolet (UV) light, acrylics can last approximately five to seven years.

Stearates. Stearates promoted for use on masonry are generally aluminum or calcium stearates. They are sometimes known as metallic soaps. Stearates form a water-repellent surface by reacting with free salts in mineral building materials and plugging the pores. Some formulations are used as integral water repellents in concrete masonry and mortar. Their effectiveness as applied water repellents varies, and typically film-forming stearates must be reapplied every year. Stearates also have the potential to turn cloudy if moisture gets behind the coating.

Mineral Gum Waxes. Paraffin wax and polyethylene wax are commonly referred to as mineral gum waxes. These products are typically solvent-borne and can be good water repellents, able to bridge hairline cracks. As with other coating types, mineral gum waxes can be used to protect units from staining. However, they have been known to darken the substrate and, in cases where moisture gets behind the coating, turn the surface a milky white. If the sources of moisture are not addressed, clouding and eventual spalling of the masonry may occur.

Urethanes. Urethanes, chemically referred to as polyurethanes, are isocyanate resins. They are classified as either aromatic or aliphatic, depending on the resulting chemical. They are considered one-part urethanes if cured by moisture in the substrate or air and two-part if they require a chemical catalyst to cure. While urethanes can be excellent water repellents and provide good gloss, they can break down under UV light and have very low vapor permeability. Chemical additives often are used in urethanes to prevent UV degradation and yellowing and to improve gloss retention. Urethanes with such additives usually last from one to three years.

Penetrants

Penetrating type coatings are characterized by their penetration into the substrate, typically to depths up to ⅜ in. (10 mm). They repel water by changing the capillary force, or contact angle with water, of the pores in the face of the masonry from positive (suction) to negative (repellency). Penetrating coatings are typically more resistant to UV degradation because of their chemical composition and because they penetrate below the masonry surface. Because they coat the pores rather than bridge them, penetrants tend to have better water vapor transmission characteristics. The solids content of these materials commonly ranges from 5 to 40 percent by weight. Higher solid content typically indicates better water penetration resistance. Penetrants can be categorized into six groups — siloxanes, silanes, silicates, methyl siliconates silicone resins and RTV silicone rubber — and blends of these.

Siloxanes. Siloxanes have a larger molecular structure than silanes and provide good penetration and water repellency. Siloxanes bond chemically with silica- or alumina-containing materials, such as brick and mortar, to make the material water-repellent. This results in a long life, up to 10 years or more, and makes the coating more difficult to remove. Some siloxanes can also be applied to slightly damp surfaces. Siloxanes are less volatile than silanes and react with chemically neutral substrates without a chemical catalyst. Siloxanes are typically used in solutions having 5 to 12 percent solids by weight. Siloxanes have been known to work well on certain brick

masonry installations. However, siloxanes are highly reactive with silica and will bond with glass that is not properly protected.

Silanes. Silanes used as clear water repellents have a smaller molecular structure than siloxanes, which allows good penetration on dense substrates. They are used in relatively high concentrations (typically 20 percent or greater solids content). Like siloxanes, silanes bond chemically with silica- or alumina-containing materials and can bond with unprotected glass. Silanes can be applied to slightly damp substrates. An alkaline substrate, such as concrete or concrete masonry, acts as a catalyst to speed the reaction to form a water-repellent surface. Chemical catalysts also are used with silanes to improve the chemical reaction on less alkaline substrates such as brick.

Silicates. Ethyl silicates are commonly used in restoration of deteriorated masonry as consolidants for natural stone and occasionally brick masonry. Consolidants are designed to react with and stabilize the substrate to which they are applied. Their use on brick is uncommon. None are effective water repellents, and they are not recommended for this use on brick masonry.

Methyl Siliconates. Methyl siliconates are alkaline solutions that react with silica-containing materials in the presence of carbon dioxide to form a water-repellent surface. Siliconates are sometimes injected into brick masonry to form a horizontal barrier to rising damp.

Silicone Resins. Silicone resins come in many weights and forms. The 5 percent silicone resin is the most common penetrating formula. Silicones do not chemically bond with the substrate and as a result have a short life. Many silicones require reapplication on a yearly basis, although some last longer.

RTV Silicone Rubber. Room temperature vulcanizing (RTV) silicone rubber is a penetrating water repellent that contains petroleum distillates. It does not require the presence of alkali to react with the substrate. Once cured, RTV silicone rubber retains its elasticity, helping it to bridge hairline cracks. Asphalt, plastic rubber and glass surfaces must be protected from contact with it. RTV silicone rubber is commonly used in anti-graffiti coatings.

Blends. Colorless coatings also are made from blends of the materials listed above. Blends are created to produce products with the benefits of the constituent materials. As such, they reflect the properties of the constituent materials, but the properties will be modified somewhat. Thus, it is important to review product data and test results for products, especially blended ones. For quality assurance that a blend is formulated in the correct proportions, select a product that is pre-blended by the manufacturer.

PERFORMANCE CRITERIA

Any coating applied to brick masonry will change the physical properties of the masonry. The most critical properties of colorless coatings to be evaluated are water vapor transmission, water penetration and repellency, durability, compatibility with the substrate, gloss, slip resistance, graffiti resistance, VOC content and environmental considerations. A variety of industry standard tests for evaluating these properties exist; however, it can be difficult to compare products because the reported performance characteristics of each product may be based on a different set of tests.

Another difficulty exists in correlating test results with in-service performance of coatings applied to brickwork. For example, one method of evaluating water repellency of a coating is by comparing the cold water absorption of an untreated brick to that of a treated brick, using the method described in ASTM C67, *Test Methods of Sampling and Testing Brick and Structural Clay Tile*. Although such a test may indicate the ability of a coating to reduce the amount of water absorbed through the faces of individual brick, it neglects the effect of mortar joints on the water penetration resistance of brickwork. The presence of partially filled mortar joints, hairline cracks and minute separations that occur in brickwork will often reduce, and sometimes completely negate, the “tested” effectiveness of a coating.

Until standard tests better correlate with performance of brickwork in service, good judgment and experience are necessary in establishing performance criteria. The properties discussed in the following sections can be useful in comparing colorless coating alternatives. Table 1 presents a relative comparison of several colorless coating properties.

TABLE 1
Typical Properties of Colorless Coatings for Brick Masonry[1]

	Water Vapor Transmission	Water Repellency	Life Span, Years	Available with Glossy Finish	Graffiti Resistance
Film Formers					
Acrylics	Poor	Very good	5 to 7	Yes	Yes
Stearates	Poor	Varies	1	No	No
Mineral gum waxes	Poor	Good	Varies	No	No
Urethanes	Poor	Very good	1 to 3	Yes	Yes
Penetrants					
Siloxanes	Very good	Very good	10+	No	No
Silanes	Very good	Very good	10+	No	No
Silicates	Poor	Poor	Varies	No	No
Methyl siliconates	Good	Fair	Varies	No	No
Silicone resins	Fair	Varies	1	Yes	No
RTV silicone rubber	Good	Good	5 to 10	No	Yes
Blends	Varies	Varies	Varies	No	No

1. Refs. 6, 14

Water Vapor Transmission Rate and Permeability

The most important property to consider when selecting a coating for application on exterior brick masonry is the water vapor transmission rate. The water vapor transmission, or breathability, determines the rate and amount of water that can evaporate through the face of the brickwork. Coatings that have low water vapor transmission rates inhibit evaporation and can trap water within the brickwork, leading to clouding of the coating, as shown in Photo 2 and Photo 4.

Low water vapor transmission may also result in the premature deterioration of brickwork. Water that is unable to pass through a coating increases risks of masonry deterioration due to freeze-thaw cycles and deposition of water-soluble salts behind the coating. As these salts crystallize, they grow significantly in size and can create enough expansive pressure to cause spalling of brick.

Mike Dickey, Frieze & Associates

Photo 4
Clouding of a Colorless Coating on a Brick Pavement

For these reasons, the effect of a coating on the water vapor transmission rate of brickwork should be carefully considered, particularly for walls exposed to freezing and when moisture problems such as rising damp and condensation are known to exist. Coatings with a water vapor permeability of 0.98 or higher allow natural evaporation to occur, thus reducing the potential for problems. However, even a highly breathable coating may lower the vapor transmission of a wall by preventing moisture migration to the exterior surface where evaporation occurs. A condensation analysis, as described in *Technical Note* 47, should be performed before applying a coating to determine the effect of the coating on the location of condensation within the wall system.

At present, there is no definitive test establishing the effect of colorless coatings on the water vapor transmission rate and durability of brick masonry. However, the water vapor transmission rate of a coating can be measured using ASTM E96, *Test Methods for Water Vapor Transmission of Materials*. To accurately replicate field conditions (air rather than water on one side of the brick), the desiccant method is preferred. Using this test, the effect of a coating can be evaluated through a comparative measurement between an untreated and a treated brick. For comparative testing, a maximum 10 percent reduction in the rate of vapor transmission is the recommended limit.

Another method to evaluate the potential of a colorless coating to entrap damaging salts and cause spalling is proposed by Binda [Ref. 2]. Individual brick are treated with the colorless coating on their exposed faces. The sides of the units are sealed with rubber to prevent evaporation except through the treated face. The units are subjected to cycles of immersion in a salt solution for four hours and air drying for 44 hours. The cross-sectional size is measured after each cycle. Deterioration is typically by delaminations of the treated brick face, hence a reduction in brick cross section. A correlation of the number of cycles to deterioration in this test to the durability of a masonry assemblage has not yet been established. However, this method is one means of assessing salt crystallization damage potential when evaluating colorless coatings.

Water Repellency

Water repellency is an important criterion when a coating is intended to reduce water penetration resistance. However, water repellency of most coatings is based on reducing the amount of water absorbed by a substrate. Water repellency is often evaluated by comparing the absorptions of treated and untreated brick using the ASTM C67 test for cold water absorption. As discussed previously, this approach has significant limitations. Because most water penetrates brickwork through voids or cracks in mortar joints and minute separations between brick and mortar, tests of water repellents on individual brick cannot accurately indicate the performance of a water repellent on brickwork. The effectiveness of water-repellent coatings in reducing water penetration through brickwork is more accurately evaluated by using representative brickwork panels.

ASTM E514, *Test Method for Water Penetration and Leakage Through Masonry*, is the preferred laboratory test for evaluating the ability of a coating to reduce the water penetration of brickwork. The test can be used to compare the water penetration resistance of brickwork treated with water-repellent coatings to untreated brickwork. Testing should be performed on a minimum of three identical wall specimens of the intended materials and construction. The amount of water penetration should be measured on each specimen in accordance with ASTM E514 before and after coating with the clear water repellent. The percentage reduction in water penetration is a measure of the water repellent effectiveness. A 90 percent reduction in maximum leakage rate; and a 75 percent reduction in percent area of dampness on the back face of the wall and total water collected after 24 hours of testing [Ref. 3] as compared to the untreated wall panel is recommended. ASTM E514 has its limitations. Performance of coatings in laboratory tests may differ from results on actual brickwork due to the variables inherent in construction. Thus, a tested percent reduction rate for a laboratory test does not automatically translate into the same percent reduction in water leakage through the exterior brickwork of a constructed building.

ASTM C1602, *Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces*, provides a means to evaluate the effectiveness of a coating in the field. The test can be used on existing masonry walls or field mock-ups. A sheet of water is to be developed and maintained on the wall surface during testing. If the sheet of water does not consistently form, the results of this test may be inaccurate. After a preconditioning period, a specified water flow rate and air pressure are maintained. The amount of water applied to the face of the wall during the test is measured and the water loss calculated. Again, a coating should provide at least a 75 percent reduction in loss of water.

Durability of Coating

The durability of a coating is an important selection criterion. Greater depth of penetration or film thickness and greater resistance to degradation in UV light and harmful environments imply longer life for coatings applied to exterior brickwork. Durability of coatings applied to brick pavements may also depend on resistance to abrasion. A coating's durability also determines how often it must be reapplied, which may have permeability and ongoing maintenance implications.

Most coatings must be reapplied every five to 15 years, and some last considerably shorter periods of time. Many coatings are warranted by the manufacturer to last 10 years or more. It is common for film-forming products to require reapplication more often than penetrants, particularly if they are applied to brick floors subject to significant

amounts of traffic. Evaluation of a coating's resistance to abrasion is difficult, because there are no direct test methods for measurement on brick. Reapplication of a coating (especially if carried out prematurely) may decrease the vapor permeability of the brickwork. This may be a concern for exterior brick masonry walls, particularly in climates subject to freezing and thawing.

One way to evaluate the durability of a coating is with laboratory tests that simulate outdoor exposure. ASTM G154, *Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*, is one often specified. The difficulty with using laboratory tests to measure the life span of a coating is trying to correlate laboratory test results to field performance. Coating characteristics, such as gloss or water repellency, can be measured before and after exposure and the results compared, but such tests have not been correlated to the actual life expectancy of the coating.

Periodic evaluations of field performance can also be used to determine whether a coating continues to be effective. Results of field tests conducted on a specified area of a newly treated wall can be compared to tests performed in the same location after some period of service. Such evaluation will indicate if the coating has met its warranted life and help to determine when reapplication may be necessary.

Compatibility. Compatibility of a coating with the brickwork and its existing surface treatments should be determined prior to application. Only coatings specifically formulated for use on brickwork should be selected. Incompatibility of a coating with the brickwork or an existing coating may adversely affect durability, appearance or otherwise prevent the coating from performing as intended. Penetrating coatings are typically incompatible with existing film-forming coatings. In some cases, reapplication of a coating may cause clouding and may be difficult or impossible to remove.

It may be necessary to remove any existing coating, following the coating manufacturer's recommendations before reapplication or application of a different coating. This procedure may involve hazardous chemicals often regulated or restricted from use by local, state or federal environmental regulations. Thus, an existing coating may have to remain in place until it wears off, even if deterioration of the masonry calls for its removal.

Environmental Considerations

Possible environmental hazards are also of concern when considering a colorless coating. Often the chemicals used in colorless coatings are highly reactive and can etch glass, damage paint, kill vegetation and emit harmful vapors. This requires attention to worker safety and proper protection of adjacent surfaces.

Appearance

Some coatings, particularly film-formers, may impart a gloss, sheen or darkening to brickwork. Acceptable appearance is a subjective matter and should be determined by the designer or owner prior to application. Gloss is best evaluated by treating half of a test area representing the entire range of brick colors and textures and comparing the treated half to the untreated half. An accepted test area should be retained as a means of judging acceptability of other treated areas. When necessary, a number of ASTM test methods can be used to evaluate differences and to establish tolerances [Ref. 1, Volume 6.01].

Slip Resistance

A coating can adversely affect the slip resistance of a brick floor or pavement. The slip resistance of coated floors or pavements should be evaluated for safety reasons, especially in public access areas and in areas where water may contact the floor or pavement. The slip resistance of coatings often is measured in the laboratory using ASTM D2047, *Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine* [Ref. 1]. A value of 0.5, measured by the James machine, is the recognized minimum value for slip-resistant walking surfaces in courts of law in the United States. Slip resistance can be measured in the field using portable devices such as the NBS-Brungraber machine (also known as the Mark I Slip Tester). The United States Access Board recommends coefficient of friction values of 0.6 for a level surface and 0.8 for ramps, as measured using the NBS-Brungraber machine [Ref. 14].

Graffiti Resistance

Effective graffiti resistance depends on the ability of a coating to prevent penetration of unwanted markings into brickwork and facilitate their removal. Often, water repellency, appearance, durability and other properties are also

important selection criteria for anti-graffiti coatings. A method for determining the effectiveness of an anti-graffiti coating is described in ASTM D7089, *Practice for Determination of the Effectiveness of Anti-Graffiti Coating for Use on Concrete, Masonry and Natural Stone Surfaces by Pressure Washing* [Ref. 1]. Satisfactory performance is indicated by successful removal of intentionally applied graffiti. Always consult the coating manufacturer prior to testing, as reactions between the cleaner and the coating may be hazardous.

Anti-graffiti coatings generally employ either a "barrier" or "sacrificial" strategy to resist graffiti. Barrier or permanent coatings must be resistant to cleaning chemicals so that they remain on the surface of brickwork after graffiti is removed. Conversely, sacrificial coatings should be easy to remove. Removal of graffiti should always follow coating manufacturers' recommendations, because many anti-graffiti coatings are intended to be used with a particular removal method or cleaning product.

As anti-graffiti coatings provide a barrier to paint and other staining, they also provide a barrier to water evaporation through the outer face of the brick, similar to that of glazed brick. Therefore, most of the drying of the brickwork occurs by evaporation through the back face of the brick, into the air space. It is important that when an anti-graffiti coating is used, the cavity behind the brick be vented at top and bottom to help remove the excess moisture in the air space created by this evaporation.

CONSIDERATIONS PRIOR TO COATING

Selection of a colorless coating for use on brick masonry should be based on the desired performance, the information discussed in this *Technical Note* and literature from the coating manufacturer. Additional items to be considered prior to application of a colorless coating follow. Whenever possible, consult with the brick manufacturer for specific recommendations regarding coating of a particular brick. Properties of each brick are unique and can affect coating performance.

1. It is suggested that the designer or user require test reports for relevant performance criteria and a written warranty from the coating manufacturer for the performance of the coating over a designated period of time.
2. The coating should be that of a well-known manufacturer who has been in business for at least five years. It is suggested that a brand name be used that has a good track record over a period of at least five years. References of projects with similar installations, materials and exposure should be investigated.
3. The coating should be applied at the application rate and under the climatic conditions recommended for clay brick masonry substrates by the coating manufacturer. Typically, temperatures above 40 °F (4 °C) and below 100 °F (38 °C) are required. Application on windy days should be avoided when possible.
4. Repair and replacement of brick and mortar joints and other necessary repairs should be completed prior to applying a colorless coating.
5. A minimum of one month should pass after close-in of the building before a water repellent is applied to newly constructed brickwork. This period allows the evaporation of moisture from the building materials to occur naturally, unimpeded by a coating on the brickwork, and permits the walls to cure sufficiently. In fact, many colorless coating manufacturers recommend application only to a relatively dry substrate. A delay of one year is preferred so that efflorescence due to water absorbed during construction, often known as "new building bloom," is not entrapped by the coating. For a more complete discussion of efflorescence, refer to the *Technical Note* 23 Series.
6. There should have been no efflorescence or, at the maximum only a minor occurrence of efflorescence, on the brick masonry to be treated. Walls with a history of efflorescence should be coated only after the source of moisture has been addressed.
7. The wall must be clean at the time of application [Ref. 9]. Heavy accumulations of dirt will interfere with proper penetration or adhesion of the coating and result in poor performance and shorter life. See ASTM D5703, *Practice for Preparatory Surface Cleaning for Clay Brick Masonry* [Ref. 1], for a discussion of cleaning techniques that may be required. In addition, freshly repointed mortar and repaired sealant joints should cure for a minimum of 72 hours before a coating is applied [Ref. 11].
8. The brickwork should have a moisture content consistent with that recommended by the coating manufacturer. Moisture content of the brick masonry should be checked at several locations by the method recommended by the coating manufacturer.
9. Apply samples of the selected coating to test areas of at least 10 ft² (1 m²) on the building at a location representative of the area to be treated or on a sample panel. Allow these test areas to cure as recommended by the coating manufacturer. Inspect and test them to determine satisfactory performance with respect to the performance criteria established.

10. The application contractor should know the work to be performed and should protect adjacent and surrounding surfaces from over-spray as necessary. Qualifications of the contractor should be verified.

These steps must be taken in conjunction with the recommendations contained within the applicable sections of this *Technical Note*. They cannot guarantee successful performance but will greatly increase the likelihood that the colorless coating will perform as intended. The coating manufacturer often will have additional recommendations regarding coating selection, substrate preparation, curing, application methods and coverage rates. The coverage rate is especially critical, because over-application of the coating can reduce its breathability. Failure to consider these items can result in poor performance of the coating and can cause severe harm to the masonry or surrounding elements.

RECOMMENDATIONS FOR USE

Selection of a specific product should be based on recommended performance criteria described herein and any other criteria set by the designer to address the particular conditions involved. In addition, the brick manufacturer should be consulted for recommendations on the use of colorless coatings prior to coating selection.

There are a variety of reasons that colorless coatings may be considered for application to brickwork. However, it is important to recognize that coatings change the physical properties of the brickwork to which they are applied. Therefore, the potential advantages of colorless coatings should be carefully weighed against their disadvantages.

Exterior Walls

Penetrating coatings are preferred for exterior brick masonry walls because they permit water vapor transmission. Only coatings with a water vapor permeability of 0.98 or greater as measured by ASTM E96 should be used. If a water repellent is to be used, siloxanes are recommended. Siloxanes provide the advantage of good water repellency and long-term performance and have been shown to be effective on many brick masonry walls. Silanes containing chemical catalysts also have been used successfully.

Because of the effect of a film on the breathability of masonry, use of film-forming coatings is discouraged, particularly in freezing climates. Some film-forming coatings have been known to perform successfully; however, there can be significant risks. If use of a film-forming coating, such as an anti-graffiti coating, is necessary, select only products known to successfully perform in a similar climate, wall type and exposure on brick masonry with similar physical properties.

When a drainage wall is treated with a colorless coating, the use of vents at the top and bottom of wall cavities can promote evaporation of moisture from the brickwork.

Chimneys and Parapets. These elements can be subject to premature deterioration because of severe exposure. They are often exposed to wind-driven rain and water rundown on the exterior walls from the crown or coping. Because of the large amount of moisture that can contact the surface of a chimney or parapet wall, a clear water-repellent coating can sometimes be effective in reducing water-related problems. Conditions in which a clear water repellent may be recommended on chimneys and parapet walls include climates with a driving rain index above 3 (see Figure 1) and on sloped or horizontal projections of such elements where water and snow can accumulate.

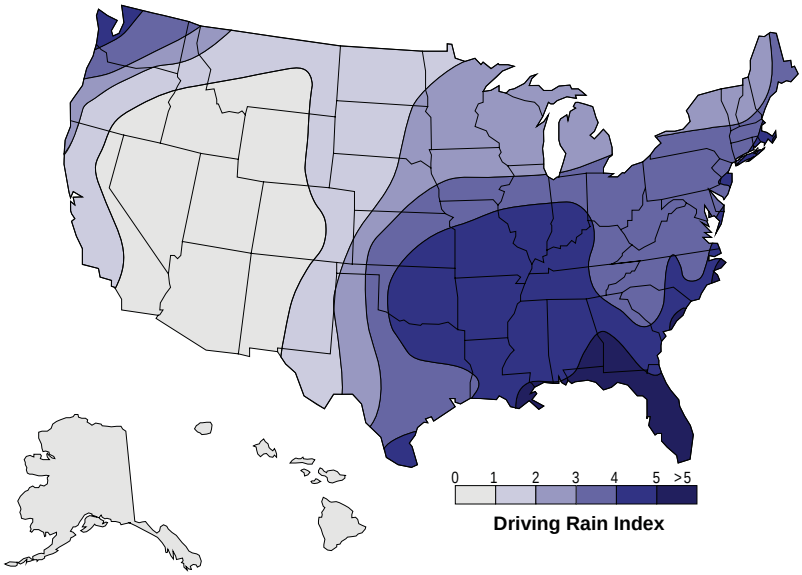

Figure 1
Driving Rain Index Map [Ref. 9]

Interior Walls

Colorless coatings are generally applied to interior walls to facilitate cleaning or to provide a gloss. Water repellency and breathability of interior walls is generally not a concern. Film-forming products, specifically water-borne acrylics (acrylic emulsions) and urethanes, typically will give the best results when gloss and ease of cleaning are desired. However, some penetrating coatings may also provide this effect. Acrylics in particular are known to provide a high gloss. Both acrylics and urethanes are durable in installations with no UV exposure.

In the case of exterior brick masonry walls that have their interior faces exposed, water vapor transmission may be a concern. Film-forming products should be used cautiously, only after the effect of the film on the water vapor transmission of the wall system has been evaluated.

Pavements and Floors

Coatings may be desired on brick pavements to resist staining or to decrease moss and mildew growth. The exposure and construction of brick pavements are significantly different from those of vertical brickwork. Lack of a drainage cavity or air space to aid in drying increases the severity of exposure. There are several disadvantages associated with the use of a colorless coating on pavement surfaces. Colorless coatings can decrease the slip resistance of the pavement or floor, especially when wet. Also, pavements and interior floors are subject to abrasion due to foot traffic, which shortens the life expectancy of most coatings compared to vertical installations. Exterior brick pavements are subjected to more severe weathering exposures than exterior vertical walls. Pavements often have prolonged contact with moisture due to their horizontal orientation and are seldom protected by overhangs.

Any joint sand stabilizers needed to protect sand in joints from erosion are typically applied before coatings. For more information about these products, refer to *Technical Note* 14A.

Exterior Pavements. By the nature of their construction, pavements allow evaporation of moisture from the masonry through only one face, the wearing surface. As a result, the potential for problems associated with reduced water vapor transmission are significant. These disadvantages usually outweigh any potential benefit. For this reason, colorless coatings are not recommended for use on exterior brick pavements subject to freezing and thawing. In exterior environments not subject to freezing, the water vapor transmission rate of the coating must be high. Clouding of the coating is a particularly common problem (see Photo 4).

Interior Floors. Colorless coatings are often applied to interior brick floors to provide a glossy finish and to facilitate cleaning. Mortarless brick pavements also can be coated to help retain the jointing sand in the joints. Urethanes, acrylics, waxes and some penetrating coatings that meet the performance criteria discussed herein, and those set by the designer, can be used on interior brick masonry floors not subject to freezing. The primary disadvantage of most colorless coatings used on floors is their tendency to reduce the skid resistance of the floor. New epoxy-based coatings show promise in this area. Film-forming coatings may separate from the brick paving and turn cloudy if moisture from the brickwork or supporting members migrates through the brick floor. Consequently, film-forming coatings should be applied only when the brick floor and supporting members are dry. Past successful performance is the best measure of a satisfactory coating.

SUMMARY

This *Technical Note* has discussed both the reasons for and the suitability of colorless coatings for brick masonry. For most exterior brick masonry, use of colorless coatings is discouraged. Furthermore, clear water repellents are not necessary on properly designed and constructed brick masonry. However, under certain conditions, clear water repellents and other colorless coatings may be beneficial.

> *The information and suggestions contained in this* Technical Note *are based on the available data and the experience of the engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this* Technical Note *are not within the purview of the Brick Industry Association and must rest with the project architect, engineer and owner.*

REFERENCES

1. *Annual Book of ASTM Standards*, ASTM International, West Conshohocken, PA, 2007:

   Volume 4.05
   - C67 "Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile"
   - C1601 "Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces"
   - E514 "Standard Test Method for Water Penetration and Leakage Through Masonry"

   Volume 4.06
   - E96/E96M "Standard Test Methods for Water Vapor Transmission of Materials"

   Volume 6.01
   - D523 "Standard Test Method for Specular Gloss"
   - D3134 "Standard Practice for Establishing Color and Gloss Tolerances"
   - D4449 "Standard Test Method for Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance"

   Volume 6.02
   - D5703 "Standard Practice for Preparatory Surface Cleaning of Clay Brick Masonry"
   - D7089 "Standard Practice for Determination of the Effectiveness of Anti-Graffiti Coating for Use on Concrete, Masonry and Natural Stone Surfaces by Pressure Washing"

   Volume 15.04
   - D2047 "Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine"
   - G154 "Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials"

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UW Marinette Fieldhouse Assessment - Priority List

HIGH PRIORITY LIST		MEDIUM PRIORITY LIST		LOW PRIORITY LIST	
EIFS		**BRICK**		**ROOF**	
Repair at Impact Damage Locations		Masonary Cleaning	$2,000	Replacement of membrane	
100 sft of patching, 250 sft of removal and		Repointing South Wall	$3,000	with overflow drains	$120,000
replacement, 2000 sft paint to match	$12,000			**GYMNASIUM**	
Sealant at Control Joints	$200	**Option 1** - Repointng North & West		Replace bleachers	$87,500
WINDOWS/DOORS		Walls, Replace Cracked Brick,		Replace devider curtain	$50,000
Patching/Repair and Painting	$150/door	repair flashing at wall base	$36,000	Replace ventilation grilles	$1,600
GYMNASIUM		**Option 2** - Water Repellant w/		Recoat walls at damaged	
Seal at areas with exposed spray foam	$500	Tuck pointing & brick replacement		areas 200 sq ft	$1,000
Replace door closers and overhead stops	$400/each	on North & West Walls	$25,000	**NATATORIUM**	
NATATORIUM		**GYMNASIUM**		Decommissioning Opton:	
Door hardware replacement	$600/each	Add ceiling fans (2)	$12,000	Renovate to New Space	$490,000
Patch/Repair/Recoat Steel Intels	$3,000	**NATATORIUM**		**LOBBY**	
Add small room in mechanical room	$20,000	Miscellaneous tile repairs	$500	Replace damaged ceiling tile	$2.50/sq ft
ACCESSIBILITY		**ACCESSIBILITY**		**LOCKER ROOMS**	
install grab bars at toilets adjacent to classrooms	$600	Renovate single user toilet room		Replace damaged ceiling tile	$2.50/sq ft
Wrap piping below lavatories at Locer Room	$600	at showers	$8,000	**CLASSROOM/FITNESS ROOM**	
Renovate shower stall area	$10,000	**MECHANICAL SYSTEM**		Replace damaged ceiling tile	$2.50/sq ft
MECHANICAL SYSTEM		Replace unit ventilators in		**MECHANICAL SYSTEM**	
Option 1 - Replace dehumidification system		classrooms	$45,000	Replace gym air handling unit	$25,000
for pool with one larger unit	$325,000	**POWER DISTRIBUTION**		Replace hot water boiler for pool	$35,000
Option 2 Replace Dehumidification unit		Replace the Federal Pacific		**PLUMBING SYSTEM**	
with two small units	$350,000	distribution panels (2)	$10,000	Replace water heaters with high	
Replace locker room MUA with energy recovery		**EXTERIOR SIDEWAKS/PAVEMENT**		efficiency units	$24,000
unit with heating and cooling	$38,000	Replace the areas of the sidewalk		Install low-flow fixtures	$1500/fixture
ELECTRICAL SYSTEM		and entry pads that need repair	$5,000	**LIGHTING**	
add emergency lighting	$20,000	**ASPHALT PAVEMENT**		Replace exit signs with LED signs	$3,000
		Option 1 - Seal existing	$100,000	Replace high pressure sodium	
		Option 2 - Full replacement	$150,000	wall pack lights with LED	$10,000
				MECHANICAL LOADS	
				Upgrade motor conrtrols to variable	
				frequency drives	$7,500
				FIRE ALARM	
				Replace fire alarm system	$30,000
				Misc. ELECTRICAL EQUIPMENT	
				Replace scoreboards	$12,000

Exhibit F

Invoice

Fox Valley Clean Air
W5957 County Rd KK
Appleton WI 549515

Date	Invoice #
10/20/2015	2874

Bill To

Marinette County
1926 Hall Avenue
Marinette,WI 54143

Fox Valley Clean Air has moved.
Please send payments to

W5957 Cty Rd KK
Appleton WI 54915

P.O. No.	Terms	Project

Quantity	Description	Rate	Amount
	Cleaned all accessible cold air return and fresh air duct work at Marinette County Building.	4,500.00	4,500.00T
		0.00	0.00

Total $4,500.00