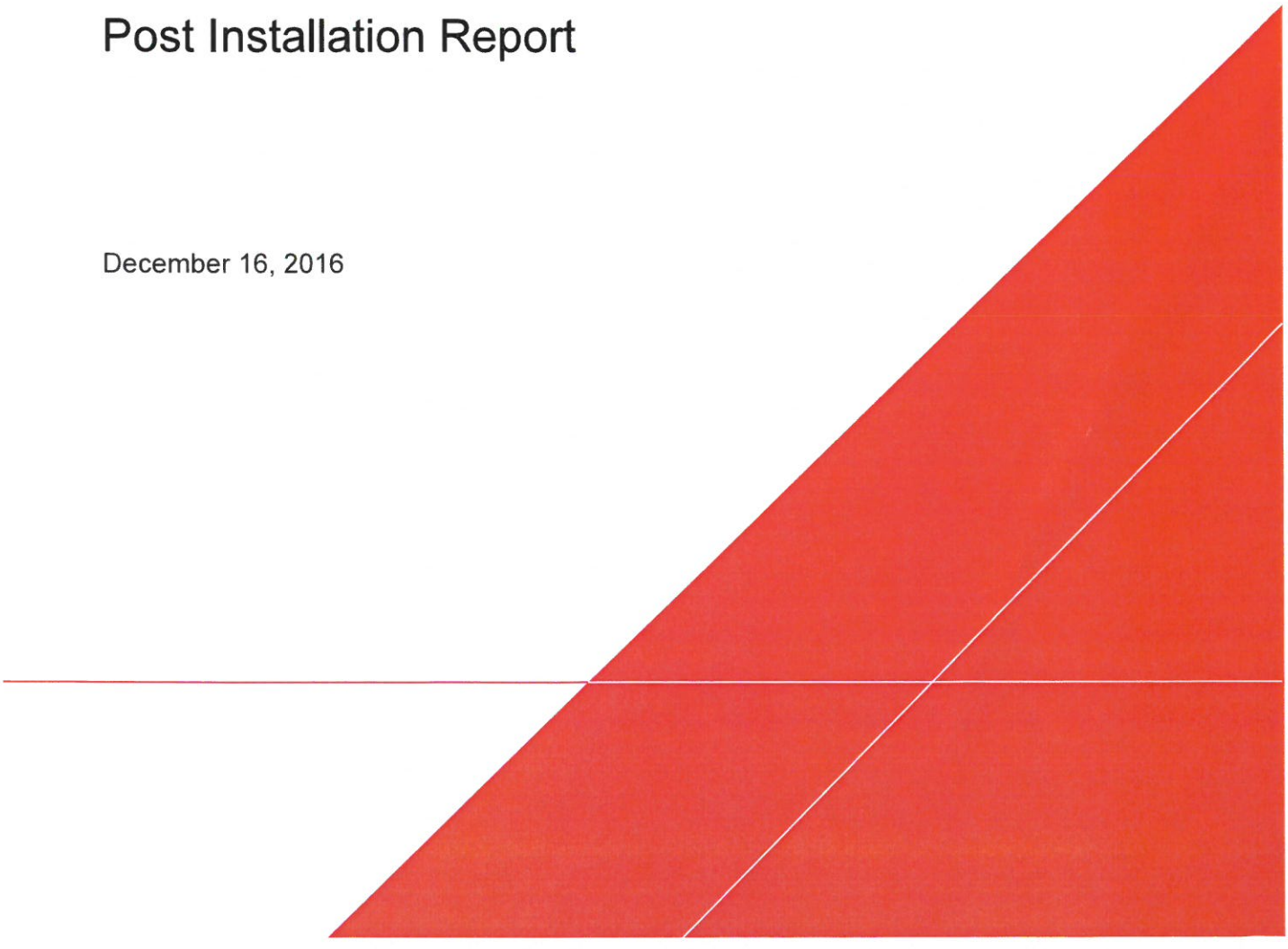
ARCADIS Design & Consultancy for natural and built assets

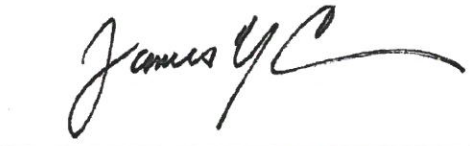
City of Mt. Vernon

# MEMORIAL FIELD TENNIS BUBBLE

## Post Installation Report

December 16, 2016





James A. Callahan, P.E.
Vice President

# MEMORIAL FIELD TENNIS BUBBLE

**Post Installation Report**

Prepared for:
Ralph Uzzi
DPW Commissioner
City of Mt. Vernon
City Hall
One Roosevelt Square
Mt. Vernon NY 10550

Prepared by:
Arcadis of New York, Inc.
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Our Ref.:
009100

Date:
December 21,2016

# VERSION CONTROL, OPTIONAL

| Issue | Revision No | Date Issued | Page No | Description | Reviewed by |
|---|---|---|---|---|---|
| Final Draft | 1 | 12/17/16 | | Draft final report. Report defining the design and construction activities required to install the air supported structure (bubble) at Memorial Field | |
| Final Draft | 2 | | | | |
| Final Report | 3 | 1/24/16 | | Minor clerical edits included | JMC |

# CONTENTS



# TABLES



# FIGURES



# APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AHU | Air Handling Unit |
| ATS | Automatic Transfer Switch |
| Arizon | Arizon Structures Worldwide, LLC (Tennis Bubble Manufacturer) |
| Con Ed | Consolidated Edison |
| Kela | Kela Tennis Inc |
| PSIG | Pound per square inch, pressure |

# EXECUTIVE SUMMARY

The Mt. Vernon Tennis facility rehabilitation and expansion project was started in 2014. The new facility is replacing an existing two tennis court facility which included small wooden structures that served as tennis programing offices, changing rooms, restrooms, etc. The facilities current design is partially complete with the tennis bubble fabric newly erected utilizing the steel shell of the planned facility as a supporting wall. All construction on the tennis facility building has halted awaiting direction from the City of Mt. Vernon.

Arcadis was brought on the project to assist the City complete all required engineering and construction management tasks required to erect the tennis bubble. As of December, 13 2016, the fabric bubble is "up" and is available for tennis play. The Kela family who owns the tennis bubble structure and operates the tennis facility is satisfied with the outcome, and has acknowledged the assistance of the City.

This report documents the efforts undertaken in erecting the tennis bubble.

# 1 BACKGROUND

Arcadis was engaged by the current mayor's administration to assist the City with a project at Memorial Field on E. Sanford Avenue in Mt. Vernon. The initial request was to identify a method of erecting the fabric tennis bubble given that the adjoining building's construction had not been completed. The City had contracted with the architectural firm of Errol McIntosh RA to design the tennis facility building and the corresponding utilities. It appears that the contract documents were never fully completed and lacked engineering and architectural detailing.

The City had taken it upon themselves to attempt to finish the design of the building, system by system, component by component and either bid the work to contractors for construction and installation services or to vendors for equipment or materials. The City was also attempting to construct portions of the facility themselves. Neither of these construction methods appear to have any rapid success.

The City signed a 15-year license agreement with Kela (Kela) Tennis Inc, to maintain and operate an Indoor and Outdoor Tennis Facility at the Memorial Field Tennis Area, commencing April 1, 2015. The Kela family engaged tennis bubble manufacturer Arizon Structures Worldwide, LLC (Arizon), sales order A10212, to design, fabricate and install a fabric bubble to enclose the six-court facility. The bubble relies on the tennis facility building's east wall as an integral component of the enclosure. At the time Arcadis was brought on, the building and the bubble's supporting utilities were behind schedule for a fall 2016 erection having already missed the fall 2015 target date.

# 2 TIMELINE

- City of Mt. Vernon owned and operated the Memorial Field Tennis facility, as an outdoor open court facility (1980-2014) with small wooden structures serving as restroom, changing and office facilities.
- Design of new courts, demolition of existing court and construction of the new 6-USTA approved Har-Tru courts was completed in 11/2014. A portion of the at-grade first floor concrete slab for the proposed building was completed at this time as well. Electrical conduit was installed below the courts, linking the proposed building on the west with the mechanical equipment slab on the east side of the courts. The City designed the natural gas piping for the site and had the 2 PSIG below ground piping installed at the same time as the court foundation was constructed.
- The building's metal superstructure was erected in the fall of 2015.
- Kela signs purchase order of the tennis facility on March 12, 2016
- Arcadis meets with Commissioner Uzzi for a project briefing, discussion of scope of services and request for a proposal.
- Arcadis submits original proposal to Commissioner Uzzi Sept. 2, 2016. Arcadis initiates design and construction administration assistance without a signed contract
- Arcadis prepares proposal and draft solution presentation to Commissioner Uzzi and the Kela family at city hall (Sept 9, 2016).

- Mayor Thomas signs revised proposal Oct. 18, 2016
- Design and Construction, activities under Arcadis direction starts on August 31st and is completed on December 15th.

# 3 DESIGN ACTIVITIES

## 3.1 General

- Coordinated with Arizon, the City's list of outstanding items and a number of various outstanding proposals from associated contractors.
- Arcadis performed a review of Arizon's shop drawings. This had not been done prior to our involvement in the project.
- Design services described within Sections 3.2-3.5 were performed by Arcadis engineers and architects. These design activities were in support of the original design, as they were not included in the documentation that was provided by the City to Arcadis.
- The Arcadis design services were all extra work performed and not included in the original proposal.

## 3.2 Electrical Design

- Designed electrical distribution of the tennis bubble equipment and the future main building, providing 480/277 Volt, Three Phase and 120/240 Volt, Three Phase systems. Developed one-line electrical power diagrams.
- Coordinated with Consolidated Edison (Con Ed) for new utility and electrical service setup. Developed the electrical load letter for the Con Ed power request.
- Collaborated with Arizon for electrical installations of field equipment such as air handling unit (AHU-2500), backup generator, roll-up door, and indoor lighting.
- Field verified existing electrical installations such as temporary power, conduits, etc. to utilize with new electrical systems.

## 3.3 Structural Design

- The metal decking that supports the concrete on the second floor was accepted by the City as 22-gauge thick steel. The design drawings call for 18-gauge thick steel, a much stronger decking. The installation of the thinner material required temporary shoring to be designed, and installed while the concrete cured and developed strength.
- Connection plate at the top of the building was modified to allow the bubble fabric to connect to the top steel box beam. The original design had fabrication and installation design deficiencies preventing that connection. Arcadis developed four alternative attachment scenarios and sent them to Arizon for their comment and approval.

- The steel plate, box beam and bolt connections at the top of the building were structurally analyzed based on loading provided by Arizon.
- The bent steel angle and bolts that accept and connect the bubble fabric on the north and south side of the building were structurally analyzed.

## 3.4 Architectural Design

- Design items descripbed
- A Building Code review was performed and a letter memo prepared (Oct. 11, 2016) to understand and relay the building's adherence to applicable codes (See Appendix B). This letter memo details a list of design deficiencies.
- The exterior first floor walls of the building had been constructed but were not structurally capable of withstanding the air pressure of the bubble. Shoring, along with exterior sheathing and an air barrier, were designed to stiffen the walls.
- The second-floor walls, including the exterior sheathing and air barrier, were also designed to withstand the bubble's air pressure.
- An electrical room had to be designed to house the required electrical equipment to operate the bubble's air handling unit (AHU).
- An entrance lobby was designed to allow tennis patrons to enter the bubble through Arizon's revolving door.
- Stairs and landings were designed to access the emergency exit doors on the north side of the bubble.
- A ramp was designed to allow access down from the revolving door to the court surface elevation.
- A concrete pad, including bollards, was designed at the gas meter location to comply with plumbing code and Con Ed requirements.
- Concrete pads were designed outside of each emergency exit door.
- Rain gutter details were designed, partially installed. (photo 18)

## 3.5 Plumbing Design

- Back checked the plumbing calculations for the natural gas piping.
- Coordinated on behalf of the project with Con Ed for installation of the gas meters and pressure regulating valves.
- Coordinate many, many times with Con Ed regarding the natural gas service installation.

# 4 CONSTRUCTION ACTIVITIES

- East half of the building's second floor concrete slab is poured by Landi, after wood shoring is installed below to compensate for deficient structural conditions there were present at the time of the first Arcadis construction oversight engagement. Sept. 26, 2016. (Photo 3)
    - At the direction of Arcadis concrete test cylinders were prepared, at each concrete pour, for later concrete strength testing. Testing was not specified on the original structural drawings.
- Remaining portion of the building's first floor concrete slab on grade is poured by Landi. Arcadis site oversight Sept. 28, 2016
- Arcadis requested an independent concrete testing lab, Advance Testing Company, Inc., to perform strength tests on the Landi concrete. Proposal delivered and fee included in Landi change order. Sept. 29, 2016
- Arcadis conducted a site walk-through with the electrical contractor, C. Williams, to direct them where to install the exterior grade conduit on the exterior concrete wall. Oct. 3, 2016
- Arcadis evaluated and negotiated C. William's electrical proposal. Oct. 7, 2016
- Trench for Con Ed underground electrical service conduit is excavated. Oct. 10, 2016.
- West half of building's second floor concrete slab is poured by Landi, after wood shoring is installed below. Arcadis site oversight. Oct. 11, 2016. (See first dot under the Section 4 above)
- CWC, the Kela family's building framing contractor starts construction on enclosing the east and portions of the north and south walls to accept the tennis bubble connection.
    - The original contractor's work that included framing the exterior of the building was deemed by Arcadis to be unacceptable and the contractor was asked to stop work, collect his unused materials and leave the site.
- CWC begins wall construction. Oct. 11, 2016
    - Coordinated with the original tennis court engineer regarding weight limitations on the court. Then directed CWC that their equipment needed wood planking below the wheels to spread the loading, so as not to damage the Har-Tru court surface and piping below.
- Electrical equipment installation starts. Oct. 13, 2016. (Photos 11,12,13&14)
- Requested that CWC construct an electrical room on the northwest side of the first floor within the building to house all of the electrical equipment. The electrical room included in the original design. This is a Con Ed approval requirement.
- C. Williams starts the installation of the electrical service from the existing power pole via an earthen trench on the west side of the building to the proposed electrical room. (Photo 11 & 12) Oct. 11, 2016
- Instructed the City how and where to pour the concrete pad to house the natural gas meters and pressure regulators.

- Coordinated with Kela's steel fabrication contractor. Arcadis had to instruct them what to do, how to do it and walk the site to show them where work needed to be performed. Oct. 11, 2016
- Requested that the City assist in removal of construction debris. Oct. 14, 2016
- Continued on-site construction management, directing all trades on what, where and how to perform their respective tasks. Oct. 14, 2016
- Coordinated with City regarding exit door concrete pad installations and directed them where to back fill the natural gas piping on the east side of the tennis courts. Oct. 18, 2016
- Coordinated with CWC for construction of main entrance vestibule. Oct. 18, 2016
- Assisted Arizon's shipping company to offload their equipment. This entailed providing driving directions to the shipping company's driver from the NY/PA border to the site, removal of Memorial Field's entrance gating, requesting the City to assist with manpower and machinery to remove heavy and large materials from the truck, inspect the load and sign for it and then close up the field gate.
- Coordinated with the City to form and pour the emergency door concrete pads, assisted Landi's crew on where and how to pour the vehicle door concrete pad, and directed Landi to remove the wood shoring under the second floor that was supporting the concrete pour. Oct. 20, 2016.
- Coordination of the routing of multiple interior conduits for the exterior roll-up door, interior tennis court lighting fixtures and exit/emergency lighting fixtures. (Photo 24) Oct. 21, 2016
- Con Ed underground electrical service conduit is, sketched, formed and encased in a concrete ductbank and backfilled. Oct. 26, 2016
- Arcadis oversees Arizon's air handling unit (AHU-2500) placement and coordinated electrical connection utilizing the existing conduits crossing the tennis courts. (Photo 13) Oct. 28, 2016
- Electrical equipment in the electrical room is finished and inspected. Con Ed inspects the underground feeder conduit for the main service. (Photo 16) Oct. 31, 2016.
- Existing conduits are cleaned with assistance from the City. Feeder cables for AHU and ATS are installed in existing conduits between the main building and the field equipment pad. (Photo 19 & 20) Nov. 3, 2016
- Guy wire on the existing electrical pole is installed to provide additional support, conforming to Con Ed specification. Con Ed overhead service cable is connected to new underground service cable. Electrical equipment in the electrical room is energized and tested. (Photo 14) Nov. 7, 2016.
- Electrical installation of AHU is finished and tested. (Photo 21) Nov. 10, 2016
- Coordinated the steel plate locations on the roof, the steel angles on the perimeter wall, directed the installation and connection of the standby generator to the AHU, and verified that the doors and locks were installed at the entrance hallway and electrical room. Nov. 14, 2016
- City of Mt. Vernon trims trees for replacement of the existing electrical feeder cable. Emergency generator and ATS are tested for normal and emergency conditions. (Photo 22) Nov. 17, 2016

- Assisted Con Ed in piping the natural gas service. Started up the standby generator that was a requirement of Arizon's to install the bubble fabric. Nov. 21, 2016
- Arizon's crew starts bubble fabric installation. Nov. 27, 2016. Complete installation approximately two weeks.
- After a week of failed attempts of the bubble's fabric to be inflated, mostly due to weather hindering the inflation as well as on-site fabric modifications, the bubble was completely inflated and the installation of lights was started. Dec. 12, 2016
- Request from Kela and Arizon to field trouble shoot the AHU's heater. Assisted Arizon via phone to put the burner back on-line. Dec. 12, 2016
- The tennis structure is fully operational, with lighting, and ready for play. Dec. 13, 2016

# 5 CHALLENGES

- The project's initial and immediate challenge was to expedite all construction activities on site to meet the Kela family's operating schedule. All aspects of the tennis facilities' construction were significantly behind schedule to allow for tennis activities in the fall. The design of the building, plumbing, concrete and bubble structure were not complete.
- The electrical design had not been started.
- The electrical conduits that were installed underneath the tennis courts, by the City, were not documented on the drawings or in any written form. This caused a significant amount of investigation time and rework to remedy this situation. The mechanical equipment pad was not coordinate with Arizon's equipment layout and a work-around had to be developed to accommodate this situation. (Photo 19)
- The tennis facilities first floor exterior was determined to be of questionable structural capacity, so all further construction was halted by the onsite contractor and additional shoring had to be designed and installed to accommodate the tennis bubble's pressure requirements. (Photo 1)
- The building's first floor exterior wall was partially installed when Arcadis visited the site for the first time. It was noticed that the wall was not being fabricated with structural materials, and the structural capacity of this wall was deemed structurally suspect. Due to the accelerated pace of the project it was decided to clad this work with plywood and brace it from behind to provide additional structural capacity. In the spring of 2017 when the bubble is taken down, we recommend that the plywood be removed and repurposed and that the metal wall framing be removed and recycled. (Photo 25)
- Under standard construction schedules the installation of new electrical and natural gas services require a significant amount of time. Con Ed had been contacted by the City prior to Arcadis' involvement but little to no movement had been made for either of the services' connections in some time.

# 6 REMAINING WORK

- Coordinate with Con Ed for replacement of existing overhead service cable with larger cable.
- Install the AHU's remote display and wind sensor at a permanent location.
- Relocate the lighting receptacle plug installations for indoor lighting fixtures. Their current location needs to be coordinate with the final building façade.
- Installation of a temporary gutter system and storm water piping to drain rain water and snow melt that comes off the west side of the tennis bubble and the east side of the building's roof. (Photo 18)
- Design and installation of a temporary rest room facility. Presumably these facilities will be installed on the first floor of the building. Men's and woman's toilet facilities will require walls, lighting, heat, hot and cold water, water fixtures, ventilation, security and sanitary services. The original design, that was not completed, directs the sanitary flow from this facility to connect to the Memorial Field bleacher rehabilitated sanitary line. As of this time this sanitary line is not available and a temporary or temporary-to-permanent below ground pump pit may have to be installed to lift the flow to Garden Avenue's sanitary piping that is up gradient to the building.
- The design of the tennis facility building, including review of the structural work done to date, architectural, HVAC, electrical, plumbing, and site work is required. A new set of biddable construction documents should be compiled, publicly bid and awarded to the lowest qualified contractor, or contractors. Coordination with New York State's Wick's Laws and PAF bidding requirements should also be performed.
- Remaining Work – Kela
    1. Purchase portable shipping containers to store the bubbles fabric, hardware, steel supports, cables and wooden pallets during the summer season.
    2. Contract with a local mechanical company to maintain and repair the AHU.
    3. Contract with a local Generac generator company to maintain and repair the standby generator.

**Table 1. Key Project Personnel**

| Role | Company | Name, title | Contact Info | Phone Number |
|---|---|---|---|---|
| Project Manager | Arcadis | James Callahan PE, Vice President | James.callahan@arcadis.com | 914 588 8553 |
| Lead Electrical | Arcadis | Wooin Jung | Wooin.jung@arcadis.com | 914 641 2741 |
| Lead Architect | Arcadis | Richard Bello RA | Richard.Bello@arcadis.com | 914 641 2480 |
| City's Main Contact | City of Mt. Vernon | Ralph Uzzi, DWP Commissioner | - | 914 665 2475 |
| City's Project Assistant | City of Mt. Vernon | Joe Carretta | - | 914 804 0806 |
| City's Plumbing inspector | City of Mt. Vernon | John Royce PE | - | 914 447 1296 |
| Tennis bubble owner and facility Leasee | Kela Tennis | Kela Simunyola, Owner | - | |
| Electrical Contractor | C. Williams | Chris Williams, Owner | - | 914 667 5754 |
| Concrete Contractor | Landi Constructing | Anthony DeBenedictis | - | 914 447 1032 |
| Concrete Testing Laboratory | Advance Testing | - | - | 845 496 1600 |
| Plumbing Contractor | | Elio Guglielmi, Owner | - | 914 769 1431 |
| Façade Contractor | CWC | Vincent Fiore, Principal | Vincent@cwccontractingcorp.com | 201 661 1459 |
| Tennis Structure Supplier | Arizon Structures Worldwide LLC | Jan Ligas, President | jligas@arizoncompanies.com | 201 264 5547 |
| Utility Representative | Con Edison | James O'Connell | O'connellj@coned.com | 914 925 6132 |


**Figure 1. Aerial Site Photo**

**Figure 2. Zoomed in Aerial Site Photo**

(tennis courts constructed and operating, partial first floor slab)

# APPENDIX A

## Photo Log

ARCADIS Design & Consultancy for natural and built assets

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 1

**Date:**
9/23/2016

**Description:**
Metal decking was too thin requiring additional support to hold concrete during placement.

**Location:**
Underside of second floor metal decking.

**Photo:** 2

**Date:**
9/23/2016

**Description:**
Steel stairs fabricated incorrectly and improperly supported due to there being no floor slab.

**Location:**
First floor south stair.

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 3

**Date:**
9/26/2016

**Description:**
Slab reinforcing only added after Arcadis inspection.

**Location:**
Second floor slab.

**Photo:** 4

**Date:**
9/27/16

**Description:**
First concrete pour in 2016. Second floor eastern side. Post rain event

**Location:**
Second floor

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 5

**Date:**
9/28/2016

**Description:**
First floor walls improperly built: metal gauge is too thin, strapping at column is incorrect detail, wall is reinforced with wood.

**Location:**
First floor east wall.

**Photo:** 6

**Date:**
9/28/2016

**Description:**
Initial concrete poured without reinforcing or vapor barrier

**Location:**
First Floor Slab.

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 7

**Date:**
9/28/2016

**Description:**
Improper first floor slab resulted in severe cracking and settling.

**Location:**
First floor Slab.

**Photo:** 8

**Date:**
9/30/16

**Description:**
Metal stair runners were not set correctly and create a half step on first step. Remedy has been identified

**Location:**
First floor slab

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 9

**Date:**
9/30/16

**Description:**
Mechanical equipment pad. Electrical conduits are in the wrong location and the retaining wall in the rear has failed.

**Location:**
East side of courts

**Photo: 10**

**Date:**
10/7/2016

**Description:**
Steel beam placed 1-1/2" out of level.

**Location:**
South second floor.

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 11

**Date:**
10/14/16

**Description:**
Underground service conduit from Con Ed utility pole and feeder conduits from field equipment, routing to Electrical Room.

**Location:**
Exterior wall of Electrical Room, looking north

**Photo:** 12

**Date:**
10/14/16

**Description:**
Underground conduits laid in trench before ductbank installation

**Location:**
West side of Main Building, looking south

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 13

**Date:**
10/14/16

**Description:**
Underground pull box, intercepting existing conduits to route to Electrical Room

**Location:**
West side of Main Building, looking south

**Photo:** 14

**Date:**
10/21/16

**Description:**
Electrical Room under construction

**Location:**
Main Building, looking north

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 15

**Date:** 10/28/16

**Description:**
Aluminum extrusion requires cleaning and new wooden shims. This is completed the last day prior to fabric installation

**Location:**
Northern side of tennis courts

**Photo:** 16

**Date:**
10/31/16

**Description:**
Electrical Room

**Location:**
Main Building, looking West

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 17

**Date:**
11/3/16

**Description:**
Temporary roof built on the second floor slap to protection the first floor electrical room from rain

**Location:**
Building's second floor at rear stairwell.

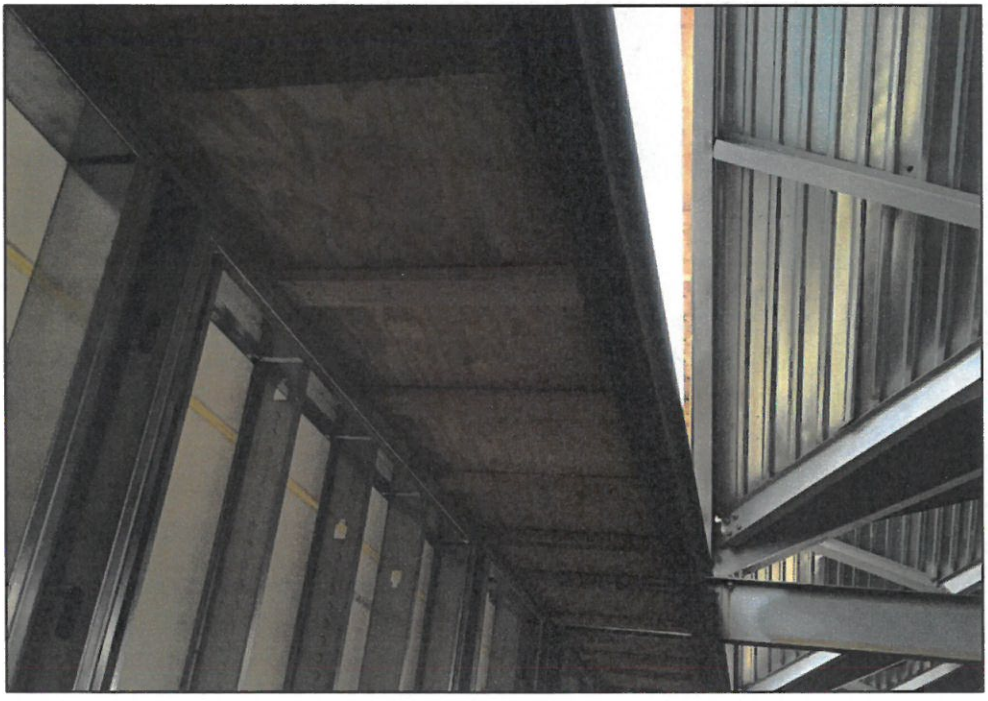

**Photo:** 18

**Date:**
11/3/16

**Description:**
Top of building's east wall. Plywood acting as a walkway for fabric installation and as gutter for rain drainage.

**Location:**
Photo from second floor in building

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 19

**Date:**
11/3/16

**Description:**
Undocumented electrical conduit. Field testing proved them connected to building's west side

**Location:**
Mechanical equipment pad, north side

**Photo:** 20

**Date:**
11/3/16

**Description:**
Pull string installation in existing conduit installed between equipment pad and Main Building

**Location:**
Equipment Pad, looking north

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

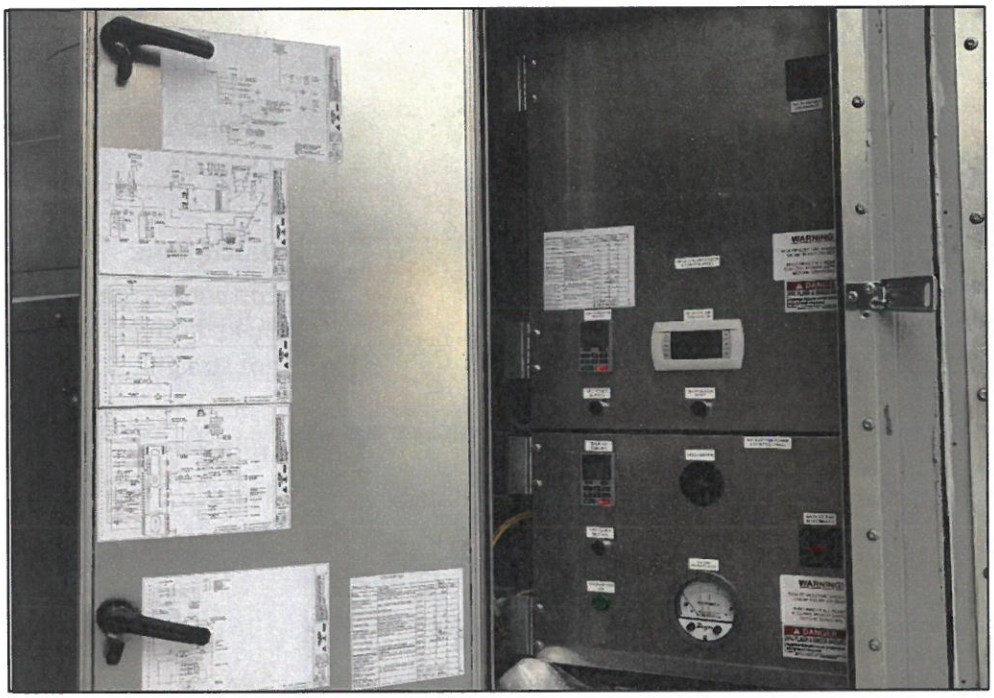

**Photo:** 21

**Date:**
11/8/16

**Description:**
Power/Control Cabinet of Air Handling unit

**Location:**
Equipment Pad, looking south

**Photo:** 22

**Date:**
11/10/16

**Description:**
Emergency generator and ATS on Air Handing unit

**Location:**
Equipment Pad, looking west

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

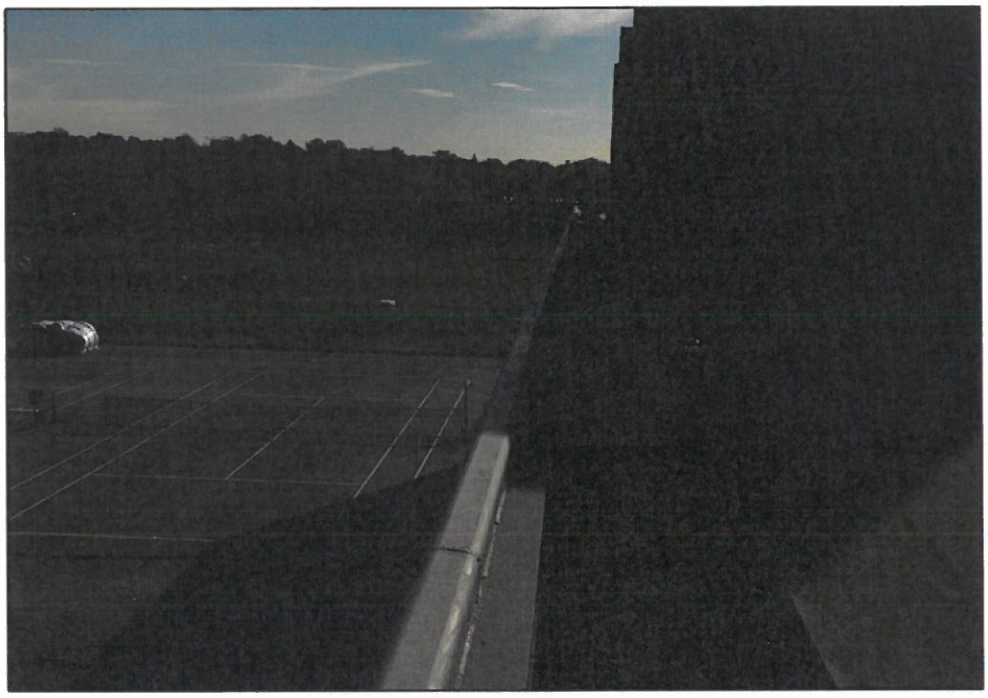

**Photo:** 23

**Date:**
11/14/16

**Description:**
Top connection box beam. Building steel members are not straight

**Location:**
Roof

**Photo:** 24

**Date:**
11/17/16

**Description:**
Lighting Conduit and Receptacle boxes installed on concrete wall

**Location:**
Tennis Court, looking south

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

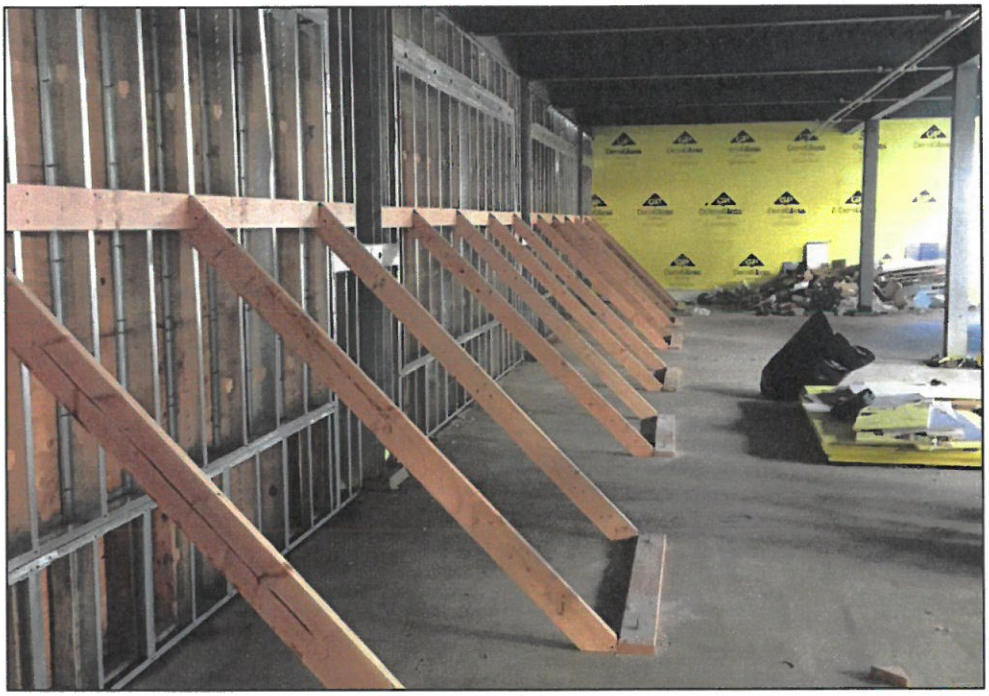

**Photo:** 25

**Date:**
12/4/16

**Description:**
Wooden bracing. Bracing first floor non-structural steel wall framing. This wall will require replacement

**Location:**
First floor within building


**Photo:** 26

**Date:**
12/7/16

**Description:**
Bubble fabric binds on both sides of building. Field modifications required to make fit.

**Location:**
Outside of bubble, looking east on west side of courts

## Project Photographs

Mount Vernon Tennis
Facility at Memorial Field

**Photo:** 27

**Date:**
12/12/16

**Description:**
Installation of lights.

**Location:**
Inside bubble looking north

# APPENDIX B

## Building Code Review

# MEMO

ARCADIS Design & Consultancy for natural and built assets

To:
James Callahan, PE

Copies:
Richard Bello, RA
Report, Appendix B

Arcadis, CE. Inc
44 S. Broadway
15th Floor
White Plains
New York 10601
Tel 914-694-2100
Fax 914-694-9286

From:
Errol Dawkins, RA

Date:
Sept. 30, 2016

Arcadis Project No.:
00096001.0000

Subject:
Tennis Facility Building at Memorial Field
Mount Vernon, NY

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This memorandum is to provide guidance related to the building code requirements. I have reviewed the existing documents for the construction of the Tennis Facility and have not found any building code documentation. The construction of the Tennis Facility is under way prior to the effective date of the current 2014 NYS Building code. Therefore, the 2010 NYS Building Code governs the construction of the tennis facility. Below is my review and interpretation of the building design as related to the NYS Building Code.

The Tennis Facility is 2 story steel frame construction structure with insulated non-load bearing metal stud **walls and stucco finish. The building footprint is 40'-8" by 131'-8". The** first-floor gross area is 5,493 square feet and the second-floor area is 5,353 square feet. The first floor includes reception desk area, office, pro shop, concession, **men's and women's restroom with showers, utility room, storage room and viewing** gallery. The second-floor spaces include restrooms and a viewing gallery.

## SUMMARY OF PROGRAM OF SPACES

| Floor | Space | Estimate SF (net sf) | Occupancy Load |
|---|---|---|---|
| First Floor | Vestibule | 110 sf | 0 |
| | Reception Desk | 132 sf | 2 |
| | Office | 323 sf | 4 |
| | Hall | 99 sf | 0 |
| | Employee Toilet | 30.25 sf | 0 |
| | Viewing Area | 2690 | 180 (@ 15sf per person) |
| | Stair A | 49.5 sf | 0 |
| | Stair B | 97.5 sf | 0 |
| | Pro Shop | 192 sf | 2 |
| | Concession | 178 sf | 2 |
| | Women's Restroom | 440 sf | 0 |
| | Men's Restroom | 403.2 sf | 0 |
| | Utility Room | 115.5 sf | 0 |
| | Storage | 215 sf | 0 |
| First Floor Total Occupant Load | | | 190 people |
| Second Floor | Viewing Area | 4,242.4 sf | 283 (@ 15sf per person) |
| | Women's Restroom | 247 sf | 0 |
| | Men's Restroom | 142.5 sf | 0 |
| | Stair A | 240.6 sf | 0 |
| | Stair B | 117 sf | 0 |
| Second Floor Total Occupant Load | | | 283 people |

## NYS BUILDING CODE REVIEW

A building code review was conducted at a high level of the existing plans, elevations and sections documents being used to construct the tennis facility. The building code review, as outlined below, indicates that the design documents do not fully illustrate compliance with the NYS Building Code or provide sufficient detail to complete a comprehensive code review. Specifically, in the areas of fire-resistance construction, fire protection, accessibility, and energy efficiency compliance, the documents are largely silent. New or supplement documents will be needed to ensure compliance with the code.

## 2010 NYS BUILDING CODE REVIEW SUMMARY CHART

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| **USE AND OCCUPANCY CLASSIFICATION** | | | | |
| Chapter 3 | Occupancy Group | A-4 | Intended for viewing of indoor sporting events and activities with spectator seating | Not indicated on documents |
| **GENERAL BUILDING HEIGHTS AND AREAS** | | | | |
| Table 503 | Allowable height | 55 feet | From grade plane | |
| | Max stories | 2 | From grade plane | |
| | Building Area | 9,500 sf | Per story | |
| Table 508.2 | Storage rooms over 100 sf | 1 hour rated separation or Automatic sprinklers | Incidental use area | Not indicated on documents |
| **TYPE OF CONSTRUCTION** | | | | |
| Table 601 (based on construction type III B) | Structural frame | 0 – hour | Minimum fire resistance rating | |
| | Bearing Walls – exterior | 2 - hours | Minimum fire resistance rating | |
| | Bearing Walls – interior | 0 - hours | Minimum fire resistance rating | |
| | Nonbearing Walls – exterior | Table 602 | Minimum fire resistance rating | |
| | Nonbearing Walls – interior | 0 - hours | Minimum fire resistance rating | |
| | Floor construction including supporting beams and joists | 0 - hours | Minimum fire resistance rating | |

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| | Roof construction including supporting beams and joists | 0 - hours | Minimum fire resistance rating | |
| Section 602.3 | Construction Classification | III B | The exterior walls are of non-combustible materials and the interior building elements are of any material permitted by code. | Not indicated on documents |
| Table 602 | Fire separation distance of x < 5 | 1 - hour | Minimum fire resistance rating | |
| | Fire separation distance of 5 =/< x < 10 | 1 - hour | Minimum fire resistance rating | |
| | Fire separation distance of 10 =/< x < 30 | 1 - hour | Minimum fire resistance rating | |
| | Fire separation distance of x >/= 30 | 0 - hour | Minimum fire resistance rating | |
| **FIRE-RESISTANCE-RATED CONSTRUCTION** | | | | |
| Section 706.3.6 | Fire barriers used on Incidental Use Areas | Table 508.2 | Storage room to be fire barrier assembly | Not indicated on documents |
| Section 707 | Shaft Enclosures | | Enclosed stairs and shafts shall be constructed per Section 707 | |
| **INTERIOR FINISHES** | | | | |
| Table 803.5 | Interior Finishes – Rooms | Class B | Maximum wall and ceiling finish material flame spread and smoke-development | |
| | Interior Finishes – Exits | Class A | Maximum wall and ceiling finish material flame spread and smoke-development | |
| | Interior Finishes – Corridors | Class A | Maximum wall and ceiling finish material flame spread and smoke-development | |
| **FIRE PROTECTION** | | | | |
| Section 903.2.1.4 | Automatic Sprinkler Systems | Required | Required if one of the following is met: | Not indicated on documents |

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| | in an A-4 Occupancy | | Fire area exceeds 12,000 sf<br>Fire has occupant load of 100 or more<br>Fire area is located on a floor other than the level of exit discharge | |
| Section 904 | Alternative automatic fire-extinguishing systems | Undetermined | Concession area cooking? | |
| Section 905.3.1 | Standpipe System based on building height | Not Required | Highest story not greater than 30 feet above lowest level of fire dept. vehicle access | |
| Section 905.3.2 | Standpipe System in A-4 occupancy | Not Required | A occupancy not greater than 1,000 people | |
| Section 906 | Portable Fire Extinguishers | Required | | Not indicated on documents |
| Section 907 | Fire Alarm and Detection System | Required | Based on automatic sprinkler system monitoring requirements Section 903.4 | Not indicated on documents |
| Section 912 | Fire Department Connections | Comply | Based on sprinkler system | Not indicated on documents |
| **MEANS OF EGRESS** | | | | |
| Section 1003.2 | Ceiling Height | Min 7'-6" | | Not indicated on documents |
| Section 1004.3 | Posting of occupant load in Assembly occupancy | Required | | Not indicated on documents |
| Section 1006 | Means of Egress Illumination | Required | | Not indicated on documents |
| Section 1007.1 | Accessible Means of Egress | One Required | Can be stair or elevator | Not indicated on documents |
| Section 1007.3 | Accessible Exit Stairways - width | Min 48" betw handrails and area of refuge | Exception 3: bldg. with sprinkler system – clear width of 48" is not required | Not detailed on documents |
| Section 1007.6.1 | Area of Refuge - Size | 30" by 48" for each 200 occupants or portion thereof | 2 area of refuge spaces required | Not indicated on documents |

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| Section 1007.6.4 | Area of Refuge Two-way communication | Required | | Maybe – not denoted |
| Section 1008.1.9 | Panic and fire exit hardware | Required | A occupancy with occupant load equal to or greater than 50 | Not indicated on documents |
| Section 1009.1 | Stair – width | Min 44" | | Not indicated on documents |
| Section 1009.2 | Stair – Headroom | Min 80" | | Not indicated on documents |
| Section 1009.3 | Stair – Tread and Riser | Tread Min 11" and Riser Max 7" | | Not indicated on documents |
| Section 1010 | Ramps | - | Refer to accessible | |
| Section 1011 | Exit signs | Required | | Not indicated on documents |
| Section 1014.3 | Common Path of Egress Travel | Max 75'-0" | | |
| Section 1015.1 | Exit or exit access Doorways Required | Min 2 remote exits | For first and second floors | Maybe – first floor second exit is onto tennis courts? |
| Table 1016.1 | Exit Access Travel Distance for A Occupancy | Max 200'-0" | | |
| Table 1019.1 | Minimum Number of Exits for Occupant Load | Min 2 exits from each floor | Floor with less than 500 occupant load:<br>First floor occupant load 190<br>Second floor occupant load 238 | |
| Section 1020.1 | Vertical exit enclosures | Min 1 – hour exc. | Exception 8: 50% of egress stairways serving one adjacent space can be unenclosed<br>Exception 9: Interior egress stairways serving only first and second stories of a building equipped throughout with an automatic sprinkler system are not required to be enclosed | |

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| Section 1025 | Assembly – Means of Egress | | Building to comply with applicable provisions of this section | |
| **ACCESSIBILTY** | | | | |
| Section 1103.1 | Where Required | Required | No exceptions to the accessibility chapter of the code | Yes – must comply with accessibility code and ADA (federal law and regulation) |
| | | | | |
| Section 1104 | Accessible route | Required | Accessible route includes<br>Arrival accessible curb;<br>Arrival accessible parking;<br>Accessible pedestrian walkway from parking to entry;<br>Accessible route within facility to public area and employee areas. | Not indicated on documents |
| Section 1104.4 | Multilevel buildings and facilities | 1 accessible route required to second story | No exception applies to the second story | Not indicated on documents |
| Section 1109.2 | Toilet and bathing facilities | Comply with accessibility requirements | | Not indicated on documents |
| Section 1109.6 | Elevators | Comply with accessibility requirements | | Yes – Elevator is required |
| Section 1109.7 | Lifts | Not allowed | Condition not listed in code allowing the use of a lift on the accessible route | Yes – Lift is not allowed for this design function or condition |
| Section 1109.12.3 | Point of Sale and Service Counters | Comply with accessibility requirements | | Not indicated on documents |
| Section 1109.13 | Controls, Operating Mechanisms and Hardware | Comply with accessibility requirements | | Not indicated on documents |

| Code Reference | Code Item | Allowable or Requirement | Notation | Design Review Issue |
|---|---|---|---|---|
| Section 1109.14.3 | Other Occupancies – Recreational and sports facilities | Comply with accessibility requirements | | |
| Section 1109.14.4 | Recreational and Sports Facilities exceptions | One accessible route to court sports | | |
| Section 1110 | Signage | Comply with accessibility requirements | | Not indicated on documents |
| **ENERGY EFFICIENCY** | | | | |
| Chapter 13 | | Climate zone - 4 | Comply with Energy Conservation Construction Code of NYS | |
| ECC | Metal framed walls | U-Factor of 0.064 or R-Value of 13 = 7.5 ci | | Not indicated on documents |
| ECC | Roof | U-Factor of 0.027 or R-Value of 38 | | Not indicated on documents |
| ECC | Slab on grade | F-0.730 | | Not indicated on documents |
| ECC | Swing Door | U-Factor of 0.70 | | Not indicated on documents |
| ECC | Storefront Walls | U-Factor of 0.50 | | Not indicated on documents |
| ECC | Storefront Door | U-Factor of 0.85 | | Not indicated on documents |