SILVER LLC
McGEE
CONSULTING

[redacted] 2013

[redacted]
Property Claims Supervisor
[redacted]
[redacted]
[redacted] NY [redacted]

Re: [redacted] Bus Garage, [redacted]
[redacted] NY
[redacted]

Dear [redacted]

I inspected the above address on [redacted] 2013 in the presence of [redacted] P.E., Director of School Facilities, [redacted]. My inspection was conducted to examine the damage to the building and to determine if the proposals being offered to repair the damage are both appropriate to the incurred damage and compliant with the NY State adopted ICC Energy Code 2010. I examined the proposals of [redacted] Construction Corp., dated 7/9/2013, Options 1 & 2 as well as the proposal of [redacted] Construction Corp., dated 8/14/2013, submitted to [redacted], retained to solicit a roofing proposal.

The Structure

The overall building is a one-story, roughly "L" shaped, masonry structure with a central, steeply sloped, raised gable atrium with polycarbonate translucent panels and two large flat roofs toward the front of the building and two smaller flat roofs at the rear. The building is a bus garage utilized for the repair and maintenance of school buses. The flat roofs are covered in a modified bitumen roof membrane and covered in asphalt-based aluminum paint. These uppermost roof coverings were installed over the original roofs. The reroofing process included the installation of a wood fiber insulation over the gravel surfacing of the original hot tar built up roofs. It appears that the insulation was adhered to the original roof possibly after the gravel surface was prepared by vacuuming or brooming the loose gravel and possibly priming the remaining gravel, embedded in the flood coat of the hot tar roof. The building has a concrete plank deck clipped to steel ceiling beams.

The Damage

The larger section on the south end of the building is a rectangular-shaped, low sloped roof measuring approximately 2,589 sq. ft. including a factor for waste. This roof sustained damage to the SW corner of the roof where an approximately 560 sq. ft. triangular-shaped corner of the roof blew back from the edge. The corner remained attached and folded over

onto the field of the roof where it remained until it was discovered accidently when viewed from an adjacent building. The building did not leak after the initial damage. The exact date of loss is unknown, however historical imagery on Pictometry.com shows the membrane to be in place on 3/12/2012 and it is likely that the DOL was Hurricane Sandy on 10/29/2012. The damage to the roof is consistent with wind failure based on the location of the failure at the corner of the building and the physical state of the folded over roof membrane. The decision to adhere the recovery insulation to the gravel without mechanical fastening is both the probable reason for the failure (poor adhesion to the gravel substrate) and the reason for no leaks after the failure (the underlying hot tar roof was not punctured when the new roof was installed) when the most recent torch applied, modified bitumen roof was installed.

The proposal from [redacted] Construction Corp. includes a line that states “Note : Positive test for asbestos”. I am accepting this statement as fact for the purposes of this analysis. The uppermost torch applied roof most likely does not include asbestos; however the underlying original hot tar built-up roof is much more likely to contain asbestos, especially at the roof perimeter where asbestos reinforced flashing sheets such as Celotex AB-20 were a standard staple.

Given the fact that asbestos exists in the roof assembly, the roof must be removed as per the State Labor Law Industrial Code Rule 56 which prohibits the encapsulation of asbestos containing material. If the roof had not contained asbestos and it was determined that the roof could be overlaid without removal that exposes the insulation of sheathing (concrete roof deck), the installation may have been exempted from complying with the NY State 2010 ICC adopted Energy Code under 101.4.3.5. if the leveling board installed over the gravel was not considered “insulation”. The removal of the roof however is required to comply with the Labor Law.

[redacted] Proposals

Option 1 of the [redacted] proposal includes an overlaid roof and the scope of work is for a 9,500 sq. ft. area which includes another large section of the roof that was not damaged. Reroofing is not an option given the presence of asbestos. The scope of work is not appropriate given that only the south roof measuring 2,589 sq. ft. was damaged.

Option 2 of the [redacted] proposal includes a complete removal but the scope of work is for a 9,500 sq. ft. area which includes another large section of the roof that was not damaged. There is also no mention of asbestos, nor the needed precautions dictated by the Labor Law.

Neither of the [redacted] proposals is appropriate for the reasons stated above.

[redacted] Construction Corp. Proposal

The [redacted] proposal states a scope of work that includes a 2,462 sq. ft. area which is the raw square footage of the south roof and the area of damage. The proposal includes removal of the all the roofing to the concrete deck and the transportation and disposal of the Asbestos Containing Material (ACM) in accordance with NYSDOL, EPA, and OSHA regulations.

It has been suspected that this proposal does not meet the NY State Energy Code 2010. The present code dictates minimum R-values for various building components based on the Zone that the building is located in and the type of building (residential or commercial). This building is clearly a commercial building located in Zone 4 having a non-residence use.

The minimum R-value listed for this building when a roof is being removed to expose the sheathing must comply with the NY State 2010 Energy Code. That R-value for commercial buildings in Zone 4 with insulation installed exclusively above the roof deck is stated to meet a minimum of R-20ci (continuous insulation). Table 502.2(1) lists three categories for commercial structures: Insulation entirely above deck, Metal buildings (with R-5 thermal block), Attic and other. The bus garage is neither metal nor does it have an attic and the insulation is to be installed entirely above the roof deck so the choice is clear for this structure. This required minimum R-value is well below the required R-38 for residential buildings (non-commercial) which may be the confusion on this issue.

The [redacted] proposal lists the insulation as a "1 iso" (polyisocyanurate) over which a 1/8" per foot tapered insulation is installed. The tapered insulation will start out at a ½" minimum thickness (this info is not in the proposal however all tapered insulation has a minimum thickness of ½") and slope upwards in thickness as the insulation tapers away from the drain. The south garage roof has no internal drains. The roof drains toward the rear edge. The tapered insulation therefore will be installed from that edge for 44 ft. to the front parapet. Along that 44 ft. run, the insulation will grow in thickness 5.5", as per the equation below:

$$44\,ft * \frac{1}{8} in\,/\,ft = 5.5in$$

We can calculate the average R-value based on the minimum thickness and the final thickness as the NY State Energy Code 2010 allows for a roof assembly. The average thickness therefore is the 1" layer plus the average of the tapered insulation which starts at .5" thick and grows to 6" thick (.5" + 5.5") using this equation:

$$AverageThickness = 1in + \frac{(0.5in + 6in)}{2} = 4.25in\,.$$

The average thickness therefore is 4.25". Using the R-value of R-6/inch as an approximate standard, the Average R-value for the roof assembly is 6 x 4.25 or R = 25.5 which exceeds the minimum requirement of R-20.

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Assumptions in the Analysis

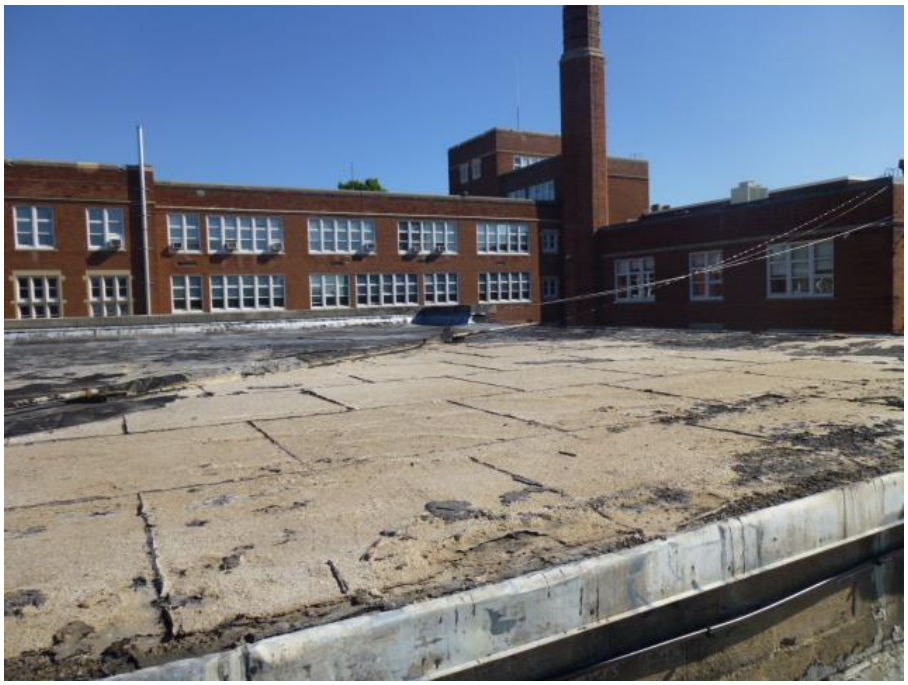
The layout of the tapered insulation will greatly affect the thickness and average R. The manufacturer of the insulation will also affect the R-value per inch. The aged R-value (calculated to be a truer value that takes into account the declining R-value over the life of the roof). When a contractor receives a supplier bid for a tapered insulation system the quote will include a diagram with the average R-value stated in the quote. This document is the final word on whether or not the system is laid out according to my assumption with the R-value per inch that is a minimum standard for most manufacturers. The contractor should be required to supply the tapered insulation design stating the Average R for the roof assembly to confirm that it complies with the minimum R-20 stated in the NY State 2010 code.

If the objection to the [redacted] proposal is based on a different section of the NY State 2010 Energy Code than the average R-value for the roof assembly, I would be happy to discuss the specific objection with the architect and research the same.

Please feel free to contact me if you have any questions regarding this report.

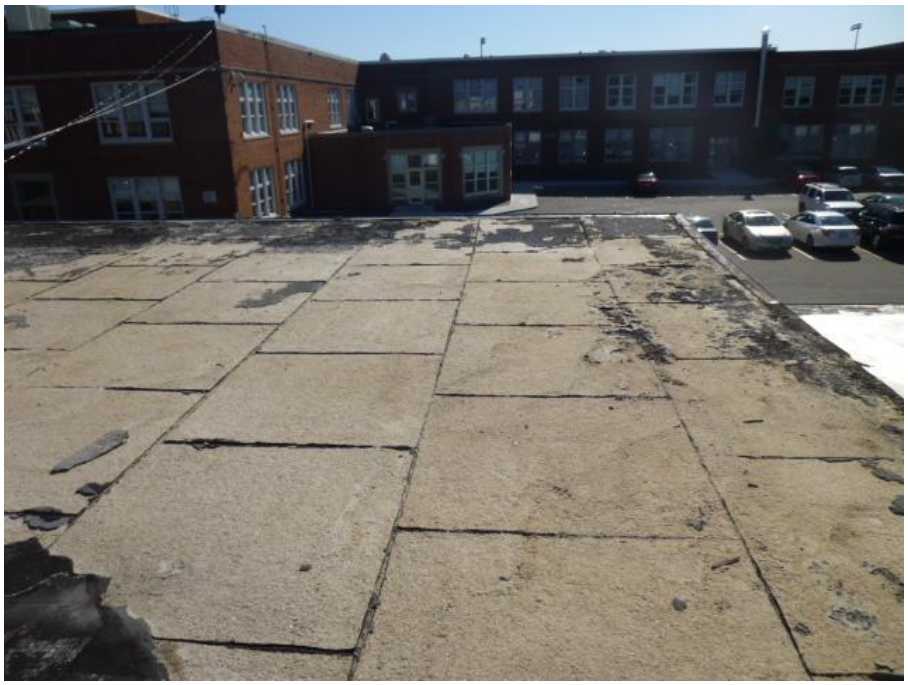
Sincerely,

Louis R. Silver
Managing Partner
Silver McGee

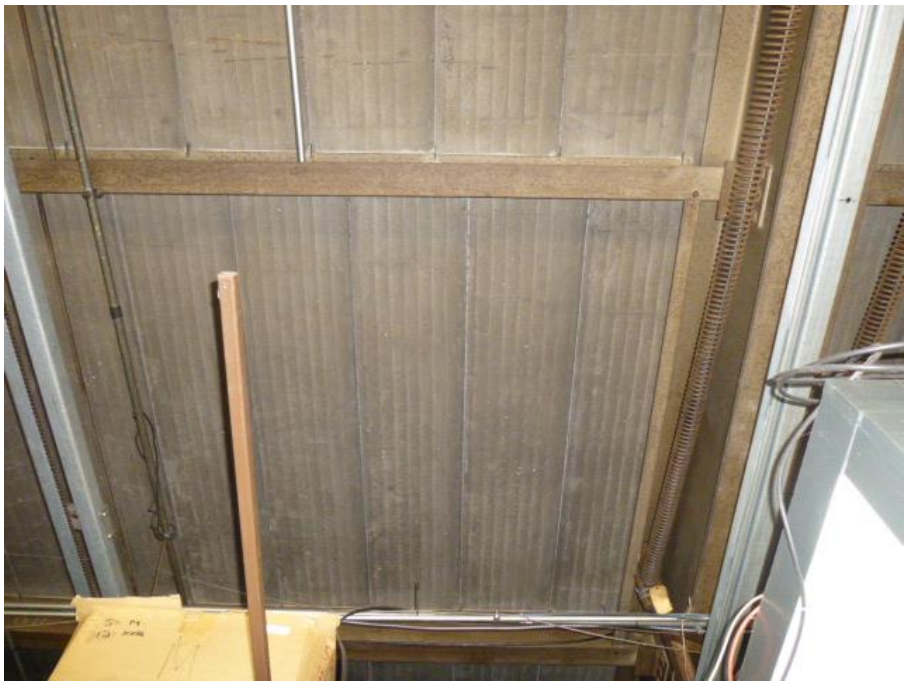


The wind damaged SW corner of the south roof on the bus garage.

The 2,589 sq. ft. roof area with wind damage to 560 sq. ft. in the bottom left corner.



Exposed recovery board insulation.



Concrete panel deck clipped to steel I-beams.

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ELEMENT, MAXIMUM *U*-FACTORS

CLIMATE ZONE	4		5		6	
	ALL OTHER	GROUP R	ALL OTHER	GROUP R	ALL OTHER	GROUP R
Roofs						
Insulation entirely above deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048
Metal buildings	U-0.055	U-0.055	U-0.055	U-0.055	U-0.049	U-0.049
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Walls, Above Grade						
Mass	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071
Metal building	U-0.084	U-0.084	U-0.069	U-0.069	U-0.069	U-0.069
Metal framed	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064
Wood framed and other	U-0.089	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051
Below-Grade Walls[a]						
Below-grade walls[a]	C-1.140	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119
Floors						
Mass	U-0.087	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057
Joist/Framing	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-Grade Floors						
Unheated slabs	F-0.730	F-0.540	F-0.730	F-0.540	F-0.540	F-0.520
Heated slabs	F-0.860	F-0.860	F-0.860	F-0.860	F-0.860	F-0.688

a. When heated slabs are placed below grade, below-grade walls must meet the *F*-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

U-values (Inverse of R-values).

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

CLIMATE ZONE	4		5		6	
	ALL OTHER	GROUP R	ALL OTHER	GROUP R	ALL OTHER	GROUP R
Roofs						
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci
Metal buildings (with R-5 thermal blocks[a,b])	R-13+ R-13	R-19	R-13+ R-13	R-19	R-13+ R-19	R-19
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38
Walls, Above Grade						
Mass	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3 ci	R-13.3ci	R-15.2ci
Metal building[b]	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci
Metal framed	R-13 + R7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci
Wood framed and other	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci
Walls, Below Grade						
Below-grade wall[d]	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci
Floors						
Mass	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-14.6ci
Joist/framing Steel/(wood)	R-30	R-30	R-30	R-30	R-30	R-30[e]
Slab-on-Grade Floors						
Unheated slabs	NR	R-10 for 24 in. below	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below
Heated slabs	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 48 in. below
Opaque doors						
Swinging	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.50
Roll-up or sliding	U –0.50	U – 0.50	U –0.50	U – 0.50	U – 0.50	U – 0.50

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.
a. When using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method. [see Tables 502.1.2 and 502.2(2)].
b. Assembly descriptions can be found in Table 502.2(2).
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-ft^2 - F°.
d. When heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e. Steel floor joist systems shall be R-38.

Group R and All others for Zone 4 (Nassau County) requires R-20ci (continuous insulation) as per Table 502.2(1) in the NY State Energy Code 2010 for Insulation installed entirely above roof deck.

No attic.

Building not metal.