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29 August 2011

Dr. David G Title
Superintendent
Fairfield Public Schools
501 Kings Highway
Fairfield, CT 06825

Via E-Mail

Re: Roof Pitch Waiver Request
211040 – Roof Replacement Consultation
Fairfield Warde High School, Fairfield, CT

Dear Dr. Title,

This letter is to assist you in the preparation of a formal roof pitch waiver request for the proposed roof replacement project at Fairfield Warde High School.

According to Section 10-291 (b)(2)of the Connecticut General Statutes, a minimum roof pitch of ½" per foot is required, except that for a total replacement of and existing roof, the Commissioner of Education may waive the ½" per foot requirement and permit the minimum roof pitch to be reduced to ¼" per foot.

The Connecticut State Department of Education, Bureau of School Facilities has issued a set of requirements for applying for such a waiver. We have attached the procedure for requesting the waiver for your reference.

To aide you in the waiver process, we offer the following assessment of the conditions that may prohibit the use of the required ½" per foot pitch:

1. **Such reduction of roof pitch will not impede drainage or cause pooling of water that may leak into the building to a greater degree than that of a roof of a minimum roof pitch of one-half inch per foot.**

   In our opinion, the source of the water infiltration into the building is related to the base flashing conditions at walls and roof penetrations and not due to a lack of adequate pitch on the roof. Any ponding water that is visible is minimal and not a

likely contributor to the ongoing leaks into the building. As part of the proposed roof replacement project we would recommend the relocation of existing roof drains, the installation of secondary overflow drains and where possible the installation of new overflow scuppers at the roof edge. It is our opinion that the addition of these drains in conjunction with a revised pitch design will increase the ability of the roof to drain excess water. As the existing roof currently has a roof pitch that varies from 0 to ¼", we feel that with the installation of additional drains, secondary drainage and overflow, use of the ¼" per foot slope in place of the required ½" per foot would not impede the drainage of water from the roof or cause significant ponding.

2. **The cost of replacing the roof with a minimum roof pitch of one-half inch per foot would substantially exceed the cost of replacing the roof with a minimum roof pitch of one-quarter inch per foot.**

   While there is a slight increase in the material and labor costs to install ½" per foot insulation in place of ¼" per foot, we feel that the greatest increase in cost would come from additional work to the existing building to accommodate the increased height of insulation. In order to achieve an R-value of 30 for the roof assembly there needs to be an average thickness of 5"of insulation throughout the roof. This would mean adding up to over a foot of insulation in some locations should the required ½" per foot pitch be used.

   There are several locations on the roof including existing window and doors sills, equipment curbs, wall flashings and roof edges where increasing the overall thickness of the insulation would require the raising of flashing heights. In many cases it would impossible to raise these flashings without replacing said windows, doors and curbs.

   In order to replace curbs existing rooftop units would have to be disconnected and removed. Skylights would also need to be removed and/or replaced and installed on new curbs. The edges of the roof would need to be raised with new two-piece metal flashing and gravel stops installed throughout. The change in pitch and added insulation height would also require the reworking of existing piping and conduit supports throughout the roof. Existing piping and vent stacks would have to be replaced in several locations to provide adequate height above the finished roof. The replacement of these pipes and vents would likely require work below the roof deck. Also, the replacement of existing drain piping below the deck may be required to accommodate the increased flow of water that would result from a steeper pitch.

   If the required ½" per foot pitch is to be used, it is our opinion that addressing the above conditions would greatly increase the scope of the work beyond a typical

roof replacement project. This increased scope result in an overall cost that is nearly double that of a replacement project using a ¼" per foot slope.

3. **The time needed to replace the roof with a minimum roof pitch of one-half inch per foot would be substantially longer than the time needed to replace the roof with a minimum roof pitch of one-quarter inch per foot.**

   In addition to the increased cost associated with the use of the ½" per foot pitch, the additional labor required to address the previously mentioned conditions would likely result in a significant increase in the amount of time needed to complete the roof replacement project. The increased scope would require multiple trades to perform the work, additional work force requirements and some items such as windows and doors that may have long lead times. The time needed to disconnect, remove and reinstall existing rooftop units in order to replace curbs below and reconfigure piping and conduits would also add significantly to the duration of the project.

   Given that construction work on the roof can only occur during summer months, the increase in the scope of the work to accommodate the increase in roof pitch would make it more difficult to get as much of the replacement work completed in a given summer. This could result in what is anticipated to be a project that is phased over four summers extending into one that is completed over a course of six or seven if not longer.

4. **The existing building would not support a roof pitch of one-half inch per foot without a substantial rebuilding of the existing building.**

   According to a basic analysis of the roof's loading capacity performed by Di Salvo Associates in 1990, it appears that the 1955 portions of the building were designed to support a load of 67 psf and the both the 1955 and 1970 addition were designed using a 40 psf snow load. This provides for a dead load allowance of 27 psf which is more than adequate to support the average weight of the new insulation and roofing system, however this does not take into account the additional weight due to snow drifting.

   Without an overall structural analysis of the building, it is difficult to determine what effect, if any, increasing the pitch to 1/2" per foot may have on the roof in terms of structural capacity. While a cursory look would make it seem that

substantial structural modifications would not be required to accommodate the change in pitch, we cannot make a definitive conclusion at this time.

Photo Survey:

Included at the end of this letter is a photographic survey of the building's roof and existing conditions. In addition to overall photos of the roofs, we have documented areas and conditions that we feel would be of concern should the required ½" per foot pitch be implanted in the new roof design. These include the following:

- Base flashing heights
- Heights of window and door sills
- Rooftop equipment and skylight curb heights
- Heights of existing piping, conduits and vents
- Roof edge conditions

Proposed Roofing System:

Hoffmann Architects recommends the installation of a multi-ply modified bitumen roofing system. The system would be composed of the following:

- Asphalt-coated fiberglass base sheet mechanically attached to the existing deck.
- Tapered polyisocyanurate insulation set in adhesive.
- Protective cover board
- Modified-bitumen base sheet
- Modified-bitumen cap sheet and flashing surfaced with granules.

This system is composed of multiple layers of bituminous membrane that have been modified with polymers to increase the durability, flexibility and overall performance. There are two types of modified bitumen roofing membranes:

- SBS polymer-modified bitumen membranes commonly are installed in hot moppings of asphalt (similar to traditional built-up systems) or cold adhesive.

Some SBS modified membranes are self-adhering; that is, they contain an adhesive backing.

- APP polymer-modified bitumen membranes typically are heat-welded or torch-applied.

Similar to traditional built-up roofing systems, modified bitumen systems have several advantages over other low-slope roofing systems:

- The bituminous membrane is thicker and more substantial than other systems . They are resistant to foot traffic and abuse and also have the strength to resist most environmental changes and rooftop stresses.

- Multiple-plies provide redundancy within the system.

- They generally have a lower life-cycle cost than other systems

- Built-up roofing systems have a proven history, being the most common low-slope roofing system. They are considered to be among the most durable, long lasting and impact resistant systems available.

Modified bitumen roofing systems also have advantage over traditional built-up systems:

- Modified bitumen systems are extremely versatile with many different means of application including torched, hot-applied, or cold-applied.

- Modified systems are more durable than traditional built-up systems and have a longer lifespan.

- These systems are very resistant to foot traffic and abuse and also have the strength to resist most environmental changes and rooftop stresses.

- These systems generally perform better in cold weather by remaining flexible at low temperatures. Modified membranes are able to stretch and relax with changes in temperatures better than built-up systems

The average life span of a multi-ply modified bitumen roofing system can be anywhere from 30-50 years, depending on quality of installation and level of maintenance.

Included at the end of this letter is product data and warranty information for two typical modified-bitumen roofing systems:

Siplast : Paradiene SBS Modified Roofing System

Soprema: Elastophene SBS Modified Bitumen Roofing System

According to each manufacturer's product specifications and data, all components in the above systems are designed to meet the latest standards required by the American Society for Testing and Materials (ASTM).

We hope this letter proves helpful in the waiver application process. Should you need any additional information and have any questions regarding our findings, please feel free to contact us. Hoffmann Architects values the relationship we have established with the Fairfield Board of Education and the Town of Fairfield We look forward to continuing that relationship and providing any assistance we can in future projects.

Very truly yours,

Hoffmann Architects, Inc.

Erin L. Aichler
Project Manager

ELA/ela

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Included Attachments:

1. Photo Survey
2. Roof Plan

3. Letter from DiSalvo Associates (dated 9 July 1990) regarding Roof Framing Adequacy

4. Roofing Product Data and Warranty Information

Photo Survey:

Overall Roof Photos

Photo 1:

Looking west towards

cafeteria wing. Administration wing and Pequot House roofs in foreground.

Photo 2:

Looking northwest towards Townsend House. Library roof in foreground

Photo 3:

Looking west towards Industrial Arts and Early Childhood Wing. Pequot House roof in the foreground.

Note:

- Skylights
- Rooftop equipment

Photo 4:

Looking northwest towards Townsend House. Library roof in the foreground.

Note:

- Conduits and piping
- Rooftop equipment

Photo 5:

Industrial Arts wing roof, looking northeast. Cafeteria Roof in background.

Note:

- Ductwork and rooftop equipment
- Low profile roof edge condition

Photo 6:

Pequot House roof. Looking south.

Note:

- Skylights
- Vent pipes
- Fan curbs

Photo 7:

Pequot House roof, looking southwest.

Note:

- Skylights

Photo 8:

Auditorium roof, looking northeast.

Note:

- Equipment curbs
- Lightning protection system

Photo 9:

Orchestra Room roof, looking southeast.

Note:

- Expansion joint
- Lightning protection system

Photo 10:

Fitness Room roof, looking southeast.

Note:

- Skylights
- Rooftop unit
- Fan curb

Photo 11:

Boys' Locker Room roof, looking north.

Note:

- Skylights
- Fan Curbs
- Low windows along wall

Photo 12:

Fitness Room roof, looking south.

Note:

- Skylights
- Roof top unit
- Lightning protection system

Photo 13:

Pequot House, looking east.

Note:

- Low profile edge condition
- Rooftop units and ductwork

Photo 14:

Pequot House, looking west.

Note:

- Equipment curbs
- Low profile edge condition

Detail Photos:

Photo 15:

Base flashing condition and window sill.

Issue:

Low flashing height at base of wall which would need to be raised to accommodate increased height and pitch of insulation. Existing window above flashing.

Photo 16:

Base flashing and conduit supports.

Issue:

Low base flashing height at wall. Increase in pitch and height of insulation would require removal and replacement of existing conduit.

Photo 17:

Base flashing, vent stack and roof access stair.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch. Existing vent stack would also need to be replaced to be of adequate height. Stairs would require removal and replacement.

Photo 18:

Base flashing at corner of chimney.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch.

Photo 19:

Base flashing at base of windows.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch. Flashing could not be raised without requiring the installation of new windows with higher sills.

Photo 20:

Base flashing at roof edge.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch. Low roof edge would also need to be raised to accommodate new pitch.

Photo 21:

Base flashing below windows at Cafeteria roof.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch. Flashing could not be raised without requiring the installation of new windows with higher sills.

Photo 22:

Base flashing at corner of Cafeteria roof.

Issue:

Low base flashing height at wall. Flashing would need to be raised to accommodate new pitch. Flashing could not be raised without requiring the installation of new windows with higher sills.

Photo 23:

Base flashing below roof transition.

Issue:

Low clearance between top of roof and edge of roof above. An increase in pitch and insulation height would make area more difficult if not impossible to properly flash.

Photo 24:

Typical vent stack.

Issue:

Existing vent stack would also need to be replaced to be of adequate height above finished roof

Photo 25:

Piping supports.

Issue:

Existing piping/conduit supports would need to be adjusted or replaced to accommodate change in pitch and insulation height

Photo 26:

Curb flashing at rooftop unit. Vent pipe in foreground.

Issue:

Low flashing height at curb. Unit would need to be removed to install higher curb.

Photo 27:

Base flashing at equipment curb.

Issue:

Low flashing height at curb. Unit would need to be removed to install higher curb.

Photo 28;

Base flashing at equipment curb.

Issue:

Low flashing height at curb. Unit would need to be removed to install higher curb.

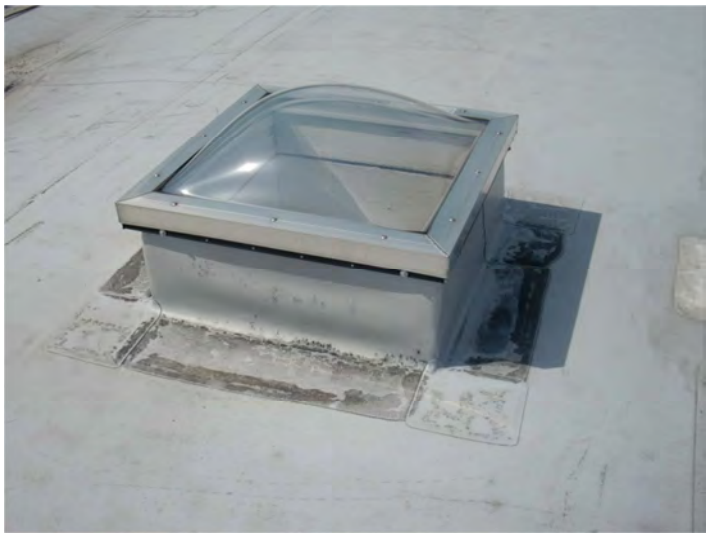

Photo 29:

Dome skylight.

Issue:

Skylight may require replacement to install higher curb to accommodate pitch and height in insulation.

Photo 30:

Sloped skylight.

Issue:

Skylight may require replacement to install higher curb to accommodate pitch and height in insulation.

Photo 31:

Roof edge with lightning protection.

Issue:

Low profile roof edge. Edge would need to be raised, new flashing and gravel stop installed. Work at roof edge may also require replacement of existing lightning protection system.

Photo 32:

Roof edge with lightning protection.

Issue:

Low profile roof edge. Edge would need to be raised, new flashing and gravel stop installed. Work at roof edge may also require replacement of existing lightning protection system.

Photo 33:

Base flashing and edge flashing at roof transition.

Issue:

Low flashing height at lower roof. Low profile roof edge and existing lightning protection system.

Photo 34:

Roof edge, piping and rooftop equipment at roof transition.

Issue:

Low vertical clearance between roofs. Existing piping and conduits would need to be removed and reinstalled to accommodate steeper pitch.

Photo 35:

Roof edge with lightning protection.

Issue:

Low profile roof edge. Edge would need to be raised, new flashing and gravel stop installed. Work at roof edge may also require replacement of existing lightning protection system.

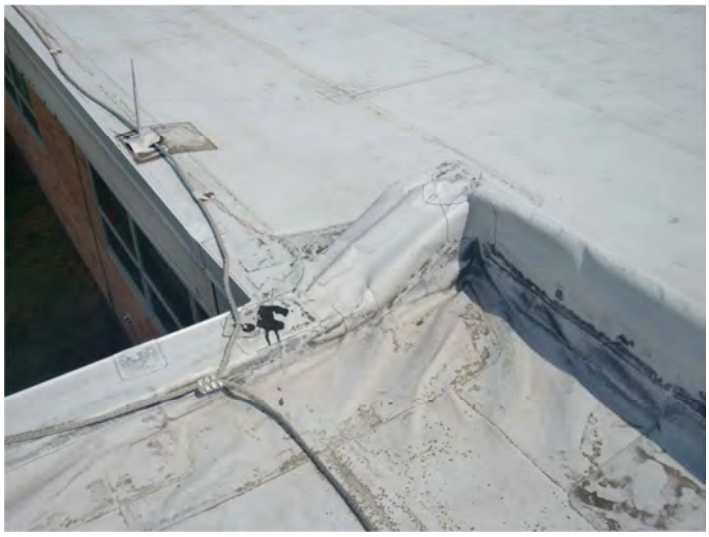

Photo 36:

Expansion joint transition at roof edge.

Issue:

Expansion joint and roof edge would need to be raised to accommodate steeper pitch and increased insulation height.