



September 11<sup>th</sup>, 2020

Town Manager  
Town of Bowdoinham  
13 School Street,  
Bowdoinham, ME 04008

RE: Bowdoinham Recycling Building Required Repairs

To whom it may concern,

This letter is to enumerate all the repairs that the building requires to operate using the entire recycling building, as well as an explanation as to why these repairs are necessary.

#### 1. Roof Truss Repairs:

Calderwood Engineering calculated an unbalanced snow load of 60psf (pound per square foot) on the roof using the 2012 International Building Code (IBC) and the Minimum Design Loads for Building 2010 (ASCE 7). This snow load is much larger than the capacity of the following roof members:

- 2x6 Rafters in the upper section of the truss, spaced at 3'-0"
- 2x6 Rafters in the lower section of the truss, spaced at 3'-0"
- (2) 2x8's roof beam carrying rafter loads to columns, Spanning 12'-0"

The members all exceed the limits for allowable tension, compression, or flexure under these applied snow loads. This is evidenced by the fact that there has already been a structural failure of the roof that was repaired prior to 2013. During the 2013 inspection only a fraction of roof members were found to be reinforced, and those that were reinforced were not strengthened to the level that was shown in Calderwood Engineering's details. These modifications, although better than leaving the roof as it was originally, are not enough to bring the roof structure up to code.

#### Repair Required:

Rafters Option 1: Sister 2x4 and 2x6 members to existing rafters, install additional 2x members between top and bottom rafter member.

Rafters Option 2: Sister new 2x10's and 2x6's to top rafters.

Roof Beam Option 1: Install new 2x4 kickers between 2x8 roof beam and columns

Roof Beam Option 2: Sister new Versa-Lam Timber Composite beam to existing roof beam.

#### 2. Floor members and Columns:

Calderwood Engineering used the required 125psf design live load for Light Storage Warehouses using the 2012 IBC and ASCE 7. This load is much larger than the capacity of all of the existing floor members:

- Floor joists (2x8 @ 2' spacing, spanning 12')



- Triple 2x8 Beams (Span 12'-0" between columns)
- 6x6 Columns supporting 1<sup>st</sup> and 2<sup>nd</sup> floors

These floor members are undersized and exceed the limits for allowable flexure under the applied live loads. This is especially noticeable for the 2x8 beams, which show noticeable deflection from the excess loading. All of these members must be strengthened in order to achieve enough capacity to carry the design loads.

#### Repair Required:

Floor Joist Repair: Sister Versa-Lam Timber Composite to all floor joists.

Floor Beam Option 1: Install new 5x5 kicker between beam and existing columns

Floor Beam Option 2: Bolt (2) C6x8.2 channels to existing beam

2<sup>nd</sup> Floor Column: Attach new 2x6 to existing columns (Not required if 5x5 kicker is installed)

1<sup>st</sup> Floor Column: Attach (2) 2x6's to existing columns

### 3. Ceiling Truss

On the east end of the building, there is a portion where the 1<sup>st</sup> floor is extended up to the floor joists of the 3<sup>rd</sup> floor. This section is approximately 16' high and has (2) large trusses that span 24'-0" each. The trusses were previously modified to include 1" diameter bolts to some of the connections. Currently, some of the truss members are not sized to carry the design loads:

- Bottom Chord – (3) 2x10's
- Top Chord – (3) 2x10's
- Diagonal members – (2) 2x8's

All of these members are undersized and exceed the limits for allowable tension and compression to carry the applied loads from the 3<sup>rd</sup> floor.

#### Required Repairs:

Bottom Chord: Install (2) 1/4" thick Steel Plates to existing bottom chord to middle 12'-0" of chord.

Top Chord: Install (2) 2x4 kickers between top chord and 3<sup>rd</sup> floor joists @ 6' spacing.

Middle Diagonal Chords: Install (2) 2x8 members sistered to existing chords.

Outside Diagonal Chords: Install (2) 1/4" Steel Plates to chords.

### 4. South Wall

The existing exterior wall on the South side of the building is in need of repair. The existing wall consists of 2x4's @ 2'-0" on center. In good condition, these would have the capacity to carry the applied vertical loads, as long as they are braced using 1/2" plywood or OSB sheathing.

#### Required Repair:

Replace damaged 2x4's as required, and install sheathing to entire wall.

### 5. Northeast Wall Repair



At the vehicle door on the northeast side of the building, the wall has been disconnected from the foundation and swings out when the door is used. Calderwood Engineering recommends installing a timber nail plate on top of the existing foundation, connected to the wall to resist movement.

**Required Repair:**

Install nail plate and connect wall to foundation per our details.

**6. Pest Damage**

It was brought to Calderwood Engineering's attention that the building may have become infested with Powderpost Beetles. These can cause significant structural damage, with no easy way to assess the full extent of the damage.

**Required Repair:**

Any member that shows signs of Powderpost Beetle activity should be replaced. The remainder of the building should be treated to stop any further spread of the beetle.

Attached are details of the required repairs.

Should you have any further questions please feel free to contact us directly.

Respectfully Submitted

Thad D. Chamberlain, EI