

923.86.01

January 31, 2011

Mr. Michael Magnant  
Town Administrator  
Town of Rye, New Hampshire  
10 Central Road  
Rye, NH 03970

SUBJECT: Town Hall Structural Investigation Services  
Rye, New Hampshire

Dear Mr. Magnant:

In accordance with our proposal dated December 1, 2010 (Revised December 9, 2010), AMEC Earth & Environmental (AMEC) has performed a structural review of the existing foundation and roof structure of the Rye Town Hall in Rye, New Hampshire. The purpose of this review was to determine the structural integrity of these specific building elements, report any issues or deficiencies discovered, and recommend a course of action for retrofits. Design of any recommended reinforcing/repairs is not part of the scope of this report.

The following report is based on our visual observations of the existing conditions. Our review was not intended to be an all-inclusive inspection of the structural features of the building, but rather an observational visit. Some aspects of the structure were hidden or inaccessible and therefore could not be reviewed or verified. Given the limited scope of our services no guarantees are expressed or implied with respect to the following comments.

## **1.0 OBSERVATIONS**

A site visit was conducted on January 3, 2011 by AMEC personnel to document the existing conditions of the roof structure and foundation. The Rye Town Hall is a former Congressional church built in 1846 and has two additions constructed in 1890 and 1974. The original building and first addition were constructed with heavy timber frames. The last addition was a minor infill under a second floor balcony. Our analysis of the roof structure was only conducted for the original building. This portion of the building is approximately 40 feet wide and 60 feet long.

### **Foundation**

The original building foundation along the south perimeter was identified as a granite stone, brick and mortar perimeter wall that rises approximately twenty inches above a concrete slab on grade (Figure 1). It appears several repairs have been made to the foundation wall on the south side. There are several deteriorated sections where cracked and spalled mortar has created gaps in the foundation wall (Figures 2 and 3).

The front (west) and north perimeter foundation walls of the original building consist of a concrete wall extending below grade (Figure 4). We believe at some point these walls replaced the original granite stone foundation. The foundation walls appear to be in good condition. There were a few areas where cracking has occurred (Figures 5 - 7) but there are no signs of settlement.

The east perimeter is the foundation under the newest addition. It is comprised of masonry block and brick pillars (Figures 8 and 9).

We have assumed the exposed concrete slab along the south perimeter is separate from what we believe is a continuous slab on grade under the main portion of the building as they are at two different elevations. We were able to visually inspect a portion of the slab on grade located in the mechanical room. No indications of settlement or other defects were observed.

### **Roof Framing**

The original building is a two-story structure constructed with heavy timber frames. Please reference the attached sketches (SK1 – SK8) for framing nomenclature and configuration. The roof is comprised of asphalt shingles on 1" x 12" decking. The deck spans between 5" x 5" wood purlins spaced at approximately 4 feet. These purlins are the roofing support from frames 2 to 7 and span 10' - 0" between the trusses. Between frames 1 and 2, the roofing changes direction and is supported by 2" x 8" rafters which span from the edge beam at the ceiling level up to where the sloped roof stops to create the belfry. These rafters are spaced approximately 26 inches apart.

There are two types of frames that make up the primary roof truss structures. The first is a truss frame called a King Post Truss (SK8). This type of truss makes up frames 4, 5, and 6 of the roof structure. The king post truss is comprised of two principle rafters, a tie beam, and a central vertical post which is called the "king post". The king post is assumed to take only compression loads due to its connection at its base. Two angled struts span from the king post to each rafter. A secondary rafter runs from the bottom of the strut to the tie beam on each side. This secondary rafter helps with compression forces in the primary rafter. These trusses are spaced 10 feet apart.

The second type of frame is a Queen Post Truss (SK4, SK6, and SK7) which makes up frames 1, 2, and 3, each having slight modifications. These truss frames are spaced 10 feet apart. The main queen post truss is comprised of two principle rafters and two vertical "queen posts" with a restraining tie beam at the bottom and a straining tie beam at the top. Four struts create a diamond shape bracing between the queen posts in frame 3. In frames 1 and 2, two struts run from the middle of the queen posts up to the center of the straining tie beam. As with the king post, a secondary rafter runs from the tie beam to the queen post on each side. At frames 1 and 2, the queen posts extend vertically to make up the belfry. The belfry was not analyzed in this report.

Ceiling joists run between each tie beam at each frame to create the support for the decorative tin ceiling below. These joists are 2" x 8" and are spaced at approximately 40 inches on center.

We visually reviewed each frame and its connections for deficiencies. Many of the framing and truss members have checked (Figures 10-12). At the north end of Frame 6, we noted some sawdust on the top of the tie beam, but found no signs of deterioration or distress that would have created it (Figure 13). At the north end of Frame 4, the column

has cracked at the dowel connection to the perimeter beam (Figure 14). At Frame 3, the north end queen post has been removed and replaced with a smaller post and a support brace was added. It appears the original queen post had failed at some point in the past and was reinforced (Figures 15 and 16). At the south end queen posts of Frames 1 and 2, dowels are missing at the connections of the post to the tie beams.

## **2.0 RESULTS AND RECOMMENDATIONS**

### **Foundation**

Based on our visual observations of the perimeter foundation walls, we found that the existing foundation walls have only minor cracks and/or deterioration of mortar joints. During our visit, the foundation walls showed no signs of overstress or excessive settlement. Although the top and bottom of the foundation walls were concealed and we could not verify the existing condition of these elements, it is our opinion that the existing foundation is in good condition. We recommend filling in the cracks in the poured concrete sections of the walls with pressure grout. At the granite walls, we recommend that the deteriorated/cracked mortar be removed and new mortar be installed. Both of these recommended repairs are to help prevent future deterioration due to water infiltration.

### **Roof Framing**

AMEC performed a structural analysis on the timber framing members using field measurements, existing conditions, and information provided to us by the current owner. We calculated dead loads, live loads, snow loads, and wind loads based on the current code (ASCE 7-05 and IBC 2006). We created a computer model of the roof structure to determine how the structure will act under current loading requirements. The results of this analysis indicate the existing roof structure is inadequate to support the current code required loads.

Although the roof trusses and purlins do not meet the current code requirements they appear to be in good condition. Minor deficiencies and deterioration were found, but nothing to suggest the structural integrity of the roof trusses or the purlins have been compromised except for the repaired truss on Truss Frame #3.

In our opinion, the effort required to bring the existing roof framing up to meet current code requirements would be significant. The work would include reinforcing many (if not all) of the truss joint connections, all the roof purlins and select truss members at every truss frame. The reinforcing could consist of bolting new steel plates and structural shapes to the existing wood joints and members.

If you have any additional questions or comments, please do not hesitate to call us.

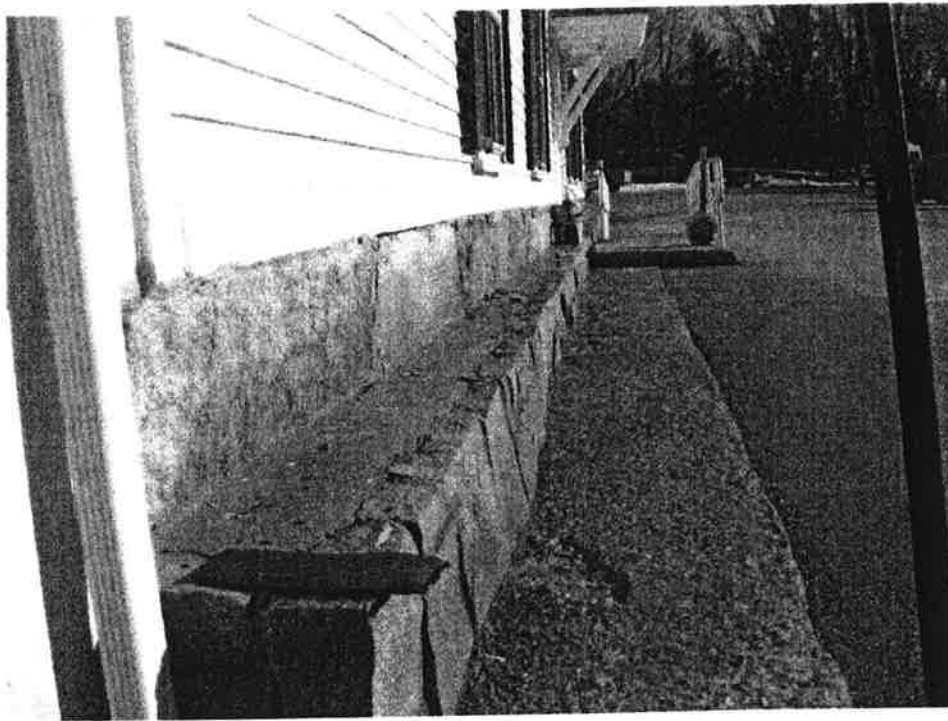
Sincerely,  
AMEC Earth & Environmental, Inc.

Jeffery D. Evans, PE

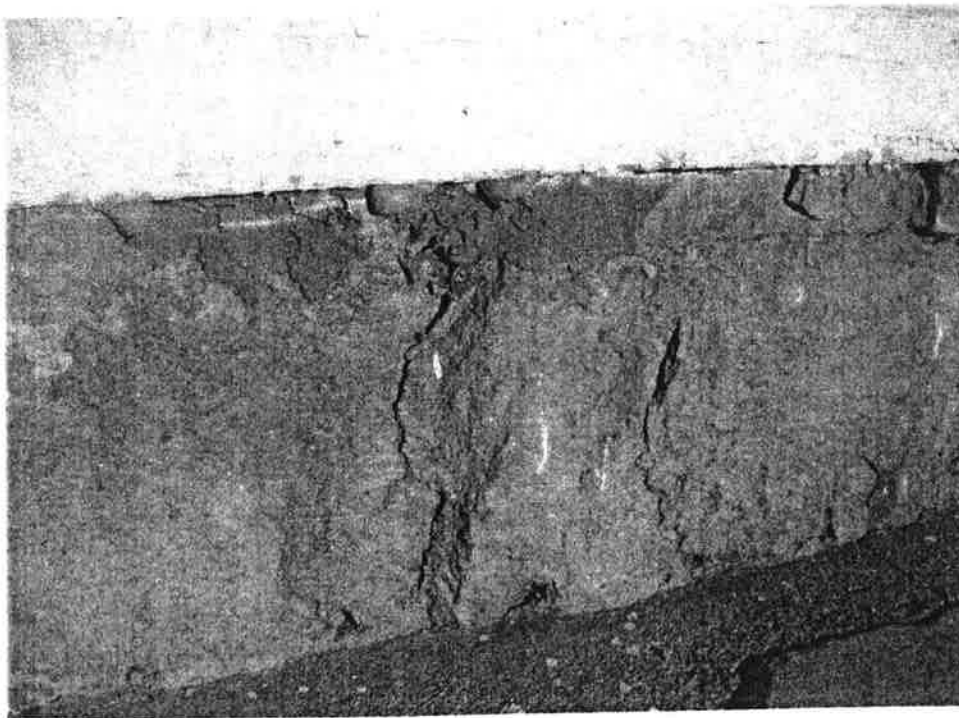
Michael S. Deletetsky, PE

JDE:smb

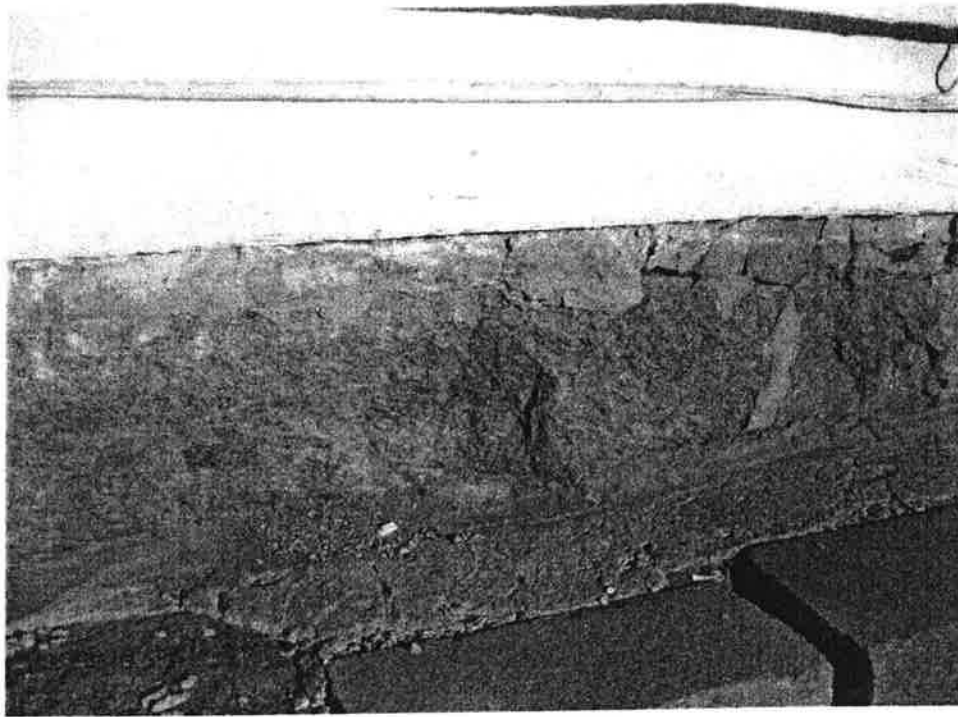
cc: Steve Harding, P.E., AMEC Earth & Environmental, Inc.  
Jeffery R. Walker, P.E., AMEC Earth & Environmental, Inc.  
Michael S. Deletetsky, P.E., AMEC Earth & Environmental, Inc.  
Sheena M. Bitetti, AMEC Earth & Environmental, Inc.



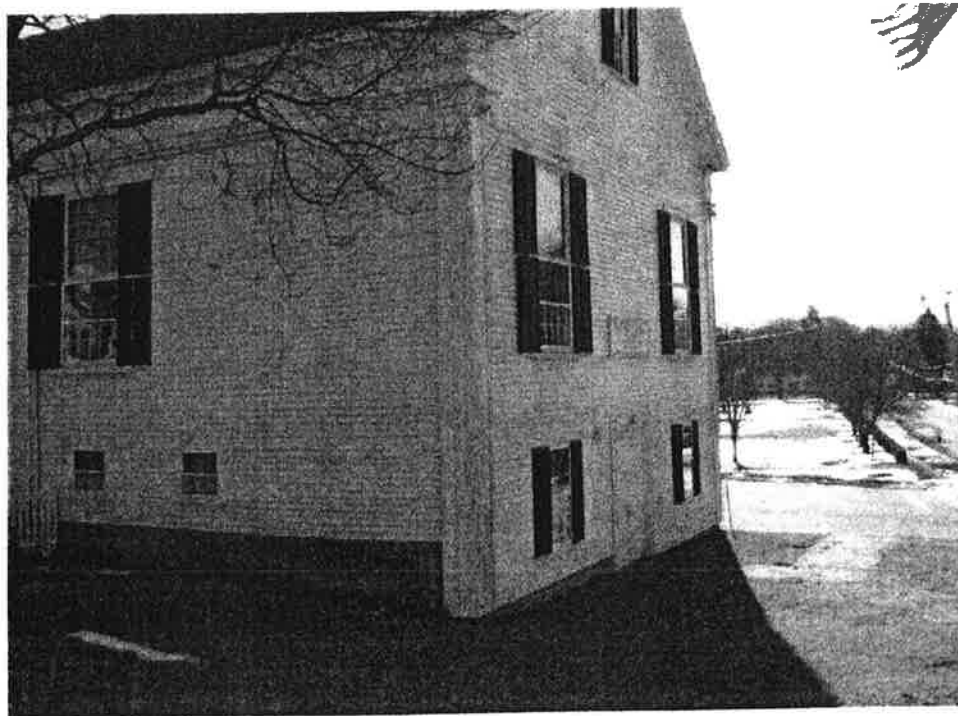
**Figure 1: South Side Foundation**



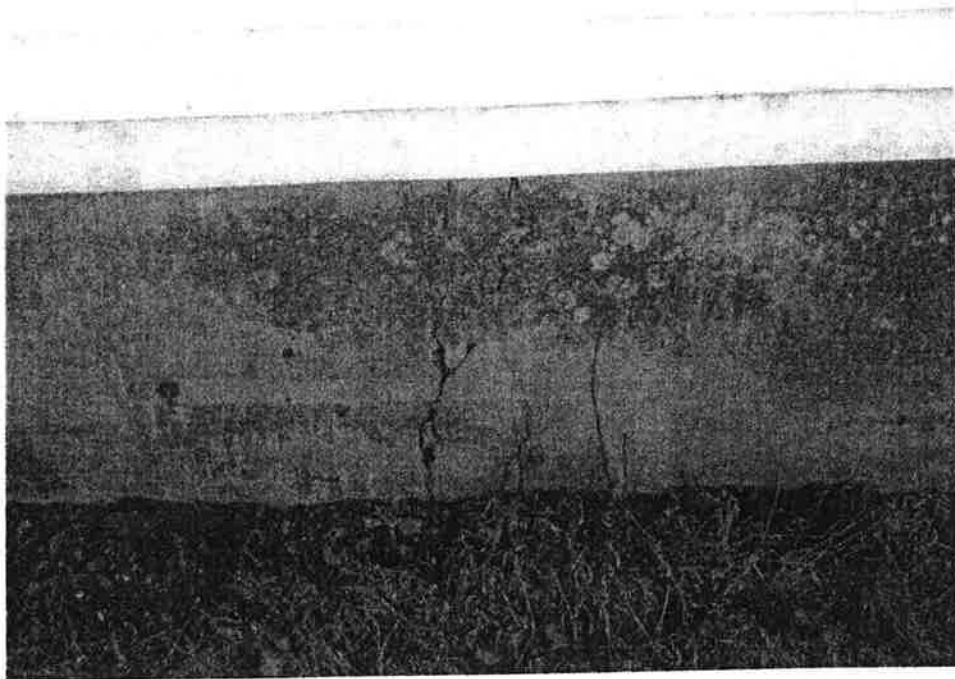
**Figure 2: Cracks in Granite Foundation – South Side**



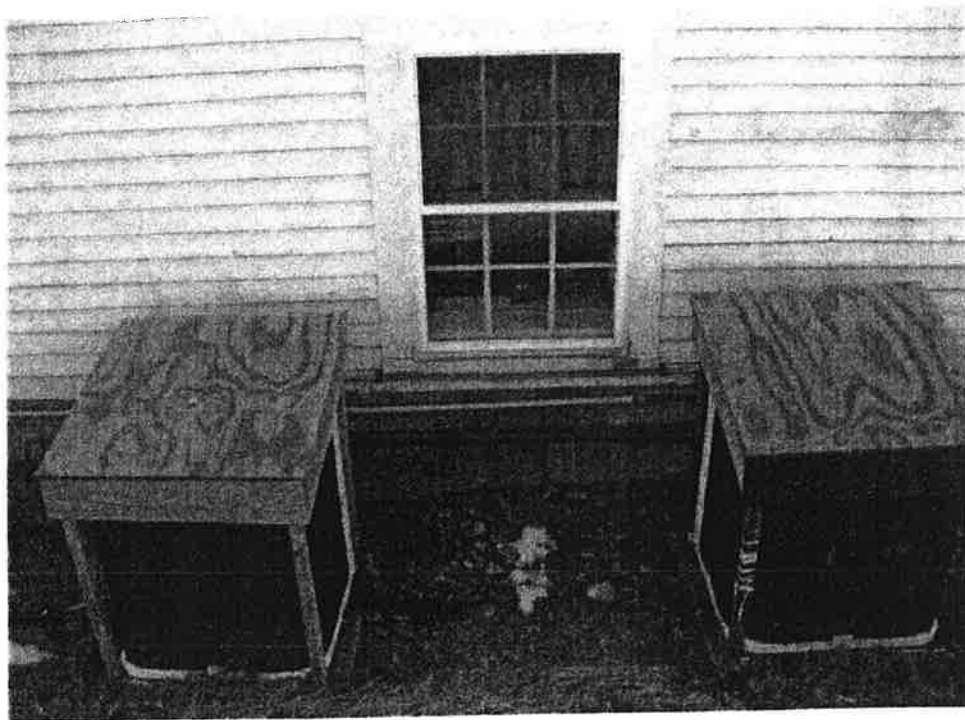
**Figure 3: Cracks in Granite Foundation – South Side**



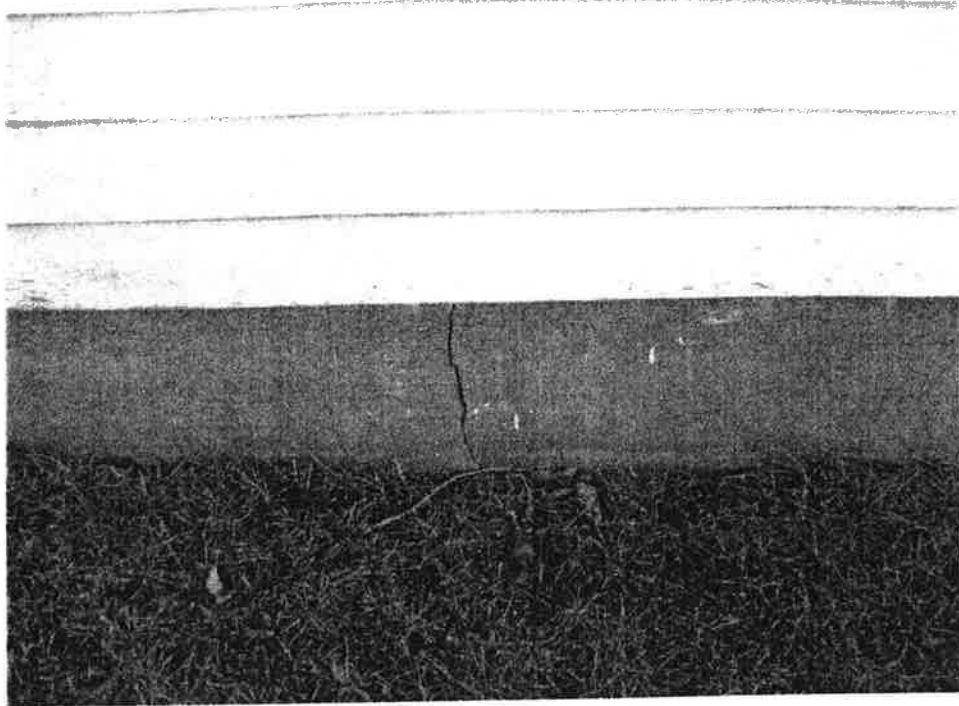
**Figure 4: North and West Side Foundations**



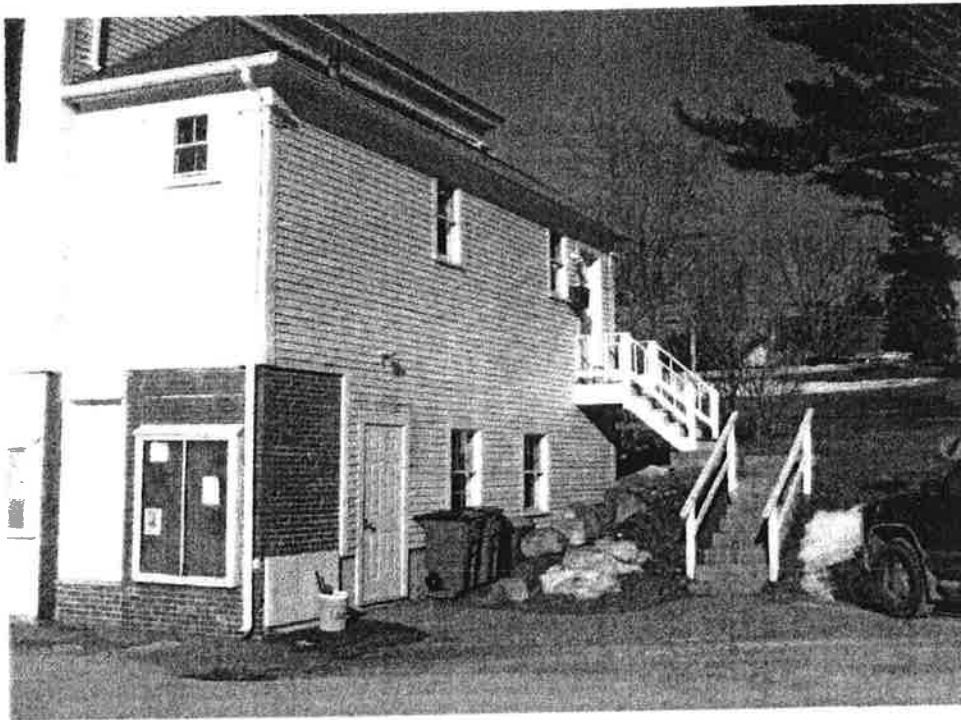
**Figure 5: Cracks in Foundation – North Side**



**Figure 6: Cracks in Foundation – North Side**

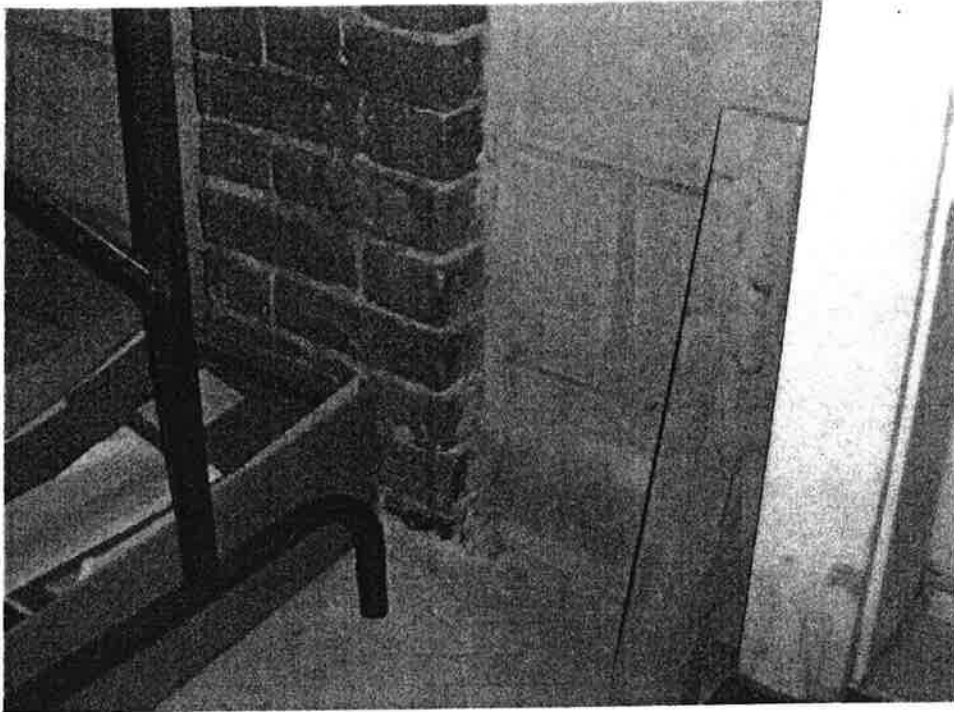


**Figure 7: Cracks in Foundation – West Side**

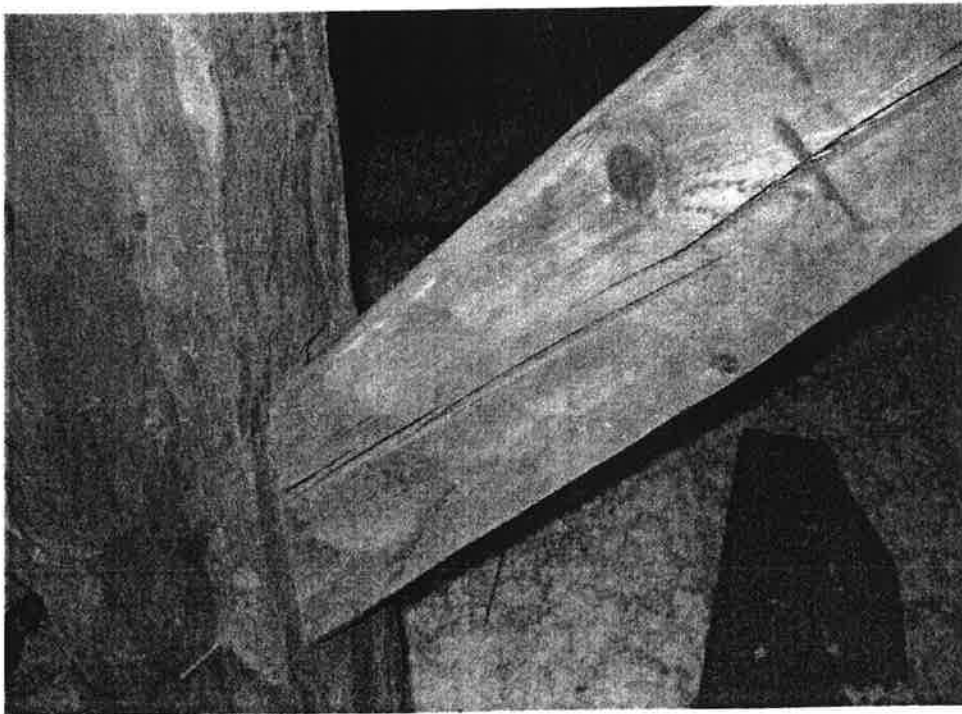


**Figure 8: East Side Foundation**

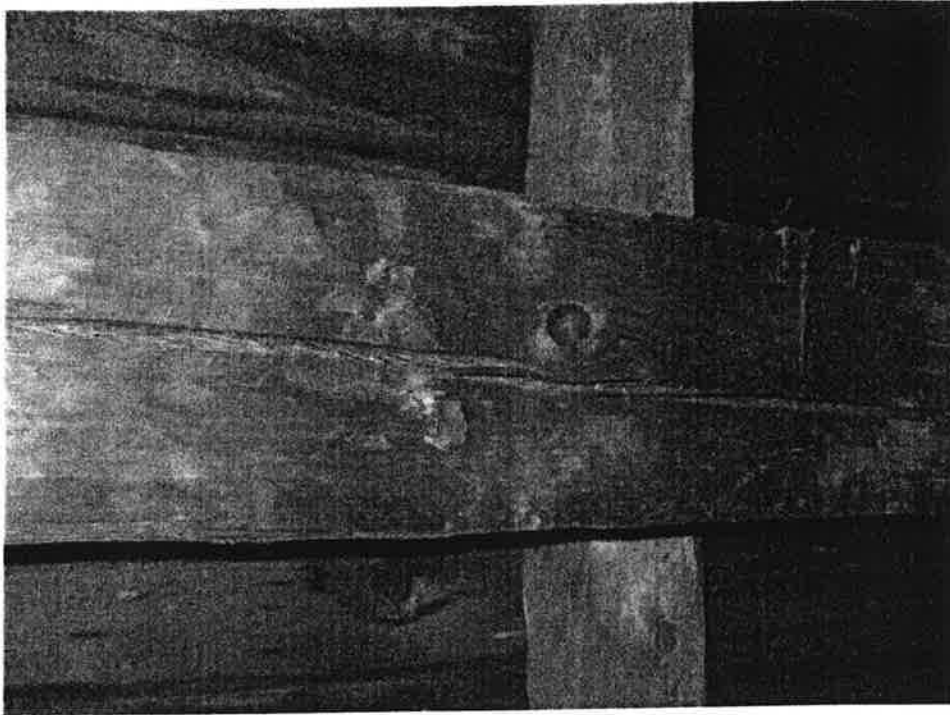




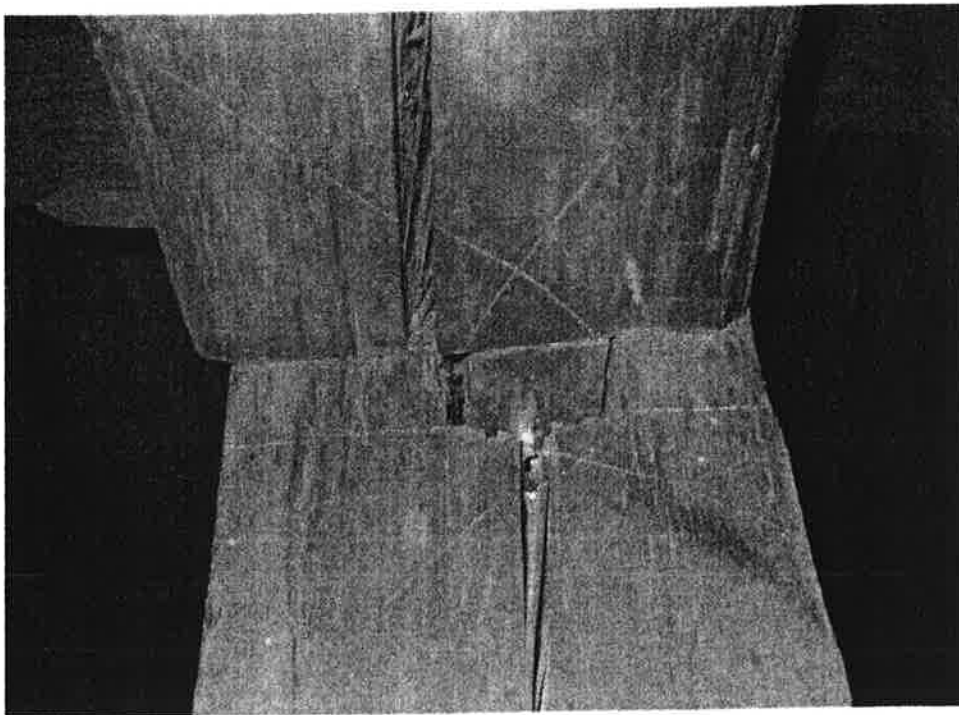
**Figure 9: East Side Foundation**



**Figure 10: Checking in Truss Member**



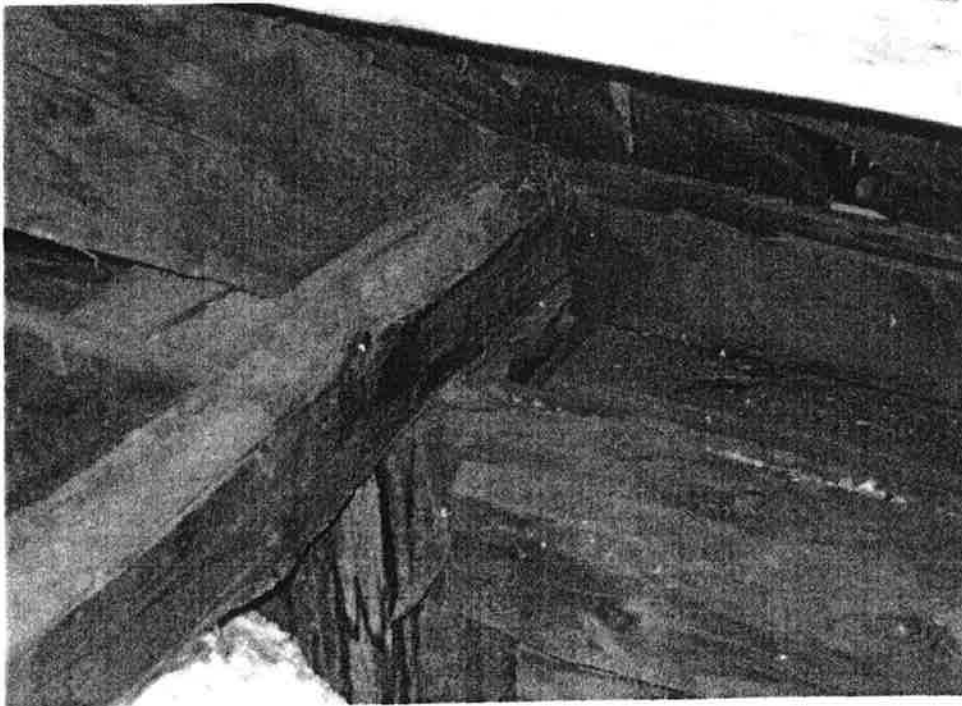
**Figure 11: Checking in Member**



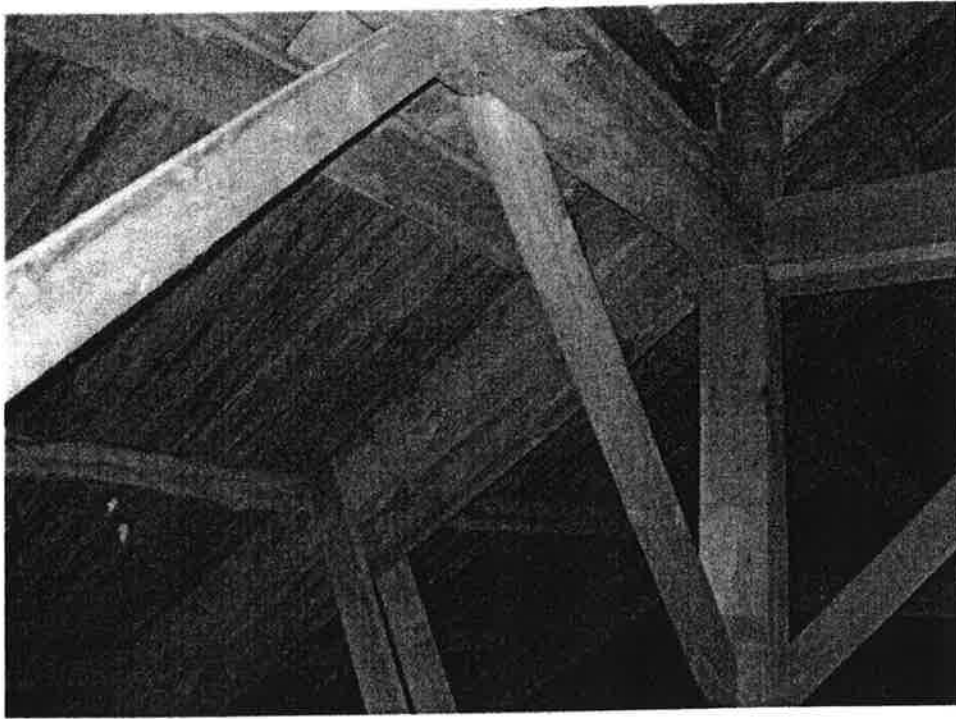
**Figure 12: Checking in Member**



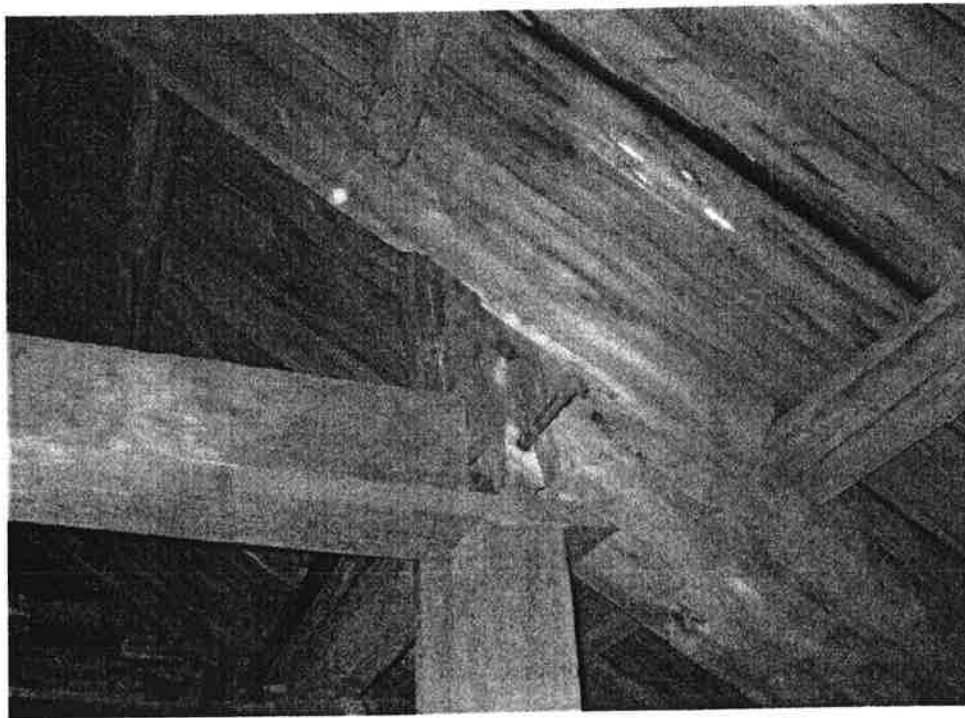
**Figure 13: Sawdust**



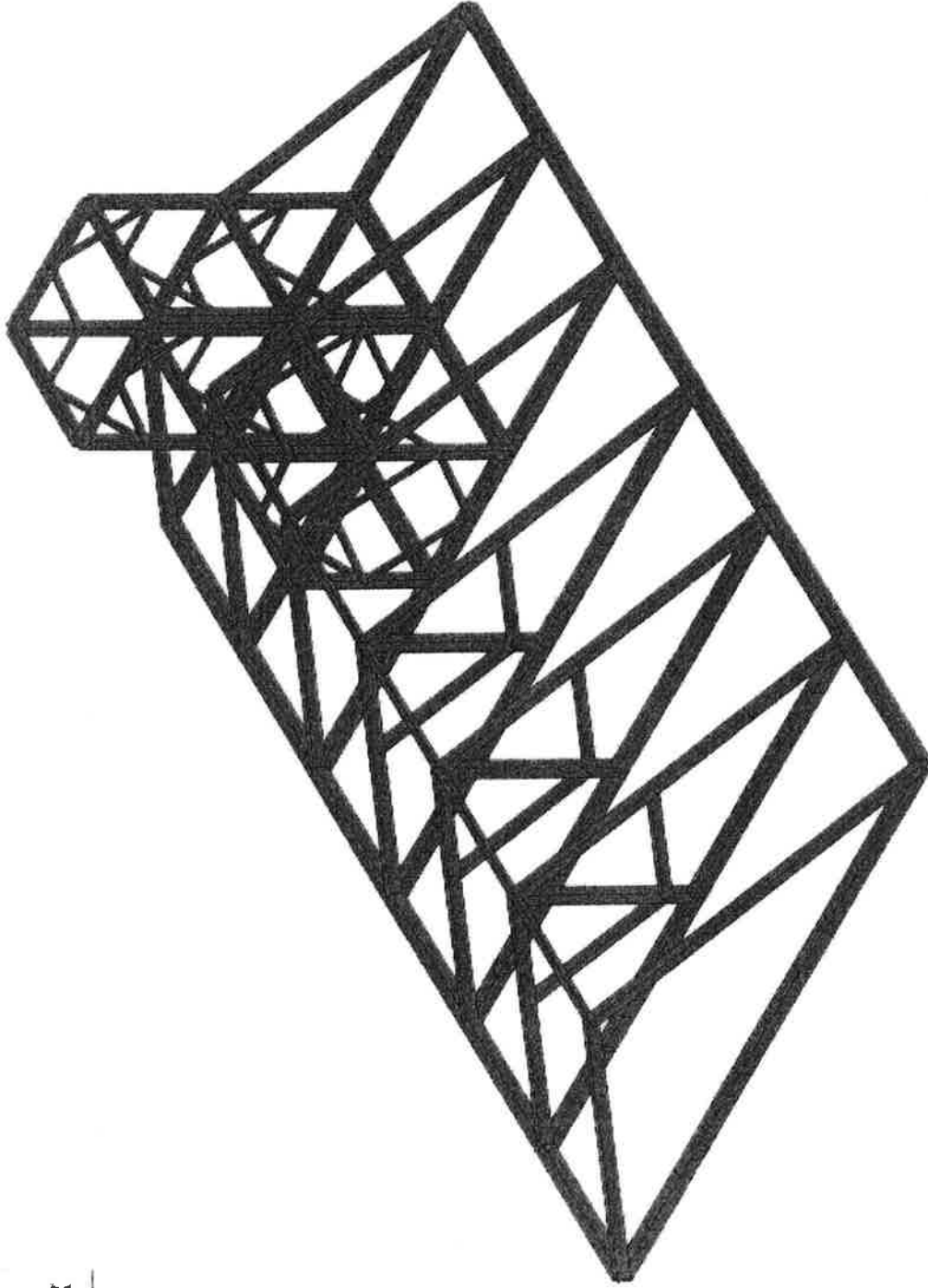
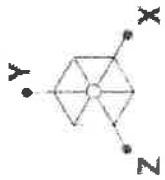
**Figure 14: Column cracked at the dowel connection to perimeter beam**



**Figure 15: Queen Post Column Replacement and added Brace**



**Figure 16: Queen Post Column Replacement**



Rye, NH Town Hall Structural Analysis



SK1

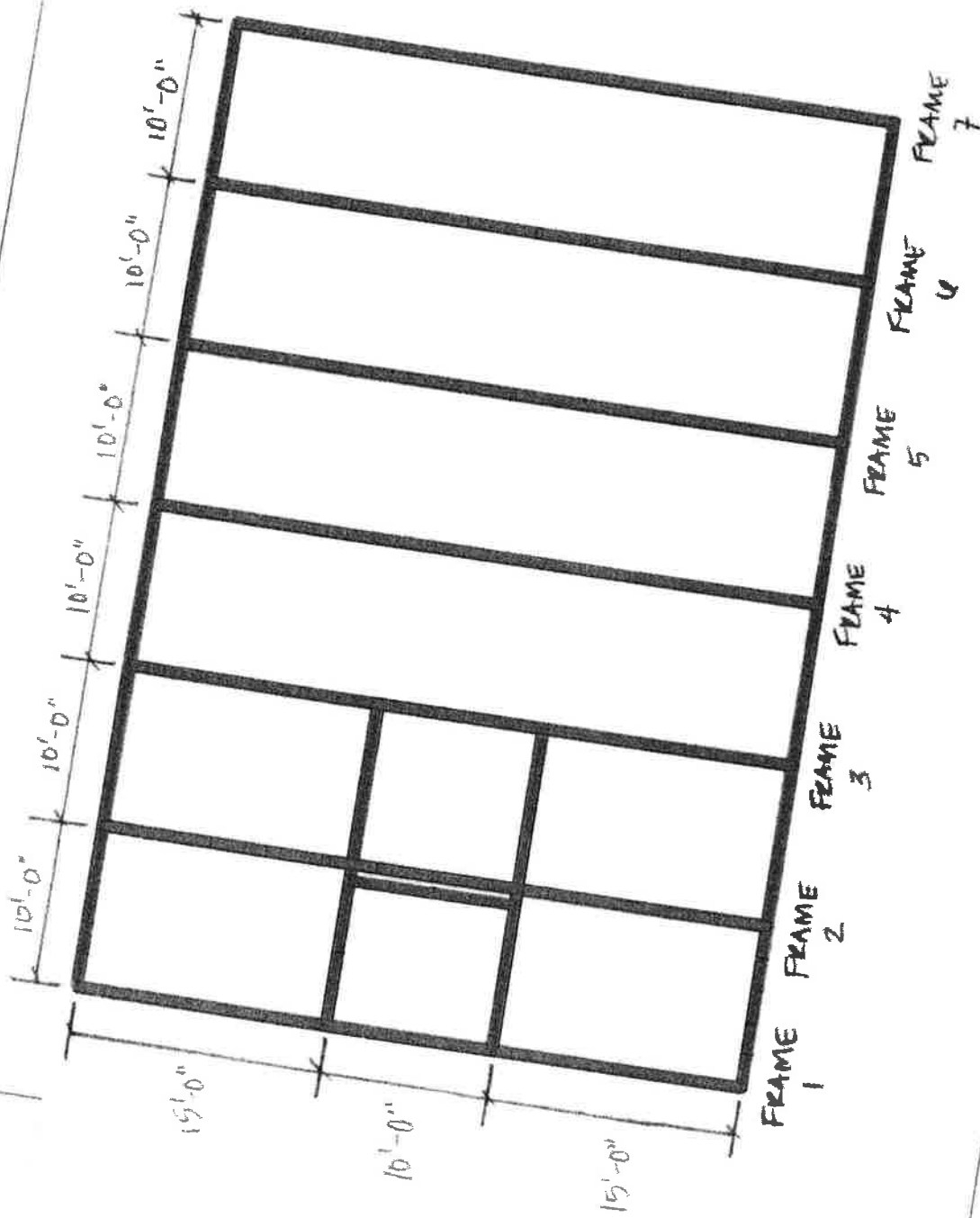
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Rye, NH Town Hall Structural Analysis

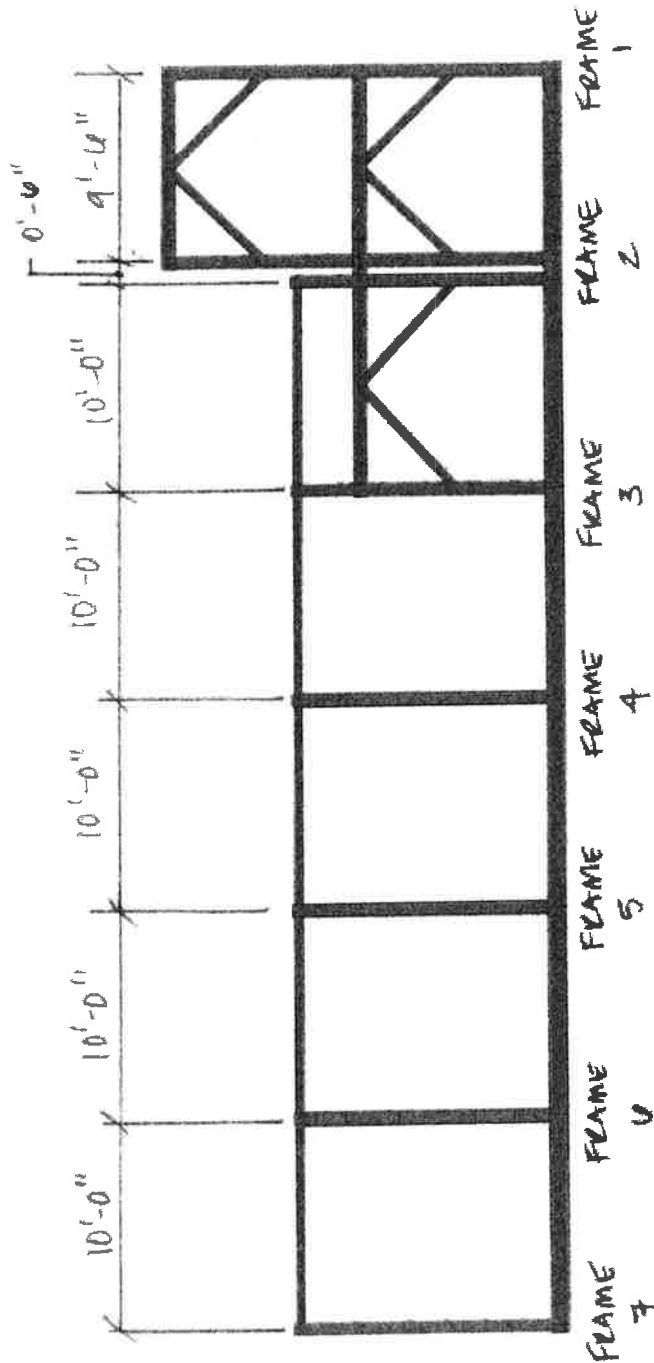
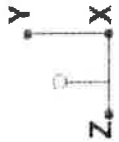
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Rye, NH Town Hall Structural Analysis



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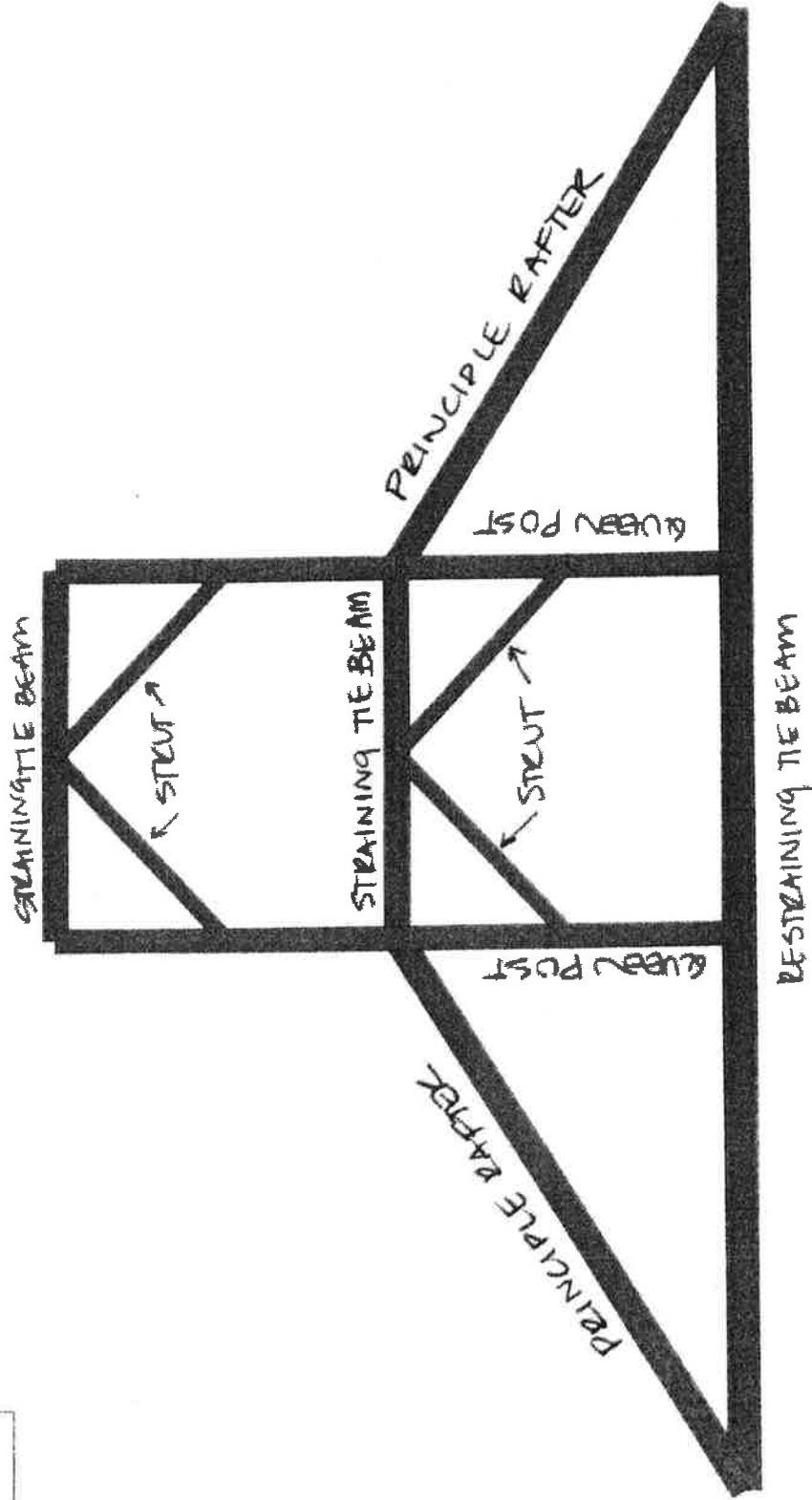
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Rye, NH Town Hall Structural Analysis

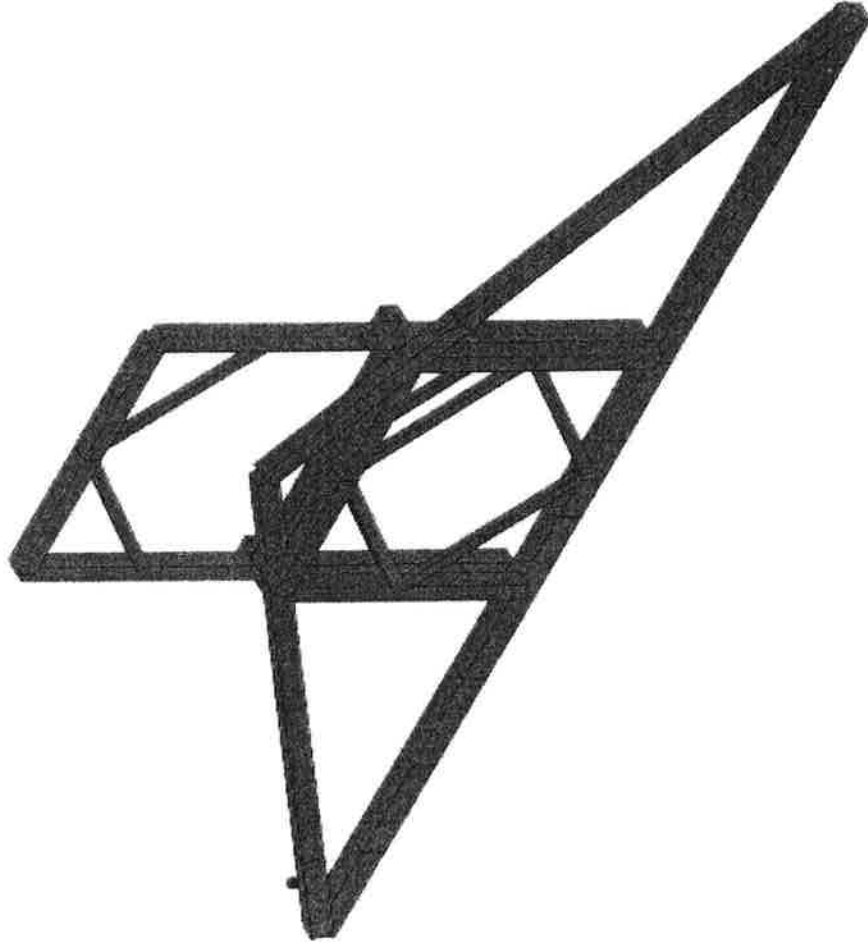
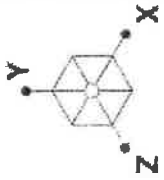
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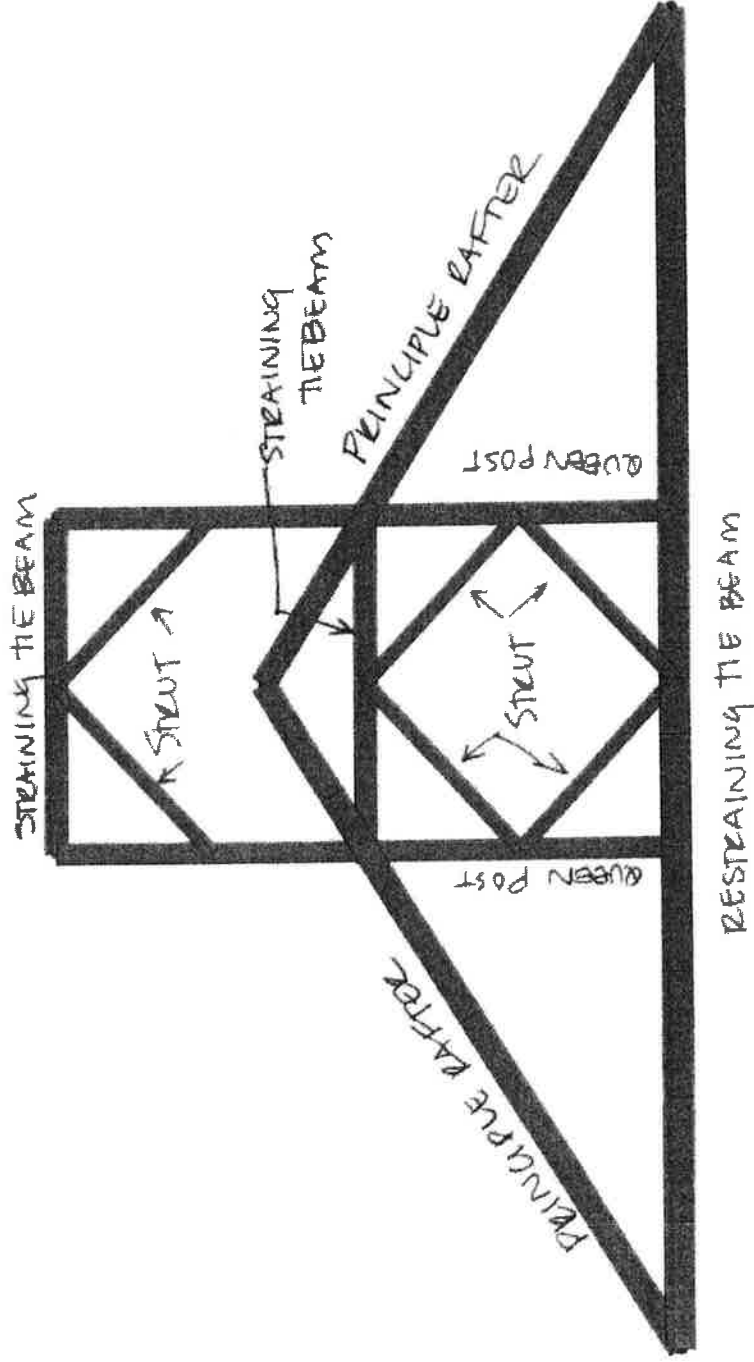
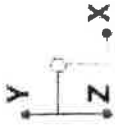
Rye, NH Town Hall Structural Analysis

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SK5

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Rye, NH Town Hall Structural Analysis

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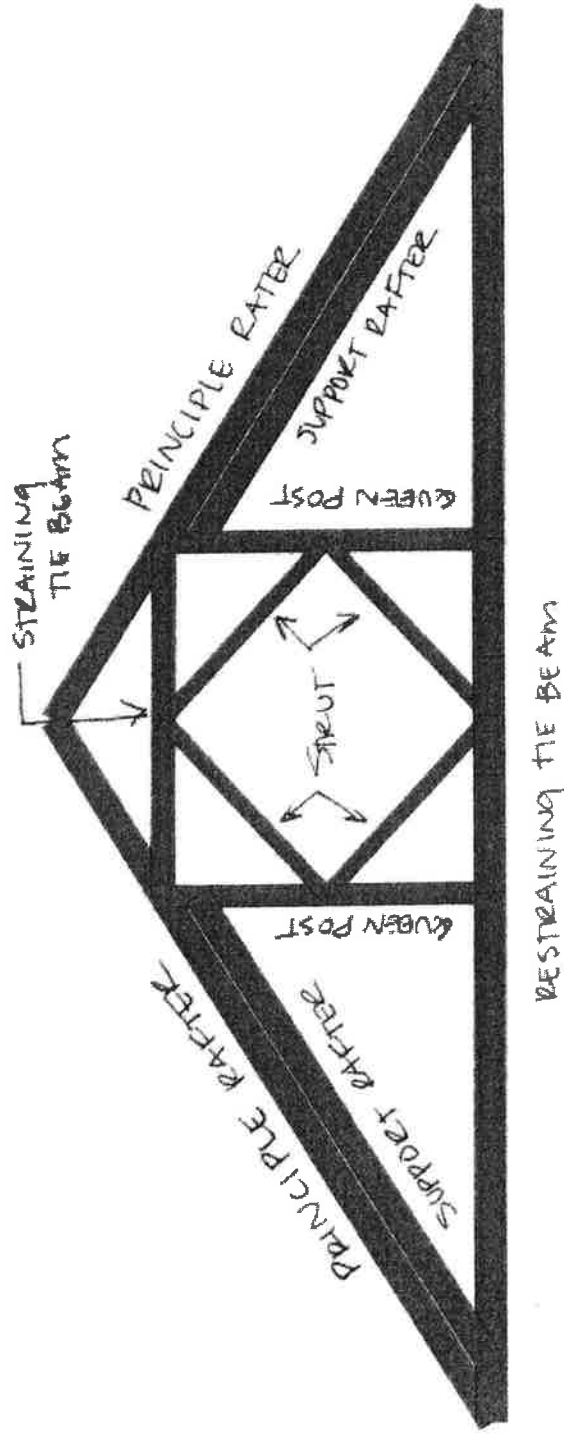
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SK6

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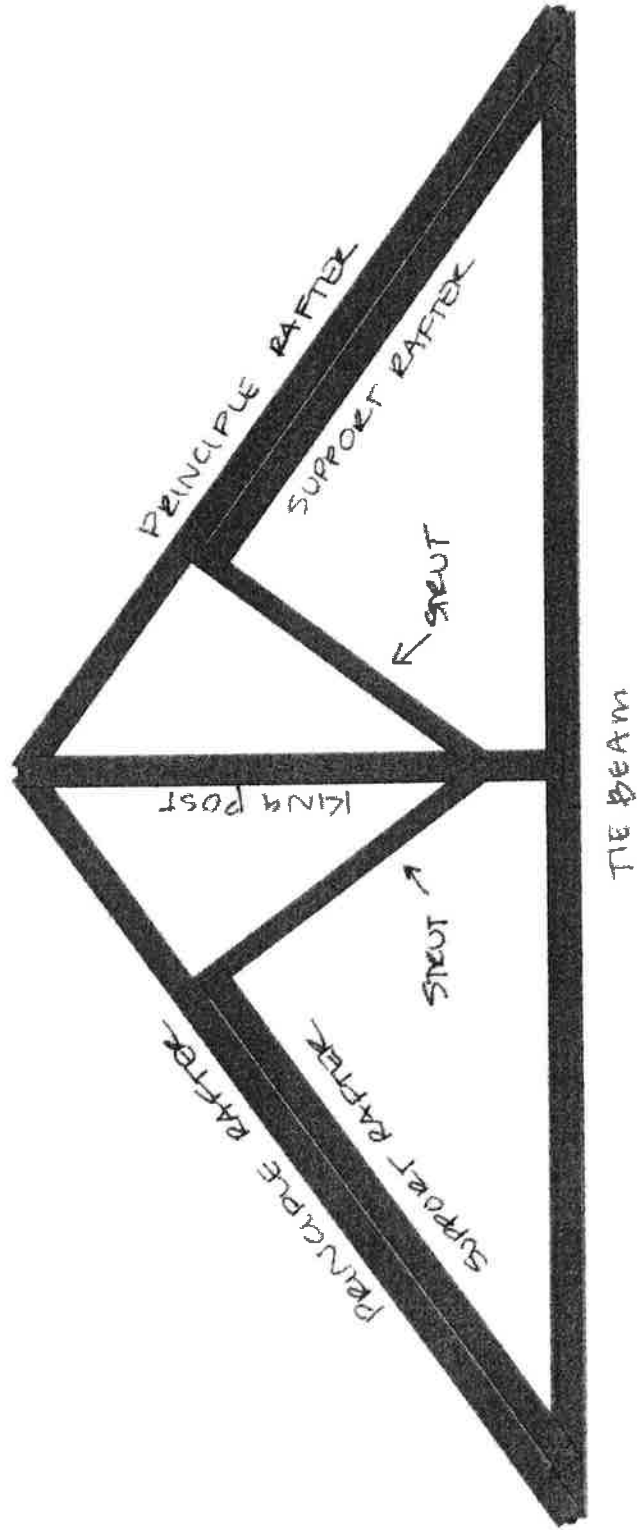
Rye, NH Town Hall Structural Analysis

FRAME ③

SK7

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Rye, NH Town Hall Roof Analysis

SKB

FRAME ④, ⑤, and ⑥

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