Moultonborough Grange Hall

973 Whittier Highway (Route 25)
Moultonborough NH

Building Condition Assessment

December 2012

Bedard Preservation & Restoration LLC
PO Box 430
Gilmanton, NH 03237
603 524-1773

This report was funded, in part, by a grant from the New Hampshire Preservation Alliance with funding from the New Hampshire Land and Community Heritage Investment Program (LCHIP).

Scope of this Building Condition Assessment

This limited building assessment of the Moultonborough Grange hall focuses on three major areas: the grade around the building, the foundation and deck framing in the cellar, and the roof structure. This report will provide an assessment of existing conditions on these major areas and recommendations for repairs utilizing the Secretary of the Interior's Standards for Rehabilitation, as well as cost estimates for the repair work. While all three of these major areas should be addressed and treated as important, it was determined in late July that the existing roof structure was in imminent danger of collapse and that emergency steps should be taken as soon as possible and before any significant amount of snow occurs in winter of 2012/2013. The critically unstable structural condition of the building lent urgency to the need for a building assessment. Emergency repairs were completed in late October 2012. The overall condition of the Moultonborough Grange building has also been reviewed and while requiring additional work in other areas, it was not found to be "life threatening" and will not be part of this assessment.

History, Development, and Significance of the Property

Located centrally in today's Moultonborough Village, the Moultonborough Grange hall is part of the Moultonborough Historical Society compound along with the Lamprey House Museum (c. 1820, State Register 2004) and the town-owned Moultonborough Town House (1834-1835, National Register 1989) and Middle Neck School (c. 1900). The Moultonborough Grange is significant both for its architecture and for its social history in the community during the heyday of Moultonborough Grange #197.

The Moultonborough Grange building dates to c. 1810 and town histories report that it was a tavern on the coach route in the 1850s, and later a hotel, known as the Red Hill House. In 1894, Moultonborough Grange #197 (incorporated 1893) purchased the building and then renovated it substantially in the next decade. By 1903, the Federal-style building had been transformed into a Grange hall with characteristic features and furnishings, and became a center for community activity and theatrical entertainments.

In May 1993, the Grange celebrated its centennial, printing a list of 'Past Members' that includes numerous prominent Moultonborough figures. In 2006, after a period of decline in membership and resources, Moultonborough Grange #197 was disbanded, and the building was transferred to the Moultonborough Historical Society. Repair and rehabilitation of the Grange hall must be consistent with preservation standards, as per a deed restriction in the transfer of the property (26 December 2006).

In June 2012, a preliminary structural evaluation by Moultonborough Historical Society board member Josh Bartlett indicated that the Grange was at serious risk. In late July, preservation contractor Stephen Bedard and architectural historian James Garvin made a site inspection, confirming that the building was in imminent danger of collapse, unless stabilization of the failing roof system was completed before winter of 2012/2013. Garvin's detailed report on the building's architecture and condition is attached.

The Moultonborough Heritage Commission and the Moultonborough Historical Society are now partnering to save this landmark building and to plan for its future in Moultonborough Village. In July 2012, the Grange's potential role in village revitalization was discussed as part of the Plan NH Moultonborough Community Charrette. In October, the Grange hall was put on the NH Preservation Alliance's 'Seven to Save' list for 2012, and recognized on the NH State Register of Historic Places.

Existing Conditions Assessment and Recommended Treatment

1. Grade around the building. This structure was originally built with adequate grade around the building so that water coming off the roof would be carried away from the building, thereby keeping the cellar dry. Over the years, with various plantings, soil build-up, and the addition of the "his and hers" privy in the early 20th century, the grade around the building now generally slopes towards the building rather than pitching away from the building. This negative slope brings the water collected by the roof and funnels it towards the building, as can be seen in the example (fig. 1) below.

2. Foundation and Deck Framing. The stone foundation and related deck framing are in need of a considerable amount of work. Due to the exterior grade pitching towards the building, as mentioned previously, water has been funneled toward the cellar and has caused significant damage to the foundation walls. There is some damage to the foundation in the northwesterly and the westerly area, but the damage is especially bad in the area of the "his and her" privy. The photograph below (fig. 2) shows 20 feet or more of foundation that could easily collapse into the cellar in the next few years.

Around 2000, a "good faith" effort was made to replace sills, replace some joists/carriers and shore-up the deck framing (see fig. 3 a/b below). While a substantial sum was clearly expended, the work was never completed and this area is still a major concern. Some of the old log floor joists were "sistered" but only one side of the new joist was attached back to the sill, and major carriers were "ended out" (replacement pieces were merely butted-up to the old carriers and simply "toe-nailed" together), without having been connected with steel for adequate support.

New concrete piers were installed in the cellar floor to allow for additional posts for shoring purposes under the old and new floor joists. While this was a good idea, the new shoring material is not adequately attached to the existing old/new joist and at last one section has fallen to the cellar floor. Also, when installing the new concrete piers, the soil was excavated around the area and piled up wherever, rather than being removed. Currently, with the water being funneled towards the building, the water is then subsequently pitched towards these new concrete piers.

3. Roof System. The existing roof system is in imminent danger of complete failure and collapse especially under any snow load (inspection July-September 2012, visible from exterior, fig. 4). The problems of the roof system date back to the late 19th/early 20th century when the center chimney was removed, the second floor partitions were removed, and the collar ties (the timber framing that "ties" the front wall to the back wall) were removed in order to install a vaulted ceiling.

In this photograph taken during stabilization in October (fig. 5), the orange arrow shows the rafter with a "birds-mouth" connection to the remainder of the collar tie beam that was cut off (white arrow) when the ceiling height was raised. The blue arrow indicates the top plate into which the collar tie beam is notched so that the building does not spread apart. The existing plaster with lath was covered over with "furring" strips and the beaded interior sheathing was then applied.

At a later date and in an attempt to keep the building from spreading apart, two one-inch rods with turnbuckles were installed. There is physical evidence in the existing beaded board interior sheathing that the building had already spread apart before the steel rods were even installed. Also, when these rods were installed, the connections were not made through and at the vertical post locations. Instead, the connections for these rods were made *between* the vertical posts, which compounded the problem of the spreading of the building at the plate height.

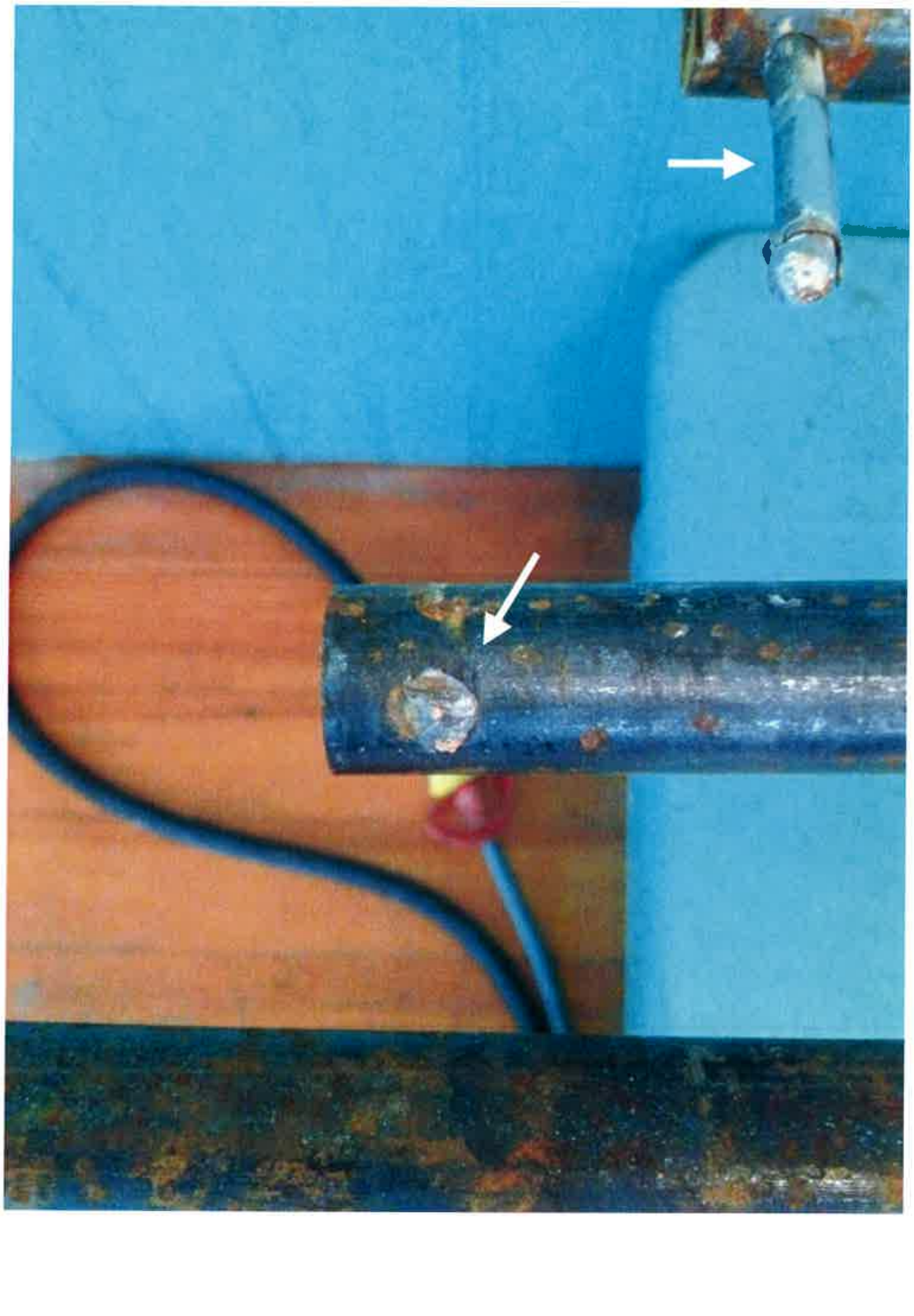
In early 2012, it was discovered that the two existing steel rods had apparently pulled out or away from their original connections on the shed sides of the building. While the rods were still in place, they were not under tension and could be seen drooping under their own dead load weight (figs. 6 and 7, interior photographs taken August 2012 prior to inspection/stabilization).

In early September 2012, as part of this partial building assessment, measurements were taken across the building at the plate height as well as across the floor in the corresponding areas. It was found that the building has spread apart at the plate height from between 4 ½ to 5 ½ inches.

Upon the removal of the exterior siding on the northerly side during priority stabilization in late October, in the location of the iron rod connection to the wood timber plate, it was discovered that the iron rods had pulled through the iron plates set into the wood timber plate and were within an inch of completely falling out onto the interior of the Grange building's floor (fig 8).

When the turnbuckles were removed so that the rods could be brought into the building, it was quickly discovered that the connections on the exterior were not finished with a threaded rod and nut as this connection is typically made. Instead, the connection on the outside of the plate was made by simply drilling a hole through the rod and by inserting a one-quarter inch (1/4") steel pin. It was only the strength of these one-quarter inch (1/4") steel pins, as long as they lasted, that was keeping the building from spreading apart (fig. 9, pins after removal during stabilization process).

The photograph below (fig. 10) shows one of the rods where the pin had completely sheared off and then had pulled through the steel plate. In the upper right hand side of the photograph, one can see a pin that was distorted from the outward forces of the roof system.



In this photograph (fig. 11), the lower arrow points toward a sheared-off pin on an unthreaded rod. The arrow near the top shows a section of the rod that was threaded for the turnbuckles. It is interesting that while the obviously the "technology" existed for threaded rods (when the upper floors of the building were renovated into an auditorium space), as is shown in the threaded rod at the top, a decision was made to utilize a one quarter inch (1/4") pin instead of a threaded nut.

Upon examination of the attic roof area, it was found that one of the existing rafters had been "sistered" to support a crack or damaged area. Also, another rafter has a significant crack near the junction of the flat roof area. These cracks were caused by the continued spread of the building at the plate height where the rafter connections to the new upper ceiling height did not allow the rafters to flex. Further structural analysis and investigation should be undertaken here.

This is a limited building assessment intended to address the urgent stabilization needs of the Moultonborough Grange hall as identified in summer 2012. Once immediate stabilization/repairs are accomplished, more complete rehabilitation planning is recommended, along with further structural analysis for all future phases of repair. As regards the proposed final repairs to the roof system outlined here, please refer to requirements specified in the H.E. Bergeron Engineers, Inc. review letter dated December 5, 2012 with attached modified drawings and structural note sheet.

Recommendations with Cost Estimates

1. Change the grade around the building. The existing grade around the structure should be sloped away from the building, wherever possible. This may require the removal of trees and bushes and their root systems to allow for proper grading. Prior to disturbance of any such areas, the NH Division of Historical Resources should be consulted with regard to potential archaeological resources.

Cost Estimate Range $ 2,500 - $3,000

2. Foundation and Deck Framing. The foundation and deck framing repairs should be carried out in conjunction with each other due to the need for potential structural repairs when the foundation walls are being repaired, especially in the largest area of damage along the north wall.

The foundation repairs should proceed by first removing all the debris and bad soil types on the cellar floor. Approximately 6 inches of material should be removed and then gravel should be brought in and then floor should be topped with crushed stone.

After any additional shoring up of the deck framing is accomplished in the areas where the stone walls will be repaired, the soil behind the walls should be *carefully* excavated so that the stone foundation can be removed and rebuilt properly. Those repaired areas should then be backfilled with gravel and stone and then the finish grade should be pitched away from the building.

The deck framing repairs should consist of individually constructed and installed steel brackets that will adequately make the various connections in the deck framing structurally appropriate and sound. A significant number of these steel brackets have to be custom fabricated and appropriately installed. The posts and carriers that have been installed to support the joists should also be appropriately attached to the existing joists so that they will not fall out.

Cost Estimate Range $ 23,400 -$ 25,800

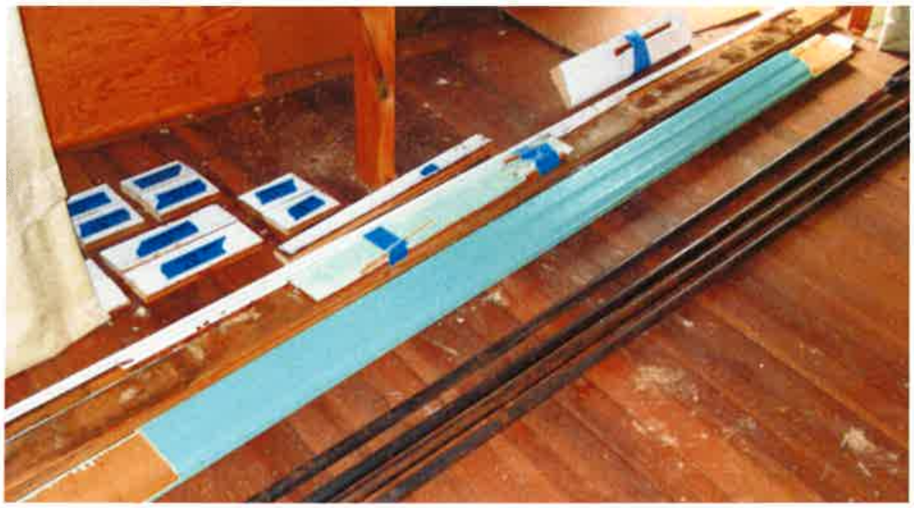
3. Roof System Emergency Stabilization. The existing roof should be stabilized before snow due to the fact that the steel rod system has failed at the connections and any increase of load on the roof would most likely result in the roof collapsing and thereby causing significant and irreversible damage to the entire structure (July – September inspection, see also Garvin report).

The roof system should be temporarily strengthened through the installation and use of at least five heavy duty "come-a-longs" to keep the shed walls of the structure from spreading. Commercial type wall stabilizers may also be located along the sidewalls and attached to the floor to help keep the building from spreading. All of this work will require the careful removal of some of the interior beaded sheathing and also the removal of some of the exterior trim (this work completed October 2012).

Cost Estimate Range $ 6,000 - $ 6,500

Please note: This emergency stabilization work was completed on October 29, 2012 by installing five "come-a-longs" and removing the existing iron rods. Wall stabilizers were not required and the price was reduced to $5,800.00 and has been paid directly by the Moultonborough Historical Society.

4. Roof System Final Repair. After the roof is stabilized, as detailed above, the existing two steel rods with turnbuckles can be reused and relocated appropriately with the proper connections. Two or three more rods, of similar dimension, will then have to be installed. It is recommended that the two existing rods be relocated to the vertical posts in the two chimney bents. One of the three new rods can be installed in-between the chimney bents. The other two new rods should be located on each side of the chimney bents. The installation of the rods will require the *careful* removal of an additional amount of interior woodwork as well as exterior trim. After the rods have been installed, all of the woodwork, interior and exterior, will have to be reinstalled (such as in fig. 12 below).



While it is probable that the existing plates at the eave height have rotted and/or have damaged areas that will have to be repaired, the areas of the plate examined while removing the existing rods appear to be in good condition. Due to the connection of the rafters, cut-off collar tie beams, and the top plate being compromised when the ceiling was raised, all of the areas where rafters are located will require custom steel plating made for each rafter as all interior rafters and their connections are of varying dimensions. This would translate into eight (8) to ten (10) custom-made steel connections. These new steel connections will be hidden behind the walls underneath the bead board, which unfortunately requires the careful removal of more bead board then originally anticipated. The cracked rafter in the attic area will also need to be repaired. It is also possible that the repair that was done to one of the attic rafters in the 1970s might have to removed temporarily so that the building can be pulled back together, and then that rafter can also be repaired.

***** Please note***** For the purpose of this proposal, it is assumed that it will be structurally acceptable to reuse the existing steel rods and add two or three new rods and make appropriate connections for the outside walls. This cost estimate on the Roof System Final Repair is based upon that assumption (see H.E. Bergeron structural review). If it is found that this approach in unacceptable structurally, then another approach will have to be investigated and would probably be considerably more expensive.

Cost Estimate Range $ 24,000-$ 25,500.

Total Project Cost. (stabilization measures not already completed)

Cost Estimate Range $ 49,900- $ 54,300

H.E. Bergeron Engineers, Inc.

PO Box 440, 2605 White Mountain Hwy
North Conway, NH 03860-0440

(603) 356-6936 (phone)
(603) 356-7715 (fax)
www.hebengineers.com

HEB
Civil • Structural • Surveying

December 5, 2012

Steve Bedard
Bedard Preservation and Restoration, LLC
PO Box 430
Gilmanton, NH 03237

Re: Moultonborough Grange Hall, Moultonborough, NH
HEB Project #2012-102

Dear Steve,

H.E. Bergeron Engineers, Inc. (HEB) has prepared the following structural review of the rafter beam repair at the Moultonborough Grange Hall. We visited the site with you on November 16, 2012 and received your proposed repair sketches via email on November 26, 2012. This work was conducted in accordance with our Letter Agreement, dated November 14, 2012.

This review is based on the current New Hampshire building code, IBC 2009 and its related documents, including the ANSI/AF&PA National Design Specification for Wood Construction (NDS-2005).

During our site visit you told us the Grange Hall was originally constructed with tie-beams at the rafter ends and since that time they have been cut off, flush with the wall below. The walls supporting the rafters are bowed outwards due to thrust from the unrestrained rafters. Subsequently, tie-rods were added to the Hall, but failed to alleviate the problem. At this time you propose to repair to restrain the thrust from the rafters utilizing tie-rods attached to the wall top plate and rafters with a steel bracket.

The sketches you provided are generally acceptable as a repair to the cut off tie-beam with the following exceptions/requirements:

- All bolts shall be ¾".
- Bolts shall be installed in two rows with a minimum center of bolts spacing of 2.25" between bolts, 3" from the inside rafter/post edge, and 1.25" from the outside rafter/post edge.
- Tie-beam shall be ½" min. steel rod.
- Tie-rod plate washer shall be 5"x5"x ¼" min.

See the attached marked up sketches and note sheet for structural and structural steel requirements.

Disclaimer:
The opinions and recommendations contained in this report are based on information provided by the Steve Bedard and on a "walk-through" of the site performed as part of this work. Only limited design checking calculations were performed to determine if certain structural members are in compliance with adopted building codes and no physical testing was performed. This report does not address any other part of the structure other than those mentioned, including, nor does it provide any warranty, either express or implied. Rafters were not analyzed as part of the project.

Please let me know if you need additional information or have any other questions regarding the review.

Sincerely,
H.E. Bergeron Engineers, Inc.

Christopher R. Fournier, PE
Senior Project Engineer

STATE OF NEW HAMPSHIRE
CHRISTOPHER FOURNIER
No. 12651
LICENSED
PROFESSIONAL ENGINEER

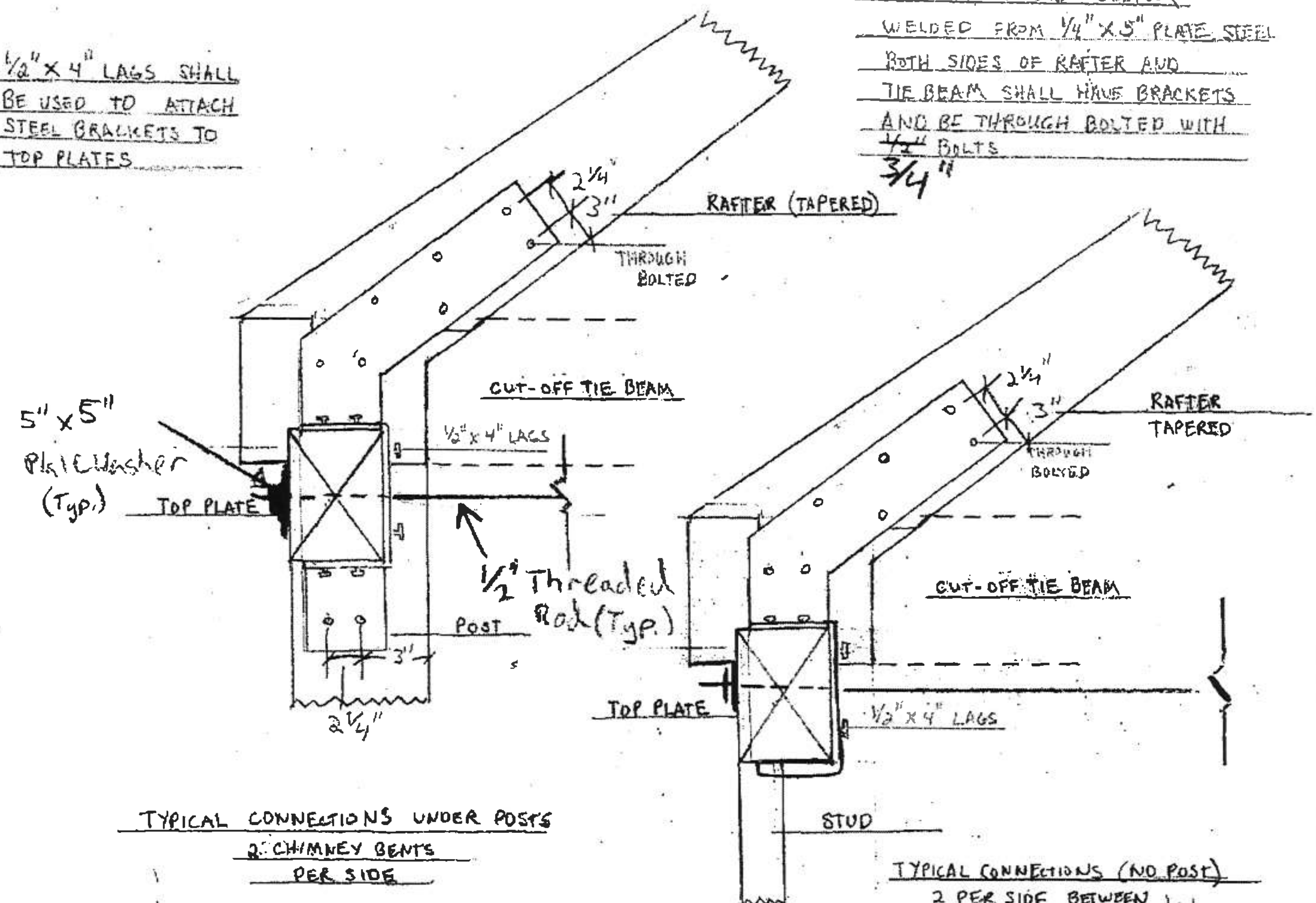
Enclosures

Copy: File

2012-102
JKM
11-05-12
provided by steve Bedard

1/2" x 4" LAGS SHALL BE USED TO ATTACH STEEL BRACKETS TO TOP PLATES

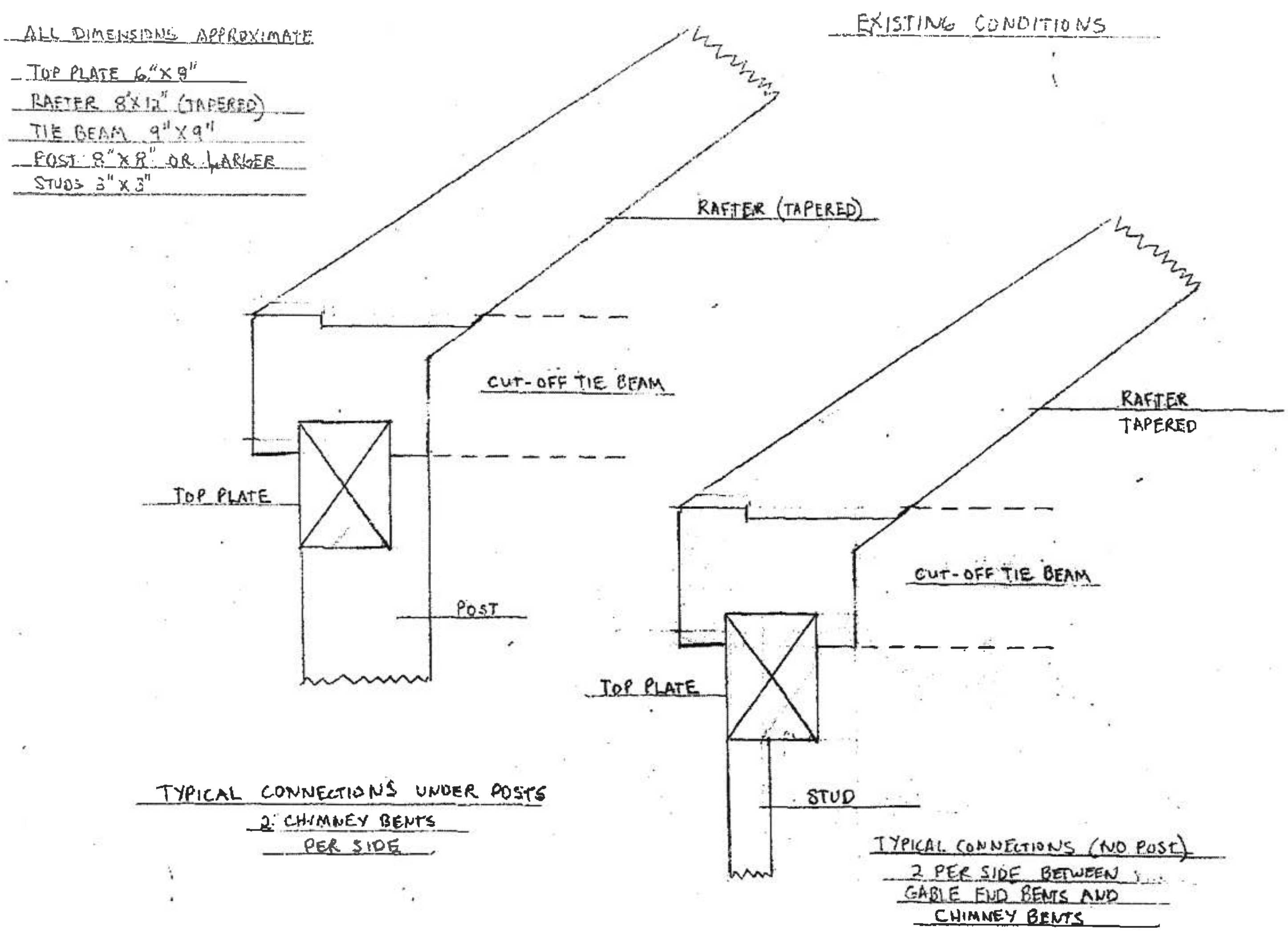
STEEL BRACKETS CUSTOM WELDED FROM 1/4" X 5" PLATE STEEL BOTH SIDES OF RAFTER AND TIE BEAM SHALL HAVE BRACKETS AND BE THROUGH BOLTED WITH ~~1/2"~~ 3/4" BOLTS



TYPICAL CONNECTIONS UNDER POSTS
2 CHIMNEY BENTS
PER SIDE

TYPICAL CONNECTIONS (NO POST)
2 PER SIDE BETWEEN
GABLE END BENTS AND
CHIMNEY BENTS

2012-10R
provided by
Steve Bedard



Structural Notes:

1. All dimensions and existing conditions must be verified by the Contractor in the field. Any discrepancies shall be brought to the attention of the Engineer before proceeding with the affected portion of the work.

2. All construction shall conform to the current New Hampshire State Building Code (International Code Council (ICC), International Building Code (IBC), 2009 Edition, with NH Ammendments).

3. Details shown on any drawing are considered typical for all similar conditions unless noted otherwise.

4. The Contractor shall be responsible for any shoring or temporary bracing required to complete the work.

5. The Owner shall determine the need for structural tests and/or special inspections as required by Chapter 17 of (IBC 2009, and in accordance with the requirements of the local Building Official. The Contractor is required to notify the Architect/Engineer 48 hours in advance of the requirements for any structural tests and/or special inspections.

6. The following criteria was used for the design of the structure:
   - Dead Loads
     - Roof = 10 psf
   - Live Loads
     - Roof = 20 psf
   - Snow Loads
     - Approx. Site Elevation = 560 ft
     - Site Ground Snow Load = 73 psf
     - Terrain Category B
     - Exposure Factor, Ce = 1.0
     - Thermal Factor, Ct = 1.2
     - Importance Factor, Is = 1.0
     - Roof Slope Factor, Cs = 1.0

Structural Steel Notes:

1. All structural steel work shall conform to the American Institute of Steel Construction, Inc. (AISC), Specifications for Structural Steel Buildings, (ANSI/AISC 360-05).

2. Bolts shall consist of ASTM A307 material, and shall be tightened at installation using the turn of the nut method. Bolts shall be ¾"ø unless noted otherwise.

3. All welding and details shall be recommended by the AISC and shall conform to the requirements of the American Welding Society (AWS). Welding shall be performed by AWS certified welders. Minimum size of fillet welds shall be 3/16 inch. Minimum return shall be 1 inch. Weld shall be done using an E70XX electrode.

4. Structural steel to be ASTM A36 steel. Minimum yield stress to be 36 ksi.

5. All structural steel members shall receive a coat of shop primer.

H.E. Bergeron Engineers, Inc.
PO Box 440, 2605 White Mountain Hwy
North Conway, NH 03860-0440
www.hebengineers.com
Phone (603) 356-6936
Fax (603) 356-7715
Civil • Structural • Surveying

Construction Notes
for the
Moultonorough Grange Hall
located in
Moultonborough, New Hampshire
prepared for
Bedard Preservation and Restoration, LLC

		PROJECT	2012-082
DESIGNED BY	JKM	REVISION	—
DRAWN BY	JKM	DATE	12/05/2012
CHECKED BY	CRF	SCALE	N.A.