

ROOF EVALUATION REPORT

**PRINCETON TOWN HALL
(BAGG HALL)
6 TOWN HALL DRIVE
PRINCETON, MA 01541**

Prepared For:

**Mr. Robert Reed, Town Administrator
Town of Princeton
Princeton, Massachusetts**



Prepared By:

**Northeast Roof Consultants, LLC
2 Peggy Drive
Southborough, MA 01772
(508) 490-9937**

Date: August 23, 2015
NRC Project No. 150024

August 23, 2015

Mr. Robert Reed
Town Administrator
Town of Princeton
6 Town Hall Drive
Princeton, MA 01541

RE: Roofing Consulting Services
Roof Investigation & Report
Bagg Hall
Princeton, Massachusetts

Dear Mr. Reed:

Following is the result of our roof evaluation performed at the above referenced location on Thursday, August 13, 2015. The evaluation included a visual inspection of the roof utilizing the Town bucket truck. We examined the existing conditions in the field of the roof, perimeter locations, valleys, hips, ridges and wall bases. The gutters and down spouts were also inspected to see if repair or replacement is necessary. No test cuts or slate samples were taken as part of this report. An inspection of the building interior, including the upper floor and attic space were performed to view the location and extent water damage in these areas. Our cost estimates are based on visual defects observed while on site and typical costs for similar work in other locations.

A specific scope of work for future repairs should be provided to all qualified contractors bidding on the work, so that the Town of Princeton can accurately evaluate the bids.

Our scope of services for this project included the following:

INVESTIGATION/ EVALUATION PHASE

1. A review of all records, reports, proposals, drawings, specifications and other documents pertinent to the project.
2. Visit the site and perform a visual inspection of the roof, noting rooftop deficiencies in the field of the roof, perimeter locations, valleys, flashings, gutters and drainage system. An inspection of roof to wall intersections, rain shelves, and other above roof components will be conducted to determine whether these areas are contributing to the existing moisture problems.
3. Perform a visual inspection of the building interior to note any areas that have been affected by moisture penetration.
4. Prepare a written report including observations and conclusions, photo documentation, recommendations and estimated construction costs for the proposed repairs or corrective action.
5. Attend a meeting with the Client to discuss roof repair/replacement options and their associated costs.

I. IDENTIFICATION

Subject: Princeton Town Hall (Bagg Hall)

Location: 6 Town Hall Drive
Princeton, MA 01541

Evaluation Date: August 13, 2015

Report Prepared By: John R. Skypeck
Registered Roof Consultant

Site Contact: Mr. Steve Mirick
Mirick & Daniels
508-962-1598

Client: The Town of Princeton, Massachusetts

Roof Access: Access to the roof was provided by the Town of Princeton,
Light and Power Department via a town bucket truck.

Available Documents: No existing original architectural drawings were available for
review. A review of the recent HKT Architects, Inc. Report
provided minimal information concerning the condition of the
Bagg Hall roof. Documents pertaining to the history of leaks,
repairs and roof renovations were not available, if they exist.

Reliance: This report is for exclusive use and may be relied upon by the
Town of Princeton and there selected personnel. No parties or
persons other than those identified as authorized users may
use or rely on the information or opinions in this report without
the express written content of Northeast Roof Consultants,
LLC.

II. DESCRIPTION

(General) - The main roof over Bagg Hall is a hip-style roof sloping to all four perimeters of the building. A small wood framed cupola is located at the center ridge line of the main roof and is also covered with a small hip-style roof. The lower front entrance to the building is covered by a steep-sloped gable roof which drains to the sides of the main entrance. In addition, a gable style dormer roof is present at the main roof level and located directly over the front entrance. A conical shaped cone roof (steeple) is present at the southwest corner of the building, and is the highest roof on Bagg Hall. The building, built-in 1884, (130+ years old) is a brick masonry and wood framed structure, which utilizes wood rafters and tongue and groove boards of varying widths for the roof deck. The upper main roof, including the front dormer and the cupola roof all have a general roof pitch of 10:12. This means that for every foot of horizontal length the roof rises approximately ten inches (10"). The low front entrance roof has a pitch of 12:12. The roof on the steeple varies slightly, but has a general pitch of 24:12. The roof ridges are covered with an ornamental copper metal ridge cap secured through the top of the ridge cap. The hips are covered with a straight V-shaped copper cap, also fastened through the top of the cap.

Based on conversations with on site personnel and through our observations, the Bagg Hall roof has suffered from periodic leaks for a prolonged period of time. Numerous repairs were noted on the various roof areas, including repairs required for renovations work including the removal of the original chimneys. The repairs include replacement of isolated random shingles, concentrated repairs from past renovation work and replacement of aged or deteriorated metal flashings. Previous repairs and replacement have been noted at the gutters and down spouts. These include, new sections of gutter, replacement of deteriorated down spouts and coating of the gutter interiors with an asphaltic black coating.

An inspection of the attic space revealed that the center cupola had unobstructed opening from the roof level into the exposed attic space. The roof over the cupola was the only covering preventing water infiltration into the attic. In addition, we noted previous water staining on the wood rafters and decking in select areas. Several of the wood rafters under and around the remaining chimney are badly cracked at this time. The top finished floor of the building had numerous water stains and interior damage throughout the ceiling and upper half of the interior walls.

The original slate is an unfading black slate from Maine, commonly known as "Monson Black". According to documents on the history of slate, Monson is the name of the specific town in north central Maine where a majority of the black slate was quarried in the late 1800s, and early 1900s. Although no longer quarried, small quantities of salvaged Monson slate are available. Monson slate are considered some of the best quality slate ever produced.

The original slate are 8" wide by 12" in length and $\frac{1}{4}$ " to $\frac{3}{8}$ " thick and appear to be grade S1. S1 is the highest rating and the only slate that should be used for as roofing slate. The existing exposure varies from $4\frac{1}{4}$ " to $4\frac{3}{4}$ ". Typically slate of that size were installed with a $4\frac{1}{2}$ " exposure. The exposure is the part of the slate visible from the exterior. Slate installed in this fashion typically had a 3" headlap. Headlap is the amount of slate that is lapped by the second course of shingles above. This headlap is what makes a roof watertight. Many of the

slate used for repairs are either slightly smaller or slightly larger than the original. Larger slate were simply cut down to fit the space.

Although not visible from either the exterior or attic space, typically a layer of heavy asphalt saturated felt was installed over the wood deck prior to installing the slate. The felt was used as a temporary waterproofing layer while the roof was being installed. Felt paper was often omitted on roofs where leaks weren't a major concern, such as over barns and other holding structures. It is probable that for a roof that is over 130 years old, that the felt has disintegrated and no longer offering any type of protection for the building.

The metal flashings at wall intersections, valleys, chimneys, hips and ridges appears to have been replaced over a period of time. Generally, red copper was used as a replacement material which may match the original flashings installed in 1884. The gutters and down spouts also have been replaced in the past, with the existing gutters and down spouts in generally poor condition. The gutters are 5" wide by 5" deep and are hung on 1¼" wide copper straps, which extend under the first course of slate and is secured to the wood decking. The exterior of the gutters have been painted red to match the exterior soffit and wood trim of the building. A section of gutter over the front entrance and adjacent to the front steeple was replaced with a red copper hanging gutter within the past 3-5 years. With the exception of the steeple roof and front entrance roof, all other roofs drain into perimeter gutters and drains into down spots to the ground below.

Snow guards are present along the bottom of the northeast elevation of the roof only. A snow fence system with metal brackets and three rails is in place to prevent ice and snow from sliding off the roof to the parking area and sidewalk below.

We observed only two penetrations through the roof. Both appear to be plumbing stacks and are located on the northeast side of the main roof area.

Roof Area Calculations

<i>Roof Location</i>	<i>Roof Type</i>	<i>Roof Pitch</i>	<i>Roof Area</i>
Front Entrance	Slate	12:12	130 sq. ft.
Steeple	Slate	24:12+	550 sq. ft.
Upper Front Gable	Slate	10:12	100 sq. ft.
Front Hip Roof	Slate	10:12	390 sq. ft.
Rear Hip Roof	Slate	10:12	546 sq. ft.
Upper Main NE Side	Slate	10:12	1,330 sq. ft.
Upper Main SW Side	Slate	10:12	1,170 sq. ft.
Cupola Roof	Slate	10:12	48 sq. ft.

III. ROOF/FLASHING ISSUES

Slate Roofs: The slate roofs are suffering from typical problems associated with this type of roof covering. These include random broken, missing, cracked, lifting and loose slate shingles; and repairs done with slate of different size and thickness. We also observed slate that were installed with the pre-punched holes visible and exposed to the weather. Many of the previous repairs were poorly done and have subsequently failed. These include slate around the remaining brick chimney. areas where previous roof projections were removed and random isolated slate. Some slate have been covered with an asphalt mastic in lieu of removal and replacement. The steeple has an inordinate amount of slate in need of repair and replacement. Slate work done on very steep roof areas and curved roof decks need proper attachment to the substrate and special attention to the nail length at the curved areas. Typically, slate roof replacement is recommended when the number of slate in need of repair or replacement exceeds 30%. The number of slate needing attention at this time falls well below the 30% level. Our estimate at this time, is that approximately 300 slate require repair/replacement. Unfortunately, some slate may be broken under overlying slate and not visible during the course of this investigation.

Flashing: Much of the existing metal flashing appears to have been replaced previously, with the most recent work performed around the base of the steeple and front upper roof dormer. This includes the chimney flashing and cricket, the hip and ridge caps, valley flashing and wall base flashing. The copper metal repairs appear to be in generally good condition, although the finished slate work around the metal flashing repairs is questionable. We noted that the ridge cap was lifting at the ends of the ridge, and that exposed fasteners were used to secure the ridge and hip caps rather than hidden or blind cleats. As no destructive test cuts were performed as part of this investigation, we could not determine if the flange of the ridge cap was wide enough to cover the head of the last full course of slate. This may allow for water infiltration along the line. Voids were observed in the masonry joints where new copper counter flashing had been installed. This may allow water behind the flashing and under the slate roof.

Gutter and Down Spouts: Although portions of the gutter have been recently replaced with new copper hanging gutters, the majority of the gutters are aged and in need of future replacement. The gutters have been coated with an asphaltic based coating to extend the useful service life. Sections of the gutter were holding water on the day of the inspection. Several of the down spouts were found to be severely corroded where they intersect the bottom of the gutter. This may be due to ice formation during winter or the use of dissimilar metals, which can accelerate corrosion of the metals.

Low Rear EPDM Roof: Although not part of the scope of work, a brief inspection of the adhered, unreinforced Ethylene Propylene Diene Monomer (EPDM) roof was performed. The roof appears to have been installed in accordance with manufacturer's requirements and is in good condition. A small area of edge metal has detached from the cleat and is loose.

IV. MAINTENANCE & WARRANTY INFORMATION

Roof Warranty:

Slate Roofs - Not Applicable, although the recent repairs may have a short term guarantee from the installing contractor.

EPDM Roofing – No warranty information was available for the EPDM roof in the rear of the building. The Town of Princeton may have this information in their files.

History of Repairs:

Repairs to the slate roofs were evident in many areas. The exact age of all the repairs is unknown. Coating of the hung gutters with an asphaltic coating is considered a short term repair (5-7 years).

History of Roof Studies/Inspections:

Northeast Roof Consultants, LLC is not aware of previous roof-only studies. A report by HKT Architects, Inc. briefly references the roof over Bagg Hall. A roof inspection with written report is recommended for this roof at least once a year.

V. CONCLUSIONS/ RECOMMENDATIONS

The majority of the slate roof is in good condition and with proper repairs and maintenance could last an additional 20-30 years before replacement is necessary. Those slate needing repair or replacement should be replaced by an experienced and qualified contractor familiar with slate roofs and slate roof repair. Small quantities of salvaged Monson slate are still available. The closet match still being quarried is a slate called "North Country Black". This slate is quarried in Quebec.

Repairs to the upper main roof could be done by utilizing hook ladders and planks as necessary. This would distribute the weight of the roofers and prevent additional damage to the slate roof by walking on the slate. Work on the steeple roof will require either staging or the use of a lift/ bucket truck. In areas where multiple repairs need to be done slate roof scaffolding brackets may be necessary.

Damaged or loose slate should be removed using a slate ripper. Loose slate that are still in acceptable condition may be reused. Slate should never be turned over and reused in the fashion. New slate should be secured with one of two methods: the nail and copper bib, or using a slate hook. The bib method allows for the replacement slate to be slid back into the void where the broken slate was removed. A copper or stainless steel nail is driven between the vertical joint of the two slate above. A copper bib (small piece of sheet metal) is slid into place over the top of the repair slate and under the slate that form the vertical joint. The top of the bib is often folded to hook over the top of the repair piece. Sealant should be applied over the head of the nail before the bib is applied. A slate hook is generally 3 inches long and nailed through the vertical joint in the underlying slate. The replacement slate is slid in place and the butt of the slate will rest on the hook. Heavy wire and nails are also an acceptable alternative to the slate hook. Only copper or stainless steel nails are recommended.

The gutters and down spouts are nearing the end of their useful service life and should be replaced over the next few years or as budget allows. Replacement of the hung gutter will require removal of the first few courses of slate to expose the gutter strap fasteners. Once the old gutters are removed a new gutter can be installed. The new attachment method can vary from the original, unless the local historic commission is involved. Once a new gutter design is accepted, replacement of the cant, eave slate and new drip edge can be completed.

The newer EPDM roof over the rear one story structure is in good condition and needs no repair work at this time. The small section of edge metal referenced previously should be re-crimped on to the underlying cleat to prevent wind blow-off. It is important to review the warranty language (if applicable) as some manufacturer's require yearly inspections be documented for the continuation of the warranty coverage.

VII. RECOMMENDATIONS

Funds should be budgeted for short term slate roof repairs and future gutter and down spout replacement. Without the slate repairs, the building interior is susceptible to water infiltration through the roof and continued damage to the interior elements.

COST ESTIMATES:

1. (Slate Repair) - Since the slate that require repair/replacement are located randomly throughout the various roof areas, and not clustered in one or several large areas, estimating the repair costs is difficult. The cost not only depends on whether salvaged Monson slate can be found, but also on the type of access that is required for the roofing contractor to reach the various areas. Typically large concentrated areas can be repaired for \$30-\$75 per square foot. Individual slate replacement can range from \$40 to \$200 per slate depending on the access, pitch of the roof and size and type of slate used.

For budgetary purposes, repairs to the steeple roof are estimated at \$15,000. This is based on 75 slate @ \$200 per slate. This covers materials, shipping, access and insurance.

The upper main roof and lower front entrance roof have somewhat easier access and less of a roof pitch. For budgetary purposes we estimate the repairs at \$25,000. This cost is based on an estimated 250 slate @\$100 per slate. This cost also covers materials, shipping, access and insurance.

Estimated Construction Cost –Slate Repairs/Replacement
(Steeple Roof) - 75 Slate @ \$200 per Slate = \$15,000
(Other Roofs) – 225 Slate @ \$100 per Slate = \$25,000
Total = \$40,000

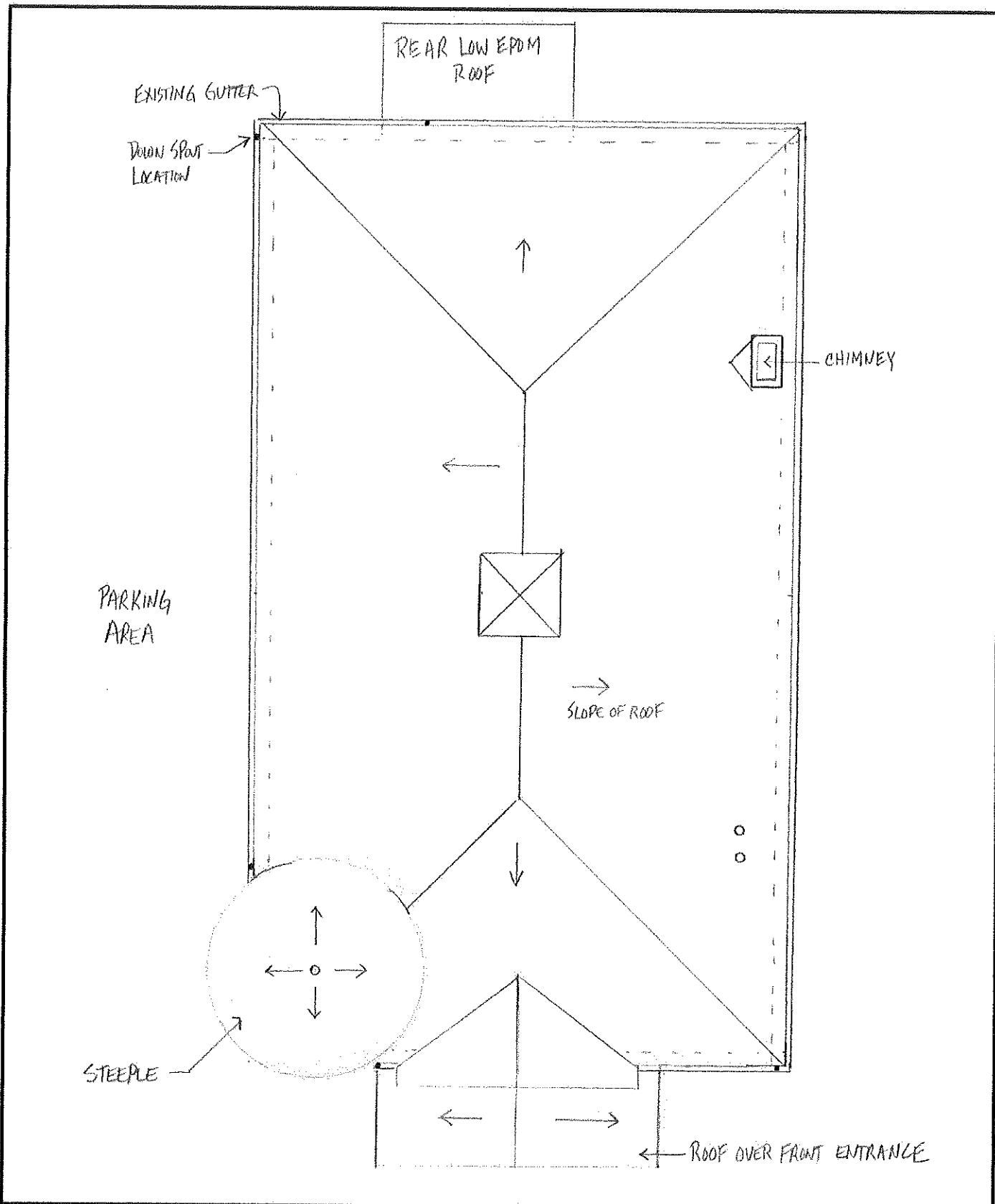
(If repairs are delayed, the number of estimated slate in need of replacement may increase and undetermined amount.)

2. Replace existing hung gutter as follows: Remove several courses of existing slate to expose gutter strap fasteners. Once exposed remove existing gutter, straps and down spouts. Install new wood cant along edge of roof and new copper drip edge. Strip in flange of drip edge with strip and ice and water shield. Install new 20 ounce red copper hung gutter and hook back of gutter to drip edge. Install gutter spacers as required. Secure and attach new down spouts in original locations. (Gutter attachment must not only take the weight of the gutter, but any loads associated with snow and ice.)

Estimated Construction Cost – Gutter Replacement
(Upper Main Roof Only) - 180 (LF) @ \$125/LF = \$22,500*

(* Other gutter materials or alternate replacement design could be done for less than the estimate for the copper gutter shown above.)

The above listed estimates do not include the cost for design fees (if applicable), permitting, hazardous material testing, structural deck renovation (if any) and hidden conditions. These estimates are preliminary and for budgetary purposes only. More accurate costs are possible after a defined scope of work is established by the Owner.

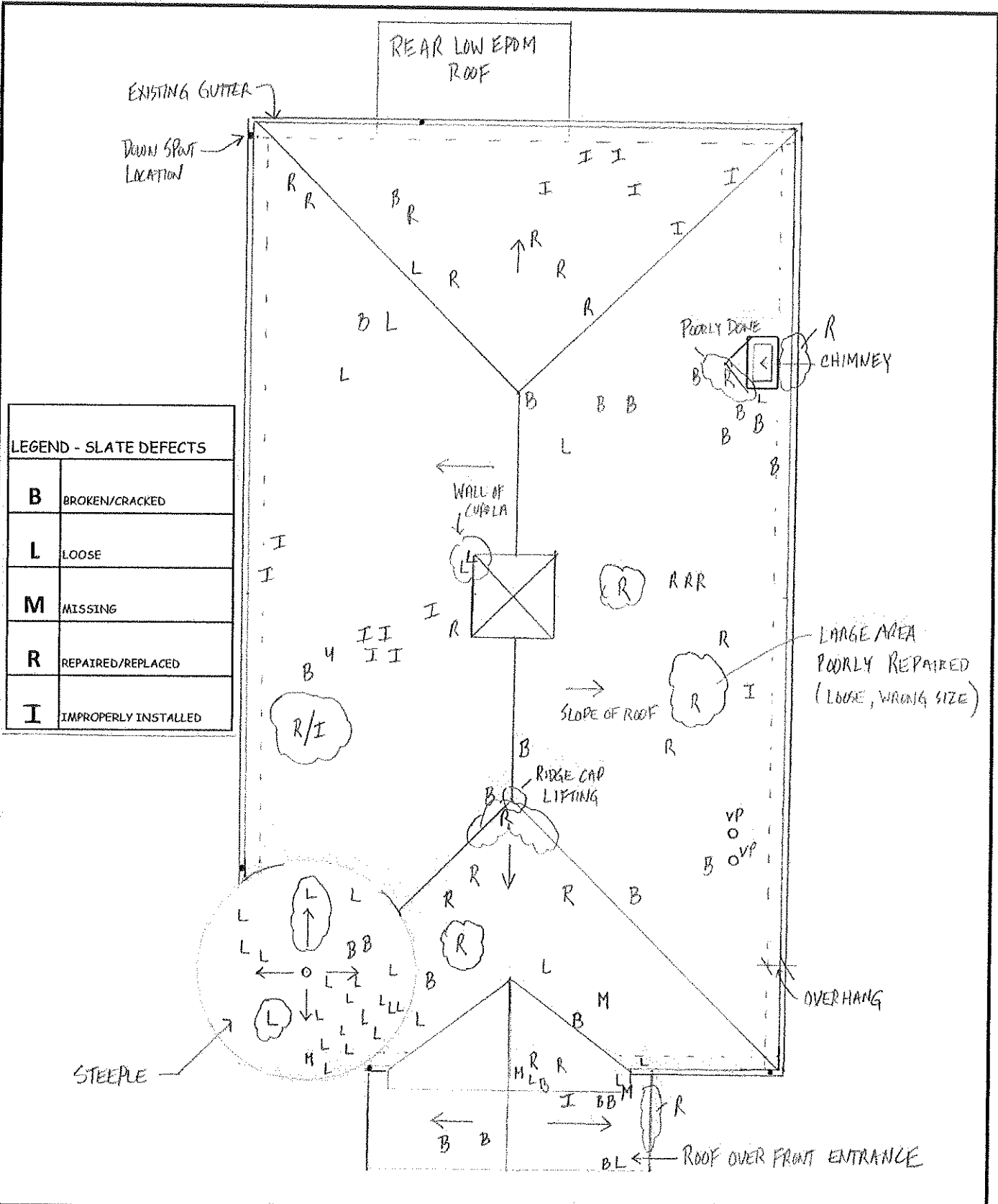


NORTHEAST ROOF CONSULTANTS, LLC
 2 PEGGY DRIVE
 SOUTHBOROUGH, MA 01772
 508-490-9937

PRINCETON TOWN HALL
 BAGGS HALL
 1 TOWN HALL DRIVE
 PRINCETON, MA 01541

DRAWN BY:	SCALE:
JRS	1" = 10'
DATE:	REV. DATE:
8/16/2015	
DESCRIPTION: Roof Plan	

DRAWING NUMBER:
 SK-1



LEGEND - SLATE DEFECTS

B	BROKEN/CRACKED
L	LOOSE
M	MISSING
R	REPAIRED/REPLACED
I	IMPROPERLY INSTALLED

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ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R1

08/13/15

Photo Location:

Parking Area
Facing North.

Description:

View of the conical shaped steeple roof and upper main hip roof to the left.



Photo R2

08/13/15

Photo Location:

View facing west.

Description:

Overview of front hip roof and front dormer over the main entrance to the building.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R3
08/13/15
Photo Location:
Attic interior.

Description:
Opening directly
below center
cupola over main
roof ridge line.



Photo R4
08/13/15
Photo Location:
Attic interior.

Description:
Old water stains on
existing wood
rafters below upper
main roof.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R5
08/13/15
Photo Location:
Upper floor.

Description:
Peeling paint on ceiling and walls from roof leaks.



Photo R6
08/13/15
Photo Location:
Interior upper floor.

Description:
Water damage to plaster ceiling exposing wood lath.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R7
08/13/15
Photo Location:
Upper main roof.

Description:
Typical original
Monson slate on
main roof.



Photo R8
08/13/15
Photo Location:
Low front entrance
roof.

Description:
New red copper
counter flashing
and step flashing at
roof to wall
intersection. Note:
void in masonry
joint at new work.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R9
08/13/15
Photo Location:
Upper main roof
northwest
elevation.

Description:
View of existing
hung gutter at base
of slate roof.



Photo R10
08/13/15
Photo Location:
Northeast
elevation.

Description:
Existing snow
fence along edge of
slate roof over
parking area. Note:
two plumbing vents
with copper cone
flashing above
snow fence.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R11

08/13/15

Photo Location:

Roof over front entrance.

Description:

Cracked slate adjacent to new copper flashing. Most likely caused by installers of new copper flashing.



Photo R12

08/31/15

Photo Location:

Roof over front entrance.

Description:

Broken and loose slate along rake edge of roof.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R13

08/13/15

Photo Location:

Upper main hip roof.

Description:

Loose slate in field of the roof.



Photo R14

08/13/15

Photo Location:

Upper main hip roof.

Description:

Broken slate adjacent to replaced slate.
Note: Bottom of slate hook visible at butt end of slate.
Adjacent slate most likely caused by replacement of underlying slate.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R15
08/33/15
Photo Location:
Upper main hip
roof.

Description:
Large area of
replaced slate.
Note: Use of slate
smaller than
original does not
provide adequate
coverage of
underlying slate.



Photo R16
08/13/15
Photo Location:
Valley of front
dormer roof.

Description:
Loose slate at base
of copper valley
flashing. Note:
broken slate from
above caught in
gutter.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R17
08/13/15
Photo Location:
Upper main hip
roof.

Description:
Lifting slate along
hip line of main
roof. Underlying
nail may not have
been set properly.
These slate are
likely to break in
time.



Photo R18
08/13/15
Photo Location:
Upper main hip
roof.

Description:
Slate installed
upside down with
pre-punched holes
exposed to the
weather.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R19

08/13/15

Photo Location:

Base of steeple roof.

Description:

Numerous loose slate at curve in steeple roof. Longer nails required to conform to curved section.



Photo R20

087/13/15

Photo Location:

Steeple roof.

Description:

Loose slate in upper middle section of steeple.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R21
08/13/15
Photo Location:
Upper main hip roof.

Description:
Slate around new cricket flashing poorly installed.



Photo R22
08/13/15
Photo Location:
Upper main hip roof adjacent to remaining chimney.

Description:
Poorly matched slate and poorly installed slate around chimney repair.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R23

08/13/15

Photo Location:

Upper main hip roof.

Description:

Lifting ridge cap at end of ridge line. Heavy winds can lift cap even high and allow wind driven rain under the cap.



Photo R24

08/13/15

Photo Location:

Roof to wall intersection at front entrance roof.

Description:

Void in masonry joint at inside corner above new red copper counter flashing.

ROOF EVALUATION
TOWN OF PRINCETON (BAGG HALL)
PRINCETON, MASSACHUSETTS
(Photo Documentation)



Photo R25
08/13/15
Photo Location:
Upper main hip roof edge.

Description:
Existing hung gutter is holding water despite little or no rain the previous few days.



Photo R26
08/13/15
Photo Location:
Rear of building above low-slope roof.

Description:
Overview of adhered EPDM roof system. Wood blocking should have buffer pad between wood and EPDM membrane.