



**NH Preservation Alliance
Historic Barn Assessment Grant Program**

Houston Barn

Houston Drive, Contoocook, NH

Owner: Town of Hopkinton, NH

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Assessment Report by:



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Overview

Known as the "Houston Barn," this impressive barn is a dominant landmark on Houston Drive, which is on the north side of Pine Street less than a half-mile west of Contoocook Village in Hopkinton, NH.

Previously used for keeping hay and dairy cattle prior to being purchased by the Town of Hopkinton, it stands high on a prominent knoll. It overlooks and is attractively surrounded by other Town facilities more recently developed on the one-time agricultural land, today including the public library, recreational sports fields, children's playground, and a senior center. Although two other original farm buildings were removed, the newer public buildings were designed to complement the barn's appearance and reflect its agricultural heritage. (A remarkable granite water trough salvaged from the barn now greets visitors at the library.)



Photo #1- Hewn granite water trough, previously located at Houston Barn.

Since the initial purchase twenty-five years ago, the residents and officials of Hopkinton have conducted wide-ranging debate and study on options for the Houston Barn's future, including its ultimate best use, conservation, or removal. Over that time, various Town committees have published many written comments and conducted planning studies. It is hoped this assessment and report may help further that process to a productive conclusion and a near-term plan of action.

Since other competent in-depth histories and engineering studies have been commissioned and created over the last two decades, including the well-detailed application to the NHPA for this assessment, this author will not duplicate them here but suggests that they be referenced in combination with this report.

(For example, physical labeling and compass directions, etc. will here follow those of the 1999 drawings by SFC Engineering. Thus for consistency the main door and gable-end towards the playing fields will be considered "Project North" and specific areas within will be designated by the SFC mapping terminology.)

Please note this writer does not claim professional qualifications regarding engineering considerations, accessibility issues, and life-safety codes, etcetera, that may apply to potential conversion of the barn for public assembly functions. The perspective offered here is one of a specialist craftsman with several decades of experience in assessing, repairing, and restoring other historic barns in the local area. This report is therefore focused on the physical condition and immediate needs of the structure as it stands, in regard to its conservation.

History and Ownership

This barn is presently owned by the Town of Hopkinton NH, which purchased the Tyrus C. Houston Farm in 1997.

The present massive (100' x 44' x 50'high) barn is said to have been built in 1912 over the same footprint of a smaller barn destroyed by fire circa 1908. Observations in the basement support that hypothesis.

The barn has braced-frame construction, a hybrid of heavy softwood posts and beams assembled with traditional pegged joinery, utilized in combination with more modern type 2" thick "dimension lumber" studs, joists, and rafters. This was typical of the transitional period between classical heavy timber framing, and lighter modern "stick" framing.



Photo #2 - Typical view of barn frame showing heavy timber "bents" and "balloon" type wall studding.

Notably, the full height 'balloon frame' type wall studs are almost 20ft. long, and the barn thus achieves the high-volume efficiency resulting from both unusually tall walls and a gambrel style roof. This was a radical departure from typical First Period New England barns. The gambrel design also facilitated a rope-powered overhead hay trolley and forks that were state-of-the-art for handling massive quantities of loose hay in bulk before the advent of mobile gasoline-powered hay balers. The Meyers "Clover Leaf Unloader" forks, trolley, and overhead rail system remain visible suspended high up under the ridge.

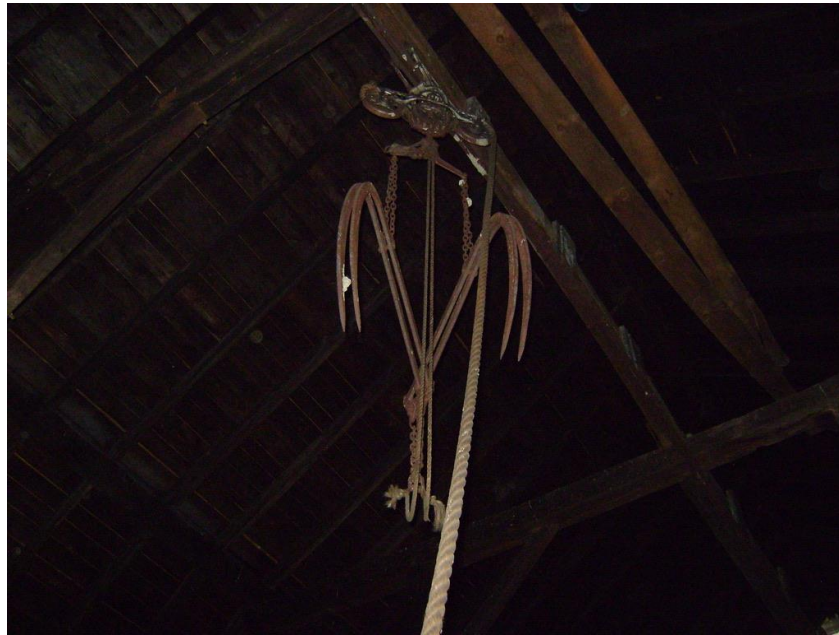


Photo #3 - Meyers Clover Leaf Unloader hay forks and trolley in situ.

Also in keeping with the agricultural science of the time, and the aesthetic ideals, it boasts an imposing rooftop ventilator/cupola. (It was originally taller but was reduced in height in the 1940s by Tyrus Houston.)

The building thus authentically represents the immediate pre-WWI period, in both style and construction. It displays a contemporary pride in progressive farming, and testifies to a bygone era when New Hampshire fostered an affluent agronomy.

From 1931 onward it was part of a farm owned and operated by members of the Tyrus Houston family. Through the mid-twentieth century, it supported mixed farming, then a later specialization in retail dairy products marketed locally until 1975. The barn retains many modifications made to keep it updated for efficient and hygienic dairy production, such as concrete feed troughs and plumbed-in individual automatic watering points. Cattle areas are wood paneled, sealed with either whitewash or aluminized paint for public health reasons, and provided with controlled ventilation points for livestock well-being.

A smaller "horse barn" connected by a shed to the south-west corner was removed to Northwood, NH, in approximately 2005. There is also evidence, in the foundation wall and in-filled clapboards, that supports the anecdotal information of a large 'ell' wing, no longer extant, running east perpendicular from the main barn's north end. This, and the farmhouse (since demolished) to the south of the smaller horse barn, can be seen in a photograph dated 1931. It appears this was a large and prosperous operation of the time and doubtless an important part of the community, surviving even as agriculture generally declined in New England.

Under latter-day Town ownership, multiple reports have been generated, and many discussions conducted, and opinions solicited, regarding the future of the Houston Barn and its potential value to the residents of Hopkinton. Meanwhile during that time, considerable investment has been made to protect and preserve the building, in physical repairs and upgrades such as modern re-roofing and re-siding.

This important upkeep has bought time for planning. It also allowed the barn to serve in the interim as unfinished storage space for various town groups such as sports teams, to provide an interior space for Fire Department training, and to house maintenance equipment for the surrounding grounds and playing fields. At this time the barn has no active electrical service, nor running water connection beyond a single exterior standpipe.

One proposal for the future suggests that the barn be upgraded as a finished and conditioned space for public assemblies and social functions. That would require evaluations beyond the scope of this report, but certainly the concept might seem reasonable and desirable.

Existing Conditions & Recommendations

Overall, the Houston Barn is in a remarkably good condition. Such "survivors" are increasingly rare and cost prohibitive to replace in kind.

It sits notably upright and level, its foundation continuing to serve despite some visible flaws. Its heavy timber frame, board sheathing, and wood flooring are largely sound. It was clearly both designed and raised with care and skill, and consequently has held up well for the most part, honoring its builders.

Some areas of past neglect can be found, but are limited. Although having emergent needs today, recent re-roofing and re-siding have preserved the sheathing and framing, and indeed the barn itself, for the moment. Foundation drainage and soil erosion is an ongoing issue, especially on the east side. There is some evidence

of wood-boring insect activity in the structural members. Limited frame-timber displacement and some other areas of pre-existing faults remain to be corrected.

The barn largely retains its integrity overall, and if cared for its continued existence is certainly possible indefinitely. The particulars to follow will necessarily focus on pointing out various defects and exceptions, but are not meant to denigrate the barn's value as a whole. Again, prior reports and studies by others should also be reviewed for their supplemental details and to gain a full perspective.

Roof

Barns live or die by their roofs. Vast numbers have been forever lost from this factor alone. Fortunately, the Houston barn was re-roofed in recent memory and this undoubtedly saved it. Unfortunately, as with many other buildings in recent decades, it has suffered the catastrophic premature failure of the asphalt shingles used. They are in very poor condition, especially on the west side. The east side is not as bad yet, but sure to follow.

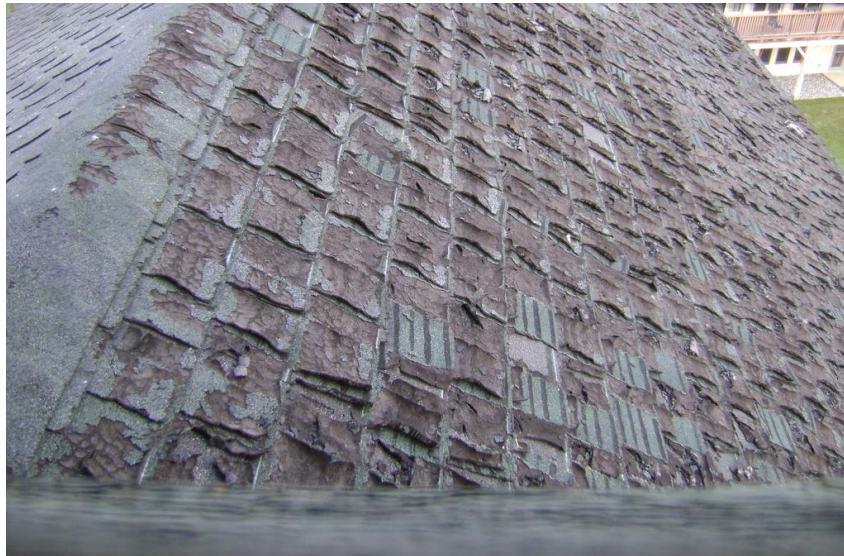


Photo #4 - Roof shingles in extreme failure, west side.

On the plus side, there is a layer of modern 1/2" tongue-and-groove plywood under the shingles, providing the benefit of a smooth surface and secure attachment for roofing. The original board sheathing below the plywood also seems sound, and the 2" x 7" common rafters appear to be expertly fitted and in good condition. The upper pitch is about 8:12 and the lower pitch is about 14:12.

Roof Recommendations

The roofing shingles are in extreme failure and the barn should be re-roofed as an urgent priority.

Given a history of similar class-wide failures among products from several shingle manufacturers in recent decades, it is difficult to recommend asphalt shingles, regardless of advertised warranties.

A painted/galvanized metal roof seems likely to be more reliable for the long run. Screw-down ribbed panels are simple, good value, and have demonstrated a long life span. They are visually rustic but appropriate for agricultural buildings. Site-formed "standing seam" metal roofing is perhaps more elegant but is also more expensive. Specialty products such as genuine or faux slate could be considered. In all these examples it should be noted that snow and ice build-ups may drop precipitously, and snow guards (and ground-level snow removal needs) should be considered, especially if the basement doors are to be used in winter.

Foundation

The foundation provides for a full basement, with the added benefit of three drive-in access doors in the lower west wall, and exceptionally tall headroom throughout. Except on the west, it is largely of dry-laid natural granite in its lower three quarters, capped by a poured concrete wall adding 2 feet or more in height. It seems this extra height was added during reconstruction after the fire of 1908. As was also about four feet in added width, and approximately twenty feet in extra length, evidenced by the original stonework dimensions, included an abandoned approach ramp at the north door now encapsulated below the newer barn's floor.

This large and remarkably deep basement was reportedly "filled to the ceiling" with manure stored during winter to preserve its valuable nutrients until being spread on fields and pastures. In the main floors overhead, wood "scuttles" are found, which could be opened to drop manure down daily from the cattle tie-ups. Much of the basement has a rudimentary concrete slab floor, and combined with the unusually generous headroom, and open "walk-out" access, this makes the basement exceptionally useful.

Within the concrete slab floor is a large visible ring where an internal silo once stood, in the west aisle between frame bents #4 and #5. Relatively newer wood framing in the floor above is another artifact, and water damage to the wood in that area may be related to the silo and its subsequent deletion. (A marker of evolving agricultural construction practices, airtight silos allowed green materials, such as corn stalks, to ferment and be preserved as valuable feed.)

The western wall of the basement differs in being a combination of poured concrete stem-wall, about waist high, topped by wood framing, incorporating three doorways each large enough to accept vehicles. Five modern windows provide light. An area at the north-east is subdivided by a full height poured concrete wall, probably added a later date, to support a slab floor above which displays a date of 1969. The basement also shows an arched opening, now in filled with cinder blocks, in the south foundation wall. This may have been a post-1912 passageway connecting under a shed to the horse barn nearer the farmhouse.

The interior of the barn generally is supported by rows of 12" x 12" concrete columns, roughly nine feet tall, and probably original. It should be noted that in 1912, concrete reinforcement with steel "re-bar" was a new engineering concept and rarely used, although routine today. It seems unlikely that steel reinforcing was added to the concrete to the Houston Barn foundation. The posts appear to be adequate at this time.

As documented in other reports, some cracks and distortions are evident in the concrete in the raised portions of the south and east walls, but the overall average elevations have fortunately remained fairly true.

The stem-wall on the west side, however, does have more visible issues. Although the barn's elevations remain true, and no overall settling is evident, cracking and distortion of the (un-reinforced?) concrete is readily visible, especially at its north end. Also the several individual sections of concrete show some tilting outward to the west, and a departure from plumb by several inches as seen compared to the vertical wood trim-work.



Photo #5 – West foundation, concrete stem-walls leaning out at top.

This lean would seem to reduce and threaten its load-bearing capacity, although no larger harm is yet apparent. At the exterior base of the stem-wall sections, it seems various past efforts have been made to arrest the tilting, with fieldstone rubble, and/or concrete buttressing being added. It seems likely this was to counter the effects of water falling along this wall from the roof, and destabilizing the footings (if any).

Significantly, water is also definitely a clear and present hazard on the east side. A combination of surface drainage, and large quantities of runoff from the barn roof, is eroding the fine sand fill against the eastern foundation.



Photo #6 - East foundation, water infiltration and soil erosion.

Seepage through the granite foundation wall is carrying away the subsoil, and conversely depositing it as large amounts of silt on the basement floor.

Moreover if (when) the wet subsoil freezes in winter it can expand and exert enormous pressure on the foundation, distorting it westward. Signs of this seem to be visible. This would have been less likely when the barn was in use and the foundation "insulated" with manure

Foundation Recommendations

Visually the basement's interior support columns seem to be functioning well, but because they ultimately carry the vast majority of the barn's weight (dead load), plus contents and occupants (live load) and even snow load from the roof, an engineering evaluation of these columns would be prudent. Fire resistance is also a consideration, to preclude premature structural collapse in a major fire.

It is possible that the tilted western concrete knee-wall is currently stable, but it should be evaluated and monitored. Possible replacement with modern foundation and footing, including appropriate drainage, could be considered.

The eastern side of the barn should have definitive attention paid to correcting the drainage issues. The existing fine sand fill is aggravating the situation, eroding, and being transported easily. This would likely require significant excavation and drainage measures, and re-contouring of surface grades, to include diverting both rainfall from the roof and flowing surface water. Also effective removal of sub-surface groundwater should be addressed, which will also mitigate any frost-expansion forces. Uncorrected, the long-term destabilization of the east foundation wall is possible, even likely.

The most comprehensive solution would be to support the building and excavate the original foundation, and replace it with entirely new poured concrete footings, walls, and slab. This expense would be offset by the opportunity to enhance the basement space for higher quality occupancy uses, and energy efficiency, etc.

There is a set of wooden stairs at the southeast corner leading up to the main floor. These are deteriorated and should be replaced.

Frame

The Houston Barn frame is based upon heavy mill-sawn timbers, possibly hemlock, with pegged mortise-and-tenon connections, including some very workmanlike bladed scarf joints. Infilling that structural armature, the wall studs, floor joists, rafters, etcetera are "two-by" dimension lumber. It was substantially designed and built, and remains generally strong and in good condition. Overall, it sits remarkably level and plumb on average.

There are limited specific areas where repairs are needed and are discussed below. Not every instance can be exhaustively listed here, but the following are the major examples.

The main aisle floor (center "drive") and its major supporting beams are decayed in the first bays inside the large doors at both north and south ends of the barn, perhaps from snow and water entering at the open doorways over many years. Past partial repairs are visible, and ad-hoc cribbing and posts have been installed to support decayed or spliced beams.



Photo #7 - Northwest section of undercarriage, damage to floor and sub-floor framing, temporary cribbing.

These repairs are less than optimum and are themselves deteriorating. Examples are areas beneath posts 1C, 2C, 3C and near the basement stairway below posts 8B, 9B. (Refer to previous SFC Engineering Partnership Inc. report's first floor framing plan.) This includes important structural floor beams, but would be relatively straightforward to repair.

It was observed in some areas of the east wall interior, in the cattle tie-up area, that past decay has occurred at wall post feet and their knee type "up braces," likely from the effects of animal wastes.



Photo #8 - Repairs indicating possible decay at sills from animal wastes.

Past repairs have been made, but wall paneling, plywood floor overlay, and stored items made full assessment for this report impossible. The sill(s) beneath may or may not also be involved.

On the main floor, massive concrete feed troughs (bunks) were retro-fitted by cutting off the feet of the primary timber posts on each side of the main drive. These fore-shortened posts now sit supported upon cast concrete steps.



Photo #9 - Concrete feed trough with step for shortened primary post. (Typical)

Two concerns arise. Firstly, concrete can conduct moisture into the wood, engendering decay or insect infestation, and indeed powder post beetles appear to be active at a number of these locations. Secondly, if it is contemplated to ever remove the concrete bunks, the posts will need extending or other supporting measures installed to fill the gap and maintain the load-path to the basement posts below.

In the remaining area not perched on concrete (at the northwest of the main drive) there has been a shortening and downward displacement of the major post(s), centered in the area of Posts 2C, 3C. This may have been rot resulting from a roof leak in the past, accumulating in hay or bedding materials. A decayed section of the 3C Post foot has been sawed off and blocked up, but inadequately. Again insect damage seems to be active at that location.



Photo #10 - Post 3C, cut off and shimmed, also active insect boreholes and frass evident.

Importantly, at the attic loft level, it can be observed that the same Post 3C has sunk enough (3") to detach the higher queenpost's foot tenon from its mortise in the tie-beam and allow the tie-beam itself to sag notably.



Photo #11 - Displaced tenon at tie beam above post 3C. Vital roof support is potentially compromised.

A scab block has been nailed to restrain the tenon but that is inadequate for such a critical connection - one that carries the load of the roof. If it fully detached, the roof area above could be at risk of partial collapse.

Even ignoring that worst-case scenario, uneven post elevations induce unhealthy tensions and stresses on a frame. That slumping or sagging has the secondary effect of inducing some lean in other posts. The frame though-out is strengthened by knee braces mortised into the major timbers, and some are displaced or missing as a result of the main posts settling unevenly. This weakens the frame resistance against wind loads, etcetera.



Photo #12 - Disconnected knee-brace, indication of settling and distortion of major frame timbers such as Post 3C.

Also, for reasons possibly associated with the necessary sequence of operations during the original barn-raising, the knees from tie beams to wall posts are not mortised at their heels, but only nailed. A number of these points are loosened or detached.



Photo #13 - Nailed knee-brace connection at wall post separated. (Typical)

Remarkably, the frame remains on average very close to true and plumb. But its size and location make it vulnerable to windstorms and protecting against those potential forces should be a priority.

While considering windstorms, it can also be noted that the structural purlin beams, supporting the rafters at the break angle of the roof, are connected to their cantilevered horizontal support beams only by gravity and a very few toe-nails.



Photo #14 - Structural major roof purlin attached to bent by toe-nails only.

Obviously this has sufficed well enough for over a century - but perhaps does not take into consideration the potential uplift forces in a major unique storm event. (Areas neighboring Hopkinton have indeed experienced more than one actual tornado in recent years, and at least one barn roof was lost.)

The barn generally has the considerable benefit of 'high and dry' siting. However at the south door concrete steps, blacktop, and landscaping details are in close contact with the barn frame at ground level, and likely directing rainwater into sill timber areas.



Photos #15 - Entry step fostering sill decay under southeast doorway.



Photos #16 - Landscaping details (grade too high) fostering sill decay, south wall.

The threshold area has indeed been replaced with concrete already, and also at the north door. It would not be unusual if the north doorway threshold had similar issues, although the north end is generally well above grade and better drained.

At a number of points in the frame, widely distributed but most especially at the basement and first floor levels (high-humidity areas), the many small bore holes and fine frass (wood dust) indicate the presence of active powder post beetles.

Frame Recommendations

The door threshold and sill areas should be fully accessed and investigated. Decayed timbers can be replaced or repaired if needed, and then very thoroughly protected with flashing and/or waterproof membranes, followed by re-grading for improved drainage.

The sill area and post feet of east wall tie-ups should be exposed and evaluated for rot caused by animal waste. Logically the same may be true for the west wall sills and posts, although it was not possible to view them. However, a small amount of superficial decay need not condemn a large sill timber that is well supported on the foundation.

The damaged interior floor carrying-beams, joists, and flooring over the basement should be opened up from the main floor and fully replaced in the areas needed - especially northern and southernmost bays of the main drive. New heavy timber beams and load-bearing structural connections should replace the jury-rig posts and cribs. As this is done, corrected (level) elevations can be restored throughout by jacking in areas where frame members may have settled.

The post feet on the concrete feed troughs should be treated to arrest insect damage. If the concrete is to be removed, the posts can have base extensions spliced into them, or supporting plinths constructed, to maintain their correct elevation and carry their full loads.

Post 3C and its neighborhood requires prompt attention, in conjunction with associated repairs at the basement level and the joinery at attic level. This would include jacking to restore correct elevation and load bearing, with strong splices and/or plinths to restore their bases as necessary. In that process the 3C attic Queen-post tenon should be drawn back into original position, and permanently secured. A solid continuous load-path from roof to basement footings must be re-established.

Knee braces should be refitted securely at all locations to achieve rigidity when in compression. It is suggested that the anomalous nailed connections at the wall posts be supplanted with threaded lag bolts, multiple structural ('GRK' type) screws, or other stress resisting hardware.

Similarly, where the roof purlins are toe-nailed to their cantilever bent beams it may be prudent to add "hurricane anchor" type straps or hardware to resist uplift at those connections.

The infestations of powder post beetle require consultation with a specialist, and treatment is strongly advised. Their action is slow, but in the long term can greatly

weaken and even destroy timbers, working unseen within the wood.

Not all areas were accessible for observation, and a full systematic evaluation (beyond the scope of this assessment) should be done of the various points made above.

Flooring

The basement floor is mostly a somewhat primitive concrete slab. It suffers from in-wash and sedimentation coming from the east foundation's poor drainage. Probably frost heaving is acting upon it in winter and will tend to crack it.

The main floor is heavy wood planking, except for an area of modern concrete slab in the northeast corner. Much of the wood floor is sound, but certain areas have suffered decay and exhibit expedient repairs. The portions concealed beneath the concrete feed bunks are of unknown condition but may be suspect.

The primary loft floors are two layers of nominal one-inch boards, and generally sound. Limited areas, especially in the west side, are rotted and hazardous, probably from roof leaks in the past.



Photo #17- East loft, floor decay.

The upper-level lofts and cat-walks are minimally built and should be treated with extreme caution. One section of catwalk flooring is missing completely.

As a point of interest, scab blocks can be seen on the upper inner faces of the major center aisle posts. These indicate there may have once been a second higher level of center loft, since removed.

Floor Recommendations

The basement floor may suffice as is, or could be replaced now or in future. If a modern replacement slab is contemplated, consideration should be given to installing under-slab drainage, and measures for frost protection.

The repaired areas of wood planking on the main floor should probably be redone to a higher standard, and any other potential areas of decay located and investigated for replacement. Some areas will necessarily be removed and replaced in any case, to repair the damaged framing beneath.

The loft flooring needs simple replacement in limited areas, prioritized with safety in mind. The high catwalks can be inspected and repaired if needed, but should be considered generally off-limits meanwhile.

Siding

The siding is of recent date, being natural (unfinished cedar?) clapboards. It was attached with 2" long stainless ring-shank nails, driven by air-powered nail gun. The sheathing beneath is the original nominal 1" boarding and seems sound.

The modern clapboarding was obviously a great, even heroic, investment towards saving the Huston Barn and is aesthetically attractive. Very regrettably it is displaying some cupping and detachment in various widespread places, and the nails are pulling loose from the sheathing over large areas, the result of cyclical wood movement as weather acts upon the clapboards.



Photo #18 - Clapboards warped and detached, with nails pulled. Typical of many.

Siding Recommendations

The clapboard siding is both problematic, and a dauntingly large matter to deal with. As can be seen easily, the clapboard installation is failing prematurely. They represent a considerable expense, both originally and to address again now.

At a very minimum, the most cupped and warped clapboards could be individually replaced, or perhaps nailed back down in lesser cases. Loose nails that are "popping" through-out could be perhaps re-driven and the clapboards possibly tightened up. But it is most likely these measures would be only partially successful, and temporary. The same issues would recur for the same reasons.

In this writer's opinion, the cupping and nail-pulling is the result of uneven wetting and drying (exacerbated by sun and wind) between the interior and exterior faces of the wood. This may be especially found in some modern clapboards that are largely lower quality face-grain, as opposed to traditionally quarter-sawn (edge-grain) premium siding which is far more stable.

Also the nailing technique here may have been minimal. While current thinking is indeed to use ring-shank nails, older builder's reference tables say that ring-shanks are intended for green wood, and actually withdraw more easily than common nails from dry lumber. The nailing pattern is moreover random, not lined up to penetrate the framing studs, and in any case the 2-inch length would not be sufficient engage the studs. Perhaps driving some longer nails located into the studs might help, but the established pattern of wood movement active now would still be inexorable.

Most importantly, it appears that the clapboards were not painted, oiled, or sealed in a way that would effectively retard uneven wetting and drying (possibly because of concern about "cedar bleeding" in fresh clapboards). However, painting, or preferably staining, them now would be of limited value. They are already warped and distorted, and the weathered surface will not hold coatings as well as fresh wood would have. A priming coat would be needed, at a minimum.

Moreover, to truly stabilize wood products from the effects of weather, best practice is to seal both the front and back equally, and all end-grain surfaces. Obviously, that is impossible now in-situ.

(The author's personal opinion is that present-day latex paints are a very poor choice, and a penetrating or solid oil or stain will be far easier to maintain in the long term, since they do not peel or flake, and are less deleterious to the wood from moisture retention.)

The very best installations today in fact even go further to install clapboards over

strapping, spacers, or a built-out drainage plane air-gap including membranes to protect the building beneath. This allows rapid and even drying of the backs of the clapboards, giving the greatest possible stability and lifespan, thus protecting what is a considerable investment.

All the options here are expensive to some degree, if only because of the sheer size of the building and the fact that clapboards are a high-priced material. Possibly the better options could someday be combined with a larger master plan, for instance if removing the clapboards were desirable to insulate the exterior of the barn walls, and then re-side it, either with clapboards or some other choice.

There is no easy answer. In the meanwhile, the existing clapboards are nevertheless protecting the barn adequately and importantly. Perhaps some expedient re-nailing and tightening-up will serve for a time.

Exterior Trim/Doors/Windows

The trim work (corner boards, soffits, fascia, etc.) is generally satisfactory or easily re-habilitated.

The main north and south rolling pocket doors are heavily weathered and aged. Their window glass is missing. They are somewhat fancy and decorative in design and workmanship. The basement doors are more prosaic but seem functional.

The double-hung windows used various places seem to be of 1990's vintage, and in fair condition. Other more historic window openings in the west cow tie-up and both gables are sashless and have been boarded over from the interior.

Exterior Trim/Door/Window Recommendations

Trim can be repaired as needed in limited areas, such as the corner board by the southeast cow door. A carpenter-built set of bins at the south end of the east wall is splashing roof water back onto the siding and skirt-board, causing decay, and has ruined the window casing there. The bins should be re-located and the casing replaced.



Photo #19 - Water damage to window resulting from proximity of bin assembly.

The elegant main level doors probably could be restored attractively, including reglazing their generous window lights. The simpler basement doors should be monitored for decay from rainwater splashing off the roof and protected accordingly. (They presently allow birds and rodents to freely enter the barn through the wide gaps at the base of the doors. It would be desirable to minimize the gaps.)

Windows generally are an item rewarding regular frequent examination and upkeep. If not regularly re-painted, traditional glazing putty will fail, eventually followed by the glass. Also, the windowsills and lower casings are prone to decay from water if not routinely examined and protected.

The boarded-over window openings should be monitored to ensure no decay is happening to the barn's frame from water or snow penetrating the exposed casings. Potentially, new wood six-over-six windows would be recommended.

Cupola

Cupolas served to ventilate the barn for the benefit of both hay and livestock, but also as a strong statement of style and pride. Older photos show this cupola to have been much taller, but it was deliberately and carefully reduced in height, a task interesting to imagine. It almost certainly was topped with a mast. A turned wooden post found in the loft stairway, may have been the original mast.



Photo #20 - Possibly original mast from Cupola. Could be used as pattern for replication.

The 7ft. x 7ft. cupola is in excellent condition, seemingly square and level and without leaks or rot. Insect screening has been fitted to discourage insects, bats, and birds from entering through the louvers.

When it was reduced in height, long iron staples were driven to secure the sawed off posts at roof level, and they have served. But their performance in an extreme weather event might be pondered.



Photo #21 - Interior of Cupola, showing iron staple anchoring cut post. (Typical)

Cupola Recommendations

It would be prudent to check routinely for water intrusion, especially where the mast once penetrated at the peak. Heavier screen, such as well fastened hardware cloth might more durably back up or replace the light insect screen now in place. Re-roofing of the cupola should be done at the same time as the main roof.

Supplementing the iron anchoring staples with securely bolted steel straps, vertically bridging the cut posts, could be good "hurricane insurance" for the cupola.

Priorities

- 1) The roofing needs replacing and that should be done immediately. Leaks and decay are inevitable otherwise, endangering the barn.
- 2) Timber frames are astonishingly resilient. But posts in the northwest quadrant should be jacked as soon as possible to proper level and the displaced joinery refitted securely, as a minimum. That would include securing and fastening all knee braces. Ad hoc supports in the basement would be replaced/up-graded as needed to achieve permanence for the critical load bearing points represented by each major post.
- 3) Imminent disaster seems unlikely, but the foundation issues should be corrected as a priority before the foundation is further displaced or undermined and the support of the barn frame compromised.
- 4) For longer term preservation, the insect infestations need to be treated and/or controlled by a specialist.

The above items will conserve the barn itself for the near term. Before the barn can be generally used safely, weakened and broken floor beams and/or joists should be replaced, and all decayed areas of flooring replaced.

Barns are particularly vulnerable to rapid and destruction by fire. Fire protection may eventually be a priority for life safety reasons, but in the near term, at least a fire-detection and connected alarm system could be important to conserve the building itself. Fire extinguishers prominently placed within the building might also reduce the chance of an accidental loss from daily activities.

Reportedly this barn was built to replace one struck by lightning. Opinions differ, but given the high and exposed location, consulting an expert on lightning protection may be a prudent action item.

Conclusion

The Houston Barn is an outstanding monument to Hopkinton's heritage and culture. It exemplifies values and times easily forgotten that once characterized our State. While its very size alone makes any conservation efforts correspondingly expensive, even more so for public occupancy uses, it also has great intrinsic value as a vast and already existing enclosed space.

Enhanced by its historic and aesthetic qualities, future uses could see it repaying any investment as a focus of community bonding and civic pride.



Photo #22 - Houston Barn, viewed from southwest. August 2021

The townspeople of Hopkinton-Contoocook have the good fortune of owning a building that was well designed and substantially constructed, which remains strong despite some current disrepair. They have chosen to protect it for over two decades already. While this report lists deficits, it can be said that the Houston Barn also retains many positive strengths and attributes.

In purely physical terms there is no reason this barn cannot survive and stand proud for many more generations if adequate funding can be provided.

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