ENGINEERING VENTURES PC

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January 5, 2018

Maclay Architects
Attn.: Kevin Dennis
4509 Main St.
Waitsfield, VT 05673 EV#17510
kevin@maclayarchitects.com

Re.: Foundation Evaluation – Goshen Grange Hall
Goshen, NH

Dear Kevin,

At your request, we have visited and performed a structural visual conditions assessment of a portion of the above referenced structure. During a site visit on August 23rd, we have documented the exposed portion of the structure in question.

Observations and Assumptions:

1. This evaluation consists of visual observations of observable portions of the structure. No testing was completed as part of our work, nor were any finishes removed. Information about the structure was also provided via discussion by Sandra Sonnichsen and Gary Dennis while onsite.

2. The scope of our evaluation consists of the foundation and interface with the first floor of the structure. No other portions of the structure are included in this study.

3. It is understood that the original structure was constructed ca. 1853 and underwent a renovation ca. 1905. The renovation work consisted of elevating the original first floor to the second floor and construction of a new first floor beneath it. It is not believed that the foundation design changed as part of this work.

4. Some signs of animal activity were observed in the crawl space.

5. While onsite I was informed by Sandra that the original site contours originally dropped sharply downward from the east edge of the building to the bank of the south branch of the Sugar River, but that a boulder retaining wall was subsequently added and backfilled to provide a more level site in the vicinity of the building, (Figure 1).

6. The structure consists of two stories with an attic space and crawl space. The superstructure is comprised of a combination of materials including of light frame wood,

timber elements, and steel posts. The foundation is comprised primarily of dry laid stone. According to Sandra, it is believed that much of the building foundation is placed directly onto bedrock. While exposed bedrock was not observed within the crawl space itself, some exposed rock was observed adjacent to the east edge of the building, (Figure 2). Sonotube piers supporting fire escape columns were observed to be in poor condition, (Figure 2). From subsequent correspondence with you it is understood that the fire escape is to be removed in the near term.

7. The ridge line of the roof was observed to be relatively straight and only relatively minor cracking of interior finishes was observed, indicating that the structure has undergone little, if any, differential settlement, indicative of the presence of non frost susceptible subgrade.

8. An 8x8 timber sill beam was observed at the interface between the superstructure and the top of the foundation wall, (Figure 3). Observed portions of the sill beam appeared to be in fair condition.

9. The first floor framing consists of 2x8 rough sawn joists and 8x8 timber girders. Typical framing details that were observed are depicted in Figures 4-7. An analysis of these framing members was completed. Floor framing actual dimensions were measured to be 2 ½"x8 ¼" sawn joists at approximately 19" on center, (o.c.), with a span of approximately 12'-3". They were observed to be supported by 8x8 timber girders, spanning across the width of the building and supported at third points by stone piers. All framing was assumed to have a design bending stress of 1000 pounds per square inch, (psi) and shear (parallel to grain) of 135 psi, based on our prior experience in evaluating similar structures in the locale from this time period. Live load was assumed to be 100 pounds per square foot, (psf), which is the current minimum design live load for new construction for an assembly area. The joists were found to be within code limits for strength but not for deflection. The girders were found to be significantly overstressed under this loading.

10. Relatively few joists were observed to have been damaged, other than a few isolated conditions depicted in Figures 8 and 9.

Conclusions and Recommendations:

1. The dry laid stone pier/footing assemblies within the crawl space are unstable and should be replaced within the next 1-2 years. Possible replacement could consist of pressure treated posts with steel caps and bases, placed onto new reinforced concrete spread footings. The interior pier with mortared joints depicted in Figure 9 could be left in place. Loose mortar should be removed and replaced within the next 1-2 years. A polyethylene vapor barrier could be installed on the crawl space floor as part of this

work, in order to provide a level of protection of the wood framing from moisture damage.

2. If the existing fire stair is to remain, then the concrete piers should be replaced.

3. The few floor joists which were observed to be damaged should be repaired. This would include joists with rotted ends and joists which have been cut/notched. Possible reinforcement measures may consist of reinforcement of ends of joists (where rot is near the end), or sistering of new framing alongside of the existing members. This work should be completed within the next 1-2 years.

4. Cracks in the foundation wall which extend through to the wall to the exterior should be filled with a non-shrinking cementicous material, ideally within the next 1-2 years.

5. The floor joists do not fall within code-required deflection criteria for new construction. A possible issue stemming from this may be that occupants on the first floor may sense a 'bounciness' in the floor system when it is loaded at or near design capacity, though this is not an unsafe condition and would not require reinforcement unless the structure is altered in a way that would either increase the loading on the joists or weaken them.

6. The 8x8 timber girders are significantly overstressed under design loads and we recommend that they be reinforced as part of any new foundation work. The relatively high level of overstress under design loads could result in long-term deflection – (ie permanent deformation of the floor system), which would impact functionality of the space and aesthetics. Possible repair measures could include placement of additional post/footing assemblies beneath them, (similar to those described in item 1 of this section) in order to reduce their span and thus the stresses under design loads, or placement of new wood framing beneath them. The latter measure may have somewhat limited applicability unless the crawl space depth is increased.

7. We did not observe any aspects of the loose laid stone foundation that would pose an immediate risk to the building or occupants. However, this type of foundation system lacks the strength to resist design-level structural forces, and positive attachment of the structure was not observed. In the long term, (approximately 25 years) a plan to remove and replace the existing foundation should be developed and implemented.

Thank you for the opportunity to be of assistance. Please feel free to contact me with any questions.

Sincerely,

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Miles Stetson, P.E. – Project Manager

Figure 1 - Site plan - note retaining wall with earth backfill, (Ref. Google Earth).

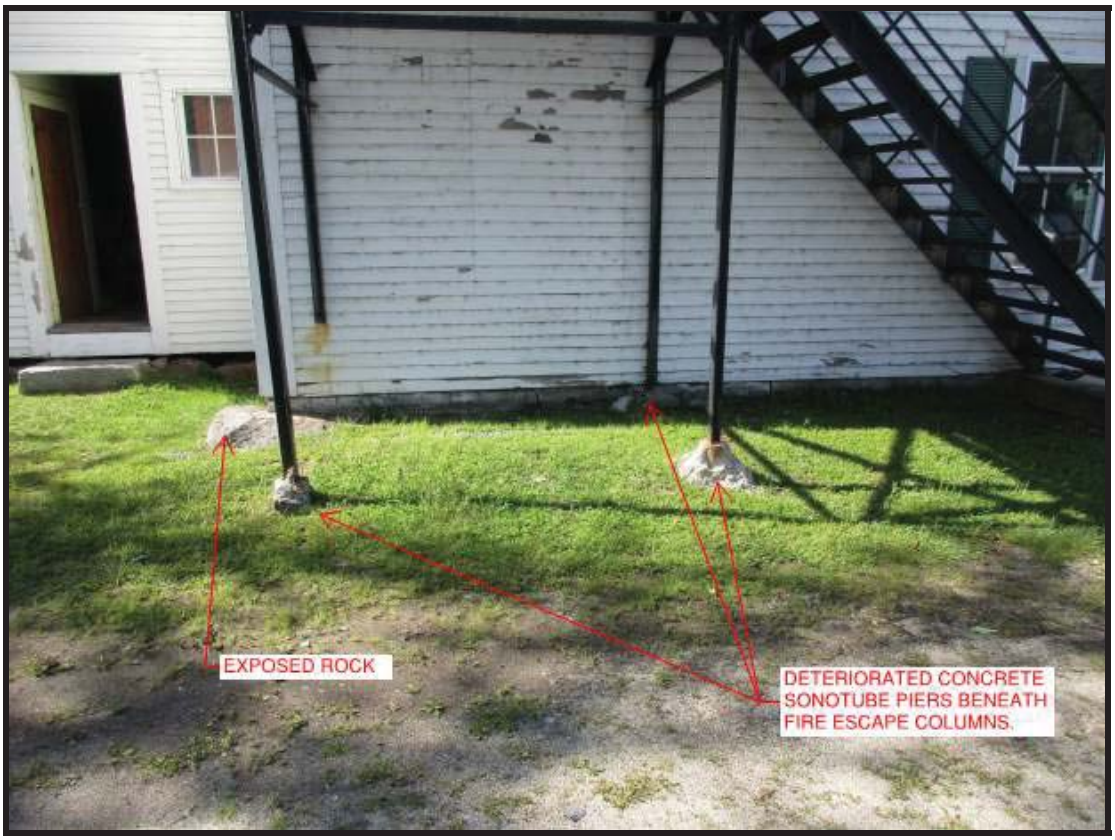

Figure 2 - Partial view of west exterior wall, depicting deteriorated concrete sonotube piers and exposed rock adjacent to the foundation.

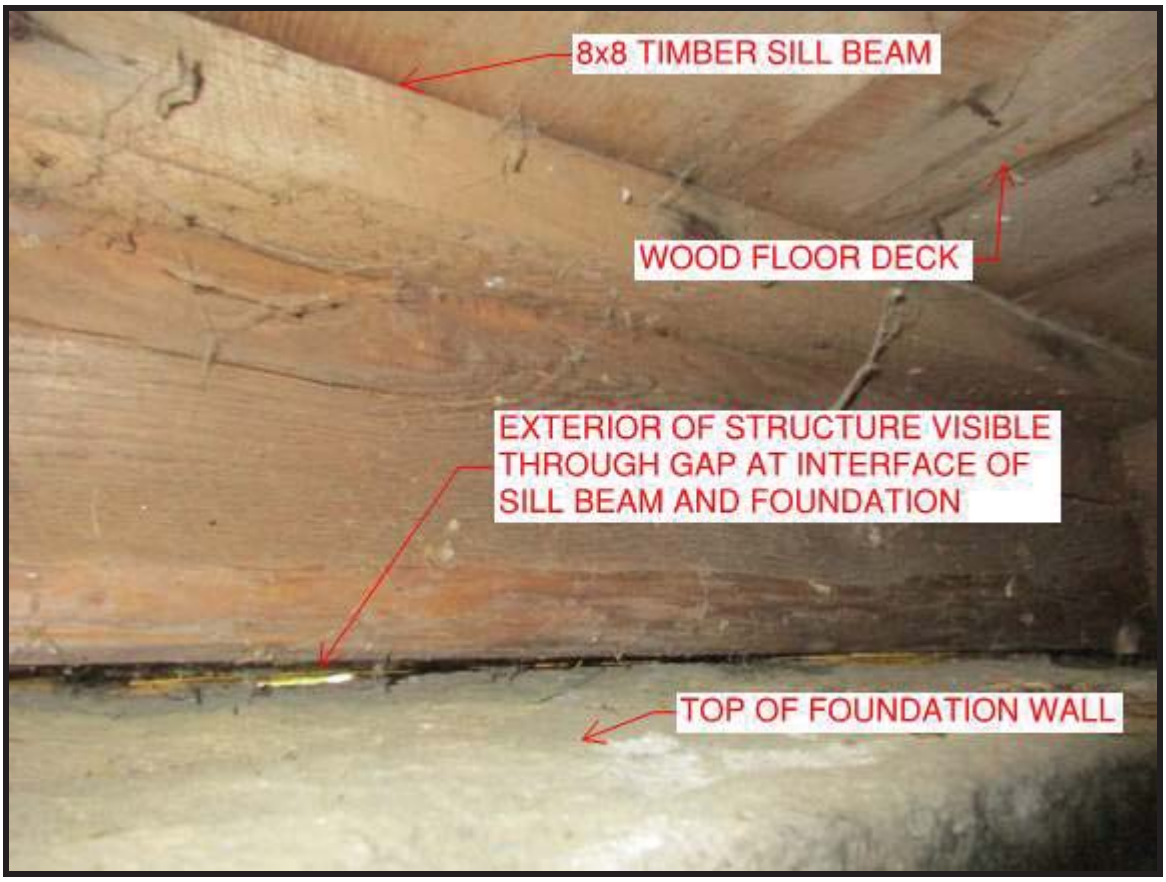

Figure 3 - Typical condition at interface of foundation and superstructure. Wood appeared to be in fair condition. Positive attachment of superstructure to foundation was not observed.

Figure 4 – Girder end bearing on stone placed within foundation wall.

Figure 5 - View of first floor framing. Dirt floor with no vapor barrier was observed within the crawl space. Wood framing appeared to be in fair condition, with little to no rot/moisture damage observed.

Figure 6 - Typical framing, supported by stone pier. Note unstable configuration of stone. See Figure 7 for close-up view of joist attachment to girder.

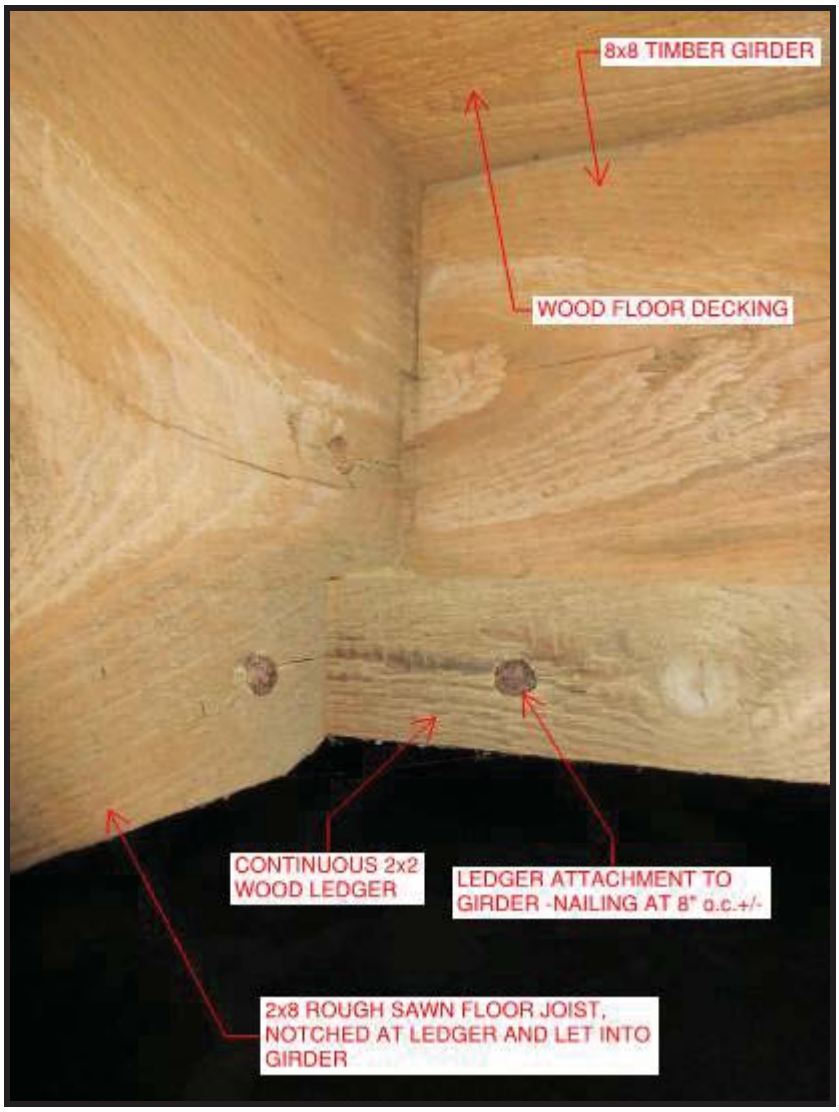

Figure 7 - Close-up view of typical joist attachment to timber girder.

Figure 8 - Floor joist near southeast corner of the building, strength compromised by pipe penetration.

Figure 9 - Damage at ends of joists was observed in a few locations.