

April 12, 2019
OKP-19-7005

Chloe Wilson, KTC President
45 Napier St.,
Kingston, ON
K7L 4E9

Dear Chloe,

RE: Structural Assessment – Existing Condition Club House Building– 45 Napier St., Kingston, ON

As requested by the client, McIntosh Perry Consulting Engineers Ltd. (MPCE) conducted a Site Visit at the above referenced project location. This review was performed to provide our opinion on the overall structural integrity and safety of the aforementioned structure and is not intended to be an exhaustive review of the entire structure, or any of its components. The Site Visit was conducted on March 18, 2019 and focused on the following main structural elements:

1. Foundation,
2. Floor Assemblies,
3. Exterior Stud Walls,
4. Roof Assembly,
5. 2nd Storey Deck Construction.

No original structural or architectural drawings were made available for use in our review. Upon completion of our review, the following outlines our findings.

Existing Conditions

The existing building, as shown in **Photo 1**, is a two-storey structure measuring 25'-0" x 30'-0" and is multi-purpose facility primarily used as a general assembly area for tennis club patrons and staff. The original club house was constructed circa 1920's and has since undergone minimal renovations and alterations. One notable renovation which took place after original construction is the construction of a 15' x 30' storage shed off the rear of the club house, as shown in **Photo 2**. Note that at the time of the site visit the building remained unheated during winter months.



Photo 1: Original Main Building



Photo 2: Rear Storage Shed Addition

1a. Foundation

There exists a small trap door into the crawlspace below the ground floor. From this trap door the crawlspace is too confined to provide full access to observe the entire foundation structure. It can be observed, however, that the building rests on an unconventional foundation constructed of various concrete blocks which form an approximate 4'-0" to 6'-0" grid on the grade below. **Refer to Photo 3.**

2a. Floor Assemblies

Between these concrete blocks at the foundation span 3ply 2x8 built up floor beams supporting the ground floor joists. These beams span in the E-W (side-to-side) direction. The ground floor assembly consists of 2x10 floor joists spaced at 18" c/c, spanning N-S (front-to-back), covered in wood plank decking. The main support for the second floor consists of a single centrally located 4ply 2x12 built up floor beam supporting the second floor joists. This beam spans 25'-0" in the N-S direction with one intermediate support at midspan, which was not exposed or accessible at the time of the site visit. The second floor assembly consists of 2x10 floor joists spaced at 18" c/c, spanning E-W, from exterior stud wall to central floor beam. Similarly, the second floor is covered in wood plank decking. **Refer to Photo 4.**



Photo 3: Existing Foundation



Photo 4: Existing Floor Assemblies



Photo 5: Typical Joist to Stud Wall Connection

3a. Exterior Stud Walls

The exterior stud walls are constructed of 17'-0" tall full height balloon framed 2x4 studs spaced at the same 18" c/c as the floor joists. This type of construction is common to the time period in which it was originally constructed. Around the entire perimeter of the building are longitudinal 1x6 members notched into the interior face of each 2x4 stud. Nails can be seen fastening the joists to both the 2x4 studs and 1x6 plate at all of the locations observed. These connections provide both bearing connection to the floor joists and lateral restraint to the stud walls. **Refer to Photo 5.**

4a. Roof Assembly

The roof consists of a conventionally wood framed hipped roof construction, with primary common rafters spanning N-S. The rafters are 2x6 rafters spaced at 20" c/c, bird mouth notched at the top of walls transitioning into 2'-0" exterior overhangs all around. The roof bears only on the four exterior walls. In addition, collar ties can be observed to be installed at each rafter within the ceiling cavity. **Refer to Photo 6.** The roof is finished with 1x6 wood decking and asphalt shingles.



Photo 6: Existing Roof Construction



Photo 7: Existing Wood Guards Surrounding Deck

5a. 2nd Storey Deck Construction

The second storey deck measures approximately 11'-6" x 30'-0" and is constructed of conventional wood framed construction. The main structure of the deck consists of 6x6 posts spaced out around the perimeter between 5'-0" to 11'-0" c/c. Between these posts span multiple ply built up wood beams supporting the second floor deck joists. These beams are believed to be 4ply 2x12 built up wood beams but exact size remains unknown as they were not exposed at the time of the site visit. These beams span in the E-W direction. The deck assembly consists of 2x10 joists spaced at 16" c/c, spanning N-S, covered in wood plank decking. **Refer back to Photo 1.**

The guards around the deck are constructed with 6x6 wood posts positioned directly above the structural posts below, **refer to Photo 7**. From the underside they can be seen protruding through the decking down to the beams below where they are surrounded by full blocking and fastened to prevent rotation by lag bolts in each. Guard rails are 42" high and pickets are spaced such that gaps do not exceed 4" in all locations (**Photo 8**).



Photo 8: Typical Guard Post Connection

Observations & Recommendations

1b. Foundation

Not all foundation elements were exposed and/or accessible at the time of the site visit. What was observable at the foundation level does not meet the requirements of the 2012 Ontario Building Code for various reasons including insufficient frost protection/waterproofing and inadequately sized footings for bearing capacity of underlying soil. These deficiencies can cause both short term and long-term effects on the foundation. Due to the relative age of the building it is believed that all expected long-term settlement has occurred, however, periodic fluctuations in moisture content and temperature can cause ongoing settlement and heaving issues for the life of the building. It is recommended that measures be taken to insulate/waterproof the underside of the building to protect the footings as well as the existing utilities. In addition, new eaves troughing is recommended to adequately collect and discharge water out and away from the building footprint.

2b. Floor Assemblies

The observed construction methodology is common to the time period in which it was originally constructed. The floor joist to stud wall connections provide bearing to the floor joists. The current spans of simply supported floor joists of 15'-0" exceed the maximum allowable for 2x10 @ 18" c/c within assembly areas. Similarly, the current spans of the floor beams of 12'-6" exceed the maximum allowable for 4ply 2x12 built up wood beam within assembly areas. The specified design live load for assembly area occupancies is 4.8 kPa [100psf] as per the 2012 OBC. These deficiencies shall be rectified by reinforcing the existing floor with additional joists and adding additional support posts/beams.

3b. Exterior Stud Walls

The observed construction methodology is common to the time period in which it was originally constructed. The floor joist to stud wall connections provide lateral restraint to the balloon framed stud walls. In general there are no significant deficiencies observed in construction methodology and/or signs of physical damage/excessive deflection that would raise concern at the present time. Locally along the rear exterior wall of the building differential settlement and inwards shifting is observed. These effects are also noticeable on the interior of the building; the wall trim can be seen detaching from the ceiling and the windows will no longer open due to their unsquared frames. It is in our opinion that this has been caused by the combination of the aforementioned deficiencies in the foundation structure and the construction of the rear storage shed addition, which took place after original construction of the main building. The following are contributing factors for the observed movement in this area:

- Roof rafters of new addition are loadbearing at the top of the ground floor wall,
- Floor joists of new addition are loadbearing at the bottom of the ground floor wall,
- The foundation along the front of the new addition is observed to be settling independent of the main building, causing an outwards pull on the ground floor wall,
- The presence of the chimney (with larger foundation) at the north-west corner of the building provides rigidity to only one side of the exterior wall, resulting in unequal support,
- Potential differences in subgrade materials between the front of the building and the rear.

In order to rectify the observed damage and mitigate future damage it is recommended that the rear storage shed be removed. This will alleviate the excess load on the rear wall and allow access to the foundation in this area. With access to the foundation in this area the wall can be jacked up, made level/plumb and new properly engineered continuous footing can be constructed beneath it down to shallow bedrock.

4b. Roof Assembly

The existing roof assembly is deemed to be satisfactory condition, with the exception of the damage/deflection caused by the movement in the rear exterior wall. There are no other significant deficiencies observed in construction methodology and/or signs of physical damage/excessive deflection. There are no immediate concerns in regard to the structural integrity and safety aspects of the building at the present time. There are some signs of water infiltration within the acoustic ceiling tile on the interior. It is recommended that roofing be repaired/replaced, as needed, in deficient areas – to be monitored by Owner.

5b. 2nd Storey Deck Construction

The existing deck construction is deemed to be in satisfactory condition. There are a couple deficiencies in the current construction of the guards causing immediate safety concerns. Lag bolts in various locations are observed to be missing the base of the 6x6 guard posts and the 11'-0" spans between guard posts, as measured, exceed the maximum allowable guard rail spans as per the 2012 Ontario Building Code. All other dimensions are found to be in accordance. It is recommended that the existing guard posts be reattached with adequate connection at there base and new posts be installed at midspan such that no guard rail spans exceed 5'-6". With this exception of the above, there are no significant deficiencies observed in construction methodology and/or signs of physical damage/excessive deflection. The current spans of the structural joists and beams do not exceed the maximum allowable spans within assembly areas.

General Notes

- *This letter outlines the required work to be done; the engineer is not responsible for the means, methods, techniques, sequencing and/or procedures used to perform the Work, or safety aspects during construction.*
- *No review was performed for architectural aspects of the building, to be completed by others.*
- *Where deficiencies are noted, and recommendations are provided, no detailed design review has been performed to determine the requirements for rectifying said deficiencies. It remains the responsibility of the Owner to retain qualified personnel for detailed design.*

Closure

This review was performed to provide our opinion on the overall structural integrity and safety of the building at the aforementioned project location. It is in our opinion that the recommendations for rectifying the outlined deficiencies within this report are adequate for ensuring the structural integrity and safety of the building. I trust this brief letter is sufficient for your present purposes. Should you have any questions, comments or needs for clarification please do not hesitate to contact the undersigned.

Regards,



Gregory Doroszkiewicz, P.Eng
Structural Project Engineer – Buildings
McIntosh Perry Consulting Engineers Ltd.

