

## **Appendix 1**

# **Structural Engineering Report**

A/S-SO.



**R&A ENGINEERING (1997) LTD.**  
**Structural Consultants**

September 29, 2019

*emailed*

Project No. 119086

GTA Architects  
Kelowna, BC

**Attention: Mr. Garry Tomporowski**

Dear Garry,

**RE: Collett Manor House at 2169 Pandosy Street , Kelowna, BC**

As requested, Greg Wylie, P.Eng., StructEng. of R&A Engineering(1997) Ltd, visited the site on Wednesday September 18, 2019, to view the state of the structure of this 1913 (+/-) old house.

We must disclose that R&A Engineering has also been retained to design a new large structure in place of this existing house. We have been asked to provide our opinion on the condition of the existing structure, and whether or not we think the house can realistically be moved.

We had a look around the exterior of the house, and in the basement and the crawlspace of the house, as well as the interior of each floor. We only looked at the structure, we did not look at any waterproofing details, or insulation etc. This report is based on our experience with structures. We did not perform any design calculations.

#### OBSERVATIONS AND COMMENTS

##### Exterior of House:

1. The covered porch at the back and the large veranda at the front of the house are showing signs of major sloping and settling.
2. The foundation system supporting the veranda looks to be in poor shape and has settled.
3. Some of the exterior walls of the house do not appear plumb, they "bulge" in areas.
4. Some of the window frames appear to be out of square and out of level.
5. The railing of the veranda also shows significant signs of sloping.
6. There are signs of rot on the exterior wood finishes.

##### Basement and crawlspace:

7. The foundation is made up of at least 3 different systems. The first, a full height basement, the second a crawlspace, and the third seemingly an at grade floor. Different areas of the basement have settled different amounts. We consider the settlement to be extreme, as it is in the magnitude of several inches. If this house were to be refurbished, then we would recommend re-

leveling the floors. Often in these old houses if the foundation system is fixed, the slopes in the floors are accepted as is, but in this case, in our opinion the slopes are extreme enough that they would have to be fixed if someone were wanting to live in the house.

8. Unfortunately, when a house is re-levelled to the extent that this house needs to be done, then structural, finishing, and functional ramifications become apparent throughout the house. For instance plaster would likely start cracking. Doors and windows may not open or close, glass may even break. Finishes around beams over windows and doorways may crack at their supports. Connections of the furnace and water tank may be affected. Wood and plaster cornices and finishes may separate. The extent and location of these issues would be difficult to assess prior to the leveling process. Generally speaking much of the finishes could be affected if the floors were to be re-levelled, and the walls were to be made plumb.
9. As there is no ceiling in the basement, the floor structure of the main floor was exposed from underneath for viewing. It consisted of wood joists supported on heavy timber beams supported on timber posts. We did not see any signs of obvious overstressing of the actual wood structure, however we did notice the post and beam line along the transition wall from full height basement to crawlspace was significantly out of plumb. This would be challenging to fix as the beam is no longer aligned (plumb) with its support.
10. A wood post had been directly placed into the concrete, which could have longevity issues, and rot would be likely. The post appears to have been added after the original structure was built.

#### Upper two stories of House

11. As mentioned the house is significantly out of level and out of plumb. We believe it has happened gradually over the years, as apart from sloping floors and out of plumb walls, the finishes do not appear to be reflecting these conditions. This makes remedial work even more difficult as once the house were to be re-levelled then movement would be telegraphed into the structure above and likely result in major cracking and shifting of finishes, as mentioned above.
12. There were signs of water leaking at the roof level.

#### Discussion of new foundation system

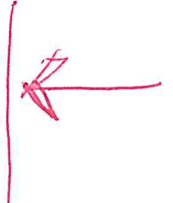
13. In order to do any upgrading and renovations to this house we strongly recommend that the poor foundation system be addressed. To build a proper foundation under this house would be, in our opinion, extremely difficult and expensive. But we do not recommend doing any major upgrades to this house without dealing with the foundations. We recommend that a Professional Geotechnical Engineer be retained to provide some solutions. We anticipate that the soils solution would involve excavating of existing soils and replacing with structural fill, or the addition of many helical piles. Either process would be considered extreme. The process to add new footings would likely include the following: excavation around the perimeter of the house, temporary insertion of several large steel beams below the house, and insertion of several large hydraulic jacks below the house, and the construction of temporary footings or cribbing all below the existing house. This could be an exhaustive exercise, as there are many loading points in the crawlspace that would all have to be supported. This is not a typical house that has perimeter footings and a couple of pads in the middle. In this house there are multiple bearing points, throughout the crawlspace, full height basement and grade level floor, all at different levels. The excavation of the crawlspace/basement would have to be done at the same time as the insertion of the temporary shoring – not an easy process. Once the cribbing/footings, jacks and steel beams are in place the house could then be jacked up to level it. In some houses we would recommend jacking the house and shifting it off its original footprint, to more easily work below the house. But in this case, we do not believe it would be prudent to shift the house, as the house does not appear to be well tied together to tolerate shifting horizontally. Once access is gained below the house, then a certain amount of soil would likely have to be excavated and replaced, under the direction of a geotechnical engineer. This step would likely be very difficult with the house remaining in place. Then the permanent formwork, rebar and concrete of the new

foundation system could be built. To get to this point of building new foundations would take considerable effort, talent and money.

14. Once the new foundation system is complete the house would then be lowered on to it. As previously mentioned, we anticipate that the jacking and moving of the house, and the re-levelling of the floors would result in cracking throughout the house, that would all need repair. Presumably the house has plaster and lath type of interior finish throughout. This would probably have to be partially stripped out to deal with the cracking and re-levelling. Once the plaster and lath is stripped, the structure would have to be reviewed for areas of dry-rot. Several of the window openings would probably have to be re-built which would also affect the existing exterior and interior finishes. The shifting and re-levelling of the house could also jeopardize the exterior envelope/water tightness of the exterior of the house as well as the roofing. This would all have to be reviewed by the various specialty consultants and repaired as required. Consequently adding a new foundation system, in an effort to save the house, would be in our opinion, extremely challenging and expensive.

Possibility of moving the house to a different site:

15. As noted above, we believe that moving the house would be extremely difficult due to the 3 types of foundations systems. Houses over full basements or even crawlspaces are much easier to move than ones where the floors are at grade, as is the case in part of this house. The house could probably be moved in segments, but in our opinion that would defeat the purpose of moving it. We recommend consulting with a Professional House Mover for more insight.



Summary:

16. In summary, we have noted that in our opinion the foundation system needs to be replaced. However, the logistics and expense of replacing the foundation system, while trying to save the house, would probably be overwhelming, and furthermore there would likely need to be significant repair to the old house once supported on the new foundation system. Also, as discussed, potentially moving the house to a new location, due to the three different types of foundation systems would also be extremely challenging.

Yours Truly,  
R & A Engineering (1997) Ltd.

Greg Wylie, P.Eng. Struct. Eng.  
Principal

