HERITAGE BUILDING CONVERSIONS AND ACOUSTICS

Gregory E. Clunis[*1]
[1]Integral DX Engineering, Ottawa, Ontario, Canada.

1 Introduction

The City of Ottawa has many heritage-designated buildings that have reached or passed the end of service life for their most recent usage. This includes old schools and institutional and commercial buildings.

This paper will present four case studies of conversions to residential (condominium) usage. Each project is unique, and most include assemblies that are not in the available test data. Challenges encountered included original as-built deficiencies, subsequently-introduced defects, major seismic weaknesses, and demanding architectural expectations.

Project one was an old, nine room school building, with high ceilings. Each classroom was cut in half to make two units, each fitted with sleeping lofts.

Project two was an old warehouse building that at one point in its history had heavy machinery within, with substantially enhanced wood floor structure. The combination of an ambitious architectural plan and many site conditions uncovered in demolition made this a very interesting project.

Project three was a small site in the Byward Market, with old sheds, garages and a couple of century-old wood houses.

Project four was also a school building, reworked with an ambitious plan for luxury condominiums. Post demolition of the old interior, many weaknesses were found in the masonry detailing, and substantial enhancements were required for seismic.

2 Project 1: École St-Charles

This century-old school building had reached the end of its useful life, and was abandoned. The flat roof was compromised and water had entered the building, soaking much of the interior, and creating habitat for mold and pigeons.

This was the first project of its type for the Developer (also acting as the General Contractor), and so there was a steep learning curve. However, the Architect and construction management team were experienced and savvy, and were able to adapt and respond quickly to emerging issues.

The classrooms had high ceilings, making them suitable for the addition of a sleeping loft above the kitchen. From an acoustical perspective, the challenge was to implement the new work at the same time as correcting prior-existing issues. Many holes had been made through the old building, and the moisture penetration had rotted some of the wood, some of which was only identified post-demolition with a section of floor collapsing.

Following demolition of the old interior finishes and removal of waste and mold, new party walls were framed as single studs. In hindsight, these would have been better as staggered or double stud walls, as the base building demising walls had higher ratings. Post-demolition sound testing would have identified this potential, but on a practical level, the design had already been completed.

The original stair wells were retained. However, these were profoundly squeaky and subjected to thousands of screws and plywood overlay.

Some issues arose with the lack of familiarity of the developer's sub-trades with the standards needed for the work. As an example, the floating floors were installed snug to the walls. After a weekend with the building closed up tight and humid, they all swelled, creating waves in the finished flooring. Fortunately, with some open windows and dehumidifiers, things settled back down.

The complexities of meeting City of Ottawa Heritage requirements were not initially fully appreciated (the building exterior had to be repaired to look the same, windows and masonry), adding time and cost to the project.

Commissioning was originally scheduled for a weekday evening, however noise disturbance through the windows to an adjacent residence meant that the testing had to be deferred to the daytime, the following weekend.

3 Project 2: 95 Beech Street

This building had very high levels of structural stiffness and noise isolation from the base building. It included 14 by 3 inch floor joists at 9 inch centers and 2 inch tongue and groove pine sub-floors which were well nailed with heritage nails.

The architectural plan included many challenging features for noise. One of those was having exposed masonry on as many interior walls as possible (exterior insulation and finish system for thermal and moisture control was applied to the outside). This created significant challenges for party wall/external wall junctions, as well as a serious impediment to the ongoing interior fit-up: the sandblasting of the internal walls to clean them had to be repeated several times, leaving a mess to be cleaned up. Another architectural issue for noise was leaving many of the original large wood beams exposed. The suite layouts all included walls at 45 degrees, further challenging the trades.

The desire to provide many features to the purchasers made the build much more complicated. This included central air conditioning for each unit (all condenser units were located on the roof) and gas fireplaces which were challenging to vent. Exacerbating the situation were many

[*] greg@integraldxengineering.ca

late changes requested by purchasers, which in hindsight should have been declined or priced more aggressively.

Many upgrades were required to meet seismic requirements. This only became fully clear once the demolition of the prior-existing interior was completed and the remaining base-building exposed to the structural engineer. Many custom made steel pieces were fabricated and installed, adding costs and delays.

The original plan had been to retain the prior-existing hardwood floors, which were clear of any knots (!). However, when the floor in the model suite was sanded and the planks were no longer glued together by many layers of finish, the squeaks were so loud as to interfere with sales during the open house. All existing hardwood was removed, and the prior-existing sub-floor thoroughly screwed. On the positive side, this allowed for the incorporation of a floating floor system under the new hardwood.

All interior framing was done in metal, the expectation being that this would be more amenable to the complicated floor layouts. However, the protracted construction interval and early rush to get the framing in lead to significant damage of the new framing and many repairs were required before it was all closed in.

Ongoing issues with the workmanship of acoustical caulking were resolved with the assignment of a young person to this task for several months.

4 Project 3: Montmartre

This project was located on a small site in the Byward Market, with old sheds, garages and several century-old wood buildings. The City of Ottawa was most adamant that the two houses and old commercial building be retained. In hindsight, almost none of the original materials remain visible and the extra work to retain them seems rather pointless. The old garages were demolished, and a new concrete apartment building notched in to the site, also providing parking below grade. A new wood building was added, configured as stacked townhouses.

The design intent was to provide an STC rating in the high fifties, and design for IIC 55.

As a result of the small size of the site, the buildings were done progressively, with the heritage structures reworked first. Following the completion of these, the concrete apartments were built, providing further revenues as they were occupied. Finally, the wood stacked townhouses were built.

This was the first project of its type for the developer and General Contractor. It in fact combined different projects using different trades for each type due to the different building types (wood and concrete). For this reason, some major issues with construction quality control arose:

- problems with GWB fasteners and resilient channels;
- gaps in insulation covered-over by GWB;
- missing insulation for drain noise control;
- wood furring substituted for resilient channels on a party floor/ceiling.

Another unanticipated complication was that the outdoor patio spaces above other occupied spaces caused disturbance. This required some disasessmbly and rework with vibration isolation components and better load distribution into primary structure.

In hindsight, we agreed with the Developer that more site inspections would have been useful, rather than the after-the-fact approach of responding to complaints and undertaking extensive testing and subsequent rework of defective areas.

Post-occupancy, noise in the corridors due to loud tenants and visitors was identified as an issue, however, this was not within our scope of control as the acoustical engineers.

5 Project 4: 19 Melrose

This building was much like the other school building discussed above: basically abandoned with the pigeons taking over. While the original architectural plan was to retain some of the interior finishes, it was not feasible on a practical level. This was due to the extensive work required on the base-building, prior to the starting of the new fit-up.

Once exposed, the interior brick work was far below acceptable standards, and it took many months for several masonry teams to re-point all of the mortar joints and make many other repairs. No other work could proceed until this was completed. It was asked if materials other than mortar could be used to fill holes (in order to save time and money). This was declined for noise as no relevant test data would be available.

Large gaps existed between the wood floors and perimeter walls at many locations.

Structurally, a considerable amount of retrofit steel work was required to meet the requirements of the Ontario Building Code. It was all custom, and all needed to be completed before the interior fit-up work could begin. These two issues added delays to the project, complicating things for the developer.

The new architectural design included removing some areas of existing floors, so as to take advantage of the large heritage windows. New balconies were added for some units.

A model unit was prepared, but not all of the acoustical detailing was compliant with the design. Resilient channels on a demising wall were inverted (open facing downwards), and the City Building Inspector insisted that it be reworked.

Post-occupancy, a complaint was raised about drumming noise coming through a bathroom wall, traced to a vibrating cell phone on the counter of the adjacent unit.