

CONDUCTING RETROFITS IN OCCUPIED APARTMENT BUILDINGS

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1. THE PROBLEM

Several thousand aging apartment towers provide more than 800,000 homes through-out Canada, acting as a core affordable housing resource. The Repair and Renewal Stream of the National Housing Co-Investment Fund brings crucial financial support to these aging towers, allowing them a path to reinvest with deep retrofits. **However, challenges remain for completing complex retrofits in occupied apartment buildings.**

The retrofit industry is still developing in Canada and lacks knowledge, skills, strategies and specialized products to effectively carry out retrofits in occupied buildings. This can lead to inflated costs and perceived risk. Retrofits are long, complex construction projects that can be disruptive and require skilled engagement, communication and means and methods not currently used within the Canadian industry to avoid undue disruption to tenants. In order to deliver the National Housing Co-Investment Fund's projected 240,000 units of renewed housing, industry must be prepared for this challenge.

From a resident's perspective, retrofit construction projects can be incredibly disruptive, confusing and create a sense of insecurity and for vulnerable people, these disruptions are amplified. Retrofits in occupied buildings require a different approach than typical new builds that considers sequencing, communication and maximizing preparation off-site. In Canada, these types of procedures are not yet standard.

***The Challenge:** How do we ensure successful tower retrofits in occupied buildings in a way that is efficient for builders and respectful for tenants?*

- What resource and training do constructors need to execute high-performance envelope refurbishments and systems upgrades with minimal resident disruption?
- What planning, considerations, and specialized workforce is required to work efficiently in occupied buildings?
- What technology, materials or other construction techniques and innovations can make retrofits quicker, faster and cheaper?

2. ABOUT THE PROCESS

Why a Lab?

CMHC Solutions Labs are 'social innovation labs' that bring experts and housing stakeholders together to incubate and co-create potential solutions to housing issues that would otherwise not be achieved through typical approaches. They provide the opportunity to examine existing issues through a new lens, reframe issues and use new processes to quickly generate prototypical solutions that can be tested. Solutions developed through a lab may result in the creation of a new program, policy, technology, or practice.

This Solutions Lab represents a new and atypical way of developing solutions within a competitive industry, with tenants playing a key role. It will be structured around two core stakeholder groups: Tenants and Constructors. Stakeholders from Ontario and BC are participating.

Methodology

CUG+R is conducting a Solutions Lab structured around two core stakeholder groups: Tenants and Constructors. Stakeholders and partners from Ontario and BC are participating. A Lab Working Group is responsible for leading the process, advancing the work, developing the Field Guide and Training Module (final outputs), and is working to convene stakeholders through workshops and interviews to co-create and test solutions. We will engage over 50 housing stakeholders. An Advisory Group, made of housing specialists, provides oversight and direction. The Solutions Lab consultants provide process expertise through each stage of the Lab. The Consultants also provide subject matter expertise, stakeholder engagement guidance and logistical support.

The research project began in early 2019. It kicked off with a series of meetings and workshops with the Lab Working Group; made up of CUG+R staff (project leads), the Solutions Lab Consultants (MaRS Solutions Lab, Evergreen and The Natural Step) and ACORN Canada (tenant representatives). To engage on the builder and industry side, NAIMA, the association that represents insulation manufacturers, also joined the working group. The meetings helped to formalize the research work plan and identify stakeholders and potential participants.

As part of the initial research phase, CUG+R conducted several types of research, conducting reviews of existing research and creating four international case studies. Case studies identified high-quality, well-executed retrofits that were implemented in occupied buildings and which included engaging the architects, designers, building owners and government officials involved in the projects. Additionally, a building in Toronto that has recently undergone a retrofit project was selected and surveyed by ACORN, to establish primary data to better understand and identify how tenants experience retrofit construction.

Moving forward, we are hosting several in-person workshops for both tenants and builders/industry stakeholders; separately and together. These workshops are focused on informing solution ideas and testing those ideas to improving retrofit practices - enabling them to be faster, cheaper and better while minimizing disruption for tenants.

The research, engagement and solutions testing will be used to create a “Field Guide” for carrying out retrofits in occupied multi-residential buildings. Online learning modules will also be created to teach and support builders, contractors and sub-trades with critical skills and techniques when conducting such retrofits.

3. CONTEXT

The retrofit industry is still developing in Canada and lacks knowledge, skills, strategies and specialized products to effectively carry out retrofits in occupied buildings. Likewise, the research in Canada about retrofit construction in occupied buildings is limited. Retrofits in occupied buildings require a different approach than typical new builds that considers sequencing, communication and maximizing preparation off-site. In Canada, these types of procedures are not yet standard and the lack of research contributes to perceived risks and increased costs as well as the likelihood that a retrofit project will create undue disruption for tenants.

CUG+R and the **Tower Renewal Partnership** (TRP) have conducted and published considerable research work on Tower Renewal to date. Publications include:

- Tower Renewal and Retrofit Finance (2019)
- Standards and Building Codes for Housing Retrofit (2018)
- Retrofit Finance Towards a Resilient Canadian Housing Stock (2018)
- Growth and Resiliency in Tower in the Park Sites Across the GGH (2018)
- Thermal Comfort and Cooling in Apartment Towers (2017)
- German Retrofit Financing (2017)
- Understanding The Tower Landscape (2016)
- Green Finance and Tower Renewal (2016)

Through engagement with building owners and residents for the above publications, TRP has identified that challenges with the delivery of retrofit projects is one of the key factors which prevent owners from undertaking complex retrofits. This Solution Lab will be the TRP's first project focused on improving the delivery of retrofits in occupied buildings to limit disruption to residents.

A limited number of organizations have conducted research that includes tenant experiences during retrofit projects, tenant engagement before, during and after retrofit projects and discussed strategies for improving these experiences. However, there is a shortage of relevant literature directly looking at how retrofits are conducted in occupied multi-unit residential buildings.

In jurisdictions where deep energy retrofits are more common, major advances in retrofitting with residents in place have been made. Countries such as the UK, Germany and the Netherlands have developed regulation around the energy performance of existing buildings, leading to major uptake of retrofits. As a result, owners and builders have had as long as two decades to develop and refine procedures, methodologies, and technologies to mitigate disruption and reduce the risk associated with complex construction in occupied buildings. Four case studies have been compiled to highlight some of the learnings associated with the following projects:

- **Güterstraße 30, Pforzheim, Germany**
- **Five Tower Blocks, Oxford, United Kingdom**
- **Grand Parc Bordeaux, Bordeaux, France**
- **Grandview Terrace, East Vancouver, British Columbia**

In Canada, federal support and interest in tower renewal and retrofits, particularly funding attached to the National Housing Strategy to retrofit 240,000 units in the next 10 years, has started to create support and momentum in Canada. Additionally, several retrofits in occupied multi-residential buildings have been executed in Canada with increasing effectiveness and tenant engagement, particularly in British Columbia.

GÜTERSTRASSE 30, PFORZHEIM, GERMANY

Owner:

Pforzheimer Bau und Grund

Building Characteristics:

- Size (floors or sq ft): 10 storeys
- Number and type of units: 21,291 sqft / 17 units
- Type of organization (private, non-profit, social housing, etc): municipal public housing provider
- Passive House certified project

Retrofit Scope:

Güterstraße 30 was one of 15 projects funded by the German federal Zukunft Haus (Future House) fund to pilot net zero construction and renovation. The end result was a Passive House certified project. The retrofit project mainly dealt with improving mechanical systems and upgrading the building envelope, with some in-suite construction required. Work included:

- Overcladding
- New windows
- Building out and extending the facade, adding balconies
- Added a new floor (penthouses that helped subsidize project)
- Ice storage in basement for energy recovery

Key Learnings:

- Though the construction team minimized the need to enter units and most work happened from the exterior, the construction was disruptive. Workers needed to enter units, though typically for only one day at a time.
- Design wise, a significant amount of new construction was prefabricated off site, reducing on-site construction. The owner also deliberately did not include in-suite interior work to avoid increasing disruptions, attempted to strike a balance of what is reasonable to do and what is not reasonable to do with residents in place.
- Aside from the construction team, the owner also managed disruptions, interfacing directly with residents (required significant staff time). However, the owner stated that they would never choose to do a retrofit with residents in place again, preferring instead to temporarily relocate residents
- The construction team minimized the need to enter units. Most work happened from the exterior. When workers had to enter suites (to remove walls, for example), they ensured that they would be able to do the work during one work day, typically while people were out at work. Tenants were provided with free vouchers for a nearby cafe.
- In this case, the owner was much more “hands on” than in other construction projects. As a social housing provider, they were more likely to be concerned with tenant satisfaction and happiness.



CHALLENGE BRIEF
OUTLINE

FIVE TOWER BLOCKS, OXFORD, UNITED KINGDOM

Owner:

Oxford City

Building Characteristics:

Five “tower blocks”: Evenlode and Windrush towers in Blackbird Leys, Hockmore Tower in Cowley, Plowman Tower in Northway and Foresters Towers in Wood Farm

- Number and type of units: ~340 units
- Type of organization (private, non-profit, social housing, etc): Public social housing (though roughly 54 units were purchased by tenants through rent-to-buy programs)
- Length of project/construction: 2016 to 2018

Retrofit Scope:

The range of repairs across all five of the city’s tower blocks will include:

- Works to the communal structure of the blocks
- Over-cladding and additional insulation (non-combustible insulation, fire breaks within the cladding system)
- Replacement of windows & New heating and ventilation system
- Upgrading communal electrical and fire safety systems and refurbishment of elevators
- Updates include post-Grenfell Code Requirements
- Works will also be carried out to improve the grounds, car parks, fencing, landscaping, and front entrances.

Key Learnings:

- Respite flats were provided (although uptake was low; residents preferred to stay in their own units)
- Council-run **independent resident group** scrutinized the process and provided feedback
- **Contractor Selection:** Residents participated in the selection of contractor (based on track record with similar projects)
 - Residents were invited to visit previous similar projects and speak to residents there
- Builder was **contractually required** to provide a “high degree of customer care” and opted to provide a **resident liaison** on-site to meet this criteria.
 - This strategy allowed the contractor to mitigate lost time due to access refusal. Although in some cases, worst case scenarios resulted in legal measures to allow suite access.
- Clear relationship established between builder and council
 - Regular check-ins between constructor and landlord re: tenant issues.
 - Builder not responsible for issues which were the legal responsibility of the landlord, but many items only escalated to landlord once vetted by constructor tenant liaison.



GRAND PARC BORDEAUX, BORDEAUX, FRANCE

Owner:

AQUITANIS, home public office of Bordeaux Métropole

Retrofit Architect:

Frédéric Druot, Anne Lacaton and Jean-Philippe Vassal (France)

Building Characteristics:

- Number and type of units: 530 units in, 3 housing blocks (16 storey buildings)
- Type of organization (private, non-profit, social housing, etc): Social Housing
- Length of project/construction: 12 - 16 days per unit
- Retrofit Cost: €50,000 per unit
- Recipient of the EU Mies award
- Video (shows building construction and before & after images): EU Mies Award 2019: Transformation of 530 Dwellings - Grand Parc Bordeaux: <https://vimeo.com/329987418>

Retrofit Scope:

- The renovation involved the addition of 3.8-metre-deep winter gardens and open-air balconies to each apartment. Small windows (with asbestos-contaminated sills) were replaced by large glass sliding doors opening on to the winter gardens and outdoor areas. Work also included renewed interior common spaces including hallways and upgrading technical facilities including: bathroom electrical and two former elevators replaced by a larger one in each building. Outdoor gardens in front of the building were also improved. Rents were kept at the same rate as before.
- Each of the 530 flats was refurbished in between 12 to 16 days: half day for laying the concrete slab, 2 days for adapting the old façade, 2 days for placing the new façade, and 8-12 days for renovating the interior.

Key Learnings:

- **Prefabrication:** New elements were prefabricated modules, installed like scaffolding to the existing building. Precast concrete slabs and columns were transported to the site and craned into position to form a freestanding structure. Only the foundations were made from concrete poured in situ.
- Due to the retrofit proposal requiring all inhabitants remain in place, the project excluded interventions on the existing structure, stairs or floors, and instead used additions and extensions, large enough to be fully used. Inside the flats, only refurbishment of facilities or finishes was done.



GRANDVIEW TERRACE, EAST VANCOUVER, BRITISH COLUMBIA

Owner:

BC Housing - Directly Managed

Building Characteristics:

- Size (floor area): 13,199 m²
- Number and type of units: 154 Units
 - Housing Types:
 - High Rise Apartment (8 storeys) x 2
 - Duplexes (attached to high rise towers, 2 storeys) x 2 connected
 - Townhouses (3 storeys) x 6 separate buildings
- Type of organization (private, non-profit, social housing, etc): Public social Housing
- Length of construction: Construction began in June 2019, and is expected to be completed by October 31st, 2019

Retrofit Scope:

- **Building Envelope Remediation (BER):** The building envelope was replaced and is now constructed of: The existing CMU structural Wall, Insulated aluminum panels on the towers, and Hardie Board exterior wall finish on the duplexes and townhomes, Weatherstripping and air sealing of the buildings, Upgraded wall cavity insulation for all buildings, with exterior insulation added in most locations, Installation of energy efficient low heat gain windows on all buildings
- **Upgraded Heating System:** New low temperature heating radiators were installed throughout all six buildings.
- **Roof Replacement:** Full roof replacement with additional insulation
- **Ventilation:** Replaced existing make-up Air unit with condensing unit prior to the current project Central air conditioning unit replacement . All bathroom and range hood fans were replaced. The new range hood fans exhaust to the exterior
- **Plumbing:** A full re-pipe of the buildings was also included in the project.
- **Electrical:** Existing natural gas generator was replaced with a diesel fuel generator, and was relocated from the mechanical room to the exterior. Energy efficient lighting upgrades. Common area lighting controls were installed
- **Landscaping:** Aged and deteriorating landscaping elements were replaced and rejuvenated, along with some grading improvements.

Key Learnings:

- Given the significant scope of this project, and the fact that the tenants would not be relocated during the revitalization, managing their comfort and complaints during the process would be key.
- Stan Bobic, Building Manager at Grandview Terrace, thought that the tenant engagement plan was largely effective, and he wouldn't recommend doing anything differently.



4. KEY ISSUES

From a resident's perspective, retrofit construction projects can be incredibly disruptive, confusing and create a sense of insecurity and for vulnerable people, these disruptions are amplified. Retrofits in occupied buildings require a different approach than typical new builds that considers sequencing, communication and maximizing preparation off-site. In Canada, these types of procedures are not yet standard.

- There is inevitable disruption to residents during retrofit projects with noise, dust and lack of light, etc.
- Retrofit work can affect people disproportionately: some people say that construction caused them little inconvenience, while others were severely impacted.
- In multi-unit rental housing, there can be institutional barriers to tenant participation, such as landlord-tenant mistrust, poor training and expertise of building staff and trades, and a lack of monitoring, evaluation, and performance feedback.
 - Lack of engagement
 - Many tenants indicated that the status quo was a lack of engagement.
 - Tenant-landlord issues
 - Lack of trust, with residents speaking of a deep fear that any request they made of their landlord would lead to an above guideline rent increase.
 - Some residents had experience (or suspect) unauthorized entry into their apartment by their landlord, others had witnessed or experienced harassment and intimidation of tenants.
 - Many residents indicated that necessary repairs were not completed, or they had to repeatedly request their landlord to have their requests for repairs addressed.
- Existing research and identified case studies reinforce the idea that engaging tenants before, during and after retrofit projects is essential for success.

5. EMERGING OPPORTUNITIES

Interim Findings

Through our research, the Lab team has identified the following emerging opportunities to improve the effectiveness and efficiency of tower retrofits for builders while being respectful of tenants.

Roles and Responsibilities

- Create new roles on the construction team, such as a superintendent 'tenant liaison' position tasked with direct contact with tenants to:
 - Communicate weekly work plans;
 - Identify unique tenant needs due to health or other issues;
 - Plan ahead so that subtrades are fully utilized even if the planned areas of work have to be shifted due to lack of access
 - Coordinate with the building owner on a regular basis regarding tenant concerns, scheduling, and escalating situations
- Modify contractor RFPs, tendering and builder selection processes to optimize complex projects with sitting tenants, including:
 - Evaluate contractor's 'Customer Care' qualifications
 - Require contractor to fill a tenant liaison role
 - Outline contractor Code of Conduct
- Engage residents throughout project, including:
 - Consult with residents on the project plan in advance of construction start-up to allow for co-benefits to be incorporated into project scope
 - Build resident participation into constructor selection process
 - Provide mechanisms for resident representatives to affect construction practices/timing

Products and Methods

- Schedule and sequence work to minimize time spent within individual suites
- Allocate areas of respite where dust, noise, and other disruptions are minimized
- Use prefabrication or off-the-shelf solutions to deliver “same day” installation
- Maximize work outside of units, such as window installation from the exterior
- Develop or import off-the-shelf retrofit solutions to limit time spent onsite
 - Draw on products currently available only in the EU where retrofit markets have been developing for 20+ years

7. ABOUT US

Canada Mortgage and Housing Corporation (CMHC)

The federal crown corporation that regulates and provides mortgages and other housing financials.

We thank CMHC for its generous funding of this research project.

Centre for Urban Growth + Renewal (CUR+G)

The Centre for Urban Growth and Renewal (CUG+R) is a non-profit research organization founded in 2009 with the mission to engage in cross-disciplinary research initiatives fundamental to achieving livable and sustainable urban, suburban and rural environments.

The Tower Renewal Partnership

Tower renewal is a model to transform Canada's remarkable stock of postwar apartment towers and their surrounding neighbourhoods into more complete communities, resilient and healthy places, fully integrated into their growing cities. Led by the Centre for Urban Growth + Renewal and supported by a group of core partners, the Tower Renewal Partnership is a collaborative initiative working to preserve and enhance this key housing through research, advocacy and demonstration projects. The Tower Renewal Partnership's goal is to enable reinvestment into these dynamic neighbourhoods, working towards building lower-carbon, healthier and more complete communities.

ACORN Canada

ACORN (Association of Community Organizations for Reform Now) Canada is an independent national organization of low- and moderate-income families. ACORN has over 130,000 members organized into twenty four neighbourhood chapters in nine cities across Canada. They believe that social and economic justice can best be achieved with a national active membership who are invested in their organization and focused on building power for change..

NAIMA Canada

NAIMA Canada is an association for manufacturers of fiberglass, rock wool, and slag wool insulation conducting business in Canada. They were established to promote energy efficiency and environmental sustainability through the use of insulation, to encourage safe production and installation of insulation materials, and to support improved comfort for the occupants throughout the home or building's lifetime.

NAIMA Canada encourages the use of insulation for making homes and buildings more energy efficient. NAIMA Canada envisions an energy-conscious Canadian population who strive to live and work in green buildings, specifically net-zero energy buildings, and who recognise that well-insulated building envelopes and properly vented structures help save on energy by avoiding waste through air leakage.

Solutions Lab Consultant (MaRS, Evergreen, TNS)

The MaRS Solutions Lab, Evergreen and The Natural Step collectively offer a unique blend of established social innovation lab approaches to Canada's most pressing housing challenges. They are three national organizations that bring a combination of subject matter expertise, facilitation experience, national networks and capacity to deliver solutions labs that drive impact on complex societal challenges in and across communities. They collectively offer vision for sustainable, inclusive communities and deep expertise using lab processes to create, lead and implement innovative solutions to complex problems.