Mining the City: A Reimagination of Old City Hall

by

Kevin Mockford

Submitted in partial fulfilment of the requirements
for the degree of Master of Architecture

at

Dalhousie University
Halifax, Nova Scotia
June 2022

Dalhousie University is located in Mi'kmaq'i,
the ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

Contents

Abstract iv

Acknowledgements v

Chapter 1: Introduction 1

Chapter 2: Society And Waste 4

- Mining The City 4
- Circular Economy 6
- Embodied Energy and Material Life Cycle 9
- Current Halifax Infrastructure 10
- Transparency of Goodwood C&D Recycling Ltd 13
- Is Halifax's System the Right System? 16

Chapter 3: Methodology of Waste 18

- Defining The Circular Economy Hierarchy 18
- Reduce (Material Sourcing) 19
- Reuse (Adaptive Reuse) 21
- Repurpose (Labour/Craft) 24
- Recycle (Remanufacturing) 27

Chapter 4: Dartmouth Old City Hall - A Case Study 30

- Dartmouth Old City Hall 30
- Project Specific Methodology 34

Chapter 5: Material Inventory 36

- Reuse 36
- Repurpose 38
- Disassembly 42
- Assembly 43
- Reduce 46
- Design for Deconstruction 48
- Recycle 49
- Carbon Related Decision-Making Process 49

Chapter 6: A Reimagination of Old City Hall 52

- A New Potential Suitor 52

A Spa and Waste 52
Downtown Dartmouth Site Analysis 53
Program and Building Transformation 55
Spa 61
Overnight Pavilions 66
Restaurant and Terrace 67
Chapter 7: Conclusion 70
Reaching A Broader Audience 70
References 73

Abstract

The built environment is a building resource with enormous potential, but in today's society, it is largely ignored. By mining the city for construction and demolition materials that have been deemed as "waste" before they reach the landfill, valuable waste streams can be used to create new buildings in our cities. This thesis imagines how Dartmouth Old City Hall, a building currently vacant located in Nova Scotia, Canada, might become a precedent for a different approach to demolition and the reuse of construction waste — employing careful disassembly, re-use of construction materials, and re-purposing them to support a new use for the building. By establishing a methodology to design with waste, a circular economy in architecture begins to take shape. Through a hierarchy of reducing, reusing, repurposing, and recycling, we can help extend the life expectancy of valuable materials found within the city limits.

Acknowledgements

I would like to thank my mom and dad for their love and support throughout this journey. This short acknowledgement is simply not enough. It would not have been possible without you two.

I would like to thank my supervisor Christine Macy for continuously pushing me through this process and advisor Jennifer Corson for providing me with knowledge in how to work with repurposed architectural components. I would also like to thank my M5 supervisor Ted Cavanagh for helping me frame the argument.

Lastly, I'd like to thank my Grannie for instilling the values of reusing a material at a young age. She had me save my pop can (and at an older age beer can) tabs to build wheelchairs for the hospital where she was a volunteer. She was a woman ahead of her time.

Fat Joe, "Find Out" (0:37)

Chapter 1: Introduction

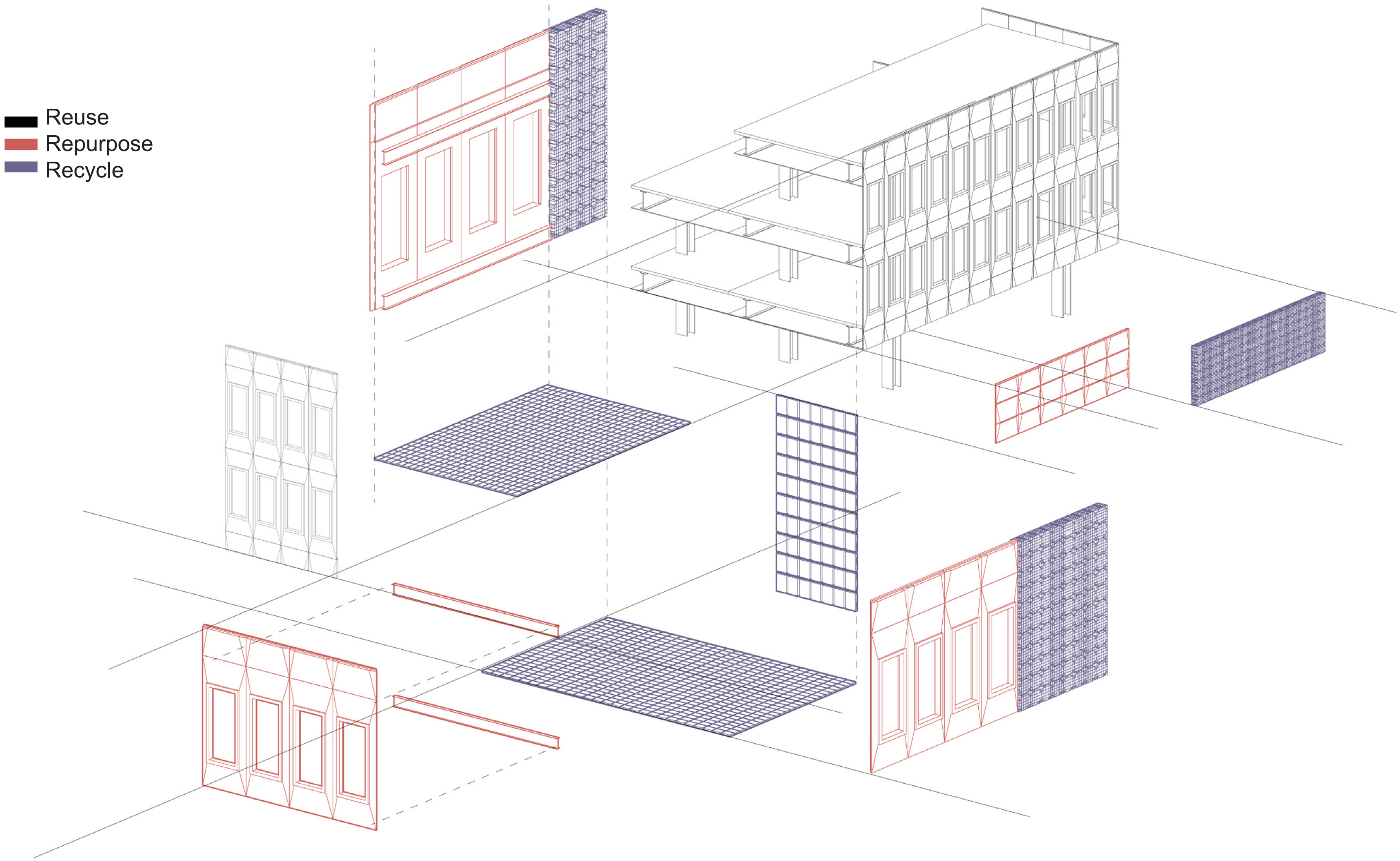
Waste in our society has always been a contentious topic; the word itself carries so many negative connotations. As a result, most people refuse to associate themselves with anything that has been historically viewed or deemed as being "waste." In his book *Wasting Away*, Kevin Lynch says "death and waste are never mentioned in polite society" (Lynch and Southworth 1991, 5). Since the industrial revolution began in the 19th century, cities in North America started to overflow with garbage, which resulted in spikes in disease, infestation, foul odors, and unpleasant aesthetics. As a result, societies often looked to hide waste from plain sight, by pushing mountains of garbage to the outskirts of towns and cities. This, out-of-sight out-of-mind approach to waste management has detached citizens from the reality of how everyday products are disposed of, and the negative impact improper disposal methods have on our health, our economy, and our overall environment. Presently, 2.12 billion tons of waste are disposed of each year across the globe and dealing with waste has reached a critical tipping point implicating every country around the world (The World Counts n.d.).

Amount of waste dumped in landfills yearly

The construction industry is one of the worst contributors to landfilling, and the cradle-to-grave system that society has become accustomed to can no longer continue at the same pace. Our once-abundant resources become increasingly scarce with each passing year.

Typical demolition practices in Halifax leave a building in a pile of rubble, rendering the material useless for any future use. Where the building once stood, a new building with virgin material takes its place. When we start to look at the pre-existing architectural components for their intrinsic material qualities, instead of exclusively for their original design or intended purpose, we can start to see our concrete jungle as a collection of untapped material resources.

This thesis looks to apply the model of a circular economy to construction material, to divert as much waste as possible from landfills. A methodology that uses four incremental levels to reduce, reuse, repurpose, and recycle, aims to keep building components in circulation, maximizing their material life cycle.



Understanding the different ways we can begin to divert material from the landfill is essential. This methodology shows how reuse, repurposing, and recycling can be applied in different scenarios.

Chapter 2: Society And Waste

Mining The City

The future of mining is not underground but in our built environment. There are more valuable metals and rare earth in our cities and landfills than in our natural world (Hebel, Heisel, and Wisniewska 2014, 27). Many of the materials we obtain from great distances can already be found within our city limits—but rather than reusing them, we dispose of them and seek new raw materials of the same sort. For example, the Halifax region is blessed with an abundance of stone and rock, and it has always been quite easy for the city to acquire these materials locally. However, due to a rise in population and the continued use of short-sighted and exhaustive mining practices, a resource that was once

Construction and demolition waste piled high in a landfill abundant in our region, is now becoming increasingly scarce and difficult to access. Recent ecological footprint studies have shown that cities exceed their bio-capacities by typically 15-150 times (Agudelo-Vera et al. 2012, 1). It is predicted in the coming few decades Halifax will be forced to import these from great distances (NSDNR 2007, 8). Across the world, cities have taken their natural resources for granted and we are now seeing the repercussions of our actions. As a society, we need to shift the sourcing of construction materials away from extractive industries and start moving towards more sustainable and less harmful practices. We need to start prioritizing the exploration of alternative uses for the materials that already exist in our day-to-day world and embrace the opportunity to find creative solutions to these complex problems.

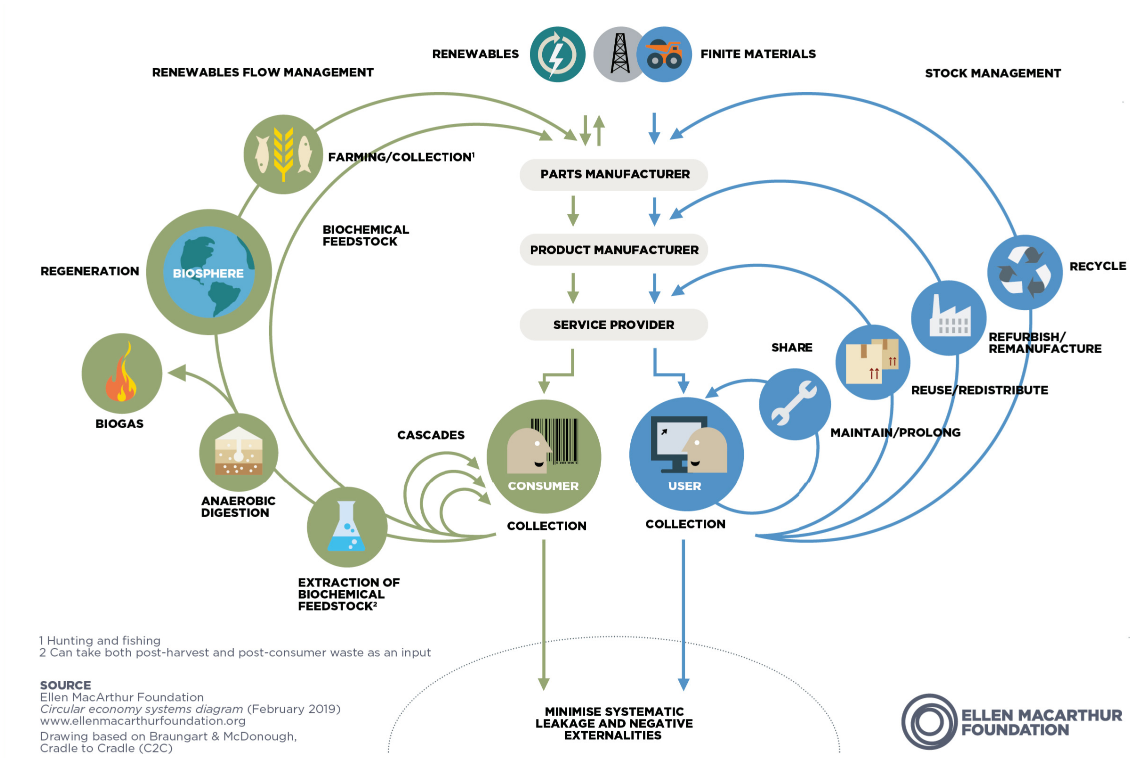
Construction and demolition materials are one of the most prevalent sources of waste today. Halifax Regional Municipality estimates that 25 to 30 percent of its waste comes from construction and demolition — that is, 175,00-200,000 tonnes of construction waste disposed of each year (Government of Nova Scotia 2019, 1). Many building materials condemned to landfills have years remaining in their “life expectancy” — their disposal is not considered best practice, from an ecological perspective (Government of Nova Scotia 2019, 23). Yet the building industry finds it easier to demolish a building into rubble, destroying the re-use potential of all components before the “waste” is transported to a construction and demolition landfill. This is mainly due to time constraints and disassembly complexity. Hiring deconstruction professionals to disassemble the building is more time-consuming than demolishing. In demolition, a building could be torn down in days, while it could take weeks or months to disassemble a building for its components. Part of the reason for the time is the complexity — buildings are not designed to be disassembled and contain a lot of chemical connections that leave some components stubborn to remove and impossible to salvage. However, a more holistic approach to how construction material is disposed of is necessary. Deconstruction can help generate income from a project, utilize local labour, and improve public relations, while also being far more environmentally friendly and creating far less landfill waste for companies that choose to take this route. Mining the city for its resources will require a large shift in how the building industry values materials gleaned from the built environment and shifting this mindset could drastically help decrease waste produced in the demolition process.

Circular Economy

It is apparent the cradle-to-grave method we have become so accustomed to needs to drastically change. “Repurposing and reusing items is still common in developing countries, however, not as an act of environmentalism, but as an act of relieving extreme poverty” (Bahamon and Sanjines 2010, 7). These negative connotations that have been tied to “waste” by our society, have stripped it of the “value” that it has. That mentality has caused many people to view the items that we choose to throw away as being of little value. If we shift our mindset and get our planet’s first-world countries to begin to see the value of “waste”, then a massive quantity of usable material can easily start to be diverted from landfills and cycled back into our construction sites.

The Ellen MacArthur Foundation, an organization committed to accelerating the transition to a circular economy by working with businesses, academia, and policymakers, states that the circular economy is based on three principles, all of which are driven by design. These are: eliminating waste and pollution, circulating products and materials (at their highest values), and regenerating nature (Ellen MacArthur Foundation n.d.). The diagram below, based on Braungart and McDonough's concept of "Cradle to Cradle" is a brilliant portrayal of a circular economy. It describes how systemic leakage is minimized through two main streams: renewables and finite materials.

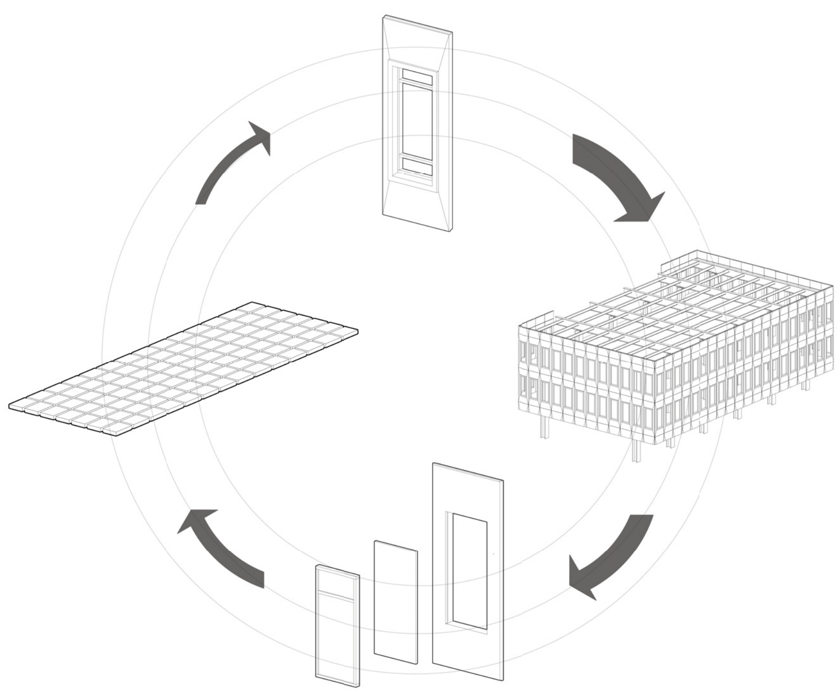
When examining the finite materials there is a clear hierarchy. The first goal is to share/maintain/prolong a product, and this is done among users. It dramatically



Ellen MacArthur diagram based off Cradle To Cradle showing the two aspects of the circular economy and how the system can tie into each other (Ellen MacArthur Foundation n.d.)

extends the life of a product and keeps usable materials in circulation. Reuse/redistribute is the next level in the Ellen MacArthur Foundation's circular economy. This level must go back to the service provider and be taken care of there. Refurbishing and remanufacturing are the next level of the circular economy, requiring the material to be returned to their manufacturer. The final level of the product within the circular economy is recycling, which also entails a return to a manufacturer.

When examining these distinct levels, a clear correlation can be made between products within a circular economy and how construction materials should be treated. We simply cannot continue to dispose of our building components as we have in the past. This thesis focuses on showing how a circular economy can be applied to architectural materials,



Four different levels of the circular economy when applied in architecture: reduce, reuse, repurpose and recycle.

and how each level of a circular economy can begin to divert our precious resources from landfills. In referencing the Ellen MacArthur Foundation’s diagram, architectural material can be mitigated on four incremental levels:

•reduction of our use of raw resources (share/maintain/prolong),

•reuse of the building,

•repurposing (refurbishing) components that are still in good condition, and

•recycling materials that are unfit for previous applications.

As Alejandro Bahamon and Maria Camila Sanjines point out in *Rematerial: From Waste to Architecture* “it should be pointed out from the start that the very idea of manipulating garbage — and using ingenuity to turn it into something productive and beautiful — is extremely innovative and virtually contravenes social convention” (Bahamon and Sanjines 2010, 7). This process could begin to shift the paradigm for how architectural materials are used in society today. By understanding how each application can be applied in particular circumstances, we can begin to revolutionize the way architectural material is used.

Embodied Energy and Material Life Cycle

Radical change is already happening today in cities across North America. Growth is happening at an exponential rate with dozens of cranes in the air at one time, completely transforming the skylines to almost unrecognizable levels within a generation. Halifax is no exception. Between the years 2003 and 2020, Halifax issued 2535 demolition permits — this is equivalent to seventeen city blocks (Cameron

2022, 25). Part of this has to do with the value we place on existing buildings. In *Building from Waste*, Dirk Hebel states “In recent decades the life expectancy of buildings has been shrinking due to a predominantly economic valuation of architectural objects” (Hebel, Heisel, and Wisniewska 2014, 27). Many buildings on valuable property that do not meet a developer’s vision are torn to the ground, replaced by brand new buildings rather than working with existing ones. Only when buildings are deemed to have heritage value will the city and builders salvage the front facade and build an entirely new building behind it. The material from the existing building is never considered for use in other architectural applications, and after it is reduced to a pile of rubble, it is hauled off to a landfill, never to be seen again.

In this cyclical process of material extraction, use, and disposal, an extreme amount of embodied energy is required. The operational energy of a building has been the focus of reducing carbon in recent years, but recent research has shown that upwards of 70% of the carbon a building emits is from embodied carbon (Cameron 2022, 15). This invisible process that occurs before the building is even inhabited has largely been ignored; however, if we are to truly reduce the carbon footprint in buildings embodied energy needs to become the focus.

Current Halifax Infrastructure

In Halifax Regional Municipality, recycling – the lowest level of salvaging construction and demolition material – has become the most customary practice. There are only two facilities that accept construction and demolition waste: one is a transfer station in Westphal, and the second is the construction and demolition processing in Goodwood

The two construction and demolition processing stations in Halifax Regional Municipality. (Basemap from: MapCruzin 2022, HRM 2022a, HRM 2022b)

1. Sorting and Processing Facility (16 Mills Drive, Goodwood)

2. Transfer Facility (188 Ross Road, Westphal)

that sorts and processes the material. Here, construction waste is sorted and processed to be sent out as recycled products for industry. Halifax demands a 75% landfill diversion rate from these facilities, but these materials are often not recycled in the best methods. Materials deemed not good enough to be diverted from the landfill are taken to a construction and demolition landfill close to Otter Lake. Gypsum wallboard is commonly ground into a powder and used as animal bedding, wood is transformed into daily landfill cover, aggregate from brick or concrete is used in road construction, and glass is used for septic sand. While many of these products are turned into other products, can

WASTE PRODUCT	CURRENT RECYCLING METHOD IN HRM
 AGGREGATES	- Aggregate is mostly used for fill of infrastructure projects: 1. Road construction 2. Driveways
 DRYWALL	- Three main purposes: 1. Agriculture animal bedding 2. Recycled drywall (not a comon practice anymore) 3. Fertilizer
 GLASS	- Two main purposes: 1. Septic sand product 2. Asphalt sand
 WOOD	- Four main purposes: 1. Agriculture animal bedding 2. Biomass/hog fuel 3. Alternative daily cover 4. Bio filter
 ASPHALT SHINGLES	- Two main purposes: 1. Pavement 2. Replace coal in cement

Waste diversion techniques used in Halifax (Images from: Halifax C&D Recycling n.d.)

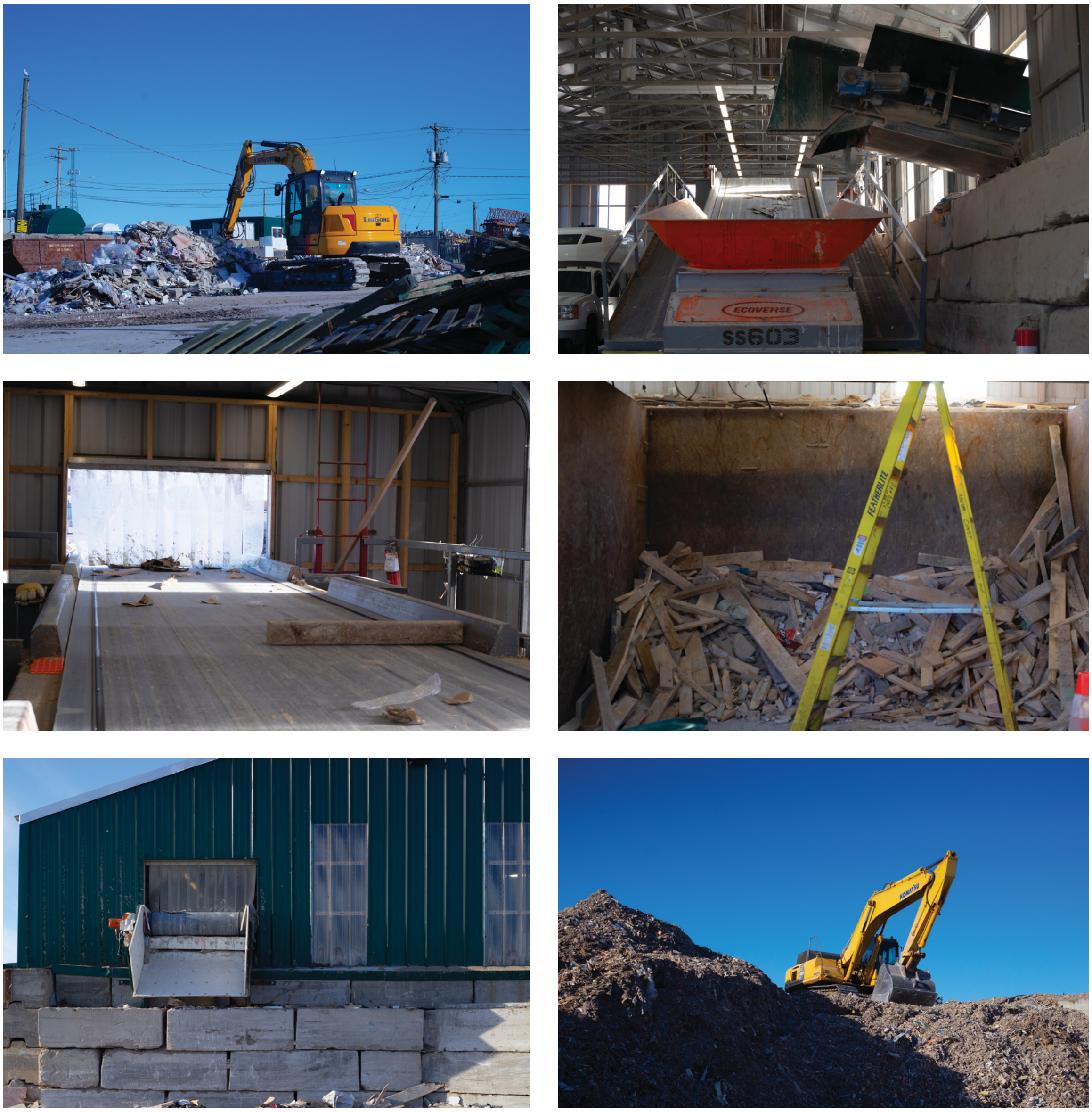
landfill cover — a material that is going into the landfill — be considered a successful landfill diversion technique?

Transparency of Goodwood C&D Recycling Ltd

One interesting observation in trying to access the construction and demolition landfill was the difficulty I faced getting permission to photograph these sites. In my first attempt, I asked permission to enter the processing station in Goodwood. There, I was given a card and told I would have to email the company to access the site. After the email was left unanswered, I called the company and, after being redirected three times, was put in contact with the operations manager Ken Jagoe. After a conversation, he said he still needed to get a hold of his bosses to see if I would be allowed on the site. After a week, he called back to say he would give me a tour of the site. While the

Piles of construction and demolition waste at the processing plant in Goodwood.

Piles of construction and demolition material at the processing facility begin to reveal how this material is being recycled.



On site sorting process. Material is moved with heavy machinery (top left) to the first belt (top right). Next it is further sorted by people on a second belt (mid left) and dropped into piles of material (mid right). Any unsortable material is dropped outside (bottom left) where it is ground and used as landfill cover (bottom right).

tour Ken gave me was highly informative and helpful for my work in understanding how the material was processed, it cannot be ignored how challenging it was to get on site. This heavily restricted access to our waste in society only increases the problem as the visibility of the system is not seen or understood.

Is Halifax's System the Right System?

The demolition process in Halifax usually begins with a vacant building. There are dozens of these across Halifax and Dartmouth. Often the program for these buildings has moved to a new facility, leaving a vacant building left standing until it is met with its inevitable fate of demolition. Vacant buildings are an important first step in understanding how we can use construction materials. At this stage, a building

Vacant buildings in Halifax and Dartmouth. (Basemap from: MapCruzin 2022, HRM 2022a, HRM 2022b) should be examined for any material that can be reused, repurposed, or recycled. Understanding this process before the building is demolished is paramount — if materials are identified before demolition begins, the amount of material salvaged can be increased: reused or its components repurposed.

In traditional demolition, a building is brought down all at once, creating a pile of waste with little of its architectural or structural value retained. This is how the current Halifax system is set up to “salvage” material, ending up at Halifax Construction & Debris Recycling Ltd. Such materials are ground down into small pieces, salvaged only through the lowest level of recycling. To make better use of construction materials in future buildings, the focus needs to be placed on salvaging building components before demolition.

Unsalvageable material at demolition site on Granville St. and George St.

Chapter 3: Methodology of Waste

Defining The Circular Economy Hierarchy

So far, we have looked at how the four levels of the circular economy can be applied to buildings slated for demolition, so they become resources for new construction. In this research, it became apparent that the industry lacks a strategy for applying a circular economy to architecture. Buzz words like “upcycling” may be marketable, but are often used incorrectly. This grey area presents a large hurdle for the construction industry moving forward. Defining each level of the circular economy is vital to understanding how construction materials should be properly dealt with. This thesis employs the following definitions of the circular economy in demolition and construction:

1. Reduce - Material sourcing. Acknowledging that the industry cannot continue to pillage our natural world’s raw resources.

2. Reuse - The building. Using an adaptive reuse strategy to keep the existing structure largely intact.

3. Repurpose - Labour and craft. It is necessary to adapt current labour practices when using building components in new architectural applications

4. Recycle - Remanufacturing. Using compromised material to create a new building component.

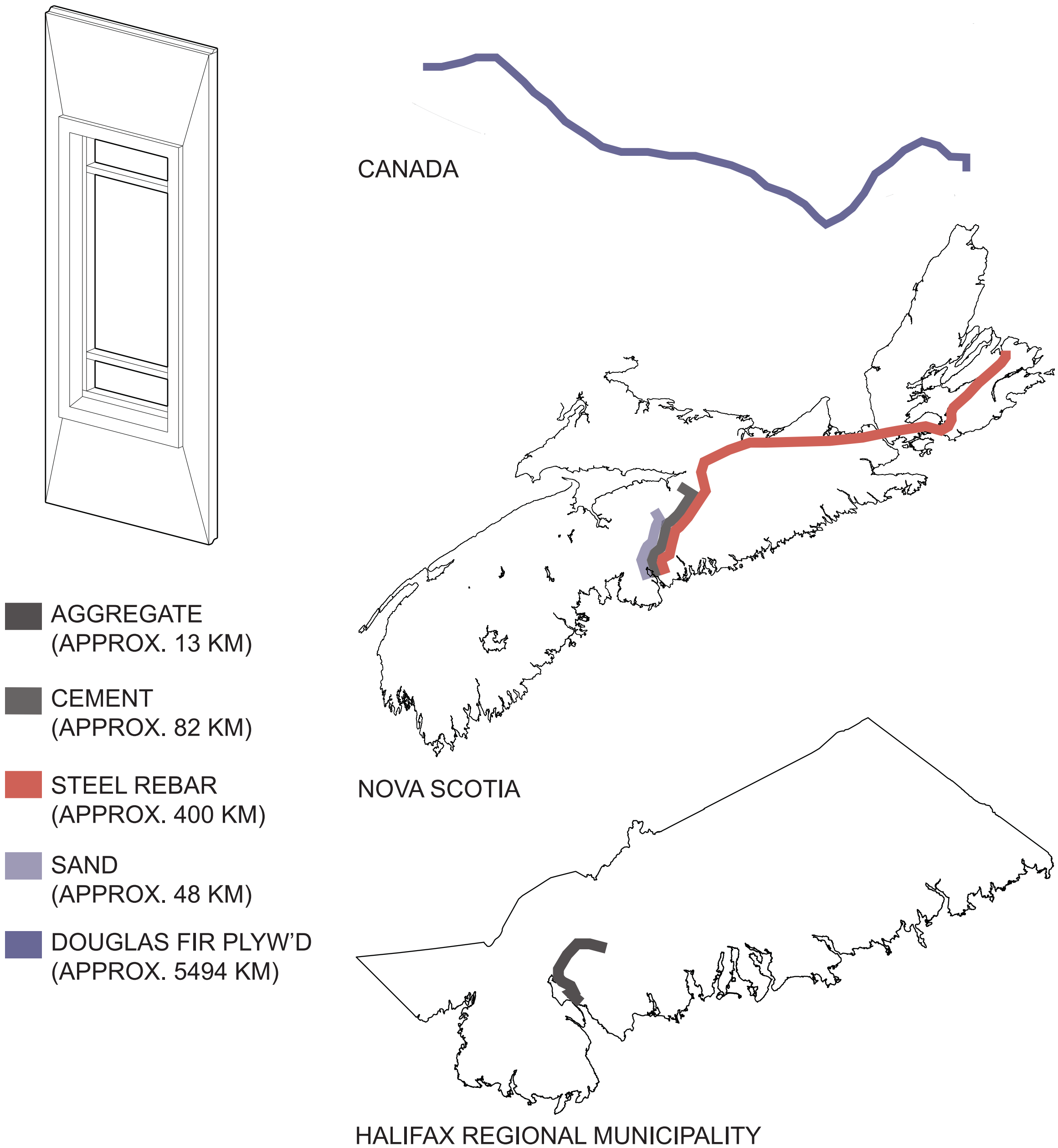
This chapter breaks down these four levels concerning variables like cost, labour, and embodied energy, to start understanding how this design methodology may be used to divert construction materials from landfills.

Reduce (Material Sourcing)

The first step to closing the waste loop in our society is to reduce the number of raw resources used in the first place. One of the fundamental purposes of the circular economy is to close loops of our finite resources. This requires knowledge of where the resource comes from, how it is harvested, and how it is transformed into a finished building product. In *Empire, State & Building*, Kiel Moe suggests that architects

> are trained to construe a building only as an isolated object-instance…. As a result, they do not see that across a range of temporal and spatial scales, the building is bonded to a range of factors and forces that extend well beyond any individual building and its plot of land. (Moe 2017, 19)

Architects must think beyond the building they are designing and consider the implications of the material systems to which they are connected. If architects could visualize these systems, their material decisions would dramatically alter. For example, a decision to import a marble countertop from Italy for a house in Halifax could be evaluated under this framework — it could be sourced from a local stone or make use of materials diverted from the construction waste stream — this would reduce the embodied energy used for that countertop. Another point made by Kiel Moe is that "without an account of the building's corporeal and incorporeal materialism, we will understand little of the building itself" (Moe 2017, 26). All building materials carry intrinsic qualities that need to be considered in design and building. Deep knowledge of the material chosen should be essential for an architect to perform their job, however, material choices are often made after the design is done, completely detaching the architect from the material.



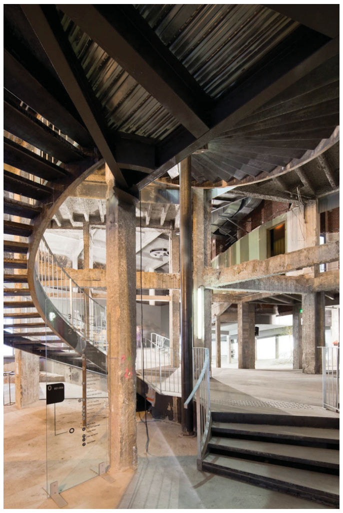
The material journey of a prefabricated concrete panel from the source of natural resources to building site.

To show the journey of a material before it reaches a site, we will look at the path taken by a prefabricated concrete panel built in the 1960s. These maps depict the resources used and the journey of the material before it arrives on site. One might assume a concrete panel is comprised only of aggregate, sand, cement, and water — which might be a lot of material coming from all over Nova Scotia. However, this does not include every material used in the fabrication of a concrete panel. Douglas fir plywood (the type commonly used for concrete formwork) is shipped over 3000 kilometres from British Columbia. The steel rebar might have been sourced from Sydney, Nova Scotia, over 400 kilometres away. Smaller components like screws or glue that connect the formwork, or concrete additives, may be sourced from much greater distances. When analyzing a building component like a prefabricated concrete panel, it becomes evident just how complex our construction system is and how much we take for granted in a material or building component that arrives on site. For our society to understand why we must reduce the extraction of raw material from our natural world, material flows and the embodied energy in material need to be front and centre in the design process.

Reuse (Adaptive Reuse)

Reusing an existing building by adapting it for a new purpose is an important and often underused strategy in Halifax. Adaptive reuse decreases construction time and can be less costly than demolition and rebuilding (Bullen and Love 2011, 3).

The central argument for adaptive reuse is that re-using an existing building lowers the embodied energy of material used, transportation, energy consumption, and pollution



Exposed structure in Palais de Tokyo (ArchDaily 2012)

Open, light filled gallery space in the Palais de Tokyo. Exposed material tells a story of the past. (ArchDaily 2012)

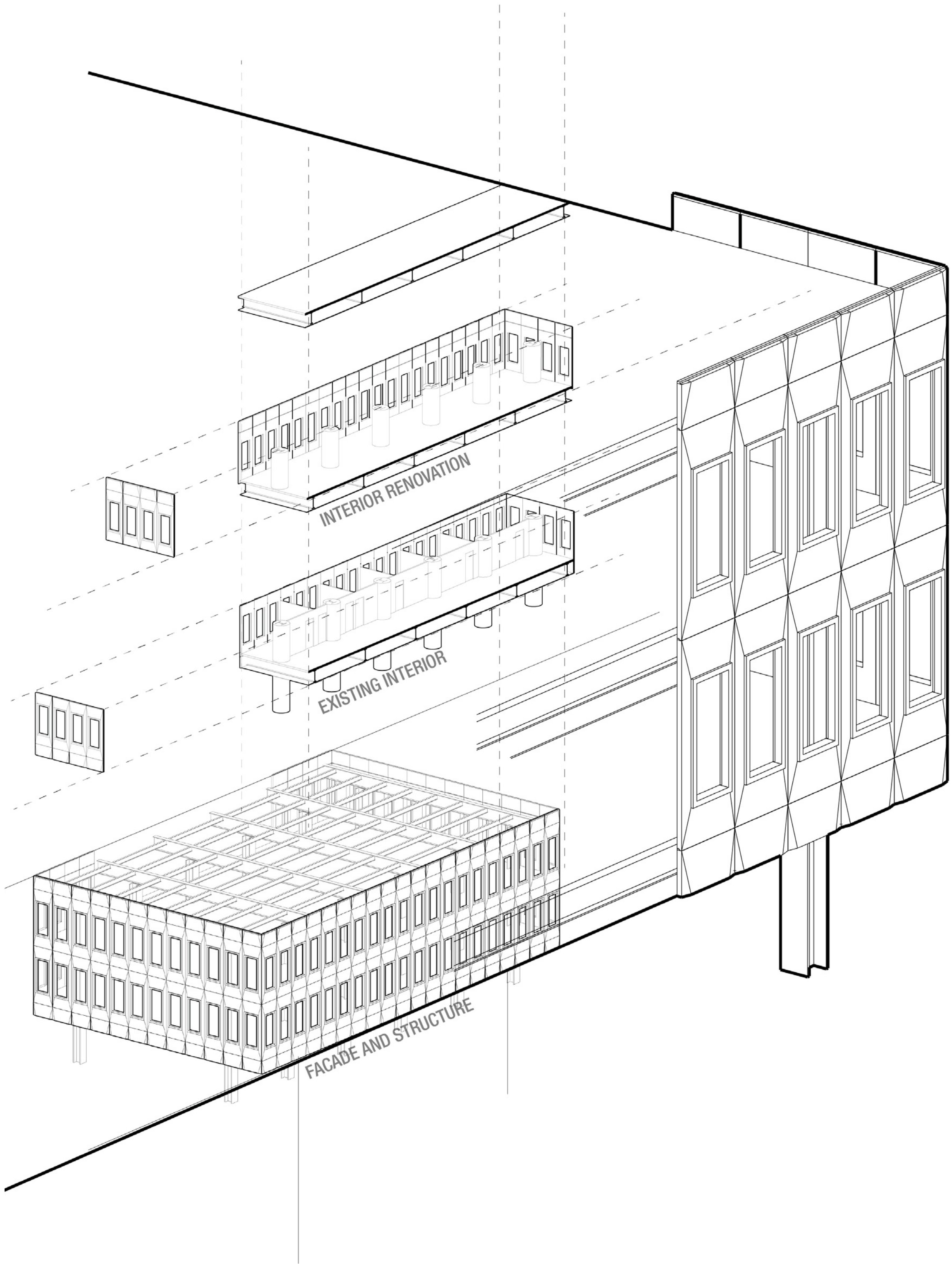
(Bullen and Love 2011, 2). For this reason, reuse is the second level of our design methodology. One of the best-known architectural firms that have embraced adaptive reuse as a core value in their practice are 2021 Pritzker Architecture Prize laureates Anne Lacaton and Jean-Philippe Vassal.

> the pre-existing has value if you take the time and effort to look at it carefully. In fact, it's a question of observation, of approaching a place with fresh eyes, attention and precision… to understand the values and the lacks, and to see how we can change the situation while keeping all the values of what is already there. (The Hyatt Foundation n.d.)

Finding value in what already exists, Lacaton and Vassal transform spaces with both modesty and thoughtfulness. Their transformation of Palais de Tokyo in Paris, France removed bleak and inefficient rooms and exposed the raw materials, used in the original building. The "barebones" aesthetic of their design created large voluminous spaces, that at a first glance appear unfinish and gritty, but also light filled and transparent.

This design encourages visitors to linger and soak in the grandeur of the space. It also provides artists with an ideal setting for creative exploration, and an environment where their imaginations are free to run wild.

By removing walls, the open spaces become more flexible and can accommodate a broader range of programmatic needs. This adaptability also increases the future lifespan of the building. Lacaton and Vassal's modest, but radical transformation of the Palais de Tokyo exemplifies the ethos of their practice. Their decision to keep the old structure exposed shows the honesty of the material and celebrates it, rather than covering it with a finish. If we return to our prefabricated panel — one that has been on a building



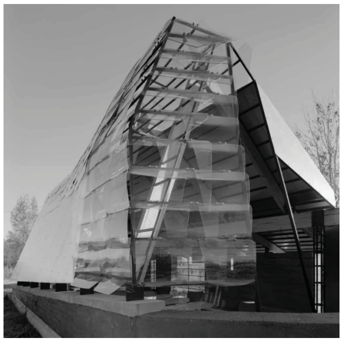
A prefabricated concrete panel in an adaptive reuse application. The facade and structure stays in place and a interior renovation is undertaken.

since the 1960s — it could also be considered for adaptive reuse. If Lacaton and Vassal's design thinking were to be applied to this 1960s brutalist building, it would reveal the value of the structure and the character of the weathered panels. The Old City Hall's deep floorplate, cluttered with offices, limit the potential of this building to accommodate new uses, while and may be removing them and revealing the open space celebrates the building's structure. Working with this approach, this thesis asserts the value of keeping the panelized façade and much of the existing structure. Adaptive reuse is therefore an important strategy.

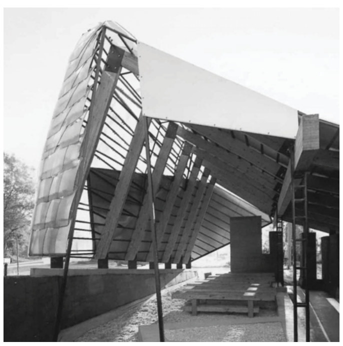
Repurpose (Labour/Craft)

Repurposing refers to the use of labour and craft to change the architectural application of a building component. It is an exceptionally creative way to divert construction material from landfill and is increasingly gaining traction in the last few years, under the slogan "upcycling."

This is not a new practice. In the history of architecture, repurposing stone was commonplace (Bahamon and Sanjines 2010, 7). The Romans took cut stone from the Greeks and the Egyptians; in Medieval Italy and Palestine, temples were pillaged to build churches and fortresses; the Spanish used Incan and Aztec masonry in their churches, and 19th century Americans brought over fragments of medieval monasteries to recreate "European" buildings in the New World. The repurposing of expensive building materials was frequent practice up to the beginning of the 19th century but was lost with the rise of industrial manufacturing. Re-employing this lost art in architecture could dramatically increase the amount of building components that are



Glass Chapel repurposing car windshields designed by Rural Studio. (Rural Studio n.d.)



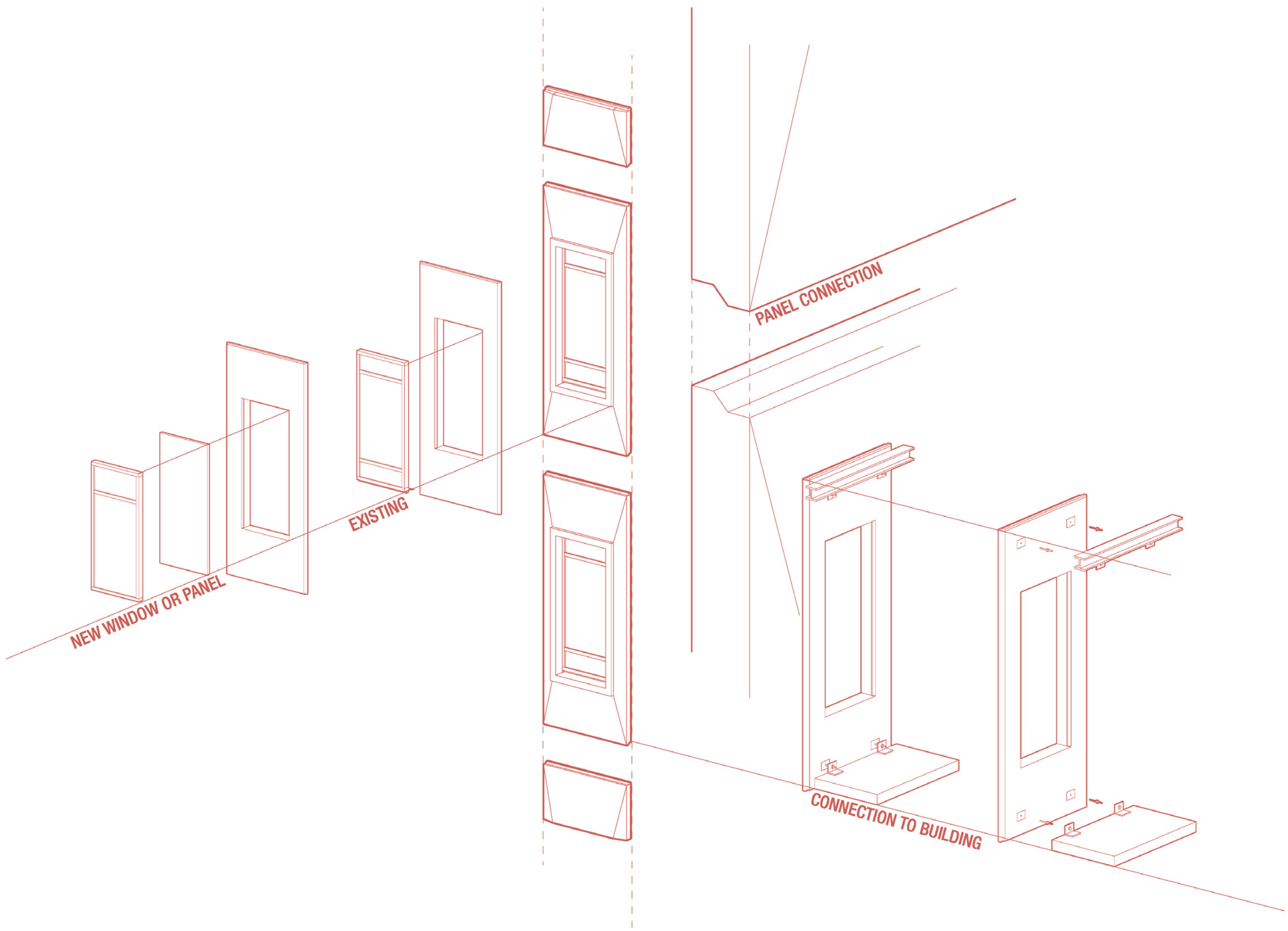
Glass Chapel interior view (Rural Studio n.d.)

reused, while also injecting creative new ways to incorporate material in design.

But to be able to upcycle construction materials, the local building trades must be skilled in adapting old components to new architectural applications. In our fast-paced society, it is often assumed that the careful, sequential deconstruction required to preserve building components is far too costly to be realistic. Mark Gorgolewski disagrees. In his article “Designing with Reused Building Components: Some Challenges,” he argues that “deconstruction may cost 30-50% less than straight demolition due to lower machinery and disposal cost” (Gorgolewski 2008, 177). This could help offset the additional labour involved in adapting the component to its new purpose. Since upcycling transfers costs from material to labour, for it to be a viable practice, other economic considerations may be put into play.

One further benefit of upcycling is — like with adaptive reuse — it adds less embodied carbon since there is less new material and construction is done on-site or nearby, reducing the carbon footprint associated with material transport.

There are many recent examples of utilizing “waste” material in innovative architecture. One of the best-known examples is Rural Studio’s Glass Chapel. Rural Studio, affiliated with Auburn University in Alabama, focuses its design research on sustainable, healthful rural living that regularly incorporates repurposed material (Rural Studio n.d.). Their Glass Chapel uses old car windshields to create a curtain wall. Emily Cassidy, a Master of Environmental Design Studies graduate who authored a thesis titled “Resourceful Materials” proposes a methodology for choosing a material to repurpose, listing: a) the abundance of the resource, b)



The concrete panel is once again used to show the different considerations in repurposing building components. Removing the component from the building, replacing the window and cleaning the edges are all factors to consider in this panel.

one's ability to modify it, c) whether there are a lot of "offcuts" (i.e., more construction waste), and d) the labour needed for repurposing (Cassidy 2017, 66).

Returning to our prefabricated concrete panel, upcycling would require work to remove the panel from the building — this would require skilled labour to properly disassemble without damaging the panel. A crane would be needed to lift the panel from the wall and store it on site. There may be work to clean the panel of sealant or grout, and of course, reuse would also require labour to install the component in its new location. While all of this would result in a fair amount of labour, using local trades, it fits well within Emily Cassidy's framework for repurposing.

Recycle (Remanufacturing)

Lastly, we have recycling defined in this thesis as remanufacturing. It should be noted that recycling has its flaws. It is often referred to as "downcycling", which means compromising the original material when creating new material. Some argue that downcycling merely delays the inevitable trajectory of material into the waste stream. In *Cradle to Cradle*, written by chemist Michael Braungart and architect William McDonough, recycling is described as "an aspirin, alleviating a rather large collective hangover of overconsumption" (Braungart and McDonough 2002, 50). However, this thesis argues that recycling has a place in a greener methodology because it is simply unrealistic to assume that all disassembled building components will come off in a salvageable condition. Yet it is still important for the material to be diverted from landfills.

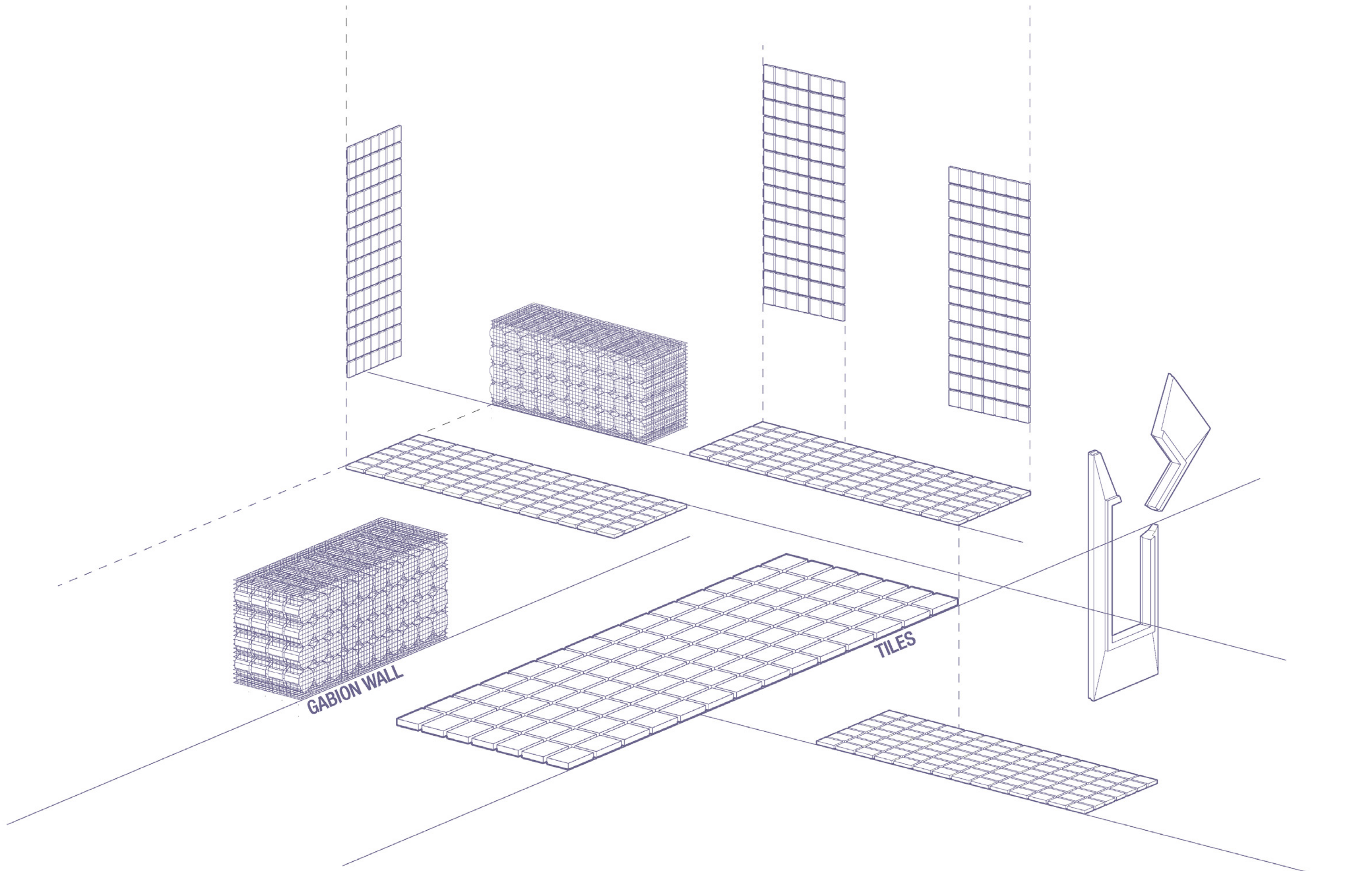
For example, since these materials slated for recycling are going back to the factory to be broken down and reformed, the


Pretty Plastic cladding made of PVC plastic (Pretty Plastic n.d.)

design could anticipate and mandate certain requirements. One example is Pretty Plastic Tiles, a tile made from PVC plastic waste and designed for easy deconstruction. It can be unscrewed when required and applied to another building (Pretty Plastic n.d.). This clever approach turns a downcycled material into a cladding system that can be upcycled, moving up the "waste hierarchy" to reduce waste in construction and demolition materials.

The largest problem with recycling in this methodology is the amount of additional embodied energy the material takes on, through being brought back to the warehouse, broken down, and reformed into a new component. Hebel argues that "only by applying corresponding processes in the energy sector a full-fledged and convincing circular waste-to-product system can be achieved" (Hebel, Heisel, and Wisniewska 2014, 95). While there is added embodied energy, this process is still less damaging than if the raw resource was extracted from the natural world. Recycling keeps materials in circulation and lessens the strain on landfills. It may have its flaws but is a framework that can be built on over time, as additional research is put into material technology.

In applying this methodology to our prefabricated concrete panel, we might imagine one that has been damaged in the removal and could not be repurposed. It could be made into tiles or formed to make a gabion wall — two recycling techniques producing two vastly different results. The gabion wall could be filled with concrete rubble; and the concrete tile might be designed for future disassembly, offsetting any added embodied energy.



Recycling the prefabricated panel provides two different options. Tiles could be created from grinding up the existing panel, adding an ability to design in deconstruction, but potential large amounts of embodied energy could be added. Gabion walls made of rubble involve no additional embodied energy, but will only serve that purpose in future applications.

Chapter 4: Dartmouth Old City Hall - A Case Study

Dartmouth Old City Hall

Built in 1967, Dartmouth Old City Hall has become an important part of the city's skyline. Originally used to house the city's politicians, the district school board moved in after the amalgamation of Halifax, Dartmouth, Bedford, and Halifax County in 1996. In 2015, after the school board moved out, the city deemed the building surplus, listing it at $2.6 million (Berman 2015a). Since the original listing, there have been several potential buyers for the site, but for one reason or another all the deals have ended up falling through.

Old City Hall in relation to Halifax and Dartmouth. (Basemap from: MapCruzin 2022, HRM 2022a, HRM 2022b)

Late 1960s photo of Dartmouth skyline. (Council of Nova Scotia Archives n.d.)

Since the site is on Dartmouth's waterfront, it is subject to strict height restrictions, and its proximity to the railway limits the expansion of the building footprint — both limitations decreased the financial potential of the site (Berman 2015b). The developer Francis Fares was interested in purchasing but walked away after he deemed it not financially feasible to add a five or six-story addition to the existing structure. Over the years, Old City Hall has gone through many different potential programs — new office space, apartments, a cafe, a storefront on Alderney Street — but through each iteration, the answer was the same: the proposal did not work for the buyers or the building. Finally, in 2017, this building was bought by Starfish Properties but remains empty.

In the age when these 1960s-70s brutalist buildings are being torn to the ground at an alarming rate, these demolitions

Old City Hall from Alderney Gate Ferry Terminal

Prefabricated concrete panels of Old City Hall

Ivy growing on core of building has become a landmark in Dartmouth

View of Old City Hall from Alderney Drive could lead to an unforeseen amount of concrete waste (Huuhka et al. 2015, 105). With no heritage designation saving the building from demolition, applying the established methodology to Old City Hall can begin to unpack how we save material in typical buildings across our cityscape.

Project Specific Methodology

To maximize the material diverted from landfill in adapting this building to a new purpose, the design portion of this thesis adopts the reduce, reuse, repurpose, and recycle methodology discussed in the previous chapter will be adapted. However, in using this methodology for any particular building, one must establish how these techniques should be employed to minimize the contribution to the waste stream.

For Old City Hall, reuse of the building becomes the most important aspect of the project as it is the best way to divert material from landfills. The majority of the building will be kept in place, only removing aspects to meet new program requirements.

Repurposing building components that are not reused becomes the second most important level. Salvaging the individual components through disassembly and utilizing local labour to refurbish the material will keep it in good condition for future architectural applications.

Reduction considers new material added to Old City Hall. Sourcing local material will help decrease the amount of embodied carbon used in the extraction, transport, and manufacturing stages.

Lastly, recycling is the final tier of the waste-reduction strategy. It is applied to any of the remaining broken material that can still be remanufactured and diverted from the landfill.

This four-step methodology will make the building more functional for its new purpose while making beneficial use of the full life expectancy of each of its constituent materials.

Chapter 5: Material Inventory

Reuse

There is simply no better way to save construction material than by reusing the material in place, and for that reason, reuse is the top priority in this methodology. In the words of Anne Lacaton “Demolishing is a decision of easiness and short term” (The Hyatt Foundation n.d.). So seen myopically, Dartmouth’s 1960s-era brutalist Old City Hall could easily be demolished for the value of its urban site, yet with modifications, it could also be transformed into a space that enhances downtown Dartmouth while recognizing its cultural and historic value as a trace of the past.

Dartmouth Old City Hall’s material palette is a perfect candidate for adaptive reuse - the poured concrete foundation and stairwell, steel structure, and precast concrete panels constitute a large quantity of demolition waste that would be diverted from the landfill if reused. The floor-to-ceiling height is a generous 12’-6”, giving the building ample vertical space for reuse. In Australia, a study investigating the refurbishment of a multi-story office building showed that 60% of a building’s embodied energy is in the foundation, structural frame, and floor slabs of a building, while the cladding, interior walls, and services represented the other 40% (Kibert and Chini 2000, 21). The most significant impact of reusing Old City Hall comes from saving the structure, and the concrete foundation. By retaining Old City Hall’s poured concrete foundation and stairwell, 99% of the material is kept in place, only on the ground floor to add of indoor pools. Similarly in this thesis proposal, 82% of the steel structure and 74% of the concrete floor slab in Old City Hall would be kept in place.

REUSE

COMPONENT	QUANTITY IN PLACE	MAT. IN PLACE
PRECAST CONCRETE	41.0 m3	57%
STEEL	31.8 m3	82%
CONCRETE FLOOR	258.9 m3	74%
CONCRETE FOUNDATION	471.3 m3	99%
WINDOW/CURTAIN WALL	4.9 m3	67%

85% REMAINS AS BASE BUILDING

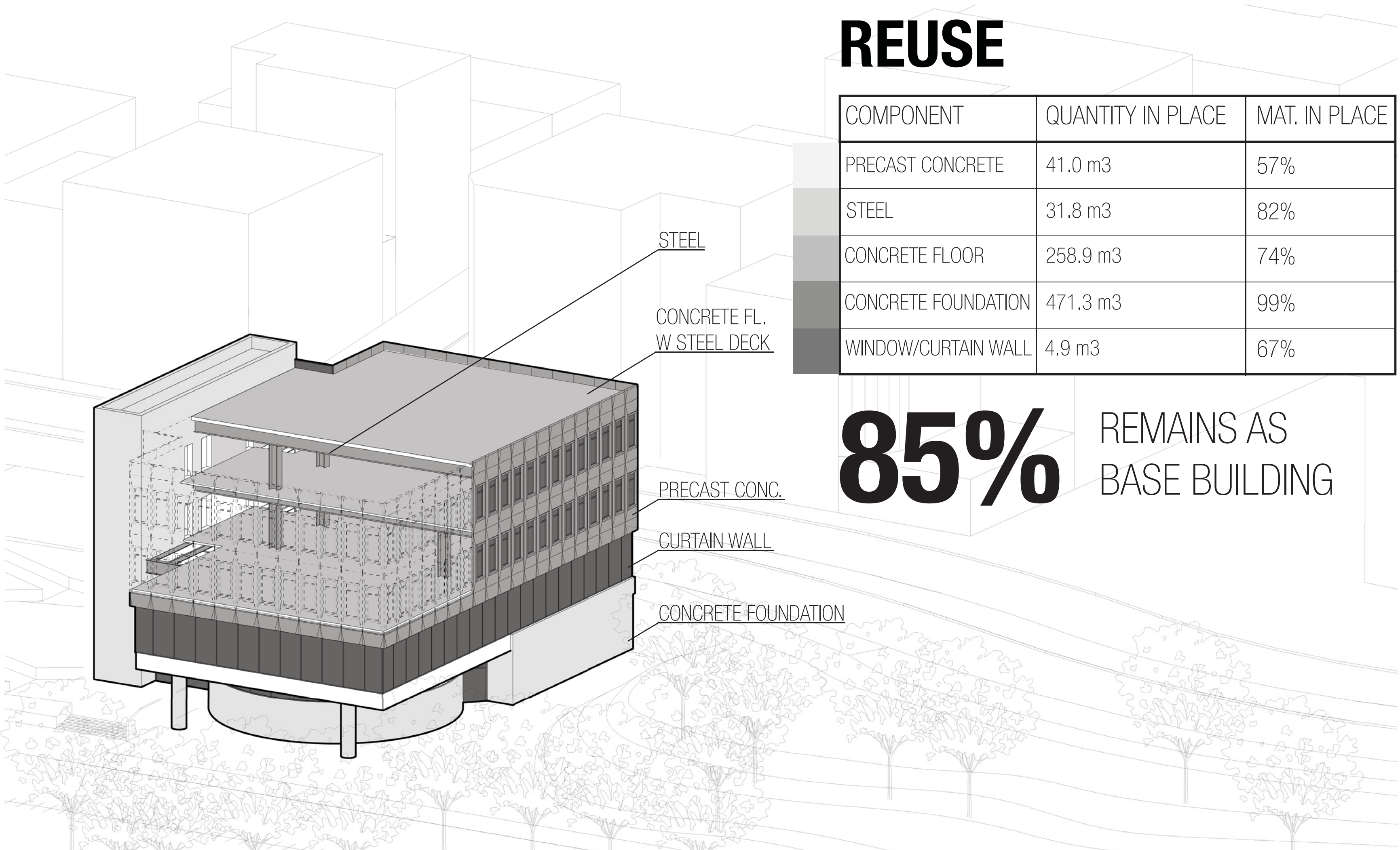
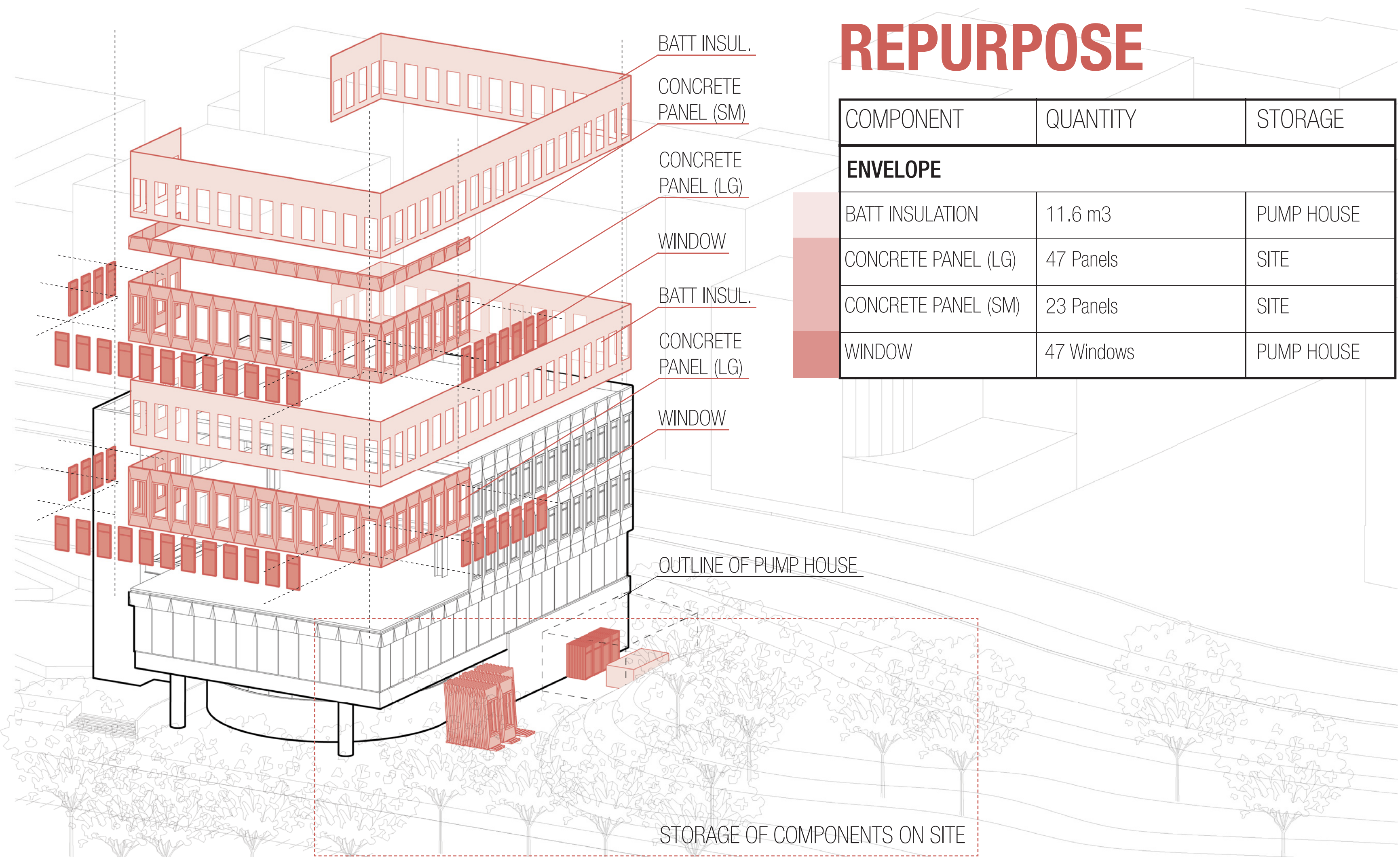


Image showing the reuse strategy. 85% of material from Old City Hall remains in place from the original design. The table represents quantities of material kept in place for the adaptive reuse.

The remainder of the steel and flooring is to be used in the repurpose phase of the methodology. Lastly, the high embodied energy aspects of the envelope will be reused. The curtain wall that spans the entire first floor and windows on the second and third stories will remain in place – as the slight upgrade in operational performance does not offset the amount of embodied energy needed to manufacture new products of similar ilk. This strategy keeps 67% of the curtain wall and 57% of the prefabricated concrete panels in place. Like the steel structure and concrete floor, the precast concrete panels will be used in the repurpose methodology, while the glass will be used in the recycling aspect of the project. In total, the reuse methodology keeps 85% of these structure and envelope materials.

Repurpose

The second level of the Old City Hall methodology repurposes building components that are disassembled. These building components are relocated in other sites of the renovation. Such repurposing keeps still-useable building components in circulation. But to successfully repurpose material, the architect must consider the intrinsic qualities of the material – its potential for being relocated, its structural and material characteristics, and how these may be best leveraged. Scale is also relevant – is the entire system being repurposed in a new location for the same or different purpose or is this done with individual components. (Brutting, De Wolf, and Fivet 2019, 2). In this project, both the system and component levels are repurposed to divert as much material as possible from recycling. For example, the steel structure and concrete floor slabs are repurposed as a system to retain their intrinsic structural value, while

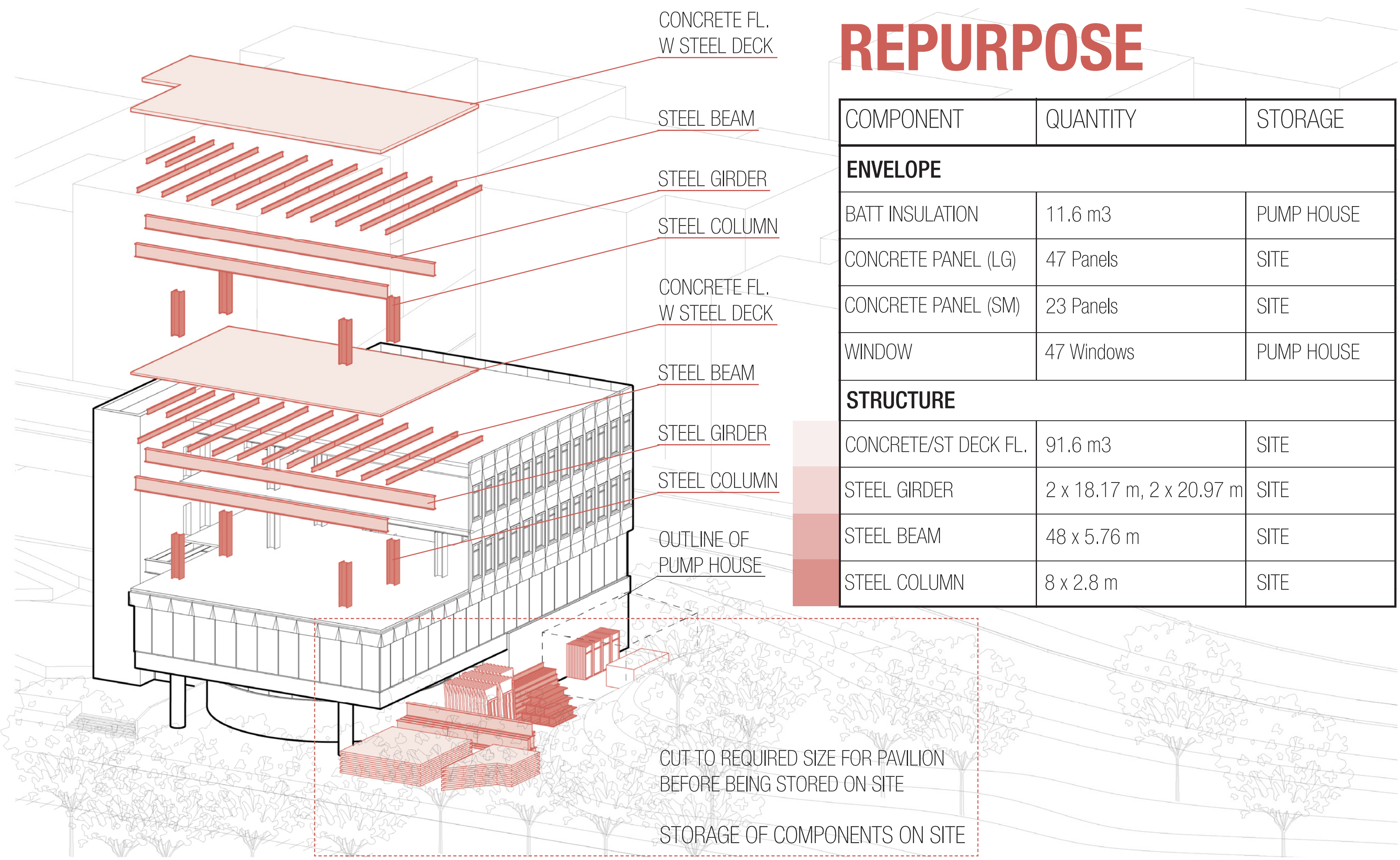


REPURPOSE

COMPONENT	QUANTITY	STORAGE
ENVELOPE		
BATT INSULATION	11.6 m3	PUMP HOUSE
CONCRETE PANEL (LG)	47 Panels	SITE
CONCRETE PANEL (SM)	23 Panels	SITE
WINDOW	47 Windows	PUMP HOUSE

Image showing the repurpose envelope strategy. Insulation, windows and precast concrete panels will be used in other applications. Table represents the quantity of material being repurposed and storage space.

REPURPOSE

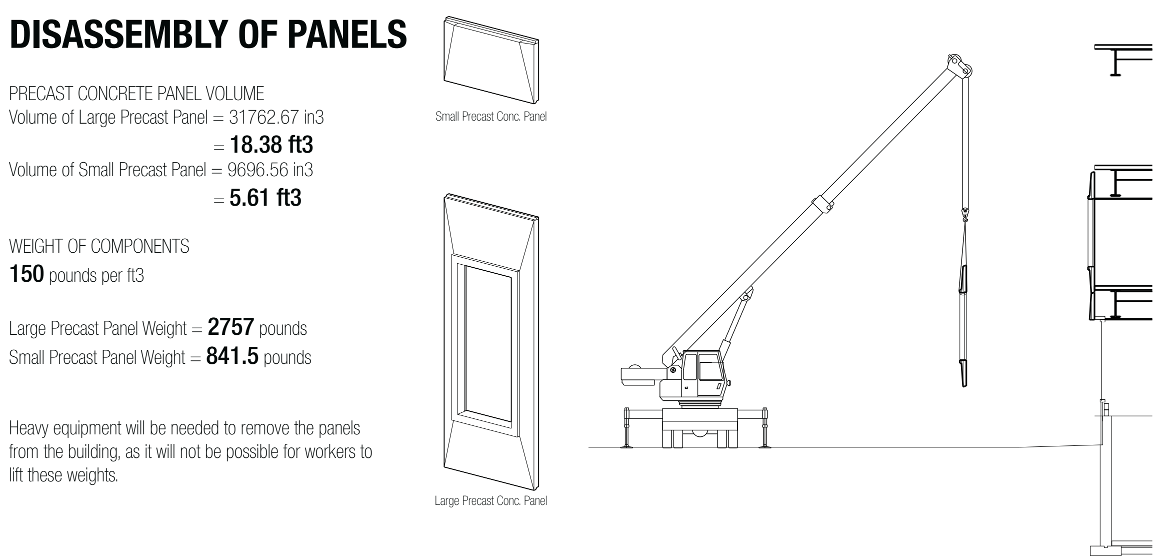


COMPONENT	QUANTITY	STORAGE
ENVELOPE		
BATT INSULATION	11.6 m3	PUMP HOUSE
CONCRETE PANEL (LG)	47 Panels	SITE
CONCRETE PANEL (SM)	23 Panels	SITE
WINDOW	47 Windows	PUMP HOUSE
STRUCTURE		
CONCRETE/ST DECK FL.	91.6 m3	SITE
STEEL GIRDER	2 x 18.17 m, 2 x 20.97 m	SITE
STEEL BEAM	48 x 5.76 m	SITE
STEEL COLUMN	8 x 2.8 m	SITE

Image showing the repurpose structure strategy. Steel and concrete floor with steel decking will be used to comprise structure of pavilions. The table adds the quantity of structural elements being repurposed.

batt insulation as an individual component is repurposed to insulate the new pavilions on site.

One of the most important aspects of repurposing material is to know what material is readily available to the architect. To design with repurposed material the archtiect needs to know exactly how much of it is available. In Geoff Crosby’s thesis “Church” he finds material around the Nova Scotian town of New Minas and catalogues the found objects to understand the inventory of material (Crosby 1988, 25). A similar strategy is applied to the repurposed material in Old City Hall. The repurposed components in the envelope consist of the concrete panels, windows, and batt insulation, while the repurposed structural members are the steel girders, beams, and columns. Storage of these components is also a crucial step when considering repurposing architectural components. On-site storage of these components must also be considered. Steel and concrete components are cut to the required size and stored on-site, while the insulation

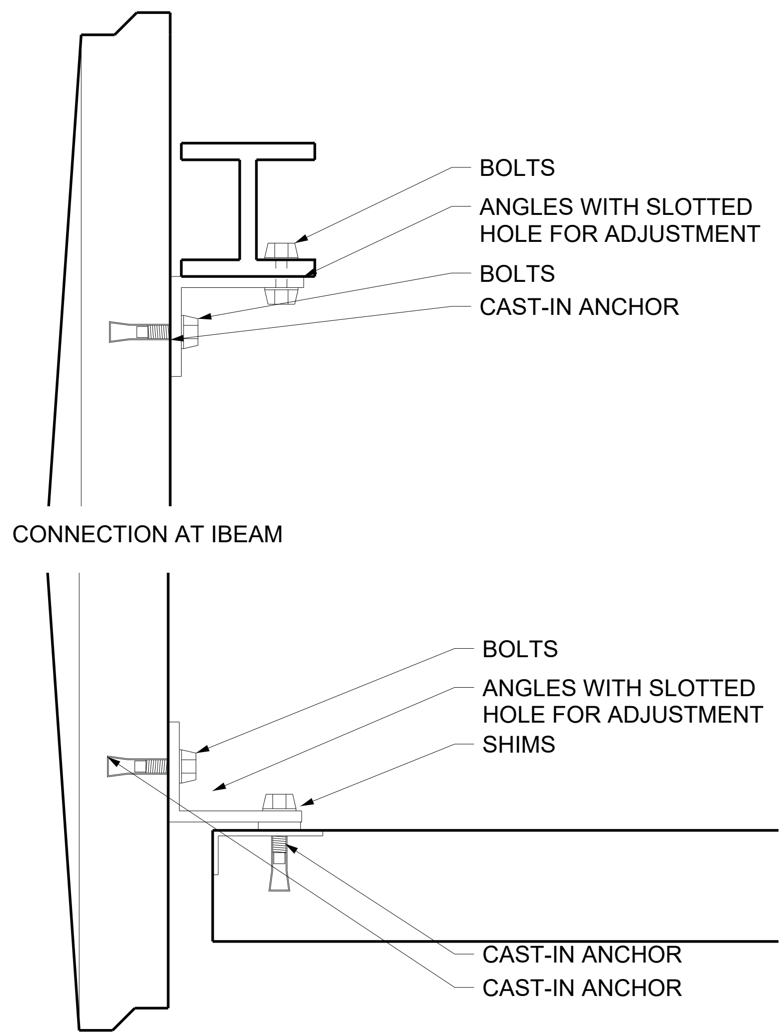


Weight of precast concrete panels requires a crane to be removed from the building.

and windows are stored in the weather-protected future pump house.

Disassembly

Disassembly is a key aspect of repurposing building material. To be salvaged, building material needs to be taken apart piece-by-piece. Unlike cast-in-situ concrete, precast concrete carries the potential to be deconstructed and repurposed, even if it was not designed with that in mind (Huuhka et al. 2015, 106). Steel frameworks and precast

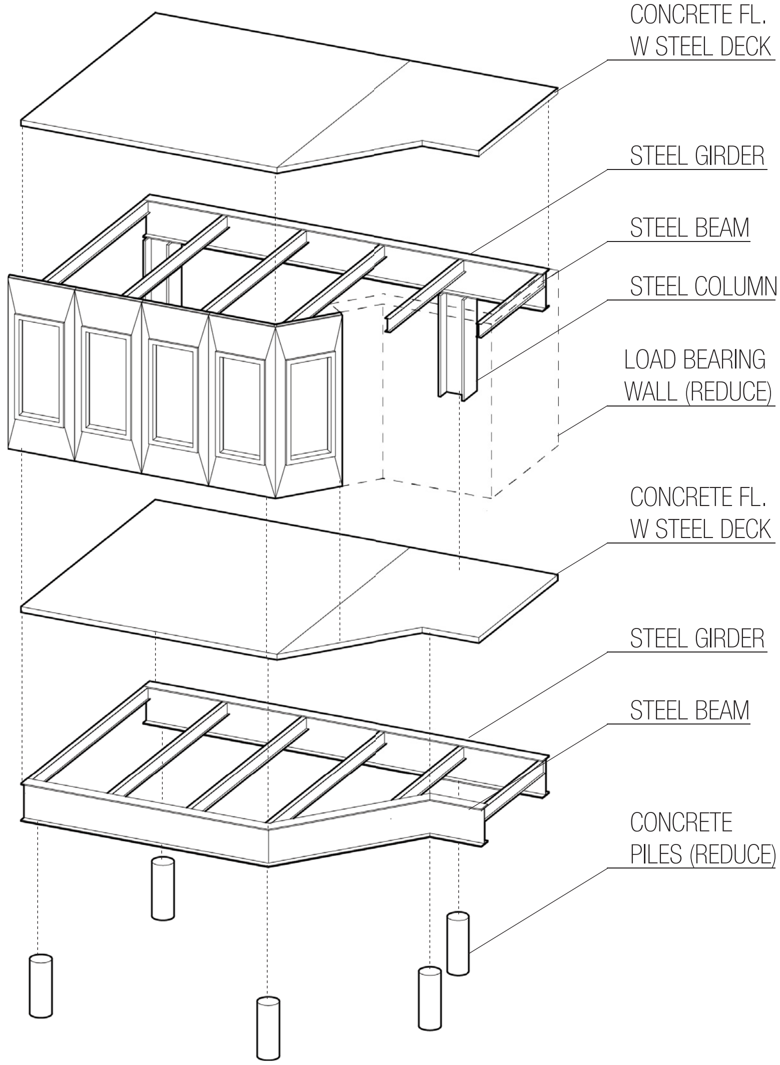


The dry connection of the prefabricated concrete panel attached to the structure of Old City Hall.

concrete panels are great candidates for repurposing as their mechanical connections can be easily disassembled. Still, a crane and a team of skilled labourers are needed to bring down these panels weighing up to 2700 pounds.

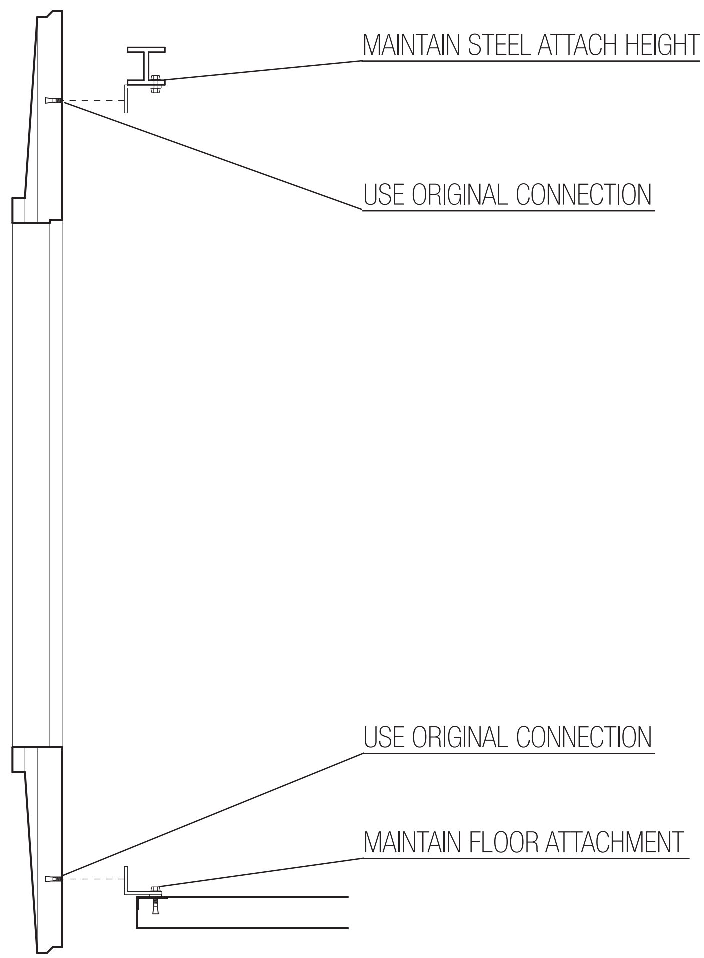
Assembly

Assembly of repurposed items should also be carefully considered to take advantage of the component's intrinsic qualities. Reuse of existing connections for the new assembly is one way to simplify the process. In Dartmouth



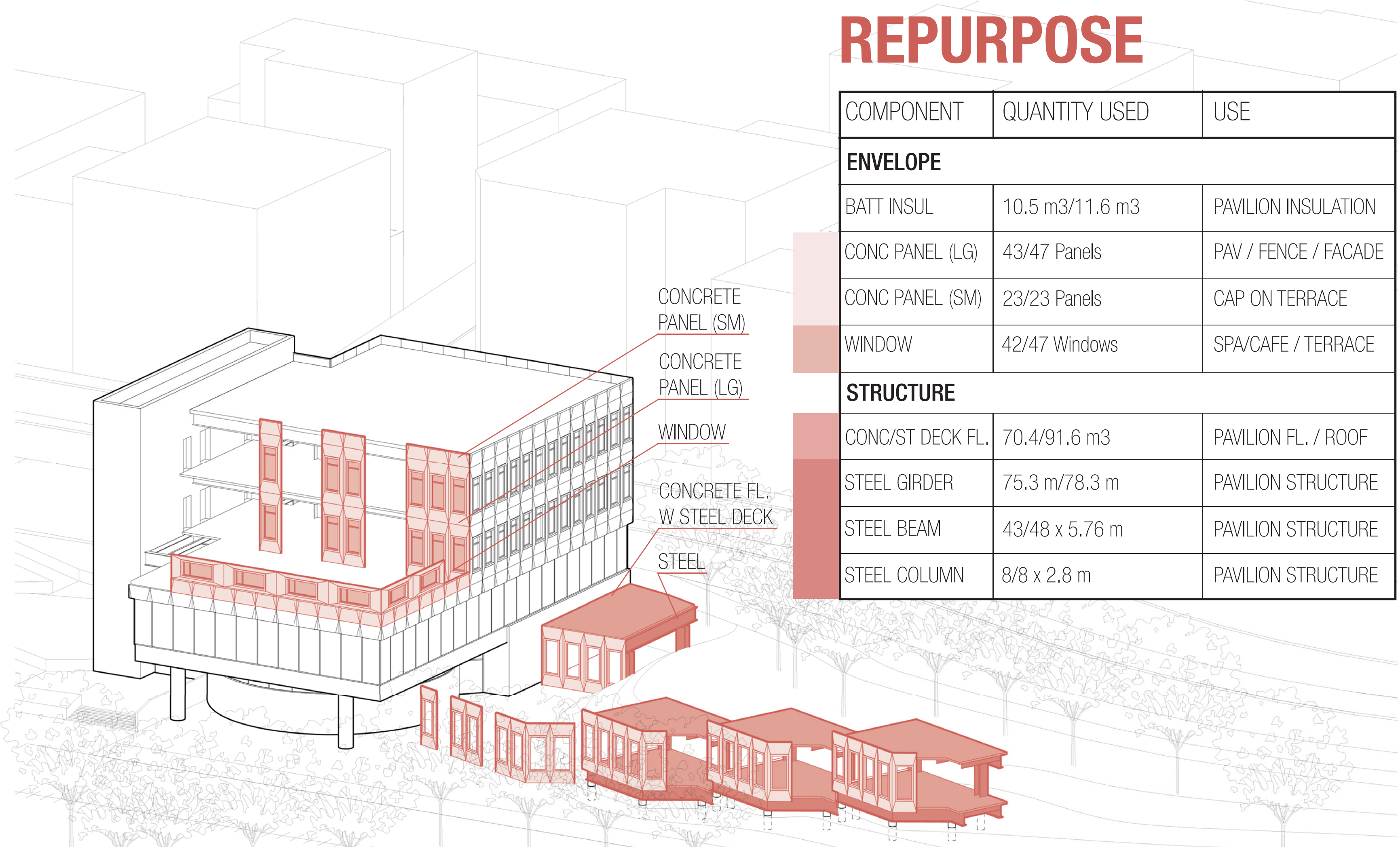
The disassembled components of the structure being repurposed as a system to create the pavilions on site.

Old City Hall, the precast panels were fitted with metal tabs when they were poured, providing a durable and re-useable connection. The design of the onsite pavilions ensures that attachment anchor points correspond to the panel connections, and that floor-to ceiling heights in the pavilions are the same as those in the City Hall — still, new hardware will need to be used. The bracket hardware in Old City Hall was smaller because it only had to span the 1” insulation. Thicker insulation in the new pavilions (6”) require a longer bracket to span that gap.



Using the existing connections of Old City Hall in the new pavilion design.

REPURPOSE



COMPONENT	QUANTITY USED	USE
ENVELOPE		
BATT INSUL	10.5 m3/11.6 m3	PAVILION INSULATION
CONC PANEL (LG)	43/47 Panels	PAV / FENCE / FACADE
CONC PANEL (SM)	23/23 Panels	CAP ON TERRACE
WINDOW	42/47 Windows	SPA/CAFE / TERRACE
STRUCTURE		
CONC/ST DECK FL.	70.4/91.6 m3	PAVILION FL. / ROOF
STEEL GIRDER	75.3 m/78.3 m	PAVILION STRUCTURE
STEEL BEAM	43/48 x 5.76 m	PAVILION STRUCTURE
STEEL COLUMN	8/8 x 2.8 m	PAVILION STRUCTURE

Image showing the repurpose application strategy. Majority of the repurposed items create the overnight pavilions. The table shows the quantity of material being repurposed. A 10% buffer to account for damaged material is typical practice.

Finished interior showing steel and concrete overpass structure. (ArchDaily 2012)

The repurposing of structural systems in buildings is a topic that is being heavily researched now. A family home by Single Speed Design used the steel and concrete of an old highway overpass to form the structure of the house. In this process the architects kept it simple, using similar techniques to those applied in prefabricated concrete (Bahamon and Sanjines 2010, 164). The Old City Hall project takes a similar approach for the small on-site pavilions. Pile foundations are poured to support the steel framework, allowing the columns, girders, and beams to work as they did in Old City Hall. The precast concrete panels are then attached to the structure, providing shear for the pavilion.

Concrete overpass being placed on steel structure. (ArchDaily 2012)

Other repurposed components include the windows to create a private fogged glass wall between the cafe and the entrance of the spa. The batt insulation in Old City Hall is only one inch thick and desperately short of the R-value needed in Halifax's climate, but this material can be used in the smaller pavilion's walls. These smaller structures allow the insulation to have a proper thickness with the existing batt insulation.

Reduce

In adding new material to the building, the strategy is to keep it as minimal as possible. Embracing this brutalist structure and celebrating its steel and concrete structure fit in well with the spa program. However, some new material needs to be added to meet the new program requirements. These will be placed as standalone pods that are centered around columns. These pods will house restrooms, a restaurant kitchen, change rooms, and storage and will be made of reclaimed wood, common vernacular construction material in Nova Scotia.

REDUCE

MATERIAL	APPLICATION	SOURCE
FIBREGLASS CURT. WALL	CURT. WALL / PAV. WIN.	GLASSCURTAIN
TYRES	RETAINING WALL	WASTE STREAM
CONCRETE	POOL / PAVILION PILES	CARBONCURE
HEMLOCK STRUCTURE	TERRACE BAR COVER	NS TREE
RECLAIMED WOOD	FACADE/ INT. FINISH	WASTE IN NS
CELLULOSE INSULATION	BUILDING INSULATION	INDUSTRY IN NS

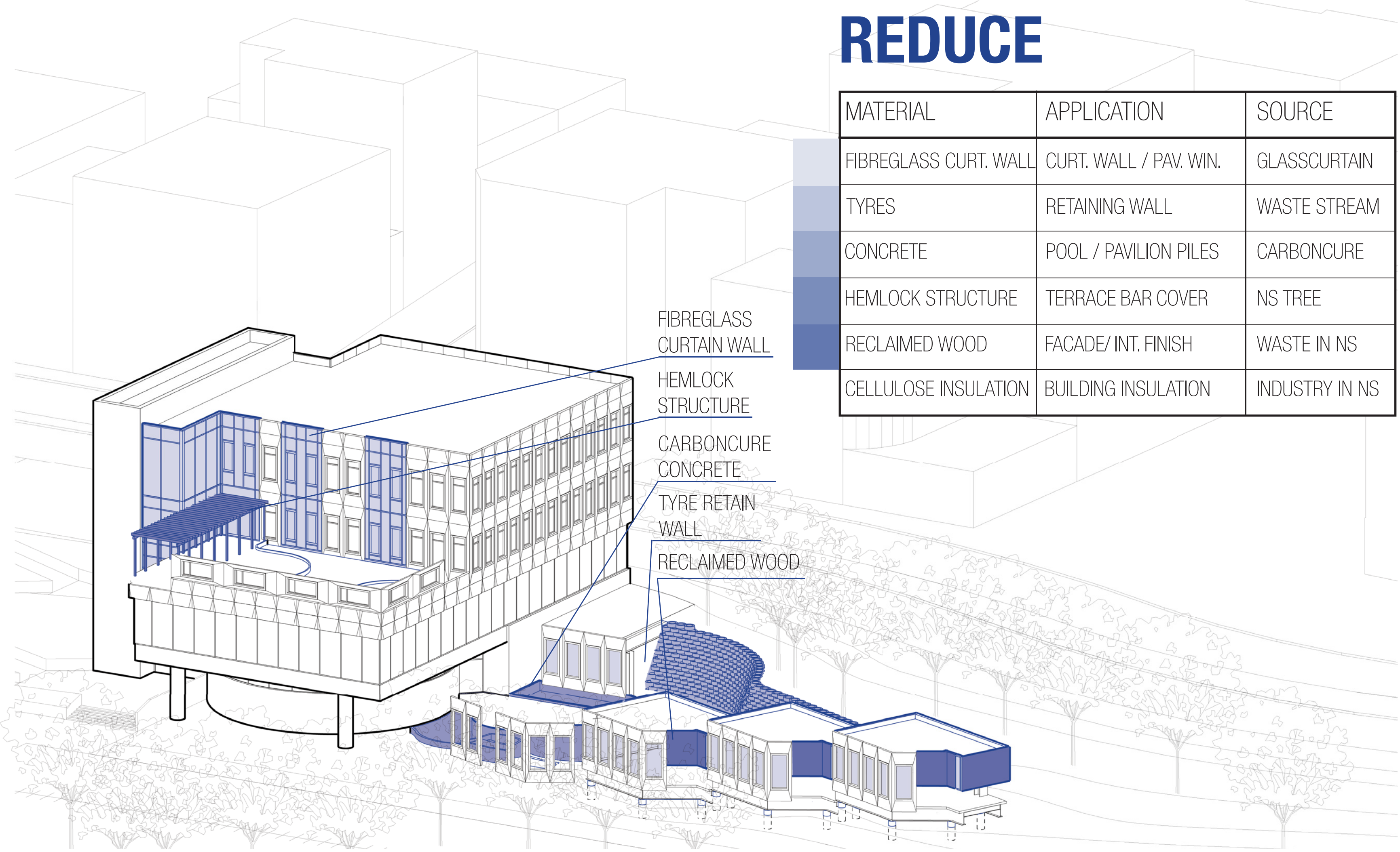


Image showing the reduce strategy. Fibreglass curtain wall, hemlock structure, tyres, and CarbonCure concrete are specified. The table shows the material specification for new materials added to the building.

The new fibreglass frame curtain wall employs 40-90% less embodied carbon than a traditional aluminum curtain wall, and does not suffer from thermal bridging usual in such assemblies. New materials in the interior include flax insulation and reclaimed wood for interior finishes. Any new wood specified is hemlock, a common tree in Nova Scotia. Retaining walls in the outdoor spa area are made of recycled tyres rather than concrete, not only reducing use of carbon-intensive concrete, but also tapping into a prevalent waste stream. Concrete is still needed to form the pools and provide foundations for the pavilions, although these are designed as piles, keeping the volume to a minimum.

CarbonCure, a company operating in Nova Scotia, will be specified for concrete, further reducing the carbon footprint (CarbonCure 2022). These locally sourced materials reduce the embodied carbon in the building and take advantage of Nova Scotian labour already in practice.

Design for Deconstruction

Design for Deconstruction (DfD) is an important aspect of design to consider in this methodology. DfD "uses mechanical connections as opposed to chemical ones – this will allow the easy separation of components and materials without force and reduce contamination to materials and damage to components" (Kibert and Chini 2000, 38). By using screws instead of nails or glues to secure interior finishes, the insulation can be replaced when needed without damaging other materials, increasing the life cycle of all materials. Interior wood finishes are secured by screws, also allowing easy removal for maintenance or repair.

Recycle

The last step in the project methodology is recycling. By this stage, all the material that could be salvaged have been, yet still a few materials remain, and these should be recycled. The plaster that coated the interior walls that crumbles during its removal is a great lime-based material that could be used as a substitute for cement in a concrete mixture (Hansen and Sadeghian 2020). Similarly, the glass that could not be repurposed is made of silica, and can substitute for sand in a concrete mixture. This process is well documented and might even add interesting optical properties that for the spa program. Together, these two materials can be recycled as constituents of the outdoor concrete tiles.

Aluminum recovered from the removed windows is diverted into aluminum recycling. Studies have shown recycling aluminum uses 5% of the energy needed to extract virgin materials (Howard Precision Metals n.d.). This project might employ aluminum as stakes to hold the gabion walls in place. So even the recycling step of the four-part methodology helps to keep construction material out of the waste stream and out of landfills.

Carbon Related Decision-Making Process

In this design methodology, most of the design decisions were based around decreasing waste, utilizing the material that was existing in Old City Hall, and using as little new material as possible. One example of this thought process was the choice of foundation for the overnight pavilions. The foundation could have been a typical solid concrete wall, but in order to limit the amount of concrete used, piles were specified. This used a fraction of the material and enabled

RECYCLE

MATERIAL	QUANTITY	MANUFACTURE PROCESS
PLASTER	7.5 m3	QUALITY CONC - CONC MIX (6.2 KM)
GLASS	0.11 m3	QUALITY CONC - CONC MIX (6.2 KM)
ALUMINUM	0.3 m3	FABTEK ALUM FABRICATION (7.9 KM)
BROKEN CONC	21.6 m3	ON SITE GABION

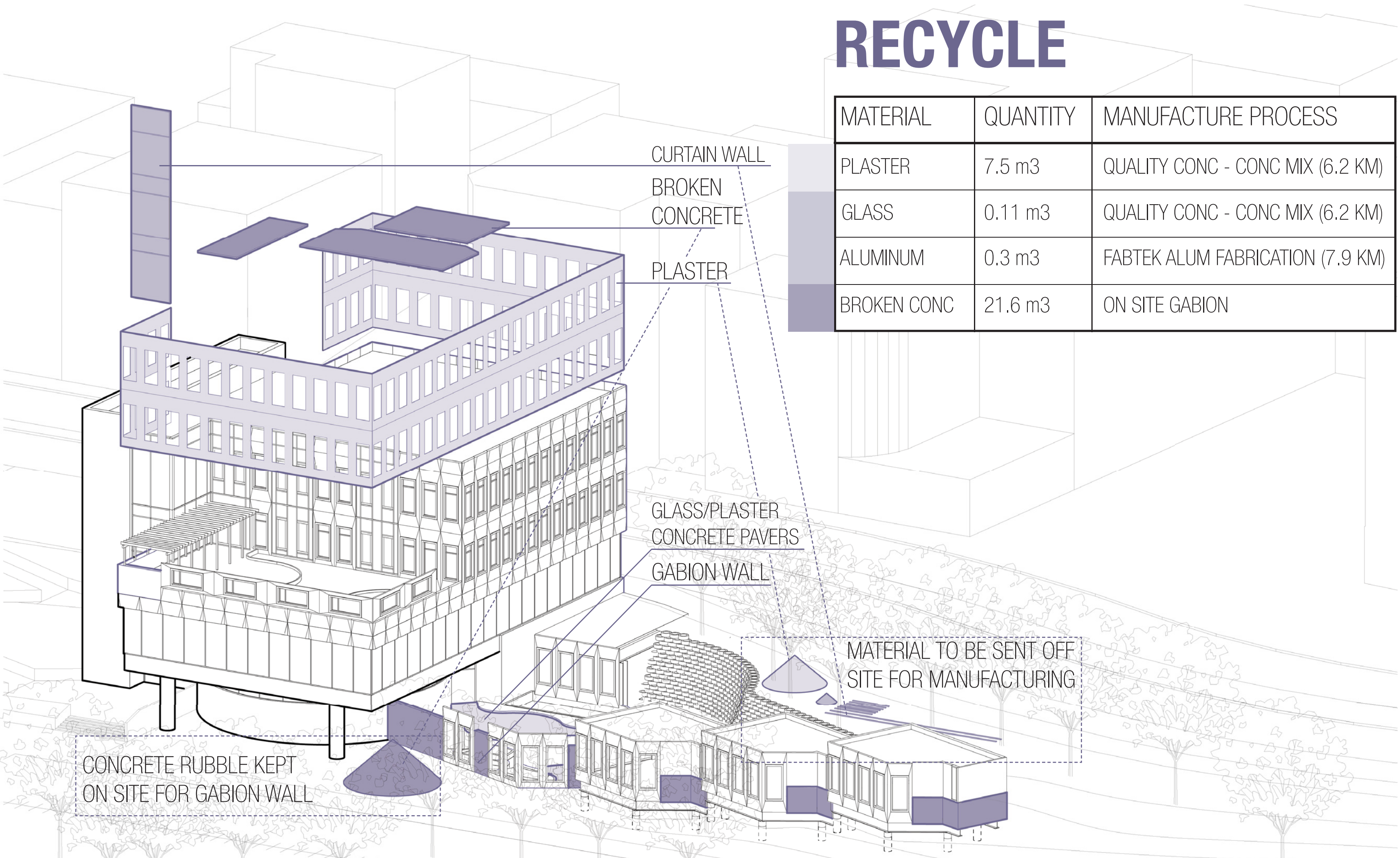


Image showing the recycle strategy. Curtain walls, plaster and broken concrete are recycled. The table represents the amount of material that is sent back to the manufacturer and the distance the material has to travel.

the steel structure being repurposed from Old City Hall to lie directly on the piles. This design decision not only used less carbon intensive material, but also took advantage of the intrinsic qualities of the steel structure being repurposed.

Chapter 6: A Reimagination of Old City Hall

A New Potential Suitor

Rendering of Hewn + Barter's design for the new Nordic spa coming to Old City Hall. (Berman 2022)

In January 2022, Nature Folk and Wellness Studio announced their plan to lease the former council chambers on the ground floor of Dartmouth Old City Hall, their plan is to create a spa and wellness retreat on the site, which conveniently neighbours the Halifax harbour (Berman 2022). That begs the question – If a bathhouse feels this space is suitable for expansion into Dartmouth Old City Hall – might compatible programs be added to utilize all floor plates of the building? This would bring a destination program to Dartmouth, while also serving as an example of a new progressive and necessary approach to architecture.

A Spa and Waste

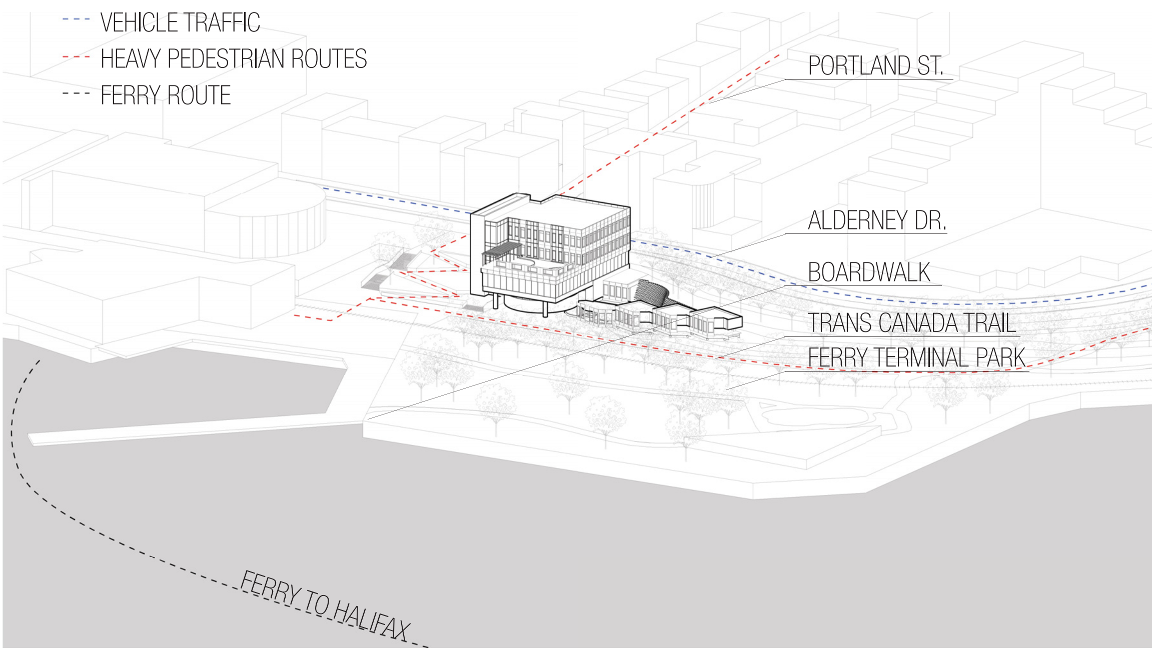
At first, a spa seems like an unlikely program to showcase a “waste diversion” methodology, however, it might be an appropriate one to begin to tear down the stigma associated with waste. A spa is typically associated with luxury; it is a place where people go to be pampered, and at the end of their experience are left feeling calm and rejuvenated. Because of this, spas are stereotypically thought of as having expensive, high-quality materials and finishes. This preconceived notion of who a spa is for and what it should be made of, presents an interesting and ironic opportunity. Imagine if the foundation of the places we go to indulge in our lavish lifestyles, was made of trash!

The idea of using “waste” materials to give a building designed for the social elite, new life is quite poetic. This case study serves as an excellent means of challenging the status quo and acts as an ideal stepping stone to begin to break down the perception that “waste” does not have a place in our everyday society.

In *Wasting Away*, Kevin Lynch argues that places of waste provide nothing for the imagination (Lynch 1991, 26). Perhaps a spa program can give this Brutalist building a new lease on life. Through the spa program, matter can be recycled, re-energized, and even celebrated, breaking down such negative connotations.

Downtown Dartmouth Site Analysis

Old City Hall was strategically sited to serve as a landmark in downtown Dartmouth. Located between Dartmouth’s waterfront and its historic core, it is also adjacent to the cross-harbour ferry terminal — making it first building one encounters when arriving in Dartmouth from Halifax.



Downtown Dartmouth site conditions

View of building from Alderney Gate Ferry Terminal, one of the most heavily trafficked pedestrian paths in Dartmouth.

Between Alderney Gate Ferry Terminal and Old City Hall, an outdoor “stramp” — generous stairs with an integrated accessible ramp — bridge the escarpment between waterfront and street levels. The massive circulation core of Old City Hall forms the backdrop for this public space; overgrown with ivy, it has become a Dartmouth landmark. This landscaped transition leads people up to Alderney Drive and Portland Street, the heart of Dartmouth’s downtown with flourishing cafes, restaurants, and shops.

Alderney Drive is one of Dartmouth’s busiest streets, since it is not only its waterfront road, but it is also used as an artery to connect the northern and southern portions of town. Old City Hall fronts on Alderney Drive, right where it intersects with Portland Street, offering excellent street visibility for both motorists and pedestrians.

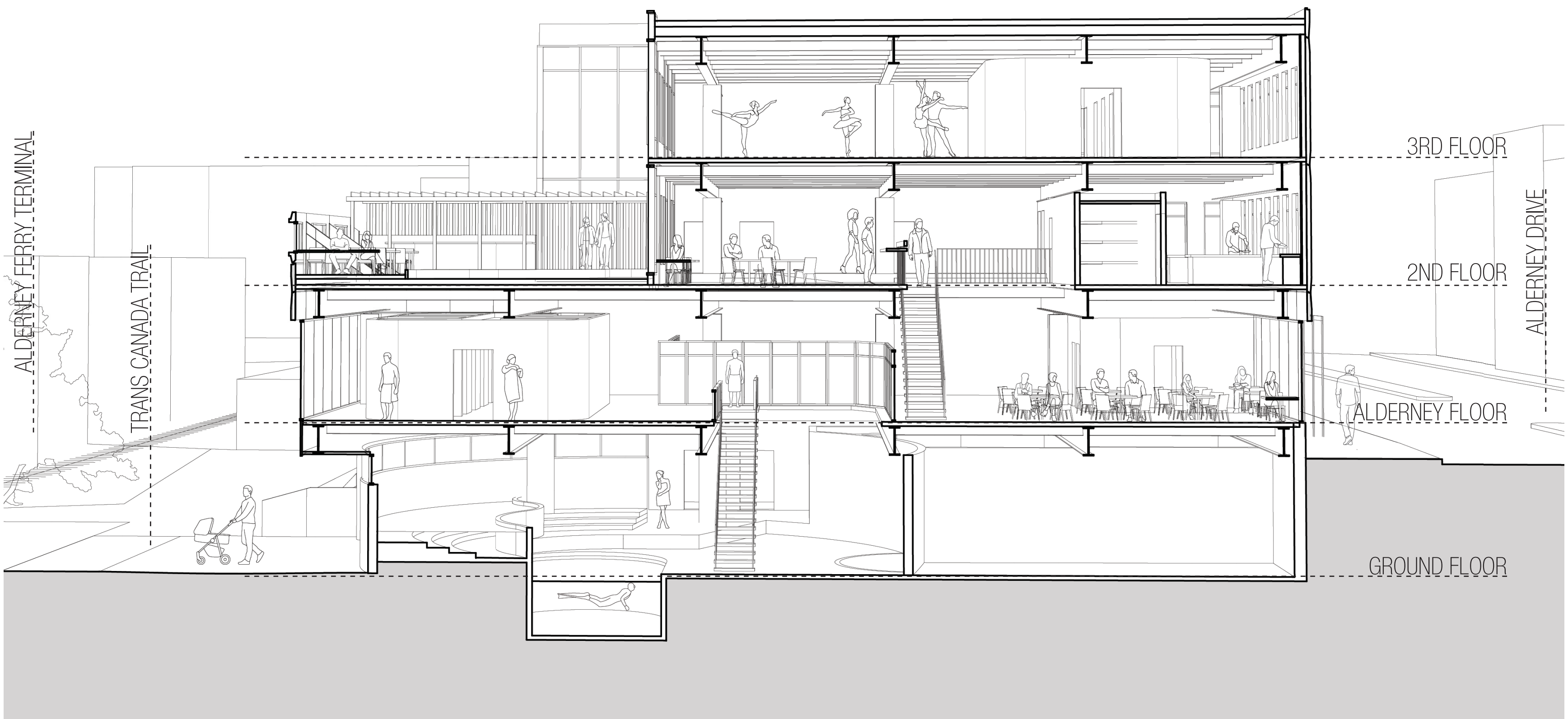
To the south of Old City Hall, Ferry Terminal Park is designed for public recreation. It has a pier, a playground, and a pavilion for seasonal events. It is also a stop along the famous Trans Canada Trail, the longest network of multi-use recreational trails in the world. Lastly, the park is well-used, offering excellent views of the Halifax skyline across the harbour.

The final constraint on this park is the freight rail line that runs along the length of the waterfront. Where it slides between Alderney Landing and the Ferry Terminal, the rail line is used by pedestrians walking south along the waterfront. When they reach Old City Hall, they can take the outdoor steps up to street level, or continue to Ferry Terminal Park. The waterfront face of the Old City Hall then, will be front and center to the parade of pedestrians passing by.

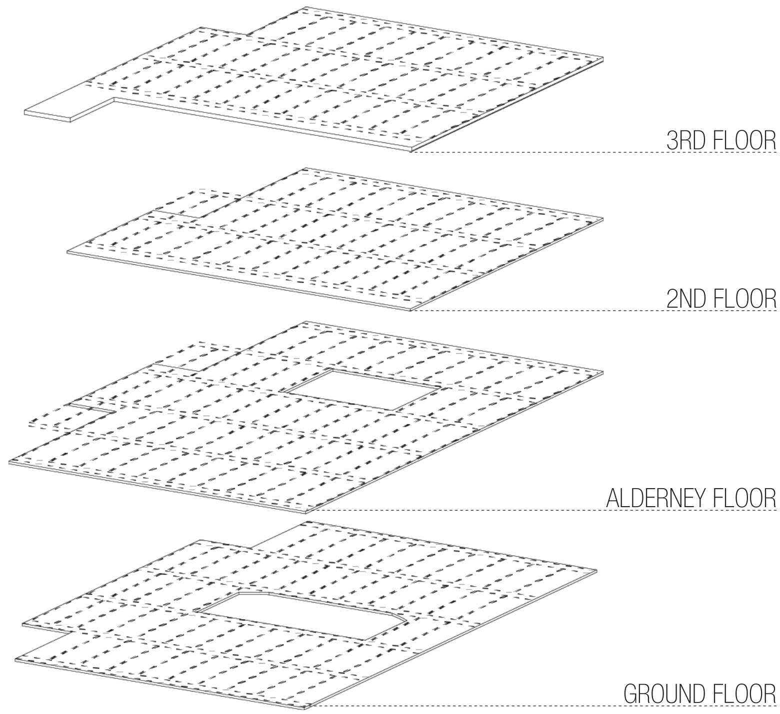
Program and Building Transformation

Three programmatic elements comprise the adaptive reuse of Dartmouth's Old City Hall: a spa, a restaurant, and a workout space. They share an entrance and reception area located off Alderney Drive. A café and bar enliven the street facade and invite pedestrians to cross this busy street. Once inside, the visitor has two choices: either take the elevator to the third floor exercise room; or come to the reception area, where one is directed to either the restaurant or the spa. All levels can be reached from the elevator.

If the choice is the restaurant, one continues up an open stair to the second floor for some of the best views of the harbour and Halifax skyline, and an outdoor terrace for seasonal dining. The east-facing kitchen ensures a bright and comfortable space to work.



Section of the vertical programmatic relationships and exposed brutalist structure.



Exploded axonometric showing the cuts in the floor plates in relation to the existing steel structure.

If, at street level, one decides to visit the spa, visitors are directed to the changing rooms, at the same level as the reception. The spa experience starts here. The bathers then descend to the pools: a cold plunge, relaxation pool created from the stepped foundation of the former council chambers, and a main pool.

Openings cut into the concrete floor plates between structural girders allow different programs to flow from floor to floor, such as the ascending restaurant stair or the descending spa stair. Such vertical connections makes the space more dynamic.

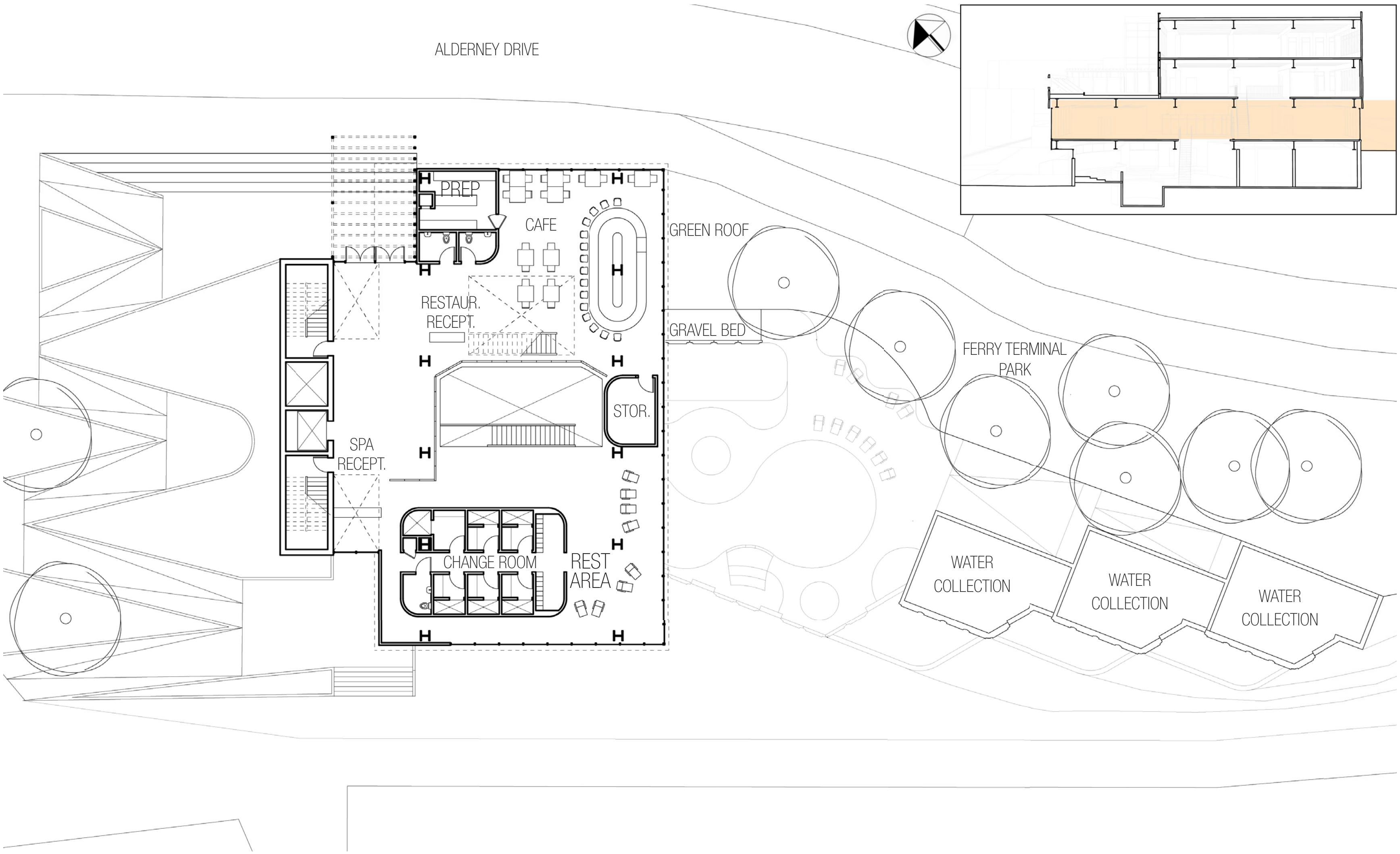
Following Lacaton and Vassal's example, the building is stripped of its finishes and interior walls, exposing the structure. This highlights the most impressive aspect of the building and reveals its mid-century modern heritage.

The exposed steel and concrete are well-suited to both spa and restaurant programs; while the disassembly of a portion of the third floor and the removal of interior partitions brings ample light into these spaces. Sometimes, new programming requires new elements — this is the case with the kitchen, change rooms, washrooms, and storage. Most of these take the form of "small pods" that just clear the steel structure. These appear to float.

Entrance and Alderney Floor

There is only one main entrance leading users into the building. Currently, the entrance is small and located in a curtain wall between the staircase and the main volume. In

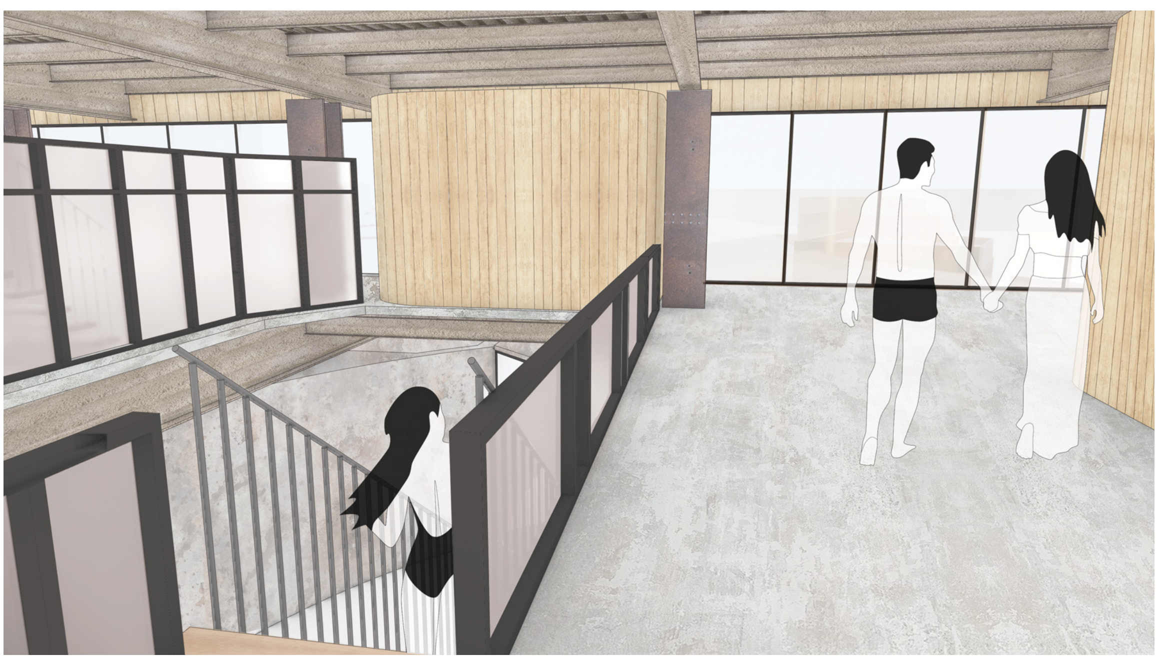
Entrance off Alderney Drive



Alderney floor plan with a cafe/bar area facing Alderney Drive and the spa reception and change rooms in the south half of the plan.

the redesign, this entrance is enlarged and extended into the main building. The steel structure enables the precast concrete panels of the main building to cantilever over a portion of the entrance. A wooden structure covers the main entrance and extends onto the sidewalk to lead visitors into the building. Again, learning from Lacaton and Vassal, creating generous space in an adaptive reuse is vital. This entrance retains the character of Old City Hall, while giving it a more generous street presence, and a clear entry point that announces to visitors that this building has a new program.

Once visitors have entered the building, the first-floor acts as an entrance to the spa program and cafe/restaurant space. As one enters from Alderney Drive, visitors are greeted at the reception. If they are looking for the food programming, they take a left into the cafe.



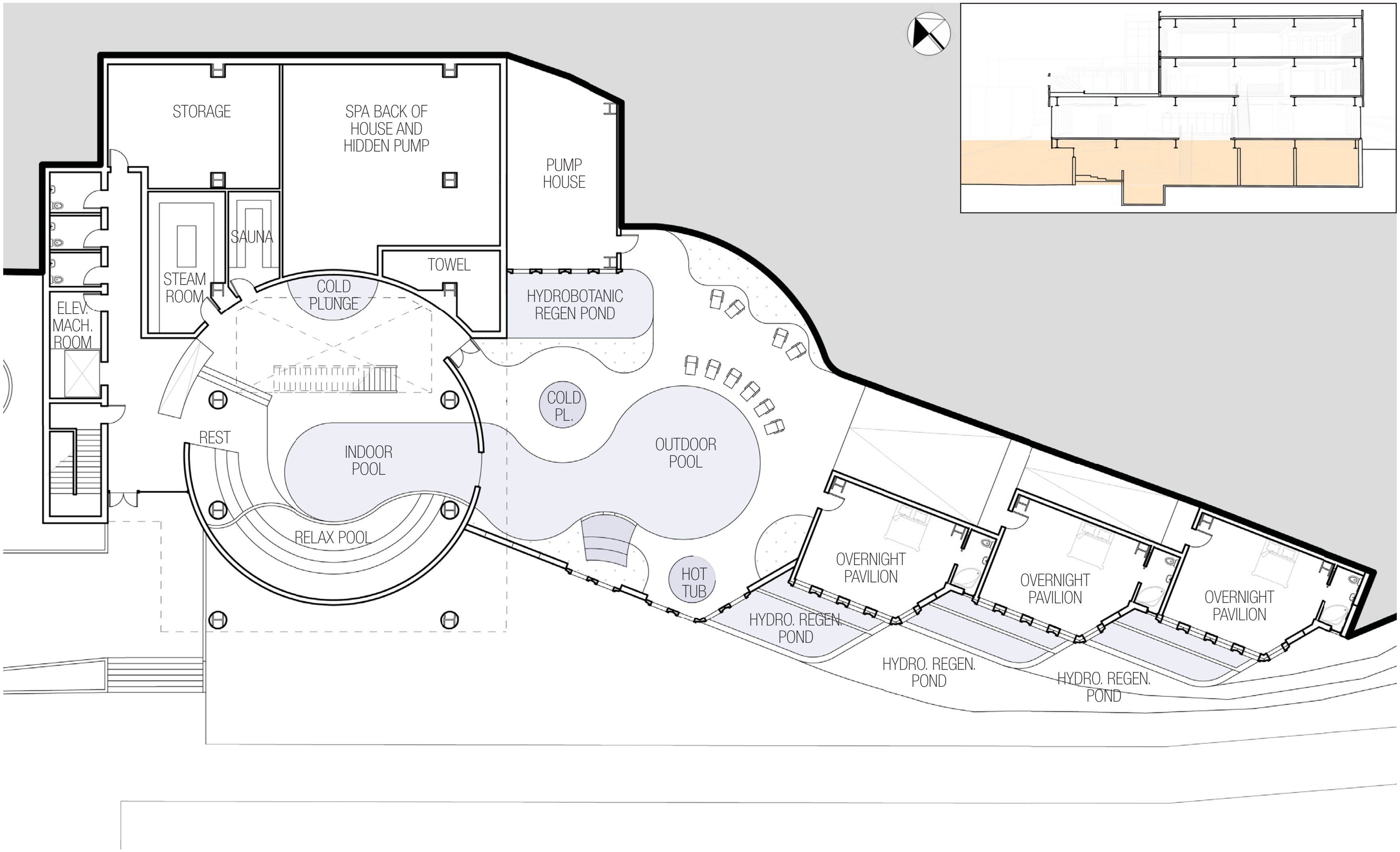
The first level of the spa where bathers get ready. The windows are repurposed as railings and a frosted glass division between the spa and cafe.

If the guest is there for the spa experience, they check in at reception and walk in past the frosted window wall, into the spa. This is where they prep to get ready with change rooms and a relaxation area overlooking the outdoor spa. Guests who have booked one of the overnight pavilions, begin their experience with a spa. Their bags are collected at reception and brought to their pavilion when they are finished.

Spa

Once the bathers are ready to begin their spa experience, they make their way down a wooden staircase which leads them into the main spa area through a two story space, which offers a glimpse of the spa program down below, with a cold plunge that puts a brave user in the spotlight. The repurposed windows are frosted, creating a privacy barrier between the spa and the cafe.

View from the stairs looking up at the two story volume. A cold plunge is in the spotlight.

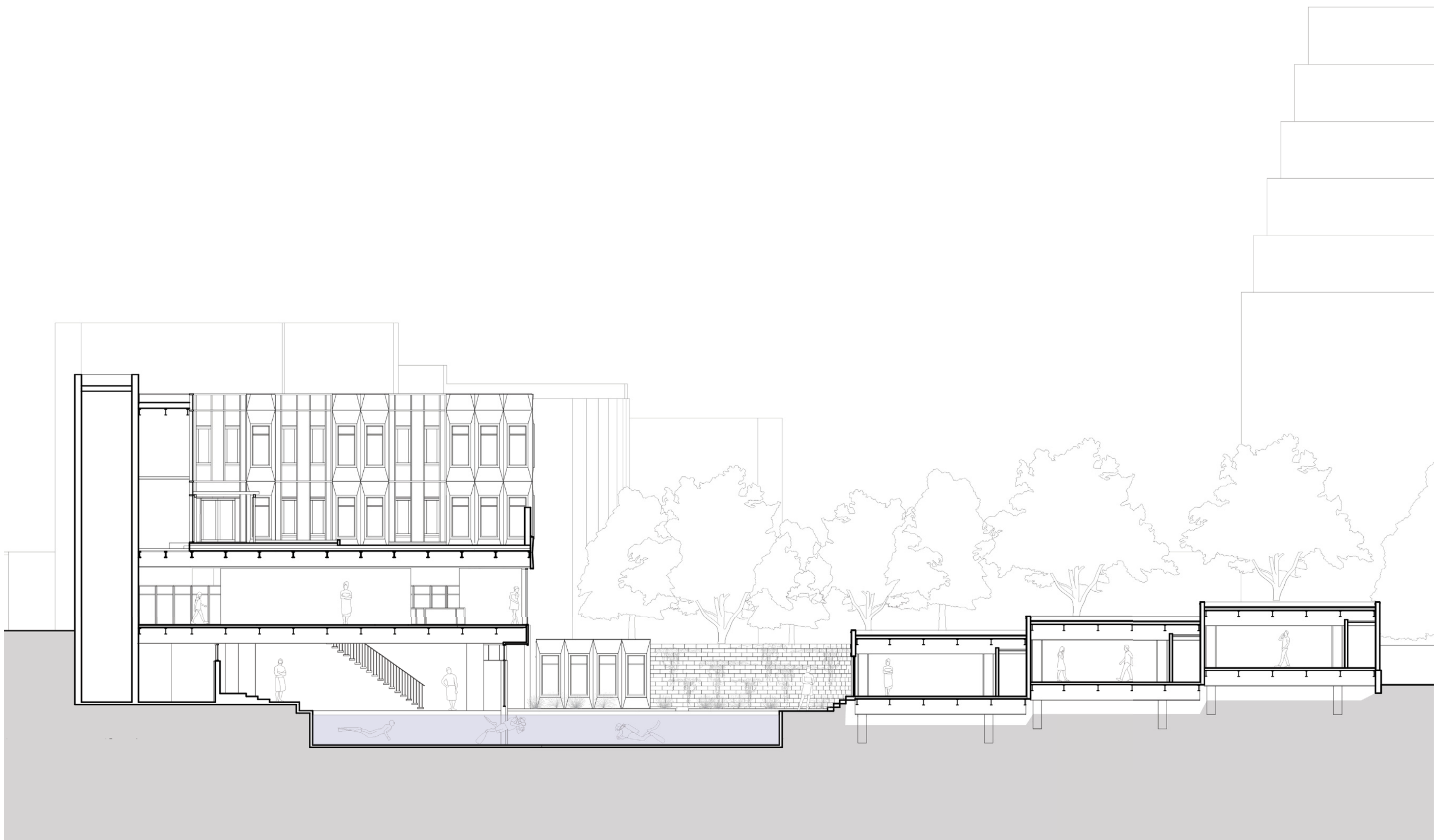


Ground floor plan showing the spa and all of its amenities

The pool built around the old council chamber steps give the bathers a place of relaxation. The clerestory illuminates the space.

The spa's interior amenities include a steam room, sauna, cold plunge, warm relaxation pool and a main pool that opens to the outside. An adjacent outdoor courtyard accommodates another cold plunge, hot tub, and overnight pavilions for guests who want to extend their stay. Hydroponic regeneration ponds recirculate greywater from the spa.

Built over the old, stepped seating of the council chambers a warm pool gives users a place to relax. The other pool is an indoor/outdoor experience that allows the users to swim outside all seasons. A new opening in the existing wall connects the indoor and outdoor spa zones. A continuous clerestory illuminates the indoor spa, while ensuring privacy from the heavily trafficked Trans-Canada Trail. As with the rest of the building, here, interior walls are removed, and the finishes are stripped, exposing the fireproofed steel and the concrete floor. These materials show their age, providing a glimpse into the past. The only walls that are refinished are



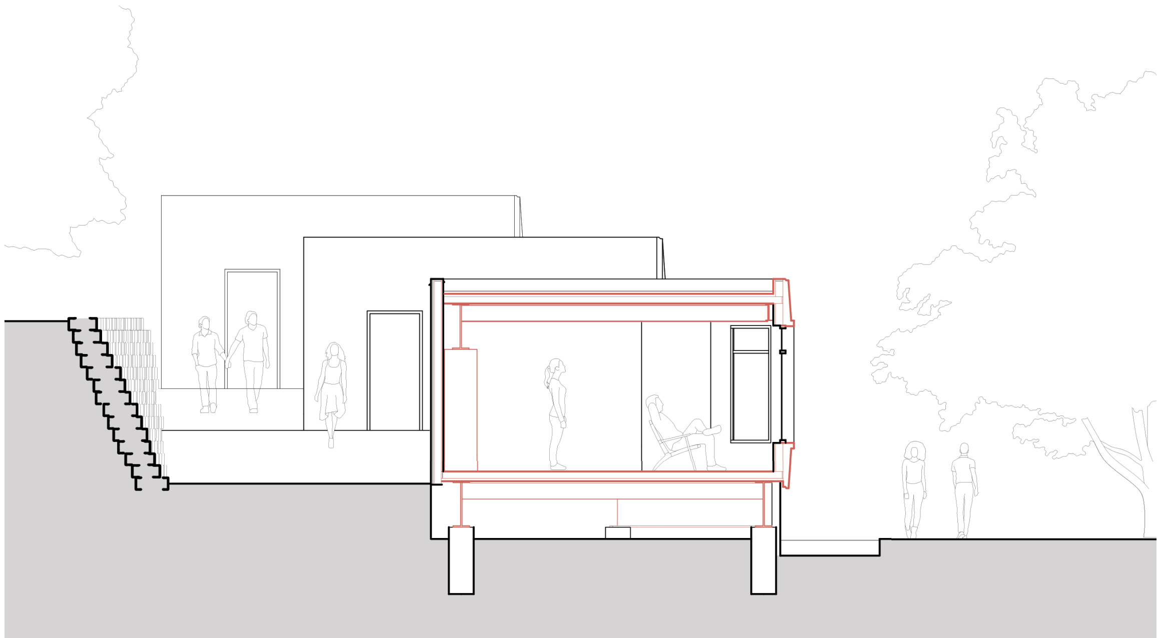
Section through spa showing the indoor and outdoor pool experience and the stepped pavilions built into the topography of the site.

View from the spa looking out at Ferry Terminal Park and the harbour.

the walls that border the exterior. A reclaimed wood is used, and the appropriate insulation thickness is put into the walls.

The outdoor spa zone occupies currently unused land near Ferry Terminal Park, that is part of the City Hall site. A tyre retaining wall holds back the slope, providing anchor for plant life that over the years will become overgrown, like the ivy growing on the stair core.

Usually, spas are secluded spaces, sheltered from public view. The location of this spa in downtown Dartmouth provides an interesting juxtaposition — on the one hand, it is impossible to hide it from public view, but on the other, it provides bathers with picturesque views of Halifax harbour, that make this site so appealing. In order to address this edge, a privacy wall between the spa and ferry terminal park, protect the spa users from a heavily circulated area.



Section through one of the overnight pavilions and parks that border the pavilions on either side.

However, to offer some views out at the park the precast panels are placed to frame views.

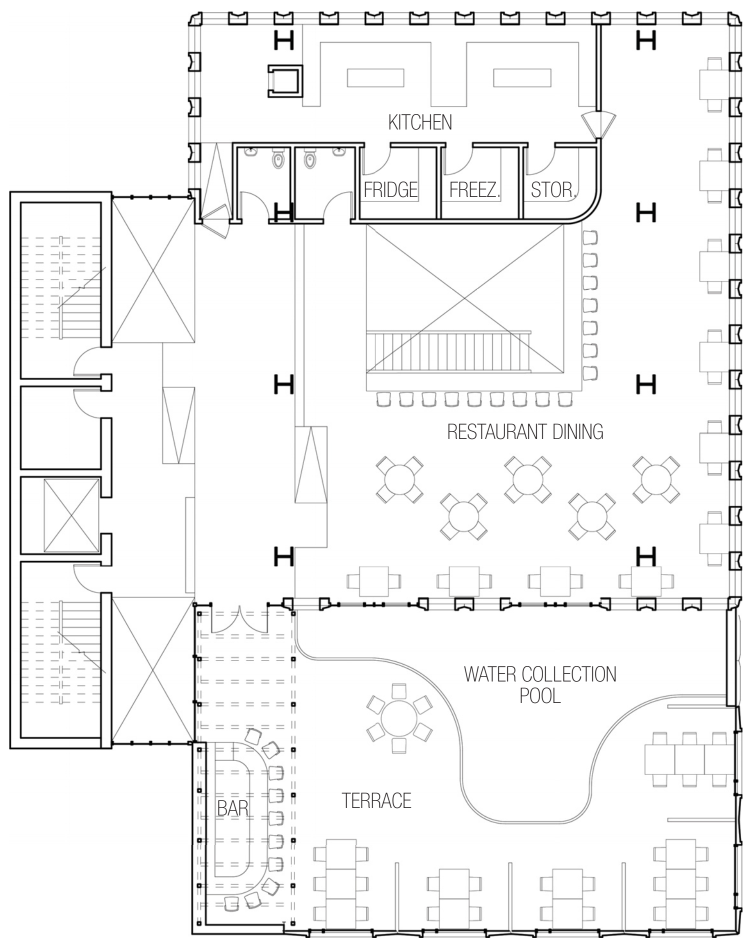
Overnight Pavilions

Most of the repurposed material comes together in the overnight pavilions. These are a way for guests to extend their stay. Again, openings in the precast concrete panels offer a beautiful view of the Dartmouth harbour and Halifax's skyline in the distance.

A ramp between the pavilions and tyre retaining wall takes the overnight guests up to their pavilions, giving a buffer to the park located directly off Alderney Drive. A pond in front of the pavilion provides a buffer zone to the people using the trans-Canada trail. While these buffer zones prevent people from coming right up to the pavilions, they are still very exposed to people passing through the park. The guests staying overnight sacrifice some privacy to get views out to the park and harbour, however, by stepping the overnight pavilions with the topography of the site passers-by cannot see into the pavilions.

Restaurant and Terrace

Now moving up to the second floor, the plan is organized to provide diners with panoramic harbour views. Dining tables follow the perimeter walls, providing either view through the window of the precast panels or the curtain wall. A standing bar wrapping the central stair allows people to gather organically and socialize while waiting for a table.



Restaurant floor plan with the kitchen facing Alderney Drive, restaurant, and terrace facing the waterfront.

Again, the brutalist structure is exposed and the now-open space on the second floor creates a flexible space for dining or hosting events. With a third of the walls removed from this level, light can now penetrate deep into the restaurant space, a stark contrast from the interior rooms that filled this floor in Old City Hall.

The floating pod on the second floor houses the kitchen, freezers, fridges, washrooms, and storage. The north facing exposure on to Alderney Drive provide kitchen staff with light and views, and passerby on the street below a glimpse of the kitchen.

Diners enter the restaurant terrace under a wooden trellis (made of hemlock); an outdoor bar is also here. The tables are distributed along the perimeter of the terrace, against precast concrete panels that are laid edgewise to form a

Terrace showing the gabion wall bar and outdoor seating overlooking the harbour.

View of the restaurant. The raised floor from the terrace extends indoors and diners eat along the exterior of the building.

parapet with framed views. The roof terrace offers diners the best views in Dartmouth. A water collection pond suggests the spa program below.

The terrace slab, once inside the building, must now be weather protected to serve as an outdoor space. Its weatherproofing, insulation and decking will raise the finished floor level of the terrace as compared to the top of slab inside. To avoid this level change, the finished floor level of the terrace continues into the restaurant.

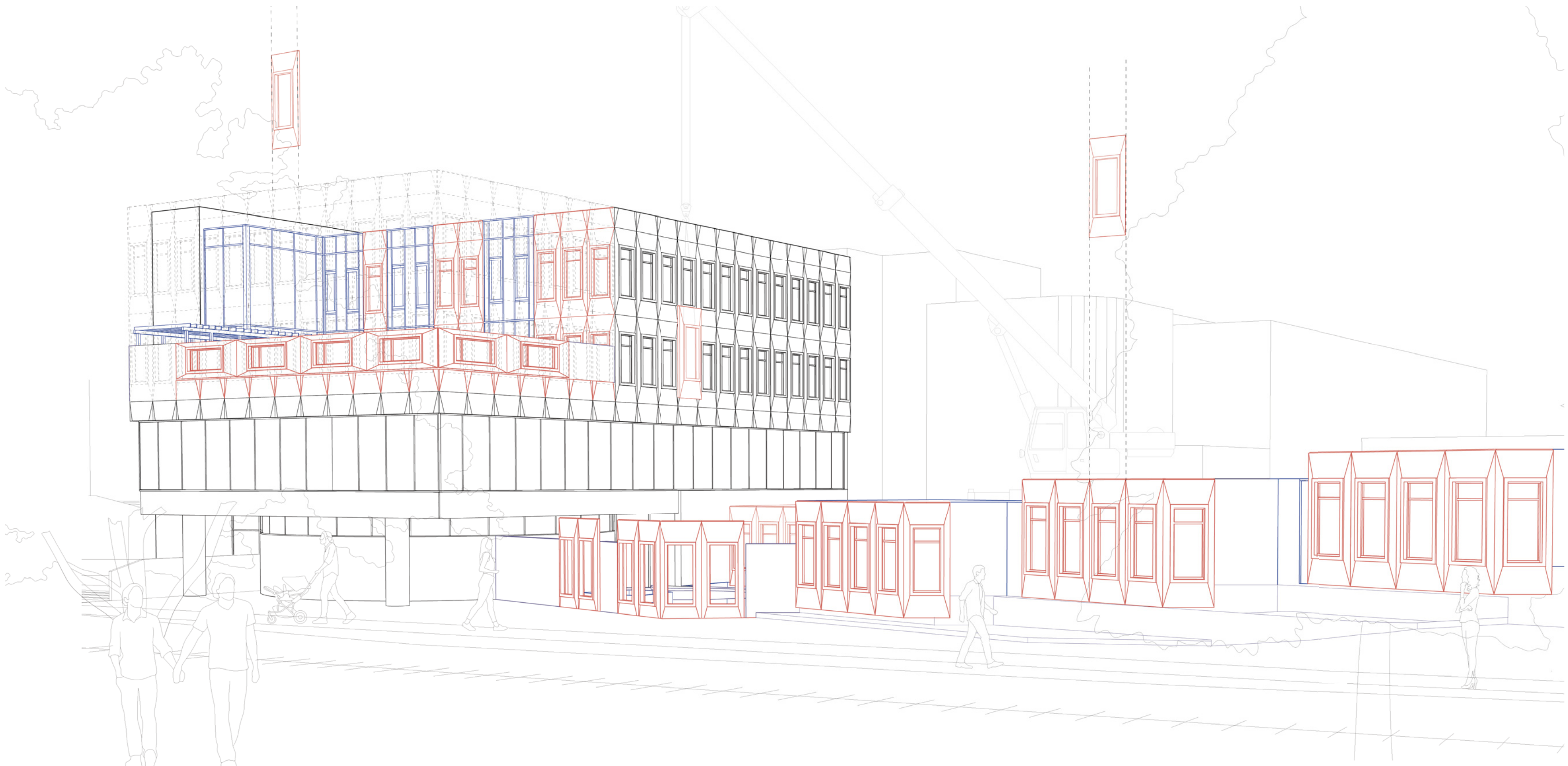
Chapter 7: Conclusion

Reaching A Broader Audience

The design methodology used in this thesis is not yet widely adopted. Because so much of the actual costs of construction waste is externalized from present-day methods of calculating construction costs, it is unfortunately, all-too common for waste reduction measures to be considered as financially unfeasible by developers, financiers, planners, architects, and builders. Using mostly site material was an interesting constraint for this thesis, however it adds to the architect's responsibilities and requires specialists to catalogue the material. In order to get the industry to whole-heartedly adopt this practice, a large-scale material catalogue may need to be established. There are some present-day examples of this, and similar approaches being developed for commercial applications.

Lendager Group, one of the leading examples of an architecture firm embracing a circular economy, has created a company called Lendager UP, now known as A: Gain. This company aims to create a warehouse of architecture "waste" that the building industry can use as material libraries in large scale deliveries (Kargaard 2021). This type of warehouse scale access to repurposed building materials appears to be the way to make the building industry adopt this kind of design methodology. If materials at a large scale are readily available to architects, it saves the step of figuring out how to salvage materials in existing buildings. This system also allows for firms to know the exact quantity of materials, a vital step in designing with pre-existing components.

REUSE / REPURPOSE / REDUCE / RECYCLE



Reuse, Repurpose, Reduce, Recycle materials all coming together to reveal a new methodology to work with and embrace architectural "waste."

With the skyrocketing prices of material, it is only a matter of time before the building industry transfers material costs into the labour costs required to turn around these architectural components. By using this methodology of reducing material consumption, reusing the building, repurposing building components, and recycling compromised material, Old City Hall can create a more holistic, long-term approach to how the building industry deals with material life cycles.

References

Agudelo-Vera, Claudia M., Wouter R.W.A. Leduc, Adriaan R. Mels, and Huub H.M. Rijnaarts. 2012. “Harvesting Urban Resources Towards More Resilient Cities.” *Resources, Conservation and Recycling* 64, 3-12.

ArchDaily. 2009. “Big Dig House / Single Speed Design.” https://www.archdaily.com/24396/big-dig-house-single-speed-design.

ArchDaily. 2012. “Palais de Tokyo / Lacaton & Vassal.” https://www.archdaily.com/248026/palais-de-tokyo-expansion-lacaton-vassal.

Athena Institute. 2009. *A Cradle-to-Gate Life Cycle Analysis of Curtainwall Framing Materials: Fiberglass-Reinforced Plastic and Aluminum Mullions*. Ottawa: Athena Sustainable Materials Institute.

Bahamon, Alejandro, and Maria Camila Sanjines. 2010. *Rematerial: From Waste To Architecture*. New York: W.W. Norton & Company.

Bak-Andersen, Mette. 2021. *Reintroducing Materials for Sustainable Design: Design Process and Educational Practice.* London: Routledge.

Bakker, Conny, Feng Wang, Jaco Huisman, and Marcel den Hollander. 2014. “Products That Go Round: Exploring Product Life Extension through Design.” *Journal of Cleaner Production* 69: 10–16. https://doi.org/10.1016/j.jclepro.2014.01.028.

Berman, Pam. 2015a. “Former Dartmouth City Hall Building Gets Another Buyer.” *CBC News*. https://www.cbc.ca/news/canada/nova-scotia/former-dartmouth-city-hall-building-gets-another-buyer-1.3115334.

Berman, Pam. 2015b. “Dartmouth City Hall Building On The Market Again.” *CBC News*. https://www.cbc.ca/news/canada/nova-scotia/dartmouth-city-hall-building-on-the-market-again-1.2998605.

Berman, Pam. 2022. “Nature Folk Wellness Studio plans to open the new facility in April.” CBC News. https://www.cbc.ca/news/canada/nova-scotia/nordic-spa-coming-to-old-dartmouth-city-hall-building-1.6305059.

Braungart, Michael, and William McDonough. 2002. *Cradle to Cradle*. London: Vintage.

Braungart, Michael, and William A. McDonough. 2013. *The Upcycle*. New York: North Point Press.

Brundtland, Gro Harlem. 1987. Report of the World Commission on Environment and Development: “Our Common Future.” New York: United Nations.

Brutting, Jan, Catherine De Wolf, and Corentin Fivet. 2019. “The Reuse of Load-Bearing Components.” *IOP Conference Series: Earth and Environmental Science* 225, no 1: 1-8.

Bullen, Peter, and Peter Love. 2011 “A New Future for the Past: A Model for Adaptive Reuse Decision Making.” *Built Environment Project and Asset Management* 1, no. 1: 32–44. https://doi.org/10.1108/20441241111143768.

Cameron, Peggy. 2022. “Buildings For The Climate Crisis - A Halifax Case Study.” Halifax: Development Options Halifax. City of Halifax. Management Guide for Construction and Demolition Debris. Halifax: Regional Waste Coordinators of Nova Scotia.

CarbonCure. 2022. https://www.carboncure.com/.

Cassidy, Emily. 2017. “Resourceful Materials.” Master of Environmental Design Studies thesis, Dalhousie University.

Council of Nova Scotia Archives. n.d. “Downtown Dartmouth.” Halifax Municipal Archives. Accessed June 3, 2022. https://archives.novascotia.ca/communityalbums/halifaxarchives/archives/?ID=468.

Crosby, Geoff. 1988. “Church.” Master of Architecture thesis, Dalhousie University.

Ellen MacArthur Foundation. n.d. “What Is A Circular Economy?”. Accessed February 19, 2022. https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview.

Gorgolewski, Mark. 2008. “Designing with Reused Building Components: Some Challenges.” *Building Research & Information* 36, no. 2: 175–88. https://doi.org/10.1080/09613210701559499.

Government of Nova Scotia. 2000. “Our Path Forward: Building on the Success of Nova Scotia’s Solid Waste Resource Management Strategy.” Environment and Climate Change. https://novascotia.ca/nse/waste/docs/Solid.Waste.Strategy-Our.Path.Forward.2011.pdf.

Government of Nova Scotia. 2019. “Management Guide for Construction and Demolition Debris.” Environment and Climate Change. http://www.wastecheck.ca/pdfs/2019/CDGuide2019.pdf.

Halifax C&D Recycling. n.d. “Materials.” Accessed June 3, 2022. https://halifaxcdrecycling.ca/materials.

Hansen, Sarah, and Pedram Sadeghian. 2020. “Recycled Gypsum Powder from Waste Drywalls Combined with Fly Ash for Partial Cement Replacement in Concrete.” *Journal of Cleaner Production* 274, 122785: 1-15.

Hebel, Dirk, Felix Heisel, and Marta H. Wisniewska. 2014. *Building from Waste: Recovered Materials in Architecture and Construction*. Basel: Birkhäuser.

Howard Precision Metals. n.d. "Aluminum: A Building Material." Accessed May 26, 2022. https://www.howardprecision.com/aluminum-a-building-material/.

HRM (Halifax Regional Municipality). 2022a. Building Outlines. Halifax Open Data. Map from GIS data, using ArcGIS. https://https://catalogue-hrm.opendata.arcgis.com/datasets/625d718e3dd04dc4ac69ae2861f6df36_0/about.

HRM (Halifax Regional Municipality). 2022b. Street Centrelines. Halifax Open Data. Map from GIS data, using ArcGIS. https://https://catalogue-hrm.opendata.arcgis.com/datasets/625d718e3dd04dc4ac69ae2861f6df36_0/about.

Huuhka, S., T. Kaasalainen, J.H. Hakanen, and J. Lahdensivu. 2015. "Reusing Concrete Panels from Buildings for Buildings: Potential in Finnish 1970s Mass Housing." *Resources, Conservation and Recycling* 101: 105-121.

The Hyatt Foundation. n.d. "Anne Lacaton and Jean-Philippe Vassal Receive the 2021 Pritzker Architecture Prize." Accessed May 24, 2022. https://www.pritzkerprize.com/laureates/anne-lacaton-and-jean-philippe-vassal.

Kargaard, Peter. 2021. "Sustainable Building Materials are Seperated into a New Company: Recycling is Ready for the Big Projects." *Licitationen*, September 28, 2021. https://www.licitationen.dk/article/view/811362/baeredygtige_byggematerialer_skilles_ud_i_nyt_selskab_genbrug_er_klar_til_de_helt_store_projekter.

Kibert, Charles J., and Abdol R. Chini. 2000. "Overview of Deconstruction in Selected Countries." Rotterdam: International Council for Research and Innovation in Building Construction.

Lewis, Helen, and John Gertsakis. 2001. *Design + Environment: A Global Guide to Designing Greener Goods*. Oxon: Greenleaf Publishing.

Lynch, Kevin, and Michael Southworth. 1991. *Wasting Away*. San Francisco: Sierra Club Books.

MapCruzin. 2022. Coastline. OpenStreetMap. Map from GIS data, using ArcGIS. https://mapcruzin.com/free-canada-nova-scotia-arcgis-maps-shapefiles.htm

Moe, Kiel. 2017. *Empire, State & Building*. New York: Actar.

NSDNR (Nova Scotia Department of Natural Resources). 2007. *Resource Development Challenges in a Growing Urban Centre - Halifax Regional Municipality*. Halifax: NSDNR.

Pretty Plastic. n.d. "A Better World, by Design." Accessed June 3, 2022. https://www.prettyplastic.nl/.

Rural Studio. n.d. “Glass Chapel.” Accessed June 3, 2022. http://ruralstudio.org/project/glass-chapel/.

St. Pierre, Davin. 2010. “Industrial Symbiosis in the HRM: Upcycling Waste in Sustainable Construction.” https://divertns.ca/sites/default/files/researchreportsfiles/2021-09/Final%20Report%20%28draft%29%20-%20Davin%20St%20Pierre_compressed.pdf.

The World Counts. n.d. “A World of Waste.” Accessed June 3, 2022. https://www.theworldcounts.com/challenges/planet-earth/state-of-the-planet/world-waste-facts/story.