Chapter 3

Buildings and Housing

Ch–3

Introduction

The Vision

Sustainable buildings that can be **constructed and adapted far more quickly**, and a new set of financial and design tools that help **improve affordability** and **expand options** for all households.

For two years running, Toronto has hoisted more construction cranes than any other city in North America.[1] But for a city that is a leader in openness and inclusion, it has been hard to achieve ambitious levels of affordability during the building boom.

Much of Toronto's new skyline consists of condo towers priced out of reach for the median Toronto household, which makes roughly $66,000 a year.[2] Faced with great uncertainty around construction costs (rising at 6 to 8 percent annually in recent years)[3] and completion timelines, developers often build condos they can sell before breaking ground. In the last 20 years, 77 percent of the new housing stock in Toronto has been condos.[4]

To help, all levels of government have increased support for affordable housing programs, but additional funding is needed, as are viable paths to create new private sources. Half of households earning $40,000 to $60,000 are housing "burdened," spending more than 30 percent of their income on rent.[5] Few options exist for middle-income households that do not qualify for housing programs but also cannot afford market-rate homes.

Beyond housing, economic opportunity improves with true live-work communities that host a lively mix of homes, offices, shops, and services. Such neighbourhoods provide residents with easier access to jobs and essential daily services and with housing options for families to grow over time. They also provide affordable commercial space in buildings and on ground floors for local retailers, community groups, artists, and startups, not just big chains and corporate offices.

The innovation plan.

To help Toronto's waterfront achieve its goals for a mixed-income community that builds on the city's diversity, and to demonstrate a path forward for affordability and economic opportunity in high-demand cities, Sidewalk Labs proposes a comprehensive strategy for construction, building, and housing innovation.

First, Sidewalk Labs proposes construction innovations that would accelerate project timelines while reducing costs and uncertainties, helping developers look beyond condo towers. This plan centres on a new factory-based construction approach, enabled by an emerging building material called "mass timber," which is easier to manufacture and better for the environment than concrete or steel, yet just as strong and fire-resistant. Digital building information modelling tools could support this factory approach by coordinating projects across the supply chain.

Second, Sidewalk Labs proposes building design innovations that could accommodate the full range of live-work needs and respond nimbly as those needs change. These include adaptable "Loft" spaces — supported by flexible interior panels and a real-time code-monitoring system — designed to cut renovation times and help communities retain a lively mix of businesses and residents. For homes in particular, efficient units and co-living spaces could improve affordability while expanding options for all types of households.

Finally, Sidewalk Labs' proposed housing innovations aim to realize an ambitious affordability program wherein 40 percent of units are below market rate, with half of the program's total units consisting of purpose-built rentals to improve long-term affordability. To achieve this program, Sidewalk Labs proposes to implement new tools that could help the private sector support below-market rental housing while still earning returns, including through leveraging the value created by factory-based construction.

With a commitment of at least 6 million square feet of construction along the waterfront, an Ontario-based factory could be financed and ready for operation by 2021, leading to 350,000 work hours during the development of Quayside.[6]

Benefits of implementing the vision

Accelerate construction timelines by as much as 35 percent

Unlock a new Ontario-based sustainable mass timber industry, creating roughly 2,500 jobs over 20 years of development at the scale of the IDEA District

Generate over $1.4 billion for below-market housing through 2048

Enable buildings to support evolving live-work communities through fast, affordable renovations

IDEA District

The 77-hectare Innovative Design and Economic Acceleration (IDEA) District, consisting of Quayside and the River District, provides sufficient geographic scale for innovations to maximize quality-of-life impact and to become financially viable.

The impact.

In Quayside, Sidewalk Labs estimates that factory-based construction techniques could demonstrate that it is possible to reduce construction timelines by as much as 35 percent,[7] while creating the world's first neighbourhood made entirely of sustainable mass timber. Adaptable structures could allow for a true live-work community by making renovations easier, with 50 percent lower costs and timelines. An ambitious housing affordability program could provide roughly 1,000 below-market units, including new options for middle-income households, growing families, and seniors.

Applied to the proposed full scale of the IDEA District, Sidewalk Labs' approach could go even further towards addressing the city's objectives concerning affordability and opportunity.

At this greater scale, factory-based construction could give rise to a new Ontario-based sustainable timber industry, creating roughly 2,500 jobs over 20 years and unlocking new land value through faster project timelines and reduced risks. Sidewalk Labs estimates that the total value created by factory-based construction, efficient housing designs (which enable developers to build more units on a given site), and other proposed financial tools (such as a condo resale fee to support mixed-income communities), could reach over $1.4 billion through 2048. This approach would also demonstrate a viable and replicable path for the development sector to support the public sector in improving housing affordability.

Such a program could include around 6,800 affordable housing units, representing nearly a third of the current annual citywide target for new affordable rental housing units, in accordance with the city's Open Door program,[8] or well over half the goal if the definition of affordable housing is expanded to include middle-income households in need.

Most of all, this approach could provide a model for Toronto to welcome its consistent influx of new arrivals — roughly 1 million additional people are projected to live there by 2041[9] — allowing the city to maintain its exemplary commitment to inclusion.

This housing vision could create over 6,800 units of affordable housing, tackling nearly a third of the annual city-wide targets for new affordable rental housing.

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Part 1

Accelerating Construction Timelines

Key Goals

1
Catalyze a new sustainable industry around mass timber

2
Launch a factory to produce a complete library of building parts

3
Coordinate the supply chain with a digital delivery system

The ability for development projects to go up quickly is critical in helping cities meet new demands for residential or commercial space. But in Canada and around the world, developers face a number of challenges that make it difficult to complete projects on predictable timelines and with predictable costs.

Perhaps the biggest challenge is the unpredictability of finding (or, in developer speak, "sourcing") a set price for the many building materials needed for a given project. Costs keep rising for concrete and steel[10] — the main urban building materials — and customized designs make each project time-consuming. Both factors can lead to construction delays or project cancellations; even in a high-demand market like Toronto, at least 17 projects have failed since the start of 2017 alone.[11]

The challenge of accelerating urban construction is not new, but no one has yet cracked the code, stymied by heavy building materials that are hard to produce in a factory and the difficulty of coordinating a construction supply chain across designing, financing, contracting, and permitting. In general, off-site (or mass-produced) construction has yielded repetitive designs applied mainly to single-family homes, hotels, and temporary housing.

But the time is right for off-site construction to take hold. Today, advances in technology are shifting the paradigm for urban construction. A wave of companies around the world is taking advantage of lightweight materials (such as mass timber), robotic machinery, and building information modelling software to construct architecturally distinct buildings faster, and at a lower cost, including: Lindbäcks Bygg in Sweden, Legal & General in the U.K., Sekisui House in Japan, Admares in Finland, and Katerra and Factory OS in the U.S.

Off-site mass timber construction can accelerate project timelines by 35 percent, reduce costs, and greatly improve overall predictability.

Vancouver's 18-storey all-wood Brock Commons went up at two floors per week.

Canada has demonstrated the promise of this approach with discrete projects. Recently, Toronto has seen the emergence of higher-quality modular construction, such as the Great Gulf Home factory, although this work has focused on low-rise buildings.[12] In Vancouver, the 18-storey, all-wood Brock Commons building on the University of British Columbia campus went up at a speed of two floors per week for the basic structure.[13]

Sidewalk Labs proposes to advance these efforts by committing to use prefabricated building components in Quayside and beyond. This commitment would enable the establishment of a factory in Ontario, which Sidewalk Labs is willing to support financially, potentially in partnership with others. Such a factory would process mass timber building parts and catalyze a new industry around this sustainable material.

Sidewalk Labs also proposes to create a library of building parts that could be combined in thousands of different ways to ensure design excellence and to develop a digital management system that coordinates the entire supply chain from conception to completion.

Together, these approaches can accelerate project timelines by 35 percent, reduce costs below current market rates, and greatly improve overall predictability for any given development.[14]

Goal 1

Accelerating Construction Timelines

Catalyze a new sustainable industry around mass timber

The first step in Sidewalk Labs' proposed approach to construction innovation is the wide-scale manufacturing of mass timber, a sort of "super wood" created by compressing multiple pieces of timber together.

Wood ranks among humanity's most ancient building materials, but today conventional timber is mostly used to create simple two-by-four wood structural elements (such as beams) for low-level housing. Mass timber emerged in Central Europe in the mid-1990s as a much stronger material than conventional timber, with the potential for use in tall urban buildings.[15] It is as strong as steel and twice as strong as concrete by weight — yet far easier to manufacture and faster to assemble.[16]

Mass timber is also far more sustainable than steel or concrete. Trees "sequester" carbon as they grow — trapping 1 tonne of carbon dioxide in every cubic metre of timber.[17] In this way, buildings made of timber act as a vault, storing carbon that otherwise would have been released back into the air through decomposition. For example, the timber required to build Brock Commons in Vancouver stored 1,753 tonnes of carbon dioxide, the equivalent of taking 511 cars off the road for an entire year.[18] Mass timber also improves air quality and has "biophilic" properties, the term for human health benefits ascribed to interaction with nature (see Page 211).

Sidewalk Labs plans to support the launch of an Ontario-based factory by 2021 that would process two mass timber products: cross-laminated timber structural panels and glulam beams. This factory would use Canadian-sourced mass timber — specifically spruce trees from the boreal forests of Quebec and Ontario and Douglas fir trees from British Columbia, the two dominant types of wood in the traditional North American timber industry. The factory would operate in collaboration with Canadian foresters, sawmills, and other industry partners.

In Quayside, Sidewalk Labs proposes to use mass timber in all buildings it develops, with the goals of proving out the technology's viability up to around 30 storeys, a new record, and of becoming the world's first fully mass timber neighbourhood. Using wood for all 2.6 million square feet of building development in Quayside would be equivalent to removing over 20,000 cars from the road annually.[19]

Across the full scale of the IDEA District, Sidewalk Labs proposes to require third-party developers to use materials that meet the sustainability standards of those buildings planned for Quayside, which would be substantially constructed of mass timber. If mass timber materials were used in the IDEA District, they would need to be certified by the international Forest Stewardship Council or equivalent forest certification bodies.

Benefits spotlight

Health, wellness, and mass timber

Mass timber is not just sustainable for the natural environment — it can also help sustain people inside the built environment.

A wide range of research shows that exposure to natural environments and materials elicits restorative responses in the body and brain.

Healing.
A seminal 1984 study by architect Roger Ulrich, which has since been replicated many times, found that surgery patients whose recovery rooms had a window view of natural scenery recovered faster and required fewer painkillers than those whose rooms did not.[20]

Stress reduction.
Japanese researchers have shown that a short walk through a natural environment reduces the body's production of cortisol (the fight-or-flight hormone) and keeps it down for hours afterwards.[21]

Comfort.
Another Japanese study showed that, in rooms with 45 percent of their surface areas covered by wood, participants not only found the room comfortable, their diastolic blood pressure decreased while their pulses quickened — a kind of relaxed alertness.[22]

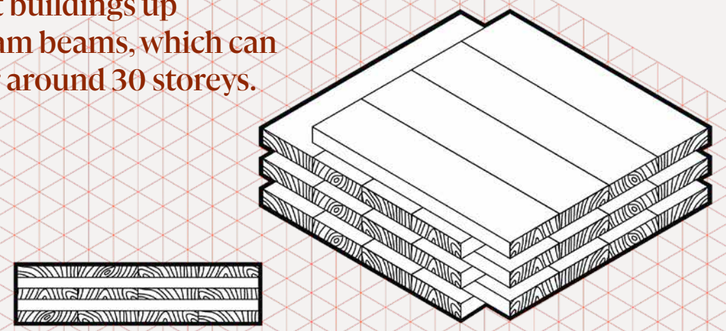
Calming.
Exposure to nature has been found to calm the subgenual prefrontal cortex, the part of the brain responsible for mental brooding. Neurologists believe it takes as little as 40 seconds of staring at an image of natural scenery for this calming effect to kick in.[23]

Cognition.
A 2008 University of Michigan study compared the cognitive effects of walking through downtown Ann Arbor with the effects of strolling through the city's arboretum. The nature walk restored voluntary attention — responsible for such tasks as problem-solving — far more effectively.[24]

Concentration.
A 2012 study from the University of Texas at San Antonio showed that, in workplaces, the presence of fractals (self-repeating patterns at a variety of scales, from small to large) serves as a buffer from stress that can help people perform challenging mental work.[25] Wood grain is, in essence, a series of fractals — like snowflakes, no two wood pieces are ever alike.

Two types of mass timber parts

To help Quayside become the world's first entirely mass timber neighbourhood, an Ontario-based factory would process cross-laminated timber panels, which can self-support buildings up to around 10 storeys, and glulam beams, which can provide structural support for around 30 storeys.



Cross-laminated timber panels

Sidewalk Labs plans to use cross-laminated timber, commonly called CLT, to manufacture structural wall panels and floor plates. In Quayside, Sidewalk Labs proposes to create a 10-storey building entirely from CLT.

Composition.

The creation of CLT begins by milling a piece of wood ranging from 15 to 35 millimetres thick. Typically, three to seven layers of such pieces are arranged with the grains perpendicular to each other, then are compressed together with a green-certified glue to create a panel of up to 4-by-18 metres.[26]

Adhesives.

The most common adhesives for CLT are polyurethane-based, or PURs, which are free of solvents and of formaldehyde, and ensure both low toxicity and capacity for future reuse or recycling. Industry testing has demonstrated that CLT panels utilizing PURs have no impact on internal air quality by the emission of volatile organic compounds, commonly called VOCs.[27]

Strength.

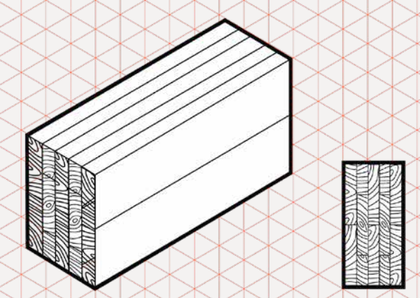
Whereas traditional timber is only strong in the direction of the grain, CLT's layered arrangement gives it strength in two directions.[28] A typical CLT wall panel is capable of bearing a vertical force of 197 kilonewtons per metre, which is equal to four elephants standing on top of a one-metre section of wall.[29] As a result, CLT wall panels and floor plates have enough strength to support up to a 12-storey building on their own, without the need for the structural beams and posts used in conventional mid-rise constructions of the same height, thus freeing up the interior space typically devoted to beams and posts.[30]

Shipping.

To optimize for shipping, CLT panels can be manufactured to fit a standard articulating truck. That means a truck can be packed up to 50 percent full with CLT walls and floor plates, with the rest of the cargo weight going towards racks that hang these pieces. By contrast, when shipping steel, a truck is considered overweight after only 5 percent of its cargo volume is filled, given the weight of the material. (More on shipping on Page 226.)

Assembly.

CLT panels can be manufactured with interlocking metal cleats at both ends to accelerate assembly.[31] The assembly speed is extremely fast because there is no need to use structural posts and beams or partition walls for structural support. While CLT panels can be treated with any type of paint or plaster, design experts believe 45 percent of the natural wood should be exposed to get the full health benefits of its biophilic properties. (More on assembly on Page 227.)



Glulam beams

For buildings that exceed the 12-storey structural limitations of CLT, Sidewalk Labs proposes to use a different type of mass timber called glulam to manufacture structural posts and beams. In Quayside, glulam supports (along with CLT floor panels) would be used to develop buildings of around 30 storeys tall, a new record that would demonstrate the technology's capabilities.

Composition.

Glulam's name comes from the use of glue to laminate wood together. Glulam is made using three to nine layers of timber, but unlike CLT, glulam is made with the timber grains oriented in the same long direction. As a result, glulam has immense load-bearing strength across the length of the beam or straight down a post — the same support steel offers in traditional construction.

Adhesives.

The adhesives used in glulam are also PURs.

Strength.

Glulam beams and posts, combined with CLT panels and floor plates, would provide the technical strength to support a skyscraper as tall as the Empire State Building.[32] However, as a building's height increases, the size of the glulam beam necessary to support the structure expands significantly, reducing the amount of usable interior space. With existing engineering, the beam size would become intrusively large, or 1.5 metres deep, when a building exceeds around 30 storeys.

Shipping.

Like CLT, glulam materials are half the weight of steel beams and posts, making them easier to transport. Whereas a typical truck can handle two or three steel beams, it can carry 10 times as many glulam beams.

Assembly.

As with CLT, the lighter weight of glulam makes these pieces easy to assemble on-site via metal cleats.

Ensuring fire resistance with “Shikkui plaster”

When people first learn about the prospect of tall wooden buildings, their first question is often: “What about fire?” Despite this reasonable concern, mass timber is engineered to be not only more fire-resistant than typical wood[33] but just as fire-resistant as concrete or steel.[34]

As a primary form of fire resistance, mass timber panels can be designed with an outer layer of wood in place solely to provide a “charring layer,” which acts as a buffer, protecting the interior (and structurally essential) layers from further combustion.[35] These fire-resistant charring layers protect mass timber pieces that are exposed (or viewable) as part of a building’s interior design. These layers also help extend the life of a mass timber building, because they can be replaced (rather than demolished) if charred.[36]

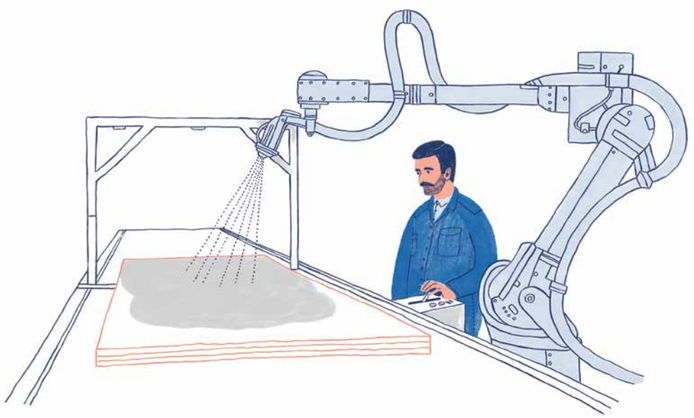
Alternatively, mass timber panels designed without charring layers (to reduce size) could be protected by a non-combustible fire-insulating panel, such as drywall. But the use of drywall, which is the typical construction practice, is labour intensive and wasteful: it generates nearly 12 million tonnes of debris every year.[37] That debris represents up to 27 percent of overall construction waste[38] and often languishes on construction sites as a potential hazard; eventually, it goes to landfills, where it becomes poisonous gas,[39] negating some of the sustainability benefits of using mass timber.

In search of a better form of protection, Sidewalk Labs is developing new applications for a natural plaster system called Shikkui plaster, which has a fire-resistance rating comparable to that of drywall (see sidebar on Page 215) and has many additional advantages, including sustainable properties, health benefits, faster application times, and a green waste stream.

Made from natural ingredients, including slaked lime, seaweed extracts, eggshells, and plant fibres, Shikkui plaster has been used in Japan for over 1,000 years on walls and ceilings as an aesthetic finish that also protects wood buildings against water and fire damage. As a hybrid of natural substances, Shikkui is completely environmentally sustainable (receiving the globally recognized Cradle to Cradle certification), fully recyclable and compostable, and produced with low amounts of energy. Its low carbon footprint is reduced even further as it continuously absorbs carbon dioxide after installation.

Shikkui also provides health benefits: its high alkalinity makes it a natural killer of bacteria and mold, and its anti-static properties prevent the accumulation of dust that allergens feed off of. Additionally, its finish includes customizable textures and colours, enabling interior variety with no need for any paint.

The Shikkui system can also accelerate construction timelines. Sidewalk Labs plans to mechanically install Shikkui onto mass timber panels in a factory, cutting the amount of time typically devoted to the application of paint and drywall in half. This approach results in a waste stream that can be recycled as plant-beneficial fertilizer.[40]

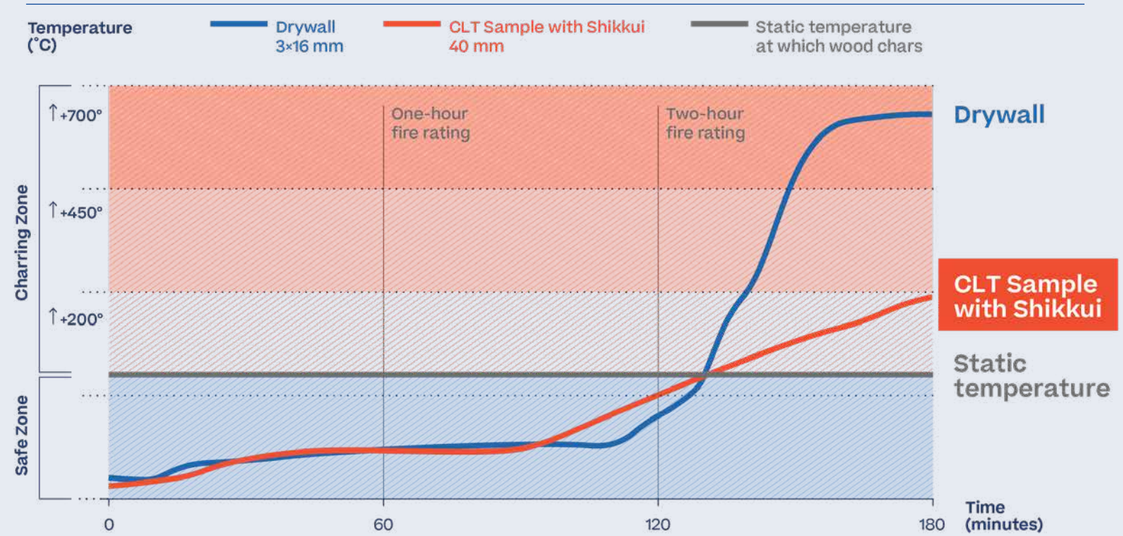


Mechanically applying Shikkui plaster to mass timber panels can help accelerate construction timelines.

In Focus

Independent test results

Shikkui system matches drywall on fire protection



To demonstrate the fire-resistance of mass timber panels coated in Shikkui plaster, the coated panels must meet the American Society for Testing and Materials (ASTM) E119 standard called “Standard Test Methods for Fire Tests of Building Construction and Materials.”[41]

The ASTM E119 test is designed to assess how well building elements can contain a fire and maintain structural integrity over a given time period, commonly referred to as one- and two-hour “rated assemblies” — the same standard achieved by double and triple five-eighths-inch drywall. These time periods are considered long enough for occupants to safely evacuate, and for firefighters to control the fire damage.

(On its own, Shikkui plaster already meets the Class A rating for the ASTM E84 standard, also known as the Steiner Tunnel test, meaning that it does not let fire spread across its wall or ceiling surfaces.)

The ASTM E119 test places the plaster-coated mass timber panels in a flat furnace and subjects them to a controlled flame. Within five minutes, the furnace reaches temperatures of 537 degrees Celsius, rising to 927 degrees Celsius at one hour and to 1,010 degrees Celsius during the second hour. The furnace test continues until the target one- or two-hour test limit is successfully achieved or until an unsuccessful outcome occurs, such as when the structure collapses or the material surface reaches a temperature of 300 degrees Celsius.

Preliminary tests conducted by an independent laboratory achieved the one- and two-hour “rated assemblies,” meaning the Shikkui-coated mass timber withstood exposure for both one and two hours, as required by ASTM E119. Further tests will be conducted in a state-of-the-art, certified independent laboratory and supervised by the National Research Council Canada.

Strengthening wind resistance and building cores

Mass timber is about half the density of concrete or steel. While that makes it easier for trucks to ship and for construction workers to assemble, this lightness also makes mass timber structures more susceptible to wind, especially once they exceed 10 storeys (depending on building massing).

Many of the tallest timber buildings in existence today integrate steel-based external frames or other lateral support systems to anchor and stiffen the building against wind, but adding steel detracts from timber's sustainability advantages. As part of the planning process, Sidewalk Labs explored three potential innovative building cores that could be used to strengthen resistance from wind and seismic activities for mass timber buildings. Sidewalk Labs plans to explore which cores provide the best fit for buildings developed in Quayside, and to make all three options publicly available for third-party developers to consider for their own building needs.[42]

Timber cores.
For buildings up to 12 storeys, cores made entirely of timber could be a viable alternative to external frames, maintaining the building's low carbon footprint.

Prefabricated steel cores.
For buildings higher than 12 storeys, a new type of prefabricated steel core could anchor the building. Although lacking the environmental advantages of timber cores, this approach has the potential to reduce on-site construction times by roughly one month over traditional concrete cores, with steel cores (including elevator rails) delivered straight to a site from a factory.

Hybrid.
The exploration also found potential in a new type of timber core that incorporates post-tension steel cables to increase the overall stiffness of the core. This option could support timber structures of at least 30 storeys, while offering a more sustainable option than a steel core.

Making Ontario a global leader

Canada has all the ingredients for a transformative industry in mass timber building materials.

The country owns about 37 percent of the world's certified forests, defined by the international Forest Stewardship Council as areas that can be harvested for wood in a sustainable way, with proper spacing to regrow trees and with access to existing railways or roads to transport supplies.[43] Almost half of Canada's 374 million hectares of forests are certified. Roughly half a billion new seedlings are planted every year. The $24.6 billion forestry industry in Canada employs more than 200,000 people (including more than 12,000 from Indigenous populations), with more than half of all jobs located in Ontario and Quebec.[44]

Canada harvests nearly 800,000 hectares of timber per year, but devotes the majority of that supply to framing lumber, such as simple two-by-fours or plywood. As a result, Canada currently imports mass timber parts from Austria and other production centres.

By supporting the launch of a factory in Ontario for the construction of mass timber structures in the IDEA District, Sidewalk Labs would help jumpstart this next-generation Canadian industry. This newly expanded supply chain would begin with local foresters and sawmills creating the baseline CLT and glulam pieces, which would then be sent to the factory to be cut into assembly-ready posts, beams, and panels — part of the complete library of factory-made building parts described in the following section of this chapter.

Engaging the timber community.
Sidewalk Labs has engaged more than 150 stakeholders across this potential supply chain to figure out what needs to happen to make Ontario a global leader in what could be a major piece of the future of urban building. Part of the answer is a commitment to ensure that the demand for mass timber starts at the proposed 6 million square feet of development — with the potential to grow to 33 million square feet at the full scale of the IDEA District.

An equally important factor is supporting close collaboration among designers, contractors, and manufacturers, thus establishing partnerships that might not be in place today across trades (see sidebar on this page).

To jumpstart the process of collaboration, Sidewalk Labs has hosted or planned a series of industry events focused on mass timber. To date, these events have included an overview of the Sidewalk Toronto project and a design review of Sidewalk Labs' proposed library of building parts to construct a building. Future events are expected to include discussions of risk mitigation and capacity building. (More information is available at the Sidewalk Toronto project website.)

By helping to grow the capabilities of local players, and by building on the timber industry's momentum, Sidewalk Labs can enable a sustainable ecosystem for mass timber that can contribute to further innovation in timber construction and realize economic benefits for the city, province, and country for decades to come.

Sidewalk Labs small research grant

Modular timber construction in Ontario

The use of mass timber to construct high-rise buildings has enormous appeal. But as with all new technologies, costs are expected to be higher at first, as production techniques are worked out and economies of scale are developed. That is also true in the regulatory world. Permitting and code agencies are unfamiliar with mass timber and may at first take more time and be less predictable in their judgements, which adds to costs.

In the report "Mass Timber in High-Rise Buildings: Modular Design and Construction," commissioned by Sidewalk Labs, authors Dalia Dorrah and Tamer E. El-Diraby, professor in the Department of Civil and Mineral Engineering at the University of Toronto, recommend that industry and government work together to accelerate the process of lowering costs and streamlining techniques, both industrial and regulatory. Doing so can help unlock the potential to build a vital new industry in Ontario, which could supply a new economic base while improving the built environment of Toronto and the region.

To this end, Dorrah and El-Diraby propose that developers, manufacturers, contractors, and government officials work to establish councils and partnerships to share information. One difficulty, the authors argue, is the fear that mass timber buildings would be fire hazards. Studies show this concern is misplaced, but the issue needs to be addressed head on.

They also suggest using an Integrated Project Delivery System, where owners and contractors can share information more fully, as well as a three-dimensional modelling system known as building information modelling (BIM). These tools would establish the common contractual and technical platforms that would boost cooperation and collaboration.

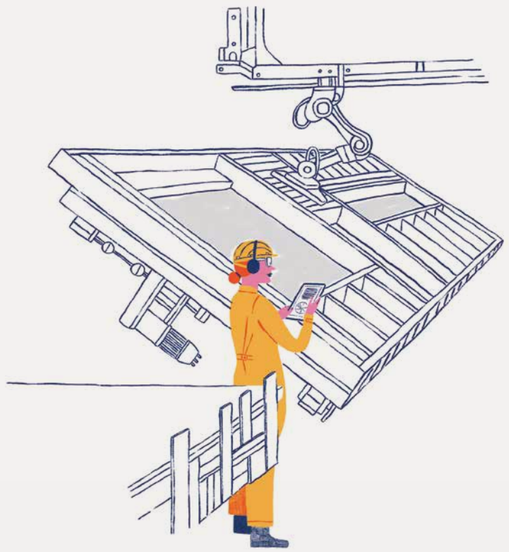
Finally, Dorrah and El-Diraby say development of mass timber has another potential side benefit: it could test the resiliencies of contractors and developers as they work out new techniques, ultimately better preparing them for a changing market.

Catalyzing a sustainable mass timber supply chain

Sidewalk Labs would build on Canada's growing efforts to embrace mass timber by reimagining the supply chain, harvesting local sustainable timber that would be processed in a new Ontario-based factory. The resulting construction process would be faster, more predictable, less expensive, and better for the environment — jumpstarting a new national industry.

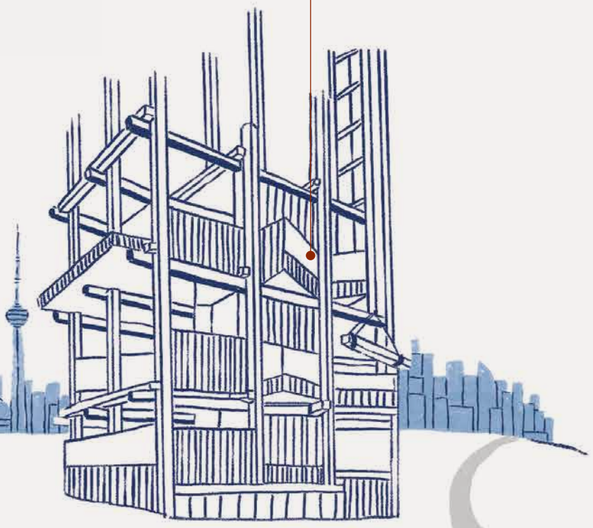
1 Harvesting sustainably.
The supply chain would begin with local foresters harvesting timber in a sustainable way.

2 Collaborating with local sawmills.
Harvested timber would then make its way to local sawmills, where it would be turned into CLT and glulam pieces.



3 Manufacturing a library of parts.
The new factory would then cut and prepare these mass timber pieces into assembly-ready wall panels, floors, beams, and posts (in addition to preparing other components of its building library).

5 Assembling faster.
Mass timber parts would be fitted with a cleat system that would make assembly fast: the structure could go up as quickly as one floor per day.



4 Shipping to the site.
Once ready for assembly, mass timber parts would be efficiently shipped to a construction site.

Goal 2

Accelerating Construction Timelines

Launch a factory to produce a complete library of building parts

A set of mass timber structural pieces is the foundation for a new, factory-based approach to sustainable urban development. But a building consists of more than panels and beams. To accelerate project timelines, improve predictability, and reduce costs in a holistic way, Sidewalk Labs plans to establish a complete library of factory-made building parts available to all developers — whether in the IDEA District, elsewhere in Toronto, or around the world.

The building parts created and assembled in this new factory would be produced in sufficient volumes to reduce both costs and sourcing time for developers and contractors. Sidewalk Labs has started to work closely with local regulators to enable these pieces to be pre-approved, creating more certainty around construction timelines and the permitting process. These parts would still be customizable by architects seeking to deliver distinctive designs, as the same library of parts can lead to dramatically different buildings.

The result would be unique designs built on a faster, more predictable timeline, with reduced risks and opportunities to lower key project cost categories. These benefits emerge from several areas:

Materials procurement.
Pre-determined components could create more predictable, shortened timelines for sourcing and procurement. Bulk purchases would also cut the rising cost of materials, ensuring consistent pricing.

Design.
A pre-designed library of parts would reduce time spent on designing. A pre-established strategy around technical details (such as fire-resistance ratings, acoustics, and deflection, as well as mechanical, electrical, and plumbing integration) would dramatically reduce overall design time and cost.

Assembly.
The easier on-site assembly of prefabricated mass timber parts would accelerate project speeds, saving time and reducing project management costs and site operational costs during the construction period.

Transportation.
Developing a library of parts created to optimize shipping would reduce transportation costs.

Factory-based construction of building parts would result in less waste, better working conditions, and streamlined regulatory approvals.

Waste.
Finishing parts in a factory would capture waste for recycling and nearly eliminate on-site waste.

Labour.
Off-site factory conditions would improve productivity and reduce on-site supervision needs, while also reducing risks of injury.

Regulatory approvals.
Pre-certified building components and assemblies would create clarity on meeting code and permit reviews.

Contingency.
The greater reliability of the factory supply chain would reduce the need for developers to build “contingency” costs into their projects.

Sidewalk Labs has considered a wide range of building materials and technologies and will continue to explore others in the hopes of further improving the sustainability of the system and the efficiency of the construction supply chain. Some of these innovations are designed to be integrated in tall timber systems (such as new manufactured timber products or wall systems) and others have driven innovation in other industries but could be incorporated in building systems (such as mineral wool insulation and pressurized walls and windows).

The following sections describe these benefits in greater detail. By injecting more certainty into the building process, Sidewalk Labs hopes to enable projects that meet both the city’s objectives for affordability and the waterfront’s standards for aesthetic excellence.

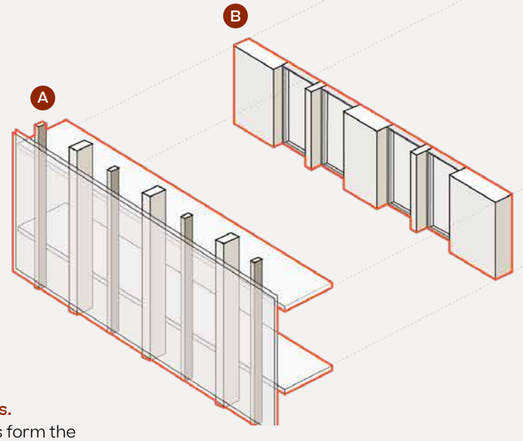
The six core components that make up the library of parts

The proposed off-site factory would process six core building components: exterior facades and windows, exterior wall systems, structural elements, interior wall systems, kitchens and bathrooms, and building roofs. Together, these parts can improve predictability of design and procurement of parts for developers.

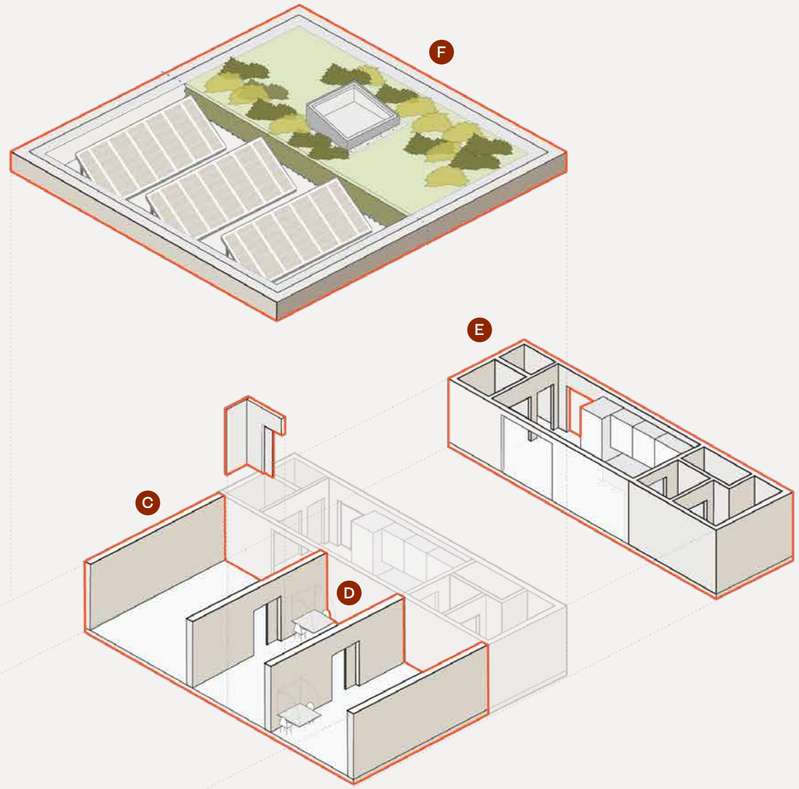
Working in collaboration with local foresters, sawmills, and suppliers, the proposed off-site factory would produce and assemble the building parts shown here, helping to reduce the time spent sourcing and procuring materials and conducting initial designs, while also making the costs of materials more predictable.

A Exterior facades and windows.
The success of manufactured buildings will rely in large part on the ability of architects to design structures that do not look like they just rolled off a factory line. Sidewalk Labs' proposed building library would incorporate a customizable facade system that includes windows of all shapes, shades, and sizes, and outer cladding (or coating) of different materials to help create unique exteriors.

As part of this facade kit, Sidewalk Labs plans to incorporate a type of triple-paned electrochromic glass that can be used for windows, skylights, facades, or curtain walls.[45] Electrochromic glass can be tinted — either manually, by building occupants, or automatically, by a building management system — to deflect heat before it enters a building, reducing the need for air-conditioning and leading to lower utility bills. While this technology is not new, it has only recently become affordable and customizable in a way that lends itself to widespread use.



B Exterior wall systems.
Exterior wall systems form the outside structure of a building. These walls can be made out of any number of materials, such as non-structural CLT panels or glass curtain walls. The factory would produce or assemble facade panels that meet Toronto Green Standard Tier-3 sustainability standards, creating an airtight building seal that reduces the need for heating and cooling.



See the "Sustainability" chapter of Volume 2, on Page 296, for more details on energy-efficient building designs.

E Kitchens and bathrooms.
Kitchen and bathroom units are the most complicated and time-consuming on-site construction elements in residential buildings, as tile layers, electricians, plumbers, and fixture installers all try to work in the same small space at once. For these reasons, Sidewalk Labs would pre-assemble these units in a factory, where each of these trades can be sequenced to avoid conflicts and to achieve higher-quality installations. These units would be customizable with appliances, finishes, and colour schemes to meet individual styles and preferences. Sidewalk Labs is working with partners to develop appliances specifically designed for a new low-voltage power system (see Page 247).

C Structural elements.
As described on Page 212, Sidewalk Labs plans to create structural components from mass timber that include CLT building floor plates, CLT structural wall panels, and glulam beams and posts, as well as the standardized cleats and fittings required for their assembly.

D Interior wall systems.
Interior wall systems include non-structural walls and the electrical and water systems that typically come with them. Sidewalk Labs would incorporate a new system of flexible interior walls that could be easily clipped into place for faster renovation, while being every bit as strong as interior walls commonly used today. These walls would feature mist-based fire systems and low-voltage power systems (see Page 246 for more details).

F Building roofs.
Sidewalk Labs plans to assemble several types of building roofs, including photovoltaic roofs designed to harvest solar energy, green roofs to integrate nature or garden space into the building structure, and "blue roofs" to help manage stormwater. Blue roofs would have a predesigned flow rate to significantly slow down the volume of water leaving the roof, helping to avoid downstream or localized flooding.

With this same library of parts, architects and developers would be able to create dramatically different buildings that achieve the highest design standards while still cutting costs; three illustrative examples from global architecture firms are shown in the accompanying visuals.

Global design exercise

Creating three unique designs from one library of parts

Sidewalk Labs' library of factory-made building parts can be combined in thousands of ways to produce strikingly different designs. Using the same set of modular components, three global architecture firms developed creative design concepts for Quayside's mass timber buildings (for illustrative purposes only).

Library of parts interpretation: Michael Green Architecture (Vancouver).

Michael Green Architecture envisioned wood buildings for Sites 1 and 2 in Quayside that incorporated garden spaces into the design and aimed to create a diverse range of public and private spaces on the lower floors. Overall, these designs aimed to strengthen connections with nature and with fellow community members. Credit: MGA | Michael Green Architecture

Library of parts interpretation: Snøhetta (New York).

Snøhetta used the Sidewalk Labs mass timber toolkit to create designs for Sites 3 and 4 in Quayside that prioritized adaptability, with lower-floor stoa spaces anchoring a vibrant open-air plaza beside Parliament Slip. The wood system also enabled the team to envision an architecturally striking "hull" that curves atop this public space. Credit: Snøhetta

Library of parts interpretation: Heatherwick Studio (London).

Using the mass timber library of parts, Heatherwick Studio created a design for Site 5 in Quayside that is both expressive and unique. Freed by the modular system from the need to focus on "how" to achieve the building, the team envisioned a more intimate scale for the site that connects with the public realm and the waterfront. Credit: Picture Plane for Heatherwick Studio

Saving on waste, shipping, and assembly

Sidewalk Labs estimates that its efficient factory process would produce a 75 percent reduction in waste, 85 percent fewer deliveries to a construction site, and a 35 percent acceleration of assembly compared with typical on-site construction techniques.

Waste

Reducing waste by 75%

	Concrete	Timber
Number of dumpsters required		
Single building Residential Site 2	303	76
All Quayside	**5,066**	**1,271**

75% fewer dumpsters

The manufacturing process nearly eliminates site waste, because the prefabricated mass timber pieces are designed as perfect fits, and new sizes can easily become standardized over time. Additionally, as noted on Page 214, Shikkui plaster dramatically reduces waste compared to drywall. For example, in Quayside, the use of Shikkui will divert over 275 tonnes of drywall debris from landfills.

Shipping

Reducing truck site deliveries by 85%

Note: These figures account for structural parts only and do not include shipments for foundations and building fit-outs.

	Concrete	Timber
Number of trucks required		
Single building Residential Site 2	695	90
All Quayside	**11,619**	**1,505**

85% fewer trucks

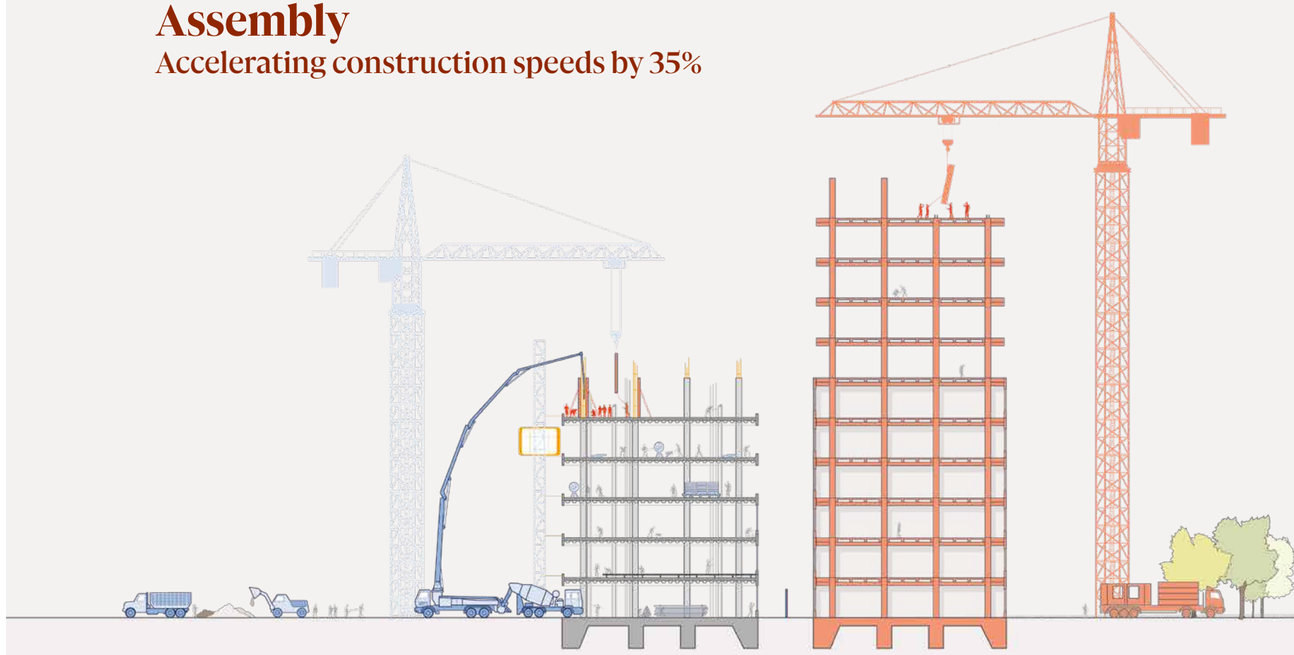
Shipping has traditionally been a difficult challenge for factory-produced structures. While whole rooms might be cheaper to assemble off-site than on-site, they are far more expensive to ship — in effect, shipping an empty room means paying to ship air.

Sidewalk Labs' library of building parts would be designed to maximize shipping efficiency, reducing the transportation costs that have hampered manufactured buildings in the past. As noted on Page 212, the lightness of mass timber makes it possible to fill a standard truck with far more parts than is possible with steel or concrete. A single 40-foot truck can hold either 18 CLT floor panels, 18 CLT wall panels, a mix of six panels and six walls, and two "wet boxes" (kitchens or bathrooms), or roughly 20 beams or posts.

On average, mass timber post and beam structures require up to 85 percent fewer deliveries to a construction site than concrete structures do, dramatically reducing the amount of congestion and neighbourhood disruption.

Assembly

Accelerating construction speeds by 35%



Sidewalk Labs' factory-based approach would dramatically speed up construction for two main reasons. First, the lightness of mass timber structures would require less extensive foundations. Second, the CLT and glulam cleat technology would make it easy for mass timber parts to snap into place quickly.

Sidewalk Labs believes the structural assembly of a building could ultimately reach speeds of one floor a day, compared with a typical on-site construction timeline of one floor per week. In other words, the basic structure for a 12-storey mass timber building could go up in as little as 12 days, compared with a more typical timeline of three months.

To complete a 12-storey building — which involves basic structural assembly as well as the installation of all finishes, the connection of all electromechanical equipment, and the execution of all tests — Sidewalk Labs estimates that its factory-based process can reduce construction time from 20 months to 13 months, delivering projects 35 percent faster than today's methods.

The advantages of assembly for mass timber exist at the scale of a single building but would likely increase over time, since construction workers would become more familiar with the cleat system and on-site managers would optimize the assembly sequence. These assembly innovations would also lead to a dramatically quieter construction site by removing the need for heavy equipment, eliminating material staging space, and reducing the number of on-site workers.

Sidewalk Labs does not plan to perform its own on-site assembly and instead proposes to work with local general contractors for this part of the process. Sidewalk Labs commits to reserve 10 percent of the hours spent on the construction of the neighbourhood for workers from historically disadvantaged and equity-seeking groups.

Improving productivity and worker conditions

Sidewalk Labs' plan for an off-site factory would result in a lower cost of construction and a faster completion time, both important steps towards helping Toronto reach new levels of affordability. But changes to the construction industry would have impacts on jobs and labour that must be taken seriously. While a new ecosystem of manufactured buildings would reduce total job hours for on-site construction crews, Sidewalk Labs believes that, on net, its approach to off-site manufacturing would have several benefits for construction workers in Toronto and across the region:

New, higher-paying jobs.
Though it would reduce on-site construction jobs, an off-site factory would increase job hours in factories and would create new jobs in related trades. Sidewalk Labs has explored these trade-offs with leadership of Ontario's Carpenters Union Local 27, who believe a new industry focused on mass timber could create new carpentry schools that teach workers to use engineered wood, leading ultimately to higher-paying factory jobs for this new specialty.

Additionally, the emergence of a mass timber factory in Ontario could bring about new local suppliers of timber as well as competing factories over time. Finally, by accelerating development within the IDEA District, a factory would catalyze an estimated 5.2 million total work hours for all factory-related trades.

Shorter commutes, greater comfort.
Shifting on-site construction jobs into factories has the potential to change the geography of labour across a region, a shift that comes with some notable advantages. Factory-based construction provides stability of commutes, since the job site never changes. Hours in factories are far more predictable. And unlike on-site construction jobs, factories are climate-controlled and well lit, with access to sanitation and lunch areas.

Safer work environments.
Labour statistics suggest an off-site construction factory would also improve worker safety. According to Ontario's Workplace Safety and Insurance Board, construction sites are considerably more hazardous for workers than manufacturing facilities. From 2013 to 2017, the WSIB recorded 4,499 claims from construction workers who lost time on the job due to injury. That amounts to 1,146 claims for every 100,000 construction workers, compared to only 641 lost-time claims for every 100,000 manufacturing employees (see table below).[46]

The safety benefits of manufacturing jobs

From 2013 to 2017, Ontario construction workers filed an average of 1,146 injury claims for every 100,000 workers, compared with 641 for factory workers.

	Construction	Manufacturing
Claims per 100,000 workers		
Lost-time claims	1,146	641
High impact claims	429	207
Fatalities	5.6	0.9

Note: All figures represent five-year averages. Manufacturing includes making, preparing, altering, repairing, ornamenting, printing, finishing, packing, packaging, inspecting, testing, assembling, and adapting for use or sale any article or commodity or raw material.

Achieving construction cost savings of 20% at scale

A factory-based approach to mass timber could reduce costs across typical construction categories, including material procurement, assembly, waste, and on-site workers. Realizing these savings requires a sufficient scale of development, such as the proposed IDEA District, both to produce a significant volume of building parts and to optimize factory operations.

	Share of typical project cost	Share of mass timber factory costs
Materials procurement Bulk purchases would limit the rising cost of materials and ensure predictable pricing.	30%	27%
Design A pre-designed library of parts would dramatically reduce overall design time and cost.	6%	5%
Assembly Easier on-site assembly of prefabricated mass timber parts would reduce project management costs and site operational costs during a shortened construction period.	14%	12%
Transportation A library of parts would enable optimized shipping, reducing transportation costs.	3%	2%
Waste Finishing parts in a factory would nearly eliminate on-site waste.	2%	1%
Labour Factory construction would reduce on-site construction needs, while increasing hours for factory workers and improving safety.	35%	26%
Contingency Greater supply chain reliability would reduce the need to build "contingency" costs into projects.	10%	7%
Total typical project cost	**100%**	**80%**

Accelerating development would catalyze an estimated 5.2 million total work hours for all factory-related trades.

Improving project predictability through pre-approved prototypes

Canadian code currently restricts mass timber buildings to a maximum of six storeys, given the relative youth of this technology. But mass timber has advanced rapidly. In the last five years, construction has begun or been completed on 21 timber towers above seven storeys worldwide.[47] Toronto has four tall timber buildings planned or in the works, including a 14-storey building at the University of Toronto and a 12-storey research and education centre at George Brown College called the Arbour.[48]

Additionally, the National Research Council, Canada's code body, may align with its equivalent body in the U.S., the International Code Council, in approving by 2021 an approach for timber buildings up to 18 stories tall. These provisions would include protections against fires, as already exist for other materials such as concrete and steel.

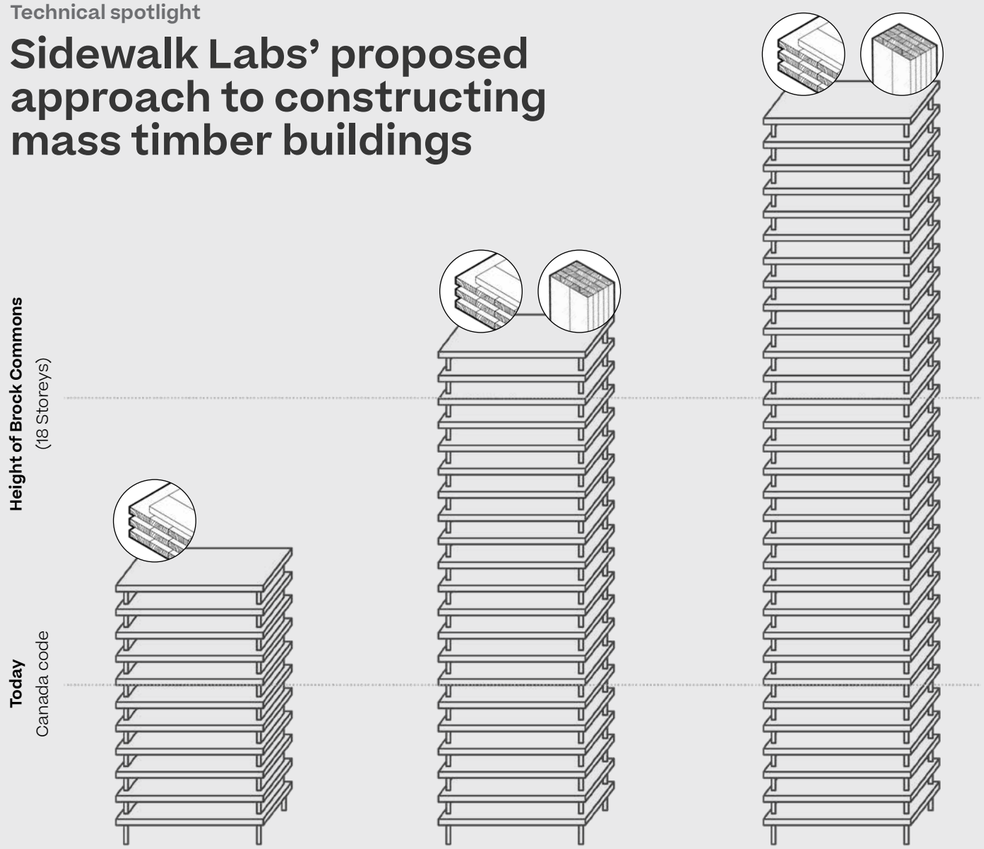
In Quayside, Sidewalk Labs proposes to create buildings up to around 30 storeys by filing for a common performance-based approvals pathway known as "alternative solutions," the approach used by Terrace House in Vancouver and being pursued by the Arbour in Toronto. Approval of this alternative solution involves submitting project-specific structural-engineering calculations and computer models to regulators, demonstrating how the building would perform as well as or better than the "acceptable solution" for conditions such as wind, rain, fire, and seismic activity.[49]

To enhance its filing, Sidewalk Labs plans to have its building designs peer-reviewed by independent evaluators, including the Vancouver-based Aspect Structural Engineers; Vortex Fire Consulting, a global fire-code consulting firm with offices in Toronto; and CHM, a fire-engineering consultancy with offices in Ottawa. Sidewalk Labs is also working with Equilibrium, a Vancouver-based structural engineering firm that was part of the team (along with CHM) that designed the Wood Innovation and Design Centre at the University of Northern British Columbia, an eight-storey, mass timber building completed in 2014.

After completing these approvals — and given the standardized components of the factory's library of parts — Sidewalk Labs anticipates that code reviewers and permit authorities could potentially identify pre-certified building components and assemblies, even for entire structures. For example, after a 10-storey CLT residential tower gained approval once, that same design could be "express" approved when applied to a new building project, with the architect or engineer of record responsible for confirming that the design has been used before.

Technical spotlight

Sidewalk Labs' proposed approach to constructing mass timber buildings



2–10 Storeys
Res – Loft 1/2/3

A self-supported tower prototype of around 10 storeys would be built using "three-ply" (or three-layer) CLT structural wall panels and five-ply floor plates.

The main advantage of CLT-only towers is that they are faster and less expensive to assemble than buildings that require interior posts and beams for structural support. Currently, a 10-storey building approaches the structural limitations of a three-ply and five-ply CLT system. To support buildings of taller heights, thicker CLT panels would be required, which would eat into usable square footage and create a more complicated and expensive structure.

10–20 Storeys
Res – Loft 1/2/3

A building prototype of around 20 storeys would be built using glulam beams and posts as the structural support system throughout the building.

Existing buildings, such as the 18-storey Brock Commons, have demonstrated the viability of mass timber construction near this height — although 20 storeys would top the existing record for Canada.

20–30 Storeys
Res – Loft 1/2

A building prototype of around 30 storeys would also be built using glulam beams and posts as the structural support system.

In 2019, Sidewalk Labs plans to begin designing a prototype of around 30 storeys called Proto Model X (or PMX) that would allow for testing and refinement of the library of building parts within Quayside. Delivering PMX would demonstrate the viability of integrating various technologies as well as the factory process. This work would require close collaboration with government partners to determine the necessary approvals for delivering a system of tall timber buildings, starting with Quayside.

Unlocking value and reducing contingency through overall project predictability

Factory-based construction techniques and a library of building parts would help developers accelerate project timelines and improve overall predictability. Sidewalk Labs estimates that 6 million square feet of delivery output would be needed to refine the factory process to a point of peak efficiency. This demonstration phase would also stabilize the operating margins critical to reducing developer risk.

With that period complete, Sidewalk Labs believes its proposed factory process would lead to improved project economics, enabling developers to clear returns while contributing to an ambitious vision for 40 percent below-market housing within the IDEA District.

A market analysis conducted by Sidewalk Labs anticipates that accelerating project timelines and reducing project risks would enable developers to create value by reducing contingency costs compared with current practices and by completing more projects over the same time period. In response to these benefits, developers might even choose to accept lower rates of return on any given project.

As described in the section of this chapter on housing affordability, beginning on Page 262, Sidewalk Labs estimates that factory-based construction techniques could unlock $639 million in value through 2048 when deployed at the full scale of the IDEA District. That value represents a sizeable contribution from developers toward below-market housing, which would complement government affordability programs to help Toronto achieve its goals for mixed-income communities.

Value unlocked for below-market housing:

$639 million

Factory-based construction enables developers to support an ambitious vision for 40% below-market housing.

Goal 3

Accelerating Construction Timelines

Coordinate the supply chain with a digital delivery system

To coordinate every part of the proposed mass timber supply chain, including the off-site factory line and on-site assembly, Sidewalk Labs plans to create a digital coordination system called Sidewalk Digital Fabrication.

Automobile manufacturers have long used integrated software systems to coordinate every stage of their production chains — from the factory in one place making hubcaps, to the regional assembly plant in another place putting all the pieces together, to the car dealership in yet another place selling whole cars on a lot. Car designers also get feedback from the product to make those cars both safer and better suited to consumers.

In the past 10 years, the emergence of similar software for buildings, known as building information modelling (or BIM), has helped organize the building process. BIMs can track essential details such as availability, price, material, weight, shape, strength, all the way down to the serial number of a given component. Just like the coordination systems for cars, BIMs create more reliable cost and time estimates, as well as a feedback loop for the supply chain to improve over time.

The proposed Sidewalk Digital Fabrication system would build on existing BIMs to create an end-to-end digital backbone for the entire construction pipeline, connecting suppliers, developers, architects, regulators, contractors, and even landlords.

An integrated software system for buildings, similar to those used by car manufacturers, can provide more reliable time and cost estimates.

A new digital system makes it possible to coordinate every part of the mass timber supply chain, from the factory to the construction site.

Lack of coordination among these groups is a big reason why construction costs are so unpredictable today. In a typical case, developers create a feasibility study for a plot of land — a lengthy, iterative process. Once that study is done, an architect typically integrates those ideas into an actual building design despite having little visibility into available construction supplies. From there, a contractor bids on the price of completing the job, which often means the architect must revise the designs to meet a budget. At that point, regulators would say whether or not the design meets approval; if not, it is back to the drawing board again. All of these hiccups add time and money to a project.

The Sidewalk Digital Fabrication system would aim to create an unprecedented degree of clarity across the entire development ecosystem, enabling all parties to reduce costs related to uncertainty.

The system would make site-specific details of a development process trackable in real-time, including factory parts, building designs, shipping statuses, construction-site management, and building operations. This integrated digital interface would provide instant feedback on how decisions impact capital costs, delivery timelines, operating performance (such as energy use), and other considerations throughout the planning process.

Sidewalk Labs plans to build the underlying infrastructure to support this advanced system but to partner with other innovative players in the field, such as Autodesk, which can provide other components of the planning platform, such as tools to estimate costs and procure materials.

Comparison

Improving the entire building supply chain

	Today	Sidewalk Digital Fabrication
Architects and designers	A lack of reliable manufacturing options encourages customization, driving up project costs and creating greater risk of delay. Design teams spend significant time coordinating and modelling a project-specific approach to building detailing; mechanical, electrical, and plumbing integration; fire performance; and acoustic performance — just to have the designs modified after bidding and the engagement of suppliers and contractors. Lack of insight into parts and costs leads to projects that are over budget. If costs must be cut late in the process, the original vision might get sacrificed.	A library of building options — with real-time prices and delivery times shown through the BIM interface — would enable architects to create designs with certainty about what supplies are available. The variation of these materials would also facilitate design excellence. Additionally, a new BIM module could enable architects to rapidly evaluate computer-generated design options and balance planning decisions with their creative vision.
Manufacturers	Customized building designs make it difficult to create parts ahead of time and in sufficient volume to reduce costs.	Feedback from a BIM could ensure that a factory created a consistent supply of standardized building component types, thus also offering pre-determined delivery timelines. This coordination would ultimately lead to more efficient operations, more predictability, and reduced costs.
Contractors	Customized designs make for a less standardized assembly process.	BIM systems can help contractors know how best to assemble the parts in a given design. Additionally, the standardization of parts would help workers assemble them easily and quickly, particularly as crews gain more familiarity with the standardized components.
Regulators	Customized designs introduce uncertainty about whether building elements will meet code or require costly alterations. A code authority reviews designs for the first time and issues permits and approvals late in the development process. If a reviewer identifies certain aspects of a plan that fail to meet code, architects and contractors must often go back to the design and procurement phase, potentially adding months to a project timeline. Additionally, code authorities are sometimes overwhelmed by the volume of applications from developers and the amount of manual work and background research required to respond. That can lead to delays in the permitting process, which in turn adds time and cost to projects throughout the city.	Code reviewers and permit authorities reviewing a BIM model could identify pre-certified building components and assemblies. This process would free architects and engineers to choose from a kit of parts with confidence that their final designs and plans will meet code and require minimal permit review. For example, after one 10-storey CLT residential tower has been approved by the buildings department, that same design could be “express” approved when applied to a new building project, with the architect or engineer of record responsible for confirming that the design has been used before.
Landlords and tenants	Customized designs make it difficult, time-consuming, and costly for landlords or tenants to replace or maintain outdated building elements.	Landlords or tenants could easily maintain and operate buildings because any replacement parts would be well documented in the digital system and available via continual supply. For example, it would be easy to find out where a broken window came from and order a new one.

Ch–3

Part 2

Helping Neighbourhoods and Households Evolve

Key Goals

1
Create an adaptable "Loft" space built for all uses

2
Accelerate renovations with a flexible interior wall system

3
Enable a safe, vibrant mix of uses with real-time building codes

4
Design affordable and flexible housing units

New construction techniques represent a first key step towards faster development and more affordable neighbourhoods. But a comprehensive plan for affordability must also design building structures with flexibility and adaptability, features that can enable a complete community of residents, businesses, and workers.

Today, most spaces within a building are created for a single purpose: residential, commercial, or industrial, with perhaps a little retail on the ground floor. Adapting these spaces to accommodate new uses requires lots of time or money. Yet the needs of cities, local economies, and households evolve over time, and rigid building designs are a barrier to meeting them.

To help neighbourhoods evolve, buildings should be able to accommodate a range of uses and shift quickly and inexpensively from one need to another. The result would be communities where people can live, work, shop, and socialize within a short walk. Residents could visit cultural installations without a car or take lively nighttime strolls past buzzing parks and restaurants. Within a single neighbourhood people could find affordable space to pursue their professional dreams, whether a single co-working desk to plot out a startup or a short-term stall to sell a hand-crafted confection. Homes could meet the needs of growing families and single-person households alike.

Adaptable spaces also enable a community to respond more effectively to larger trends. Right now, high-demand cities like Toronto need as much housing as possible, but at other moments in time they have needed industrial or office space with equal urgency. Looking ahead, retail spaces are on the verge of transforming in the face of e-commerce. When a space can be used for many different purposes, or when it can be renovated for any new use at a low cost, it is unlikely to remain vacant for very long.

Sidewalk Labs' plan to create buildings that can actively support communities over time has four core components.

A loft-style, adaptable approach to floor plans and interior spaces could be adapted for many different types of residential and non-residential uses. A flexible wall system would enhance this approach by dramatically accelerating interior renovations. A real-time building-code system could ensure consistent safety levels even as a building changes its mix of tenants. And housing units of all sizes designed for peak efficiency could provide affordable options and flexibility for all types of households.

At the neighbourhood scale of Quayside, Sidewalk Labs plans to build approximately 350,000 square feet of adaptable space to demonstrate this design's ability to accommodate residential, commercial, and other uses within a single structure. Sidewalk Labs estimates that this adaptability would reduce the time required to convert individual spaces by an estimated 50 percent. In collaboration with the city, the real-time code system would also be tested in Quayside for its ability to detect nuisances in real time. Using an efficient approach to unit design, Sidewalk Labs plans to make 40 percent of all housing units family sized (two bedrooms or more).

Adaptable spaces would reduce renovation time by
50%

Implemented at the full scale of the IDEA District, Sidewalk Labs' adaptable building innovations could be extended across hundreds of spaces, providing a dynamic new model of mixed-use development that can keep pace with a community's evolving needs. For the first time, cities would be able to know in real time that buildings are meeting safety codes, enabling a far greater mix of uses than typically found today. And an efficient approach to unit design would enable developers to create more overall units while retaining liveability, unlocking new value that could help meet the ambitious goals of affordable and below-market housing programs.

Flexible buildings enable a dynamic new model of mixed-use development that can keep pace with a community's evolving needs.

Goal 1

Helping Neighbourhoods and Households Evolve

Create an adaptable "Loft" space built for all uses

Toronto has many examples of the adaptive power of buildings with vast open floor plates, known as lofts.

Take the King Street West neighbourhood, once home to thriving manufacturers and warehousing facilities that served the city through World War II.[50] As these operations began to decline, many buildings fell into neglect, only to be revived and adapted in recent years into new homes, office spaces, shops, and restaurants — uses far different from the neighbourhood's industrial roots. But while these industrial structures proved nimble enough, adapting building spaces to dramatically different needs is generally expensive.

To reduce the cost of renovating spaces while retaining the spirit of industrial loft structures, Sidewalk Labs has designed an adaptable building space called, simply, Loft.

Sidewalk Labs' Loft concept improves upon traditional loft buildings by planning explicitly for ongoing, more frequent interior changes around a strong skeletal structure (sometimes called "good bones"). Lofts are designed around a post-and-beam skeleton and feature high ceilings as well as a flexible wall system to make renovations fast and easy.

This combination of a durable exterior with a nimble interior enables buildings to remain flexible throughout their lifecycles, accommodating a wide range of uses — including residential, retail, production, community, office, hospitality, and parking — that can respond quickly to evolving needs.

The basic idea behind Loft is to overbuild the "bones" of a building to allow for unanticipated uses in the future. A physician's office that needs a lot of interior rooms, a retail showcase that needs few interior rooms, and an artist studio that needs high ceilings could all occupy the same space over time, instead of having to find separate building spaces designed to fit their needs. That flexibility means Lofts would be more expensive to create up front, but it would also help the spaces recover these costs over time by decreasing vacancy periods by 50 percent compared to traditional spaces. If turnover of a typical space takes four weeks, adaptable space would decrease that period by about two weeks by removing time-consuming activities, such as demolishing partition walls and moving electrical wiring (see Page 246 for wall renovation comparisons). Sidewalk Labs estimates that after roughly two tenant turnovers, the initial cost of Loft would break even.

In addition to facilitating tenant changes, Loft spaces would make it easy for tenants to adjust their own spaces, thanks to reusable interior fittings such as interior walls. For example, a company could reconfigure a Loft office space to accommodate a weeklong training seminar, then return it to offices or small conference rooms. Likewise, a family might decide to subdivide a room in a Loft housing space to accommodate a long-term guest or new family member. Beyond saving time, reusable interior fittings also cut down on construction debris.

At the core of this flexibility is a system of standardized dimensions and modular interior parts that enable buildings to be reconfigured rapidly from one use to the next. This technical foundation includes: high ceilings, long floor spans, modular fittings, utility cavities, and prefabricated wetboxes. (See the next page for more.)

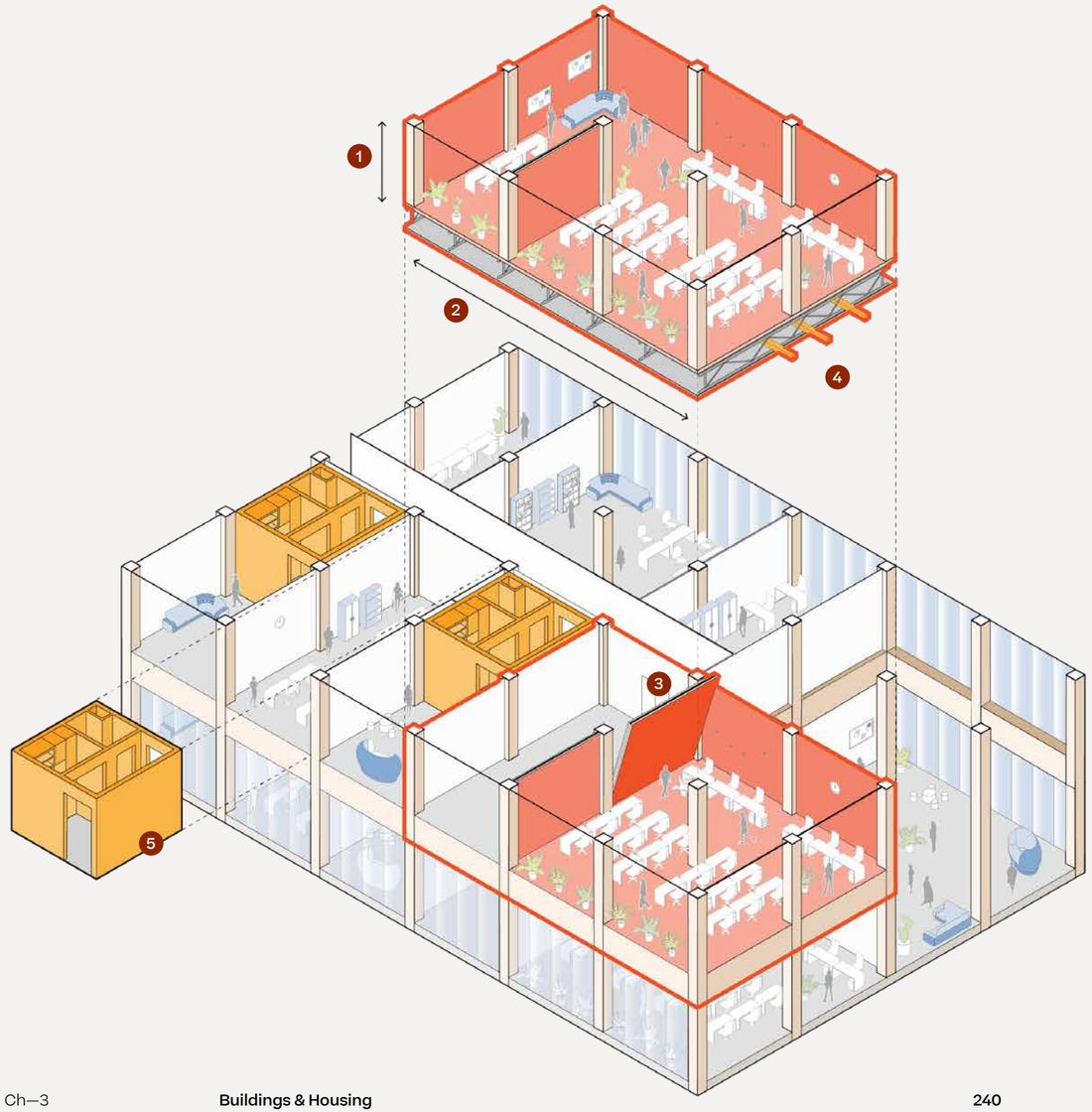
To reduce renovation costs while retaining the spirit of industrial loft structures, Sidewalk Labs has designed an adaptable building space called, simply, Loft.

In Quayside, roughly 10 percent of building square footage would be Loft space. In an effort to diversify spaces vertically, Quayside's buildings would incorporate Loft spaces from the 3rd to the 12th storeys. Loft spaces would begin as a combination of residential, commercial, office, and light industrial tenants. Over time, they would have the ability to shift across these uses in response to neighbourhood needs.

One reasonable concern with flexible spaces such as Loft is that they would all immediately shift towards the area of greatest market demand. For example, if developers converted all Loft spaces in Quayside to housing, that outcome would indeed respond to current local needs, but it would also undermine the larger goal of creating a live-work neighbourhood. For that reason, Sidewalk Labs plans to implement minimum targets on its Loft spaces for commercial usage, so they always reflect some level of mixture across commercial and residential uses.

Loft's five flexible design features

By incorporating high ceilings, long floor spans, modular fittings, utility cavities, and prefabricated kitchens and bathrooms, adaptable Loft spaces can be renovated in half the standard time. This flexibility can accommodate a lively mix of homes, shops, offices, and other uses to help a community meet its evolving needs over the short and long term.



1 High ceilings.
At roughly four metres, Loft ceilings are taller than usual to create sufficient space for a variety of interior uses, such as art studios, small businesses with lots of inventory storage, or smaller apartments that feel more comfortable with higher ceilings.

2 Long floor spans.
At 27-by-33 feet, with few columns interrupting the space, Loft floor spans would provide for the flexible arrangement of spaces and make it easier to subdivide the same space for new uses.

3 Modular fittings.
Loft's flexible interior walls (described in detail on Page 246), doors, finishes, and other modular fittings would be designed to be reusable and interchangeable across all uses.

4 Utility cavity.
By placing utilities in a cavity beneath the floor plate, Loft would create an independent home for water, electrical, lighting, ventilation, fire suppression, and heating and cooling systems, among others, enabling renovations without needing to rip out utilities and reinstall them every time.

5 Prefabricated wetboxes.
Loft is designed so that the bathroom and kitchen sub-components arrive as boxes that can be easily slotted into a building's structure during assembly and quickly connected to all utilities.

In addition to featuring long-term Loft spaces throughout buildings, Quayside would also pilot two specific applications of the concept: a lower-floor flexible space called "stoa," and a future-proof parking structure.

Loft application

Stoa: A flexible new ground floor

Much like buildings themselves, today's ground-floor spaces tend to be pre-defined for specific purposes. A barber shop needs very little storefront: just a door and a glimpse of a haircut. But a department store needs a long series of windows to attract customers with a variety of merchandise. Those specific designs make it very hard for landlords to fill retail vacancies and for business owners to contract or expand in response to changing economic conditions, such as the rise of e-commerce.

To improve the flexibility of ground-floor space, Sidewalk Labs plans to apply an adaptable structure to the lower two floors of its buildings called "stoa," taken from the lively open markets of Ancient Greece. Stoa spaces would be supported by large glulam posts spaced 12-to-18 metres apart to create long open stretches that could be divided into a variety of retail, production, or community spaces, according to neighbourhood needs. These spaces could be separated or combined to meet a variety of uses: one stoa stall might form a barber shop, while many stalls together could form a department store.

For retail tenants in particular, the cost of a launch would be significantly reduced in a stoa stall compared to a typical ground-floor retail space. In traditional retail spaces, tenants face high launch costs regardless of the length of a lease. Because stoa spaces are designed for more frequent turnover, tenants would incur a fraction of the launch costs up front and could make a return on their investment in a matter of months, rather than years.

Sidewalk Labs estimates that costs associated with structural and mechanical elements of renovation, such as moving walls and electrical wiring, would decline by roughly 50 percent. So if it would typically take a landlord $40 per square foot to conduct these aspects of a renovation, it would instead only take $20 per square foot. In addition, tenants who choose to take full advantage of prefabricated components and finishings could reap addition cost savings.

In addition, renovating a stoa space would be an estimated 50 percent faster than renovating a typical space, leading to less time between tenants, and thus to more vibrant communities. For example, companies with different peak seasons — a tax preparation firm, a costume store, a ski shop, and so on — could occupy the same stoa stall across the year.

See the "Public Realm" chapter of Volume 2, on Page 118, for more details on stoa.

Sidewalk Labs' stoa ground-floor space would be designed for fast, affordable renovations, enabling a lively mix of traditional retailers, small businesses, makers, community groups, and more, as well as a mix of short-term, seasonal, and long-term uses.

First floor roof

A **Weather-mitigation structures** (such as the building Raincoat shown here) can help to keep ground-floor spaces vibrant in all seasons.

Mezzanine

B Stoa provides spaces for **unique modular retail setups**, such as kiosks that can host temporary installations, supporting a dynamic mix of uses.

C A **flexible wall system** enables fast and affordable renovations that support the growth of businesses over time and help stoa adapt with changing neighbourhood needs.

D **Double height spaces** help stoa accommodate a wider range of uses than typical ground-floor spaces, such as art studios or small businesses with lots of inventory storage. These heights begin on the ground floor and can extend through the mezzanine area.

Ground floor

E Seamless **indoor-outdoor connections** help to break down the barriers between ground floors and sidewalk spaces, increasing vibrancy and interaction.

F Stoa space facilitates the launch of **small-scale pop-up shops** and other short-term initiatives that activate the ground floor.

Loft application

Flexible parking garages for a self-driving future

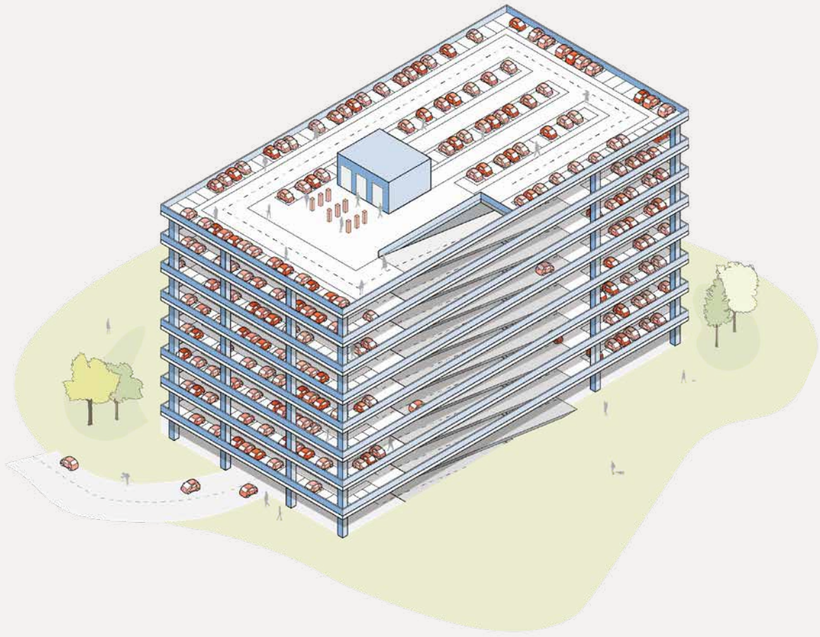
As described in the “Mobility” chapter of Volume 2, the arrival of self-driving vehicle fleets would mean neighbourhoods need fewer parking garages over time. But traditional parking garages are difficult to adapt to new uses given the inclines of their interior ramps and the orientation of their elevators, which tend to be along their perimeters. In conventional buildings, elevator shafts are placed in the centre for shared access.

Sidewalk Labs has developed a design approach for a Loft-style parking garage that can accommodate a reduced need for parking over time — without demolishing the entire structure. While an adaptable parking garage is not a fit in a small neighbourhood like Quayside with very little on-site parking, Sidewalk Labs plans to explore the potential for such a structure within the IDEA District.

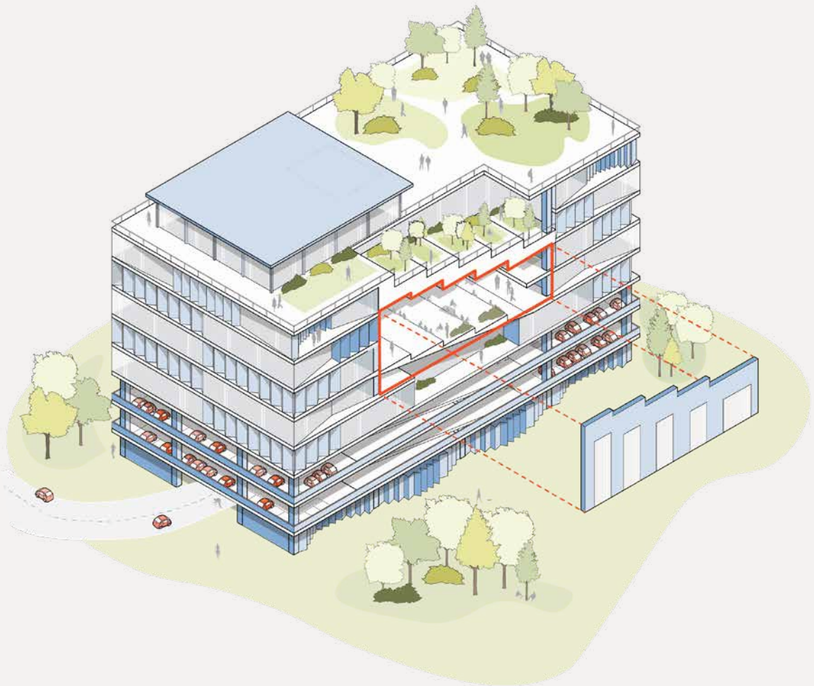
This design approach would put a majority of the parking space above ground, realizing $5.2 million in construction savings against a traditional 30,000-square-foot below-ground garage. To ensure flexibility of this design, ramps would be placed at the perimeter of the garage for easier removal or unobtrusive conversion. The elevator cores would be in the centre to accommodate an unknown mix of future uses. Stairway capacities and locations, as well as HVAC systems, would be suited to commercial or residential needs in anticipation of future conversion.

If the demand for parking did diminish, the conversion to an office or residential use could occur quickly and would incur a $8.6 million investment, much less expensive than building an entirely new office or residential building with the same capacity. This conversion would allow a building to continue generating revenue from all of its spaces, rather than getting stuck with a vacant parking garage.

Initial design
Before self-driving vehicles



Future adaptation
Once self-driving vehicles arrive



How a flexible parking garage can evolve over time

Underground parking would represent a sunk cost if demand diminishes due to the arrival of self-driving vehicles that reduce the need for car-ownership by operating as a shared-ride service. Sidewalk Labs’ adaptable design would feature only above-ground parking that could be easily repurposed in the future.

Such a parking structure, whether stand-alone or integrated within a commercial or residential building, could allow for a building’s investment to be adapted for other uses.

For example, with adaptable design of ramps and cores, a parking garage could be converted into an office or another use — instead of demolished and rebuilt at much higher cost — if parking demand declined in the future.

Goal 2

Helping Neighbourhoods and Households Evolve

Accelerate renovations with a flexible interior wall system

The rigidity of interior wall panels presents one of the biggest barriers to building renovations today. Demolishing drywall, moving electrical wires, reconfiguring sprinkler systems, and other common renovation requirements can take months and cost thousands of dollars, leading to long vacancies that take an apartment or storefront off the market, and making it hard for small businesses to compete.

Renovations are also rarely straightforward. Renovation workers almost always run into surprises, from the detection of incorrect wiring to the discovery of mold or asbestos, adding time and money to the process. It is not uncommon for adjacent tenants to get so annoyed at a lengthy renovation next door that they, too, leave a building. On top of these impacts, renovation involves knocking down drywall that ends up in landfills and churning up dust that reduces indoor air quality.

To tackle this challenge, Sidewalk Labs plans to create a flexible interior wall system that would enable adaptable Loft spaces to change within weeks instead of months, at a cost of hundreds instead of thousands of dollars, compared with traditional renovations.

These factory-produced, floor-to-ceiling interior walls would be 10 centimetres thick and made from timber panelling, with an acoustic insulation that would, according to standardized acoustical testing, make them as sound-resistant as conventional walls. Taken as a unit, this wall system would be easy to mount, move, or replace, helping building owners reduce vacant space, tenants alter space to fit business needs, and communities avoid lengthy disruptions to storefronts.

In addition to flexible walls for Loft spaces, Sidewalk Labs also plans to build flexibility into permanent interior walls in residential units, enabling them to expand (or contract) in response to resident needs. These walls would be designed with a flexible opening embedded in the wall. For example, if a family expands, a panel insert could be removed to create a new passage between rooms. The same panel could be reinserted if the additional room is no longer needed. Either process would take roughly half a day. (More on flexible units on Page 253.)

To ensure this flexibility, Sidewalk Labs also proposes new approaches to power systems and fire suppression protections, two of the biggest existing challenges to faster renovations.

See the “Sustainability” chapter of Volume 2, on Page 296, for more details on electrification.

Incorporating low-voltage power systems

Today, moving electrical wiring is a lengthy process, because most wires are protected in steel or corrugated plastic conduits and embedded in walls to reduce the risk of fires. Roughly 37 percent of all fires in Toronto are a result of electrical malfunction or cooking fires, with multifamily buildings experiencing a higher incidence of fatalities due to such events, according to Toronto Fire Services.[51]

Sidewalk Labs plans to design a low-voltage (under 2,000 watts), digital, electric power system that can travel over ethernet cables hidden under the baseboard or crown molding of flexible interior walls. Compared to electrical wires embedded inside walls, this system would dramatically reduce the risk of fires as well as the length of renovations. (To address cooking fires, Sidewalk Labs has proposed alternatives to natural gas that would result in cooking appliances being powered electrically.)

Power-over-ethernet is a controlled system that only sends power when a receiving device is active on the other end, unlike electrical outlets today, which receive a continual stream of power whether or not a device is active. That makes it possible to eliminate the cost of building a traditional “breaker box,” which typically is needed to de-energize a wall plug or light fixture when there is a malfunction. It would also save closet space where breakers are usually stored. Sidewalk Labs will initially include provisions (such as converter boxes) to support appliances designed for AC power systems.

In addition to reducing fire hazards, power-over-ethernet capabilities enable buildings to eliminate electricity meters, since the same cable that carries the power can track electricity data down to the level of an outlet. This advance makes it possible for tenants who share a space — for instance, a co-working space, or even roommates — to receive individual electricity bills, encouraging energy efficiency.

Implementing mist-based fire protection systems

Conventional sprinkler systems represent another major barrier to faster interior renovation. Typically, fire sprinkler systems embed one-to-two-inch pipes in ceilings and walls. To move this type of system requires draining the pipes, opening the walls, unscrewing the piping, re-plumbing the connections, refilling the system, and checking for leaks. It can cost thousands of dollars per move.

As part of its interior wall system, Sidewalk Labs plans to incorporate a mist-based fire protection system that can be hidden along a wall surface or ceilings in one-centimetre (three-eighth-inch) tubing, reducing renovation time to less than an hour while improving fire protection.

Mist-based fire systems originated with the shipping industry as a way to fight vessel fires using just 10 percent of the water volume of traditional sprinklers. Museums and historic buildings later adopted them to cause less water damage to the art and historic architecture.[52]

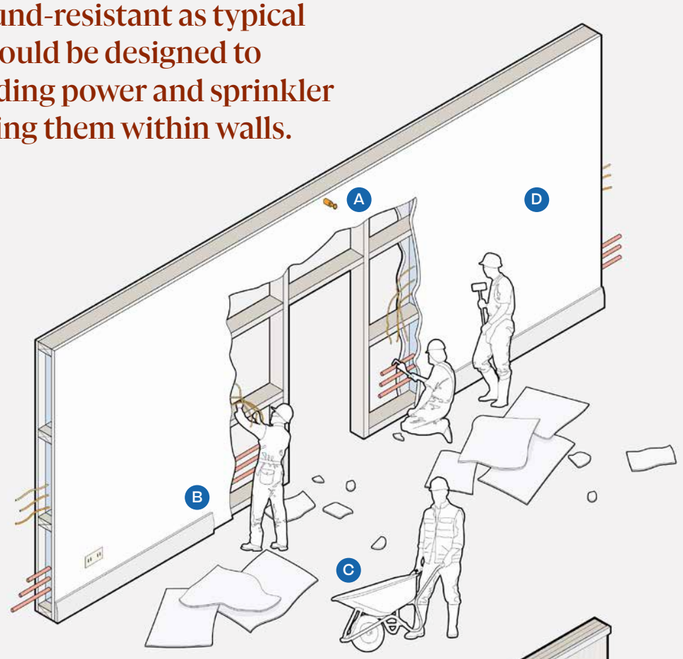
Continued on Page 250

Renovation that saves time and money

While just as strong and sound-resistant as typical walls, flexible wall panels would be designed to accelerate renovation by hiding power and sprinkler systems instead of embedding them within walls.

Residential

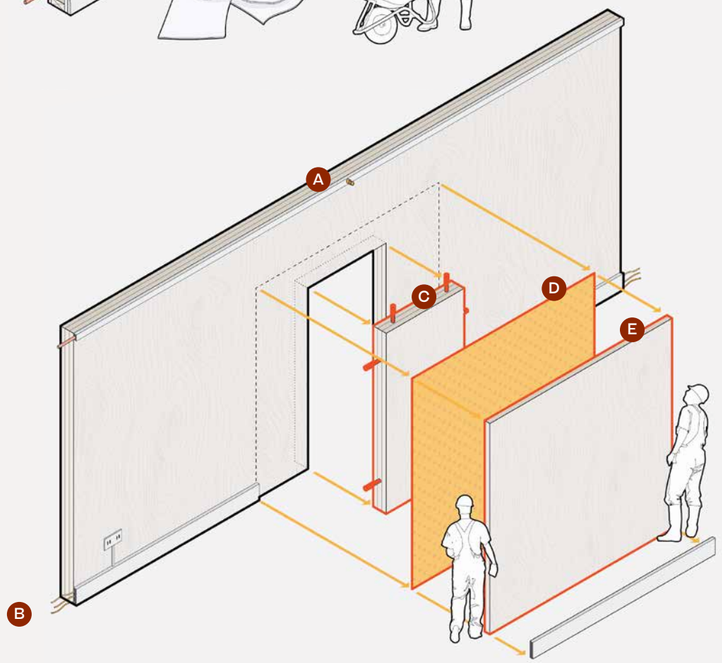
Traditional wall



- **A** Sprinkler pipes (2.5 to 5.1-centimetres) embedded in ceilings and walls require draining the pipes, opening the walls, and unscrewing the piping, re-plumbing the connections, refilling the system, and checking for leaks.
- **B** Access to embedded utilities requires drywall to be removed.
- **C** Plasterboard and wiring in partition walls creates waste during demolition.
- **D** Two iterations of spackling and sanding are typically required to produce a smooth surface ready to paint.

Residential

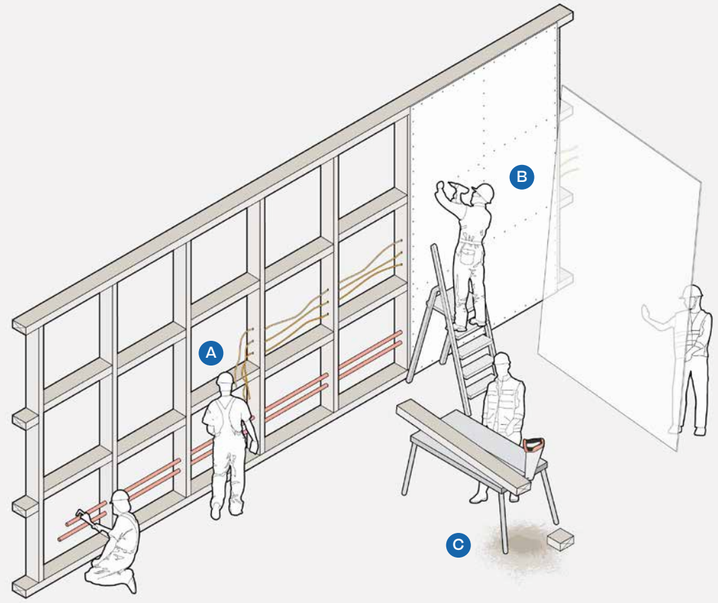
Flexible wall



- **A** Mist systems in one-centimetre tubing are hidden along a wall surface or ceiling and could be easily moved in less than an hour.
- **B** Removable baseboards hide systems, including a low-voltage digital, electric power system.
- **C** Removable panels close interconnecting spaces.
- **D** Additional soundproofing is included.
- **E** Architectural panels hide removable panel seams, and do not require spackling or sanding.

Commercial

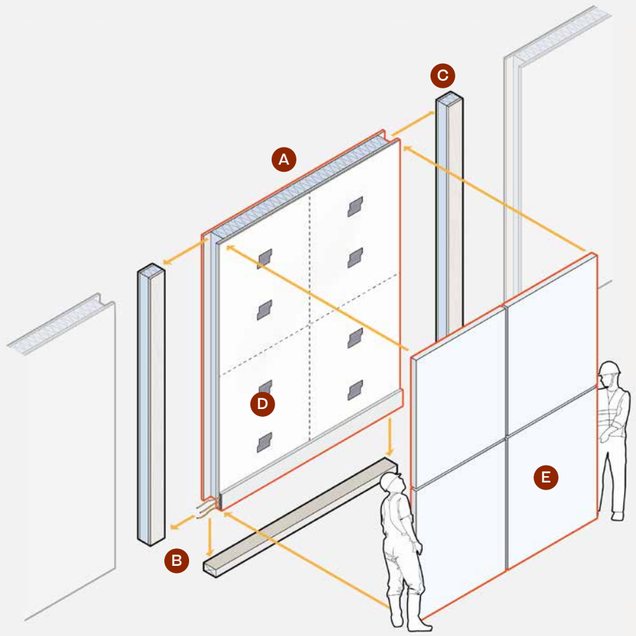
Traditional wall



- **A** Electrical wires protected in steel or corrugated plastic conduits are embedded in walls and must be roughed into the correct placement.
- **B** Installation of drywall requires coordination among carpenters, electricians, and finishers.
- **C** Wall frames make buildings inflexible; full wall demolition is required, including removal of electrical wiring, sprinkler systems, and other components embedded in wall systems.

Commercial

Flexible wall



- **A** Loft's flexible interior wall systems could allow for walls to be removed as a panel from mounts, rather than demolished.
- **B** Low-voltage power systems are surface-mounted.
- **C** Walls have support structures.
- **D** Clip system allows for tenant to apply finishes.
- **E** Finished panels are chosen by tenant.

Continued from Page 247

In a traditional sprinkler system, water floods out like a hose, causing a lot of the water to fall below the fire before it is able to absorb heat. In mist-based systems, water is sent through a high-pressure (70 bar) nozzle that disperses the droplets into a layer of fine mist. This approach effectively acts as a vapor blanket that starves the fire of oxygen, snuffing it out. The reduced water quantity of the mist system makes it easier to clean up extinguished areas, thus preventing the water damage associated with traditional sprinkler systems. A low flow of water can also be delivered through tubing that is easily concealed in the interior finishes of buildings.

While mist systems initially cost more than traditional sprinklers, they recover these costs over time through their ability to improve wall flexibility and accelerate renovations. In Canada, three mist systems have been approved thus far, including one in the Credit Valley Hospital in Mississauga.[53] Quayside would be the first development in Toronto to use such a system in a neighbourhood of new buildings, demonstrating the potential for this technology's wider adoption.

Mist-based systems use

10%

of the water volume of traditional sprinklers.

Compared to electrical wires embedded inside walls, low-voltage power would dramatically reduce the risk of fires.

Goal 3

Helping Neighbourhoods and Households Evolve

Enable a safe, vibrant mix of uses with real-time building codes

The prospect of buildings that contain a shifting mix of residential, commercial, and industrial spaces creates the need for new tools capable of ensuring all tenants can not only coexist safely, but also thrive.

For most of the 20th century, cities separated residential, commercial, and industrial uses geographically to protect homes from noise, air pollution, and other nuisances.[54] This approach of "single-use zoning" made sense in a world without reliable tools to monitor the environmental nuisances of commerce and industry. But it also discouraged an active mix of home, work, and retail spaces in the same neighbourhood — let alone the same building.

Meanwhile, the modern economy has blurred the lines of traditional uses. Should a tech startup that launches in a spare bedroom be viewed as a home or an office? Should the studio of a craft maker creating wares for an e-commerce site like Etsy be viewed as a home or an industrial space? People in cities want not only to live in places with a mix of activities but also the ability to change those activities at a rapid pace.

To enable a vibrant mix of uses while still protecting quality of life, Sidewalk Labs proposes to require a digital building code system that can measure the impacts associated with a shifting mix of building uses in real time. Designed with inputs from city government, Sidewalk Labs' proposed building code system would monitor interior spaces in a non-invasive way for noise, air pollution, and other nuisance levels.

The proposed system would be operated and managed by the building owner, and enforced by the City of Toronto, in full accordance with the standards established by the city.

In Quayside, Sidewalk Labs proposes a pilot of this system, with the city able to monitor the performance of a building using the system's real-time data. For example, if a building registered a noise level that exceeded a code standard, the landlord and city would be notified of the violation.

At full scale of the IDEA District, provided the system's value is demonstrated in Quayside, it could be used to grant permits based on proposed building uses instead of based on prescribed land uses, enabling communities to pursue a greater mix of live-work buildings and local economic activity.

A system based on "outcomes"

Sidewalk Labs' proposed real-time code system would be designed around the premise that buildings should be able to house a diverse range of tenants — residential, commercial, and light industrial alike — so long as everyone adheres to the building's rules. For example, if a mom-and-pop craft jeweler does not use noxious chemicals or make loud noises, there is no reason it should have to be located in an industrial area. In other words, it is the *outcomes* that matter most, not the *uses* that define traditional zoning.

By setting an "outcome-based" standard, a real-time code system can better protect all uses and support a broader mix of uses at the building and district scales, including the integration of production spaces and small-scale industries within a residential and commercial building or neighbourhood.

Toronto's existing building codes have distinct standards for 25 different uses. In 2018 and early 2019, Sidewalk Labs and code experts worked together to identify nine code categories whose anticipated outcomes are similar enough to be condensed into a single, flexible "use-neutral" category, such as restaurants, single-dwelling units, mercantile/retail, low-hazard industrial, and more.

Any use covered under this integrated "use-neutral" category would be allowed to occupy a building, provided the tenant adheres to the building regulations — the outcomes.

To enable this new diversity of uses while protecting quality of life and public safety, this outcome-based system would monitor several types of building regulations on an ongoing, real-time basis via environmental (non-personal) sensors. These devices would be placed in building hallways to collect information on structural integrity and vibration, interior air quality, and noise levels. For example, a strain gauge sensor in a floor slab would be able to detect structural integrity issues in cases where individual building occupants place undue loads on floors.

(These systems would not replace the need for standard building sensors, such as fire detectors.)

This proposed system would be designed to collect only the specific information pertaining to building codes, without the ability to capture any personally identifiable information, in accordance with Sidewalk Labs' proposed Responsible Data Use Guidelines. To encourage further innovation around building uses by government officials, researchers, and other third parties, access to this non-personal and aggregated data would be made publicly available in real time under the terms of the proposed Urban Data Trust.

Partnered with proper enforcement, real-time monitoring would create a responsive code system that would protect neighbourhood safety while enabling buildings to include a far more diverse array of homes, shops, and workplaces than typically found today.

All proposed digital innovations would require approval from the independent Urban Data Trust, described more in the "Digital Innovation" chapter of Volume 2, on Page 374.

Goal 4

Helping Neighbourhoods and Households Evolve

Design affordable and flexible housing units

Innovations that enable faster construction and more adaptable buildings also have the potential to unlock housing design that better meets the needs of modern families and can evolve with changing household types. In Toronto, as in many cities, housing options for downtown living currently fall short for many groups, and a number of economic and social trends suggest that traditional ways of designing downtown apartments need to change to keep pace with demographic shifts.

A mobile workforce values the ability to follow job opportunities, and find lean housing options, in new cities. Growing families and downsizing empty nesters who might once have chosen (or remained in) the suburbs are willing to trade space to live in the city for its diversity, amenities, and culture — if they can find apartments the size they need, and provided they can retain a sense of community. Also, many households are embracing the rise of sharing services, reducing their need for storage space.

In cities around the world, new housing innovations have emerged to address these trends and keep a more diverse set of people living downtown (see sidebar on Page 257), including the rise of "micro-units" (smaller units that rent for less while remaining livable through efficient design) and co-living programs (which feature shared building amenities, such as communal kitchens, to enhance community while keeping rents lower).

Building on these global trends, Sidewalk Labs plans to offer a set of efficient, ultra-efficient, and co-living units designed to deliver housing that is flexible enough to meet these changing social needs, but still affordable. To ensure that the full Quayside program supports the needs of families, 40 percent of all units would be sized for families, with two bedrooms or more.

Quayside's housing program is designed to accommodate households of all sizes

	Studio	One-bedroom	Two-bedroom	Three-bedroom	Four-bedroom	**Total**
Percent of proposed housing program	20%	38%	28%	11%	3%	**100%**

The transition to smaller units is made possible without sacrificing comfort, through thoughtful space-saving furniture; flexible walls that enable households to contract or expand with greater ease than currently found in apartments or condos; shared building amenities, such as communal eating spaces or co-working spaces; and sufficient access to neighbourhood-enhancing amenities, such as on-demand storage delivery and an extensive public realm.

Together, these new unit designs can make dense urban living more appealing — and affordable — to a wider group of people, including the singles, seniors, and multi-generational families who make up a growing percentage of the Toronto population.

Efficient and ultra-efficient units

Sidewalk Labs' proposed efficient and ultra-efficient units would be designed to make the most of their space. They would exist at a range of bedroom sizes — all the way up to four bedrooms — and cross all income levels. (These proposed options would exist in addition to proposed "standard" units that are comparable in size to existing downtown developments but designed more efficiently as well.)

Building on global research by nArchitects, Sidewalk Labs conducted initial design explorations on efficient units with three local architecture firms: gh3, Dubbeldam Architecture and Design, and Teeple Architects. This work surfaced a set of design features that would enhance the liveability of smaller units (see studio image). Using these concepts as a starting point, Sidewalk Labs plans to continue refining specific unit designs to best match market and community needs over time.

Multi-purpose furniture pieces.
Sidewalk Labs plans for its units to include efficient furniture designed to maximize space and create space for something else when not in use. Examples include multi-purpose benches on height-adjustable rails that can double as desks or shelves; convertible beds that can be configured into a couch or folded up to free up floor space; and fold-down tables. For example, in the gh3 studio concept featured here, the movable desk and flip-down table can free up an additional 9 square feet of usable space.

See the "Mobility" chapter of Volume 2, on Page 22, for more details on neighbourhood delivery.

On-demand storage.
The proposed efficient units would be designed with less in-unit storage space than a market comparison apartment design. But the efficient units would compensate in two ways. One is the availability of free in-building storage. This would enable families to store weekend recreation items, infrequently used kitchen items, or that special suit or dress.

Second is the availability of low-cost, on-demand delivery from off-site storage facilities located nearby. This service would make it easier for households to store items they seldom use — such as seasonal clothing, holiday items, or skis — outside the apartment. An underground delivery network linked into all residential and commercial buildings would ensure that residents could access their items quickly and at any time.

Spatial quality.
High-quality living in small downtown spaces requires innovative spatial designs. The gh3 units described here would be designed with tall ceilings (2.7 metres) to increase daylight penetration within the units and also allow for more vertical storage space — basic enhancements that do not significantly erode the cost basis for developers. They would also locate all bedrooms on an exterior wall with a window (no longer a common feature in new Toronto development). Finally, these units could reveal the mass-timber construction, unlocking some of the biophilic health properties that have been shown to occur with exposure to nature in cities.

Continued on Page 259

Efficient units could be designed with less storage space thanks to fast on-demand delivery from neighbourhood storage facilities.

Efficient units: Warm, flexible living

A Enclosed balcony.
Enclosed balcony with floor-to-ceiling electrochromic glazing is usable throughout the year and provides generous daylight exposure.

B Off-site storage.
Residents would have access to off-site storage space at the neighbourhood logistics hub, with packages sent and delivered on demand by self-driving dollies and tracked via app.

C Healthy, warm interiors.
Mass timber buildings would offer warm, inviting spaces with exposed wood and elegant finishes. Exposed wood also unlocks "biophilic" health benefits, such as reduced stress, that have been shown to occur with exposure to nature in cities.

D Space-saving flexible furniture.
Clever design maximizes the space in these units, including features like convertible furniture, built-in shelving, and fold-out tables and beds to improve livability.

E Efficient closets.
Efficient closet designs make use of traditionally underutilized in-unit spaces.

F Flexible wall systems.
Flexible wall systems allow future connection to adjoining units. (See the next page for more details.)

Sidewalk Labs small research grant

Housing trends from around the globe

Commissioned research from Ryerson and OCAD points to innovations that can help cities tackle affordability.

Sidewalk Labs commissioned two reports on global housing innovations, one from the Ryerson City Building Institute and one from the System-CITY Research Team in the Faculty of Design at OCAD University.[55]

Here are a few ways other cities are trying to bring down the price of housing and keep a more economically diverse set of people living downtown:

Redesign the box.
Many cities have experimented with "micro-units": smaller homes and apartments of between 250 and 400 square feet. To make sure they are livable, the city can adopt minimum unit sizes and daylight requirements.

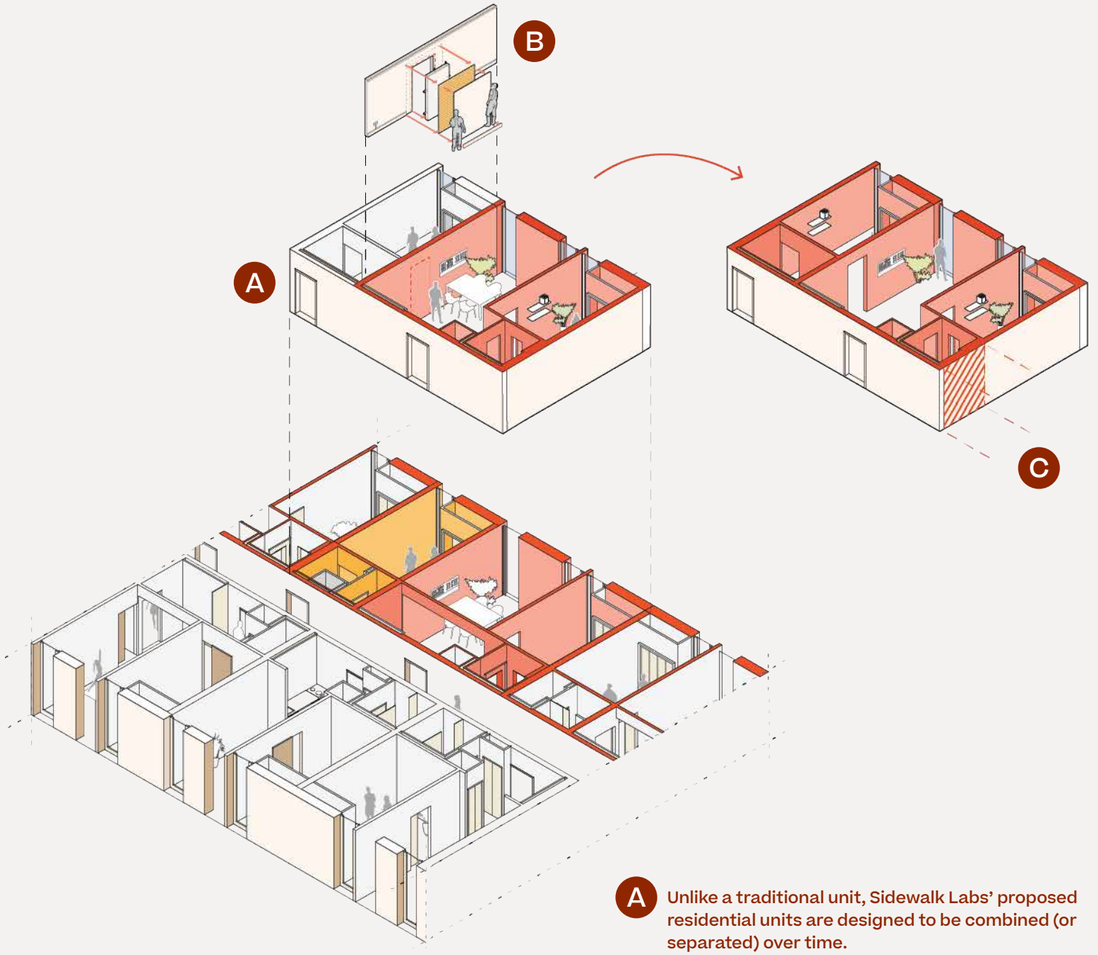
Unbundle the box.
Market condos often come with a long list of amenities: granite countertops, premium backsplash tile, washers and dryers, and more. These can all be unbundled from the cost of a home to make it more affordable.

Co-live a space.
Another strategy that combines well with smaller units is "co-living," where residents give up some private individual space in exchange for shared space within their building, such as children's spaces, workshops, and larger kitchens.

Build cheaper.
No matter the living arrangement, new construction practices can reduce the cost of development. These new approaches include modular construction, prefabrication, and adaptive designs that can meet the changing needs of residents and the community.

These are just some of the expanding options that can help increase the supply of housing while decreasing the cost.

Designing residential units to support changing household needs



A Unlike a traditional unit, Sidewalk Labs' proposed residential units are designed to be combined (or separated) over time.

B Flexible walls (shown in light red) and floor plans enable smaller units to be combined into larger ones.

C Consistent floor plans with aligned wet-box (kitchen and bathroom) corridors could be designed to accommodate the future addition or subtraction of adjacent units.

Continued from Page 255

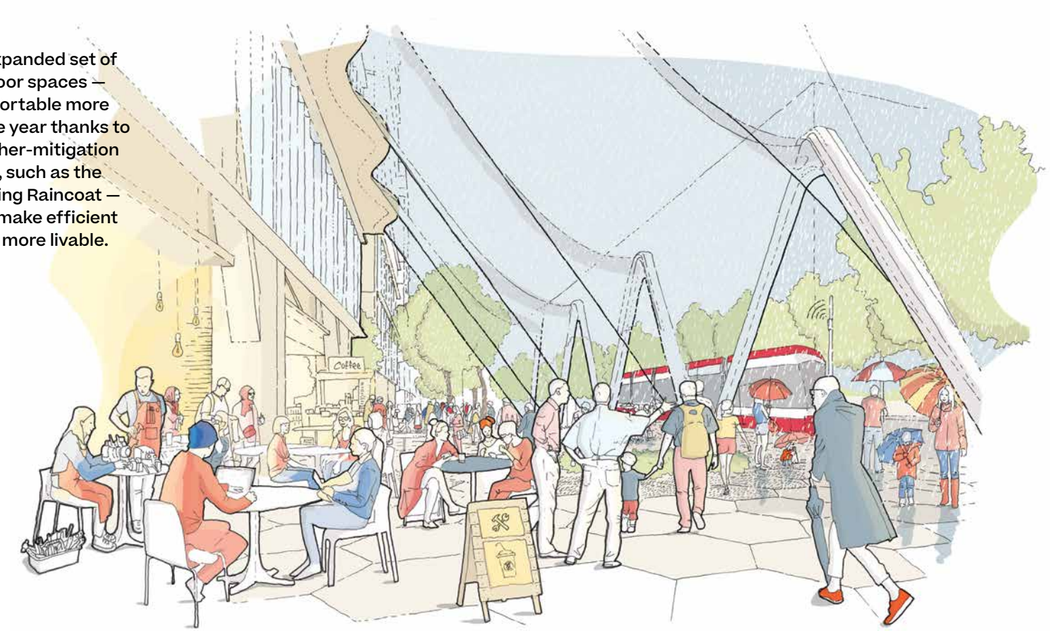
Flexible floor plans and wall panels. Floor plans with aligned wet-box (kitchen and bathroom) corridors could be intentionally designed to accommodate the future addition or subtraction of adjacent units. This approach, combined with built-in wall panel flexibility, would enable housing units to grow or shrink with household sizes, allowing families to "grow up" in Quayside. For example, a three-bedroom could be converted into two smaller units if a child leaves for college; conversely, smaller units could be combined into a larger one with the arrival of a new baby.

See the "IDEA District" chapter of Volume 3 for more details on regulatory aspects of the proposed district.

Expanded public realm. Sidewalk Labs' approach to public realm design is also meant to improve comfort for residents in efficient units. An expanded set of parks, plazas, and public spaces — comfortable year-round thanks to weather-mitigation systems — means people could spend more time outdoors, in spaces they can decide how to use themselves.

Together, these space-saving and neighbourhood-enhancing features would not only help meet the needs and preferences of modern-day Torontonian household, they would also make dense urban living more affordable to more types of people. Designed with similar features, ultra-efficient units would maximize space even further than the efficient units.

Sidewalk Labs proposes to seek relief from existing relevant guidelines and standards related to unit size to enable developers in the project area to create these new occupancy types within the IDEA District.



An expanded set of outdoor spaces — comfortable more of the year thanks to weather-mitigation tools, such as the building Raincoat — help make efficient units more livable.

Co-living offers shared amenities, such as a communal kitchen and dining room, to foster community among residents.

Providing co-living spaces to strengthen community

A co-living model combines efficient unit footprints with community-based programming and shared spaces designed to bring residents together.

Around the world, and with a few early examples in Toronto, co-living has gained popularity with younger professionals who enjoy the prospect of living in well-designed units, with access to common areas filled with more shared amenities than a typical apartment.[56] But co-living could also be built for seniors needing more in-building care, and for families with young children needing additional bedrooms or child-related amenities (such as shared playrooms) and services (such as daycare options).

Sidewalk Labs plans to dedicate certain floors of buildings in Quayside to co-living initiatives. A key feature of this housing option would be shared building space: communal areas could include co-working space, cooking and dining areas, exercise rooms, child recreational areas, and potentially a communal guest room that could be shared among residents.

These spaces would be designed to encourage social interaction among residents seeking a stronger community.

Creating value through "affordability by design"

Sidewalk Labs calls this approach towards efficient unit design "affordability by design," both because it provides more affordable options for households, and because it enables developers to meet affordable and below-market housing targets through the creation of additional units.

For example, in Quayside, the reduction in average size for each efficient and ultra-efficient unit would enable the creation of 87 more total units than would exist with conventional development.

As explained more in the following section on housing affordability, Sidewalk Labs estimates that this approach to affordability by design can create $37 million of value in Quayside and up to $475 million in value through 2048 at the full scale of the IDEA District — money that could be applied toward an ambitious 40 percent below-market program.

"Affordability by design" can create up to $475 million in value through 2048 to support an ambitious 40% below-market program across the IDEA District.

Ch–3

Part 3

Expanding Tools for Housing Affordability

Key Goals

1
Create an ambitious program to meet the housing affordability challenge

2
Achieve this program with innovation that yields greater affordability

Reducing construction timelines and risk, and making buildings more efficient and adaptable, are important steps towards creating neighbourhoods that are more affordable to more people. But to fully achieve a vision for inclusive communities, more direct action is needed — especially in a high-demand market like Toronto.

No issue is more pressing in Toronto right now than housing affordability.[57] Since 2006, home prices have far outpaced wage increases. Vacancy rates have reached all-time lows[58] and now sit around 1 percent — far below a minimum "healthy" rate of 3 percent[59] — making it more difficult for Torontonians to find affordable homes. Limited housing size options and an aging rental stock have further led to inadequate choices for multi-generational, single-person, and middle-income households.

The result is that Toronto's neighbourhoods are becoming increasingly stratified by income. In 1970, 58 percent of Toronto's census tracts (which are generally neighbourhood-sized) were considered middle-income. By 2015, only 29 percent of city tracts merited that designation. Toronto has tended to sort itself into "Three Cities": wealthy areas downtown, low-income areas forced to the edges, and middle-income pockets that continue to shrink.

The public sector has recognized these challenges and made important moves to address them. The recent National Housing Strategy laid out a $40 billion plan over 10 years to increase affordable housing, with significant provincial government matching requirements.[60] Toronto launched its Open Door plan in 2015 to provide new options and incentives for affordable housing, and recently announced the Housing Now Initiative that offers 11 city sites to create new housing units, including affordable rental.[61]

To build on that momentum and help Toronto face its housing challenges, Sidewalk Labs proposes a housing vision anchored by 40 percent of units at below-market rates. This vision is driven by the objectives of creating a truly mixed-income community with options across the income spectrum — not just narrowly affordable or market-rate — for people of all ages and families of all sizes. Sidewalk Labs proposes a two-part approach to achieve this vision that relies increasingly on private innovation and decreasingly on government sources.

First, Sidewalk Labs proposes to create new types of units designed with affordability in mind from the start. These efficient units could rent for less than comparable apartments downtown without sacrificing living quality thanks to space-saving designs, shared building amenities, and neighbourhood features that include on-demand offsite storage. Such units improve affordability by enabling developers to increase the supply of housing on a particular site, and they respond directly to the changing needs of families, seniors, and young professionals.

Second, Sidewalk Labs proposes to implement new tools that help the private sector support below-market rental housing over time. These tools include leveraging the value created by factory-based construction to help developers meet ambitious affordable housing targets while still earning returns, and implementing a resale fee on market-rate condos to help pay for below-market units and make downtown living affordable for more people. A proposed housing trust fund could "lock-box" these savings to create a sustainable source for below-market units.

In Quayside, these approaches could support a paradigm-shifting housing program featuring 40 percent of units at below-market rates, with half of the entire program consisting of purpose-built rentals. The neighbourhood can also begin to implement and refine the factory-based construction approach and demonstrate its value to developers in terms of time and cost.

But while additional tools such as factory construction and resale fees can be initiated in Quayside, a neighbourhood of this scale and near-term development timeline requires significant support from existing government funding sources to meet — and exceed — the affordability objectives established by Waterfront Toronto.

To support a mixed-income community, Sidewalk Labs proposes a housing vision with 40% of units at below-market rates.

The Sidewalk Toronto project can set a new precedent for housing affordability, generating funding through off-site construction, efficient unit design, and other innovative tools.

This plan creates nearly

1.4 billion

for below-market housing.

Implemented at the full scale of the IDEA District, this approach can unlock powerful tools that enable the private sector to support the public sector in delivering below-market housing. Sidewalk Labs estimates that the potential value created by factory-based construction, condo resale fees, and efficient unit designs could amount to over $1.4 billion through 2048.

Such a program could include around 6,800 affordable housing units, representing nearly a third of the current annual citywide target for new affordable rental housing units, in accordance with the city's Open Door program.

In so doing, the Sidewalk Toronto project would help set a new precedent for housing affordability, demonstrate that it is possible for cities to hit ambitious affordability targets while relying on a more balanced mix of government funding sources and support from private sources, and above all, give rise to mixed-income communities that live up to the city's values for inclusive growth.

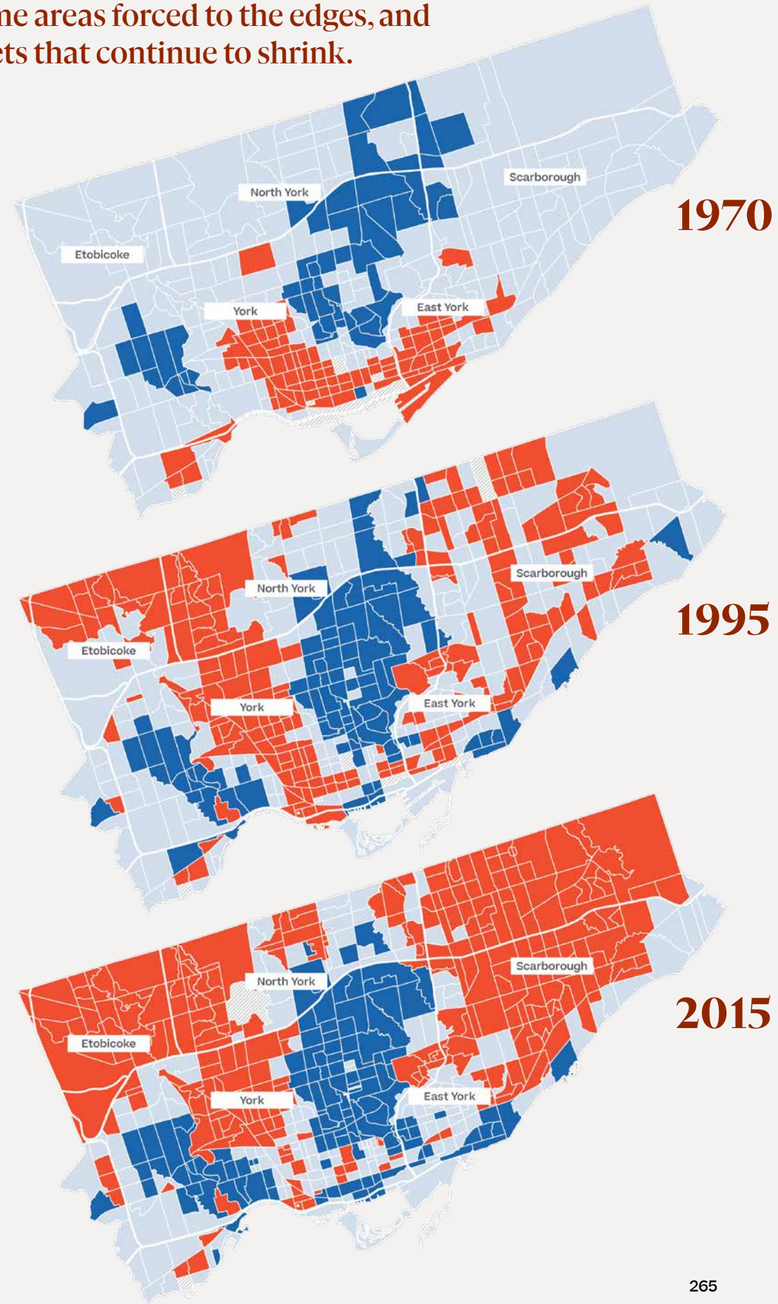
Toronto's fading middle-income neighbourhoods

Since 1970, Toronto's neighbourhoods have become increasingly segregated by income, with wealthy areas downtown, low-income areas forced to the edges, and middle-income pockets that continue to shrink.

High-income

Middle-income

Low-income



Note on methodology: Average individual income by census tract, or neighbourhood, compared to the Toronto Census Metropolitan Area (CMA) average, which was $5,756 in 1970, $28,980 in 1995, and $50,479 in 2015. Middle-income neighbourhoods refer to average individual incomes that are 20 percent above or below the CMA average, or at 80-120 percent of CMA. High-income refers to 120 percent and above; low-income refers to less than 80 percent.

Source: Statistics Canada Census Profile Series 1971, 1996, 2016; analysis by J. David Hulchanski, Neighbourhood Change Research Partnership.

Three factors that informed Sidewalk Labs' approach: Rental supply, funding, and demographic shifts

Three clear factors are driving Toronto's affordability challenges: a housing ecosystem that incentivizes condo development over purpose-built rentals; affordable housing policy that has faced historical defunding; and shifting demographics defined by record growth and more young people, seniors, and multi-generational households.

1

A development landscape lacking rentals.
Condo development has dominated Toronto residential construction for the past two decades. At the same time, Toronto has seen a precipitous decline in purpose-built rental housing.

As shown in the bar chart on the opposite page, Toronto once constructed a lot of purpose-built rentals: roughly 12,000 units a year from 1960-1974, and 3,000 a year in the decade that followed. That rental boom occurred thanks to strong tax incentives and government funding.[62] But as such incentives disappeared in the 1980s, so, too, did new rental construction.

As a result, the city has missed out on decades of "filtering," the process by which new purpose-built rentals age and thus become more affordable over time.[63] According to research by Ryerson University and Evergreen, Toronto will only rebalance its market and improve long-term affordability if purpose-built rentals make up a sizable share of new housing supply — approximately 8,000 units a year through 2041.[64]

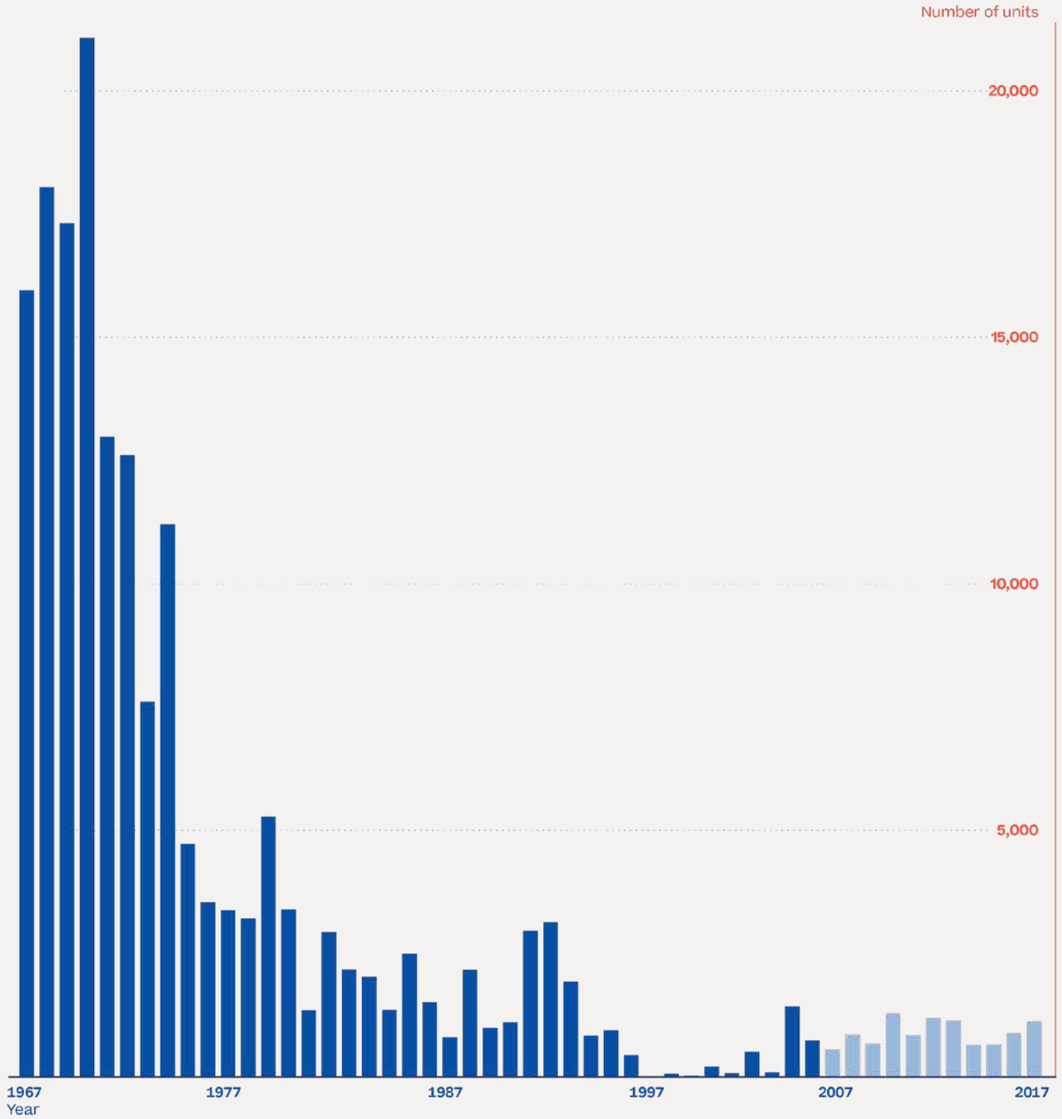
This imbalance impacts renter households in personal ways. Households unable to find a purpose-built rental unit often find accomodations on the secondary market, renting out condo (or other accessory dwelling) units instead. Condo renting is a less secure form of tenure than professionally managed rentals, since a condo can quickly transfer ownership or be taken off the market if an owner decides to sell or move back in.

It also hampers government's ability to harness the private sector for affordable housing — since tax incentives and other programs often rely on rental stock to do so. In the past year, Toronto has seen an increase in rental housing production,[65] particularly luxury rentals, in part due to new government programs, such as the Canada Mortgage and Housing Corporation's (CMHC) rental construction financing initiative program. But despite this recent rise, market conditions still favour the pre-sale of higher-end condos to reduce the risks of financing new development.

How this trend informed the approach:
Sidewalk Labs recognized that purpose-built rentals must form the core of any proposed housing program, both to build on the recent progress being made in this area and to improve long-term affordability within the IDEA District.

The decline of Toronto's purpose-built rental stock

Toronto has seen a precipitous decline of purpose-built rental development since the 1960s.



Source: CMHC

2

Limited affordable housing funding.
Toronto has a proud history of providing affordable housing. The mid-1970s were a bright spot of affordable housing,[66] as public subsidies from all levels of government flowed to private developers, nonprofits, and co-ops alike, leading to neighbourhoods like St. Lawrence that offered a robust social and cultural mix of owners and renters, families of different sizes, residents from different backgrounds, and people of all incomes. This public investment began to fade in the mid-1990s.

As mentioned on Page 262, today all three levels of Canadian government are increasing their support for affordable housing through a variety of plans and programs. As a result, the city has seen progress, such as the Regent Park revitalization, which is on track to redevelop almost 1,800 affordable units with rent geared to income, as part of a landmark five-phase public-private partnership.[67]

Still, there is an opportunity to better engage private sector partners on affordable housing. Increasing predictability and certainty of funding can enable developers to contribute more affordable housing.

How this trend informed the approach:
Based on these trends, Sidewalk Labs recognized that the private sector must play an important role in identifying financial tools that can build on public funding and help extend options across the income spectrum, including to middle-income households that currently cannot pay market rates but do not qualify for affordable housing.

3

Shifting demographics.
Since 2001, Toronto has seen record growth of intergenerational households,[68] and for the first time ever, single-person households in Canada have overtaken all other types as the dominant type.[69] Coupled with rising rates of seniors, particularly in the neighbourhoods surrounding Quayside, these shifting demographics highlight where housing options fall short.

Hampered by a limited number of multi-bedroom units downtown, Toronto families sometimes become "condo hackers" — packing far more people into a one-bedroom condo than is desirable. Older residents also struggle to find a suitable place downtown to age in place. Some are empty nesters who have more bedrooms than they need. Others simply need more support and community.

Then there are the students and young people aggressively competing for the few attainable rentals on the Toronto market. Too often the result is that young people who want to live close to the action instead wind up living back at home with their parents — a situation that affects 47 percent of Toronto residents aged 20 to 34[70] — or squeezing into shares not designed for multiple tenants.

How this trend informed the approach:
These trends informed Sidewalk Labs' approach to designing efficient and co-living units that respond to changing needs, including a mix of sizes, tenures, and flexible units that can accommodate households at every life stage. This approach to "affordability by design" can also help deliver below-market housing by increasing the supply of units a developer can provide across a project.

Goal 1

Expanding Tools
for Housing Affordability

Create an ambitious program to meet the housing affordability challenge: 40% below market

These factors and trends formed the basis for Sidewalk Labs' proposal for an ambitious housing program whose cornerstone is a proposed 40 percent of units at a below-market rate. This vision builds on the affordability commitments set by Waterfront Toronto but pushes beyond them to demonstrate the private sector's ability to support the shared objective of truly mixed-income communities that are inclusive of all households, responsive to resident needs, and adaptable over time.

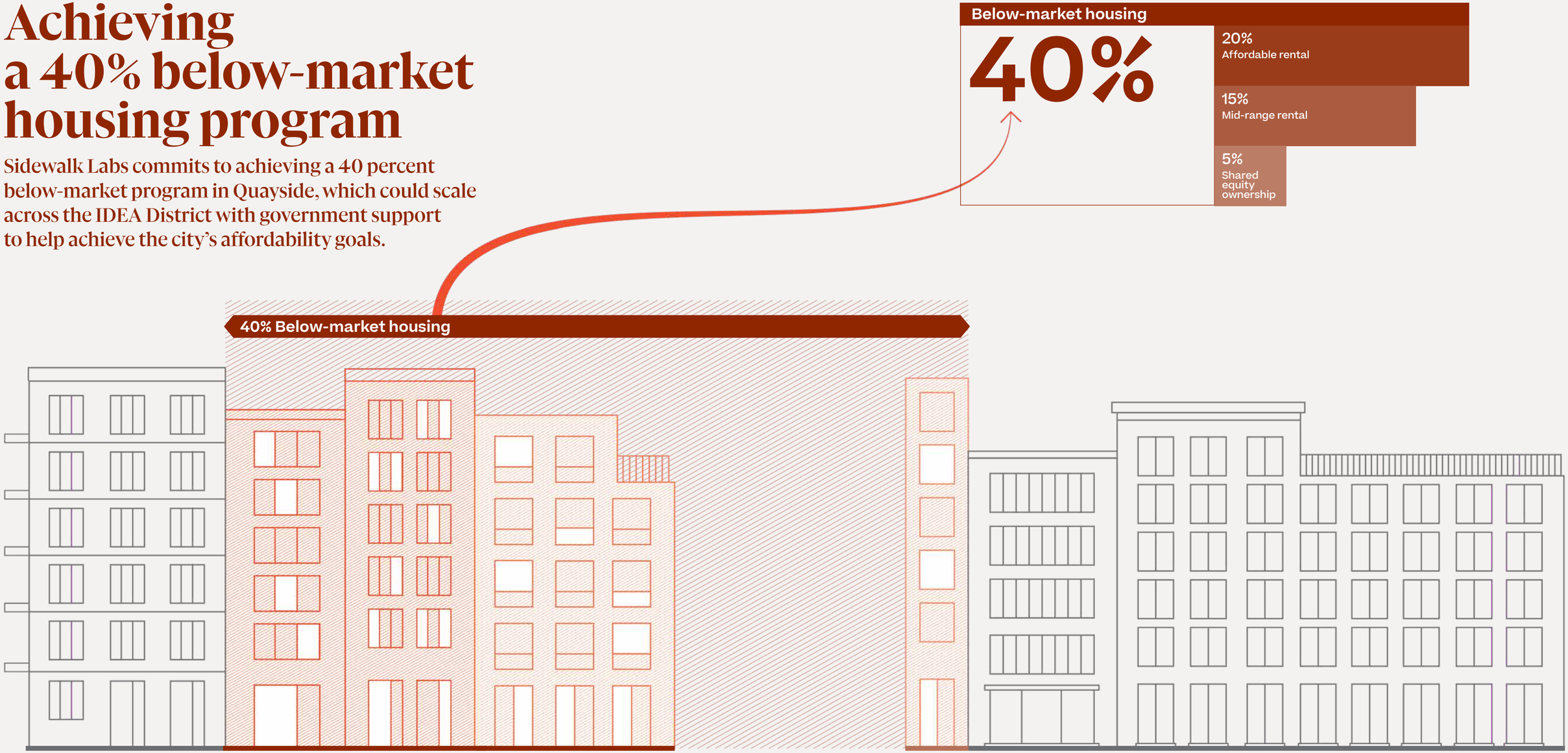
Sidewalk Labs aims to expand affordability, dedicating 20% of units to middle-income households.

The below-market housing would include 20 percent traditionally "affordable" housing units, a quarter of which would go towards households with "deep" affordability needs. It would also include 20 percent middle-income units (a quarter of which would be "shared equity" units that create an affordable ownership option), expanding the definition of affordability from its current standards. And to improve long-term affordability, half of the total proposed residential program would consist of much-needed purpose-built rentals.

Sidewalk Labs commits to achieving this program mix in Quayside using a combination of existing government funding sources and new innovations. It hopes to prove that such a program composition could be financially feasible across a larger area, once the innovations initiated in Quayside reach their full potential.

Achieving a 40% below-market housing program

Sidewalk Labs commits to achieving a 40 percent below-market program in Quayside, which could scale across the IDEA District with government support to help achieve the city's affordability goals.



50% Rental

15% Market-rate rental
These units would be purpose-built rentals renting at market rates.

20% Affordable rental
These units quality as affordable housing in Toronto (below 100 percent Average Market Rent) and include at least 5 percent deeply affordable units (at 60 percent AMR or below).

15% Mid-range rental
These units are geared towards middle-income families who do not today qualify for affordable housing (100-150 percent AMR).

50% Ownership

5% Shared equity ownership
These units would offer a new type of affordable homeownership for middle-income families unable to afford full ownership.

45% Market-rate ownership
These condo ownership units would, as with all other unit types, offer a range of new options, including family units and co-living spaces.

Affordable rental housing (20 percent).
A key element of Sidewalk Labs' proposed housing program is providing affordable rental housing for lower- and moderate-income households in Toronto.
To ensure a diverse, mixed-income community, the program would accommodate households at a range of incomes below the City of Toronto's definition of affordable housing (households paying less than 100 percent average market rent eligible to receive government funding) — not just the upper end.
At least a quarter of this supply will go towards households with "deep" affordability needs (below at least 60 percent AMR). In Quayside, Sidewalk Labs proposes keeping units affordable for the long term.

Additionally, in Quayside, Sidewalk Labs proposes to deliver the lower-income affordable units in close collaboration with non-profit operators. Rather than wait until after the development is approved, Sidewalk Labs would invite non-profit organizations to participate in the earliest stages of the design process (see sidebar on Page 273). By tapping into the deep expertise of non-profit housing operators, Sidewalk Labs seeks to ensure that the affordable housing truly meets the needs of all its residents— including those with lower incomes — while setting a path for continued capacity-building in the sector.

Mid-range rental housing (15 percent).
A strong housing plan must provide for middle-income households that do not qualify for traditional affordable housing yet struggle to pay market rates. A core feature of the proposed housing program is that 15 percent of all housing units would be purpose-built rentals priced specifically for middle-income households in the mid-range (100 to 150 percent) AMR band.

In Quayside, to ensure these units remain affordable for middle-income families, Sidewalk Labs plans to implement a rent cap. For example, rents for a two-bedroom unit would range from $1,492 to $2,238, according to existing rental bands established by the city.

Qualifying for a below-market 2BR rental in Quayside

In addition to providing traditional affordable housing, the Sidewalk Labs plan provides below-market housing for middle-income households.

	Mid-range	Affordable	Deep affordable
Households earnings at this level or below: *	$107,424	$71,616	$42,970
... can expect to pay this monthly rent: **	$2,238	$1,492	$895
... which corresponds to this level of average market rent (AMR) as defined by the city: ***	150%	100%	60%

* As determined by the City of Toronto's initial income limit, calculated as four times the monthly occupancy cost for the housing unit, multiplied by 12. CMHC and other programs may use different definitions. Numbers rounded.

** Monthly rent figures that correspond to AMR are released each year by CMHC and are used to set income thresholds for developers leasing up affordable rental units. Those shown correspond to 2019 AMR figures released by the City of Toronto and are not yet adjusted for utility allowances.

*** The City of Toronto defines affordable rental housing as being at or below 100 percent AMR. Sidewalk Labs defines "below-market" to include mid-range rental housing at 100-150 percent AMR as well.

Source: City of Toronto, 2019

In Focus

Community engagement

Catalyzing non-profit housing collaboration

Sidewalk Labs plans to collaborate with non-profit operators to deliver lower-income affordable units in Quayside, and has engaged non-profit leaders to identify ways to strengthen partnerships.

During its public engagement process for the Sidewalk Toronto project, Sidewalk Labs partnered with United Way Greater Toronto to convene a roundtable discussion with non-profit leaders representing a dozen local housing organizations. The group identified ideas and guiding principles for what partnership with non-profits in Quayside could look like. These ideas included allowing non-profits to:

Express interest.
Non-profits will be invited to submit letters of interest for participation in the project, enabling them to engage early in the development process without undue burden. Non-profits could become involved without having to spend resources on the production of an uncertain Request for Proposals response.

Be rewarded for collaboration.
An operating partner (either one or more non-profits) would be selected through a transparent evaluation process designed specifically to reward joint applications that serve diverse deep affordability populations.

Participate in design.
Selected non-profits would be invited to participate actively in the design process, helping the project identify and meet the housing needs of specific populations and create a physical design that is optimized for operations.

Sidewalk Labs believes that active collaboration would make the waterfront's proposed mixed-income neighbourhoods stronger overall. Over time, this engagement could help non-profits build their capabilities for creating and delivering affordable housing. It would also demonstrate ways of working between the non-profit and private sectors.

Market-rate rental housing (15 percent). As part of a balanced offering, the proposed unit mix would include 15 percent of units as professionally managed, market-rate rentals, contributing much-needed supply to the Toronto market. This need is driven in part by unserved segments of the population, such as empty nesters seeking to downsize into downtown living.

Shared equity housing (5 percent). In addition to mid-range rentals, 5 percent of proposed units would involve a shared equity program that enables middle-income households to own part of an apartment, providing a path to build equity while renting. This shared equity program would help address a common barrier to home ownership for middle-income Torontonians: the need for a significant down payment.

Traditional home buyers own 100 percent of a property, often with help from a bank or other lender, with a considerable down payment. A shared ownership program enables home buyers to put a lower down payment towards a partial equity stake of a property, in partnership with a non-profit or other independent entity. Residents in shared ownership programs pay mortgage payments on the part they own and pay rent on the part they do not. Buyers also profit from the appreciation of their unit, with the ability to cash out when they move.

In Quayside, Sidewalk Labs proposes to deliver this option at cost to a capable partner, believing it would contribute meaningfully to middle-income housing options. (The cost of providing this option represents a contribution by Sidewalk Labs of $13.5 million, since delivering shared equity units comes at an opportunity cost of delivering condo units.) Based on preliminary discussions with local providers of affordable ownership units, there appears to be an appetite in Toronto to partner and explore this model further.

Although the city's Home Ownership Assistance Program has made meaningful strides towards the goal of reducing barriers to home ownership, Sidewalk Labs' shared equity program would seek to address a significant drawback of such programs, which is that they typically select a single "winning" household that takes all of the value of the property upon the first sale. In Quayside's proposed shared equity model, the unit would remain affordable for the long term.

Market-rate condo housing (45 percent). Because creating a mixed-income community means including market-rate as well as below-market households, Sidewalk Labs' proposed program would include about 45 percent market-rate condos. These condos would bring in revenue, which in Quayside would cross-subsidize the overall program. And, as explored further on Page 283, a condo resale fee would generate private funds for affordable housing when condos are resold.

In Focus

Innovation explainer

Two examples of how shared equity units could work in Quayside

The program aims to address a common barrier to home ownership for middle-income households: the need for a significant down payment.

	One-bedroom $375,000		Three-bedroom $600,000	
	Traditional ownership	Shared equity program	Traditional ownership	Shared equity program
Down payment	**$75,000** 20% on 100% ownership stake	**$15,000** 20% on 20% ownership stake	**$120,000** 20% on 100% ownership stake	**$24,000** 20% on 20% ownership stake
Monthly payment	**$1,600** mortgage	**$1,300** $300 mortgage and $1,000 rent	**$2,500** mortgage	**$2,100** $500 mortgage and $1,600 rent

Young couple

As an example of how the program works, consider a couple moving into a one-bedroom apartment that costs $375,000. In a traditional ownership scenario, the buyer might have to pay up to $75,000 up front for a 20 percent down payment, with a monthly mortgage of roughly $1,600. In the shared equity program, the couple could put down just $15,000 for a 20 percent down payment on a 20 percent ownership stake, for a total monthly cost of just over $1,300, comprising $300 in mortgage payments on the part they own and $1,000 in rent for the rest. If they decided to sell in Year 5, the couple could stand to make around $12,000 profit assuming 3 percent annual appreciation on their unit.

Young family

Similarly, consider a young family that is tired of "condo hacking" a one-bedroom rental and finds a three-bedroom condo at $600,000, hoping to obtain more room for their children. In a traditional scenario, the family's down payment might be as high as $120,000, with a monthly mortgage of roughly $2,500. In the shared equity program, the family could put down just $24,000 for a 20 percent down payment on a 20 percent ownership stake, paying rent on the rest for a total of $2,100 a month, comprising $500 in mortgage payments and $1,600 monthly rent. If they decide to sell in Year 5, the family stands to make up to $20,000, assuming 3 percent annual appreciation on their unit.

Note: Figures on this page are provided for illustrative purposes only.

How Sidewalk Labs plans to work with a non-profit partner to deliver shared equity units

Sidewalk Labs' sale of units at cost to a non-profit would enable the non-profit to provide equity stakes at below-market prices to qualifying middle-income households. The non-profit would receive steady rental payments on the portion of the home that is not owned, plus any home price appreciation on its owned portion upon resale. In addition, the non-profit would oversee restrictions on resale to ensure ongoing affordability to subsequent income-qualifying households, which could include an independent appraisal process to determine selling price and maintenance of an applicant waitlist. In the young family example above, the entity would purchase at cost from Sidewalk Labs, sell 20 percent at the same price to the family, and hold the remaining 80 percent at a cost basis of $480,000 (80 percent of the $600,000). It would then receive a 4 percent rental yield, or $103,500 over five years, plus house price appreciation of $76,500 (on their 80 percent share), leading to a 7 percent annual return, or profit of $180,000 if the unit sells.

The Sidewalk Toronto project can demonstrate ways for cities to hit ambitious affordability targets with a more balanced mix of government and developer funding sources.

Innovation case study

Reimagining the process of applying for housing

A digital tool could create a one-stop portal for housing applications and updates.

Working with the City of Toronto, Sidewalk Labs proposes to develop a streamlined, digital application process for all housing options in Quayside, including mid-range, market, and affordable units. This would address known challenges in today's affordable housing application process and also foster an unparalleled resident experience of diversity and inclusion for all income levels.

Today

Many different options, no single source.
Affordable housing applicants can find out about a unit through a housing provider's flyer, by calling the city or one of its affordable housing partners, or even through social media — a highly decentralized process compared to the city's centralized waitlist for social housing units.

Many separate applications.
It is hard to keep track of each developer application's unique eligibility or submission requirements.

Hard to determine status.
Residents who complete an application might not receive updates for a long time or might be left in the dark about where they are in the process.

Future

One-stop shop.
Affordable housing applicants could find all housing opportunities in a one-stop shop. Developers could upload and market projects easily into a portal.

Common application.
A digital application means people could apply to as many projects as they would like, with a single form. Developers would have more confidence in the income-eligibility process, through an auto-verification functionality that could ensure applicants pass income eligibility requirements.

Real-time updates.
Applicants could get updates in real time and understand timing and eligibility expectations for housing matches. Developers could expedite lease-up timelines, thus reducing vacancy risk and other lease-up challenges.

Goal 2

Expanding Tools
for Housing Affordability

Achieve this program with innovation that yields greater affordability

Informed by Toronto's existing affordability challenges, Sidewalk Labs' vision for housing includes 40 percent of units at below-market rates, a focus on purpose-built rentals to improve long-term affordability, and new options for seniors, young professionals, families, and middle-income households. But identifying an ambitious program is not enough — there must be a credible financial plan to achieve it.

To make the economics work, developers of affordable housing have typically relied on a mixture of public sources of funding and high-end, market-rate rentals to subsidize below-market units. While this approach can deliver some measure of affordability, it also creates a barbell effect, with new developments consisting primarily of luxury units and a handful of affordable apartments. To break this mold and create a broad diversity of incomes across a given housing development, Sidewalk Labs has explored a range of traditional and innovative funding sources.

Sidewalk Labs has estimated the cost of implementing this housing vision by comparing the costs of delivering a program with 40 percent of units at below-market rate to the land value that would exist in a conventional market-driven development program, which would deliver the bare minimum of affordability required.

In Quayside, achieving a housing program of roughly 2,600 total units with roughly 1,040 below-market units would cost an estimated $229 million. At the full scale of the IDEA District, achieving a total cumulative residential program of more than 34,000 units that include more than 13,600 below-market units would cost an estimated $3.9 billion.

To help cover the costs of this greater level of affordability, Sidewalk Labs identified categories of traditional public sources, including existing government programs, land value, and other potential contributions. Sidewalk Labs also identified three new private sources that together enable the traditional public sources to go farther.

These private sources begin with more efficient unit design, which creates value by increasing the supply of housing units a developer can provide across a given project — an approach that Sidewalk Labs calls "affordability by design." A second source is new land value unlocked by factory-based construction techniques, as achieved by a factory in Ontario specializing in modular building components made from mass timber. A third source could be revenue generated by condo resale fees.

Continued on Page 280

Identifying funding sources to achieve a 40% below-market program

With these sources, Sidewalk Labs proposes to achieve a 40 percent below-market program in Quayside and to demonstrate the potential impact of innovative financial and design tools to achieve this same program at the full scale of the IDEA District.

	Quayside		IDEA District	
	Below-market program achieved*	$M	Below-market program achieved	$M
Traditional public sources	**20%**	**$115**	**25%**	**$2,492**
Existing government programs**	13	77	10	997
Land value or other gov't contributions	7	38	15	1,495
New private sources	**7%**	**$37**	**15%**	**$1,435**
Affordability by design	7	37	5	475
Factory-driven land value	0	0	7	639
Condo resale fee***	0	0	3	321
Sidewalk Labs contribution	**13%**	**$77**	**-**	**-**
Total sources	**40%**	**$229**	**40%**	**$3,927**

* These figures reflect the incremental impact of each source towards creating a below-market program, based on overall 40 percent below-market program cost of $229 million.

** Existing government program figures are estimated for Quayside based on recent awards and the proposed below-market housing program. These figures assume programs are scaled up across the IDEA District on the same basis as in Quayside. As a result, totals may exceed annual budget allocations pending timeline of affordable units coming online between 2024 and 2048.

*** Analysis assumes 2.5 percent annual inflation rate.

Continued from Page 278

In Quayside, traditional public sources could provide the funding needed to deliver 20 percent affordable housing, consistent with current requirements. The remainder of the below-market program proposal could be covered, in part, by affordability by design (7 percent). But factory-based construction and condo resale fees require a longer timeline to realize value (through factory efficiency and sales, respectively), leading to a need for additional private sources in Quayside.

To realize the full below-market program vision in Quayside, Sidewalk Labs proposes to make a contribution of $77 million, in an effort to catalyze those sources for the future while still realizing an ambitious affordability program in the present. (This contribution would exist in addition to other innovation investments, including support for the Ontario-based factory for mass timber building parts described earlier in this chapter, on Page 210.)

At the full scale of the proposed IDEA District, however, private sources can realize significant value. In total, it is possible to achieve a 15 percent below-market program using private sources, which could generate more than $1.4 billion between 2024 and 2048. To achieve a 40 percent target at the scale of the IDEA District, the remainder would have to be supplied by existing government programs, contributing land at below-market value, or other sources.

Together, this combination of traditional public sources and innovative private sources could help deliver a groundbreaking housing program that would supplement reliance on existing government programs to enable unprecedented levels of affordability.

New private sources could unlock

$1.4 billion

for below-market housing.

The following sections describe the proposed funding sources in greater detail, including their potential application in Quayside by Sidewalk Labs, and across the IDEA District by other developers.

New private sources

To achieve its 40 percent below-market housing vision, with a diverse range of incomes across the community, Sidewalk Labs proposes the creation or use of several private sources of funding.

These sources begin with the value created by more efficient unit design — an approach that Sidewalk Labs calls "affordability by design." They also include new land value unlocked by accelerated construction techniques, catalyzed by a factory in Ontario specializing in modular building components made from mass timber. A third source could include revenue generated by condo resale fees.

Additionally, a proposed affordable housing trust could package some of these new funding sources to meet affordability objectives.

While these tools would be initiated in Quayside, they require varying timelines and development scales to provide sufficient funding sources for the housing vision. But once the viability of these tools is demonstrated, Sidewalk Labs estimates they could generate over $1.4 billion to support housing affordability — enabling developers to meet ambitious below-market housing targets while still achieving reasonable returns.

Affordability by design.

To help achieve its 40 percent below-market housing vision, Sidewalk Labs plans to create value by designing affordability into its proposed housing units.

As described on Page 253, Sidewalk Labs plans to provide efficient, ultra-efficient, and co-living units in Quayside that are designed to make the most of their space through features such as multi-purpose furniture; reduced in-unit storage, enabled by on-demand storage recovery in the neighbourhood; and shared building amenities, such as communal eating or co-working areas. While these units are smaller than comparable units on the market, they also enable affordability and their efficient designs provide for high-quality living.

(In addition to efficient and ultra-efficient units, Sidewalk Labs also proposes to create a minor amount of new "standard" units that are comparable in size to existing downtown developments.)

The ability to design efficient units that remain comfortable enables developers to create more total units across a given project. This additional supply increases the revenue potential for developers without increasing the cost basis, creating new value that can be applied towards a mixed-income housing program.

For example, in Quayside, Sidewalk Labs' proposed efficient unit — averaged across different unit types and based on a unit mix that skews towards more bedrooms — would be 7 percent smaller than its equivalent proposed standard unit. Efficient units would benefit from features such as multi-purpose furniture that enable a smaller footprint.

Creating value for below-market housing through efficient unit design

With efficient unit design, Sidewalk Labs is able to build an additional 87 units of below-market housing at Quayside when compared to traditional unit designs. This has the potential to generate an estimated $37 million in additional revenue, which can help support the below-market housing program.

Assuming 535,035 square feet dedicated to below-market rental units	**Average below-market size** (sq ft per unit)	**Number of units**	**Value** (in millions)
Standard unit design	638*	839	$207
Efficient unit design	578**	926	$242
Impact of efficient unit design	60 fewer square feet per unit on average	87 more total units	$34 for below-market housing***

* Standard unit design is based on a market landscape analysis of comparable downtown developments.

** The average efficient unit size indicated on this table is slightly larger than the overall average efficient unit size (see prior table) because it is weighted by bedroom splits for an exclusively below-market housing program. Sidewalk Labs' proposed housing program is grounded in demographic need, which allocates more family-sized units (with more bedrooms) to below-market units.

*** Note that $37 million in sources from affordability by design includes $3 million attributable to market rental housing not included in this analysis.

Assuming the same amount of area is dedicated to below-market housing, this reduction in average size enables the creation of 87 more units in Quayside than would otherwise exist in a conventional development.

In Quayside, Sidewalk Labs estimates that affordability by design could create $37 million in value that could be applied towards its housing vision. Applied at the full scale of the IDEA District, affordability by design could generate $475 million in value that could contribute to ambitious below-market housing targets.

Critically, affordability by design not only enables more below-market housing but also provides a set of new downtown living options that respond to the needs of families, seniors, young professionals, and other groups.

Unlocking land value from factory-based construction.
As described on Page 208, Sidewalk Labs proposes to build residential and commercial spaces using an off-site factory process that can accelerate project timelines and enhance cost certainty. Once proven, these outcomes would enable developers to pay more for land, with such premiums directed towards below-market housing.

Sidewalk Labs estimates that it will take at least 6 million square feet of buildable area for the factory to hit peak efficiency; so, the impact of this approach would not take effect in Quayside.

This estimate takes into account the fact that, during the ramp-up period with the first assemblies, the factory processes would take time to reach operational efficiency and a payback on the initial investment, as well as to stabilize an operating margin that reduces timelines and risk for developers. This estimate is based on the capital cost required for the factory and initial operating costs.

But when the expected efficiencies from this investment are realized at scale, factory construction would increase land values in two key ways: faster construction and reduced project risks.

Faster construction. Sidewalk Labs has estimated that its factory process can reduce project timelines by 35 percent, thanks largely to dramatic reductions in onsite assembly time. That accelerated speed would enable developers in the Sidewalk Toronto project area (whether Sidewalk Labs or any other third party) to bring projects to market more quickly, recover their investment faster, reduce their exposure to rising interest rates, and potentially complete more projects over the same amount of time. For commercial properties, this speed also opens up the possibility of pre-leasing to a new category of tenants unserved by the current market: rapidly growing startups that are unable to pre-lease four to six years before delivery, given unknown future business needs.

Reduced risk. The factory-based construction process also creates a more reliable set of costs related to design and materials procurement, primarily by providing developers with a library of pre-designed (yet customizable) building parts that have been pre-approved for use. Additionally, this library of parts has been optimized for shipping, reducing transportation costs, and created for faster assembly, as described on Page 227. The greater reliability of this factory supply chain reduces the need for developers to build "contingency" costs into their projects and should command tighter risk premiums from equity.

Together, these factors could enable more affordability in multiple ways. First, developers who recognize these benefits could be willing to pay more for land, the value of which could be applied to below-market housing. That is the approach used to generate the estimates shown in the funding sources table.

An alternative would be that government could increase affordability requirements, knowing that better project economics would enable developers to meet them while still clearing returns.

Sidewalk Labs estimates that the premium that would accrue to land when developers have access to factory-based construction techniques has the potential to generate proceeds estimated at $639 million across government-owned parcels across the IDEA District over the 24 years, from 2024 to 2048.

A condo resale fee could generate
$321 million
by 2048.

Generating new funding with a condo resale fee.
Sidewalk Labs proposes implementing a 1 percent fee on the resale of all condo units in the Sidewalk Toronto project area as a new source of private funding for affordable housing.

As described on Page 266, one of the barriers to creating affordable rental housing in Toronto today is the need to offset affordable units with high-priced condos to make projects hit target returns. With a resale fee such as the one Sidewalk Labs proposes to implement in Quayside and across the project zone, condos could help support rental economics, creating a self-sustaining ecosystem for mixed-income housing.

The resale fee could be built in from the start as a land encumbrance — such as with a restrictive covenant or other legal mechanism; it would not be a new government-levied tax — to support affordable housing development. Sidewalk Labs would take a catalyst role by applying the condo resale fee to its condo units in Quayside, aiming to demonstrate that the fee would not impact condo sales or pricing, and thus that such a model is feasible and viable for future developers within the IDEA District.

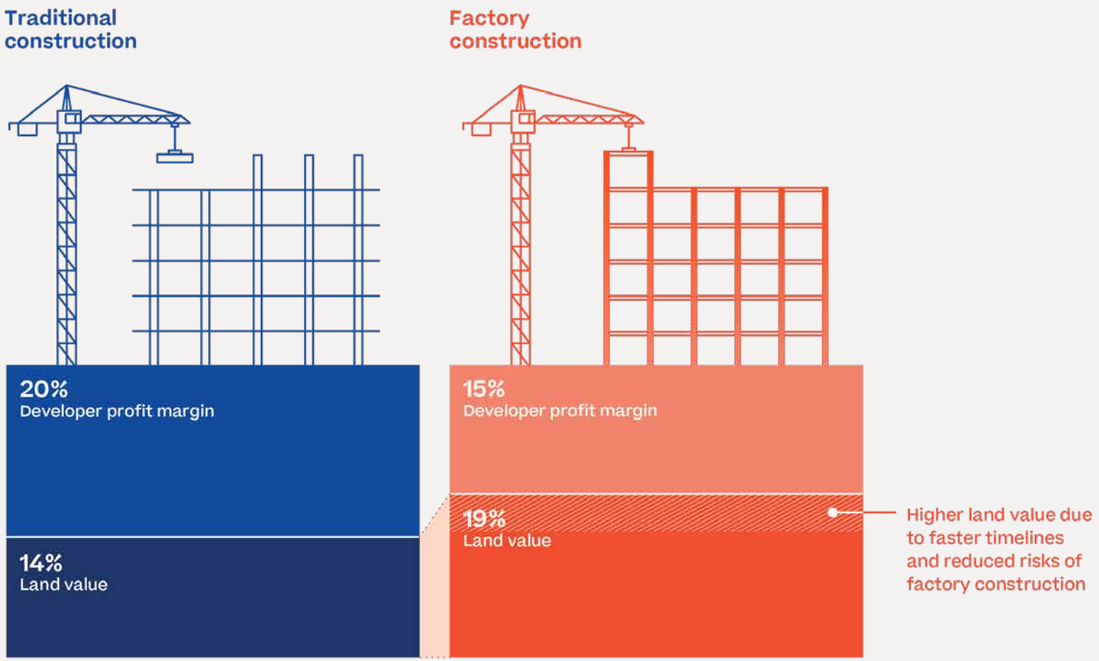
Research has shown, for example, that resale fees made common in New York City in the 1970s to generate capital for an aging housing stock did not lower prices.[71] But the resale fee in Quayside would not have sufficient time to provide capital sources to support the neighbourhood's housing program.

The resale fees generated in Quayside could also contribute to below-market housing at the full scale of the IDEA District. Assuming units in the project area are re-sold every seven years, consistent with existing trends in Toronto, Sidewalk Labs' proposal of a 1 percent fee on the resale value of each condo could generate a cumulative $321 million over 24 years for a 40 percent below-market program across the IDEA District.

That estimate would mean that each condo unit developed in Quayside carries the potential to deliver an estimated $23,000 towards below-market housing through 2048.

How factory-based construction can generate land value

Sidewalk Labs' plan to manufacture building parts could dramatically accelerate timelines and reduce risks for development projects. These benefits, once demonstrated in Quayside, would enable developers to pay more for land in the IDEA District, unlocking value that could be applied towards ambitious below-market housing programs.



Ground-up developers typically expect higher returns in exchange for taking on significant risk due to unpredictable project timelines and the need to find building materials at the right price.

Developers would be able to adjust their return expectations given faster project timelines and reduced risks. By realizing profits sooner, developers could benefit from higher "net present value" (money today is more valuable than money tomorrow) and have the opportunity to take on additional projects within the same time frame (such as doing three projects in six years instead of two).

Below-market housing impact

Potential value generated

$639M

Developers who recognize this value potential are willing to bid a higher price for the land. Across the proposed full scale of the IDEA District, this ability could generate an estimated $639 million in value for below-market housing (assuming the value is applied to publicly owned lands).

Note: Represents an illustrative and preliminary analysis on value generated by factory construction.

"Lock-boxing" funding with a Waterfront Housing Trust.

To help deliver new funding sources such as factory-based construction value or a condo resale fee, Sidewalk Labs proposes the creation of a housing trust fund: a new financial vehicle to assemble and disburse funding for below-market housing across the Sidewalk Toronto project area. (Sidewalk Labs would not participate in the trust's governance and proposes that it be publicly administered, potentially by the public administrator of the proposed IDEA District.)

See the "IDEA District" chapter of Volume 3 for more details on the proposed public administrator role.

The proposed Waterfront Housing Trust could assemble funding from a variety of public and private sources and "lock-box" this funding for below-market housing within the IDEA District, increasing the predictability and certainty of funding for developers from the outset of a project. Sidewalk Labs proposes that the Waterfront Housing Trust provide capital grants and other financial support for developers, both private and not-for-profit, seeking to meet significant affordability commitments.

The Waterfront Housing Trust would offer a replicable model for harnessing the private sector for affordable housing development.

A key advantage of the trust is flexibility. For example, in collaboration with government, the trust could disburse funding for mid-range (or middle-income) housing units in addition to affordable housing units, expanding the city's ability to meet affordability needs. Should it wish, a housing trust could also explore new funding concepts, such as an enclosed ecosystem for "cash in lieu" payments that ensures such payments go towards developments with below-market housing in the project area.

The trust also could incubate alternative funding sources as needed by the market, in addition to lock-boxing or capturing the value created by factory-based construction and condo resale fees.

For instance, the trust could create new low-cost debt financing products to better support affordable housing developers, or potentially incubate policy innovations less common in Toronto, such as air rights transfers from density bonuses. It could even attract new capital sources, as many North American cities have done, such as the New York City Acquisition Fund, which was launched in 2006 with public-private backing from the city, banks, and private foundations to provide early-stage financing for affordable housing developers.

The success of the Waterfront Housing Trust would offer a resilient and replicable model for harnessing the private sector for affordable housing development, and for creating mixed-income neighbourhoods elsewhere in Toronto, Ontario, and far beyond that could help communities offer more housing options to households of all incomes.

Traditional public sources

Sidewalk Labs' support of new private sources, including its approach to affordability by design, would reduce the reliance on government sources that would typically be needed to achieve an ambitious 40 percent below-market affordability target. But public programs remain essential to realizing affordable housing projects in Toronto.

Existing government programs.
To demonstrate one viable scenario, Sidewalk Labs examined two existing government programs that typically assist developers seeking to create affordable units in Toronto:

- National Housing Co-Investment Fund. The federal Co-Investment Fund run by the Canada Mortgage and Housing Corporation provides capital contributions and low-cost financing to developers of affordable rental housing.
- City of Toronto Open Door Affordable Housing Program. This program provides a mix of incentives, such as one-time exemptions from planning fees and development charges, as well as capital contributions.

To estimate the potential contribution of these two programs, Sidewalk Labs conducted financial testing and other analyses to compare their eligibility requirements with the MIDP's proposed housing program. (This analysis was based on past rewards and reasonable scoring performance, but it remains illustrative only.)

In Quayside, Sidewalk Labs estimates that these existing government sources could contribute an estimated $77 million towards a below-market program, including capital contributions and other incentives provided to developers.

But once new private funding sources become fully viable through the aforementioned factory or the condo resale fee, the proportionate need for these government sources would diminish.

More than 13,600 below-market units across the IDEA District

Delivering on a housing program at the proposed full scale of development across the IDEA District could create more than 13,600 below-market units, and roughly 34,000 housing units in all.

	Market housing (e.g. condo)	Below-market housing	Total
Percentage of program	60%	40%	100%
Number of units	20,400	13,600	34,000

Land value and other contributions.
To achieve a 40 percent below-market housing vision and truly set a new course for affordability in Toronto, additional public sources are needed after applying existing government sources.

While the government could fill this remaining need with whatever sources it deems appropriate, Sidewalk Labs believes there is precedent in Toronto for this funding need to be covered through adjusted land value, proceeds from land sales, or other contributions.

Land value is an essential component of the public-sector toolkit for affordable housing. In 2018, Toronto took an important step towards leveraging this public asset with the launch of CreateTO, an entity whose mandate includes reviewing the city's surplus land policies for affordable housing. The recent Housing Now initiative releases city-owned land to increase affordable housing, enabling land value to be considered a capital grant going directly to the creation of below-market units.

A comprehensive approach to affordability could help Toronto maintain its exemplary commitment to inclusion.

Today, at least six major revitalization initiatives already underway leverage city-owned lands to revitalize affordable rent-geared-to-income units. Government worked with Waterfront Toronto to leverage land value in the West Don Lands development;[72] for example, Phase 1 of that project provided "serviced and clean land" at no cost to support the development of affordable housing, ultimately leading to the creation of 243 new rental units.

Given its ambitious objective to deliver affordable housing along the waterfront, Waterfront Toronto's willingness to negotiate a price for the land in Quayside that recognizes these requirements is a critical component of filling the remaining cost gap of the proposed housing program.

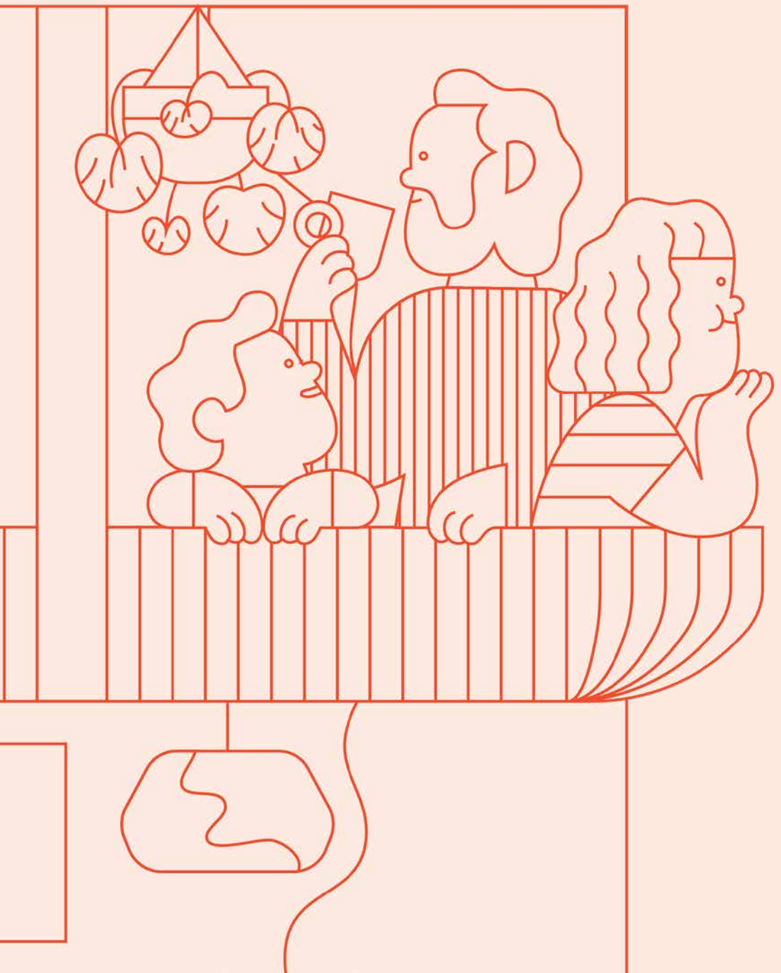
At the full scale of the IDEA District, if the public sector chose to provide the remaining need for a 40 percent below-market program, the result would be more than 13,600 units of below-market housing, including some 6,800 units of affordable housing.

Consistent with Sidewalk Labs' proposed role as a catalyst, the new private sources unlocked by this approach to housing innovation would enable the IDEA District to realize far more below-market housing than the current 10 percent requirement for the private parcels on the eastern waterfront and Waterfront Toronto's commitment to set aside land sufficient to accommodate 20 percent affordable housing — providing a new model for other parts of the city and other cities around the world.

Ch–3

Public Engagement

The following summary describes feedback related to **buildings and housing**, and how Sidewalk Labs has responded in its proposed plans.



As part of its public engagement process, members of Sidewalk Labs' planning and innovation teams talked to thousands of Torontonians — including members of the public, expert advisors, civic organizations, and local leaders — about their thoughts, ideas, and needs across a number of topics.

1 Truly affordable housing for lower- and middle-income Torontonians

Members of the Sidewalk Toronto Residence Reference Panel discussing content for their interim report, published in September 2018. Credit: David Pike

What we heard

From the very first Sidewalk Toronto Town Hall, true housing affordability — especially for lower- and middle-income households — was top of mind for participants. Roundtable 4 participants particularly urged Sidewalk Labs to be ambitious with its affordable housing program. They felt units in Quayside should be lived in, rather than being luxury investment pieces.

Torontonians want Quayside to include diverse populations, with the buildings and neighbourhood representing a mix of incomes, ethnicities, and backgrounds. As one Reference Panel participant put it: "Issues of housing costs, community cohesion, making space for new arrivals — these are all really important in today's world. Toronto has a reputation for inclusiveness. I hope it stays that way." Participants emphasized the importance of providing a mix of housing options in Quayside, including significant numbers of rental units.

Participants were open to new models for the financing and operating of housing that could stand the test of time and encourage innovation. But Roundtable participants and the Residents Reference Panel wanted more clarity on building ownership and governance and the maintenance of buildings and appliances. The Housing Advisory Working Group generally supported the proposed affordable housing program, the shared ownership model, and the housing trust concept; it also encouraged the exploration of a digital affordable housing application and suggested that Sidewalk Labs find ways to empower and partner with non-profit housing organizations, without burdening them.

How we responded

Raising the bar.
Sidewalk Labs proposes that 40 percent of housing be below market, including new rental units specifically for middle-income residents. Sidewalk Labs proposes that 20 percent of all housing be affordable, consistent with the City of Toronto's definition of "affordable" housing as anything 100 percent of AMR and below (see Page 269).

Incorporating deep affordability.
Sidewalk Labs proposes that at least a quarter of affordable units go towards deep affordability for lower-income households at or below 60 percent AMR (see Page 269).

Collaborating with non-profits.
Sidewalk Labs plans to work with experienced non-profits to deliver the deep affordability component of its housing programs, inviting these organizations to participate in an exclusive proposal process and bringing them into the design process to help ensure that deeply affordable units meet the needs of inhabitants (see Page 273).

Supporting middle-income households.
Sidewalk Labs proposes that 20 percent of housing go towards middle-income households (100-150 percent AMR), creating new options for households currently left behind by the Toronto market but who do not qualify for affordable housing (see Page 270).

Helping families build equity.
Sidewalk Labs proposes a shared equity program that would enable middle-income households to own part of a unit (facilitated by a non-profit housing organization), reducing down payment costs and providing a more affordable path to home ownership. Five percent of all units would be earmarked for this program (see Page 274).

Providing rentals.
Sidewalk Labs proposes making half of all housing in Quayside purpose-built rental housing, improving long-term affordability for the city (see Page 269).

Enhancing applications.
Sidewalk Labs proposes to work with the City of Toronto to develop a new digital affordable housing application that could provide real-time transparency into the application process (see Page 277).

Expanding funding sources.
Sidewalk Labs proposes new financial and design tools that would help the private sector support government in delivering an ambitious affordability program, including value unlocked through factory-based construction techniques, a condo resale fee, and efficient unit design. Additionally, it proposes a new entity called the Waterfront Housing Trust to assemble public and private funding sources, "lock-boxing" them for below-market needs. (Sidewalk Labs would not play a part in the trust's governance.) (See Page 280.)

2 Explore innovative building designs

What we heard

Roundtable participants were enthused about mixed-use buildings and open to innovative construction and design. As one visitor to Sidewalk Labs' Toronto headquarters, 307, said: "Every time I go to a meeting, it's been the same design for buildings in the last 30 years. It seems you have the capacity and the interest to push for new innovation and that's exciting."

Torontonians want the neighbourhood to feel human scale (no super high-rises) and be accessible for those with limited mobility. They were also supportive of healthy, natural building materials; they generally liked the biophilic, low-carbon nature of timber, although they expressed concern about the safety, durability, and toxicity of the material.

Participants in the tall timber industry events similarly questioned the long-term maintenance of the material and the extent to which the industry will buy-in and be able to respond to this new demand. But overall, they were excited about the potential of prefabricated timber construction to increase efficiencies, decrease costs, improve and speed up assembly, and generate safe, high-quality buildings.

The Housing Advisory Working Group was similarly excited about the potential of modular housing, while also questioning its viability and cost. They recommended that Sidewalk Labs work closely with the city on zoning regulations to make the mixed-use vision a reality.

How we responded

Enabling mixed-use.
Sidewalk Labs proposes to use and require a real-time building code system that could enable a mix of residential and non-residential uses without sacrificing safety or quality of life (see Page 251).

Designing for adaptability.
Sidewalk Labs plans to include a loft-style approach to buildings, with floor plans and spaces that can be easily adapted for occupancy with many different types of uses, reducing the time and cost of renovating a space (see Page 246).

Creating modularity.
Sidewalk Labs plans to create a pre-designed library of parts for construction that would reduce time spent on designing and sourcing materials, improving cost and time predictability while still enabling design excellence (see Page 220).

Building green.
Sidewalk Labs commits to using formaldehyde-free glues for its mass timber elements, and to pursuing glues and finishes that are Cradle-to-Cradle certified (see Page 212).

Ensuring safety.
To ensure the safety of all structures in Quayside, Sidewalk Labs plans to work with Equilibrium, a Vancouver-based structural engineering firm experienced in timber construction; Aspect Structural Engineers, a firm based in Vancouver; Michael Green Architects; CHM Fire Consultants, based in Ottawa; Vortex Fire Consulting, a global fire-code consulting firm with offices in Toronto; Gensler Architects, with an office in Toronto; Golder Associates LTD, based in Toronto; and Integral Group, a building system engineering firm with an office in Toronto.

Scaling for people.
While zoning for the Quayside site permits taller buildings, Sidewalk Labs plans to limit its buildings to around 30 storeys to create a more human-scale neighbourhood (see Page 231).

Incorporating accessibility.
Following its accessibility principles, Sidewalk Labs plans to design buildings that make threshold moments accessible (such as using automatic doors) and, when possible, make walkways wide enough for people to talk to each other while signing (see Page 106).

Engaging partners.
Sidewalk Labs created a forum for a wide array of players from the mass timber industry — including contractors, designers, manufacturers, and union leaders — to discuss the technical challenges of building with the material, develop potential solutions, identify opportunities for collaboration, and support the growth of this local industry (see Page 217).

Attendees of the "Open Sidewalk: Nature and the City" event explore a mass timber exhibit at 307. Credit: Jenna Wakani

3 Create units that can adapt over time and encourage neighbourliness

What we heard

Participants were enthusiastic about flexible unit designs that could adapt according to different life stages; they also expressed interest in larger units (two bedrooms or more) that could accommodate growing families and generations living together. The Family Lifestyles Research also illuminated some of the challenges facing families, who often desire (but cannot find) apartments with ample kitchens or living rooms, multiple bedrooms, and storage solutions.

Many Torontonians were generally open to sacrificing some square footage within their individual units for shared amenities, spaces (like communal kitchens, laundry rooms), and goods (like strollers or tools), especially as this sharing could generate more community bonding. Participants in the Seniors Workshop liked the idea of having multiple generations, and an active community, in one's building. As one senior requested: "Create a porch condition outside my front door."

Of course, even with a strong community, in-unit storage and enough space for personal expression is crucial, as visitors to the Efficient Unit Prototype at 307 noted. Prototype visitors also recommended making units more accessible by integrating adjustable counter and appliance heights. Others recommended ensuring that finishes are customizable and that partitions are genuinely easy to remove, so tenants can have more agency over their homes.

How we responded

Facilitating expansion.
Sidewalk Labs plans to implement a flexible interior wall system, where sections of walls can be easily clipped into place or removed, thus making renovation (expansion or contraction) easier and more affordable (see Page 246).

Welcoming families.
Sidewalk Labs plans for 40 percent of total units to have two bedrooms or more, creating new options for families (see Page 253).

Designing flexibility.
Sidewalk Labs has worked with nArchitects to explore efficient unit designs globally and with Toronto-based gh3 on a unit prototype to explore how efficient designs could meet the needs of shifting demographics in Toronto. This research, coupled with feedback on the Efficient Unit Prototype, would inform final unit design. Current designs include multi-purpose tables that could be raised or lowered when not in use, lofted beds located up short staircases that could double as storage drawers, and countertops that could serve as cutting boards (see Page 255).

Optimizing storage.
Sidewalk Labs proposes efficient units be designed to have less in-unit storage space than a market comparison apartment, compensated with free in-building storage and additional off-site storage with low-cost, on-demand delivery (see Page 255).

Exploring co-living.
Sidewalk Labs plans to provide a co-living option (efficient units with shared building amenities and community programming) for residents who prefer more communal living (see Page 260).

Strengthening community.
Sidewalk Labs plans to create abundant public space and allocate 90,000 square feet to social infrastructure, providing the spaces and programming tools to inspire a stronger community (see the "Quayside Plan" chapter of Volume 1).

Incorporating accessibility.
In keeping with its accessibility principles, Sidewalk Labs commits that 20 percent of units would have accessible fixtures and pledges to meet the evolving and growing housing needs of seniors.

Engagement spotlight

Community members share feedback during the "Re-Imagining Homes for Seniors" workshop. Credit: Sidewalk Labs

In September 2018, Sidewalk Labs convened individuals from 17 non-profits — including leaders in social service provision and housing for women, Indigenous communities, and homeless populations — for a roundtable. Sidewalk Labs Associate Director of Development Annie Koo was eager to learn from these leaders about how best to work with them on a deeply affordable housing program.

Initially, Annie had been considering a kind of non-profit bootcamp or fellowship program — a kind of incubator to which non-profits could apply and then receive funding or support. But one participant explained that the time commitment of such a program — while well-intentioned — would be particularly onerous for resource-strapped non-profits.

"So we course-corrected," says Annie. "We heard loud and clear. We want to partner with you, but don't add to our challenges. Meet us where we are." In response, Annie and her team simplified the concept to be a proposal process — exclusive to nonprofits — for organizations to design and deliver the deep affordability component of housing at Quayside.

Acknowledgements

Sidewalk Labs would like to extend special thanks to the participants of the Sidewalk Toronto Housing Advisory Working Group, and to the staffs of the City of Toronto, Province of Ontario, and Government of Canada for their time and guidance.

Endnotes

General note: Unless otherwise noted, all calculations that refer to the full proposed IDEA District scale are inclusive of the entirety of its proposed geography, including all currently privately held parcels (such as Keating West). Unless otherwise noted, all currency figures are in Canadian dollars.

Charts note: Sources for the charts and figures in this chapter can be found in the accompanying copy for a given section; otherwise, the numbers reflect a Sidewalk Labs internal analysis. Additional information can be found in the MIDP Technical Appendix documents, available at www.sidewalktoronto.ca/midp-appendix.

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