



UNIVERSITY OF  
TORONTO



# BIG IDEAS FOR SMALL TOWN AFFORDABLE HOMES:

## COST SAVINGS OF STANDARDIZED DESIGN

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## **DESIGN**

Tony Chang and Priya Perwani

# RESEARCH QUESTION

How can standardized designs address design costs, delays, and approvals as barriers to the production of housing, and expediate the production of "missing middle" housing?

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# EXECUTIVE SUMMARY

The information in this report seeks to surmise how standardized designs can address design costs, delays, and approvals as barriers to housing production, while also expediting production of "missing middle" housing.

The first half of the report summarizes data found through a literature review. Mass customization (MC) of housing is a strategy employed by businesses aiming to create high value products in a short time at low cost (T. Formoso et al., 2022; Larsen et al., 2019). Standardized design, MC, and permissive zoning are several interconnected aspects that together can engender greater housing productivity.

In Canada, MC is being tested as a solution to building housing efficiently. Published in April 2024, *Canada's Housing Plan* calls for a suite of measures to rapidly scale up Canada's housing supply. This includes reviving the idea of a design catalogue, reforming national building and zoning codes to allow standardized design, and embarking on an industrial strategy to scale up modular construction (Government of Canada, 2024).

The second half of the report is dedicated to interviews with three key informants: development consultants with experience working on nonmarket housing projects in B.C., Ontario, and the Atlantic provinces. The information gathered reveals that the cost of an architect's services for small nonmarket projects in small communities is estimated by experienced development consultants as between 2-7% of building costs in B.C. and Ontario, and higher in the Atlantic provinces. The time for initial design is two weeks to a month; a fully worked out design with all units and common spaces takes between one and two months. Architects also respond to issues that come up during public consultation and approvals processes and they supervise construction.

*Standardized design, mass customization, and permissive zoning are **several interconnected aspects** that together can engender greater housing productivity.*

Both the interviews and the literature assume that in the case where there isn't a large and experienced nonmarket developer, small nonmarket providers can and should engage in the services of an experienced development consultant. B.C. and Ontario have a preponderance of these consultancies, while the Prairies, Atlantic provinces, and the North are under-served. Although some nonmarket providers work with market developers, the latter are unused to the requirements for nonmarket and affordable housing funding. In these cases, standardized designs might help to increase productivity and speed.

# INTRODUCTION

This report seeks to identify potential cost savings of standardized, replicable housing designs, especially for smaller nonmarket housing projects (10-40 units) in smaller communities (<50,000 people). We do this by reviewing the recent literature on standardized housing design and interviewing three key informants: development consultants with experience working on nonmarket housing projects in B.C., Ontario, and the Atlantic provinces.

## WHAT IS STANDARDIZED DESIGN?

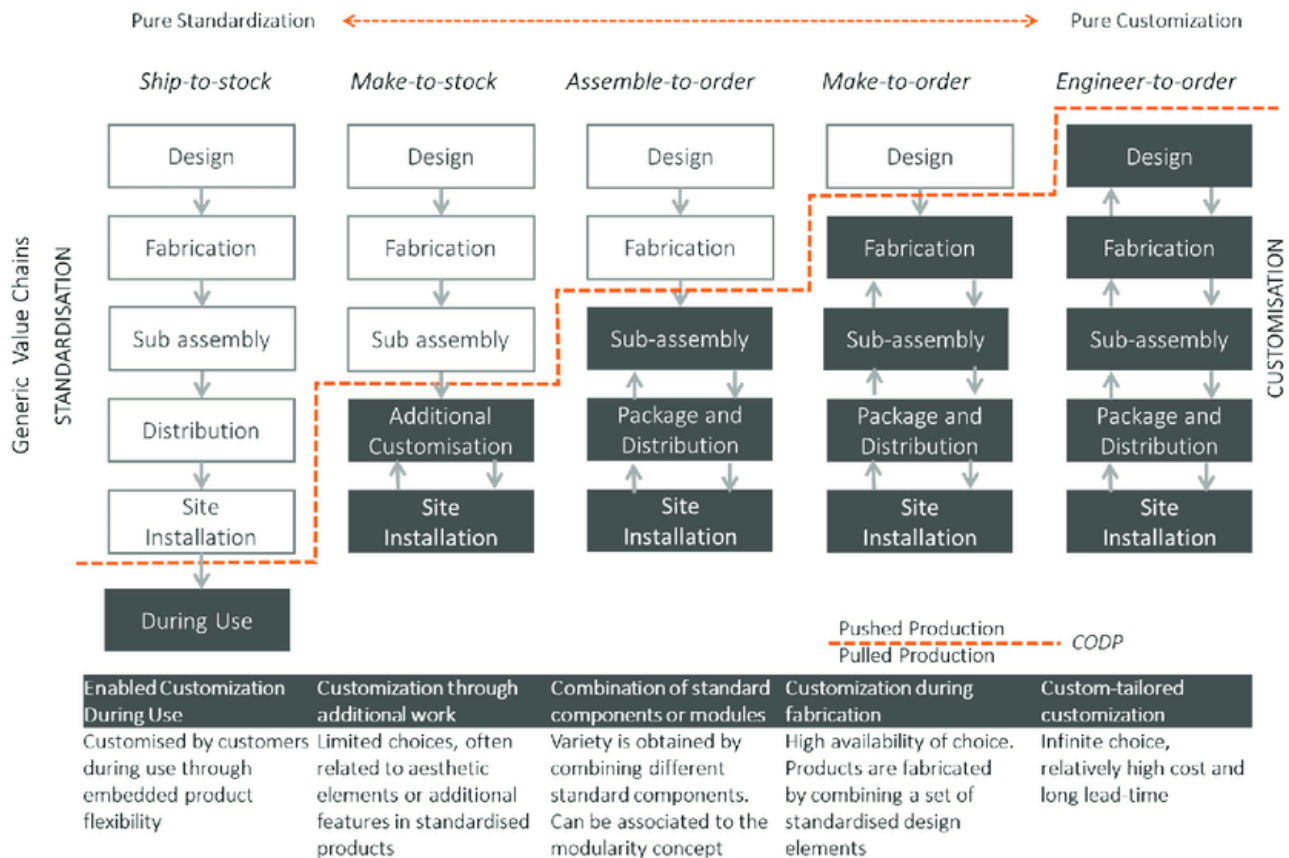
In the housing industry, standardized design – as part of mass customization (MC) of housing – is a strategy employed by businesses aiming to create high value products in a short time at low cost (T. Formoso et al., 2022; Larsen et al., 2019). MC heavily relies on standardized, replicable designs to keep costs low and contractual procedures easier to manage (T. Formoso et al., 2022). Most importantly, standardized designs work to combine customization with low unit cost without sacrificing product quality, which can include energy efficiency and accessibility considerations (Larsen et al., 2019). What makes MC a great option for housing building projects is that it delivers enough variety and customization that most consumers find what they need, while taking advantage of economies of scale (Larsen et al., 2019).

MC follows a chain effect of mass customized products that are utilized to either be standard in design (pushed) or customizable to the customer (pulled) (T. Formoso et al., 2022). By employing this method of production, companies can benefit from economies of scale through product repetition while maintaining customer satisfaction (Larsen et al., 2019).

What makes the chain process of production beneficial to MC is that it allows for various stages of customization to take place during the building process through utilizing the customer order decoupling point (CODP). The CODP marks the moment at which the customer order is placed and customization may happen (T. Formoso et al., 2022). In their publication Guidelines for the Implementation of Mass Customization in Affordable House-Building Projects, T. Formoso et al. detail how customization can take place in five approaches: ship-to-stock, make-to-stock, assemble-to-order, make-to-order, and engineer-to-order (Figure 1).

*Standardized design is a strategy employed by businesses aiming to create **high value products in a short time at low cost.***

**Figure 1: Approaches in the customization process**

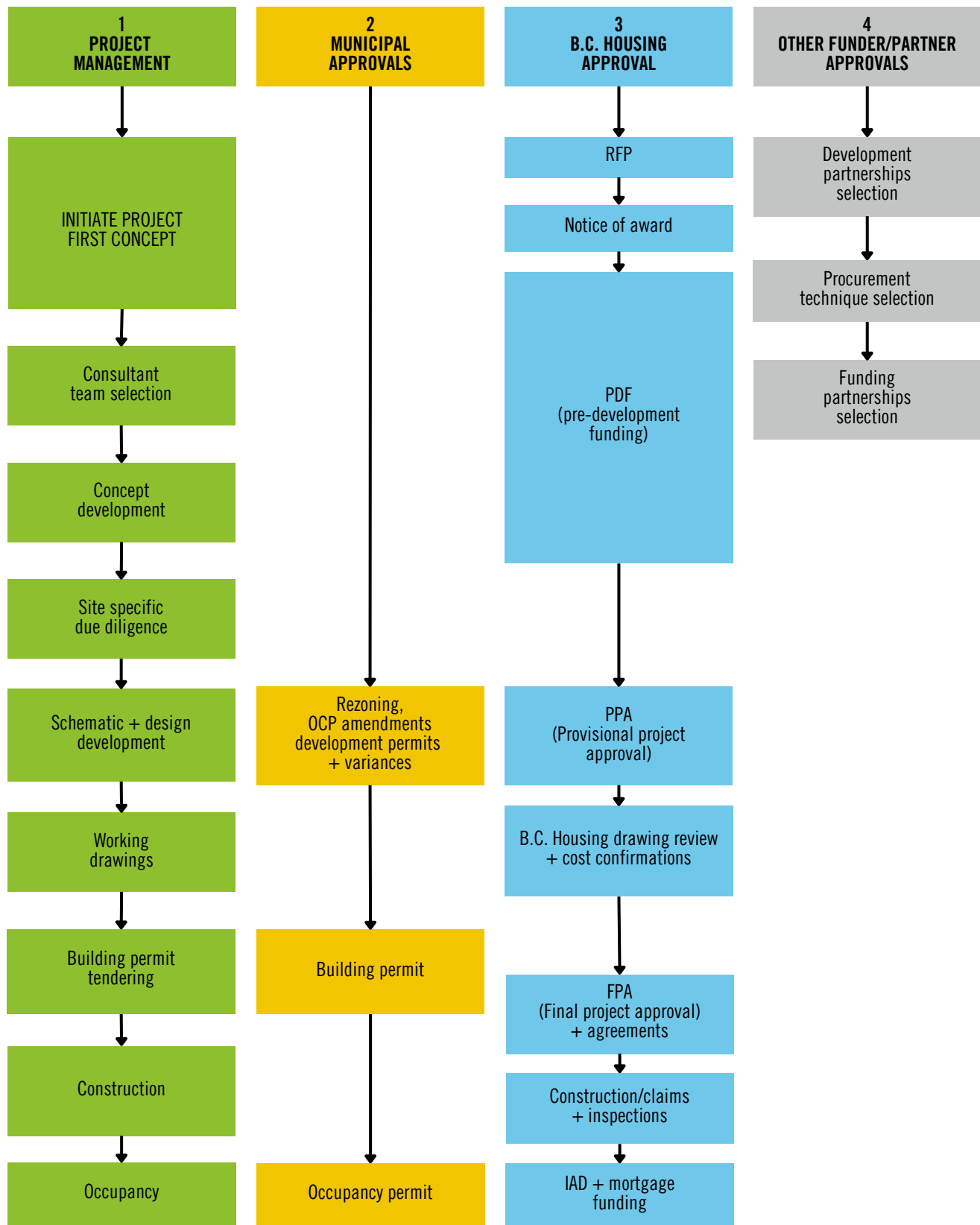


Source: T. Formoso et al., 2022

MC is a collaborative endeavour between the construction, research and development, and design teams (Bianconi et al., 2019). MC utilizes computational design to facilitate standard variations in design. Building information modeling plays a role in effectively sharing design ideas from designers to manufacturing companies, expediting the process of design modeling (Bianconi et al., 2019). To better interpret the design process, Bianconi et al. break it down into a three-step process of (1) design automation, (2) virtual prototyping, and (3) mass customization output.

What is clear from this discussion of MC is that standardized design is one of several interconnected aspects that together can engender greater housing productivity. B.C. Non-Profit Housing Association (2020) provides a detailed sense of the many steps currently required in non-profit housing design. Architects not only provide an initial design to test feasibility of the initial concept, but also must modify designs as part of site-specific due diligence, municipal approvals, and requirements from multiple funders. Moreover, a registered architect is required to review work during construction either to accept or reject its compliance with the approved design (Figure 2). There is no doubt that this complex and time-consuming process could be improved, which is the current focus of Canadian government efforts.

**Figure 2. Design and approvals processes**



Source: BCNPHA, 2020

## THE CURRENT CANADIAN POLICY CONTEXT FOR STANDARDIZED DESIGN

Although some architects, developers, and municipalities have developed ‘in house’ design catalogues – indeed, one of our interview subjects explained that B.C. Housing’s detailed specifications suggest a set of basic designs – the idea of the federal government developing a housing design catalogue is both an old and new one. The Canada Mortgage and Housing Corporation (CMHC) helped enable over a million Victory Houses after World War II by running design competitions and publishing the winning ones as a catalogue. This was combined with working with municipalities and provinces on standardized zoning and building codes that allowed rapid approvals of these designs (James, 1995).

In April 2024, *Canada’s Housing Plan*, which was released along with the 2024 federal budget, calls for a suite of measures to rapidly scale up Canada’s housing supply. This includes reviving the idea of a design catalogue, reforming national building and zoning codes to allow standardized design, and embarking on an industrial strategy to scale up modular construction (Government of Canada, 2024).

Initial consultations on a national Housing Design Catalogue have recently concluded, involving market and nonmarket developers, municipal and provincial/territorial governments, planners, architects, and Indigenous governments and organizations (HICC, 2024). Standardized design is seen as part of the solution to barriers prohibiting housing supply, particularly if combined with ‘pre-approvals’ linked to reforming existing zoning and building code barriers, expedited low-cost financing, and industrial modular construction (Figure 2). Despite standardized designs and pre-approvals being seen as separate entities, Housing, Infrastructure and Communities Canada explains that when combined they achieve solutions to overcoming housing supply shortages. Standardized design may also potentially enable better energy efficiency and accessibility, and another advantage is that it can streamline the initial time and cost for design, lowering the bar for less experienced developers, including nonmarket housing developers (Figure 3) (HICC, 2024).

**Figure 3. Alignment of standardized design with other federal initiatives**

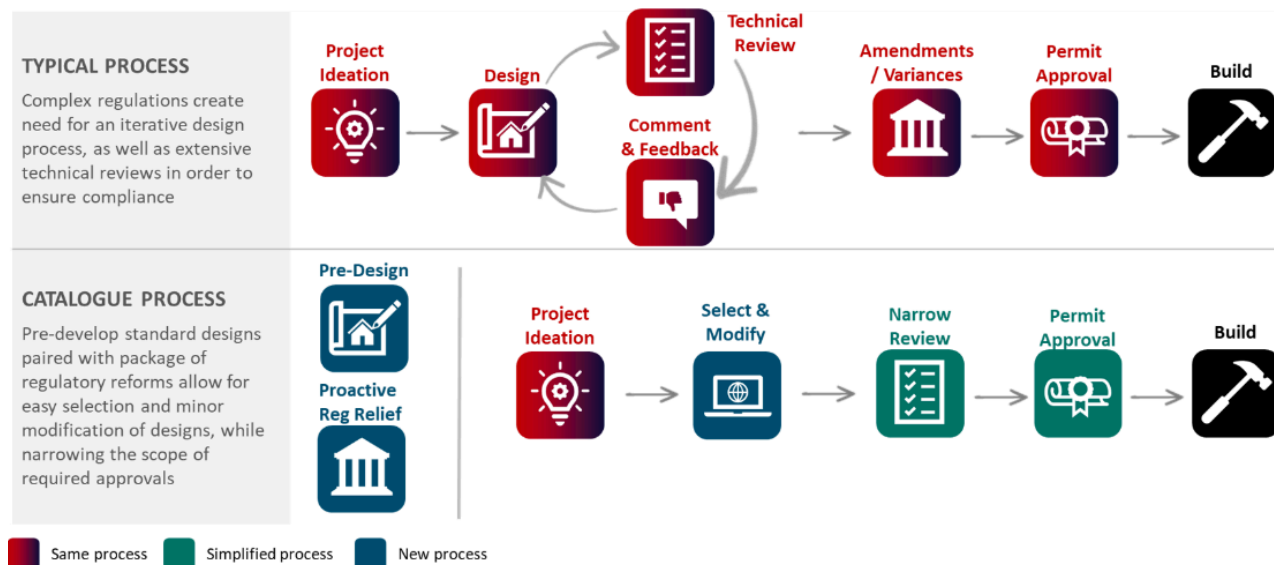


Source: HICC, 2024



One major advantage of standardized design, if combined with regulatory reforms, is cutting down on the iterative process of comment and feedback on design during development review. Figure 4 shows how standardized design can accelerate development in moving from program ideation to rapid approvals.

**Figure 4. Impact of standardized design on rapid approvals**



Source: HICC, 2024

However, those consulted pointed out that with size comes complexity. While there was strong support for an initial Housing Design Catalogue that includes ADUs, multiplexes, and mid-rise apartments, further research was felt to be needed before including mid-rise on-site construction apartment buildings in infill or greenfield areas (Figure 5) (HICC, 2024).

**Figure 5. Next stages for housing design catalogue**

Built Form	On-Site Construction			Off-Site Construction
	Infill, Conversion	Infill, New Build	Greenfield	Modular / Pre-Fab
Accessory Dwelling Units	<b>1 IN-SCOPE</b> Strong candidate given simplicity and newness; lack of familiarity with builders given previous zoning restrictiveness		<b>TO BE CONFIRMED</b> <i>Need to validate the value to industry / existence of proprietary designs already</i>	<b>3 IN-SCOPE</b> Development process for modular a clear fit with catalogue concept (i.e., modular designs are inherently standardized at-scale)  Represents potential opportunity to support this nascent built form by reducing current cost / availability disadvantages
Single Family Homes	<b>OUT-OF-SCOPE</b> <i>Too much variability in existing conditions; does not lend itself to catalog-like designs</i>	<b>2 IN-SCOPE</b> Priority type of supply; recently more planning permissibility		
Multiplexes		<b>4 IN-SCOPE (EXPLORATORY)</b> Unclear whether standardized designs are possible at this scale; will be a longer-term focus for research and development		
Mid-Rises	<b>OUT-OF-SCOPE</b> <i>Requires site-specific considerations &amp; engineering of building</i>			
High-Rises	<b>OUT-OF-SCOPE</b> <i>Requires site-specific considerations &amp; engineering of building</i>			

Source: HICC, 2024

# COST SAVINGS OF STANDARDIZED DESIGN

The recent Canadian return to pre-approved design catalogues responds to international literature describing cost savings associated with standardized design, especially when combined with zoning and building codes that enable rapid approvals and modular rapid construction. Standardizing designs without any approval or construction reforms is a rare phenomenon, and not enough research is available to determine their contribution or effectiveness to economies of scale.

One of the main factors prohibiting the development of affordable housing is inefficiencies in the construction industry that raise costs for developers, architects, and contractors (Hoyt, 2020; Woetzel et al., 2014). Pre-approved standardized designs contribute to economies of scale by eliminating the need for iterative changes during the approvals phase, saving on design and development consultancy fees. Materials for housing can also be pre-purchased in bulk, lowering material costs. Standardized nonmarket projects in the Netherlands use pre-approved home design to deliver high-quality affordable housing (Modular Weekly, 2024). KPMG, using an international housing affordability lens (Woetzel et al., 2014) estimates cost savings of 12-16% by improving productivity through a combination of simplified sets of designs, expedited approvals, and flexible zoning. When combined with standardized industrial approaches to the 'hard costs' of construction (labour and materials), project delivery costs can be reduced by close to 30% and project timelines can be shortened by up to 40%.

*Pre-approved standardized designs contribute to economies of scale by eliminating the need for iterative changes during the approvals phase, saving on design and development consultancy fees.*

The Harvard Joint Center for Housing Studies, focusing on U.S. multi-unit affordable housing (Hoyt, 2020) argues that 'soft costs' (design, engineering, approvals), which typically make up 20-30% of total housing costs, can be reduced through expedited approvals for a set of standardized designs, especially in cases where several similar buildings are being planned for one site. However, the report cautions that nonmarket and market affordable housing developers frequently rely on land with lower costs caused by constraints such as irregular lots, which can make the design process more complex. Both the KPMG and Harvard Center reports argue that scale saves per-unit costs, while cautioning that regional and rural areas often require buildings smaller than small and mid-size apartments, and rural sites sometimes lack basic infrastructure like water and sewer lines.

In Canada, the B.C. Non-Profit Housing Association (2020) builds on this discussion of location and scale. Small remote communities have limited access to local architects, development consultants, construction firms, and specialized trades people, meaning that transportation and accommodation costs for these essential services must be factored in. Smaller and remote communities may not have large-scale construction firms, and the firms that are there may lack capital to invest in new equipment and training, leading to risk aversion to new approaches (Woetzel et al., 2014). It is possible that a set of replicable designs could address these issues, but there is no evidence in the literature that this has been true.

# SUMMARY OF INTERVIEWS

For this report, we conducted three interviews with experienced staff working for nonmarket development consultancies in British Columbia, Ontario, and the Atlantic region respectively. These development consultants had a combined 15 years of experience in regional cities and rural areas, enabling small nonmarket housing projects of between 5-40 units. In each case, we asked them to use a specific example of a small-town project of between 10-40 units in their estimates.

The development consultants did not provide specific proformas. However, based on previous projects, they estimated that an architect in Ontario and B.C. typically accounts for 2-7% of the hard costs of the project. They agreed that the smaller the project, the higher the proportion of total hard costs they charge (for example, the fee for a 10-unit building may be 6% and for a 40-unit building may be 4%). However, in the Atlantic provinces, the design fees have been much higher, averaging between 8-10% of hard costs. Typically, in all provinces, the design fee is charged against project milestones: 40-60% is prior to construction and includes concept work, feasibility proposals, and design development; the other 40-60% is during/after construction and includes contract administration and site supervision.

The project timeline varies depending on the project's complexity and region. In Ontario, small apartment buildings of between 10-40 units take about two weeks for the initial concept and application package, two months to design the building's interior details, and another year or more to move through the phases of pre-consultation, site plan application, and building permit application. In the Atlantic provinces, where regulation is more limited, projects can move from concept to permit within three months. However, many of these projects are at the periphery of settlements, and require water and sewer lines to be extended, which can cause additional costs and delays. B.C. Housing's guidelines are highly prescriptive. The architect's familiarity with the document helps conceptualize the project quickly in the initial phase, with perhaps a month to develop concept and interior units. All three development consultants talked about the importance of an initial visioning session with the nonprofit provider to get specifics about the clients and their needs. Additionally, some architects assist in pre-submission community meetings.

## *There is a tension between replicable designs and site conditions.*

All three consultants said that there is a tension between replicable designs and site conditions. On the one hand, the Ontario consultant said that a replicable design would be especially useful in the concept phase, particularly with a less experienced nonmarket provider. The B.C. consultant said that most of the architects they work with usually have some knowledge of a few standardized designs. Since the B.C. Housing design guidelines are so prescriptive there are a limited number of architects who specialize in nonmarket development. If designs are pre-approved, this would assist in speeding up the approvals process, particularly if the changes that could be demanded through public meetings and political choices were limited. However, all three consultants stressed that the specifics

of local sites, such as the location of infrastructure hook-ups (or the need for new water, sewer and electricity lines), and the pre-existing landscape (including trees to be retained) required some degree of site-by-site modification. More importantly, there is the need for an on-site registered architect to ensure that the construction is proceeding according to plan. These two functions – initial design and construction supervision – can be separated, particularly in remote areas or where there is a local qualified supervisor who knows the local construction firms.

Usually, project delays occur because of local or regional planning processes: rezoning and other amendments, consultation requirements, political and community NIMBY (Not In My Back Yard) opposition. While a design catalogue or a menu of pre-approved standardized designs would allow a head start, site-specific requirements – including the topography and idiosyncrasies of the site, building codes, local politics, labour, and construction material constraints – may require local knowledge to handle. Local builders or the development consultancy may have the design knowledge to address those concerns. It is possible that smaller developers rush into planning processes without adequate research into regulations and without adequate board and organizational support to address issues that arise (Pomeroy, 2017).

# CONCLUSIONS

## ADVANTAGES OF STANDARDIZED DESIGN

There are architecture and development consultants who have developed their own formal or informal design catalogues, which are most useful at the concept stage, by enabling a pre-feasibility study without contracting architectural services. If the design catalogue can offer a fair sense of the building volume and number of units, the developers can apply for pre-development funding more quickly and conduct the required studies after securing that funding. By doing so, the use of design catalogues can minimize financial risks “for a project that you are not sure is moving forward” (nonmarket developer interview).

*If the design catalogue can offer a fair sense of the building volume and number of units, the developers can apply for pre-development funding **more quickly and conduct the required studies after securing that funding.***

Both the interviewees and the literature confirm that design catalogues are most useful for replicable, identical and small-scale sites that are developed simultaneously. That is, a plot is subdivided into smaller plots, and many small-scale buildings are added on each of them at the same time (doing it at different times lowers the efficiency on savings).

Design catalogues are most useful in small towns/rural areas where there are larger plots and fewer planning restrictions. Small towns/rural communities typically do not have access to consultants; relying on replicable design catalogues can offer great leaps to expertise outside of their region. It is recommended to partner with local housing providers and builders so that the construction management and eventual building operations run smoothly. The local expertise also brings local connections, community buy-in and passion into the project that can boost the development’s viability.

## LIMITATIONS TO OVERCOME

Pre-approved designs would speed up the approvals stage, although site-specific modifications might still be needed. The interviewees suggested that replicable design can “template what’s above ground, but it still has to connect to something below ground” (nonmarket developer interview). There are infrastructure and municipal services challenges, like potable water and sewerage, that need to be accounted for across the provinces.

The interviewees echoed the recent consultations on a national design catalogue: site complexity increases with the scale of a project. While a standardized ADU can work on almost any site, a small apartment building of 2-4 storeys with 10-40 units might need to respond to highly different climates, sites, and infrastructure availabilities. A national design catalogue would also require nationally harmonized zoning and building codes.

Another limitation of replicable designs is the de-coupling of initial design phase from site-specific design revisions and overseeing construction. The bifurcation raises questions of additional costs, design development, and “requires an architect with almost no ego” to take on the responsibility of a pre-approved design handed to them. In addition to site modification and service hookups, site approvals will require signatures of a registered architect during the construction process.

Based on an overview of the limited literature and our interviews, we conclude that design catalogues for small apartment buildings in small towns would assist the rapid development of more nonmarket and market affordable homes, particularly at the initial concept phase and particularly if there are pre-approved designs.

## **SMALL TOWN AFFORDABLE HOMES**

The cost of an architect’s services for small nonmarket projects in small communities is estimated by experienced development consultants as between 2-7% of costs in B.C. and Ontario, and higher (8-10%) in the Atlantic provinces. The time for initial design is two weeks to a month; a fully worked out design with all units and common spaces takes between one and two months. Architects also respond to issues that come up during public consultation and approvals processes and they supervise construction.

Both the interviews and the literature assume that in the case where there is not a large and experienced nonmarket developer, small nonmarket providers can and should engage in the services of an experienced development consultant. The three interview subjects provided the names of eight development consultants across the country with some experience of working in rural and regional settings with nonmarket clients. There is no doubt that B.C. and Ontario have the preponderance of these consultancies, and that Atlantic provinces, Prairies and the North are under-served. Although some nonmarket providers work with market developers, the latter are unused to the requirements for nonmarket and affordable housing funding.

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