HOUSING RESEARCH REPORT

Cost of Delivering Housing in Canada

Canada

CMHC SCHL

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RDH BUILDING SCIENCE

Cost of Delivering Housing in Canada – Southern Archetypes | Project 10704.000

CMHC Canadian Housing Cost Study, Ottawa, ON

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Executive Summary

The cost of housing is increasing across Canada due to both demand side (upward demographics, urbanization, etc.) and supply side (geographic and land use regulations) factors. The cost of constructing housing varies between urban centers across the country and has been found to be substantially higher in some instances of building in rural Northern locations. An improved understanding of the influencing factors on housing construction costs is required to guide future housing policy. This project will establish the costs that are incurred to deliver housing in Canada. The focus of this phase of the work is on two housing archetypes in Canada's South. The second phase focuses on the cost to deliver housing in Canada's North.

The cost of housing for two Southern building archetypes was estimated in Vancouver, Toronto, Halifax, Montreal, Calgary, Whitehorse, and Yellowknife to represent a range of urban centers and climate zones throughout the country. The costing was performed using detailed quantity take-offs from construction drawings representing two typical building archetypes. The costing was performed using an elemental costing approach accounting for the construction costs and development costs. The general description used in developing the archetypes for costing include:

- → 2-storey plus basement, detached single family house with 2x6 wood-frame construction, forced air natural gas space heating and hot water, HRV ventilation, air conditioning and electric appliances
- → 5-unit, 2 ½ storey, 2x6 wood-frame construction, with forced air natural gas space heating and hot water, HRV ventilation, air conditioning, and electric appliances

The total project costs were found to vary between $202/ft^2 ($2,174/m^2) and $255/ft^2 ($2,744/m^2) for the single family house archetype and $214/ft^2 ($2,303/m^2) and $268/ft^2 ($2,884/m^2) for the townhouse archetype. The Total Project Cost is comprised of Construction Costs (75% to 85%) and Development Costs (15% to 25%) which both vary in the different locations and archetypes. The Total Construction Cost for the SFH archetype varied between $172/ft^2 ($1,851/m^2) and $215/ft^2 ($2,313/m^2) whereas the TH archetype was found to vary between $182/ft^2 ($1,958/m^2) and $226/ft^2 ($2,432/m^2). The construction costs were found to be highest in Yellowknife and Whitehorse due to the higher cost of materials associated with delivery to remote locations. The Development Cost varied between $30/ft^2 ($323/m^2) and $57/ft^2 ($613/m^2) for the SFH archetype and $32/ft^2 ($344/m^2) and $67/ft^2 ($721/m^2) for the TH archetype. The highest Development Costs occurred in Toronto while the lowest occurred in Montreal. In all cases the development costs are a significant portion of the overall cost of housing.

The differences in construction costs between cities can result from construction differences to meet energy efficiency requirements, as well as differences in costs based on local material pricing and labour rates. The cost premium associated with energy efficiency requirements was found to be a maximum of 1.7% in Yellowknife compared to Vancouver. This represents a small increase compared to the overall premium associated with other location specific cost factors such as labour and materials. The result indicates that the need for higher performance buildings in Canada's colder climates is not the primary driver of cost premiums in those locations.

The incremental cost of constructing the building to improved energy efficiency standards compared to the baseline construction was also determined. The increments focus on improvements to the building enclosure performance and higher efficiency mechanical systems. The aim of costing the incremental improvements was to understand the potential costs of moving towards more stringent energy efficiency requirements in future code cycles. Increment 2 was chosen to represent an ultra-low energy building design in line with performance levels to achieve EnerPHit levels of energy use. Increment 1 represents an intermediate performance target between the baseline and Increment 2. The improvements are approximately halfway between existing construction and low energy designs.

The cost premium for Increment 2 over the baseline building varies between $\$9.54/ft^2$ ($\$103/m^2$) in Vancouver to $\$19.32/ft^2$ ($\$208/m^2$) in Yellowknife for the single family house archetype. The cost premium as a percent of the Total Construction Cost varied from 5.6% (Vancouver) to 9.1% (Whitehorse). The largest contributor to the increases in cost of Increment 2 are associated with the addition of rigid exterior insulation to the above grade walls. Additional insulation accounts for approximately 50% of the total incremental cost. Although the thickness of exterior insulation varies with city to account for different climate zones, the costs are all in the range of $\$5.00/ft^2$ ($\$54/m^2$) to $\$9.30/ft^2$ ($\$100/m^2$).

The research shows that the primary cost drivers for housing construction price differences across Canada are labour and material differences for different locations. Variations in the development costs and taxes also add to the differences but are smaller drivers. Additional research is required to compare the unique factors associated with constructing housing in Canada's North, including transportation and labour restrictions, different construction practices, and geographical constraints on some communities.

Résumé

Le coût des logements augmente partout au Canada, aussi bien en raison de facteurs liés à la demande (la croissance démographique, l'urbanisation, etc.) que de facteurs liés à l'offre (les règlements sur l'utilisation des terrains et les facteurs géographiques). Au Canada, le coût de la construction varie d'un centre urbain à l'autre, et s'est révélé beaucoup plus élevé dans le cas de certains immeubles situés dans les régions rurales nordiques. Il est nécessaire de mieux comprendre les facteurs qui influencent les coûts de construction pour orienter la politique du logement. Ce projet établira les coûts qui seront engagés pour mettre en œuvre les programmes de logement au Canada. Cette étape des travaux porte sur deux archétypes d'habitation dans le Sud du Canada. La seconde phase, quant à elle, porte sur le coût de la mise en place des programmes dans le Nord du Canada.

Le coût des logements pour deux archétypes d'habitation du Sud a été évalué à Vancouver, à Toronto, à Halifax, à Montréal, à Calgary, à Whitehorse et à Yellowknife, un échantillon représentatif des centres urbains et des zones climatiques du pays. L'établissement des coûts a été réalisé en se fondant sur l'avant-métré établi à partir de plans de construction représentant deux archétypes d'habitations typiques. La méthode d'établissement des coûts était fondée sur des éléments qui tiennent compte des coûts de construction et des coûts d'aménagement. La description générale utilisée pour élaborer les archétypes pour l'établissement des coûts comprend :

- → Maison individuelle de deux étages avec sous-sol, ossature de bois constituée d'éléments de 2 x 6 po, chauffage (eau et locaux) à air pulsé alimenté au gaz naturel, ventilateur récupérateur de chaleur (VRC), climatisation et appareils électroménagers électriques.
- → Maison en rangée superposée de deux étages et demi comprenant cinq logements, ossature de bois constitué d'éléments de 2 x 6 po, chauffage (eau et locaux) à air pulsé alimenté au gaz naturel, VRC, climatisation et électroménagers électriques.

Le coût total de projet variait entre 202 $/pi^2 (2 174 $/m^2) et 255 $/pi^2 (2 744 $/pi^2) pour l'archétype de maison individuelle (MI), et entre 214 $/pi^2 (2 303 $/m^2) et 268 $/pi^2 (2 884 $/m^2) pour l'archétype de maison en rangée (MR). Ce coût comprend les coûts de construction (de 75 % à 85 %) et les coûts d'aménagement (de 15 % à 25 %) qui varient tous les deux selon les lieux de résidence et les archétypes. Le coût total de construction pour l'archétype de MI varie entre 172 $/pi^2 (1 851 $/m^2) et 215 $/pi^2 (2 313 $/m^2), tandis que celui de l'archétype de MR variait entre 182 $/pi^2 (1 958 $/m^2) et 226 $/pi^2 (2 432 $/m^2). Il est ressorti de l'étude que les coûts de construction étaient les plus élevés à Yellowknife et à Whitehorse car le coût des matériaux est plus élevé en raison des frais de livraison dans les régions éloignées. Le coût d'aménagement variait entre 30 $/pi^2 (323 $/m^2) et 57 $/pi^2 (613 $/m^2) pour l'archétype de MI et 32 $/pi^2 (344 $/m^2) et 67 $/pi^2 (721 $/m^2) pour l'archétype de MR. Les coûts d'aménagement les plus élevés ont été relevés à Toronto et les plus bas, à Montréal. Dans tous les cas, les coûts de développement représentent une part importante du coût global des logements.

D'une ville à l'autre, les coûts de construction peuvent varier en fonction des exigences imposées en matière d'efficacité énergétique et selon les salaires et les prix des matériaux pratiqués localement. L'étude a montré que le surcoût lié aux exigences en matière d'efficacité énergétique représentait 1,7 % au plus à Yellowknife comparativement à Vancouver. Cela représente une légère augmentation comparativement au surcoût global associé à d'autres facteurs de coût propres à l'emplacement, comme la main-d'œuvre et les matériaux. Ce résultat indique que le besoin de construire des bâtiments à rendement supérieur dans les régions du Canada au climat plus rigoureux ne constitue pas la source principale des surcoût dans ces régions.

Le coût différentiel associé à la construction d'un bâtiment répondant à des normes d'amélioration de l'efficacité énergétique, comparativement à un bâtiment de référence, a également été déterminé. Les augmentations portent sur des améliorations liées au rendement de l'enveloppe du bâtiment et à une meilleure efficacité des installations mécaniques. Le but d'établir le coût des améliorations différentielles était de comprendre combien il en coûterait d'adopter des exigences plus rigoureuses en matière d'efficacité énergétique dans les futurs cycles de codes. Le niveau 2 a été choisi pour représenter la conception d'un immeuble à très faible consommation d'énergie, qui se conforme au rendement nécessaire pour atteindre une consommation d'énergie EnerPHit. Le niveau 1 représente une cible de rendement qui se situe entre la consommation de base et le niveau 2. Les améliorations se situent environ à mi-chemin entre les cibles de conception existantes et celles à faible consommation d'énergie.

Le surcoût pour atteindre le niveau 2 comparativement au bâtiment de base varie entre 9,54 $/pi^2 (103 $/m^2) à Vancouver et 19,32 $/pi^2 (208 $/m^2) à Yellowknife, pour l'archétype de la MI. En pourcentage du coût total de construction, il varie entre 5,6 % (à Vancouver) et 9,1 % (à Whitehorse). Les facteurs qui contribuent le plus aux augmentations des coûts au niveau 2 sont associés à l'ajout d'un isolant rigide à l'extérieur des murs situés au-dessus du niveau du sol. Le coût lié à l'installation de cet isolant représente environ 50 % du coût différentiel total. L'épaisseur de l'isolant extérieur varie d'une ville à l'autre selon les zones climatiques, mais les coûts se situent tous en moyenne dans une fourchette allant de 5,00 $/pi^2 (54 $/m^2) à 9,30 $pi^2 (100 $/m^2).

L'étude montre que les principaux facteurs de coûts déterminant les écarts des prix de la construction résidentielle dans les différentes régions du Canada sont la main-d'œuvre et les matériaux. Des variations dans les coûts d'aménagement et les impôts s'ajoutent à ces différences, mais constituent des facteurs moins déterminants. Il serait utile de procéder à des recherches supplémentaires pour comparer les facteurs uniques associés à la construction résidentielle dans le Nord du Canada, notamment les restrictions en matière de transport et de main d'œuvre, les pratiques de construction différentes et les contraintes géographiques dans certaines communautés.

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1 Introduction

1.1 Background

Real housing prices in Canada have been rising relative to income and compared to other countries. The reasons for this rise are influenced by both demand side (upward demographics, urbanization, etc.) and supply side (geographic and land use regulations) factors. Additionally, construction costs have been shown to vary significantly across the country between urban centers as well as for the more remote Northern regions. The reasons for these differences have been attributed to a number of factors including labour, material, fees, taxes and transportation. A detailed analysis of the cost to deliver housing in Canada is needed to improve the understanding of these influencing factors and how they can be controlled to meet the housing needs in Canada.

Cost estimates for housing construction are available from a number of sources. Costs normalized by building area allow for a generalized comparison of the expected construction costs and are typically refined throughout the design phase. Construction costs (including labour and materials) can vary substantially depending on building design and location. Examples of this variability can be found in publicly available cost guides[1]. The indicated construction costs for Single-Family Residential construction in Vancouver varies from \$125-\$215/ft^2 (\$1,345-\$2,313/m^2) compared to \$85-130/ft^2 (\$915-\$1,399/m^2) in Halifax. The differences can be driven by a number of factors associated with the construction including size of the buildings, locations within the urban center, available labour, and material costs. Additional breakdowns of the construction costs are required for a more complete understanding of the dominant drivers.

This project will establish the costs that are incurred to deliver housing in Canada. The focus of this phase of the work is on two housing archetypes in Canada's South. The second phase focuses on the cost of two archetypes specific to construction in the North. An analysis will be undertaken to examine the impact of changes to construction elements on overall costs to understand the sensitivity of overall housing costs to various influences, such as changes in labour costs, higher land costs, fees and taxes, etc. This research project will help the government and industry stakeholders understand the potential impact that different construction systems, market conditions, housing policy, codes, standards, features, incentives and programs may have on affordability.

1.2 Objectives

The objective of this project is to characterize the cost components associated with providing housing in regions across Canada. The costs investigated included those associated with planning, designing, procurement, and construction of housing in major urban centers including Halifax, Montreal, Toronto, Calgary, Vancouver, Yellowknife, and Whitehorse. The project will also characterize specific factors influencing housing costs in Canada's North (urban, rural and remote communities) and how changes to construction practices such as prefabrication or modular designs impact costs and distribution of financial benefits.

[1] Altus Group 2017 Canadian Cost Guide.

This report focuses on the results for housing archetypes specific to the Southern regions of the country. A companion report "Cost of Delivering Housing in Canada – Northern Archetypes" focuses on Northern specific cost drivers.

1.3 Scope of Research

The scope of this research project includes:

1. Provide an overview of residential construction costs across Canada.
2. Develop an inventory of costs that go into delivering two housing archetypes in the South and two archetypes in the North (included in a follow-up report).
3. Gather information related to the individual costs of the items included in the inventory for selected urban centres and calculate the overall cost of the completed housing units.
4. Test the sensitivity of the overall costs of the housing units to changes to the costs of individual elements to identify the major influences on housing costs.
5. Discuss the differences/similarities related to the cost of housing for each region.

1.4 Methodology

The cost of housing for the Southern building archetypes was determined in 7 cities representing different urban centers and climate zones throughout the country. Details of the cities included in this study are shown in Table 2.1.

TABLE 2.1 DETAILS OF CITIES INCLUDED FOR COSTING OF THE SOUTHERN ARCHETYPE

City	HDD (18°C)	Climate Zone
Vancouver	2800	4C
Toronto	3600	5
Halifax	4000	6
Montreal	4300	6
Calgary	5000	7A
Whitehorse	6580	7B
Yellowknife	8170	8

Whitehorse and Yellowknife are included in the costing of Southern archetype housing as they can be considered a link between Canada's North and South. Housing archetypes typical of more southern urban centers, including single family houses with basements, can potentially be constructed in these cities. More Northern specific building archetypes typical of rural and remote locations are also likely to be built in Whitehorse and Yellowknife. These will be explored in the companion report "Cost of Delivering Housing in Canada – Northern Archetypes".

The costing was performed using an elemental costing approach accounting for the construction costs and development costs at a Schematic Design (Class C) stage and assumed that a single townhouse unit or five single family house units were being built simultaneously. The estimated accuracy of the costing information is between ± 15% to

20%. The costing was performed in suburban locations outside of the city centers to be more representative of the location where new construction is more likely to occur. For both the townhouse and the single family house, the costing estimates assume that the buildings are being constructed on new plots of land by a developer rather than as single, one-off construction projects. The costs assume that all infrastructure surrounding the site (i.e. roads) are in place and is therefore are limited to on-site costs. The costing information is based on the gross floor area (ft^2) rather than the living area in the building to be consistent with industry convention. The gross floor area includes the area of the walls and all unfinished area including reduced height or crawlspaces in the basement.

The costs developed in this work are estimates for the specific archetypes investigated and may differ from the cost to construct other similar buildings with different design choices. Costs can be higher or lower than estimated based on elements of the buildings such as finish quality, geometric layout, and other site constraints. A description of the elements included in the Construction and Development Costs is provided in Table 2.2. Greater details of the costing approach are provided in Appendix A.

TABLE 2.2 SUMMARY OF COSTING ELEMENTS

Element	**Description**
Construction Costs	
Substructure	Below grade components of the structure including foundation and excavation
Structure	Structural components of the building such as floors, stairs and roofs
Exterior Enclosure	Enclosure components including above and below grade walls, doors, windows, roof coverings, etc.
Partitions & Doors	Partitions and doors in the interior of the building
Finishes	Floor, ceiling, and wall finishes within the building
Fittings & Equipment	Interior millwork, cabinets, appliances, etc.
Mechanical	Mechanical equipment including plumbing, HVAC, fire protection, sanitary, etc.
Electrical	Electrical components of the building including connections for mechanical equipment, lighting, conduits, receptacles, wiring, etc.
Site Work	Site preparation, detached garage allowances, hardscapes, soft landscaping, etc.
General Requirements & Fees	General fees associated with site construction
Contingencies	Contingencies to cover modifications and changes during the construction process
Taxes (GST/HST)	Taxes on the construction costs including P.S.T. and H.S.T. where applicable
Development Costs	
Land	Not included in this costing exercise
Consultants	Fees for project consultants including structural, mechanical, electrical, architectural, and cost consultants

TABLE 2.2 SUMMARY OF COSTING ELEMENTS	
Development Management	Fees associated with managing the development process
Government Taxes & Levies	Government fees associated with the development process including permitting fee, development cost charges, permits, levies, legal, and survey fees
Marketing	Fees to market the development
Financing	Costs associated with borrowing, including loan placement fee, project monitoring fees and interest, etc.
Contingency	Contingencies on budget overruns associated with the development elements

1.4.1 Building Archetypes

The cost of newly built housing was determined by performing detailed quantity take-offs and costing of two building archetypes representative of the Canadian building stock. The archetypes included a single family house and a 5-plex townhouse. A summary of the buildings is provided in Table 2.3. Construction drawings of the proposed archetypes were used for the quantity take-offs to capture the relevant building elements. Drawings of the archetypes are not included in this report as they are not publicly available documents. The building construction characteristics were chosen in part to achieve consistency between locations to allow for a common comparison of elements and some aspect, such as choice of insulation type, may differ slightly from local common practice in some areas. The general description used in developing the archetypes for costing include:

→ 2-storey plus basement, detached single family house with 2x6 wood-frame construction, forced air natural gas space heating and hot water, HRV ventilation, air conditioning and electric appliances

→ 5-unit, 2 ½ storey, 2x6 wood-frame construction, with forced air natural gas space heating and hot water, HRV ventilation, air conditioning, and electric appliances

TABLE 2.3 SUMMARY OF ARCHETYPE DETAILS		
Archetype	**Single Family House**	**Townhouse**
Stories	2 + basement	2.5
Number of Dwelling Units	1	5
Above Grade Floor Area (per dwelling unit)	2,300 ft^2 (214 m^2)	1,250 ft^2 (116 m^2)
Basement Area	850 ft^2 (79 m^2)	500 ft^2 (46 m^2)
Gross Floor Area (for costing)	3,855 ft^2 (358m^2)	1,800 ft^2 (167m^2)
Wall Framing	2x6	2x6
Bedrooms	4	2
Bathrooms	2.5	1.5
Heating	Gas-fired furnace	Gas-fired furnace
Cooling	Location dependent	Location dependent

TABLE 2.3 SUMMARY OF ARCHETYPE DETAILS		
Ventilation	HRV	HRV
Hot Water Fuel Source	Location dependent	Location dependent
Appliances	Electric	Electric
Foundation	Basement	Slab on grade
Roof	Vented Attic	Flat roof
Garage	Detached	Half of lowest level

The construction characteristics used in the costing were determined based on compliance with the National Building Code of Canada 2015. Construction details used for costing are provided for the building enclosure and mechanical systems in Table 2.4.

1.4.2 Incremental Changes to Baseline Design

Incremental changes to the baseline buildings were also costed to determine potential cost variations. The following is a list of incremental changes that were costed in isolation for each city:

- → Provide solar photovoltaic ready equipment
- → Provide brick veneer as an alternate cladding to fibre-cement lap siding
- → Provide insulated concrete form foundation wall as an alternate to the baseline concrete below grade wall construction
- → Provide drainwater heat recovery option
- → Replace the tank-type water heater with an on-demand water heater

The incremental cost of constructing the building to improved energy efficiency standards was also determined for two packaged increments. Details of these packages are provided in Table 2.5 and Table 2.6 for Increment 1 and Increment 2, respectively. The increments focus on improvements to the building enclosure performance and higher efficiency mechanical systems. An illustration of the components changed in the increments are provided in Figure 2.1.

Figure 2.1 Illustration of components included in energy efficiency improvements

Increment 2 was chosen to represent an ultra-low energy building design in line with performance levels to achieve EnerPHit[2] levels of energy use. The building performance is expected to meet the high end of potential step codes and be net zero ready in many locations. The aim of costing this high-performance building is to understand the potential costs of moving towards more stringent energy efficiency requirements in future code cycles. Increment 1 represents an intermediate performance target between the baseline and Increment 2. The improvements are approximately halfway between existing construction and low energy designs.

[2] EnerPHit is a retrofit standard for existing buildings that utilizes Passive House certified components. The standard provides prescriptive criteria for building components based on climate zone. An alternate certification method is to meet heating energy demand targets which are indicative of low energy consumption building.

TABLE 2.4 BASELINE ARCHETYPE CONTRUCTION DETAILS							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Ceiling below attics (SFH archetype)	R-38 (RSI-6.7) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-40 nominal (16" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 5/8" gypsum	R-47 (RSI-8.3) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-50 nominal (20" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 5/8" gypsum				R-56 (RSI-9.9) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-60 nominal (24" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 5/8" gypsum	
Flat roofs (TH archetype)	R-27 (RSI-4.9) 2 Ply SBS Roofing protection board 1/2" Plywood sheathing vented space 9 1/2" TJI's @ 24" o.c. R-28 fiberglass batt insulation 6 mil poly VB/AB 5/8"gypsum					R-29 (RSI-5.1) 2 ply SBS Roofing protection board 1/2" Plywood sheathing vented space 9 1/2" TJI's @ 24" o.c. R-30 fiberglass batt insulation 6 mil poly VB/AB 5/8"gypsum	
Above grade walls	R-16 (RSI-2.8) Fibre-cement board cladding 3/8" x 1.5" vertical strapping (rainscreen) Spun-bonded polyolefin WRB 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-20 batts poly AB/VB 5/8" gypsum	R-17 (RSI-3.0) Fibre-cement board cladding Spun-bonded polyolefin WRB 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum	R-17 (RSI-3.0) Fibre-cement board cladding 3/8" x 1.5" vertical strapping (rainscreen) Spun-bonded polyolefin WRB 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum	R-17 (RSI-3.0) Fibre-cement board cladding Spun-bonded polyolefin WRB 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum		R-18 (RSI-3.2) Fibre-cement board cladding Spun-bonded polyolefin WRB 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-24 batts poly AB/VB 5/8" gypsum	

TABLE 2.4 BASELINE ARCHETYPE CONTRUCTION DETAILS							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Interior partition walls	5/8" gypsum 2x4 at 16" o.c. 5/8" gypsum						
Below grade foundation walls	R-11 (RSI-1.9) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 1" XPS taped joints 2x4 framing @16" o.c. w/ R-12 batt		R-16 (RSI-2.8) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 1.5" XPS taped joints 2x4 framing @16" o.c. w/ R-12 batt				
Floor insulation	R-10 (RSI-1.8) 6" concrete slab 10 mil poly VB (radon barrier) 2" XPS 6" free draining gravel						
Windows	U-0.32 (USI-1.8) Vinyl, double pane, argon fill, 1 low-e coating		U-0.28 (USI-1.6) Vinyl, double pane, argon fill, 1 low-e coatings, improved frame design			U-0.25 (USI-1.4) Vinyl, triple pane, argon fill, 2 low-e coatings	
HRV	Min. 60% sensible heat recovery						
Furnace	Gas-fired (92% AFUE), Heat Pump Split System (SEER=14.5, EER=11.5)					Gas-fired (92% AFUE)	
Water heater (standard efficiency)	Electric storage	Gas-fired storage	Electric storage		Gas-fired storage		

TABLE 2.5 INCREMENT 1 DETAILS – INTERMEDIATE BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Ceiling below attics (SFH archetype)	R-47 (RSI-8.3) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-50 nominal (20" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum	R-56 (RSI-9.9) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-55 nominal (22" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum		R-66 (RSI-11.6) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-65 nominal (26" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum		R-75 (RSI-13.2) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-80 nominal (32" of loosefill fiberglass) in Trusses at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum	
Flat roofs (TH archetype)	R-40 (RSI-7.0) 2 Ply SBS Roofing protection board Peel and Stick AB/VB 1/2" Plywood sheathing 18" deep, 2x4 open truss @ 24" o.c. R-44 fiberglass batt insulation 5/8"gypsum	R-45 (RSI-7.9) 2 Ply SBS Roofing protection board Peel and Stick AB/VB 1/2" Plywood sheathing 18" deep, 2x4 open truss @ 24" o.c. R-50 fiberglass batt insulation 5/8"gypsum		R-50 (RSI-8.8) 2 Ply SBS Roofing protection board Peel and Stick AB/VB 1/2" Plywood sheathing 18" deep, 2x4 open truss @ 24" o.c. R-55 fiberglass batt insulation 5/8"gypsum		R-55 (RSI-9.7) 2 Ply SBS Roofing protection board Peel and Stick AB/VB 1/2" Plywood sheathing 18" deep, 2x4 open truss @ 24" o.c. R-60 fiberglass batt insulation 5/8"gypsum	

TABLE 2.5 INCREMENT 1 DETAILS – INTERMEDIATE BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Above grade walls[3]	R-29 (RSI-5.1) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 3" Rigid Mineral Wool Insulation with 6" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-20 batts poly AB/VB 5/8" gypsum	R-33 (RSI-5.8) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 4" Rigid Mineral Wool Insulation with 7" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum		R-37 (RSI-6.5) Fibre-cement board cladding3/4" x 2.5" vertical strapping 5" Rigid Mineral Wool Insulation with 8" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum		R-41 (RSI-7.2) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 6" Rigid Mineral Wool Insulation with 9" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-24 batts poly AB/VB 5/8" gypsum	
Interior partition walls	5/8" gypsum 2x4 at 16" o.c. 5/8" gypsum						
Below grade foundation walls	R-19 (RSI-3.3) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 2" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt	R-23 (RSI-4.1) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 3" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt		R-27 (RSI-4.8) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 4" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt		R-31 (RSI-5.5) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 5" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt	

[3] It is worth noting that the dimensions of the building have not been modified with the changes in wall thickness which inherently means that the interior livable floor space is reduced with thicker walls. The gross floor area however, remains the same. In some construction projects, it may be possible to increase the building floor plate to maintain the livable area when increasing wall thickness. This would increase the gross floor area.

TABLE 2.5 INCREMENT 1 DETAILS – INTERMEDIATE BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Floor insulation	R-20 (RSI-3.5) 6" concrete slab 10 mil poly VB (radon barrier) 5" EPS 6" free draining gravel	R-24 (RSI-4.2) 6" concrete slab 10 mil poly VB (radon barrier) 6" EPS 6" free draining gravel		R-28 (RSI-4.9) 6" concrete slab 10 mil poly VB (radon barrier) 7" EPS 6" free draining gravel		R-36 (RSI-6.3) 6" concrete slab 10 mil poly VB (radon barrier) 9" EPS 6" free draining gravel	
Windows	U-0.28 (USI-1.6) Vinyl, double pane, argon fill, 1 low-e coatings, improved frame design	U-0.25 (USI-1.4) Vinyl, triple pane, argon fill, 2 low-e coatings				U-0.17 (USI-1.0) Vinyl, triple pane, improved frame, argon fill, 2 low-e coatings	
HRV	85% sensible heat recovery, with electric resistance preheat						
Furnace	Gas-fired (98% AFUE), Heat Pump Split System (SEER=19)					Gas-fired (98% AFUE)	
Water heater (high efficiency)	Electric storage	Gas-fired storage	Electric storage		Gas-fired storage		

TABLE 2.6 INCREMENT 2 DETAILS – ULTRA LOW ENERGY BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Ceiling below attics (SFH archetype)	R-56 (RSI-9.9) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-60 nominal (24" of loosefill fiberglass) in Truss at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum	R-66 (RSI-11.6) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-70 nominal (28" of loosefill fiberglass) in Truss at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum		R-75 (RSI-13.2) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-80 nominal (32" of loosefill fiberglass) in Truss at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum		R-94 (RSI-16.6) Asphalt shingles Roofing underlayment Plywood sheathing Vented attic space R-100 nominal (40" of loosefill fiberglass) in Truss at 24" o.c. Poly AB/VB, 2x3 strapping 5/8" gypsum	
Flat roofs (TH archetype)	R-50 (RSI-8.8) 2 Ply SBS Roofing protection board 4" Polyiso Peel and Stick AB/VB 1/2" Plywood sheathing 9 1/2" TJI's @ 24" o.c. R-30 fiberglass batt insulation 5/8"gypsum	R-61 (RSI-10.7) 2 Ply SBS Roofing protection board 6" Polyiso Peel and Stick AB/VB 1/2" Plywood sheathing 9 1/2" TJI's @ 24" o.c. R-30 fiberglass batt insulation 5/8"gypsum		R-72 (RSI-12.7) 2 Ply SBS Roofing protection board 8" Polyiso Peel and Stick AB/VB 1/2" Plywood sheathing 9 1/2" TJI's @ 24" o.c. R-30 fiberglass batt insulation 5/8"gypsum		R-83 (RSI-14.6) 2 Ply SBS Roofing protection board 10" Polyiso Peel and Stick AB/VB 1/2" Plywood sheathing 9 1/2" TJI's @ 24" o.c. R-30 fiberglass batt insulation 5/8"gypsum	

TABLE 2.6 INCREMENT 2 DETAILS – ULTRA LOW ENERGY BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Above grade walls[4]	R-41 (RSI-7.2) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 6" Rigid Mineral Wool Insulation with 9" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-20 batts poly AB/VB 5/8" gypsum	R-49 (RSI-8.6) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 8" Rigid Mineral Wool Insulation with 11" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum		R-57 (RSI-10.0) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 10" Rigid Mineral Wool Insulation with 13" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-22 batts poly AB/VB 5/8" gypsum		R-66 (RSI-11.6) Fibre-cement board cladding 3/4" x 2.5" vertical strapping 12" Rigid Mineral Wool Insulation with 15" galvanized steel screws Self-adhered VP membrane 1/2" plywood sheathing 2x6 @ 16" o.c. w/ R-24 batts poly AB/VB 5/8" gypsum	
Interior partition walls	5/8" gypsum 2x4 at 16" o.c. 5/8" gypsum						
Below grade foundation walls	R-27 (RSI-4.8) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 4" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt	R-35 (RSI-6.2) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 6" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt		R-43 (RSI-7.6) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 8" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt		R-51 (RSI-9.0) Free draining gravel Geotextile Spray applied damp-proofing membrane 8" concrete 10" EPS taped joints 2x4 framing @16" o.c. w/ R-12 batt	
Floor insulation	R-34 (RSI-6.0) 6" concrete slab 10mil poly VB (radon barrier) 8" EPS 6" free draining gravel	R-38 (RSI-6.7) 6" concrete slab 10 mil poly VB (radon barrier) 9" EPS 6" free draining gravel		R-42 (RSI-7.4) 6" concrete slab 10 mil poly VB (radon barrier) 10" EPS 6" free draining gravel		R-50 (RSI-8.8) 6" concrete slab 10 mil poly VB (radon barrier) 12" EPS 6" free draining gravel	

[4] Ibid.

TABLE 2.6 INCREMENT 2 DETAILS – ULTRA LOW ENERGY BUILDING PERFORMANCE							
City	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Windows	U-0.17 (USI-1.0) Vinyl, triple pane, improved frame argon fill, 2 low-e coatings	U-0.15 (USI-0.9) Fiberglass, triple pane, argon fill, 2 low-e coatings, Passive House window				U-0.12 (USI-0.7) Insulated wood, Quad pane, Ar fill, 2 low-e coatings	
HRV	85% sensible heat recovery, with electric resistance preheat						
Space conditioning	Minisplit AC system					Gas-fired (98% AFUE)	
Water heater	Heat pump water heater (w internal electric resistance backup for cold weather)						

2 Costing

2.1 Single Family House Archetype

2.1.1 Cost of Construction

The cost to build the single family archetype in the seven Southern cities is shown in Table 3.1. Additional details are provided in Appendix B. Cost data has been normalized by gross floor area to fit with industry convention. The costing is broken down by element for each city and includes separate line items for construction costs and development costs. The Total Construction Cost includes all costs for material and labour to prepare the site and build the house as well as the contingencies, fees and taxes associated with the construction process. The Total Development Cost includes all soft costs associated with building including the consultant costs, marketing, permits and development fees, etc. The Total Project Cost is the sum of Total Construction Cost and Total Development Cost.

The Total Project Cost is shown in Figure 3.1 along with the breakdown between Total Construction Cost and Total Development Cost in each city. The highest project costs occur in Yellowknife ($255/ft^2, $2,744/m^2) and are 26% higher than in Montreal ($202/ft^2, $2,174/m^2).

The cost of constructing the single-family house archetype varies across the country. The cost to construct in the most expensive city (Yellowknife, $215/ft^2, $2,313/m^2) is approximately 25% greater than the least costly city (Montreal, $172/ft^2, $1,851/m^2). The range of construction costs is much smaller in the 5 more Southern cities ($172/ft^2 to $188/ft^2, $1,850/m^2 to $2,021/m^2) studied representing the smaller variation in larger urban centers. Building in the North is generally more expensive due to the higher material costs.

The development costs are also expected to be the lowest in Montreal $30.45/ft^2 ($328/m^2) and are highest in Toronto ($56.73/ft^2, $610/m^2). This results in the total project cost showing a similar variation as the construction costs.

TABLE 3.1 COST BREAKDOWN FOR SINGLE FAMILY ARCHETYPE CONSTRUCTION, $/FT² ($/M²)								
Code	Element	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A1	Substructure	$9.60 ($103)	$9.68 ($104)	$8.77 ($94)	$8.95 ($96)	$9.91 ($107)	$10.43 ($112)	$11.44 ($123)
A2	Structure	$25.45 ($274)	$26.67 ($287)	$23.66 ($255)	$24.93 ($268)	$26.38 ($284)	$26.51 ($285)	$30.45 ($328)
A3	Exterior Enclosure	$32.97 ($355)	$35.15 ($378)	$31.93 ($344)	$31.91 ($343)	$33.85 ($364)	$36.08 ($388)	$40.00 ($430)
B1	Partitions & Doors	$8.46 ($91)	$9.16 ($99)	$8.20 ($88)	$8.46 ($91)	$8.90 ($96)	$8.90 ($96)	$10.17 ($109)
B2	Finishes	$14.63 ($157)	$15.25 ($164)	$13.62 ($147)	$14.32 ($154)	$15.33 ($165)	$15.02 ($162)	$17.33 ($186)
B3	Fittings & Equipment	$7.16 ($77)	$7.32 ($79)	$6.87 ($74)	$6.9 ($74)	$7.24 ($78)	$7.5 ($81)	$7.76 ($83)
C1	Mechanical	$11.78 ($127)	$12.22 ($131)	$11.02 ($119)	$11.26 ($121)	$12.14 ($131)	$12.84 ($138)	$14.19 ($153)
C2	Electrical	$6.10 ($66)	$6.28 ($68)	$5.63 ($61)	$5.73 ($62)	$6.20 ($67)	$6.69 ($72)	$7.42 ($80)
D1	Site Work	$22.57 ($243)	$22.10 ($238)	$20.54 ($221)	$20.42 ($220)	$22.59 ($243)	$25.4 ($273)	$27.32 ($294)
Z1	General Requirements & Fees	$16.63 ($179)	$17.28 ($186)	$15.64 ($168)	$15.95 ($172)	$17.09 ($184)	$17.9 ($193)	$19.92 ($214)
Z2	Contingencies	$15.54 ($167)	$16.11 ($173)	$14.58 ($157)	$14.89 ($160)	$15.95 ($172)	$16.73 ($180)	$18.60 ($200)
Subtotal Construction		$170.87 ($1839)	$177.2 ($1907)	$160.47 ($1727)	$163.71 ($1762)	$175.59 ($1889)	$183.99 ($1980)	$204.59 ($2201)
Taxes		$8.53 ($92)	$10.64 ($114)	$12.84 ($138)	$8.20 ($88)	$8.77 ($94)	$9.21 ($99)	$10.22 ($110)
Total Construction		$179.4 ($1930)	$187.83 ($2021)	$173.31 ($1865)	$171.91 ($1850)	$184.36 ($1984)	$193.2 ($2079)	$214.81 ($2311)
Consultants		$11.67 ($126)	$12.22 ($131)	$11.26 ($121)	$11.18 ($120)	$11.98 ($129)	$12.56 ($135)	$13.96 ($150)
Development Management		$10.77 ($116)	$11.26 ($121)	$10.40 ($112)	$10.32 ($111)	$11.05 ($119)	$11.60 ($125)	$12.89 ($139)
Government Taxes & Levies		$7.44 ($80)	$23.87 ($257)	$1.40 ($15)	$0.34 ($4)	$5.24 ($56)	$2.23 ($24)	$2.62 ($28)
Marketing		$1.79 ($19)	$1.87 ($20)	$1.74 ($19)	$1.71 ($18)	$1.84 ($20)	$1.92 ($21)	$2.15 ($23)
Financing		$3.58 ($39)	$3.76 ($40)	$3.48 ($37)	$3.45 ($37)	$3.68 ($40)	$3.87 ($42)	$4.31 ($46)
Contingency		$3.58 ($39)	$3.76 ($40)	$3.48 ($37)	$3.45 ($37)	$3.68 ($40)	$3.87 ($42)	$4.31 ($46)
Total Development Costs		$38.83 ($418)	$56.73 ($610)	$31.75 ($342)	$30.45 ($328)	$37.48 ($403)	$36.03 ($388)	$40.23 ($433)
Total Project Costs		$218.24 ($2348)	$244.57 ($2632)	$205.06 ($2206)	$202.36 ($2177)	$221.84 ($2387)	$229.23 ($2467)	$255.05 ($2744)

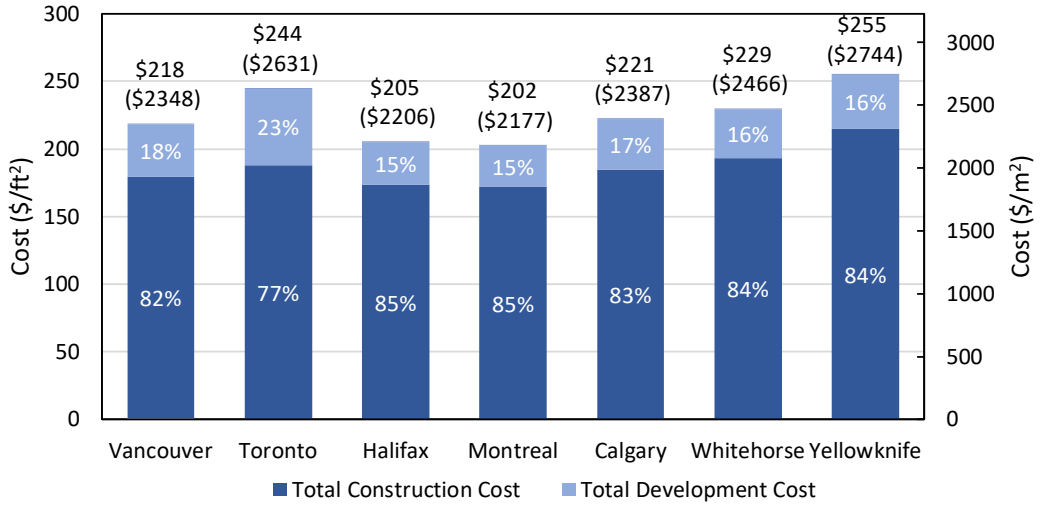

Figure 3.1 Comparison of Total Construction and Total Development Cost – Single Family House Archetype

The breakdown of components in the Subtotal Construction Costs (excluding taxes) are shown in Figure 3.2. The relative contribution of construction elements does not show a significant variation between different cities in this study even including Whitehorse and Yellowknife. This indicates that the cost premiums by location are fairly evenly distributed over the different construction cost elements. The largest contributors to the construction costs (excluding fees and contingencies) in all cities are the:

→ Exterior Enclosure (~20%)

→ Structure (~15%)

→ Site Work (~13%)

→ Finishes (~9%)

→ Mechanical (~7%)

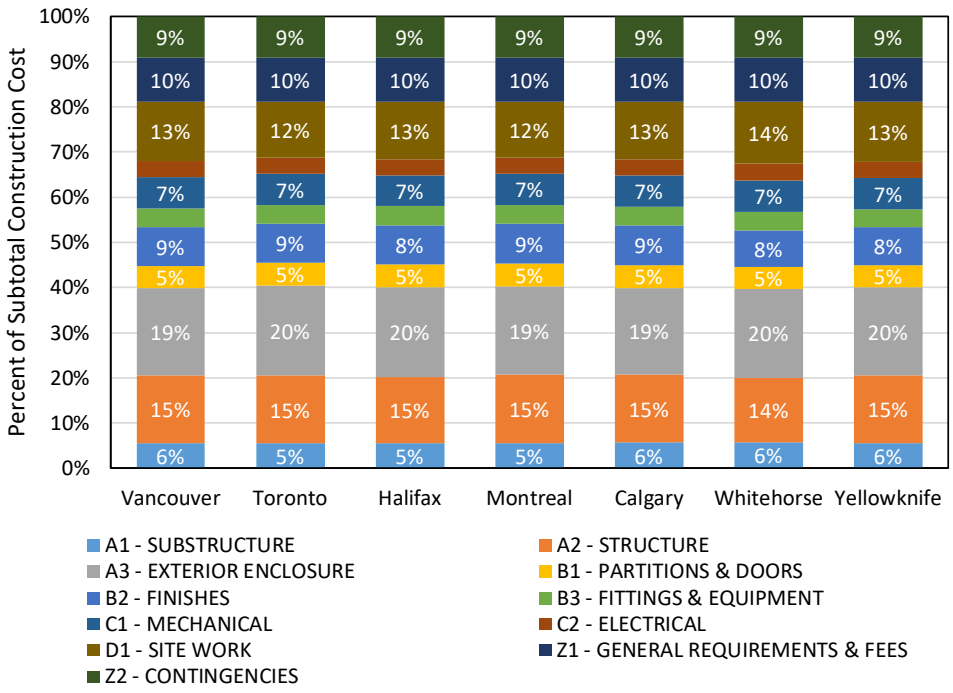

Figure 3.2 Percent of Subtotal Construction Costs by construction element

2.1.2 Impact of Energy Efficiency Requirements and Location

The differences in construction costs between cities can be further explored by comparing the incremental costs for the different elements compared to a baseline city. The baseline city selected for comparison was the metropolitan Vancouver area as it is in the climate zone with the least stringent energy efficiency requirements (with the exception of the City of Vancouver). The costing in this study was performed in a suburb of each representative city to reflect locations where new development is likely to occur. The variation in construction costs of the baseline design between different cities can be caused by the need for improved energy efficiency, as well as location specific variations in cost (i.e. labour and material cost differences). The incremental cost of each building element for the baseline design in each city relative to the corresponding construction cost for the baseline design in Vancouver is shown in Figure 3.3. The percentages indicated for each element is the increase over the total construction cost in Vancouver.

The costs for all construction elements is higher in Toronto than Vancouver except for the *Site Work* associated with construction (-$0.47/ft², -$5/m²). The largest incremental cost for Toronto compared to Vancouver is *Exterior Enclosure* elements. All construction elements are less expensive in both Halifax and Montreal compared to Vancouver. For both cities the greatest savings come from Site Development (-$2.02/ft² and -$2.15/ft², respectively). Construction costs are higher for all elements in Calgary with the largest change resulting from the Structure ($0.93/ft², $10/m²). The construction cost increments are greatest in the two Northern cities. The cost increases in Yellowknife are substantial with a number of elements costing over $1/ft² ($11/m²) more to construct compared to Vancouver. The greatest construction cost increase for these Northern cities compared to Vancouver was found to result from the Exterior Enclosure ($3.11/ft² and $7.03/ft² for Whitehorse and Yellowknife, respectively).

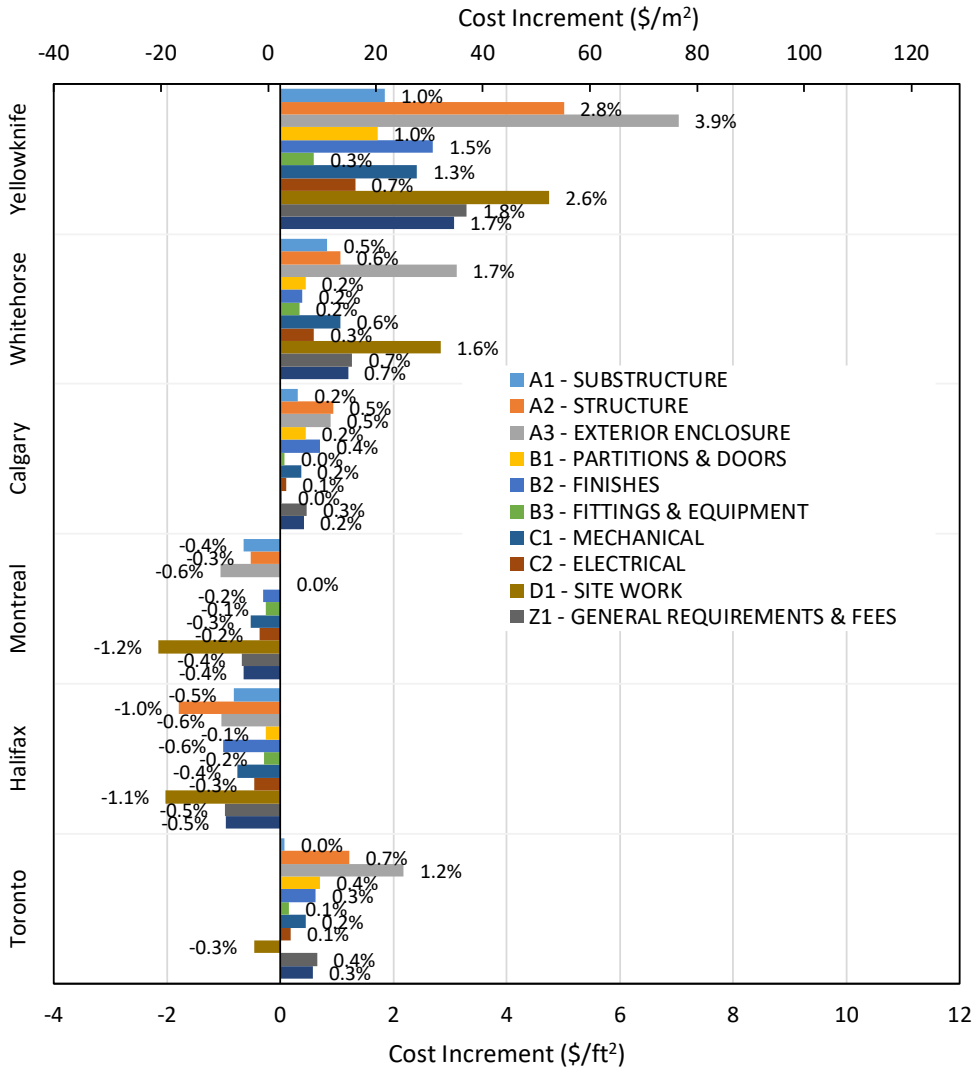

Figure 3.3 Cost increment of construction elements for baseline design in study cities compared to baseline design in Vancouver (Percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

The construction cost increases for each element to achieve compliance with different energy efficiency code requirements compared to Vancouver is shown in Figure 3.4. These increases are determined by comparing the difference in cost of the specific construction components specified for code requirements in Table 3.1. An example is the need for R-22 (RSI-4) batt in the above grade walls in Calgary compared to R-20 (RSI-3.5) batts in Vancouver. The cost difference was for R-22 (RSI-4) batts in Calgary compared to R-20 (RSI-3.5) batts in Vancouver and includes the cost difference due to location for that specific component but not the remainder of the assembly. The cost increases for the different energy efficiency code requirements between the cities is contained within the Exterior Enclosure elements (wall insulation, roof insulation, and window selection) and the Substructure element (below grade wall insulation). The different energy efficiency requirements have only a small impact on the cost differences between the cities. The increase in Southern cities (excluding Whitehorse and Yellowknife) ranges from $0.12/ft² ($1/m², 0.1%) to $0.67/ft² ($7/m², 0.4%).

The greatest increase occurs in Yellowknife where the construction elements impacted by energy efficiency requirements add $3.02/ft² ($32/m²) or 1.7% of the Total Construction Cost in Vancouver. A similarly large increase ($2.87/ft², $31/m²) is also found in Whitehorse. The differences in construction requirements are greatest between these Northern cities and Vancouver due to the climate zones. The construction cost increases for additional wall and roof insulation performance add only marginally to the costs in Whitehorse and Yellowknife; a maximum of $0.27/ft² ($3/m²) per element. The most significant driver in the cost difference results in the higher performance windows required. The window specified in Vancouver consist of a double pane, argon filled vinyl frame with one low-e coating. In contrast, the windows required in Whitehorse and Yellowknife are triple pane, argon filled vinyl frame with two low-e coatings. This results in an overall increase in cost of $2.34/ft² ($25/m²) and $2.39/ft² ($26/m²) (gross floor area) for the house in Whitehorse and Yellowknife, respectively. This cost premium is a result of a combination of higher cost for triple pane windows as well as generally higher costs for materials and labour in the North.

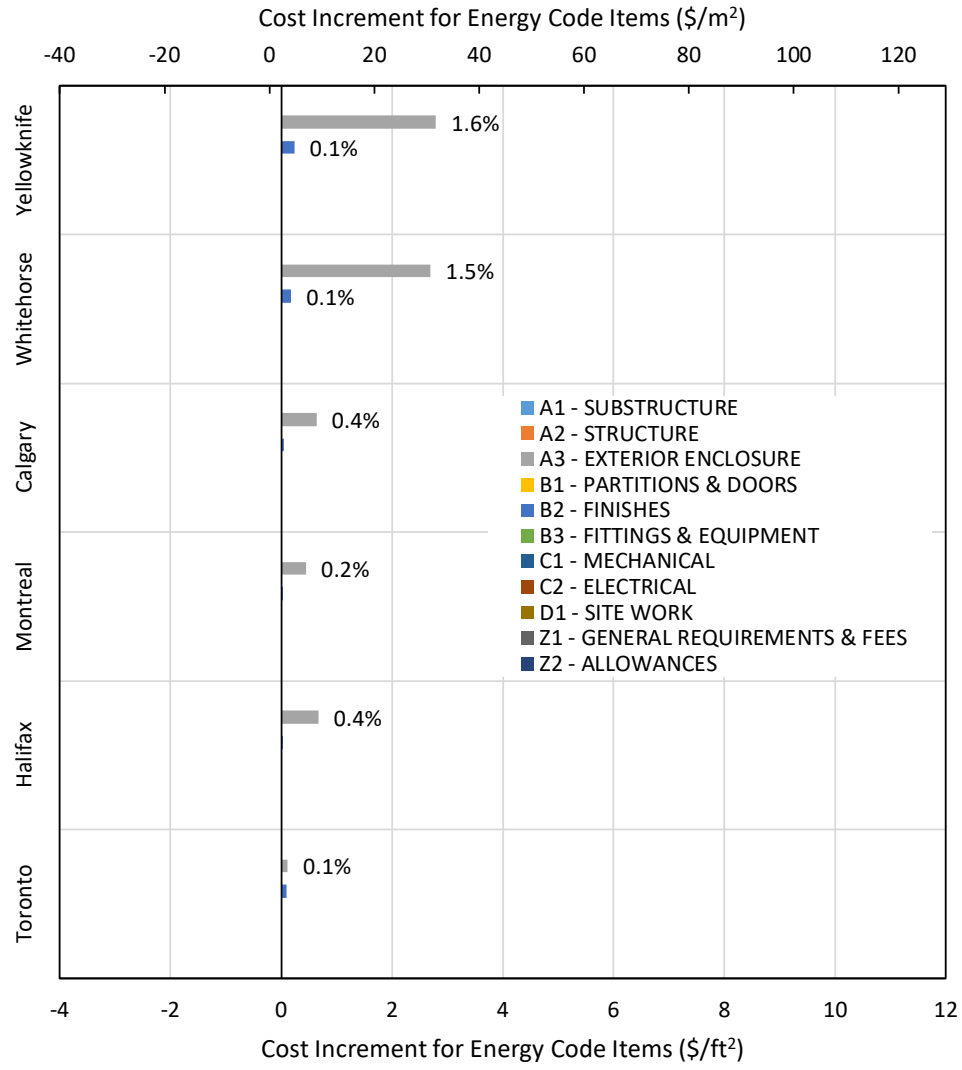

Figure 3.4 Cost increment of construction due to energy efficiency code requirements when building baseline design in study cities compared to Vancouver (Percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

The cost increment due to the locational differences excluding energy efficiency requirements compared to the baseline in Vancouver are shown in Figure 3.5. These differences are similar to those in Figure 3.3 as almost all of the cost difference to construct a single family house is a result of local pricing variations. This data would indicate that the energy efficiency requirement for different climate zones in Canada is not a dominant driver for variation in construction costs.

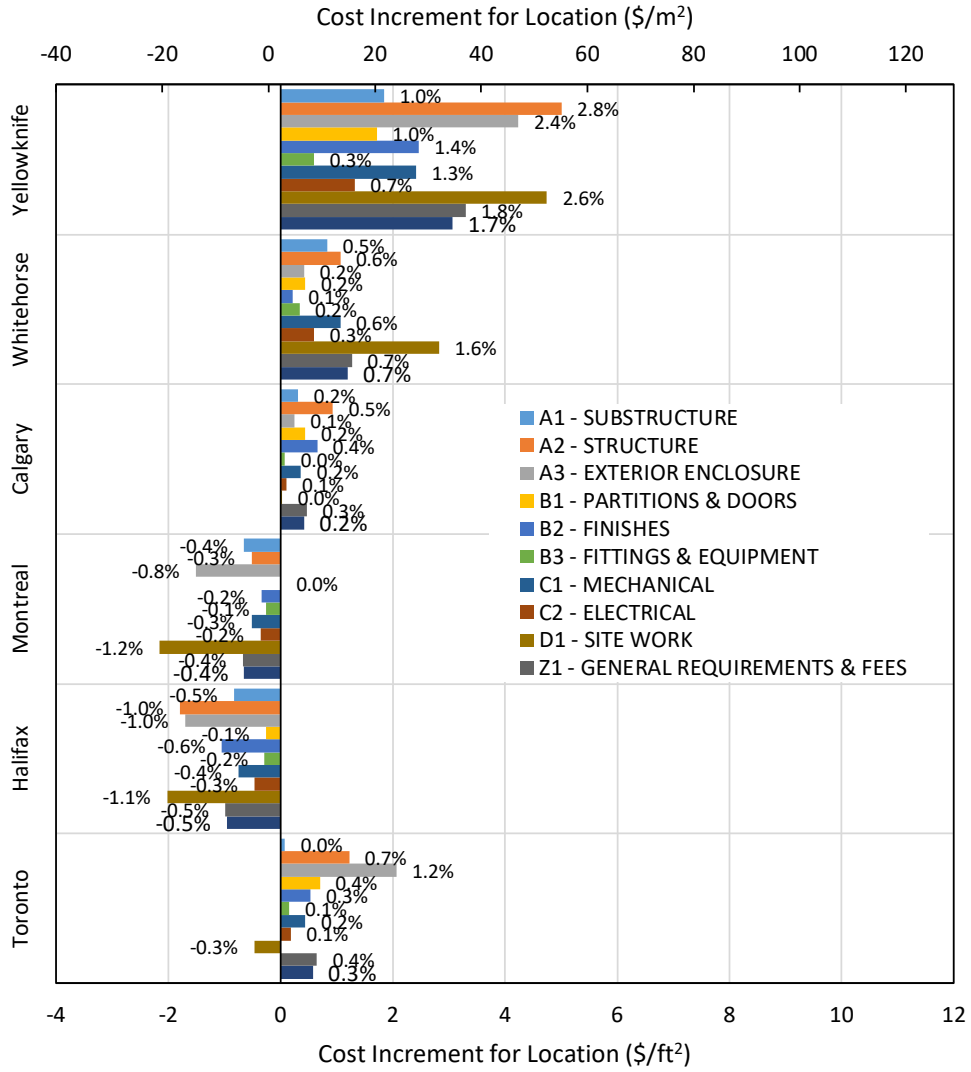

Figure 3.5 Cost increment of construction due to locational pricing changes when building to baseline design in other cities compared to baseline design in Vancouver (percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

2.1.3 Sensitivity Analysis

A sensitivity analysis was performed to determine the impact of changes in the costs of construction elements on the Total Project Cost. The cost of the 5 most high-cost construction elements (*Exterior Enclosure, Structure, Site Work, Finishes, Mechanical*) were varied by ±15% and the resulting change in Total Project Costs recorded.

Due to the relatively small contribution of any one construction element to the overall cost of delivering housing, changes of up to 15% do not have a substantial impact on

project costs. A 15% increase in the cost of the *Exterior Enclosure* element would change the Total Construction Cost from $172/ft² to $176/ft² ($1,850/m² to $1,890/m²) in Montreal and $215/ft² to $221/ft² ($2,311/m² to $2,376/m²) in Yellowknife. Changes of up to 15% on any construction cost element will result in at most a 3% change in the Total Project Cost. The results are similar for all cities in this study.

2.1.4 Impact of Incremental Changes to Baseline Design

The cost of additional incremental elements as alternatives to the building components were costed to determine the impact of variations to the building design. These increments were additions or substitutions to the baseline building design choices. The increments and resulting costs in each city are shown in Table 3.2. For increments that change the wall thickness, the approach taken was to maintain the same exterior building dimensions, and therefore gross floor area, and to reduce the interior space to account for the changing walls. Alternate approaches may be required on projects needing to maintain specific interior living area.

Of the alternate costing increments analyzed the greatest impact on construction cost would come from altering the cladding from fibre-cement lap siding to a brick veneer. The incremental cost for this change ranges from $12.04/ft² (130/m²) in Vancouver to $16.24/ft² ($175/m²) in Yellowknife. In contrast, changing the design to include insulated concrete forms for the below grade wall construction would result in a modest cost savings compared to the standard concrete construction of the baseline building.

Adding drainwater heat recovery, which has the potential to reduce the energy consumption of the building, would add costs of between $0.68/ft² to $0.91/ft² ($7/m² to $10/m²). Changing the domestic hot water system from tank type units to on demand units would add $0.15/ft² to $0.19/ft² ($1/m² to $2/m²). Adding solar PV ready components (including the inverters, switches, and other electrical components, excluding the panels and structure) would add between $1.22/ft² to $1.58/ft² ($13/m² to $17/m²).

TABLE 3.2 INCREMENTAL COST, $/FT² ($/M²) OF ALTERNATE DESIGN CHOICES – SINGLE FAMILY HOUSE ARCHETYPE

Increment	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Add solar PV ready equipment	$1.30 ($14)	$1.35 ($15)	$1.22 ($13)	$1.25 ($13)	$1.34 ($14)	$1.43 ($15)	$1.58 ($17)
Alternate cladding: brick veneer	$12.04 ($130)	$13.28 ($143)	$12.48 ($134)	$11.93 ($128)	$13.80 ($148)	$15.56 ($167)	$16.24 ($175)
Alternate foundation: insulated concrete forms	-$0.36 (-$4)	-$0.39 (-$4)	-$0.31 (-$3)	-$0.34 (-$4)	$-0.39 (-$4)	-$0.29 (-$3)	-$0.36 (-$4)
Add drain water heat recovery	$0.70 ($8)	$0.73 ($8)	$0.68 ($7)	$0.66 ($7)	$0.68 ($7)	$0.74 ($8)	$0.91 ($10)
Alternate water heater: on-demand	$0.16 ($2)	$0.16 ($2)	$0.15 ($2)	$0.15 ($2)	$0.16 ($2)	$0.17 ($2)	$0.19 ($2)

Constructing buildings with more energy efficient design features compared to code minimum requirements is expected to add a premium to the construction costs. The incremental energy performance bundles detailed in Section 2.4.2 were costed for the single-family house archetype. The results of the cost change for each applicable element

and the entire incremental cost premium are shown Table 3.3. A graphical representation of the cost change associated with the elements included in the increment bundles is provided in Figure 3.6 and Figure 3.7 for Increment 1 and Increment 2, respectively.

TABLE 3.3 COST INCREASE FOR PERFORMANCE INCREMENTS – SINGLE FAMILY HOUSE ARCHETYPE, $/FT² ($/M²), % OF TOTAL CONSTRUCTION COST

	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Roof Insulation							
Increment 1	$0.35 ($4)	$0.37 ($4)	$0.33 ($4)	$0.43 ($5)	$0.44 ($5)	$0.51 ($5)	$0.58 ($6)
	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Increment 2	$0.43 ($5)	$0.50 ($5)	$0.44 ($5)	$0.56 ($6)	$0.58 ($6)	$0.65 ($7)	$0.74 ($8)
	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%
Above Grade Wall Insulation							
Increment 1	$3.50 ($38)	$4.80 ($52)	$4.21 ($45)	$4.32 ($46)	$4.54 ($49)	$5.73 ($62)	$6.35 ($68)
	2.0%	2.7%	2.6%	2.6%	2.6%	3.1%	3.1%
Increment 2	$5.04 ($54)	$7.48 ($80)	$6.56 ($71)	$6.82 ($73)	$7.15 ($77)	$8.44 ($91)	$9.32 ($100)
	2.9%	4.2%	4.1%	4.2%	4.1%	4.6%	4.6%
Below Grade Wall Insulation							
Increment 1	$0.09 ($1)	$0.29 ($3)	$0.13 ($1)	$0.50 ($5)	$0.53 ($6)	$0.70 ($8)	$0.76 ($8)
	0.1%	0.2%	0.1%	0.3%	0.3%	0.4%	0.4%
Increment 2	$0.55 ($6)	$0.98 ($11)	$0.73 ($8)	$1.46 ($16)	$1.54 ($17)	$1.93 ($21)	$2.12 ($23)
	0.3%	0.6%	0.5%	0.9%	0.9%	1.0%	1.0%
Slab Insulation							
Increment 1	$0.52 ($6)	$0.85 ($9)	$0.74 ($8)	$1.14 ($12)	$1.21 ($13)	$1.58 ($17)	$1.74 ($19)
	0.3%	0.5%	0.5%	0.7%	0.7%	0.9%	0.9%
Increment 2	$1.39 ($15)	$1.60 ($17)	$1.40 ($15)	$1.79 ($19)	$1.90 ($20)	$2.33 ($25)	$2.57 ($28)
	0.8%	0.9%	0.9%	1.1%	1.1%	1.3%	1.3%
Window Performance							
Increment 1	$0.41 ($4)	$1.12 ($12)	$0.74 ($8)	$1.05 ($11)	$1.09 ($12)	$0.25 ($3)	$0.25 ($3)
	0.2%	0.6%	0.5%	0.6%	0.6%	0.1%	0.1%
Increment 2	$1.43 ($15)	$3.33 ($36)	$2.28 ($25)	$2.62 ($28)	$2.70 ($29)	$3.66 ($39)	$3.63 ($39)
	0.8%	1.9%	1.4%	1.6%	1.5%	2.0%	1.8%
Ventilation							
Increment 1	$0.39 ($4)	$0.40 ($4)	$0.37 ($4)	$0.37 ($4)	$0.4 ($4)	$0.43 ($5)	$0.47 ($5)
	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%

TABLE 3.3 COST INCREASE FOR PERFORMANCE INCREMENTS – SINGLE FAMILY HOUSE ARCHETYPE, $/FT² ($/M²), % OF TOTAL CONSTRUCTION COST							
Increment 2	$0.39 ($4)	$0.40 ($4)	$0.37 ($4)	$0.37 ($4)	$0.40 ($4)	$0.43 ($5)	$0.47 ($5)
	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Heating and Cooling							
Increment 1	$0.08 ($1)	-$0.05 (-$1)	-$0.10 (-$1)	$0.07 ($1)	$0.19 ($2)	-$0.17 (-$2)	-$0.19 (-$2)
	0.00%	0.00%	-0.10%	0.00%	0.10%	-0.10%	-0.10%
Increment 2	$0.16 ($2)	$0.09 ($1)	$0.02 ($0)	$0.21 ($2)	$0.23 ($2)	$0.24 ($3)	$0.27 ($3)
	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
Domestic Water Heater							
Increment 1	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Increment 2	$0.17 ($2)	$0.18 ($2)	$0.16 ($2)	$0.16 ($2)	$0.17 ($2)	$0.19 ($2)	$0.21 ($2)
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
TOTAL INCREMENT 1	$5.34 ($57)	$7.79 ($84)	$6.42 ($69)	$7.89 ($85)	$8.41 ($90)	$9.03 ($97)	$9.98 ($107)
	3.0%	4.1%	3.7%	4.6%	4.6%	4.7%	4.6%
TOTAL INCREMENT 2	$9.54 ($103)	$14.55 ($157)	$11.96 ($129)	$14.00 ($151)	$14.68 ($158)	$17.86 ($192)	$19.32 ($208)
	5.3%	7.7%	6.9%	8.1%	8.0%	9.2%	9.0%

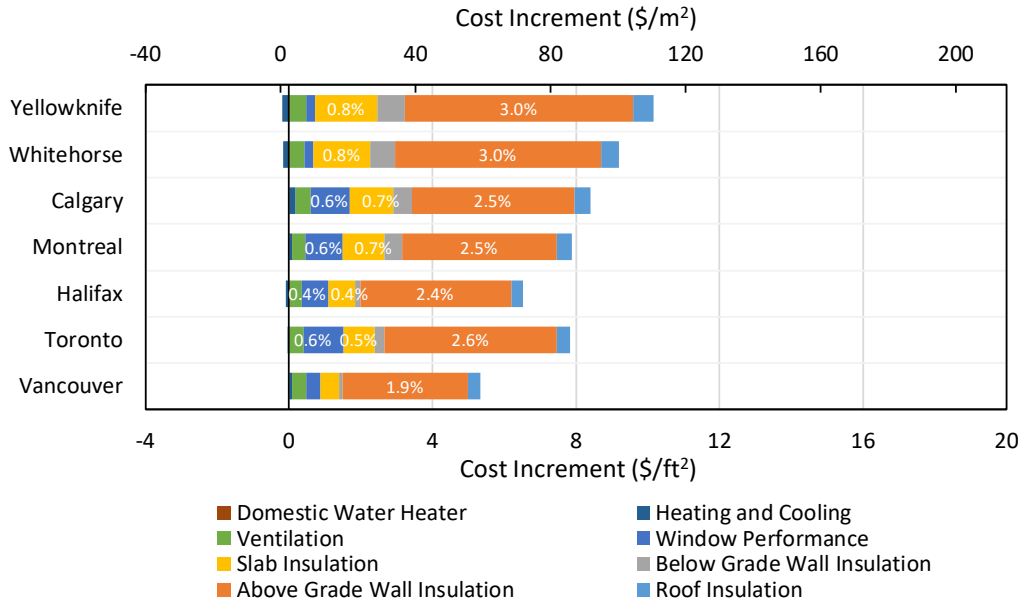

Figure 3.6 Incremental cost increase of the single family house archetype for elements in Increment 1 (percentage values for each element refer to % increase over Total Construction Cost)

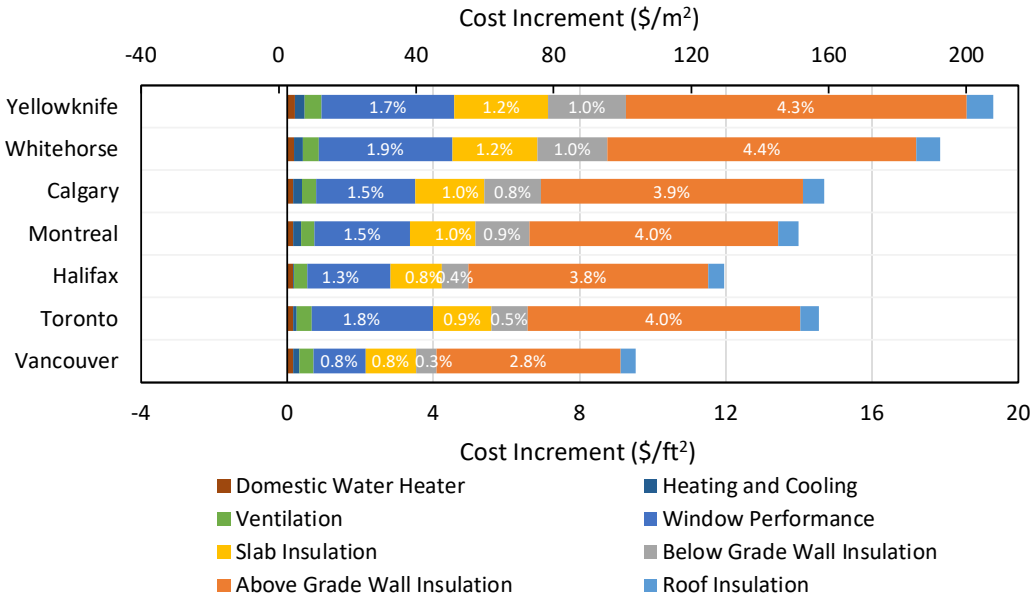

Figure 3.7 Incremental cost increase for elements in Increment 2 (percentage values for each element refer to % increase over Total Construction Cost)

Increment 2 represents insulation performance that is in line with low energy building targets, such as EnerPHit, and would represent a high-performance house at the high end of potential step codes. The cost premium for Increment 2 over the baseline building varies between $9.54/ft² ($103/m²) in Vancouver to $19.32/ft² ($208/m²) in Yellowknife. The cost premium as a percent of the Net Construction Cost in each city varies from a low of 6.1% (Vancouver) to a high of 10.7% (Yellowknife). The increase as a percent of the total construction cost is lower with a variation from 5.6% (Vancouver) to 9.1% (Whitehorse).

The largest contributor to the increases in cost are associated with the addition of insulation to the above grade walls (rigid exterior insulation). An illustration of the change in wall construction between the baseline, Increment 1, and Increment 2 is shown in Figure 3.8. The addition of exterior insulation accounts for approximately 50% of the total increment. Although the thickness of exterior insulation varies with city to account for different climate zones the costs are all in the range of $5.00/ft² to $9.30/ft² ($54/m² to $100/m²). The cost increases for Yellowknife and Whitehorse are a result of both a premium on the construction cost and a requirement for greater insulation thicknesses.

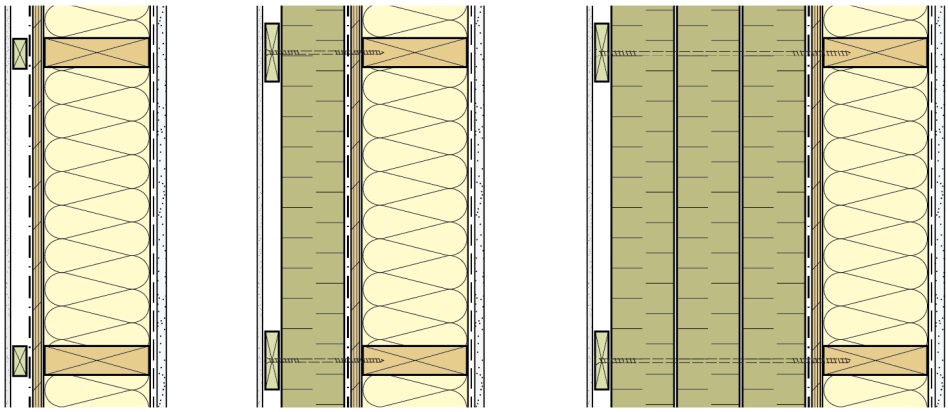

Figure 3.8 Illustration of the change in wall construction from the baseline 2x6 construction (left) to the additon (middle) and subsequent increase (right) of exterior insulation

The other envelope components also add to the cost of the bundle, though typically as a smaller fraction. The improved window performance adds costs to Increment 2 between $1.43/ft² to $3.66/ft² ($15/m² to $39/m²). The improvement in the building envelope performance can allow for a modest reduction in the size of the heating and cooling system but cost savings are offset in this example by the inclusion of higher performance equipment such as heat pumps in the place of furnaces.

Increment 1 represents an intermediate performance target between the baseline and Increment 2. The cost premium for Increment 1 over the baseline building varies between $5.34/ft² ($57/m²) in Vancouver to $9.98/ft² ($107/m²) in Yellowknife. The increase as a percent of Net Construction Cost ranges from 3.4% (Vancouver) to 5.4% (Whitehorse).

Similar to the results for Increment 2, the largest contributor to the increases in cost for Increment 1 is associated with the addition of exterior insulation to the above grade walls. The exterior insulation adds in the range of $3.50/ft² to $6.35/ft² ($38/m² to $68/m²) to the cost of the base building. The other elements provide smaller contributions due to the marginal increases over baseline performance. Examples include the increased premium for window performance between $0.25/ft² to $1.12/ft² ($3/m² to $12/m²) whereas the addition of insulation below the slab adds between $0.52/ft² to $1.74/ft² ($6/m² to $19/m²). The improved envelope performance in Increment 1 allows for a reduction in the heating and cooling system size (though of a smaller impact than seen in Increment 2). Some cities show a modest savings for heating and cooling but in others the cost is offset by the price premium associated with changing to a higher efficiency furnace.

2.2 Townhouse Archetype

2.2.1 Cost of Construction

The cost to build the townhouse archetype in the seven Southern cities is shown in Table 3.4. Additional details are provided in Appendix C. The costing is broken down by element for each city and includes separate line items for construction costs and development costs. The Total Construction Cost includes all costs for material and labour to prepare the site and build the townhouses as well as the contingencies, fees and taxes associated with the construction process. The Total Development Cost includes all soft costs associated with building including the consultant costs, marketing, permits and development fees, etc. The Total Project Cost is the sum of Total Construction Cost and Total Development Cost.

The Total Project Cost is shown in Figure 3.9 along with the breakdown between Total Construction Cost and Total Development Cost in each city. The highest project costs occur in Yellowknife ($268/ft^2, $2,884/m^2) and are 25% higher than in Montreal ($214/ft^2, $2,303/m^2).

The highest construction costs for the townhouse archetype are in Yellowknife ($226/ft^2, $2,432/m^2). This is 24% greater than the least costly city (Montreal, $182/ft^2, $1,958/m^2). As with the single-family house archetype, the construction costs are lower and the variation smaller in the 5 more Southern cities studied compared to the construction costs in Whitehorse and Yellowknife. The normalized construction costs for the townhouse archetype in this work are greater than for the single family house archetype. This is contrary to typical beliefs from the industry which estimate wood framed townhouses to be less expensive to construct on an area normalized basis. In this case the townhouse costs are only marginally higher and result from differences in design considerations between the archetypes including different roof and structure designs, and the basement being unfinished in the single family house but finished in the townhouse.

The development costs are also expected to be the lowest in Montreal ($32/ft^2, $344/m^2) and are highest in Toronto ($67/ft^2, $721/m^2). The development costs in Toronto are also significantly higher than in all other cities with the nearest costs being $42/ft^2 ($452/m^2) in Yellowknife. This difference in development costs for Toronto results in it having higher Total Project Costs ($266/ft^2, $2,862/m^2) than Whitehorse ($241/ft^2, $2,593/m^2) and slightly lower than Yellowknife ($268/ft^2, $2,884/m^2).

TABLE 3.4 COST BREAKDOWN FOR THE TOWNHOUSE ARCHETYPE CONSTRUCTION, $/FT² ($/M²)								
Code	Element	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A1	Substructure	$10.25 ($110)	$10.51 ($113)	$9.36 ($101)	$9.66 ($104)	$10.67 ($115)	$10.69 ($115)	$11.96 ($129)
A2	Structure	$24.68 ($266)	$25.94 ($279)	$22.89 ($246)	$24.08 ($259)	$25.55 ($275)	$25.98 ($280)	$29.94 ($322)
A3	Exterior Enclosure	$31.38 ($338)	$33.34 ($359)	$30.6 ($329)	$30.32 ($326)	$32.05 ($345)	$35.09 ($378)	$38.34 ($413)
B1	Partitions & Doors	$16.34 ($176)	$17.72 ($191)	$15.98 ($172)	$16.16 ($174)	$17.3 ($186)	$17.86 ($192)	$20.03 ($216)
B2	Finishes	$13.20 ($142)	$13.47 ($145)	$12.13 ($131)	$12.79 ($138)	$13.84 ($149)	$13.07 ($141)	$15.07 ($162)
B3	Fittings & Equipment	$8.72 ($94)	$8.89 ($96)	$8.39 ($90)	$8.40 ($90)	$8.88 ($96)	$9.12 ($98)	$9.43 ($101)
C1	Mechanical	$21.65 ($233)	$22.97 ($247)	$20.28 ($218)	$21.33 ($230)	$23.04 ($248)	$23.66 ($255)	$26.19 ($282)
C2	Electrical	$6.88 ($74)	$7.11 ($77)	$6.52 ($70)	$6.66 ($72)	$7.04 ($76)	$7.5 ($81)	$8.28 ($89)
D1	Site Work	$12.59 ($135)	$12.34 ($133)	$11.41 ($123)	$11.41 ($123)	$12.63 ($136)	$13.94 ($150)	$15.1 ($162)
Z1	General Requirements & Fees	$17.48 ($188)	$18.26 ($196)	$16.51 ($178)	$16.89 ($182)	$18.11 ($195)	$18.83 ($203)	$20.92 ($225)
Z2	Contingencies	$16.32 ($176)	$17.06 ($184)	$15.41 ($166)	$15.77 ($170)	$16.92 ($182)	$17.58 ($189)	$19.52 ($210)
Subtotal Construction		$179.48 ($1931)	$187.62 ($2019)	$169.47 ($1823)	$173.47 ($1867)	$186.03 ($2002)	$193.31 ($2080)	$214.79 ($2311)
Taxes		$8.98 ($97)	$11.25 ($121)	$13.55 ($146)	$8.68 ($93)	$9.30 ($100)	$9.66 ($104)	$10.74 ($116)
Total Construction		$188.46 ($2028)	$198.87 ($2140)	$183.03 ($1969)	$182.14 ($1960)	$195.32 ($2102)	$202.97 ($2184)	$225.53 ($2427)
Consultants		$12.25 ($132)	$12.92 ($139)	$11.90 ($128)	$11.84 ($127)	$12.69 ($137)	$13.19 ($142)	$14.66 ($158)
Development Management		$11.31 ($122)	$11.93 ($128)	$10.98 ($118)	$10.93 ($118)	$11.72 ($126)	$12.18 ($131)	$13.53 ($146)
Government Taxes & Levies		$12.40 ($133)	$32.33 ($348)	$2.76 ($30)	$0.24 ($3)	$5.65 ($61)	$2.96 ($32)	$2.72 ($29)
Marketing		$1.88 ($20)	$1.99 ($21)	$1.84 ($20)	$1.82 ($20)	$1.96 ($21)	$2.03 ($22)	$2.26 ($24)
Financing		$3.77 ($41)	$3.98 ($43)	$3.66 ($39)	$3.65 ($39)	$3.90 ($42)	$4.06 ($44)	$4.51 ($49)
Contingency		$3.77 ($41)	$3.98 ($43)	$3.66 ($39)	$3.65 ($39)	$3.90 ($42)	$4.06 ($44)	$4.51 ($49)
Total Development Costs		$45.38 ($488)	$67.13 ($722)	$34.79 ($374)	$32.14 ($346)	$39.82 ($428)	$38.48 ($414)	$42.19 ($454)
Total Project Costs		$233.84 ($2516)	$266.00 ($2862)	$217.82 ($2344)	$214.28 ($2306)	$235.15 ($2530)	$241.46 ($2598)	$267.72 ($2881)

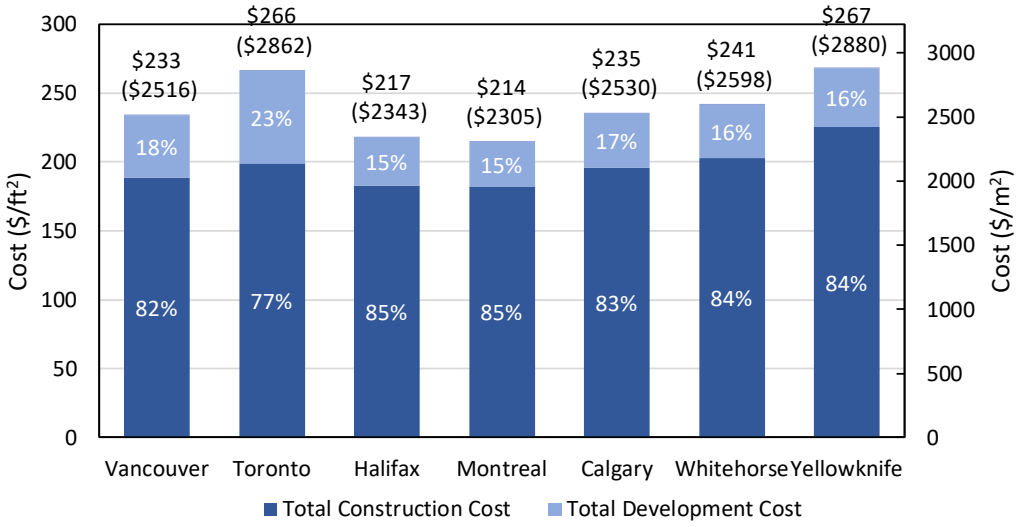

Figure 3.9 Comparison of Total Construction and Total Development Cost – townhouse archetype

The breakdown of components in the Subtotal Construction Costs (excluding taxes) are shown in Figure 3.2. The relative contribution of construction elements does not show a significant variation between different cities in this study even including Whitehorse and Yellowknife. The largest contributors to the construction costs (excluding fees and contingencies) in all cities are the:

- → Exterior Enclosure (~18%)
- → Structure (~14%)
- → Mechanical (~12%)
- → Partitions & Doors (~9%)
- → Site Work (~7%)

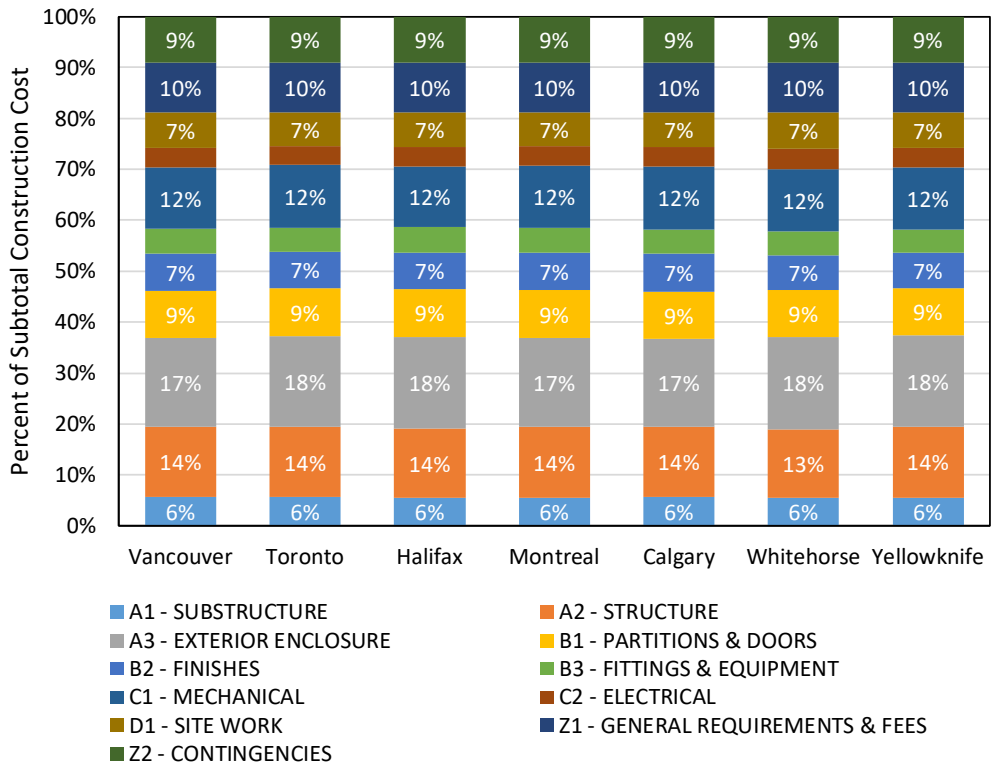

Figure 3.10 Percent of Subtotal Construction Costs by construction element for the townhouse archetype

The distribution of construction costs for the townhouse archetype shows some key changes compared to the single-family archetype. The most significant change was in the increase in contribution from the *Mechanical System* from 7% in the single-family house archetype to 12% in the townhouse archetype. This results from each dwelling unit in the townhouse requiring similar equipment within a smaller footprint. The percentage of construction costs from *Partitions & Doors* also showed a significant increase from 5% in the single-family house archetype to 9% in the townhouse archetype. The element that lost the greatest contributing share was the *Site Work* due to the reduced excavation requirements. Another element that saw a reduction in contribution to the project costs was the *Exterior Enclosure* (20% to 18%). This is a result of the reduction in wall area in the townhouse due to shared walls between suites.

2.2.2 Impact of Energy Efficiency Requirements and Location

The differences in construction costs between cities was further explored by comparing the incremental costs for the different elements against costs in Vancouver. The variation in construction costs between different cities can be caused by the need for improved energy efficiency as well as location specific variations in cost (i.e. labour and material cost differences). The incremental cost of each building element for the baseline design in each city relative to the corresponding construction cost for the baseline design in Vancouver is shown in in Figure 3.11. The percentages indicated for each element represent the percent increase over the Total Construction Cost in Vancouver.

The construction cost increments for the townhouse archetype show similar trends to those discussed for the single-family house. The costs for all construction elements are

higher in Toronto than Vancouver except for the *Site Work* associated with construction (-$0.25/ft², -$3/m²). The largest incremental cost for construction of the townhouse archetype in Toronto compared to Vancouver is for the *Exterior Enclosure* elements. All construction elements are less expensive in both Halifax and Montreal compared to Vancouver. In Montreal, the greatest savings occurs for the *Exterior Enclosure* due to cost reductions for constructing the *Above Grade Walls*. In Halifax, the greatest savings compared to Vancouver was found to be in the *Structure* of the building (-$1.79/ft², -$19/m²). Construction costs are higher for all elements in Calgary with the largest change resulting from the increased costs of the *Mechanical* components ($1.39/ft², $15/m²). This is a result of requiring larger equipment compared to Vancouver and general cost premiums on mechanical components. Contrary to the single-family house archetype, there is one construction element with lower cost in Whitehorse than in Vancouver. The *Finishes* of the townhouse archetype were found to cost $0.13/ft² ($1/m²) less in Whitehorse than in Vancouver. This is primarily due to lower costs to provide *Wall Finishes*. Construction costs for all elements were higher in Yellowknife than in in Vancouver with the greatest increase coming from *Exterior Enclosure* ($6.97/ft², $75/m²).

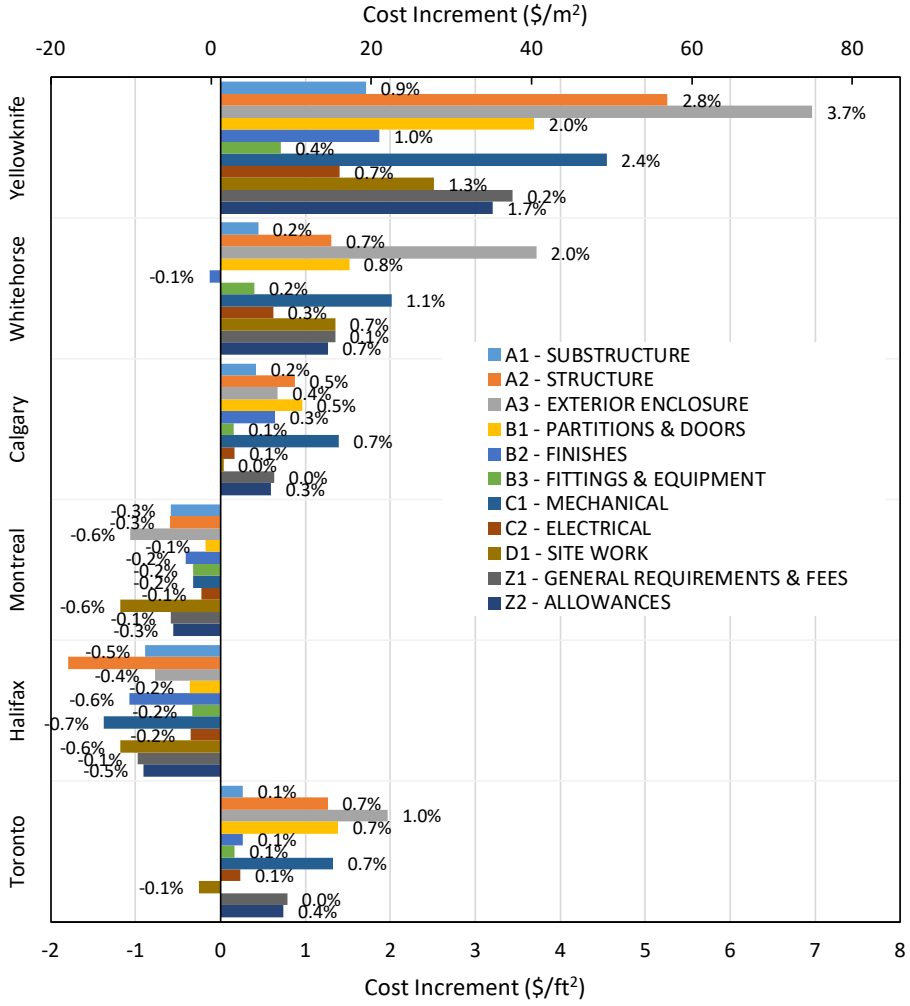

Figure 3.11 Cost increment of construction elements for baseline design in study cities compared to baseline design in Vancouver (percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

The construction cost increases for each element in the townhouse to achieve compliance with different energy efficiency code requirements compared to Vancouver is shown in Figure 3.12. These increases are determined by comparing the difference in cost of the specific construction components specified for code requirements in Table 3.1. An example is the need for R-22 (RSI-4) batt in the above grade walls in Calgary compared to R-20 (RSI-3.5) batts in Vancouver. The cost difference was for R-22 (RSI-3.5) batts in Calgary compared to R-20 (RSI-3.5) batts in Vancouver, and includes the cost difference due to location for that specific component but not the remainder of the assembly. The cost increases for the different energy efficiency code requirements between the cities is contained within the *Exterior Enclosure* elements (wall insulation, roof insulation, and window selection) and the *Structure* element (roof insulation). The increase in cost of roof insulation due to code requirements is only applicable in Whitehorse and Yellowknife and even there is of marginal impact. The energy efficiency requirements of the *Exterior Enclosure* have only a small impact on the cost differences between the cities. The greatest increase occurs in Yellowknife where the construction elements impacted by energy efficiency requirements add $2.50/ft^2 ($27/m^2) or 1.3% of the Total Construction Cost in Vancouver. The increase in Southern cities (excluding Whitehorse and Yellowknife) ranges from $0.08/ft^2 ($1/m^2, 0.04%) in Toronto to $0.57/ft^2 ($6/m^2, 0.3%) in Halifax.

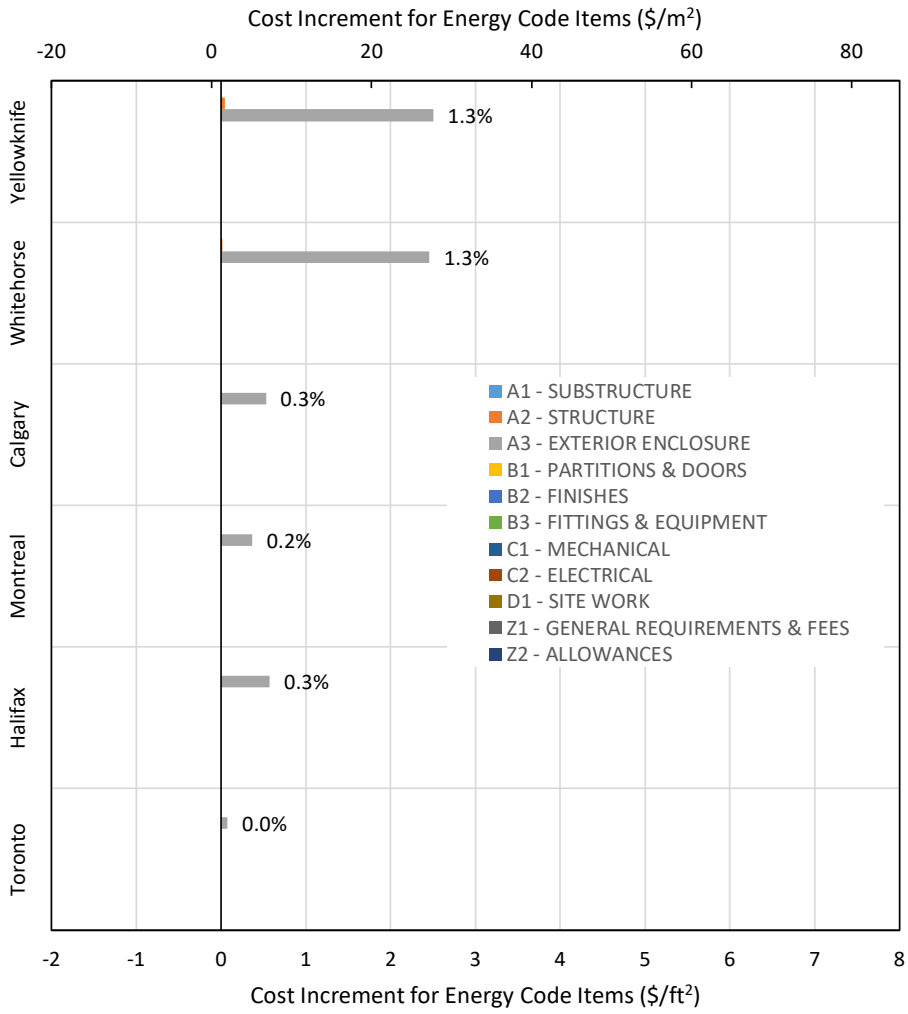

Figure 3.12 Cost increment of construction due to energy efficiency code requirements when building to baseline design in study cities compared to Vancouver (percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

The cost increment due to the locational differences excluding energy efficiency requirements compared to the baseline in Vancouver are shown in Figure 3.13. These differences are similar to those in Figure 3.11 as almost all of the cost difference to construct a townhouse is a result of local pricing variations not energy efficiency requirements. These results are similar to the single family house archetype in that they show the primary driver of cost differences between locations in Canada is not the energy efficiency requirement.

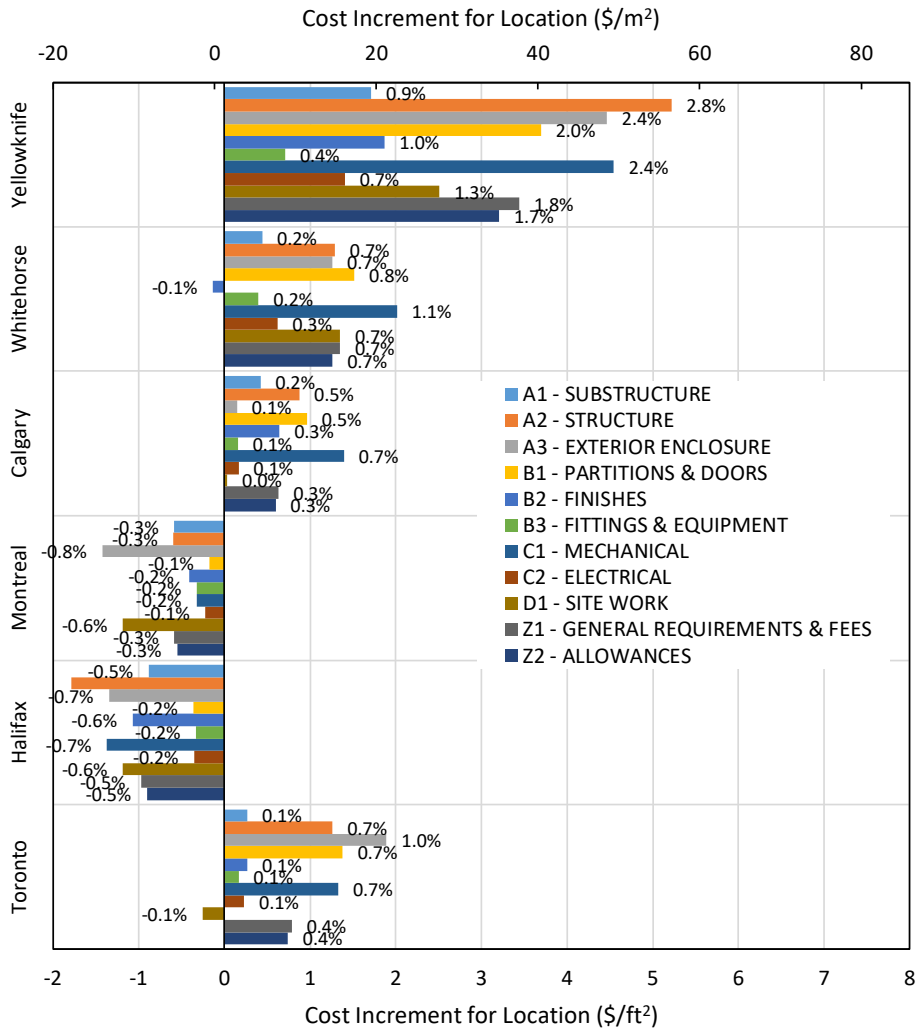

Figure 3.13 Cost increment of construction due to locational pricing changes when building to baseline design in other cities compared to baseline design in Vancouver (percentage values for each element refer to % increase over Total Construction Cost in Vancouver)

2.2.3 Sensitivity Analysis

A sensitivity analysis was performed to determine the impact of changes in the costs of construction elements on the Total Project Cost for the townhouse archetype. The elements varied were chosen to match those from the single-family house archetype; *Exterior Enclosure, Structure, Site Work, Finishes, Mechanical*. The costs of all components in these elements were varied by ±15% and the resulting change in Total Project Costs recorded.

Due to the relatively small contribution of any one construction element to the overall cost of delivering housing, changes of up to 15% do not have a substantial impact on project costs. A 15% increase in the cost of *the Exterior Enclosure* element would change the Total Construction Cost from $182/ft² to $187/ft² ($1,960/m² to $2,009/m²) in Montreal and $226/ft² to $231/ft² ($2,427/m² to 2,489/m²) in Yellowknife. Changes of up to 15% on any construction cost element will result in at most a 3% change in the Total Project Cost. The results are similar for all cities in this study.

2.2.4 Impact of Incremental Changes to Baseline Design

The cost of additional incremental elements as alternatives to the building components were costed to determine the impact of variations to the building design. These increments were additions or substitutions to the baseline building design choices. The increments and resulting costs in each city are shown in Table 3.2. Alternate approaches may be required on projects needing to maintain specific interior living area.

Of the alternate costing increments analyzed, the greatest impact on construction cost would come from altering the cladding from fiber-cement lap siding to a brick veneer. The incremental cost for this change ranges from $9.78/ft² ($105/m²) in Vancouver to $13.26/ft² ($143/m²) in Yellowknife. In contrast, changing the design to include insulated concrete forms for the below grade wall construction would result in a cost savings compared to the standard concrete construction of the baseline building.

Adding drainwater heat recovery, which has the potential to reduce the energy consumption of the building, would add costs of between $1.48/ft² to $2.05/ft² ($16/m² to $22/m²). Changing the domestic hot water system from tank type units to on-demand type would add $0.31/ft² to $0.40/ft² ($3/m² to $4/m²). Adding solar PV ready components (including the inverters, switches, and other electrical components, excluding PV panels and structure) would add between $2.38/ft² to $3.10/ft² ($26/m² to $33/m²). The cost increment for providing these modifications is higher than for the corresponding increments in the single family house archetype because of the need to provide additional components for each of the dwelling units which have a smaller floor area than in the single family house.

TABLE 3.5 INCREMENTAL COST, $/FT² ($/M²), OF ALTERNATE DESIGN CHOICES – TOWNHOUSE ARCHETYPE

Increment	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Add solar PV ready equipment	$2.54 ($27)	$2.64 ($28)	$2.38 ($26)	$2.44 ($26)	$2.62 ($28)	$2.80 ($30)	$3.10 ($33)
Alternate cladding: Brick veneer	$9.78 ($105)	$10.81 ($116)	$10.17 ($109)	$9.72 ($105)	$11.22 ($121)	$12.73 ($137)	$13.26 ($143)
Alternate foundation: insulated concrete forms	-$1.65 (-$18)	-$1.78 (-$19)	-$1.49 (-$16)	-$1.56 (-$17)	-$1.72 (-$19)	-$1.37 (-$15)	-$1.70 (-$18)
Add drain water heat recovery	$1.59 ($17)	$1.65 ($18)	$1.55 ($17)	$1.48 ($16)	$1.53 ($16)	$1.68 ($18)	$2.05 ($22)
Alternate water heater: On-demand	$0.33 ($4)	$0.34 ($4)	$0.31 ($3)	$0.32 ($3)	$0.34 ($4)	$0.36 ($4)	$0.4 ($4)

The incremental energy performance bundles detailed in Section 2.4.2 were costed for the townhouse archetype to determine the cost premium of energy efficient design. The results of the cost change for each applicable element and the entire incremental cost premium are shown Table 3.6. A graphical representation of the cost change associated with the elements included in the increment bundles is provided in Figure 3.14 and Figure 3.15 for Increment 1 and Increment 2, respectively.

TABLE 3.6 COST INCREASE FOR PERFORMANCE INCREMENTS – TOWNHOUSE ARCHETYPE $/FT², ($/M²), % OF TOTAL CONSTRUCTION COST							
	Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
Roof Insulation							
Increment 1	$1.35 ($15)	$1.61 ($17)	$1.41 ($15)	$1.52 ($16)	$1.59 ($17)	$3.07 ($33)	$3.42 ($37)
	0.8%	0.9%	0.8%	0.9%	0.9%	1.6%	1.6%
Increment 2	$2.70 ($29)	$3.73 ($40)	$3.26 ($35)	$3.99 ($43)	$4.19 ($45)	$5.91 ($64)	$6.51 ($70)
	1.5%	2.0%	1.9%	2.3%	2.2%	3.1%	3.0%
Above Grade Wall Insulation							
Increment 1	$2.37 ($26)	$3.23 ($35)	$2.66 ($29)	$2.91 ($31)	$3.06 ($33)	$3.86 ($42)	$4.27 ($46)
	1.3%	1.7%	1.6%	1.7%	1.6%	2.0%	2.0%
Increment 2	$3.57 ($38)	$5.20 ($56)	$4.40 ($47)	$4.74 ($51)	$4.98 ($54)	$5.86 ($63)	$6.47 ($70)
	2.0%	2.8%	2.6%	2.7%	2.7%	3.0%	3.0%
Below Grade Wall Insulation							
Increment 1	$0.04 ($0)	$0.14 ($2)	$0.06 ($1)	$0.23 ($2)	$0.25 ($3)	$0.33 ($4)	$0.36 ($4)
	0.0%	0.1%	0.0%	0.1%	0.1%	0.2%	0.2%
Increment 2	$0.26 ($3)	$0.46 ($5)	$0.34 ($4)	$0.69 ($7)	$0.73 ($8)	$0.90 ($10)	$0.99 ($11)
	0.1%	0.2%	0.2%	0.4%	0.4%	0.5%	0.5%
Slab Insulation							
Increment 1	$0.56 ($6)	$0.92 ($10)	$0.81 ($9)	$1.24 ($13)	$1.32 ($14)	$1.72 ($19)	$1.90 ($20)
	0.3%	0.5%	0.5%	0.7%	0.7%	0.9%	0.9%
Increment 2	$1.51 ($16)	$1.74 ($19)	$1.52 ($16)	$1.95 ($21)	$2.06 ($22)	$2.53 ($27)	$2.79 ($30)
	0.8%	0.9%	0.9%	1.1%	1.1%	1.3%	1.3%
Window Performance							
Increment 1	$0.40 ($4)	$1.09 ($12)	$0.72 ($8)	$1.02 ($11)	$1.05 ($11)	$0.25 ($3)	$0.24 ($3)
	0.2%	0.6%	0.4%	0.6%	0.6%	0.1%	0.1%
Increment 2	$1.38 ($15)	$3.22 ($35)	$2.20 ($24)	$2.53 ($27)	$2.61 ($28)	$3.54 ($38)	$3.51 ($38)
	0.8%	1.7%	1.3%	1.5%	1.4%	1.8%	1.6%
Ventilation							
Increment 1	$0.19 ($2)	$0.20 ($2)	$0.18 ($2)	$0.18 ($2)	$0.19 ($2)	$0.21 ($2)	$0.23 ($2)
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Increment 2	$0.19 ($2)	$0.20 ($2)	$0.18 ($2)	$0.18 ($2)	$0.19 ($2)	$0.21 ($2)	$0.23 ($2)
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Heating and Cooling							
Increment 1	$0.17 ($2)	-$0.40 (-$4)	-$0.21 (-$2)	-$0.42 (-$5)	-$0.46 (-$5)	$0.18 ($2)	$0.20 ($2)

TABLE 3.6 COST INCREASE FOR PERFORMANCE INCREMENTS – TOWNHOUSE ARCHETYPE $/FT², ($/M²), % OF TOTAL CONSTRUCTION COST							
	0.1%	-0.2%	-0.1%	-0.2%	-0.2%	0.1%	0.1%
Increment 2	$0.61 ($7)	$0.06 ($1)	$0.21 ($2)	$0 ($0)	$0 ($0)	$0.15 ($2)	$0.17 ($2)
	0.3%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Domestic Water Heater							
Increment 1	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)	$0 ($0)
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Increment 2	$1.02 ($11)	$1.06 ($11)	$1.06 ($11)	$0.98 ($11)	$1.05 ($11)	$1.12 ($12)	$1.24 ($13)
	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
TOTAL INCREMENT 1	$5.08 ($55)	$6.78 ($73)	$5.63 ($61)	$6.68 ($72)	$7.01 ($75)	$9.61 ($103)	$10.62 ($114)
	2.7%	3.4%	3.1%	3.7%	3.6%	4.7%	4.7%
TOTAL INCREMENT 2	$11.23 ($121)	$15.66 ($169)	$13.17 ($142)	$15.05 ($162)	$15.81 ($170)	$20.23 ($218)	$21.92 ($236)
	6.0%	7.9%	7.2%	8.3%	8.1%	10.0%	9.7%

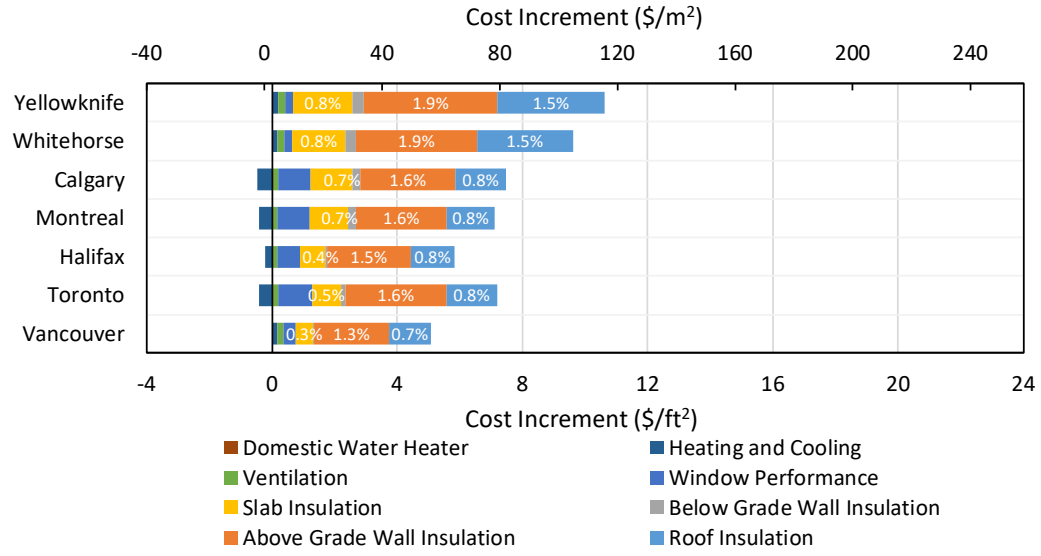

Figure 3.14 Incremental cost increase for elements in Increment 1 (percentage values for each element refer to % increase over Total Construction Cost)

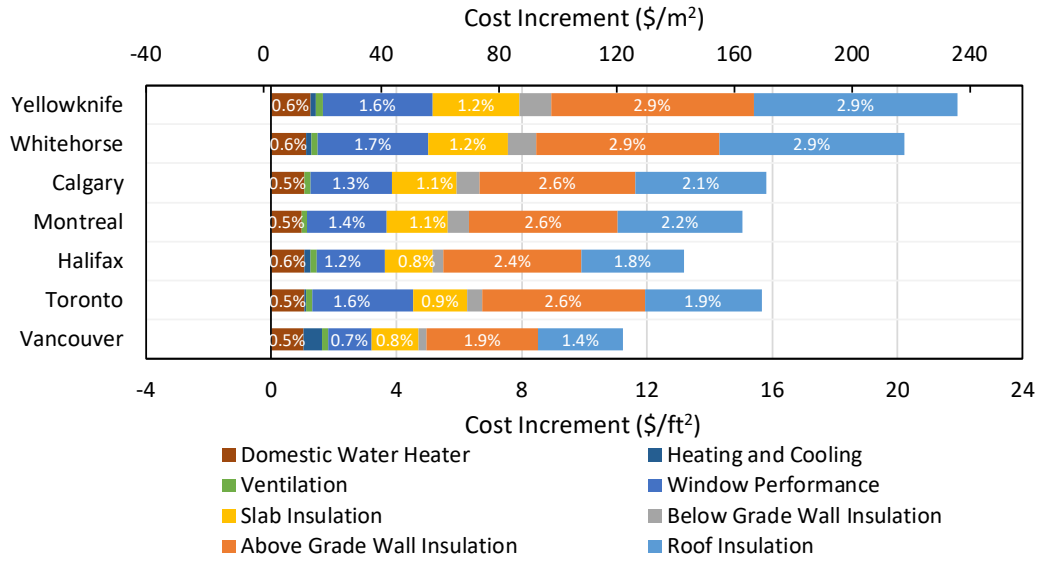

Figure 3.15 Incremental cost increase for elements in Increment 2 (percentage values for each element refer to % increase over Total Construction Cost)

Increment 2 represents insulation performance that is in line with low energy building targets, such as EnerPHit, and would represent a high-performance house at the high end of a possible step code. The cost premium for Increment 2 over the baseline building varies between $11.23/ft² ($121/m²) in Vancouver to $21.91/ft² ($236/m²) in Yellowknife. The cost premium as a percent of the Net Construction Cost in each city varies from a low of 6.9% (Vancouver) to a high of 11.5% (Whitehorse). The increase as a percent of the Total Construction Cost is lower with a variation from 6.3% (Vancouver) to 10.5% (Whitehorse).

The addition of exterior insulation adds significantly to the cost of the townhouse construction (3.57/ft² to 5.90/ft²) but is not as dominant a factor for this archetype. This is in part due to the lower exterior wall to floor area ratio resulting from shared walls between each townhouse unit as well as the increase in cost of the improvements in roof insulation. The roof insulation increments in the townhouse archetype includes the addition of a layer of polyisocyanurate above the joists which is more cost intensive than the addition of more loose fill insulation added to the attic of the single-family house archetype. The additional roof insulation adds between $2.70/ft² ($29/m²) and $6.51/ft² ($70/m²) for the townhouse. The improved window performance also adds appreciably to the cost for this increment with a range between $1.38/ft² to $3.54/ft² ($15/m² to $38/m²). The mechanical system components (HRV and heat pump) result in a modest cost increase due to the higher cost of using a heat pump system for space conditioning.

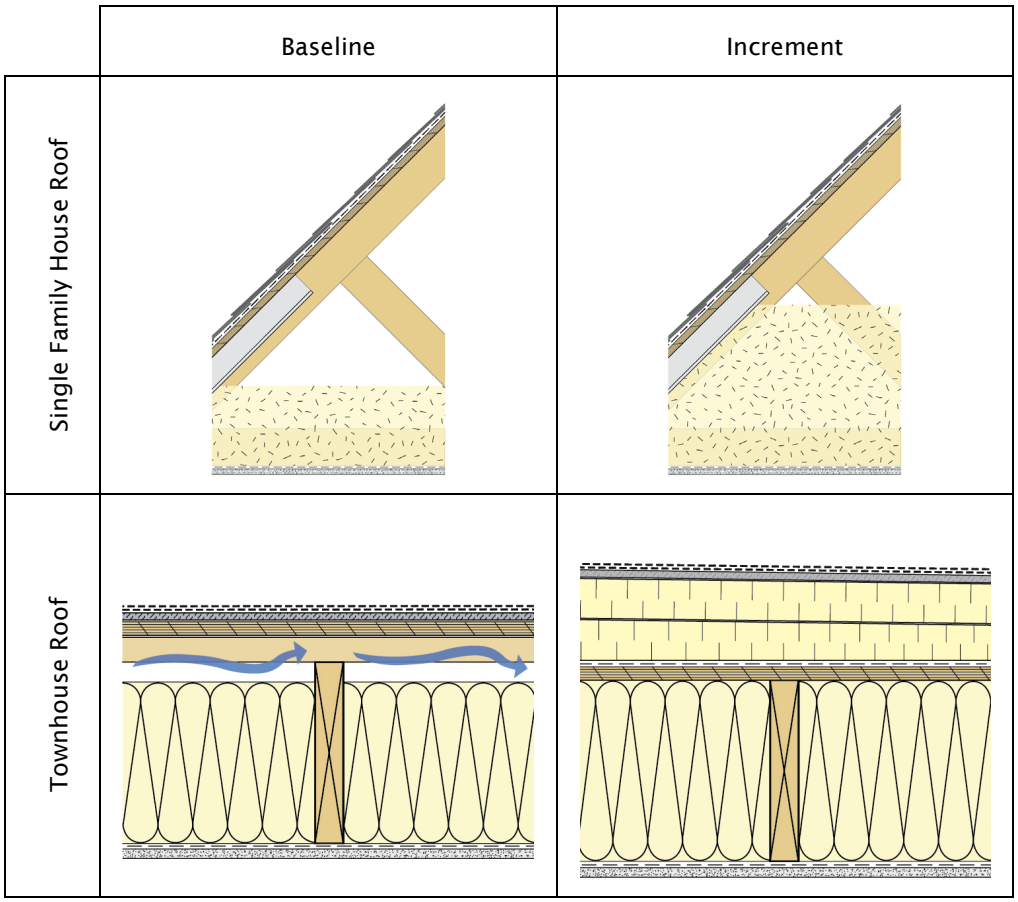

Figure 3.16 Illustration of roof increments

Increment 1 represents an intermediate performance target between the baseline and Increment 2. The cost premium for Increment 1 over the baseline building varies between $5.08/ft² ($55/m²) in Vancouver to $10.62/ft² ($114/m²) in Yellowknife. The increase as a percent of Net Construction Cost ranges from 3.1% (Vancouver) to 5.5% (Whitehorse).

Similar to the results for Increment 2, a number of elements have significant contributions to the cost increase of Increment 1. The exterior insulation adds in the range of $2.37/ft² to $4.27/ft² ($26/m² to $46/m²) to the cost of the base building. The improvements in window performance add between $0.24/ft² to $1.09/ft² ($3/m² to $12/m²) to the archetype cost. The cost premium is lower in Yellowknife and Whitehorse because of the small improvement in window performance over the baseline as they both require triple pane vinyl windows but of varying performance between U-0.25 (USI-1.4) and U-0.17 (USI-1.0).

3 Conclusions

The cost to build two different housing archetypes (single family house and townhouse) was estimated for seven Canadian cities to develop an understanding of elements driving the cost of housing in Canada. The Total Construction Cost for the single family house archetype varied between $172/ft^2 ($1,851/m^2) and $215/ft^2 ($2,313/m^2) whereas the townhouse archetype was found to vary between $182/ft^2 ($1,958/m^2) and $226/ft^2 ($2,432/m^2). The construction costs were found to be highest in Yellowknife and Whitehorse due to the higher cost of materials associated with delivery to remote locations.

The Net Building Cost, which accounts for construction of the building only and exclude site work, taxes, fees, etc., is a number more representative of the typical construction costing data presented in the industry. The Net Building Cost estimated in this study ranged from $122/ft^2 to $155/ft^2 ($1,313/m^2 to $1,668/m^2) for the single family house archetype and $141/ft^2 to $178/ft^2 ($1,517/m^2 to $1,915/m^2) for the townhouse archetype. This is comparable to the costs in other costing guidelines which indicate variations in single family house costs from $95/ft^2 to $340/ft^2 ($1,022/m^2 to $3,658/m^2) and townhouse costs from $90/ft^2 to $245/ft^2 ($968/m^2 to $2,636/m^2) in major urban centers[5]. The primary difference between the costs determined in this work and standard guidelines are lower costs found for Northern locations.

The breakdown of construction costs for the archetypes showed similar trends for all cities in the study indicating that the relative contributions of costs remain constant in different locations. The largest contributors to the Subtotal Construction Cost of the single family house archetype were found to be *Exterior Enclosure* (~20%), *Structure* (~15%), and *Site Work* (~13%). The largest contributors for the townhouse archetype were found to be *Exterior Enclosure* (~18%), *Structure* (~14%) and *Mechanical* (~12%). Given the relatively small contribution of any one construction element to the overall cost of a project bulk changes in any one cost element are not expected to have a significant impact on the overall cost of housing.

A large contributor to the Total Project Cost (which reflects the total cost of new housing) was the Total Development Cost. These include soft costs associated with the project including financing, consultant costs, permits, fees, taxes, etc. Land costs were excluded from the development costs in this work. The Total Development Cost varied between $30/ft^2 ($323/m^2) and $57/ft^2 ($613/m^2) for the single family house archetype and $32/ft^2 ($344/m^2) and $67/ft^2 ($721/m^2) for the townhouse archetype. As a percent of the Total Project Cost this represents 15% to 23% for the single family house and 15% to 25% for the townhouse. The highest development costs occurred in Toronto while the lowest costs occurred in Montreal. In all cases the development costs are a significant portion of the overall cost of housing.

The cost premium associated with constructing in different locations due to energy efficiency elements was found to be a maximum of 1.7% in Yellowknife compared to Vancouver. This represents a small increase compared to the overall premium associated with other location specific cost factors such as labour and materials. The result indicates

[5] Source: Altus Group 2017 Construction Cost Guide assuming Single-Family Residential with Unfinished Basement and Row Townhouse with Unfinished Basement.

that the need for higher performance buildings in Canada's colder climates is not the primary driver of cost premiums in those locations. An example of this is the comparison of cost in Halifax which are generally lower than in Vancouver metropolitan area despite requiring greater levels of insulation to meet the building code requirements.

The incremental bundles of energy efficiency improvements investigated resulted in most increases in the cost of construction between $5/ft^2 ($54/m^2) and $11/ft^2 ($118/m^2) for the first increment (intermediate energy performance), and $10/ft^2 ($108/m^2) and $22/ft^2 ($237/m^2) for the second increment (low energy construction). This represents a maximum cost premium of less than 11% of the Total Construction Cost for the townhouse archetype in Yellowknife and Whitehorse. Smaller cost premiums were found in the more Southern cities and were less than 9% for Increment 2.

Primary cost drivers for housing construction price differences are labour and material differences for different locations. Development costs and taxes also add to the variation but are smaller drivers.

Additional research is required to compare the unique factors associated with constructing housing in Canada's North including transportation and labour restrictions, different construction practices, and geographical constraints on some communities.

Yours truly,

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Appendix A

BTY Costing Report

COST MANAGEMENT REPORT

Cost of Newly Built Housing

REPORT NUMBER 1.0

JULY 20, 2017

PREPARED FOR:

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People to count on.
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Contents

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1.0 *Introduction*

1.1 Instructions Received

This report has been prepared by BTY Group ("BTY") at the request of RDH Building Science (the "Client").

CMHC has appointed BTY to develop the cost models used in the analysis of defining the costs of newly built housing (the "Project"). The Project delivery model is yet to be determined, therefore, BTY recommends that estimates are prepared at each of the key design milestones.

Information related to the Project for the purposes of this report was received by BTY from January 2017 to April 2017. Please refer to Section 14.0 for a list of information reviewed in producing this report.

1.2 Report Reliance

This report has been prepared in accordance with the scope of our Fee Proposal dated October 18, 2016 and is subject to the terms of that appointment. This report is for the sole and confidential use and reliance of RDH Building Science and its client, CMHC. BTY Group, its Directors, staff or agents do not make any representation or warranty as to the factual accuracy of the information provided to us on behalf of CMHC, the Client or other third-party consultants or agents, upon which this report is based. BTY Group will not be liable for the result of any information not received which, if produced, could have materially changed the opinions or conclusions stated in this report. This report shall not be reproduced or distributed to any party without the express permission of BTY Group.

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1.3 Contacts

Should you have any queries regarding the content of this report, please do not hesitate to contact either of the following:

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2.0 *Executive Summary*

2.1 Report Purpose

The purpose of this report is to provide realistic estimates of the cost of residential building for series of urban centres in Canada. The report is divided into two main sections, the first for southern locations and the second for the North

The opinions expressed in this report have been prepared with limited architectural and structural drawings. While no mechanical, electrical or processing system drawings were provided, an outline specification was. On this basis, the cost estimates should be considered to be at the Schematic Design (Class C) stage. Based on the documents reviewed, our opinion on cost should be correct within a range of approximately +/- 15% to 20%.

2.2 Project Background and Description

Housing prices in Canada have been rising relative to income and compared to other countries due to increasing demand in the market. In addition, construction costs have shown a significant variance across the country between urban centres as well as for the more remote Northern regions. Various factors contribute to the variation in costs, including labour, material, fees, taxes and transportation.

To investigate the drivers of costs in each location, RDH developed archetypal building designs: two for southern locations and two for the North. Each archetype included some element of regional variation. BTY costed the construction for each archetype, in each location and added in other (soft cost to arrive at total project costs. The price of land was omitted from the calculation.

RDH has proposed the following characteristics for the cost models:

1) Southern archetypes to be priced for Halifax, Montreal, Toronto, Calgary, Vancouver, Whitehorse and Yellowknife;
2) Northern archetypes are in 3 categories: Primary (Urban: Whitehorse, Yellowknife, and Iqaluit), Secondary (Rural: Dawson City, Inuvik and Arviat) and Tertiary (Remote: Old Crow, Ulukhaktok and Coral Harbour);
3) Building types: Town-homes and single-family homes;
4) Sensitivity analysis: impact of changing certain elements of the designs on total project cost.

3.0 *Development Cost Summaries*

The current estimated cost of the Southern Archetypes may be summarized as follows:

	Item	Estimated Costs ($) - Single Family Home						
		Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A	Land Cost (Excluded)	0	0	0	0	0	0	0
B	Construction	658,700	683,100	618,600	631,100	676,900	709,300	788,700
C	Taxes (GST / HST)	32,900	41,000	49,500	31,600	33,800	35,500	39,400
D	Consultants	45,000	47,100	43,400	43,100	46,200	48,400	53,800
E	Development Management	41,500	43,400	40,100	39,800	42,600	44,700	49,700
F	Municipal and Connection Fees	28,700	92,000	5,400	1,300	20,200	8,600	10,100
G	Marketing	6,900	7,200	6,700	6,600	7,100	7,400	8,300
H	Financing	13,800	14,500	13,400	13,300	14,200	14,900	16,600
I	Contingency	13,800	14,500	13,400	13,300	14,200	14,900	16,600
	Total Project Cost (Jul 2017 Dollars)	$841,300	$942,800	$790,500	$780,100	$855,200	$883,700	$983,200
K	Escalation (Excluded)	0	0	0	0	0	0	0
	Project Cost (Jul 2017 Dollars)	$841,300	$942,800	$790,500	$780,100	$855,200	$883,700	$983,200

Table 1 Development Cost Summary for Single Family Home South Archetype

The construction cost estimates for both the Single-family Home (SFH) and Townhome (TH) models were developed for the Vancouver area, using measurements and pricing from the drawings and specifications provided by RDH. Specifically, Coquitlam was selected as a location and costs were adjusted to reflect labour costs in that municipality. Costs were broken down by trade and then adjusted by application of location factors for each of the cities studied.

	Item	Estimated Costs ($) - Town Home						
		Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A	Land Cost (Excluded)	0	0	0	0	0	0	0
B	Construction	1,623,400	1,697,000	1,532,900	1,569,000	1,682,600	1,748,500	1,942,800
C	Taxes (GST / HST)	81,200	101,800	122,600	78,500	84,100	87,400	97,100
D	Consultants	110,800	116,900	107,600	107,100	114,800	119,300	132,600
E	Development Management	102,300	107,900	99,300	98,900	106,000	110,200	122,400
F	Municipal and Connection Fees	112,200	292,400	25,000	2,200	51,100	26,792	24,600
G	Marketing	17,000	18,000	16,600	16,500	17,700	18,400	20,400
H	Financing	34,100	36,000	33,100	33,000	35,300	36,700	40,800
I	Contingency	34,100	36,000	33,100	33,000	35,300	36,700	40,800
	Total Project Cost (July 2017 Dollars)	$2,115,100	$2,406,000	$1,970,200	$1,938,200	$2,126,900	$2,183,992	$2,421,500
K	Escalation (Excluded)	0	0	0	0	0	0	0
	Project Cost (July 2017 Dollars)	$2,115,100	$2,406,000	$1,970,200	$1,938,200	$2,126,900	$2,183,992	$2,421,500

Table 2 Development Cost Summary for Town House South Archetype

Soft-cost estimates are largely based on percentage estimates typical for this type of construction. Municipal and Connection Fees are based on specific research for each municipality. Further definitions of each soft-cost type are included below in Section 7.

The current estimated cost of theNorthern Archetypes may be summarized as follows:

	Item	Estimated Costs ($) Single Family Home								
		Urban			Rural			Remote		
		Whitehorse	Yellowknife	Iqaluit	Inuvik	Dawson	Arviat	Ulukhaktok	Old Crow	Coral Harbour
A	Land Cost (Excluded)	0	0	0	0	0	0	0		
B	Construction	442,100	490,200	603,800	606,400	577,800	653,400	875,500	867,600	750,800
C	Taxes (GST / HST)	22,100	24,500	30,200	30,300	28,900	32,700	43,800	43,400	37,500
D	Consultants	30,200	33,456	41,210	41,386	39,436	44,597	59,755	59,215	51,240
E	Development Management	27,900	30,882	38,040	38,202	36,402	41,166	55,158	54,660	47,298
F	Municipal and Connection Fees	17,700	6,300	3,800	3,800	3,700	4,100	5,300	5,200	78,830
G	Marketing	4,600	5,147	6,340	6,367	6,067	6,861	9,193	9,110	7,883
H	Financing	9,300	10,294	12,680	12,734	12,134	13,722	18,386	18,220	15,766
I	Contingency	9,300	10,294	12,680	12,734	12,134	13,722	18,386	18,220	15,766
	Total Project Cost (July 2017 Dollars)	$563,200	$611,073	$748,750	$751,923	$716,573	$810,268	$1,085,478	$1,075,625	$1,005,083
K	Escalation (Excluded)	0	0	0	0	0	0	0	0	0
	Project Cost (July 2017 Dollars)	$563,200	$611,073	$748,750	$751,923	$716,573	$810,268	$1,085,478	$1,075,625	$1,005,083

Table 3 Development Cost Summary for Single Family Home Northern Archetypes

Estimates for the Northern Archetypes were calculated based on first principles, as comparable data and location factors are not available for most of the locations, Whitehorse and Yellowknife being the exceptions. Again, detailed measurement of quantities and pricing of each item was initially undertaken for Whitehorse and then adjusted by trade location factor for Yellowknife. For all the remaining locations, detailed analysis was undertaken examining a wide variety of cost factors, including:

For Materials:

- Shipping logistics and ports of origin, including insurance requirements;
- Modes of transportation, primarily by sea lift from Montreal (Ste. Catherine) and by road from Whitehorse;
- Requirements for, and windows of availability of, ice road to Old Crow, which does not have permanent road access;
- Redundancy, i.e. inclusion of spare items because it is very difficult to ship replacements to many of these locations.
- Packaging in containers, numbers of containers required.

For Labour:

- Crew sizes and supervision requirements;
- Availability of local labour;
- Labour transportation costs to remote sites, including allocations between those who might stay on site for the full duration of the project and those requiring regular breaks;
- Live-out allowances, room and board;
- Crew scheduling.

For General Conditions, Overhead and Profit:

- Increased expectations of profitability, based on increased risk.

Contingencies

- Special risk factors associated with construction in the North, such as unpredictable weather, local seasonal practices that may interfere with scheduling, availability of temporary power, etc.

Soft Costs

- Specific permitting costs for each location.

	Item	Estimated Costs ($) Town House								
		Urban			Rural			Remote		
		Whitehorse	Yellowknife	Iqaluit	Inuvik	Dawson	Arviat	Ulukhaktok	Old Crow	Coral Harbour
A	Land Cost (Excluded)	0	0	0	0	0	0	0	0	0
B	Construction	2,302,100	2,526,700	3,112,900	3,087,600	2,940,900	3,321,400	4,514,300	4,420,200	3,833,600
C	Taxes (GST / HST)	115,100	126,300	155,600	154,400	147,000	166,100	225,700	221,000	191,700
D	Consultants	157,100	172,445	212,453	210,730	200,714	226,688	308,100	301,678	261,645
E	Development Management	145,000	159,180	196,110	194,520	185,274	209,250	284,400	278,472	241,518
F	Municipal and Connection Fees	30,600	31,900	18,750	18,650	17,850	19,850	26,150	25,650	402,530
G	Marketing	24,200	26,530	32,685	32,420	30,879	34,875	47,400	46,412	40,253
H	Financing	48,300	53,060	65,370	64,840	61,758	69,750	94,800	92,824	80,506
I	Contingency	48,300	53,060	65,370	64,840	61,758	69,750	94,800	92,824	80,506
	Total Project Cost (July 2017 Dollars)	$2,870,700	$3,149,175	$3,859,238	$3,828,000	$3,646,133	$4,117,663	$5,595,650	$5,479,060	$5,132,258
K	Escalation (Excluded)	0	0	0	0	0	0	0	0	0
	Project Cost (July 2017 Dollars)	$2,870,700	$3,149,175	$3,859,238	$3,828,000	$3,646,133	$4,117,663	$5,595,650	$5,479,060	$5,132,258

Table 4 Development Cost Summary for Town House North Archetypes

Please note that, where zero dollar values are stated, BTY has excluded these costs and the values should be carried in a separate budget (if applicable).
For Construction Cost Summary in Trade Divisions please refer to section 8.0
For Construction Cost Summary in Elemental Summary please refer to Appendix 1

4.0 *Northern Archetype Cost Adjustments*

To arrive at the cost adjustments required for the Northern Archetype estimates, we took the following steps:

- Telephone discussions with local representatives in each community to gain an understanding of local market conditions;
- Telephone discussions with contractors and suppliers with northern experience;
- Research on material shipping routes and pricing;
- Checking flight and accommodation charges;
- Analysis of potential increase in profit allowance due to higher risk.

5.0 *Panelisation*

Given the high cost of building in the North, what potential is there to reduce costs by employing panelisation of building components? The approach reviewed here is to replace stick-framing of single-family homes and townhouses with pre-fabrication of component panels and assembly on site. The panels envisaged here would not include any additional components such as insulation and windows.

Panel fabrication is generally undertaken in a yard and, unlike modular construction, requires little up-front capital investment. Framers using panelisation stress the saving on material through optimal use of dimensional lumber, lower on-site labour costs and reduced general requirements and carrying costs due to reduced schedule durations. The economics of panelisation make the most sense when there is a high degree of repetition, so the smaller projects typical of the North are challenged in that respect. Panel assembly in an urban centre with plentiful skilled labour and then a shorter time on site make the case for panelisation in the North, with savings on expensive labour and general conditions. It is more attractive the more remote a site is, even though transportation costs are marginally higher, as panels take up more space than lumber and OSB in their un-assembled state.

Taking into account these various factors, our calculations suggest the following potential savings on the archetypes in each of the study locations:

Location	Single-family $	Townhouse $
Whitehorse	(8,300)	(41,700)
Yellowknife	(9,100)	(45,800)
Iqaluit	(10,200)	(51,500)
Inuvik	(10,400)	(52,300)
Dawson City	(10,000)	(50,000)
Arviat	(11,100)	(55,500)
Ulukhaktok	(14,000)	(70,200)
Old Crow	(13,800)	(69,500)
Coral Harbour	(12,700)	(63,900)

The cost savings shown are for the full, 5-unit townhouse development and per single-family house as part of a five-unit development.

6.0 *Exclusions*

The construction estimate includes all direct and indirect construction costs identified in the drawings and other information provided by the Prime Consultant.

The construction estimate specifically excludes the following:

- Land costs;
- Legal fees and agreement costs / conditions;
- Removal of hazardous materials;
- Demolition of building;
- Loose furnishings and equipment;
- Unforeseen ground conditions and associated extras;
- Environmental remediation outside;
- Servicing outside the project site boundary;
- Phasing of the works and accelerated schedule;
- Decanting & moving;
- Costs associated with “LEED” certification;
- Project commissioning;
- Cost escalation past July 2017;
- Dewatering;
- Rock /boulder excavation;
- Building services beyond 3 feet from the building perimeter.

7.0 *Definitions*

The estimate for the project has been prepared and summarized in the following categories. The scope of work covered within each category is as follows:

A. Land Cost:

These costs include the acquisition of the site and associated fees, service obligations and property purchase tax. These costs are not part of this study.

B. Construction:

This category encompasses all direct and indirect construction costs including labour, materials, equipment, transportation and general contractor's general requirements and fee.

C. Taxes

Taxes as applicable in each province or territory.

D. Consultants:

Professional fees for the primary design team consultants including: the architect, structural, mechanical & electrical engineers, and the cost consultant. Other specialist consultants and an allowance for disbursements are also included. Where available, all consultant fees have been calculated based on the current schedule of recommended charges published by the professional associations.

E. Development Management:

The project management fee is charged by a company or individual providing project management services. The Owner's Planning and Administrative cost covers the owner's project-related management costs. Provisions are also included for project insurance and commissioning the facility prior to handover.

F. Municipal & Connection Fees:

This section includes an estimate for all project related fees and charges required by the municipality and other authorities having jurisdiction as part of the development. These costs include Development Cost Charges (DCC's), Building Permits, levies and associated legal and survey fees. These costs are based on current municipal formulas and schedules.

G. Marketing

Costs associated with selling the units, such as advertising and show home. Realtors' commissions are excluded.

H. Financing

Includes the costs associated with placing a real estate loan and interest during construction.

I. Project Contingency:

This allowance is provided as an owner's contingency to cover changes to non-construction items.

8.0 *Construction Cost Summaries*

The estimated construction costs of the southern archetypes may be summarised as follows:

	Item	Single Family Home						
		Vancouver	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A1	SUBSTRUCTURE	37,000	37,300	33,800	34,500	38,200	40,200	44,100
A2	STRUCTURE	98,100	102,800	91,200	96,100	101,700	102,200	117,400
A3	EXTERIOR ENCLOSURE	127,100	135,500	123,100	123,000	130,500	139,100	154,200
B1	PARTITIONS & DOORS	32,600	35,300	31,600	32,600	34,300	34,300	39,200
B2	FINISHES	56,400	58,800	52,500	55,200	59,100	57,900	66,800
B3	FITTINGS & EQUIPMENT	27,600	28,200	26,500	26,600	27,900	28,900	29,900
C1	MECHANICAL	45,400	47,100	42,500	43,400	46,800	49,500	54,700
C2	ELECTRICAL	23,500	24,200	21,700	22,100	23,900	25,800	28,600
D1	SITE WORK	87,000	85,200	79,200	78,700	87,100	97,900	105,300
D2	ANCILLARY WORK	0	0	0	0	0	0	0
Z1	GENERAL REQUIREMENTS & FEES	64,100	66,600	60,300	61,500	65,900	69,000	76,800
Z2	CONTINGENCIES	59,900	62,100	56,200	57,400	61,500	64,500	71,700
	SUBTOTAL CONSTRUCTION	**658,700**	**683,100**	**618,600**	**631,100**	**676,900**	**709,300**	**788,700**
	TAXES (GST / HST)	32,900	41,000	49,500	31,600	33,800	35,500	39,400
	TOTAL CONSTRUCTION	**691,600**	**724,100**	**668,100**	**662,700**	**710,700**	**744,800**	**828,100**
	LAND	0	0	0	0	0	0	0
	CONSULTANTS	45,000	47,100	43,400	43,100	46,200	48,400	53,800
	DEVELOPMENT MANAGEMENT	41,500	43,400	40,100	39,800	42,600	44,700	49,700
	GOVERNMENT TAXES & LEVIES	28,700	92,000	5,400	1,300	20,200	8,600	10,100
	MARKETING	6,900	7,200	6,700	6,600	7,100	7,400	8,300
	FINANCING	13,800	14,500	13,400	13,300	14,200	14,900	16,600
	CONTINGENCY	13,800	14,500	13,400	13,300	14,200	14,900	16,600
	TOTAL DEVELOPMENT	**149,700**	**218,700**	**122,400**	**117,400**	**144,500**	**138,900**	**155,100**
	TOTAL PROJECT	**841,300**	**942,800**	**790,500**	**780,100**	**855,200**	**883,700**	**983,200**
	Construction Unit Cost	**$171/sf**	**$177/sf**	**$160/sf**	**$164/sf**	**$176/sf**	**$184/sf**	**$205/sf**

Table 5 Construction Cost for Single Family Home South Archetype

	Item	Townhouse						
		Vancouver $	Toronto	Halifax	Montreal	Calgary	Whitehorse	Yellowknife
A1	SUBSTRUCTURE	92,700	95,100	84,700	87,400	96,500	96,700	108,200
A2	STRUCTURE	223,200	234,600	207,000	217,800	231,100	235,000	270,800
A3	EXTERIOR ENCLOSURE	283,800	301,600	276,800	274,200	289,900	317,400	346,800
B1	PARTITIONS & DOORS	147,800	160,300	144,500	146,200	156,500	161,500	181,200
B2	FINISHES	119,400	121,800	109,700	115,700	125,200	118,200	136,300
B3	FITTINGS & EQUIPMENT	78,900	80,400	75,900	76,000	80,300	82,500	85,300
C1	MECHANICAL	195,800	207,800	183,400	192,900	208,400	214,000	236,900
C2	ELECTRICAL	62,200	64,300	59,000	60,200	63,700	67,800	74,900
D1	SITE WORK	113,900	111,600	103,200	103,200	114,200	126,100	136,600
D2	ANCILLARY WORK	0	0	0	0	0	0	0
Z1	GENERAL REQUIREMENTS & FEES	158,100	165,200	149,300	152,800	163,800	170,300	189,200
Z2	CONTINGENCIES	147,600	154,300	139,400	142,600	153,000	159,000	176,600
	SUBTOTAL CONSTRUCTION	**1,623,400**	**1,697,000**	**1,532,900**	**1,569,000**	**1,682,600**	**1,748,500**	**1,942,800**
	TAXES (GST / HST)	81,200	101,800	122,600	78,500	84,100	87,400	97,100
	TOTAL CONSTRUCTION	**1,704,600**	**1,798,800**	**1,655,500**	**1,647,500**	**1,766,700**	**1,835,900**	**2,039,900**
	LAND	0	0	0	0	0	0	0
	CONSULTANTS	110,800	116,900	107,600	107,100	114,800	119,300	132,600
	DEVELOPMENT MANAGEMENT	102,300	107,900	99,300	98,900	106,000	110,200	122,400
	GOVERNMENT TAXES & LEVIES	112,200	292,400	25,000	2,200	51,100	26,792	24,600
	MARKETING	17,000	18,000	16,600	16,500	17,700	18,400	20,400
	FINANCING	34,100	36,000	33,100	33,000	35,300	36,700	40,800
	CONTINGENCY	34,100	36,000	33,100	33,000	35,300	36,700	40,800
	TOTAL DEVELOPMENT	**410,500**	**607,200**	**314,700**	**290,700**	**360,200**	**348,092**	**381,600**
	TOTAL PROJECT	**2,115,100**	**2,406,000**	**1,970,200**	**1,938,200**	**2,126,900**	**2,183,992**	**2,421,500**
	Construction Unit Cost	**$179/sf**	**$188/sf**	**$169/sf**	**$173/sf**	**$186/sf**	**$193/sf**	**$215/sf**

Table 6 Construction Cost for Town House South Archetypes

The estimated construction costs of the Northern Archetypes may be summarised as follows:

	Item	Single Family Home								
		Whitehorse $	Yellowknife $	Iqaluit $	Inuvik $	Dawson $	Arviat $	Ulukhaktok $	Old Crow $	Coral Harbour $
A1	SUBSTRUCTURE	24,300	24,200	30,000	30,400	29,100	32,400	41,000	40,500	37,300
A2	STRUCTURE	80,200	94,400	108,600	100,500	96,200	117,100	148,200	133,800	134,900
A3	EXTERIOR ENCLOSURE	87,100	96,600	108,700	109,100	104,100	117,200	148,200	145,000	134,800
B1	PARTITIONS & DOORS	18,700	21,000	24,000	23,500	22,500	25,900	32,800	31,200	29,800
B2	FINISHES	26,600	30,100	34,400	33,400	31,900	37,100	46,900	44,400	42,700
B3	FITTINGS & EQUIPMENT	20,600	21,000	26,400	25,800	24,600	28,500	36,100	34,300	32,800
C1	MECHANICAL	48,500	53,900	58,600	63,100	60,400	66,800	83,000	82,300	76,200
C2	ELECTRICAL	13,200	14,600	16,200	16,200	15,800	16,800	15,100	20,900	19,100
D1	SITE WORK	39,600	42,000	44,900	41,400	39,500	39,700	50,200	55,000	45,700
D2	ANCILLARY WORK	0	0	0	0	0	0	0	0	0
Z1	GENERAL REQUIREMENTS & FEES	43,100	47,800	73,200	83,900	78,300	86,700	128,100	135,600	99,600
Z2	CONTINGENCIES	40,200	44,600	78,800	79,100	75,400	85,200	145,900	144,600	97,900
	SUBTOTAL CONSTRUCTION	**442,100**	**490,200**	**603,800**	**606,400**	**577,800**	**653,400**	**875,500**	**867,600**	**750,800**
	TAXES (GST / HST)	22,100	24,500	30,200	30,300	28,900	32,700	43,800	43,400	37,500
	TOTAL CONSTRUCTION	**464,200**	**514,700**	**634,000**	**636,700**	**606,700**	**686,100**	**919,300**	**911,000**	**788,300**
	LAND									
	CONSULTANTS	30,200	33,456	41,210	41,386	39,436	44,597	59,755	59,215	51,240
	DEVELOPMENT MANAGEMENT	27,900	30,882	38,040	38,202	36,402	41,166	55,158	54,660	47,298
	MUNICIPAL CHARGES AND FEES	17,700	6,300	3,800	3,800	3,700	4,100	5,300	5,200	78,830
	MARKETING	4,600	5,147	6,340	6,367	6,067	6,861	9,193	9,110	7,883
	FINANCING	9,300	10,294	12,680	12,734	12,134	13,722	18,386	18,220	15,766
	CONTINGENCY	9,300	10,294	12,680	12,734	12,134	13,722	18,386	18,220	15,766
	TOTAL DEVELOPMENT	**99,000**	**96,373**	**114,750**	**115,223**	**109,873**	**124,168**	**166,178**	**164,625**	**216,783**
	TOTAL PROJECT	**563,200**	**611,073**	**748,750**	**751,923**	**716,573**	**810,268**	**1,085,478**	**1,075,625**	**1,005,083**
	Construction Unit Cost	**$409/sf**	**$453/sf**	**$558/sf**	**$560/sf**	**$534/sf**	**$604/sf**	**$809/sf**	**$802/sf**	**$694/sf**

Table 7 Construction Cost for Single Family Home North Archetypes

	Item	Townhouse								
		Whitehorse $	Yellowknife $	Iqaluit $	Inuvik $	Dawson $	Arviat $	Ulukhaktok $	Old Crow $	Coral Harbour $
A1	SUBSTRUCTURE	166,300	168,100	202,100	208,500	199,300	218,000	275,600	277,300	250,800
A2	STRUCTURE	318,900	379,600	434,700	399,800	382,100	469,000	592,900	531,600	539,400
A3	EXTERIOR ENCLOSURE	418,600	462,300	522,300	524,800	501,400	563,600	712,400	697,900	648,300
B1	PARTITIONS & DOORS	161,300	183,000	209,100	202,200	193,200	225,700	285,300	268,800	259,600
B2	FINISHES	199,800	226,800	259,900	250,500	239,400	280,400	354,500	333,200	322,600
B3	FITTINGS & EQUIPMENT	81,800	83,900	105,000	102,500	98,000	113,300	143,200	136,300	130,400
C1	MECHANICAL	302,000	318,800	351,000	337,500	323,200	356,500	444,400	440,400	406,300
C2	ELECTRICAL	95,200	95,200	103,500	103,200	99,100	96,600	135,800	135,100	124,500
D1	SITE WORK	124,700	133,200	142,000	129,100	123,300	124,600	157,300	171,700	143,200
D2	ANCILLARY WORK	0	0	0	0	0	0	0	0	0
Z1	GENERAL REQUIREMENTS & FEES	224,200	246,100	377,300	426,800	398,300	440,500	660,500	691,200	508,500
Z2	CONTINGENCIES	209,300	229,700	406,000	402,700	383,600	433,200	752,400	736,700	500,000
	SUBTOTAL CONSTRUCTION	**2,302,100**	**2,526,700**	**3,112,900**	**3,087,600**	**2,940,900**	**3,321,400**	**4,514,300**	**4,420,200**	**3,833,600**
	TAXES (GST / HST)	115,100	126,300	155,600	154,400	147,000	166,100	225,700	221,000	191,700
	TOTAL CONSTRUCTION	**2,417,200**	**2,653,000**	**3,268,500**	**3,242,000**	**3,087,900**	**3,487,500**	**4,740,000**	**4,641,200**	**4,025,300**
	LAND	0	0	0	0	0	0	0	0	0
	CONSULTANTS	157,100	172,445	212,453	210,730	200,714	226,688	308,100	301,678	261,645
	DEVELOPMENT MANAGEMENT	145,000	159,180	196,110	194,520	185,274	209,250	284,400	278,472	241,518
	MUNICIPAL CHARGES AND FEES	30,600	31,900	18,750	18,650	17,850	19,850	26,150	25,650	402,530
	MARKETING	24,200	26,530	32,685	32,420	30,879	34,875	47,400	46,412	40,253
	FINANCING	48,300	53,060	65,370	64,840	61,758	69,750	94,800	92,824	80,506
	CONTINGENCY	48,300	53,060	65,370	64,840	61,758	69,750	94,800	92,824	80,506
	TOTAL DEVELOPMENT	**453,500**	**496,175**	**590,738**	**586,000**	**558,233**	**630,163**	**855,650**	**837,860**	**1,106,958**
	TOTAL PROJECT	**2,870,700**	**3,149,175**	**3,859,238**	**3,828,000**	**3,646,133**	**4,117,663**	**5,595,650**	**5,479,060**	**5,132,258**
	Construction Unit Cost	**$219/sf**	**$241/sf**	**$297/sf**	**$294/sf**	**$280/sf**	**$316/sf**	**$430/sf**	**$421/sf**	**$365/sf**

Table 8 Construction Cost for Town House North Archetypes

9.0 *Sensitivity Analysis*

In addition to main estimates for each archetype in each location, we have also priced potential design increments for each archetype in each location. The proposed design increments were provided by RDH. Details of these costs are included in Appendix II.

10.0 *Areas*

The gross floor areas of the archetypes measured in accordance with the guidelines established by the Canadian Institute of Quantity Surveyors are as follows:

Building	Southern Archetypes		Northern Archetypes	
	Single	Townhouses (4 units)	Single	Townhouses (5 units)
Gross Floor Area	3,855 ft²	9,045 ft²	1,082 ft²	10,496 ft²

BTY has based its pricing on the proposed projects being either one townhouse development with 4 or 5 units, as shown in the drawings, or 5 single-family homes.

11.0 *Taxes*

The estimate includes the Provincial Sales Tax (P.S.T.), Goods & Services Tax (G.S.T.) and Harmonized Sales Tax (H.S.T.) where applicable.

12.0 *Project Schedule & Escalation*

No cost escalation allowance has been included in the estimate. BTY strongly recommends that the client establish a separate budget to cover the escalation cost from the date of this estimate to the mid-point of construction for the project. Our current projected escalation rates are shown below.

	2017	2018	2019
Current BTY Group Forecast	2% - 4%	2% - 4%	2% - 4%

13.0 *Pricing*

The estimate has been priced at current rates taking into account the size, location and nature of the project. The unit rates utilized are considered competitive for a project of this type, bid under a stipulated lump-sum form of tender in an open market, with a minimum of five (5) bids, supported by the requisite number of sub-contractors.

The estimate allows for labour, material, equipment and other input costs at current rates and levels of productivity. It does not take into account extraordinary market conditions, where bidders may be few and may include in their tenders disproportionate contingencies and profit margins.

14.0 *Contingencies*

14.1 Design and Construction Contingency

A design and construction contingency of Ten Percent (10%) has been included in the estimate base case to cover modifications to the design and changes occurring during construction. This has then been adjusted to reflect higher levels of risk in remote locations.

14.2 Project Contingency

A project contingency of 2% of construction cost has been allowed to cover risks associated with non-construction costs such as design fees and permits.

15.0 *Documents Reviewed*

The following information has been reviewed in the preparation of the estimates:

	Description	Received Date
Southern Archetype		
	Architectural drawings for town house (3 sheets)	December 14, 2016
	Architectural & structural drawings for single family home (8 sheets)	December 14, 2016
	Baseline Archetype Construction Details from RDH	December 14, 2016
	Increments Details	February 24, 2017
Northern Archetypes		
	Architectural drawings for town house (3 sheets)	January 25, 2017
	Architectural drawings for single family home (3 sheets)	January 25, 2017
	Baseline Archetype Construction Details from RDH	January 25, 2017
	Increments Details	March 22, 2017

CANADA

Vancouver

Toronto

Calgary

Edmonton

Saskatoon

Montréal

Ottawa

St. Catharines

UNITED STATES

Atlanta

Denver

Seattle

Phoenix

Cleveland

Orlando

Los Angeles

EUROPE

London

Belfast

Dublin

MENA

Ankara

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People to count on.
Knowledge to build with.

Appendix B

Single Family House Costing Details

Costs of Newly Built Housing
South Archetypes - Single Family Home
Vancouver
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**37,000**	**9.60**	**7.4%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.67	18,000		4.67	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	28.27	19,000		4.93	
A2	**STRUCTURE**						**98,100**	**25.45**	**19.6%**
A21	Lowest Floor Construction	0.36	1,371	ft²	10.36	14,200		3.68	
A22.1	Upper Floor Construction	0.59	2,292	ft²	21.16	48,500		12.58	
A22.2	Stair Construction	0.01	28	risr	142.86	4,000		1.04	
A23	Roof Construction	0.39	1,512	ft²	20.77	31,400		8.15	
A3	**EXTERIOR ENCLOSURE**						**127,100**	**32.97**	**25.3%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	27.72	30,300		7.86	
A32.1	Walls Above Grade	0.62	2,395	ft²	25.89	62,000		16.08	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	41.37	16,300		4.23	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,550.00	3,100		0.80	
A34.1	Roof Covering	0.50	1,939	ft²	4.44	8,600		2.23	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	31.19	6,800		1.76	
B1	**PARTITIONS & DOORS**						**32,600**	**8.46**	**6.5%**
B11.1	Fixed Partitions	0.92	3,549	ft²	6.79	24,100		6.25	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	447.37	8,500		2.20	
B2	**FINISHES**						**56,400**	**14.63**	**11.2%**
B21	Floor Finishes	0.54	2,089	ft²	9.43	19,700		5.11	
B22	Ceiling Finishes	0.58	2,227	ft²	13.43	29,900		7.76	
B23	Wall Finishes	1.70	6,539	ft²	1.04	6,800		1.76	
B3	**FITTINGS & EQUIPMENT**						**27,600**	**7.16**	**5.5%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.11	12,000		3.11	
B31.3	Specialties	1.00	3,855	ft²	1.53	5,900		1.53	
B32	Equipment	1.00	3,855	ft²	2.52	9,700		2.52	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**45,400**	**11.78**	**9.1%**
C11	Plumbing and Drainage	1.00	3,855	ft²	7.11	27,400		7.11	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.46	17,200		4.46	
C14	Controls	1.00	3,855	ft²	0.21	800		0.21	
C2	**ELECTRICAL**						**23,500**	**6.10**	**4.7%**
C21	Service & Distribution	1.00	3,855	ft²	0.42	1,600		0.42	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	4.75	18,300		4.75	
C23	Systems & Ancillaries	1.00	3,855	ft²	0.93	3,600		0.93	
Z1	**GENERAL REQUIREMENTS & FEES**						**53,700**	**13.93**	**10.7%**
Z11	General Requirements	9.0%				40,300		10.45	
Z12	Fee	3.0%				13,400		3.48	
NET BUILDING COST							**501,400**	**130.06**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Vancouver
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**501,400**	**130.06**	
D1	**SITE WORK**						**87,000**	**22.57**	
D11.1	Site Preparation	1.00	3,855	ft²	2.08	8,000		2.08	
D11.2	Hard Surfaces	1.00	3,855	ft²	3.89	15,000		3.89	
D11.3	Site Improvements	1.00	3,855	ft²	12.45	48,000		12.45	
D11.4	Landscaping	1.00	3,855	ft²	2.59	10,000		2.59	
D12	Mechanical Site Services	1.00	3,855	ft²	1.56	6,000		1.56	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**10,400**	**2.70**	
Z11	General Requirements	9.0%				7,800		2.02	
Z12	Fee	3.0%				2,600		0.67	
NET CONSTRUCTION COST							**598,800**	**155.33**	
Z2	**ALLOWANCES**						**59,900**	**15.54**	
Z21	Design Allowance	10.0%				59,900		15.54	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**658,700**	**170.87**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**658,700**	**170.87**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**658,700**	**170.87**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Toronto
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**37,300**	**9.68**	**7.1%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.85	18,700		4.85	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	27.68	18,600		4.82	
A2	**STRUCTURE**						**102,800**	**26.67**	**19.6%**
A21	Lowest Floor Construction	0.36	1,371	ft²	10.80	14,800		3.84	
A22.1	Upper Floor Construction	0.59	2,292	ft²	22.12	50,700		13.15	
A22.2	Stair Construction	0.01	28	risr	150.00	4,200		1.09	
A23	Roof Construction	0.39	1,512	ft²	21.89	33,100		8.59	
A3	**EXTERIOR ENCLOSURE**						**135,500**	**35.15**	**25.8%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	29.92	32,700		8.48	
A32.1	Walls Above Grade	0.62	2,395	ft²	27.52	65,900		17.09	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	43.65	17,200		4.46	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,600.00	3,200		0.83	
A34.1	Roof Covering	0.50	1,939	ft²	4.80	9,300		2.41	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	33.03	7,200		1.87	
B1	**PARTITIONS & DOORS**						**35,300**	**9.16**	**6.7%**
B11.1	Fixed Partitions	0.92	3,549	ft²	7.41	26,300		6.82	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	473.68	9,000		2.33	
B2	**FINISHES**						**58,800**	**15.25**	**11.2%**
B21	Floor Finishes	0.54	2,089	ft²	8.86	18,500		4.80	
B22	Ceiling Finishes	0.58	2,227	ft²	14.95	33,300		8.64	
B23	Wall Finishes	1.70	6,539	ft²	1.07	7,000		1.82	
B3	**FITTINGS & EQUIPMENT**						**28,200**	**7.32**	**5.4%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.22	12,400		3.22	
B31.3	Specialties	1.00	3,855	ft²	1.56	6,000		1.56	
B32	Equipment	1.00	3,855	ft²	2.54	9,800		2.54	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**47,100**	**12.22**	**9.0%**
C11	Plumbing and Drainage	1.00	3,855	ft²	7.34	28,300		7.34	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.67	18,000		4.67	
C14	Controls	1.00	3,855	ft²	0.21	800		0.21	
C2	**ELECTRICAL**						**24,200**	**6.28**	**4.6%**
C21	Service & Distribution	1.00	3,855	ft²	0.42	1,600		0.42	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	4.93	19,000		4.93	
C23	Systems & Ancillaries	1.00	3,855	ft²	0.93	3,600		0.93	
Z1	**GENERAL REQUIREMENTS & FEES**						**56,300**	**14.60**	**10.7%**
Z11	General Requirements	9.0%				42,200		10.95	
Z12	Fee	3.0%				14,100		3.66	
NET BUILDING COST							**525,500**	**136.32**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Toronto
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**525,500**	**136.32**	
D1	**SITE WORK**						**85,200**	**22.10**	
D11.1	Site Preparation	1.00	3,855	ft²	2.02	7,800		2.02	
D11.2	Hard Surfaces	1.00	3,855	ft²	3.81	14,700		3.81	
D11.3	Site Improvements	1.00	3,855	ft²	12.19	47,000		12.19	
D11.4	Landscaping	1.00	3,855	ft²	2.54	9,800		2.54	
D12	Mechanical Site Services	1.00	3,855	ft²	1.53	5,900		1.53	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**10,300**	**2.67**	
Z11	General Requirements	9.0%				7,700		2.00	
Z12	Fee	3.0%				2,600		0.67	
NET CONSTRUCTION COST							**621,000**	**161.09**	
Z2	**ALLOWANCES**						**62,100**	**16.11**	
Z21	Design Allowance	10.0%				62,100		16.11	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**683,100**	**177.20**	
	Harmonized Sales Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**683,100**	**177.20**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**683,100**	**177.20**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Halifax
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**33,800**	**8.77**	**7.1%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.28	16,500		4.28	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	25.74	17,300		4.49	
A2	**STRUCTURE**						**91,200**	**23.66**	**19.3%**
A21	Lowest Floor Construction	0.36	1,371	ft²	9.56	13,100		3.40	
A22.1	Upper Floor Construction	0.59	2,292	ft²	19.68	45,100		11.70	
A22.2	Stair Construction	0.01	28	risr	132.14	3,700		0.96	
A23	Roof Construction	0.39	1,512	ft²	19.38	29,300		7.60	
A3	**EXTERIOR ENCLOSURE**						**123,100**	**31.93**	**26.0%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	26.08	28,500		7.39	
A32.1	Walls Above Grade	0.62	2,395	ft²	24.55	58,800		15.25	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	46.45	18,300		4.75	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,550.00	3,100		0.80	
A34.1	Roof Covering	0.50	1,939	ft²	4.18	8,100		2.10	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	28.90	6,300		1.63	
B1	**PARTITIONS & DOORS**						**31,600**	**8.20**	**6.7%**
B11.1	Fixed Partitions	0.92	3,549	ft²	6.45	22,900		5.94	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	457.89	8,700		2.26	
B2	**FINISHES**						**52,500**	**13.62**	**11.1%**
B21	Floor Finishes	0.54	2,089	ft²	8.14	17,000		4.41	
B22	Ceiling Finishes	0.58	2,227	ft²	13.02	29,000		7.52	
B23	Wall Finishes	1.70	6,539	ft²	0.99	6,500		1.69	
B3	**FITTINGS & EQUIPMENT**						**26,500**	**6.87**	**5.6%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.01	11,600		3.01	
B31.3	Specialties	1.00	3,855	ft²	1.45	5,600		1.45	
B32	Equipment	1.00	3,855	ft²	2.41	9,300		2.41	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**42,500**	**11.02**	**9.0%**
C11	Plumbing and Drainage	1.00	3,855	ft²	6.59	25,400		6.59	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.23	16,300		4.23	
C14	Controls	1.00	3,855	ft²	0.21	800		0.21	
C2	**ELECTRICAL**						**21,700**	**5.63**	**4.6%**
C21	Service & Distribution	1.00	3,855	ft²	0.42	1,600		0.42	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	4.38	16,900		4.38	
C23	Systems & Ancillaries	1.00	3,855	ft²	0.83	3,200		0.83	
Z1	**GENERAL REQUIREMENTS & FEES**						**50,800**	**13.18**	**10.7%**
Z11	General Requirements	9.0%				38,100		9.88	
Z12	Fee	3.0%				12,700		3.29	
NET BUILDING COST							**473,700**	**122.88**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Halifax
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**473,700**	**122.88**	
D1	**SITE WORK**						**79,200**	**20.54**	
D11.1	Site Preparation	1.00	3,855	ft²	1.89	7,300		1.89	
D11.2	Hard Surfaces	1.00	3,855	ft²	3.53	13,600		3.53	
D11.3	Site Improvements	1.00	3,855	ft²	11.34	43,700		11.34	
D11.4	Landscaping	1.00	3,855	ft²	2.36	9,100		2.36	
D12	Mechanical Site Services	1.00	3,855	ft²	1.43	5,500		1.43	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**9,500**	**2.46**	
Z11	General Requirements	9.0%				7,100		1.84	
Z12	Fee	3.0%				2,400		0.62	
NET CONSTRUCTION COST							**562,400**	**145.89**	
Z2	**ALLOWANCES**						**56,200**	**14.58**	
Z21	Design Allowance	10.0%				56,200		14.58	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**618,600**	**160.47**	
	Harmonized Sales Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**618,600**	**160.47**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**618,600**	**160.47**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Montreal
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**34,500**	**8.95**	**7.1%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.49	17,300		4.49	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	25.60	17,200		4.46	
A2	**STRUCTURE**						**96,100**	**24.93**	**19.8%**
A21	Lowest Floor Construction	0.36	1,371	ft²	10.21	14,000		3.63	
A22.1	Upper Floor Construction	0.59	2,292	ft²	20.72	47,500		12.32	
A22.2	Stair Construction	0.01	28	risr	139.29	3,900		1.01	
A23	Roof Construction	0.39	1,512	ft²	20.30	30,700		7.96	
A3	**EXTERIOR ENCLOSURE**						**123,000**	**31.91**	**25.3%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	27.45	30,000		7.78	
A32.1	Walls Above Grade	0.62	2,395	ft²	24.26	58,100		15.07	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	44.16	17,400		4.51	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,500.00	3,000		0.78	
A34.1	Roof Covering	0.50	1,939	ft²	4.13	8,000		2.08	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	29.82	6,500		1.69	
B1	**PARTITIONS & DOORS**						**32,600**	**8.46**	**6.7%**
B11.1	Fixed Partitions	0.92	3,549	ft²	6.82	24,200		6.28	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	442.11	8,400		2.18	
B2	**FINISHES**						**55,200**	**14.32**	**11.4%**
B21	Floor Finishes	0.54	2,089	ft²	8.66	18,100		4.70	
B22	Ceiling Finishes	0.58	2,227	ft²	13.65	30,400		7.89	
B23	Wall Finishes	1.70	6,539	ft²	1.02	6,700		1.74	
B3	**FITTINGS & EQUIPMENT**						**26,600**	**6.90**	**5.5%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.04	11,700		3.04	
B31.3	Specialties	1.00	3,855	ft²	1.48	5,700		1.48	
B32	Equipment	1.00	3,855	ft²	2.39	9,200		2.39	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**43,400**	**11.26**	**8.9%**
C11	Plumbing and Drainage	1.00	3,855	ft²	6.72	25,900		6.72	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.33	16,700		4.33	
C14	Controls	1.00	3,855	ft²	0.21	800		0.21	
C2	**ELECTRICAL**						**22,100**	**5.73**	**4.6%**
C21	Service & Distribution	1.00	3,855	ft²	0.42	1,600		0.42	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	4.44	17,100		4.44	
C23	Systems & Ancillaries	1.00	3,855	ft²	0.88	3,400		0.88	
Z1	**GENERAL REQUIREMENTS & FEES**						**52,000**	**13.49**	**10.7%**
Z11	General Requirements	9.0%				39,000		10.12	
Z12	Fee	3.0%				13,000		3.37	
NET BUILDING COST							**485,500**	**125.94**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Montreal
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**485,500**	**125.94**	
D1	**SITE WORK**						**78,700**	**20.42**	
D11.1	Site Preparation	1.00	3,855	ft²	1.87	7,200		1.87	
D11.2	Hard Surfaces	1.00	3,855	ft²	3.53	13,600		3.53	
D11.3	Site Improvements	1.00	3,855	ft²	11.26	43,400		11.26	
D11.4	Landscaping	1.00	3,855	ft²	2.36	9,100		2.36	
D12	Mechanical Site Services	1.00	3,855	ft²	1.40	5,400		1.40	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**9,500**	**2.46**	
Z11	General Requirements	9.0%				7,100		1.84	
Z12	Fee	3.0%				2,400		0.62	
NET CONSTRUCTION COST							**573,700**	**148.82**	
Z2	**ALLOWANCES**						**57,400**	**14.89**	
Z21	Design Allowance	10.0%				57,400		14.89	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**631,100**	**163.71**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**631,100**	**163.71**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**631,100**	**163.71**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Calgary
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**38,200**	**9.91**	**7.4%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.95	19,100		4.95	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	28.42	19,100		4.95	
A2	**STRUCTURE**						**101,700**	**26.38**	**19.6%**
A21	Lowest Floor Construction	0.36	1,371	ft²	11.31	15,500		4.02	
A22.1	Upper Floor Construction	0.59	2,292	ft²	21.86	50,100		13.00	
A22.2	Stair Construction	0.01	28	risr	146.43	4,100		1.06	
A23	Roof Construction	0.39	1,512	ft²	21.16	32,000		8.30	
A3	**EXTERIOR ENCLOSURE**						**130,500**	**33.85**	**25.2%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	30.10	32,900		8.53	
A32.1	Walls Above Grade	0.62	2,395	ft²	25.59	61,300		15.90	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	45.69	18,000		4.67	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,550.00	3,100		0.80	
A34.1	Roof Covering	0.50	1,939	ft²	4.33	8,400		2.18	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	31.19	6,800		1.76	
B1	**PARTITIONS & DOORS**						**34,300**	**8.90**	**6.6%**
B11.1	Fixed Partitions	0.92	3,549	ft²	7.19	25,500		6.61	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	463.16	8,800		2.28	
B2	**FINISHES**						**59,100**	**15.33**	**11.4%**
B21	Floor Finishes	0.54	2,089	ft²	9.29	19,400		5.03	
B22	Ceiling Finishes	0.58	2,227	ft²	14.50	32,300		8.38	
B23	Wall Finishes	1.70	6,539	ft²	1.13	7,400		1.92	
B3	**FITTINGS & EQUIPMENT**						**27,900**	**7.24**	**5.4%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.19	12,300		3.19	
B31.3	Specialties	1.00	3,855	ft²	1.53	5,900		1.53	
B32	Equipment	1.00	3,855	ft²	2.52	9,700		2.52	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**46,800**	**12.14**	**9.0%**
C11	Plumbing and Drainage	1.00	3,855	ft²	7.24	27,900		7.24	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.70	18,100		4.70	
C14	Controls	1.00	3,855	ft²	0.21	800		0.21	
C2	**ELECTRICAL**						**23,900**	**6.20**	**4.6%**
C21	Service & Distribution	1.00	3,855	ft²	0.42	1,600		0.42	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	4.85	18,700		4.85	
C23	Systems & Ancillaries	1.00	3,855	ft²	0.93	3,600		0.93	
Z1	**GENERAL REQUIREMENTS & FEES**						**55,500**	**14.40**	**10.7%**
Z11	General Requirements	9.0%				41,600		10.79	
Z12	Fee	3.0%				13,900		3.61	
NET BUILDING COST							**517,900**	**134.35**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Calgary
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**517,900**	**134.35**	
D1	**SITE WORK**						**87,100**	**22.59**	
D11.1	Site Preparation	1.00	3,855	ft²	2.08	8,000		2.08	
D11.2	Hard Surfaces	1.00	3,855	ft²	3.89	15,000		3.89	
D11.3	Site Improvements	1.00	3,855	ft²	12.48	48,100		12.48	
D11.4	Landscaping	1.00	3,855	ft²	2.59	10,000		2.59	
D12	Mechanical Site Services	1.00	3,855	ft²	1.56	6,000		1.56	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**10,400**	**2.70**	
Z11	General Requirements	9.0%				7,800		2.02	
Z12	Fee	3.0%				2,600		0.67	
NET CONSTRUCTION COST							**615,400**	**159.64**	
Z2	**ALLOWANCES**						**61,500**	**15.95**	
Z21	Design Allowance	10.0%				61,500		15.95	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**676,900**	**175.59**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**676,900**	**175.59**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**676,900**	**175.59**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Whitehorse
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**40,200**	**10.43**	**7.5%**
A11.1	Standard Foundations	1.00	3,855	ft²	4.88	18,800		4.88	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	31.85	21,400		5.55	
A2	**STRUCTURE**						**102,200**	**26.51**	**19.1%**
A21	Lowest Floor Construction	0.36	1,371	ft²	12.33	16,900		4.38	
A22.1	Upper Floor Construction	0.59	2,292	ft²	21.86	50,100		13.00	
A22.2	Stair Construction	0.01	28	risr	142.86	4,000		1.04	
A23	Roof Construction	0.39	1,512	ft²	20.63	31,200		8.09	
A3	**EXTERIOR ENCLOSURE**						**139,100**	**36.08**	**26.0%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	27.17	29,700		7.70	
A32.1	Walls Above Grade	0.62	2,395	ft²	26.72	64,000		16.60	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	64.72	25,500		6.61	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,900.00	3,800		0.99	
A34.1	Roof Covering	0.50	1,939	ft²	4.74	9,200		2.39	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	31.65	6,900		1.79	
B1	**PARTITIONS & DOORS**						**34,300**	**8.90**	**6.4%**
B11.1	Fixed Partitions	0.92	3,549	ft²	6.85	24,300		6.30	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	526.32	10,000		2.59	
B2	**FINISHES**						**57,900**	**15.02**	**10.8%**
B21	Floor Finishes	0.54	2,089	ft²	9.81	20,500		5.32	
B22	Ceiling Finishes	0.58	2,227	ft²	13.96	31,100		8.07	
B23	Wall Finishes	1.70	6,539	ft²	0.96	6,300		1.63	
B3	**FITTINGS & EQUIPMENT**						**28,900**	**7.50**	**5.4%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.35	12,900		3.35	
B31.3	Specialties	1.00	3,855	ft²	1.56	6,000		1.56	
B32	Equipment	1.00	3,855	ft²	2.59	10,000		2.59	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**49,500**	**12.84**	**9.2%**
C11	Plumbing and Drainage	1.00	3,855	ft²	7.81	30,100		7.81	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	4.80	18,500		4.80	
C14	Controls	1.00	3,855	ft²	0.23	900		0.23	
C2	**ELECTRICAL**						**25,800**	**6.69**	**4.8%**
C21	Service & Distribution	1.00	3,855	ft²	0.44	1,700		0.44	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	5.24	20,200		5.24	
C23	Systems & Ancillaries	1.00	3,855	ft²	1.01	3,900		1.01	
Z1	**GENERAL REQUIREMENTS & FEES**						**57,300**	**14.86**	**10.7%**
Z11	General Requirements	9.0%				43,000		11.15	
Z12	Fee	3.0%				14,300		3.71	
NET BUILDING COST							**535,200**	**138.83**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Whitehorse
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**535,200**	**138.83**	
D1	**SITE WORK**						**97,900**	**25.40**	
D11.1	Site Preparation	1.00	3,855	ft²	2.33	9,000		2.33	
D11.2	Hard Surfaces	1.00	3,855	ft²	4.38	16,900		4.38	
D11.3	Site Improvements	1.00	3,855	ft²	14.01	54,000		14.01	
D11.4	Landscaping	1.00	3,855	ft²	2.91	11,200		2.91	
D12	Mechanical Site Services	1.00	3,855	ft²	1.76	6,800		1.76	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**11,700**	**3.04**	
Z11	General Requirements	9.0%				8,800		2.28	
Z12	Fee	3.0%				2,900		0.75	
NET CONSTRUCTION COST							**644,800**	**167.26**	
Z2	**ALLOWANCES**						**64,500**	**16.73**	
Z21	Design Allowance	10.0%				64,500		16.73	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**709,300**	**183.99**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**709,300**	**183.99**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**709,300**	**183.99**	

Costs of Newly Built Housing
South Archetypes - Single Family Home
Yellowknife
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**44,100**	**11.44**	**7.4%**
A11.1	Standard Foundations	1.00	3,855	ft²	5.47	21,100		5.47	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.17	672	cuyd	34.23	23,000		5.97	
A2	**STRUCTURE**						**117,400**	**30.45**	**19.6%**
A21	Lowest Floor Construction	0.36	1,371	ft²	13.27	18,200		4.72	
A22.1	Upper Floor Construction	0.59	2,292	ft²	25.26	57,900		15.02	
A22.2	Stair Construction	0.01	28	risr	167.86	4,700		1.22	
A23	Roof Construction	0.39	1,512	ft²	24.21	36,600		9.49	
A3	**EXTERIOR ENCLOSURE**						**154,200**	**40.00**	**25.7%**
A31	Structural Walls Below Grade	0.28	1,093	ft²	31.66	34,600		8.98	
A32.1	Walls Above Grade	0.62	2,395	ft²	30.23	72,400		18.78	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	394	ft²	64.72	25,500		6.61	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	2	lvs.	1,850.00	3,700		0.96	
A34.1	Roof Covering	0.50	1,939	ft²	5.21	10,100		2.62	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.06	218	ft²	36.24	7,900		2.05	
B1	**PARTITIONS & DOORS**						**39,200**	**10.17**	**6.5%**
B11.1	Fixed Partitions	0.92	3,549	ft²	8.20	29,100		7.55	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.00	19	lvs.	531.58	10,100		2.62	
B2	**FINISHES**						**66,800**	**17.33**	**11.2%**
B21	Floor Finishes	0.54	2,089	ft²	10.67	22,300		5.78	
B22	Ceiling Finishes	0.58	2,227	ft²	16.70	37,200		9.65	
B23	Wall Finishes	1.70	6,539	ft²	1.12	7,300		1.89	
B3	**FITTINGS & EQUIPMENT**						**29,900**	**7.76**	**5.0%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	3,855	ft²	3.48	13,400		3.48	
B31.3	Specialties	1.00	3,855	ft²	1.63	6,300		1.63	
B32	Equipment	1.00	3,855	ft²	2.65	10,200		2.65	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**54,700**	**14.19**	**9.1%**
C11	Plumbing and Drainage	1.00	3,855	ft²	8.69	33,500		8.69	
C12	Fire Protection	0.00	0	ft²	0.00	0		0.00	
C13	HVAC	1.00	3,855	ft²	5.24	20,200		5.24	
C14	Controls	1.00	3,855	ft²	0.26	1,000		0.26	
C2	**ELECTRICAL**						**28,600**	**7.42**	**4.8%**
C21	Service & Distribution	1.00	3,855	ft²	0.49	1,900		0.49	
C22	Lighting, Devices & Heating	1.00	3,855	ft²	5.84	22,500		5.84	
C23	Systems & Ancillaries	1.00	3,855	ft²	1.09	4,200		1.09	
Z1	**GENERAL REQUIREMENTS & FEES**						**64,100**	**16.63**	**10.7%**
Z11	General Requirements	9.0%				48,100		12.48	
Z12	Fee	3.0%				16,000		4.15	
NET BUILDING COST							**599,000**	**155.38**	**100%**

Costs of Newly Built Housing
South Archetypes - Single Family Home
Yellowknife
Class C Estimate
March 16, 2017
GFA: 3,855 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**599,000**	**155.38**	
D1	**SITE WORK**						**105,300**	**27.32**	
D11.1	Site Preparation	1.00	3,855	ft²	2.52	9,700		2.52	
D11.2	Hard Surfaces	1.00	3,855	ft²	4.70	18,100		4.70	
D11.3	Site Improvements	1.00	3,855	ft²	15.07	58,100		15.07	
D11.4	Landscaping	1.00	3,855	ft²	3.14	12,100		3.14	
D12	Mechanical Site Services	1.00	3,855	ft²	1.89	7,300		1.89	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**12,700**	**3.29**	
Z11	General Requirements	9.0%				9,500		2.46	
Z12	Fee	3.0%				3,200		0.83	
NET CONSTRUCTION COST							**717,000**	**185.99**	
Z2	**ALLOWANCES**						**71,700**	**18.60**	
Z21	Design Allowance	10.0%				71,700		18.60	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**788,700**	**204.59**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**788,700**	**204.59**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**788,700**	**204.59**	

Appendix C

Townhouse Costing Details

Costs of Newly Built Housing
South Archetypes - Townhouse
Vancouver
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**92,700**	**10.25**	**6.9%**
A11.1	Standard Foundations	1.00	9,045	ft²	6.98	63,100		6.98	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	29.69	29,600		3.27	
A2	**STRUCTURE**						**223,200**	**24.68**	**16.6%**
A21	Lowest Floor Construction	0.34	3,072	ft²	10.42	32,000		3.54	
A22.1	Upper Floor Construction	0.66	5,998	ft²	15.42	92,500		10.23	
A22.2	Stair Construction	0.02	155	risr	147.10	22,800		2.52	
A23	Roof Construction	0.39	3,489	ft²	21.75	75,900		8.39	
A3	**EXTERIOR ENCLOSURE**						**283,800**	**31.38**	**21.1%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	27.74	33,400		3.69	
A32.1	Walls Above Grade	0.51	4,571	ft²	26.21	119,800		13.24	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	41.28	36,700		4.06	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	1,858.82	31,600		3.49	
A34.1	Roof Covering	0.39	3,489	ft²	11.03	38,500		4.26	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	50.11	23,800		2.63	
B1	**PARTITIONS & DOORS**						**147,800**	**16.34**	**11.0%**
B11.1	Fixed Partitions	1.44	13,022	ft²	9.05	117,900		13.03	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	453.03	29,900		3.31	
B2	**FINISHES**						**119,400**	**13.20**	**8.9%**
B21	Floor Finishes	0.82	7,385	ft²	7.18	53,000		5.86	
B22	Ceiling Finishes	0.85	7,688	ft²	5.57	42,800		4.73	
B23	Wall Finishes	2.84	25,700	ft²	0.92	23,600		2.61	
B3	**FITTINGS & EQUIPMENT**						**78,900**	**8.72**	**5.9%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	3.87	35,000		3.87	
B31.3	Specialties	1.00	9,045	ft²	1.57	14,200		1.57	
B32	Equipment	1.00	9,045	ft²	3.28	29,700		3.28	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**195,800**	**21.65**	**14.5%**
C11	Plumbing and Drainage	1.00	9,045	ft²	11.03	99,800		11.03	
C12	Fire Protection	1.00	9,045	ft²	3.00	27,100		3.00	
C13	HVAC	1.00	9,045	ft²	7.25	65,600		7.25	
C14	Controls	1.00	9,045	ft²	0.36	3,300		0.36	
C2	**ELECTRICAL**						**62,200**	**6.88**	**4.6%**
C21	Service & Distribution	1.00	9,045	ft²	0.75	6,800		0.75	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	5.13	46,400		5.13	
C23	Systems & Ancillaries	1.00	9,045	ft²	1.00	9,000		1.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**144,400**	**15.96**	**10.7%**
Z11	General Requirements	9.0%				108,300		11.97	
Z12	Fee	3.0%				36,100		3.99	
NET BUILDING COST							**1,348,200**	**149.05**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Vancouver
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,348,200**	**149.05**	
D1	**SITE WORK**						**113,900**	**12.59**	
D11.1	Site Preparation	1.00	9,045	ft²	2.21	20,000		2.21	
D11.2	Hard Surfaces	1.00	9,045	ft²	3.87	35,000		3.87	
D11.3	Site Improvements	1.00	9,045	ft²	0.43	3,900		0.43	
D11.4	Landscaping	1.00	9,045	ft²	3.87	35,000		3.87	
D12	Mechanical Site Services	1.00	9,045	ft²	2.21	20,000		2.21	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**13,700**	**1.51**	
Z11	General Requirements	9.0%				10,300		1.14	
Z12	Fee	3.0%				3,400		0.38	
NET CONSTRUCTION COST							**1,475,800**	**163.16**	
Z2	**ALLOWANCES**						**147,600**	**16.32**	
Z21	Design Allowance	10.0%				147,600		16.32	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,623,400**	**179.48**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,623,400**	**179.48**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,623,400**	**179.48**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Toronto
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**95,100**	**10.51**	**6.7%**
A11.1	Standard Foundations	1.00	9,045	ft²	7.33	66,300		7.33	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	28.89	28,800		3.18	
A2	**STRUCTURE**						**234,600**	**25.94**	**16.5%**
A21	Lowest Floor Construction	0.34	3,072	ft²	10.81	33,200		3.67	
A22.1	Upper Floor Construction	0.66	5,998	ft²	16.17	97,000		10.72	
A22.2	Stair Construction	0.02	155	risr	154.84	24,000		2.65	
A23	Roof Construction	0.39	3,489	ft²	23.04	80,400		8.89	
A3	**EXTERIOR ENCLOSURE**						**301,600**	**33.34**	**21.3%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	29.82	35,900		3.97	
A32.1	Walls Above Grade	0.51	4,571	ft²	27.96	127,800		14.13	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	43.31	38,500		4.26	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	1,941.18	33,000		3.65	
A34.1	Roof Covering	0.39	3,489	ft²	11.87	41,400		4.58	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	52.63	25,000		2.76	
B1	**PARTITIONS & DOORS**						**160,300**	**17.72**	**11.3%**
B11.1	Fixed Partitions	1.44	13,022	ft²	9.91	129,000		14.26	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	474.24	31,300		3.46	
B2	**FINISHES**						**121,800**	**13.47**	**8.6%**
B21	Floor Finishes	0.82	7,385	ft²	6.76	49,900		5.52	
B22	Ceiling Finishes	0.85	7,688	ft²	6.17	47,400		5.24	
B23	Wall Finishes	2.84	25,700	ft²	0.95	24,500		2.71	
B3	**FITTINGS & EQUIPMENT**						**80,400**	**8.89**	**5.7%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	3.99	36,100		3.99	
B31.3	Specialties	1.00	9,045	ft²	1.58	14,300		1.58	
B32	Equipment	1.00	9,045	ft²	3.32	30,000		3.32	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**207,800**	**22.97**	**14.7%**
C11	Plumbing and Drainage	1.00	9,045	ft²	11.35	102,700		11.35	
C12	Fire Protection	1.00	9,045	ft²	3.12	28,200		3.12	
C13	HVAC	1.00	9,045	ft²	8.13	73,500		8.13	
C14	Controls	1.00	9,045	ft²	0.38	3,400		0.38	
C2	**ELECTRICAL**						**64,300**	**7.11**	**4.5%**
C21	Service & Distribution	1.00	9,045	ft²	0.78	7,100		0.78	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	5.30	47,900		5.30	
C23	Systems & Ancillaries	1.00	9,045	ft²	1.03	9,300		1.03	
Z1	**GENERAL REQUIREMENTS & FEES**						**151,900**	**16.79**	**10.7%**
Z11	General Requirements	9.0%				113,900		12.59	
Z12	Fee	3.0%				38,000		4.20	
NET BUILDING COST							**1,417,800**	**156.75**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Toronto
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,417,800**	**156.75**	
D1	**SITE WORK**						**111,600**	**12.34**	
D11.1	Site Preparation	1.00	9,045	ft²	2.16	19,500		2.16	
D11.2	Hard Surfaces	1.00	9,045	ft²	3.78	34,200		3.78	
D11.3	Site Improvements	1.00	9,045	ft²	0.46	4,200		0.46	
D11.4	Landscaping	1.00	9,045	ft²	3.78	34,200		3.78	
D12	Mechanical Site Services	1.00	9,045	ft²	2.16	19,500		2.16	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**13,300**	**1.47**	
Z11	General Requirements	9.0%				10,000		1.11	
Z12	Fee	3.0%				3,300		0.36	
NET CONSTRUCTION COST							**1,542,700**	**170.56**	
Z2	**ALLOWANCES**						**154,300**	**17.06**	
Z21	Design Allowance	10.0%				154,300		17.06	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,697,000**	**187.62**	
	Harmonized Sales Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,697,000**	**187.62**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,697,000**	**187.62**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Halifax
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**84,700**	**9.36**	**6.6%**
A11.1	Standard Foundations	1.00	9,045	ft²	6.40	57,900		6.40	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	26.88	26,800		2.96	
A2	**STRUCTURE**						**207,000**	**22.89**	**16.2%**
A21	Lowest Floor Construction	0.34	3,072	ft²	9.60	29,500		3.26	
A22.1	Upper Floor Construction	0.66	5,998	ft²	14.25	85,500		9.45	
A22.2	Stair Construction	0.02	155	risr	136.77	21,200		2.34	
A23	Roof Construction	0.39	3,489	ft²	20.29	70,800		7.83	
A3	**EXTERIOR ENCLOSURE**						**276,800**	**30.60**	**21.7%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	26.00	31,300		3.46	
A32.1	Walls Above Grade	0.51	4,571	ft²	24.94	114,000		12.60	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	46.12	41,000		4.53	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	1,894.12	32,200		3.56	
A34.1	Roof Covering	0.39	3,489	ft²	10.38	36,200		4.00	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	46.53	22,100		2.44	
B1	**PARTITIONS & DOORS**						**144,500**	**15.98**	**11.3%**
B11.1	Fixed Partitions	1.44	13,022	ft²	8.76	114,100		12.61	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	460.61	30,400		3.36	
B2	**FINISHES**						**109,700**	**12.13**	**8.6%**
B21	Floor Finishes	0.82	7,385	ft²	6.17	45,600		5.04	
B22	Ceiling Finishes	0.85	7,688	ft²	5.39	41,400		4.58	
B23	Wall Finishes	2.84	25,700	ft²	0.88	22,700		2.51	
B3	**FITTINGS & EQUIPMENT**						**75,900**	**8.39**	**5.9%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	3.75	33,900		3.75	
B31.3	Specialties	1.00	9,045	ft²	1.50	13,600		1.50	
B32	Equipment	1.00	9,045	ft²	3.14	28,400		3.14	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**183,400**	**20.28**	**14.4%**
C11	Plumbing and Drainage	1.00	9,045	ft²	9.99	90,400		9.99	
C12	Fire Protection	1.00	9,045	ft²	2.81	25,400		2.81	
C13	HVAC	1.00	9,045	ft²	7.13	64,500		7.13	
C14	Controls	1.00	9,045	ft²	0.34	3,100		0.34	
C2	**ELECTRICAL**						**59,000**	**6.52**	**4.6%**
C21	Service & Distribution	1.00	9,045	ft²	0.77	7,000		0.77	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	4.82	43,600		4.82	
C23	Systems & Ancillaries	1.00	9,045	ft²	0.93	8,400		0.93	
Z1	**GENERAL REQUIREMENTS & FEES**						**136,900**	**15.14**	**10.7%**
Z11	General Requirements	9.0%				102,700		11.35	
Z12	Fee	3.0%				34,200		3.78	
NET BUILDING COST							**1,277,900**	**141.28**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Halifax
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,277,900**	**141.28**	
D1	**SITE WORK**						**103,200**	**11.41**	
D11.1	Site Preparation	1.00	9,045	ft²	2.00	18,100		2.00	
D11.2	Hard Surfaces	1.00	9,045	ft²	3.50	31,700		3.50	
D11.3	Site Improvements	1.00	9,045	ft²	0.40	3,600		0.40	
D11.4	Landscaping	1.00	9,045	ft²	3.50	31,700		3.50	
D12	Mechanical Site Services	1.00	9,045	ft²	2.00	18,100		2.00	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**12,400**	**1.37**	
Z11	General Requirements	9.0%				9,300		1.03	
Z12	Fee	3.0%				3,100		0.34	
NET CONSTRUCTION COST							**1,393,500**	**154.06**	
Z2	**ALLOWANCES**						**139,400**	**15.41**	
Z21	Design Allowance	10.0%				139,400		15.41	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,532,900**	**169.47**	
	Harmonized Sales Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,532,900**	**169.47**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,532,900**	**169.47**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Montreal
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**87,400**	**9.66**	**6.7%**
A11.1	Standard Foundations	1.00	9,045	ft²	6.71	60,700		6.71	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	26.78	26,700		2.95	
A2	**STRUCTURE**						**217,800**	**24.08**	**16.6%**
A21	Lowest Floor Construction	0.34	3,072	ft²	10.25	31,500		3.48	
A22.1	Upper Floor Construction	0.66	5,998	ft²	15.11	90,600		10.02	
A22.2	Stair Construction	0.02	155	risr	143.87	22,300		2.47	
A23	Roof Construction	0.39	3,489	ft²	21.04	73,400		8.11	
A3	**EXTERIOR ENCLOSURE**						**274,200**	**30.32**	**20.9%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	27.33	32,900		3.64	
A32.1	Walls Above Grade	0.51	4,571	ft²	24.61	112,500		12.44	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	44.09	39,200		4.33	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	1,805.88	30,700		3.39	
A34.1	Roof Covering	0.39	3,489	ft²	10.29	35,900		3.97	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	48.42	23,000		2.54	
B1	**PARTITIONS & DOORS**						**146,200**	**16.16**	**11.2%**
B11.1	Fixed Partitions	1.44	13,022	ft²	8.99	117,100		12.95	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	440.91	29,100		3.22	
B2	**FINISHES**						**115,700**	**12.79**	**8.8%**
B21	Floor Finishes	0.82	7,385	ft²	6.58	48,600		5.37	
B22	Ceiling Finishes	0.85	7,688	ft²	5.70	43,800		4.84	
B23	Wall Finishes	2.84	25,700	ft²	0.91	23,300		2.58	
B3	**FITTINGS & EQUIPMENT**						**76,000**	**8.40**	**5.8%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	3.76	34,000		3.76	
B31.3	Specialties	1.00	9,045	ft²	1.50	13,600		1.50	
B32	Equipment	1.00	9,045	ft²	3.14	28,400		3.14	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**192,900**	**21.33**	**14.7%**
C11	Plumbing and Drainage	1.00	9,045	ft²	10.45	94,500		10.45	
C12	Fire Protection	1.00	9,045	ft²	2.87	26,000		2.87	
C13	HVAC	1.00	9,045	ft²	7.65	69,200		7.65	
C14	Controls	1.00	9,045	ft²	0.35	3,200		0.35	
C2	**ELECTRICAL**						**60,200**	**6.66**	**4.6%**
C21	Service & Distribution	1.00	9,045	ft²	0.80	7,200		0.80	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	4.91	44,400		4.91	
C23	Systems & Ancillaries	1.00	9,045	ft²	0.95	8,600		0.95	
Z1	**GENERAL REQUIREMENTS & FEES**						**140,400**	**15.52**	**10.7%**
Z11	General Requirements	9.0%				105,300		11.64	
Z12	Fee	3.0%				35,100		3.88	
NET BUILDING COST							**1,310,800**	**144.92**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Montreal
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,310,800**	**144.92**	
D1	**SITE WORK**						**103,200**	**11.41**	
D11.1	Site Preparation	1.00	9,045	ft²	2.00	18,100		2.00	
D11.2	Hard Surfaces	1.00	9,045	ft²	3.49	31,600		3.49	
D11.3	Site Improvements	1.00	9,045	ft²	0.42	3,800		0.42	
D11.4	Landscaping	1.00	9,045	ft²	3.49	31,600		3.49	
D12	Mechanical Site Services	1.00	9,045	ft²	2.00	18,100		2.00	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**12,400**	**1.37**	
Z11	General Requirements	9.0%				9,300		1.03	
Z12	Fee	3.0%				3,100		0.34	
NET CONSTRUCTION COST							**1,426,400**	**157.70**	
Z2	**ALLOWANCES**						**142,600**	**15.77**	
Z21	Design Allowance	10.0%				142,600		15.77	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,569,000**	**173.47**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,569,000**	**173.47**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,569,000**	**173.47**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Calgary
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**96,500**	**10.67**	**6.9%**
A11.1	Standard Foundations	1.00	9,045	ft²	7.41	67,000		7.41	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	29.59	29,500		3.26	
A2	**STRUCTURE**						**231,100**	**25.55**	**16.5%**
A21	Lowest Floor Construction	0.34	3,072	ft²	11.33	34,800		3.85	
A22.1	Upper Floor Construction	0.66	5,998	ft²	16.07	96,400		10.66	
A22.2	Stair Construction	0.02	155	risr	149.68	23,200		2.56	
A23	Roof Construction	0.39	3,489	ft²	21.98	76,700		8.48	
A3	**EXTERIOR ENCLOSURE**						**289,900**	**32.05**	**20.7%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	30.07	36,200		4.00	
A32.1	Walls Above Grade	0.51	4,571	ft²	26.14	119,500		13.21	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	45.67	40,600		4.49	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	1,864.71	31,700		3.50	
A34.1	Roof Covering	0.39	3,489	ft²	10.83	37,800		4.18	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	50.74	24,100		2.66	
B1	**PARTITIONS & DOORS**						**156,500**	**17.30**	**11.2%**
B11.1	Fixed Partitions	1.44	13,022	ft²	9.68	126,100		13.94	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	460.61	30,400		3.36	
B2	**FINISHES**						**125,200**	**13.84**	**8.9%**
B21	Floor Finishes	0.82	7,385	ft²	7.05	52,100		5.76	
B22	Ceiling Finishes	0.85	7,688	ft²	6.11	47,000		5.20	
B23	Wall Finishes	2.84	25,700	ft²	1.02	26,100		2.89	
B3	**FITTINGS & EQUIPMENT**						**80,300**	**8.88**	**5.7%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	3.98	36,000		3.98	
B31.3	Specialties	1.00	9,045	ft²	1.58	14,300		1.58	
B32	Equipment	1.00	9,045	ft²	3.32	30,000		3.32	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**208,400**	**23.04**	**14.9%**
C11	Plumbing and Drainage	1.00	9,045	ft²	11.33	102,500		11.33	
C12	Fire Protection	1.00	9,045	ft²	3.08	27,900		3.08	
C13	HVAC	1.00	9,045	ft²	8.25	74,600		8.25	
C14	Controls	1.00	9,045	ft²	0.38	3,400		0.38	
C2	**ELECTRICAL**						**63,700**	**7.04**	**4.5%**
C21	Service & Distribution	1.00	9,045	ft²	0.76	6,900		0.76	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	5.25	47,500		5.25	
C23	Systems & Ancillaries	1.00	9,045	ft²	1.03	9,300		1.03	
Z1	**GENERAL REQUIREMENTS & FEES**						**150,100**	**16.59**	**10.7%**
Z11	General Requirements	9.0%				112,600		12.45	
Z12	Fee	3.0%				37,500		4.15	
NET BUILDING COST							**1,401,700**	**154.97**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Calgary
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,401,700**	**154.97**	
D1	**SITE WORK**						**114,200**	**12.63**	
D11.1	Site Preparation	1.00	9,045	ft²	2.21	20,000		2.21	
D11.2	Hard Surfaces	1.00	9,045	ft²	3.87	35,000		3.87	
D11.3	Site Improvements	1.00	9,045	ft²	0.46	4,200		0.46	
D11.4	Landscaping	1.00	9,045	ft²	3.87	35,000		3.87	
D12	Mechanical Site Services	1.00	9,045	ft²	2.21	20,000		2.21	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**13,700**	**1.51**	
Z11	General Requirements	9.0%				10,300		1.14	
Z12	Fee	3.0%				3,400		0.38	
NET CONSTRUCTION COST							**1,529,600**	**169.11**	
Z2	**ALLOWANCES**						**153,000**	**16.92**	
Z21	Design Allowance	10.0%				153,000		16.92	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,682,600**	**186.03**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,682,600**	**186.03**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,682,600**	**186.03**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Whitehorse
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**96,700**	**10.69**	**6.7%**
A11.1	Standard Foundations	1.00	9,045	ft²	7.05	63,800		7.05	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	33.00	32,900		3.64	
A2	**STRUCTURE**						**235,000**	**25.98**	**16.2%**
A21	Lowest Floor Construction	0.34	3,072	ft²	12.40	38,100		4.21	
A22.1	Upper Floor Construction	0.66	5,998	ft²	15.92	95,500		10.56	
A22.2	Stair Construction	0.02	155	risr	145.16	22,500		2.49	
A23	Roof Construction	0.39	3,489	ft²	22.61	78,900		8.72	
A3	**EXTERIOR ENCLOSURE**						**317,400**	**35.09**	**21.9%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	26.83	32,300		3.57	
A32.1	Walls Above Grade	0.51	4,571	ft²	27.41	125,300		13.85	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	64.57	57,400		6.35	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	2,247.06	38,200		4.22	
A34.1	Roof Covering	0.39	3,489	ft²	11.61	40,500		4.48	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	49.89	23,700		2.62	
B1	**PARTITIONS & DOORS**						**161,500**	**17.86**	**11.2%**
B11.1	Fixed Partitions	1.44	13,022	ft²	9.70	126,300		13.96	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	533.33	35,200		3.89	
B2	**FINISHES**						**118,200**	**13.07**	**8.2%**
B21	Floor Finishes	0.82	7,385	ft²	7.35	54,300		6.00	
B22	Ceiling Finishes	0.85	7,688	ft²	5.53	42,500		4.70	
B23	Wall Finishes	2.84	25,700	ft²	0.83	21,400		2.37	
B3	**FITTINGS & EQUIPMENT**						**82,500**	**9.12**	**5.7%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	4.16	37,600		4.16	
B31.3	Specialties	1.00	9,045	ft²	1.60	14,500		1.60	
B32	Equipment	1.00	9,045	ft²	3.36	30,400		3.36	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**214,000**	**23.66**	**14.8%**
C11	Plumbing and Drainage	1.00	9,045	ft²	12.18	110,200		12.18	
C12	Fire Protection	1.00	9,045	ft²	3.29	29,800		3.29	
C13	HVAC	1.00	9,045	ft²	7.78	70,400		7.78	
C14	Controls	1.00	9,045	ft²	0.40	3,600		0.40	
C2	**ELECTRICAL**						**67,800**	**7.50**	**4.7%**
C21	Service & Distribution	1.00	9,045	ft²	0.83	7,500		0.83	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	5.58	50,500		5.58	
C23	Systems & Ancillaries	1.00	9,045	ft²	1.08	9,800		1.08	
Z1	**GENERAL REQUIREMENTS & FEES**						**155,200**	**17.16**	**10.7%**
Z11	General Requirements	9.0%				116,400		12.87	
Z12	Fee	3.0%				38,800		4.29	
NET BUILDING COST							**1,448,300**	**160.12**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Whitehorse
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,448,300**	**160.12**	
D1	**SITE WORK**						**126,100**	**13.94**	
D11.1	Site Preparation	1.00	9,045	ft²	2.47	22,300		2.47	
D11.2	Hard Surfaces	1.00	9,045	ft²	4.30	38,900		4.30	
D11.3	Site Improvements	1.00	9,045	ft²	0.41	3,700		0.41	
D11.4	Landscaping	1.00	9,045	ft²	4.30	38,900		4.30	
D12	Mechanical Site Services	1.00	9,045	ft²	2.47	22,300		2.47	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**15,100**	**1.67**	
Z11	General Requirements	9.0%				11,300		1.25	
Z12	Fee	3.0%				3,800		0.42	
NET CONSTRUCTION COST							**1,589,500**	**175.73**	
Z2	**ALLOWANCES**						**159,000**	**17.58**	
Z21	Design Allowance	10.0%				159,000		17.58	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,748,500**	**193.31**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,748,500**	**193.31**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,748,500**	**193.31**	

Costs of Newly Built Housing
South Archetypes - Townhouse
Yellowknife
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

	Element	Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
A1	**SUBSTRUCTURE**						**108,200**	**11.96**	**6.7%**
A11.1	Standard Foundations	1.00	9,045	ft²	8.04	72,700		8.04	
A11.2	Special Foundations	0.00	0	ft²	0.00	0		0.00	
A12	Basement Excavation	0.11	997	cuyd	35.61	35,500		3.92	
A2	**STRUCTURE**						**270,800**	**29.94**	**16.8%**
A21	Lowest Floor Construction	0.34	3,072	ft²	13.38	41,100		4.54	
A22.1	Upper Floor Construction	0.66	5,998	ft²	18.54	111,200		12.29	
A22.2	Stair Construction	0.02	155	risr	171.61	26,600		2.94	
A23	Roof Construction	0.39	3,489	ft²	26.34	91,900		10.16	
A3	**EXTERIOR ENCLOSURE**						**346,800**	**38.34**	**21.5%**
A31	Structural Walls Below Grade	0.13	1,204	ft²	31.40	37,800		4.18	
A32.1	Walls Above Grade	0.51	4,571	ft²	30.78	140,700		15.56	
A32.2	Structural Walls Above Grade	0.00	0	ft²	0.00	0		0.00	
A32.3	Curtain Walls	0.00	0	ft²	0.00	0		0.00	
A33.1	Windows & Louvres	0.10	889	ft²	64.68	57,500		6.36	
A33.2	Glazed Screens	0.00	0	ft²	0.00	0		0.00	
A33.3	Doors	0.00	17	lvs.	2,241.18	38,100		4.21	
A34.1	Roof Covering	0.39	3,489	ft²	12.93	45,100		4.99	
A34.2	Skylights	0.00	0	ft²	0.00	0		0.00	
A35	Projections	0.05	475	ft²	58.11	27,600		3.05	
B1	**PARTITIONS & DOORS**						**181,200**	**20.03**	**11.2%**
B11.1	Fixed Partitions	1.44	13,022	ft²	11.18	145,600		16.10	
B11.2	Moveable Partitions	0.00	0	ft²	0.00	0		0.00	
B11.3	Structural Partitions	0.00	0	ft²	0.00	0		0.00	
B12	Doors	0.01	66	lvs.	539.39	35,600		3.94	
B2	**FINISHES**						**136,300**	**15.07**	**8.4%**
B21	Floor Finishes	0.82	7,385	ft²	8.04	59,400		6.57	
B22	Ceiling Finishes	0.85	7,688	ft²	6.74	51,800		5.73	
B23	Wall Finishes	2.84	25,700	ft²	0.98	25,100		2.78	
B3	**FITTINGS & EQUIPMENT**						**85,300**	**9.43**	**5.3%**
B31.1	Metals	0.00	0	ft²	0.00	0		0.00	
B31.2	Millwork	1.00	9,045	ft²	4.32	39,100		4.32	
B31.3	Specialties	1.00	9,045	ft²	1.65	14,900		1.65	
B32	Equipment	1.00	9,045	ft²	3.46	31,300		3.46	
B33.1	Elevators	0.00	0	stop	0	0		0.00	
B33.2	Escalators & Moving Walkways	0.00	0	no.	0.00	0		0.00	
B33.3	Material Handling Systems	0.00	0	no.	0.00	0		0.00	
C1	**MECHANICAL**						**236,900**	**26.19**	**14.7%**
C11	Plumbing and Drainage	1.00	9,045	ft²	13.44	121,600		13.44	
C12	Fire Protection	1.00	9,045	ft²	3.66	33,100		3.66	
C13	HVAC	1.00	9,045	ft²	8.65	78,200		8.65	
C14	Controls	1.00	9,045	ft²	0.44	4,000		0.44	
C2	**ELECTRICAL**						**74,900**	**8.28**	**4.6%**
C21	Service & Distribution	1.00	9,045	ft²	0.91	8,200		0.91	
C22	Lighting, Devices & Heating	1.00	9,045	ft²	6.16	55,700		6.16	
C23	Systems & Ancillaries	1.00	9,045	ft²	1.22	11,000		1.22	
Z1	**GENERAL REQUIREMENTS & FEES**						**172,800**	**19.10**	**10.7%**
Z11	General Requirements	9.0%				129,600		14.33	
Z12	Fee	3.0%				43,200		4.78	
NET BUILDING COST							**1,613,200**	**178.35**	**100%**

Costs of Newly Built Housing
South Archetypes - Townhouse
Yellowknife
Class C Estimate
March 16, 2017
GFA: 9,045 ft²

Element		Ratio G.F.A.	Element Quantity	Element Unit	Average Unit Cost	Amount $	Total Cost $	Cost/Floor Area $/ ft²	%
NET BUILDING COST							**1,613,200**	**178.35**	
D1	**SITE WORK**						**136,600**	**15.10**	
D11.1	Site Preparation	1.00	9,045	ft²	2.65	24,000		2.65	
D11.2	Hard Surfaces	1.00	9,045	ft²	4.65	42,100		4.65	
D11.3	Site Improvements	1.00	9,045	ft²	0.49	4,400		0.49	
D11.4	Landscaping	1.00	9,045	ft²	4.65	42,100		4.65	
D12	Mechanical Site Services	1.00	9,045	ft²	2.65	24,000		2.65	
D13	Electrical Site Services	0.00	0	ft²	0.00	0		0.00	
D2	**ANCILLARY WORK**						**0**	**0.00**	
D21.1	Demolition	0.00	0	ft²	0.00	0		0.00	
D21.2	Hazardous Materials	0.00	0	ft²	0.00	0		0.00	
D22	Alteration	0.00	0	ft²	0.00	0		0.00	
Z1	**GENERAL REQUIREMENTS & FEES**						**16,400**	**1.81**	
Z11	General Requirements	9.0%				12,300		1.36	
Z12	Fee	3.0%				4,100		0.45	
NET CONSTRUCTION COST							**1,766,200**	**195.27**	
Z2	**ALLOWANCES**						**176,600**	**19.52**	
Z21	Design Allowance	10.0%				176,600		19.52	
Z23	Construction Allowance	0.0%				0		0.00	
SUBTOTAL CONSTRUCTION COST							**1,942,800**	**214.79**	
	Goods & Services Tax	**0.0%**					**0**	**0.00**	
TOTAL CONSTRUCTION COST							**1,942,800**	**214.79**	
Z22	Escalation Allowance	0.0%					**0**	**0.00**	
ESCALATED CONSTRUCTION COST							**1,942,800**	**214.79**	

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