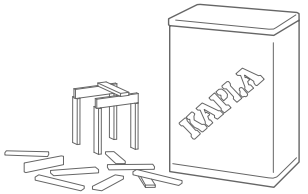
KAPLA



The original "Kapla" blocks are a toy construction set of identical wood planks measuring 11.7cm x 2.34cm x 0.78cm. It is a fun and simple modular system for children and adults.

Mass timber towers are not quite so simple, but our design is grounded in this modularity.

The building is a rectangle, optimized to the typical dimension of a 10' (3.05m) CLT panel width. The unit layouts align carefully with the glulam column grid and the facade is panelized accordingly. This is not sculptural architecture, there are no structural gymnastics. The beauty is in the material itself and the sustainable industry it supports.

That's why Kapla's proudest moment is during construction.

20 storeys (63.2m)	Building Height	80	Dwellings
525m²	Building Area	200	Bedrooms
10,140m²	Gross Floor Area	2	Elevators
8,500m²	Residential GFA	4	Car Parking
5.0	Density (FSI)	160	Bike Parking

A SIMPLE, SKINNY EXTRUSION UNLOCKS THE SITE

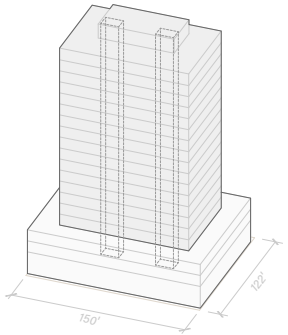
Kapla has a much smaller floorplate than typical high-rise projects, made possible by the compact vertical circulation core commonly known as a "Point Access Block" with a single exit stair and two elevators.

Rather than a dozen or more units along a long hallway, this compact tower has 4 to 6 dwellings per storey, so that most of the homes get a large corner balcony and living space as well as daylight and fresh air from multiple sides.

The skinny building also means smaller shadows on adjacent properties and is in keeping with the rhythm of narrower mixed-use buildings on 50' lot widths along the street. The simple structural grid also avoids costly and carbon-intensive load transfers over the long-span space of the theatre.

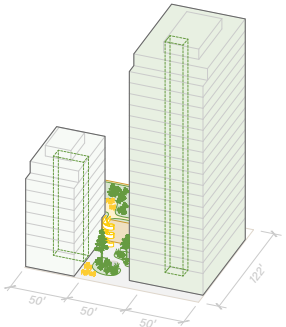
The result is a highly efficient tower that unlocks more outdoor space for the public at street level.

TYPICAL TOWER + PODIUM
"DOUBLE-LOADED CORRIDOR"



750m² residential floorplate
95% lot coverage

KAPLA TOWER
"POINT ACCESS BLOCK"



510m² residential floorplate
67% lot coverage

A HYBRID STRUCTURE ACHIEVES HEIGHT & SAFETY

The BC Building Code prescribes a maximum building height for encapsulated mass timber (EMTC) buildings up to 18 storeys, exposed mass timber up to 8 storeys and light wood-frame construction up to 6 storeys. However, the current limit of 18 storeys is a risk threshold established by the height of UBC Brock Commons and can be exceeded through performance-based design.

We propose to achieve the same risk tolerance by providing a 2-storey concrete podium and 18 storeys of mass timber above, aligned with the permitted building height of 20 storey in the TOA Tier 1 Policy Area. This noncombustible podium also inherently addresses other risks such as floods, explosions and electric vehicle fires.

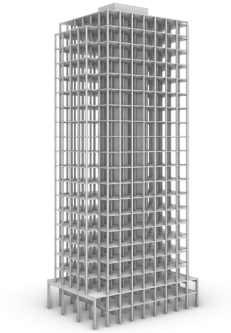
Although an entirely mass timber building is conceptually simpler and maximizes carbon sequestration, Kapla also has a hybrid structural design with a noncombustible vertical circulation core (exit stair, elevator shafts) to address fire and seismic risks in the lower BC mainland.

[1] Table 1: Social Cost of Greenhouse Gas Estimates – Interim Updated Guidance for the Government of Canada

MORE CARBON SEQUESTRATION THAN CONCRETE EMISSIONS

Emissions have been calculated using the Fast+Epp Embodied Carbon Calculator. The scope is limited to the structural system of the 20-storey residential tower only and does not include below-grade basement or foundation systems. Kapla uses 72% less concrete than a typical tower and achieves a net negative carbon balance if carbon sequestration in wood products is included in the calculation.

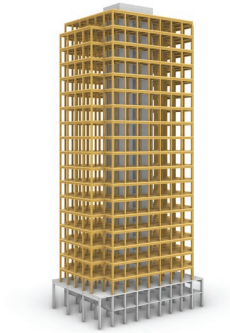
The current estimated social cost of carbon emissions is $271 per tonne [1] !!



494,540 $kgCO_2eq$	Concrete Slabs *(200mm, 35 MPa + 80kg rebar/m³)*	1,515.6m³	*326.3 $kgCO_2eq/m3$*
64,920 $kgCO_2eq$	Concrete Posts *(275x275, 35 MPa + 100kg rebar/m³)*	219.4m³	*295.9 $kgCO_2eq/m3$*
158,099 $kgCO_2eq$	Concrete Core *(200mm, 35 MPa + 100kg rebar/m³)*	534.3m³	*295.9 $kgCO_2eq/m3$*
85,463 $kgCO_2eq$	Concrete Podium *(35 MPa +125kg rebar/m³)*	230.8m³	370.3 $kgCO_2eq/m3$
803,022 $kgCO_2eq$	total upfront concrete emissions	2,500m³	total concrete volume
$217,610	estimated social cost of GHG emissions [1]		

78.6 $kgCO_2eq/m^2$

emissions factor, concrete structure of typical towers
same building height and 10x10 column grid



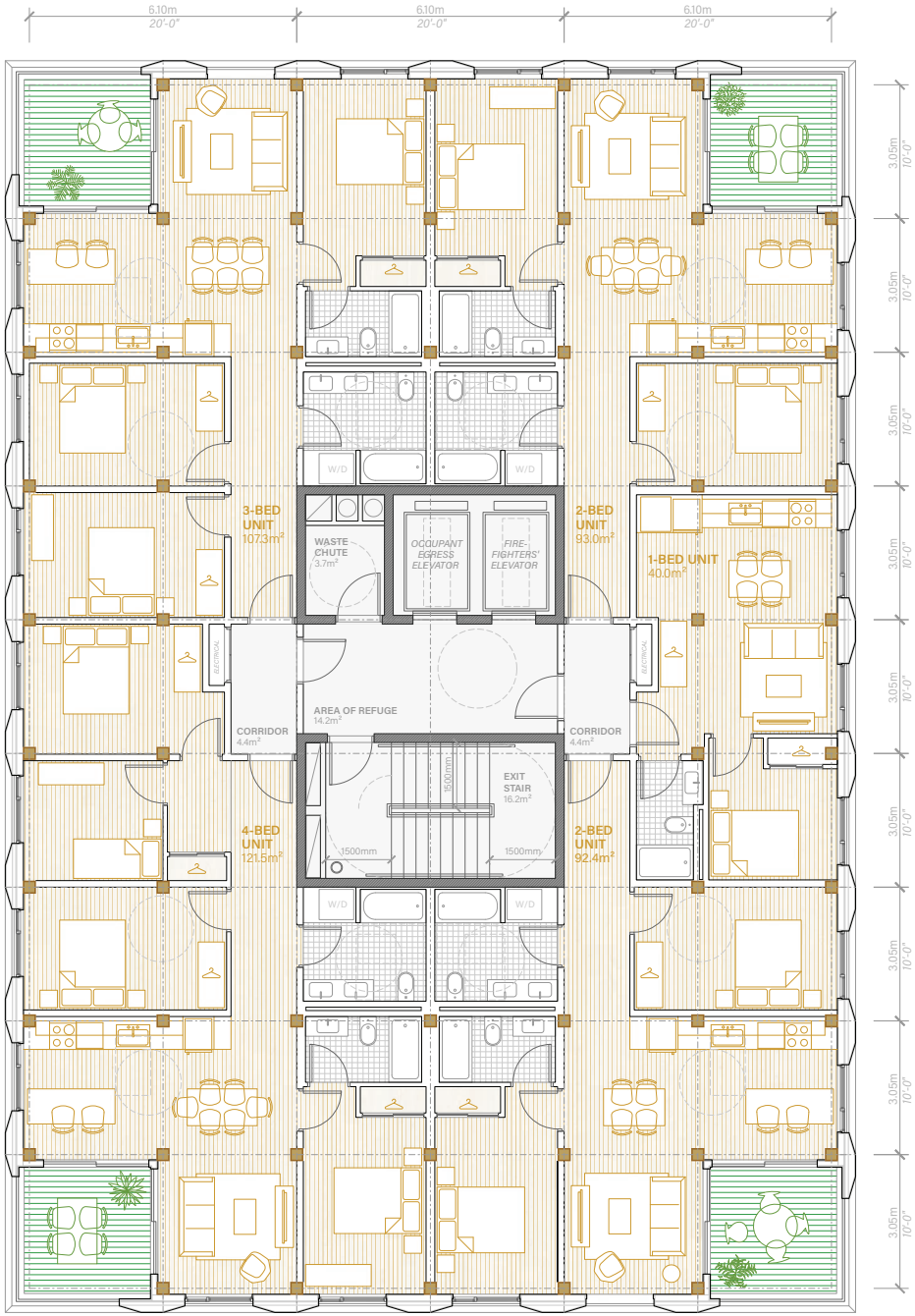
175,894 $kgCO_2eq$	CLT Slabs *(175mm, 5-Ply, 10ft wide)*	1,283.9m³	*137.0 $kgCO_2eq/m3$ (slab topping excluded)*
24,873 $kgCO_2eq$	Glulam Beams *(260 x 336mm Douglas Fir)*	181.3m³	*137.2 $kgCO_2eq/m3$*
35,752 $kgCO_2eq$	Glulam Posts *(305x315mm Douglas Fir)*	260.6m³	*137.2 $kgCO_2eq/m3$*
158,099 $kgCO_2eq$	Concrete Core *(35 MPa + 100kg rebar/m³)*	534.3m³	*295.9 $kgCO_2eq/m3$*
68,371 $kgCO_2eq$	Concrete Podium *(35 MPa +125kg rebar/m³)*	184.6m³	370.3 $kgCO_2eq/m3$
236,519	total mass timber embodied carbon		
226,470	total upfront concrete emissions		
(10,049) $kgCO_2eq$	net balance with carbon sequestration		

-0.98 $kgCO_2eq/m^2$

emissions factor, hybrid structure of KAPLA tower
incl. sequestration (45.3 $kgCO_2eq/m^2$ excl. sequestration)

ADAPTABLE & ACCESSIBLE LAYOUTS

The typical floor plan is a diverse mix of one to four-bedroom units. Each of the corner units has a barrier-free adaptable bathroom, bedroom and living space. The symmetry of the design also makes it easy to merge two of the units to create a co-housing arrangement of up to 7 bedrooms. The non-structural stud partitions allow for new openings to interconnect or reconfigure the layouts for a variety of family structures and help families stay in their community as they grow or contract during different stages of life.



REVEALING THE BEAUTY OF MASS TIMBER

Exposed Ceilings: Whereas the BCBC allows a maximum of 25% of the ceiling in each suite to be exposed, we have exposed 50 to 100% of the ceiling, beams and posts in the living areas. The slabs are increased from 3-ply to 5-ply thickness to achieve the required 2-hour char time. This province should adopt proposed changes to the national model building code[2] based on fire testing that demonstrates the existing code is *"now conservative in nature and can be safely expanded to provide additional options..."*

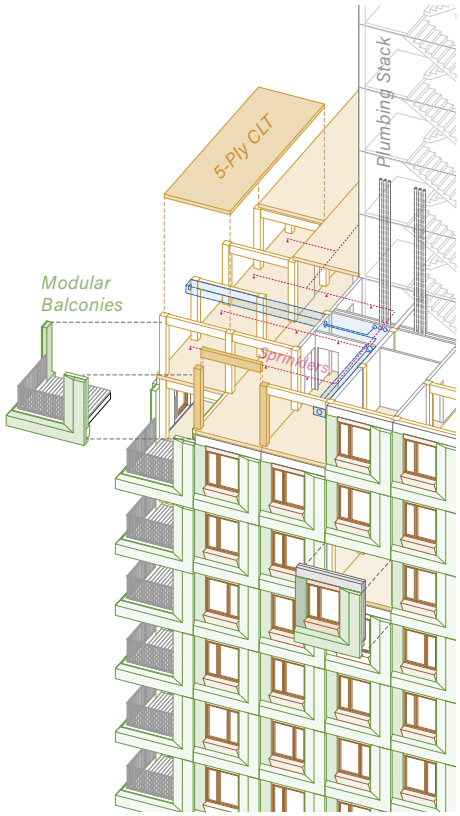
[2] CBHCC. Proposed Change 1870. https://cbhcc-cchcc.ca/

SAFETY FOR PEOPLE WITH REDUCED MOBILITY

In spite of 1 in 10 Canadians having a mobility disability, the code assumes people are able to use stairs to leave buildings in an emergency. KAPLA's design makes sure no one is left behind.

Egressibility: We have provided an occupant evacuation elevator (OEE) in addition to the firefighter's elevator so that persons with disabilities are able to independently and safely evacuate the building without assistance. This means updating building codes and technical standards to accommodate OEE options.

Single Exit Stair (SES): British Columbia limits SES to 6 storeys in height, whereas the 20-storey KAPLA building has a single exit stair based on examples in Sweden, Switzerland, Austria and Germany. The stair width is significantly increased, the elevator lobby is a separate area of refuge from the corridors, and a mechanical smoke control system is provided to achieve a better level of safety than the prescriptive code.



BUILDING A COMPLETE COMMUNITY

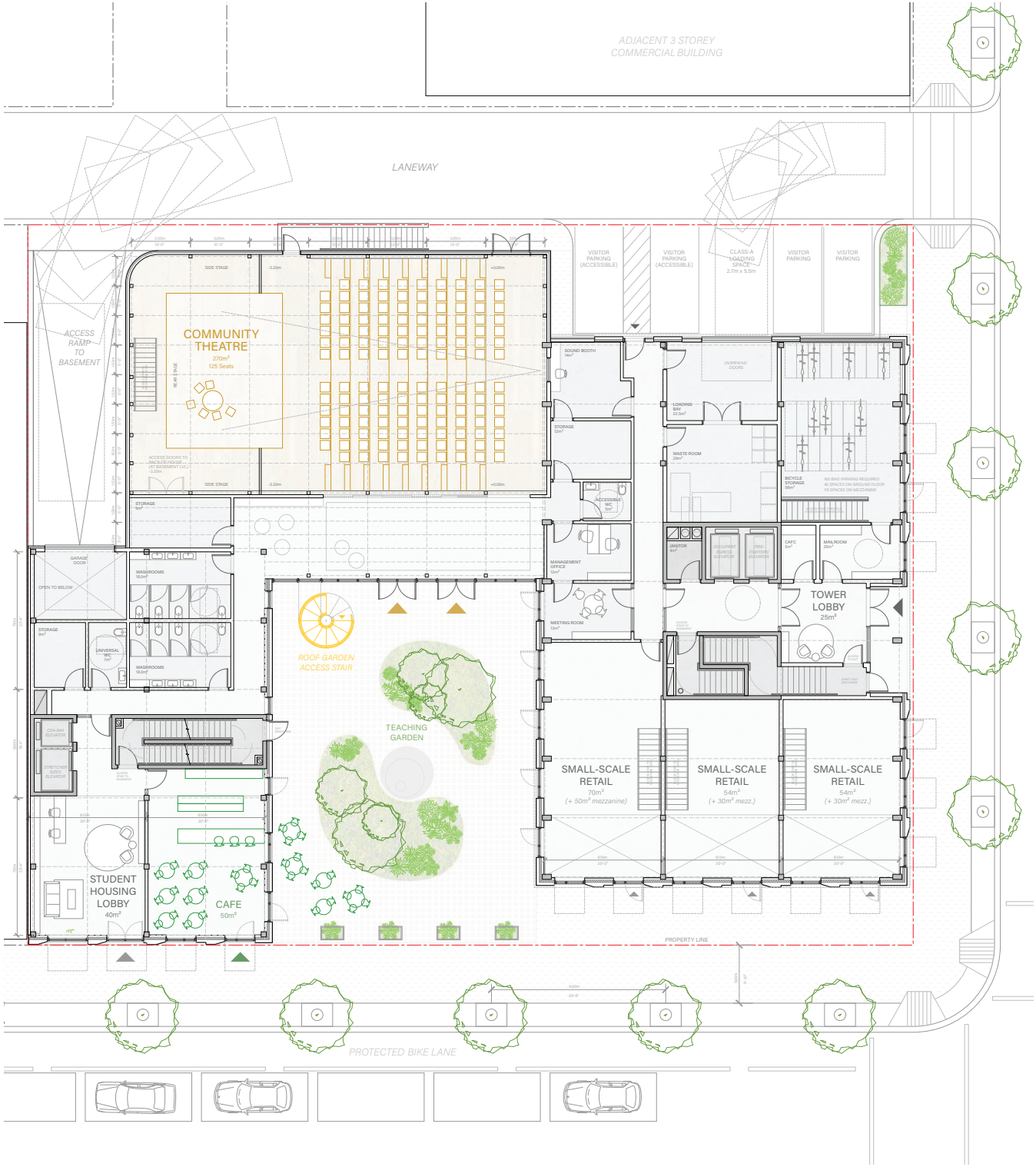
Community Theatre
The 'Kapla Playhouse' is a small theatre for local events. The warmth of the glulam structure and nail-laminated timber ceiling creates a welcoming glow visible from the street. All the back-of-house areas are at the basement level. The fire alarm system is customized for the bypass of smoke detector activation during indigenous smudging ceremonies.

Teaching Gardens
The buildings frame an outdoor space landscaped with plantings that are significant to the Musqueam, Squamish, and Tsleil-Waututh Nations. Native species such as Sitka Spruce, Pacific Crabapple and Vine Maple trees are arranged around a circular reflecting pool. The landscape extends up onto the roof of the community theatre as a garden of sage, cedar, sweetgrass and other native herbs. The deep glulam beams of the theatre are sized to handle the weight of the green roof and the edge of the basement is pulled back from the root balls of street trees.

Cars and Bicycles
Given the location of the site near transit and the cost/carbon intensity of parking garages, the building does not have resident parking. There are four visitor parking spots and 160 bicycle parking spaces (two per dwelling). 45 short-term spaces are on the ground floor and the remaining 115 long-term spaces can be accessed by stair and elevator on the mezzanine level. Additional storage space is in the basement.

Off-Street Loading Space Regulations
Different cities in the lower BC mainland and across Canada have different size requirements for garbage pick-up and loading bay areas. Smaller garbage trucks have a smaller turning radius, making a lot more space available for other uses on the ground floor.

Student Housing
The smaller mid-rise building provides 40 rooms of student housing for a nearby trades college. This includes a kitchen and dining hall beside the rooftop amenity terrace and ground floor lounge with adjacent cafe. At 8 storeys in height, the building code (BCBC 3.2.2.93) allows the mass timber posts and ceiling to be fully exposed.



UNITIZED FACADE PANELS & CAREFUL USE OF COMBUSTIBLE CLADDING

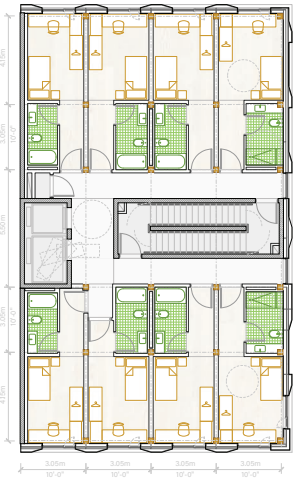
The facade is mostly required to be noncombustible, however combustible cladding is permitted for 100% of the first storey within 15m of a street and on small portions of the upper storeys if it is not contiguous over multipe storeys and is separated horizontally by a distance of at least 2.4m from any adjacent portions. The arrangement of the wood cladding panels is defined by these conditions.

INVENTORY OF REPETITION

(residential tower only)

792	5-PLY (175mm) CLT Slabs *440 linear ft per storey (10' spans, 20' to 40' panels)*
504	Glulam Beams (260x336mm Douglas Fir) *28 beams per storey (2.75m span)*
972	Glulam Posts (305x315mm Douglas Fir) *54 posts per storey (2.95m height)*
396	Facade Panels (ACM Panel on Steel Stud) *(3 variations of window and inset cladding details)*
72	Corner Balconies (Prefabricated Steel Frame) *4 per storey*
144	Sliding Glass Door Wall Panels at Balconies *8 per storey*
80	Linear Kitchens *5 per storey (semi-modular, shorter run in 1-bed units)*
160	Modular Bathroom Pods *(two variations, barrier-free/adaptable and regular)*
64	Window Sill Planter Boxes *on lower storey windows only*
1,200	Sprinklerhead Count (NFPA 750 Water Mist Type) *average of 60 per storey (pipefitter to install)*

Water Mist Systems
The use of water mist systems (NFPA 750) is subject to alternative solutions compliance because Canadian building codes only reference NFPA 13. Water mist systems reduce post-fire water damage and mold risks.



Noncombustible Sidewalls
The BCBC requires any exposed building face in close proximity to a property line to be of noncombustible construction. The code should be updated to allow mass timber and wood-frame options with increased fire-resistance ratings to achieve the same level of performance.

LOWER CONSTRUCTION COST PER BEDROOM

Kapla is situated on a smaller site than the Urbanarium's mass timber base case, reducing land costs. Our design has less dwellings but more bedrooms and bigger balconies. The small basement, compact core and exposed ceilings compensate for the complexity of hybrid construction.

PRO FORMA ANALYSIS	BASE CASE		KAPLA		NOTES
Building Type	18 Storey EMTC Tower		20 Storey Hybrid Tower		*hotel and theatre excluded*
FSR	5.0		5.0		*incl. permitted GFA exclusions*
Lot Size	25,540	sq.ft.	18,300	sq.ft.	
Building Area	7,094	sq.ft.	5500	sq.ft.	*Kapla residential tower only*
Lot Coverage	28%		30%		*Kapla residential tower only*
Building Height	18 storeys	above grade	20 storeys	above grade	
	2 storeys	below grade	1 storey	below grade	
GFA (above grade)	127,700	sq.ft	110,000	sq.ft.	*Kapla residential tower only*
Efficiency	85%		89%		*SES compact circulation*
Residential Area	108,545	sq.ft.	88,110	sq.ft.	
Non-Residential Area	19,155	sq.ft.	20,390	sq.ft.	*incl. circulation, amenity, etc.*
Amenity Area	850	sq.ft.	1,500	sq.ft.	
Basement Area	14,189	sq.ft.	5,500	sq.ft.	
Dwellings (#)	86		80		
Average Unit Size	1,262	sq.ft.	1,101	sq.ft.	
Bedrooms (#)	178	(2.07 beds/unit)	200	(2.5 beds/unit)	

CONSTRUCTION COST	*$/sq.ft.*	*Total Cost*	*$/sq.ft.*	*Total Cost*	
Basement	$299	$4,242,478	$299	$1,644,500	*smaller basement area in Kapla*
Ground and Mezzanine	$403	$2,859,061	$360	$3,690,000	*concrete podium in Kapla*
Upper Storeys	$431	$51,980,994	$450	$44,550,000	*exposed ceilings, concrete core in Kapla*
	$/balcony		*$/balcony*		
Balconies (1x per dwelling)	$25,000 (small)	$2,150,000	$45,000 (big)	$3,600,000	*larger prefabricated balconies in Kapla (80 sq. ft. each)*
	# of months		*# of months*		
Overhead ($50,000 monthly)	16	$800,000	14	$700,000	*smaller basement, repetitive structure and plan in Kapla*
CONSTRUCTION ONLY		**$62,032,533**		**$54,454,500**	*smaller overall GFA in Kapla*
SOFT COSTS (design, approvals, legal)					
25% of construction cost		$15,508,133		$13,613,625	
LAND COSTS	*property area*		*property area*		
assume $250/sq.ft.	25540 sq.ft.	$6,385,000	18300 sq.ft.	$4,575,000	*smaller site for Kapla*
DEVELOPMENT CHARGES	*$/unit*		*$/unit*		
avg. DCC in lower BC mainland	$31,645	$2,721,470	$31,645	$2,531,600	*applicable for apartments 5+ storeys (Vancouver)*
TOTAL PROJECT COST		**$86,647,137**		**$75,174,725**	Δ $11,472,412
cost per sq.ft.	127,700 sq.ft.	$788	110,000 sq.ft.	$683	Δ $104
cost per dwelling	86 dwellings	$1,083,089	80 dwellings	$939,684	Δ $143,405
cost per bed	178 beds	$486,782	200 beds	$375,874	Δ $110,908

LIMITED EQUITY HOUSING CO-OPERATIVE

Kapla will be developed by a non-profit developer supported by low-cost loans and mortgage insurance from the CMHC and BC Housing. The homes will be sold at-cost without typical developer profit (12-20%) and marketing expenses (3-5%). Some of the units will be sold to a "scattered" community land trust, others will be sold to the market under a restrictive covenant known as an LEHC (limited equity housing co-operative).

The purchaser benefits from buying the home at-cost, but the LEHC means that the future market value of the home is indexed to inflation and cannot be resold above this assessed value.

The units that are purchased by the community land trust are rented out at-cost. As the mortgages held by the land trust are paid down, the rents remain constant and subsidize future acquisitions of the land trust, while also becoming lower rents relative to the market over time.

This particular model recognizes that new construction is very expensive and it is very difficult to build new affordable housing without major government subsidies. The benefits of an LEHC, land trust and non-profit development model are combined to remove the project from speculation and focus on making Kapla increasingly affordable over time.