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Cost-Effective Strategies to Cut Embodied Carbon

Tue Sep 23, 2025 12 - 1pm PDT Free Webinar zebx.org



bosa properties (







Embodied Carbon:

Aligning Customer, Investor, and Regulatory Values for a Sustainable Future

SEPTEMBER 23, 2025 Ayden Kristmanson, Sustainability Specialist Vincent Delfaud, Design & Sustainability



Government of Canada

2030

40-45% GHG reduction by 2030 compared to 2005 levels.

37% reduction in building GHG emissions.

City of Vancouver

40% embodied carbon reduction by 2030. Additional Bylaw changes in 2027 & 2030.

https://vancouver.ca/files/cov/embodied-carbon-guidelines.pdf

2023

< 800 kg CO2e/m2

Measure embodied carbon on all new Part 3 buildings (greater than 3

storeys or 600 m2)

April 2025

< 360 kg CO2e/m2

or

10% reduction to baseline

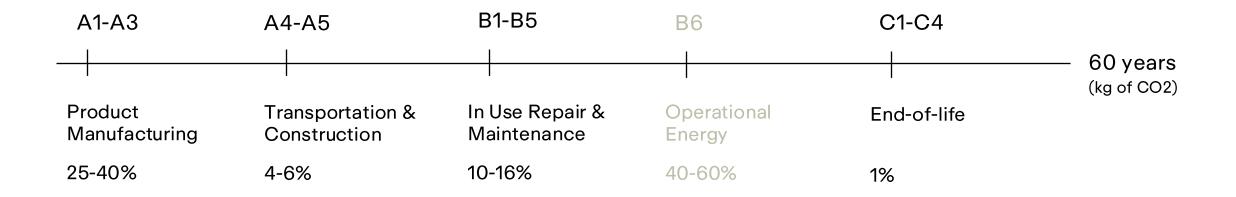
Rezoning

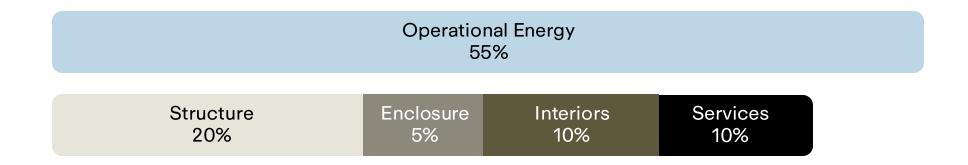
- Estimations are accepted
- Goal: To inform building design to reduce embodied carbon and prepare for future compliance.

Building Permit

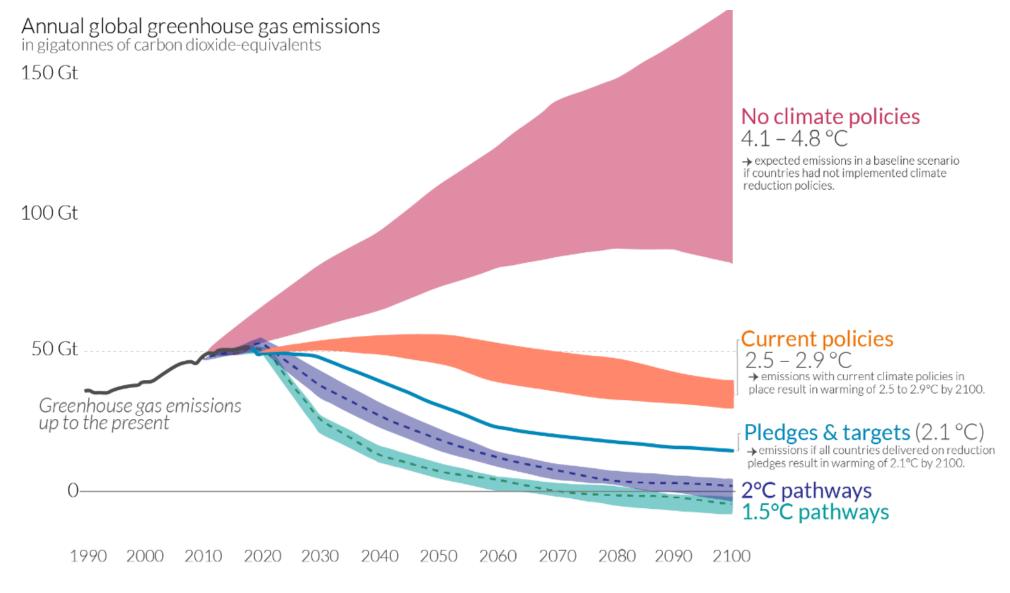
- Estimations are NOT accepted; calculations are based on product specifications.
- Goal: create a more accurate embodied carbon model to inform the design and demonstrate compliance.

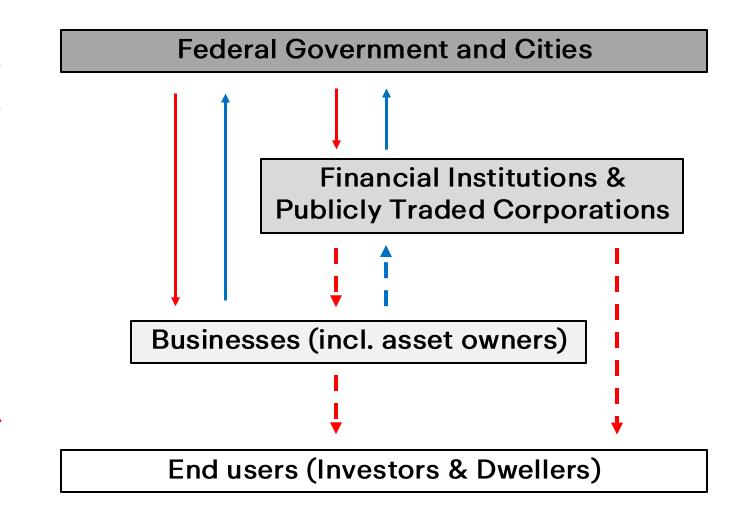
Reporting & Alignment to Policies **Building Emissions**





Greenhouse Gas Impact





End Users Dwellers

Between 130,000 and 225,000 new homes must be built in Canada every year to reach demand.

Residential
Construction

Is the highest emitting sub-sector across most provinces.

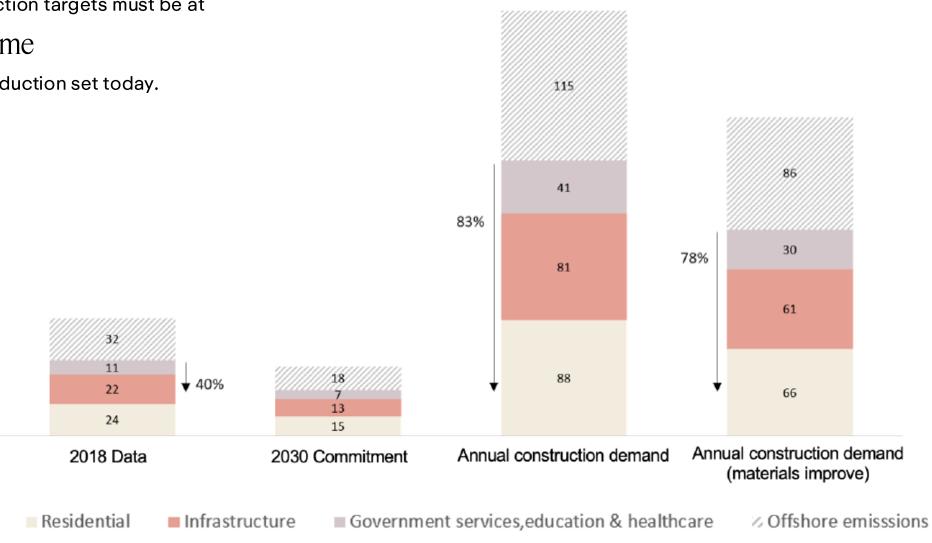
Build More with
Less Impact

The (multi) million-dollar question.
How do we build more with less?

Under current construction practices, Canada reduction targets must be at

83% per home

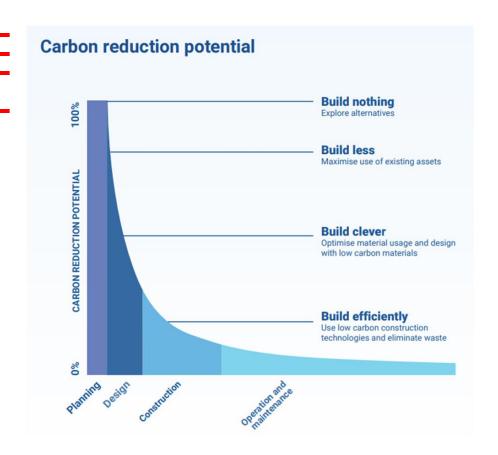
vs the 40% reduction set today.



Carbon Impact related to Dweller/Customer Value

"The end users don't want to pay for sustainable buildings."

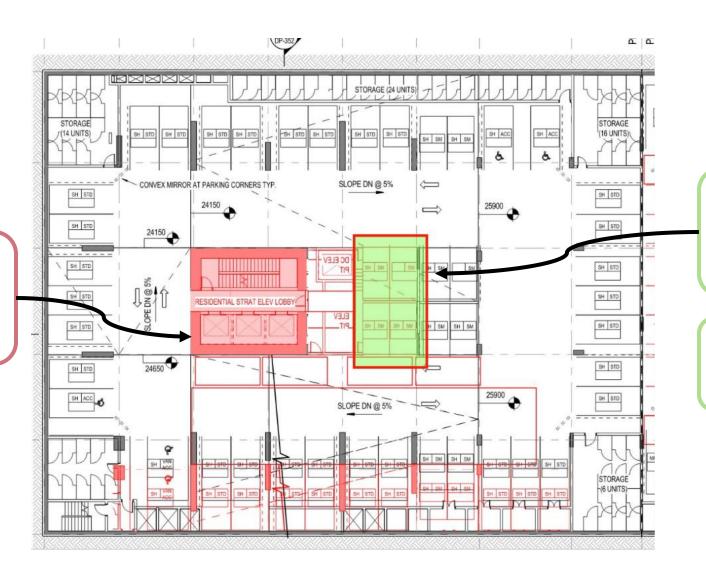
Criteria	Different customers types						Total -	
Location of the property	91%	91%	95%	91%	93%	91%	92%	
Overall quality of the building	91%	92%	91%	91%	90%	90%	91%	
Price of the property	88%	90%	92%	90%	88%	85%	89%	
The building security	83%	90%	85%	86%	85%	86%	86%	
The interior design	80%	86%	90%	88%	82%	89%	85%	
Available parking	67%	85%	83%	90%	84%	88%	80%	
Brand/reputation of the developer	67%	84%	80%	88%	89%	89%	80%	
The building amenities	79%	85%	80%	81%	75%	78%	80%	
Timing for the completion of the condo(s)	74%	81%	78%	88%	68%	78%	77%	
Access to transit	72%	79%	67%	88%	77%	84%	77%	
Potential return on investment / appreciation	61%	81%	72%	89%	88%	87%	76%	
Onsite management	69%	82%	73%	82%	70%	82%	75%	
Early access to be able to purchase my unit of choice	62%	81%	73%	83%	79%	89%	75%	
Brand/reputation of the strata/condo/ property management	63%	81%	71%	86%	77%	85%	75%	
Inclusion of natural elements on the property (such as green spaces, gardens, and trees)	67%	82%	80%	86%	67%	77%	75%	
The rental market/ability to rent the property	62%	78%	58%	85%	85%	85%	74%	
The view from the condo/property	61%	83%	77%	86%	71%	76%	73%	
Wanting to buy with a premium developer	50%	77%	71%	85%	81%	85%	71%	
The exterior design	56%	82%	70%	83%	67%	81%	70%	
The sense of community	57%	79%	68%	82%	65%	84%	70%	
Being pet friendly	66%	72%	49%	78%	56%	67%	66%	



Design Efficiency Parking

Reposition the core:

Flip the core and have three elevators extend to the parkade and two in a soft core.



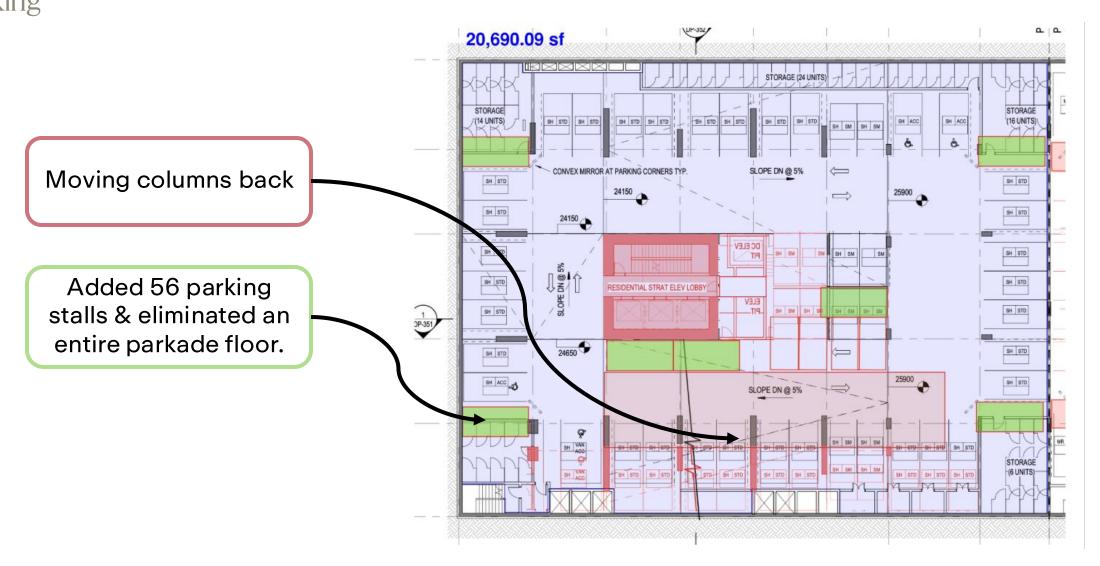
Results in four additional stalls per floor

(32 stalls total)

Below-grade area/stall decreased from 492 ft² to 390 ft².

- + increases parking revenue
- decreases hard cost & emissions

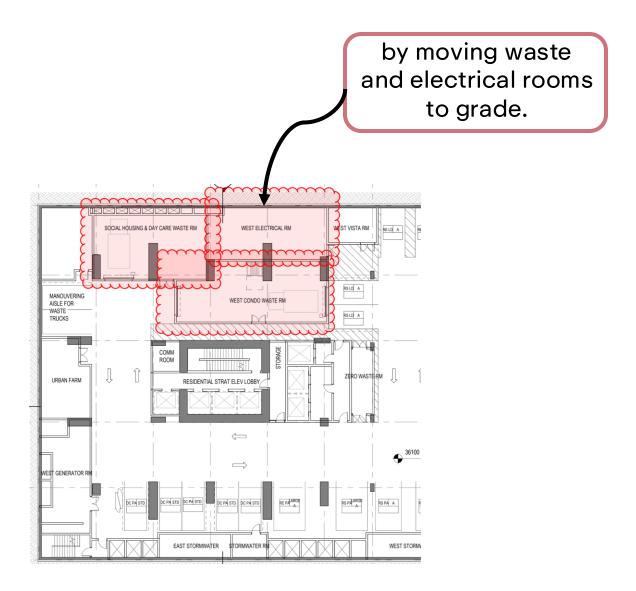
Design Efficiency Parking



Design Efficiency

Below-Grade Double Height Spaces

Remove double height spaces in parkade... Double Height



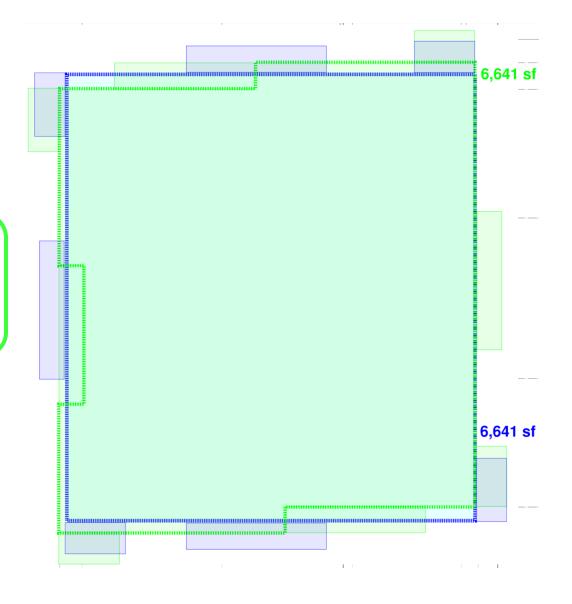
Design Efficiency Massing Compley

Massing Complexity

Enclosure / Enclosed

Floor area = 6641 ft^2 Enclosure = $3480 \text{ ft}^2 (348 \text{ x } 10 \text{ ft})$

 $3480/6641 = .52 \text{ ft}^2$



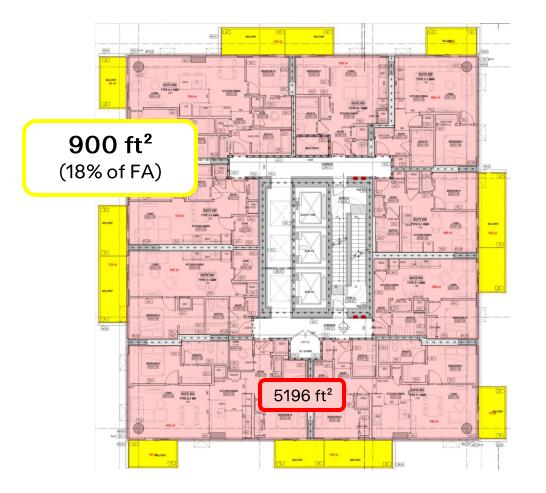
Enclosure / Enclosed

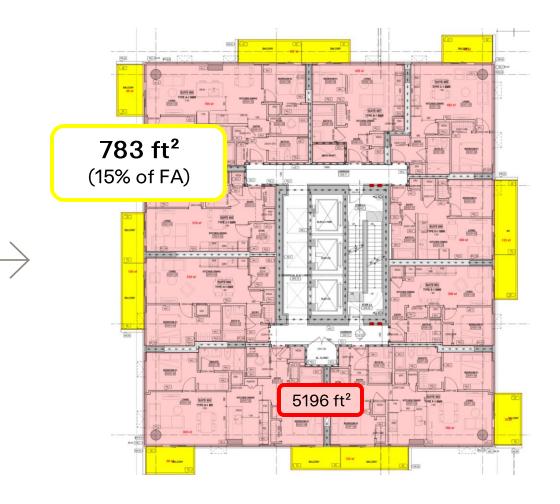
Floor area = 6641 ft^2 Enclosure = $2934 \text{ ft}^2 (326 \text{ x } 10 \text{ ft})$

 $2934/6641 = .44 \text{ ft}^2$

Design Efficiency

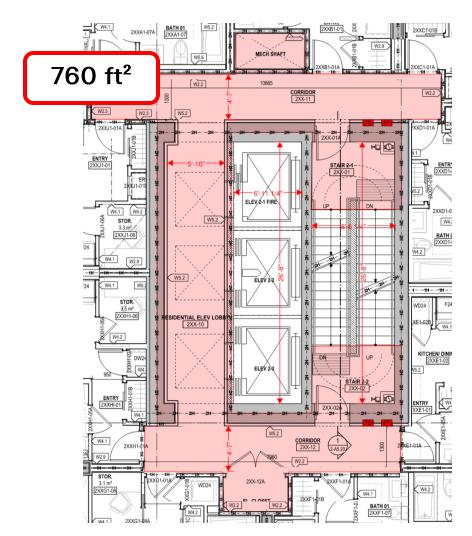
Balcony Space

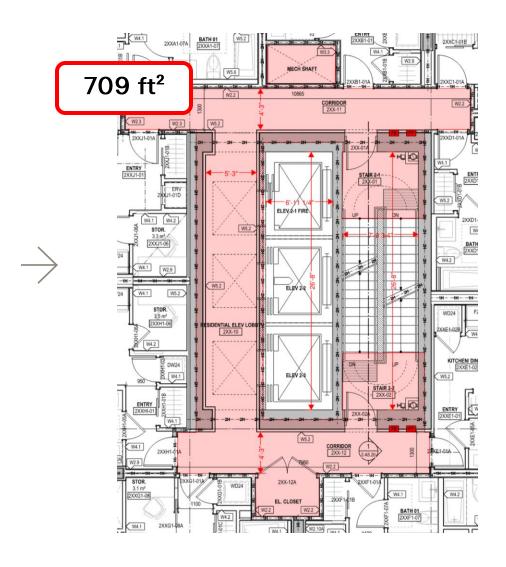




Design Efficiency

Common Circulation Space





Total Savings

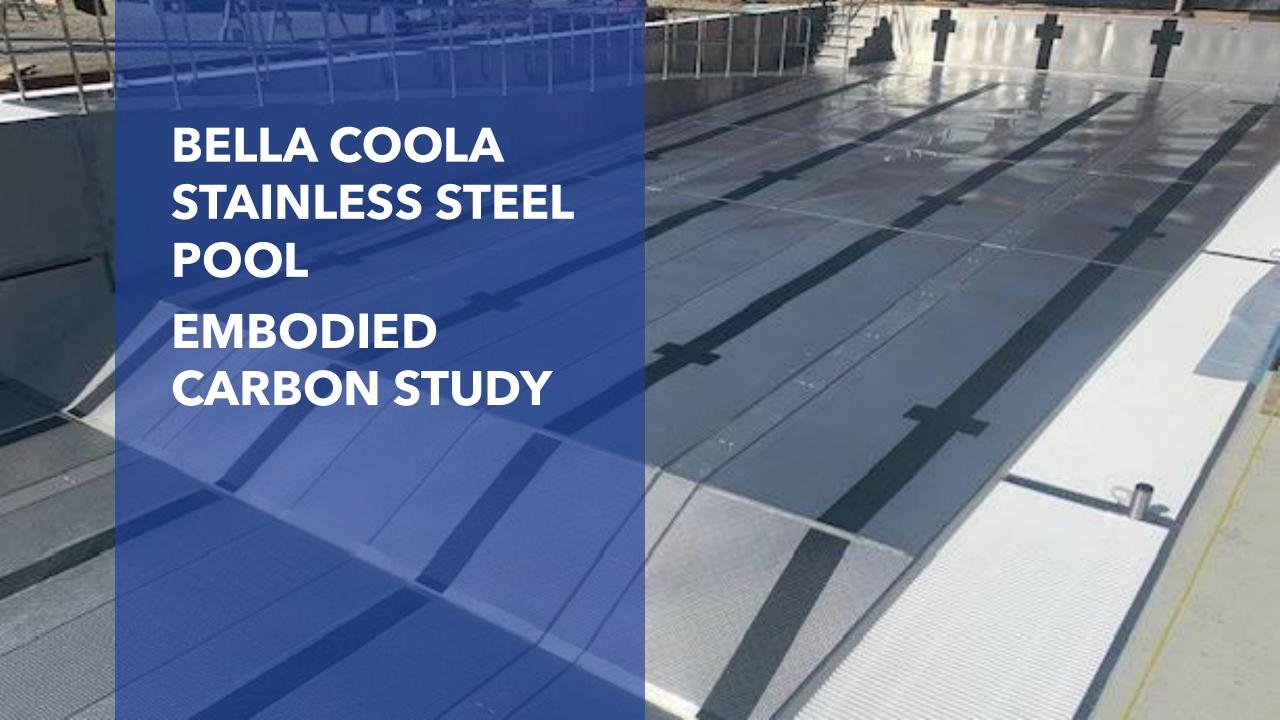
ypology	Baseline Building	Post Design Efficiency		
# Units	275	275		
Net ft²/Unit	700	700		
Parking Ratio	.65	.52		
Parking ft ² / Stall	492	390		
Lobby ft² / Unit	12	9		
Amenity ft ² / Unit	30	17		
Overall Efficiency	76%	79.4%		
Typ Floor Efficiency	82%	83.6%		
GSF / Unit	1,335	1,202		
Hard Cost	\$169.7M	\$157.2M		
Embodied Carbon Intensity	361 kg CO2e/m²	341 kg CO2e/m² (-10%)		
Embodied Carbon per Unit	39.8 tonnes	36 tonnes		
Hard Cost Savings		\$12.5 million (-7%)		
Profit / Cost		+6%		

Thank you

IMPLEMENTING LOWER CARBON STRATEGIES ON PROJECTS. 3 CASE STUDIES.





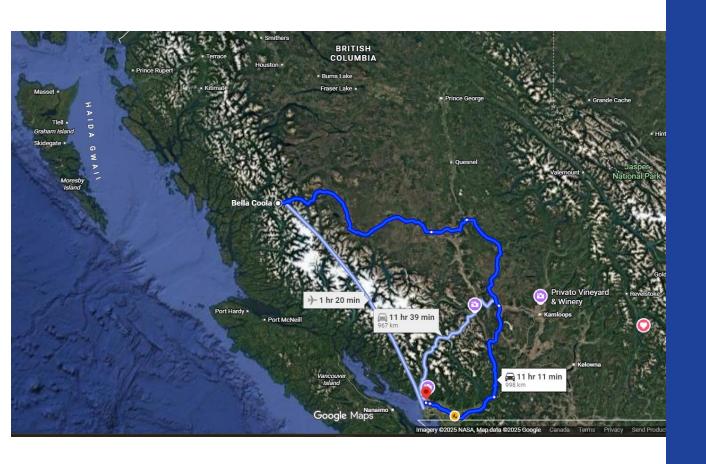




- PRE-FABRICATION
- SAVE ON CARBON
- SAVE ON SCHEDULE
 AND COST.







Logistical challenge:

1000kms from Metro Vancouver by road.

Suppliers were also selected for proximity to enable transportation efficiency.









Transporting early on schedule:

Rigorous preconstruction and design approach

Pre-fabricated and shipped flat packed.

Transportation was by road to Bella Coola, ready to weld and assemble on site.

Schedule savings:

2 months on schedule, also allowing us to avoid winter conditions in comparison to a concrete pool.

\$75k on heat and hoarding allowance.

Approx 20,000L of diesel.

53 Metric Tonnes of CO2e avoided.

(2.68kg CO2e emissions factor.)

Construction mobilized 2024 December.

- **Dec 3 2024:** Excavation, Demolition and set up.
- **Feb 3 2025:** Strip footings 2 weeks.
- Feb 26 2025: Pool arrived with pool crew,

 - 16 days install for wall and fittings,9 days for floor and accessories install
 - 7 days final cleaning ready to back fill.

Traditional concrete build for pool: 6 months.

The install for the SS pool: 6 weeks.

Still holding to October 2, 2025 for handover date.

SS pool total materials:

SS316L with a density of 7990kg/m3

Total rebar = 10,993kg Total 32MPa C2 Concrete = 85m3 Total SS 316L = 9783kg

- Shipped 3 sea cans
- No water proof liner or xypex
- 2 way tanked system
- No risk of hydrostatic fracture.

Concrete pool total materials:

Rebar density 130kg/m3 concrete.

Total rebar = 47,265kg

Total Concrete with xypex = 251m3

Total C-2 concrete = 158m3

Total liner (laticrete 2x) = 715.12m2

for pool liner

Total 6mm tile and 4mm epoxy grout
mortar (10mm assembly) = 715m2

199,193.28 kg CO2e

68% REDUCTION ON EMBODIED CARBON IN MATERIALS ALONE

SCHEDULE SAVINGS 6 WEEKS

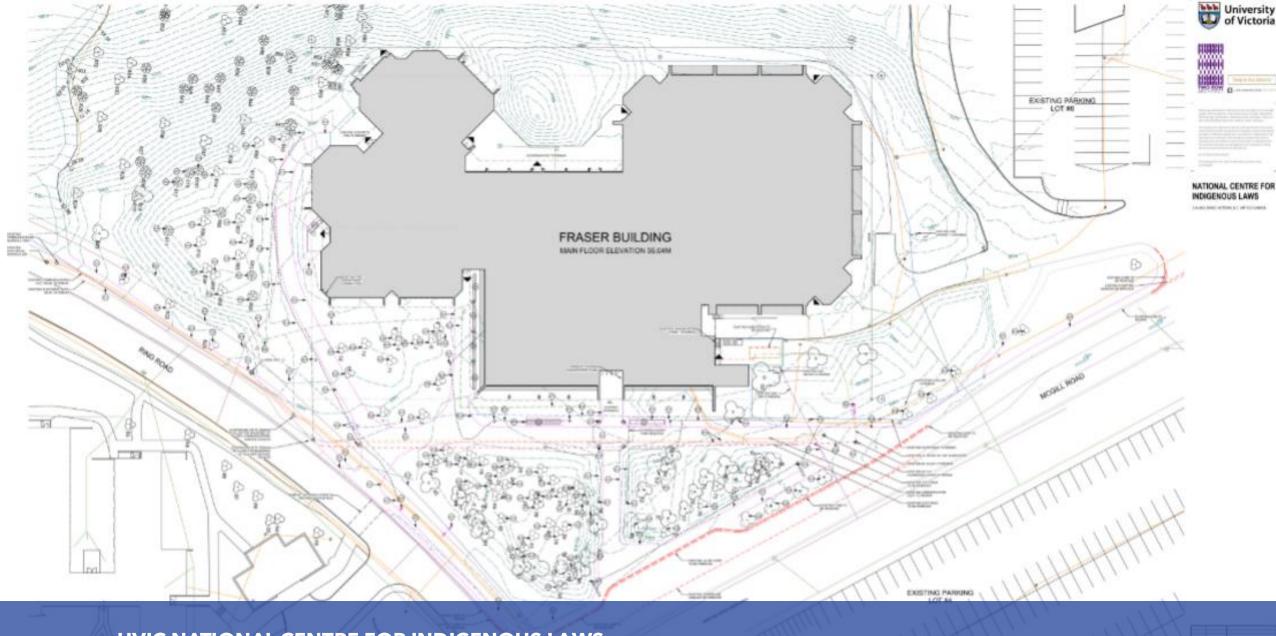
VS

6 MONTHS

\$75K SAVINGS ON HEATING AND HOARDING.

63,678.16 kg CO2e





UVIC NATIONAL CENTRE FOR INDIGENOUS LAWS

TREE REMOVAL - SITE CLEARING

23 TREES WERE
DESIGNATED TO BE
REMOVED STRUCTURAL AND
POOR HEALTH.

ADDITIONAL 7 TREES WERE NOTED TO BE REQUIRED TO BE REMOVED

13 MORE WERE
DESIGNATED FOR
REMOVAL DURING
ARBORIST REVIEW

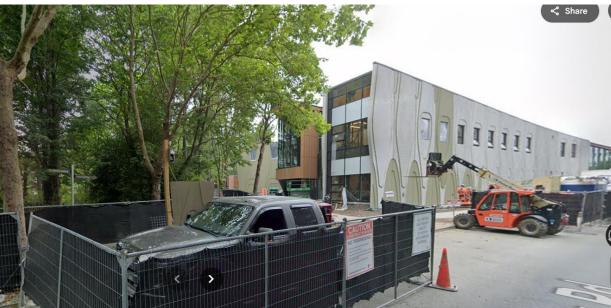
79 TREES ON SITE 43 REMOVED

UVIC NATIONAL CENTRE FOR INDIGENOUS LAWS

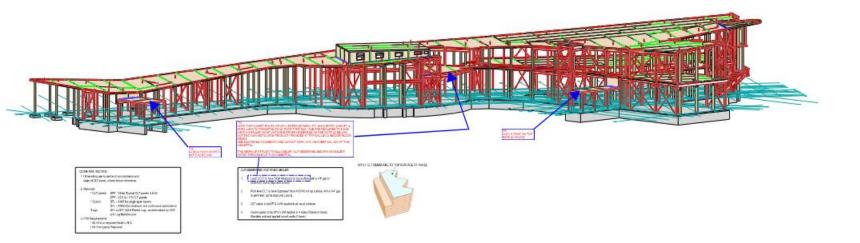
TREE REMOVAL - SITE CLEARING











TOTAL VOLUMES:

125.38 m3 for vertical columns

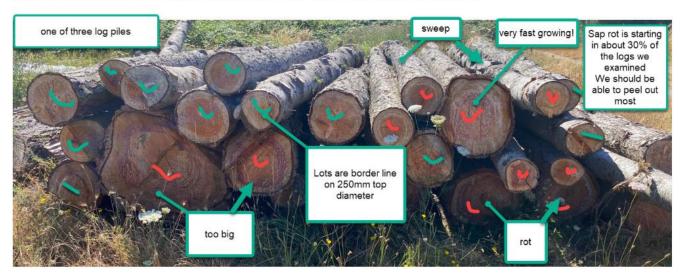
116.81 m3 for beams

490.46 m3 for CLT walls, floors and roof.

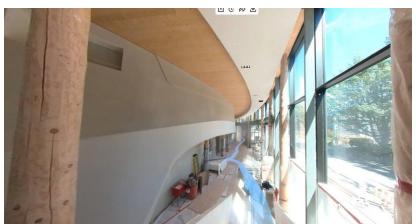
We salvaged 34 logs (24 cubic meters) for use in the building

Where possible these logs were located in the most public areas. We retained as much of the natural character of the original tree as possible.

None of these logs were used in the exterior as they all had some sap rot.







Resource \$

Glulam produced in British Columbia ?

Dried timber, conifer (Canadian ? 😱

Quantity \$

24.0 m3 🗸

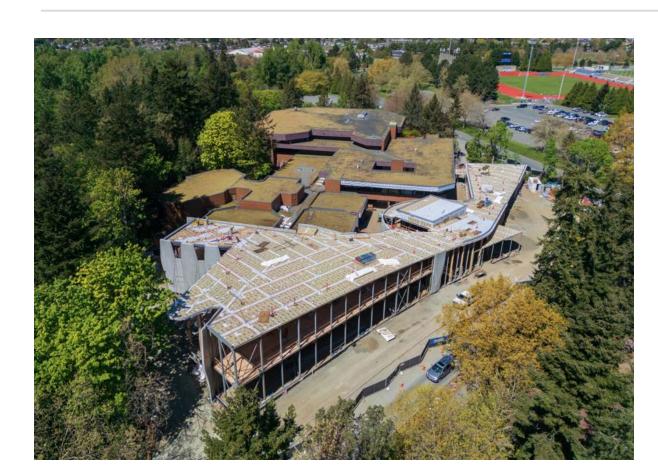
24

m3 🗸

CO₂e \$

2.9t - 65%

1.5t - 35%



COLUMNS: 20% OF MATERIAL VOLUME WAS SALVAGED FROM SITE.

34/116 TOTAL LOGS.

UTILIZING LOGS NOTED 50% LESS EMBODIED CARBON COMPARED TO GLULAM COLUMNS.

LOCALLY SOURCED LOGS FROM WITHIN BC.





SACRED HEART PARISH AVOIDED EMISSIONS & EMBODIED CARBON STUDY

Common goal - values alignment.

Fundraised money - provide value back to owner

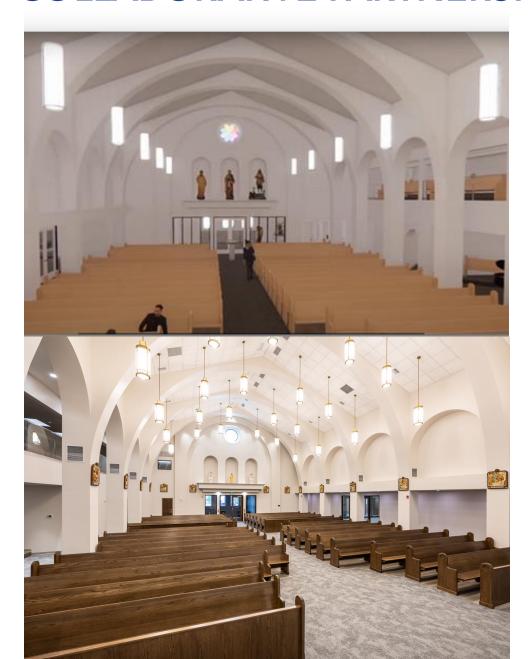
Schedule was not in alignment to owner's objectives through traditional construction methods.

Collaborative contract CCDC 5B.

Open collaborative environment on project teams.

Enable change and flexibility

COLLABORATIVE PARTNERSHIPS



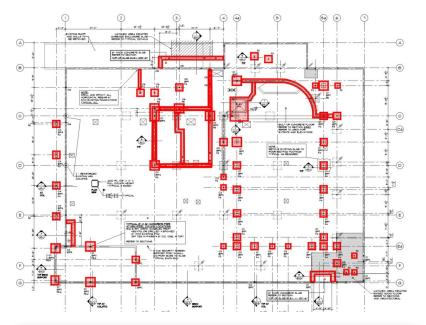
\$256,000 of savings to owner.

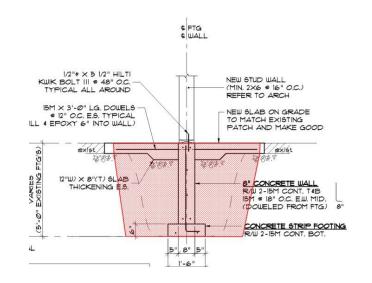
146.21MT CO2e savings on emissions.

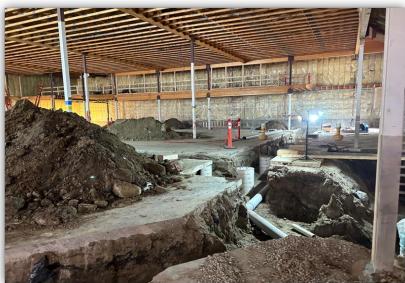
(73% savings was from material efficiency.)

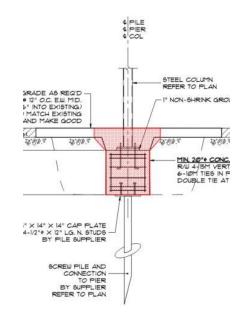
2 month direct schedule savings.

VALUE ENGINEERING









Foundation:

- New Pad Footings, Strip Footings, and Foundation Walls
- All below existing Slab on Grade

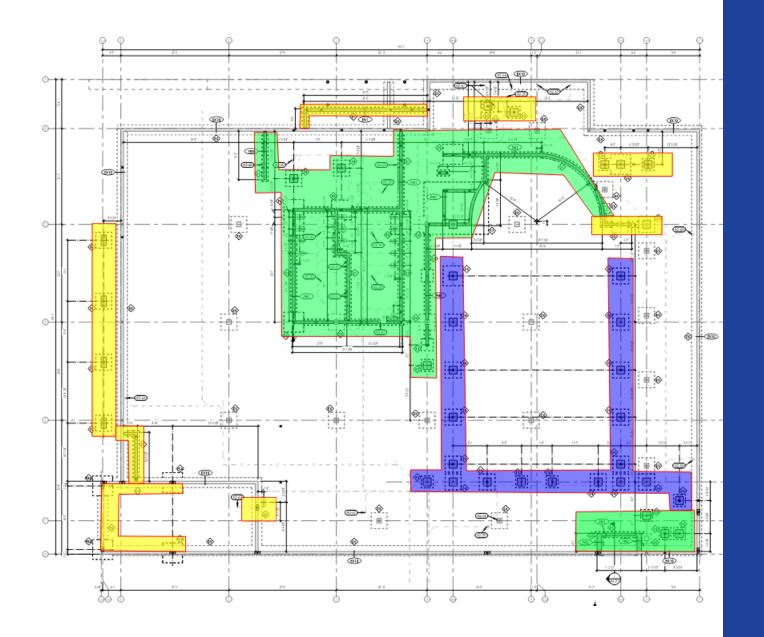
Solution:

 Revise foundation design while preserving structural integrity

Outcomes:

- Minimized invasive demo
- Reduced costs of new foundation
- Reduced waste
- Increased site efficiency

FOUNDATION EDITS



Green

 Slab Thickening as alternative design solution

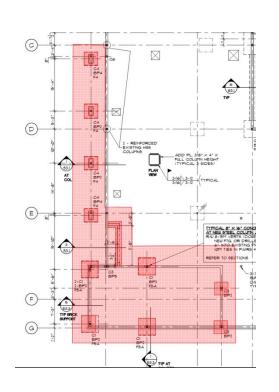
Yellow

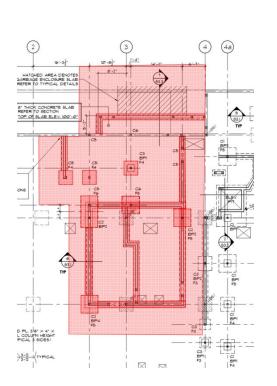
 Screwpiles as alternative design solution

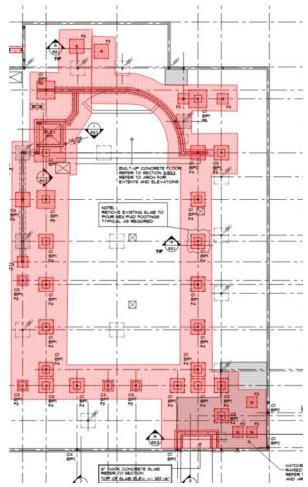
Blue

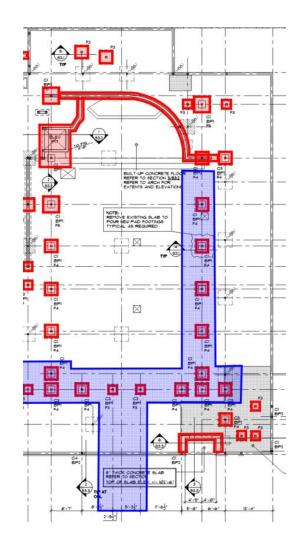
 Original design solution, however the western run was solved with screw piles.

SLAB REMOVAL AVOIDED

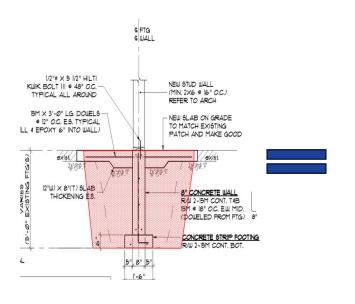




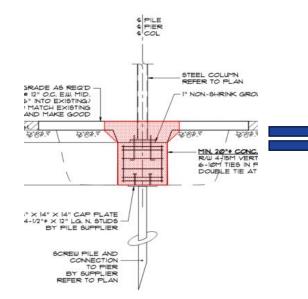




RESULTS







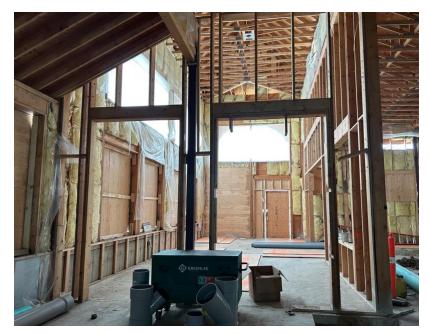


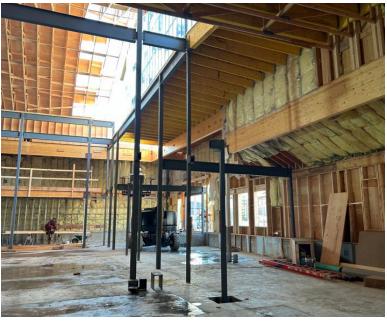


Reduced new foundation material and costs

- Concrete formwork, rebar, prep
- Reduced potential heat and hoard
- Reduced concrete delivery and pour
- Reduced concrete curing timelines
- Reduced backfill of material after new concrete foundations

MATERIAL REDUCTIONS





By being efficient with materials, we saved on **107.5 MT of CO2e** in embodied carbon.

This is equivalent to 1778 tree seedlings grown for 10 years.

TOTAL MATERIAL REDUCTION:

32 MPa replacement conc slab

25 MPa conc slab + footing

25 MPa existing slab retained

10M + 15M Re-Bar

Switch to Steel core piling

-53m3

-19.1MT CO2e

-205m3

-68.6MT CO2e

-33.15m3

-11.9MT CO2e

-12,900kg

-11.6MT CO2e

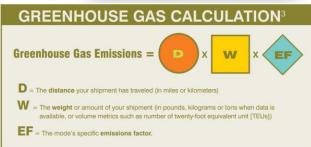
+90 m2

+3.7MT CO2e

These figures indicate the materials reduction from the original design, and with these values utilized One Click LCA to compile the GWP (A1-A3) associated with the materials. The basis of this information is from Industry Average EPDs for the concrete mix types, from Alberta Canada Regional data.

ACTIVITY REDUCTIONS





DISTANCE:

Sacred Heart Parish to Recycling Worx is 36 kms/ 22.3 miles

EFFICIENCY:

(86.13m3 = 203.5MT of conc.) 20 hauls at 22.3miles (D) x 10MT (W) x Heavy Bulk Vehicle (2kg CO2e) (EF) =8,920kg CO2e or 8.92 MT of CO2e. emissions.

This is equivalent to 200 tree seedlings grown

By reducing activity with

materials, we saved on

12.07 MT of CO2e in

hauling demolition

transportation

for 10 years.

ACTIVITY REDUCTION:

Elimination of hauling 86.15 m3 concrete waste Concrete transport delivery savings 324.3m3
Reduced Excavation and Demolition

-8.92 MT CO2e -3.15 MT CO2e Unmeasured.

SCHEDULE REDUCTIONS





SCHEDULE REDUCTION:

With optimization, our team saved 2 months on the construction schedule.

This enabled the majority of foundation works to be completed prior to the winter frost, saving on 5 weeks (840 hours) of heating and hoarding. This avoided an additional 399K BTU Propane Heater with a fuel consumption rate of 16.5L/h.

We utilized the emissions factors for Propane from the Environment and Climate Change emissions factors reference values for 2023 (table 3). By consolidating schedule, we saved on **26.64 MT of CO2e** in heating and hoarding emissions.

This is equivalent to 440 tree seedlings grown for 10 years.

SUMMARY

- BEING CREATIVE ON SOLUTIONS CAN SAVE CARBON EMISSIONS AND COSTS.
- UPFRONT DESIGN POTENTIAL AND COLLABORATIVE CONTRACTS ENABLE SAVINGS ON EMISSIONS, COSTS AND OPTIMIZE YOUR SCHEDULE.
- CHALLENGE BUSINESS AS USUAL CONCEPTS
- LOOK AT THE VALUE IN EXISTING MATERIALS AND ASSETS.
- USE LCA TOOLS TO EVALUATE STRATEGY AND BENEFIT
- SHARE LESSONS LEARNED WIDELY WITH INDUSTRY SO WE CAN CREATE A NEW 'BUSINESS AS USUAL' THAT IS LOW CARBON AND OPTIMIZED ON COST.



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