



ASPECT

STRUCTURAL ENGINEERS

BERNHARD GAFNER

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ASPECT INTRO

Pleasure to meet you!

OUR TEAM



and growing....

ASSOCIATES



DUNCAN BOURKE

P.Eng., B.Sc.



ILANA DANZIG

P.Eng., M.Eng., PE, SE



ANDREW SEETON

P.Eng., M.A.Sc.

PRINCIPALS



BERNHARD GAFNER

Struct.Eng., P.Eng., MiStructE,
Dipl. Ing. FH/STV.

ANDREW CHAD

Struct.Eng., M.Eng., P.Eng.

MEHRDAD JAHANGIRI

P.Eng., Dipl.Ing. (Germany)

GINA SHEPPARD

CAD / BIM Manager

ADAM GERBER

P.Eng., M.A.Sc., CPHC®

OUR OFFICE LOCATIONS

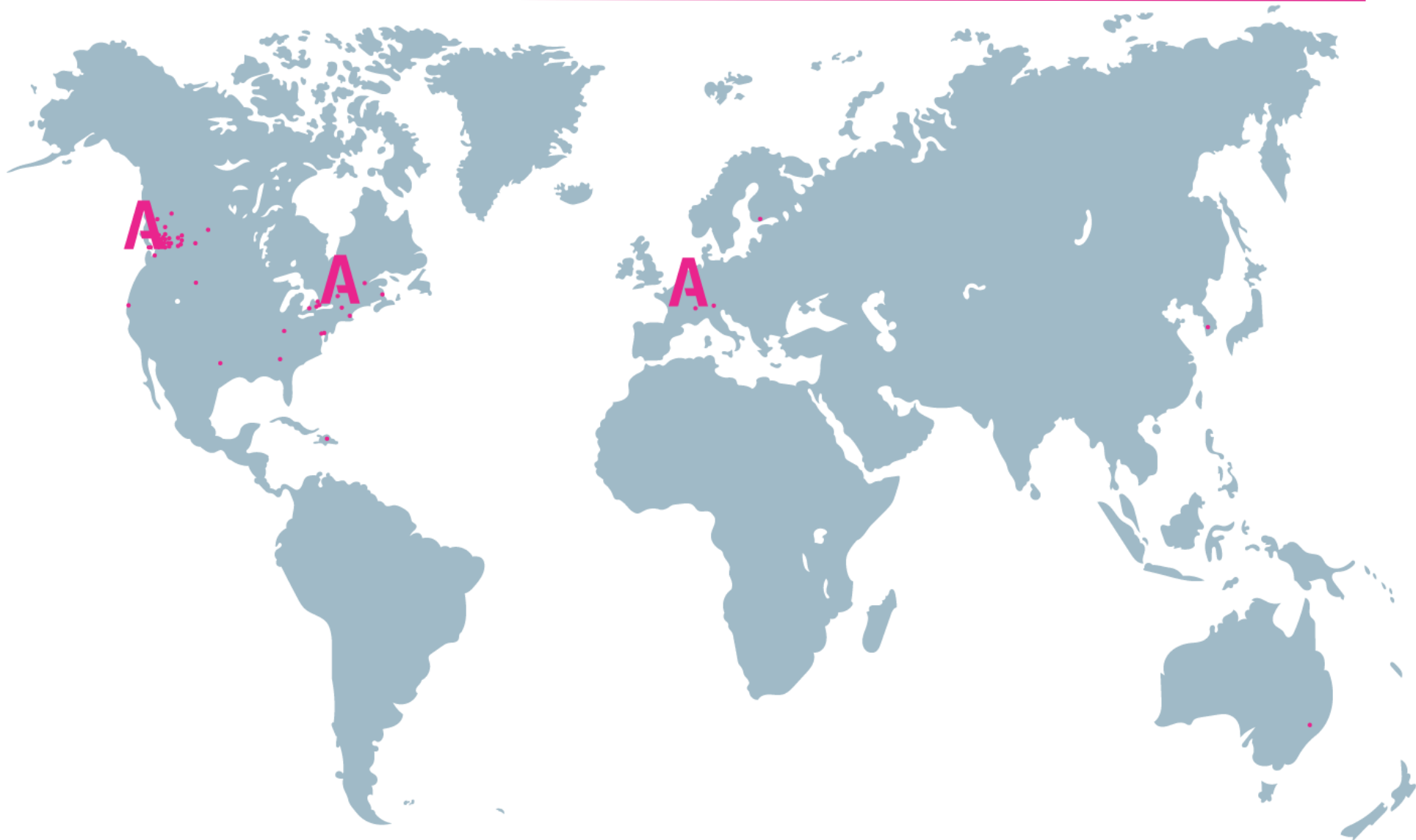


OUR SERVICES

- Full-service Engineer of Record
- Specialty Timber Engineering
- Timber Design Assist
- Supplier Market Integrations
- Tendering and Procurement Optimizations



OUR PROJECTS



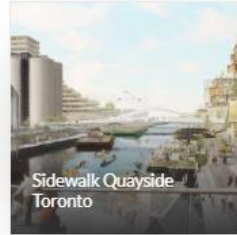
OUR PROJECTS



Sea To Sky Elevated Tree Walk



Microsoft Silicon Valley Campus



Sidewalk Quayside Toronto



Langford



Clippership Wharf



TRU School Of Nursing And Population Health



Seaparc Fitness Addition



Westbay Passive House



West 48 Reno



Railtown Mixed-Use Development



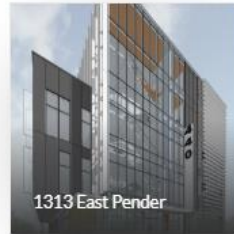
Mount Carmel Spirituality Centre



Waterfront Botanical Garden Education Pavilion



550 E Broadway Mixed Use



1313 East Pender



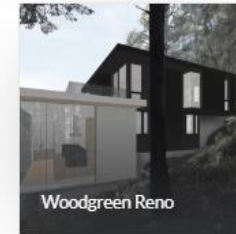
Lauwelnew School Expansion



1541 House



The Lady



Woodgreen Reno



Malahat Skywalk



Cardinal House



UNBC Wood Innovation Research Lab



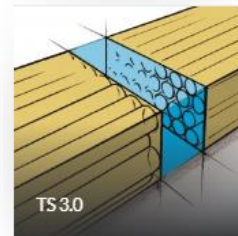
Bowen Island Community Center



Oakville Firestation No.8



Kettle & Stony Point - Cultural Centre



TS 3.0



Marking



House With Two Bay Windows



Wadajir Market & Residences



Catalyst Building Spokane



Kettle & Stony Point - Golf Club House



Violet's Corner



Copper Spirit Distillery



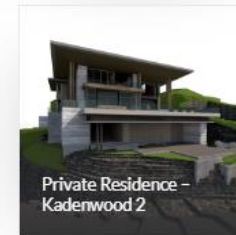
Okanagan College Daycare



Commodore Storefront



Gu Residence



Private Residence - Kadenwood 2

HOW WE THINK



“Number crunching is easy.

Crunching the right numbers is the key to successful projects.”

HOW WE THINK

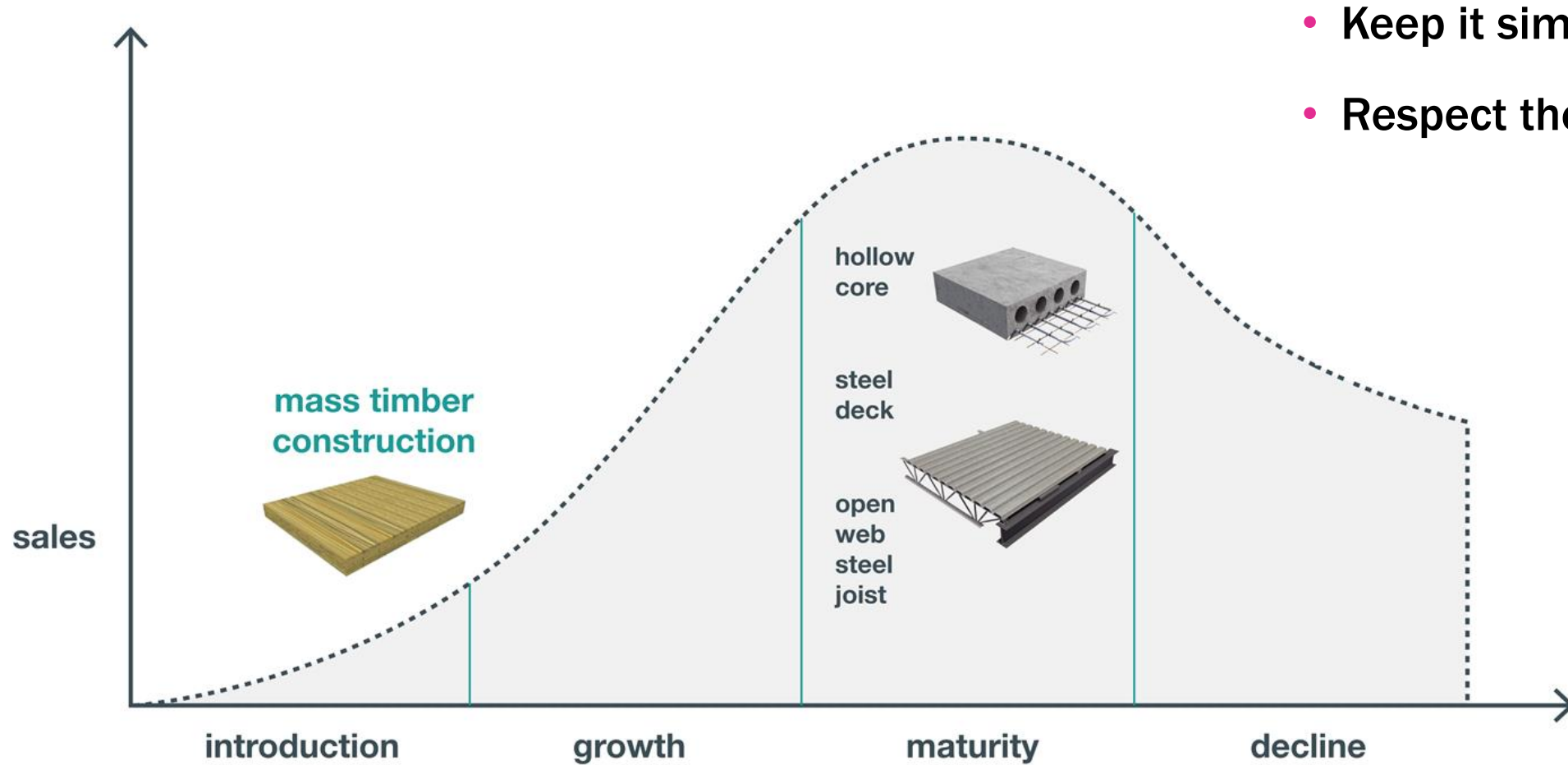
We are currently 6 engineers who are either carpenters, ran a carpenter shop or worked at a supplier's technical department – across 3 continents.

You can't switch off that side of the brain....

Today's Agenda

- **Market Maturity**
- **Building Materials**
- **Connection Systems**
- **Supply**
- **Pitfalls**
- **Specialty Engineering**
- **ASPECT Design Process**

Market Maturity



- Keep it simple!
- Respect the Supply Chain!

BUILDING MATERIALS

- Linear Products
- Panel Products
- Timber Concrete Composite
- Specialty

Linear Products

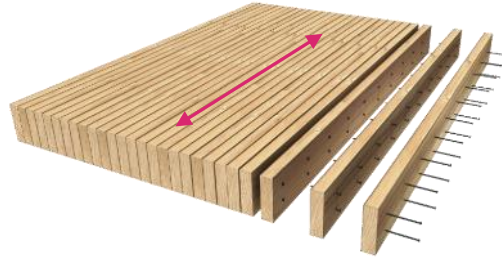


GL
“Glue Laminated Timber”

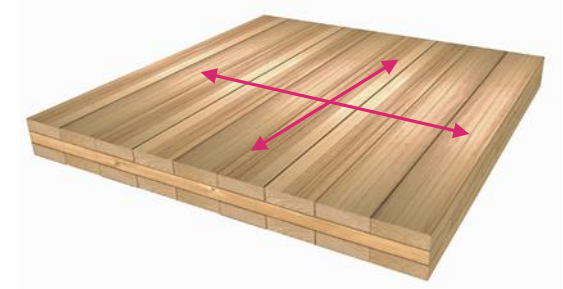


PSL
“Parallel Strand Lumber”

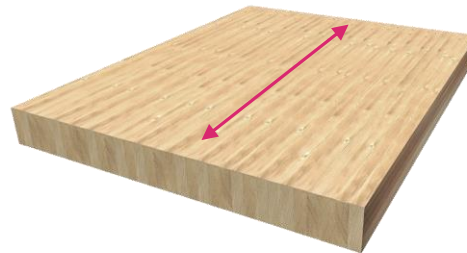
Panel Products



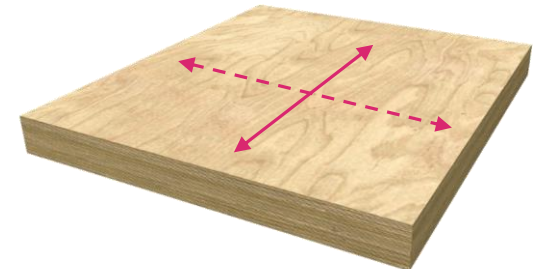
NLT / DLT
“Nail or Dowel Laminated Timber”



CLT
“Cross Laminated Timber”

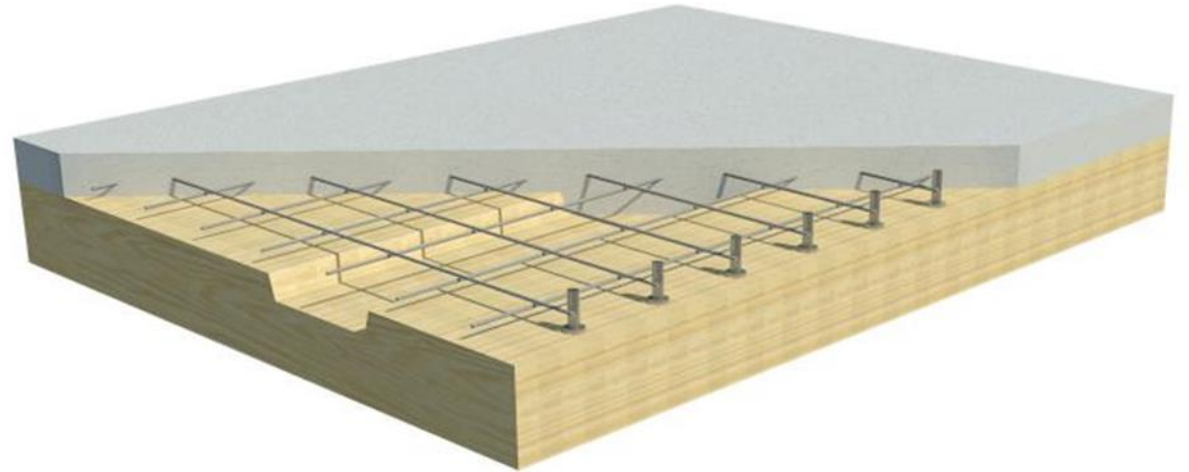


GLT
“Glue Laminated Timber”



SCL
“Structural Composite Lumber”

Timber Concrete Composite



TCC
“Timber Concrete Composite”



Specialty

Stressed Skin Panel /
Delta Beam / LVL



CONNECTION SYSTEMS

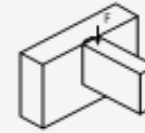
- Standard
- Proprietary
- Custom

Standard

Simpson / Rothoblaas / ASSY

STRENGTH

Choice of the connection system according to the vertical component of the shear load



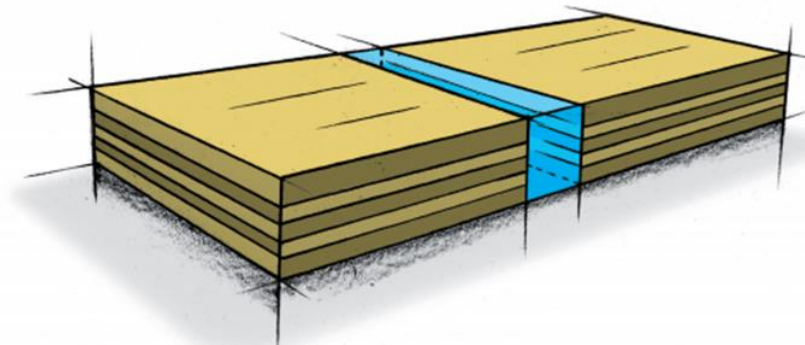
* For more details see "WOOD CONNECTORS AND TIMBER PLATES" catalogue



Images provided by suppliers

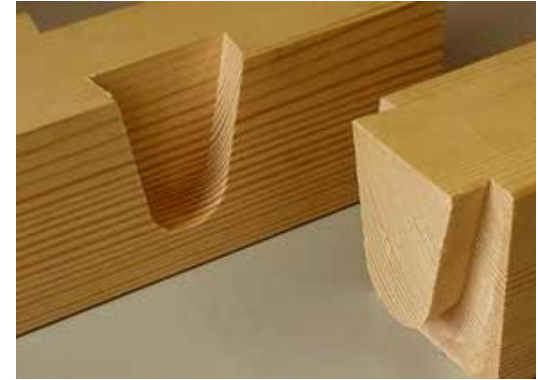
Proprietary

HSK HBV TS3.0 Glued in Rods



Custom

Pins / Notches

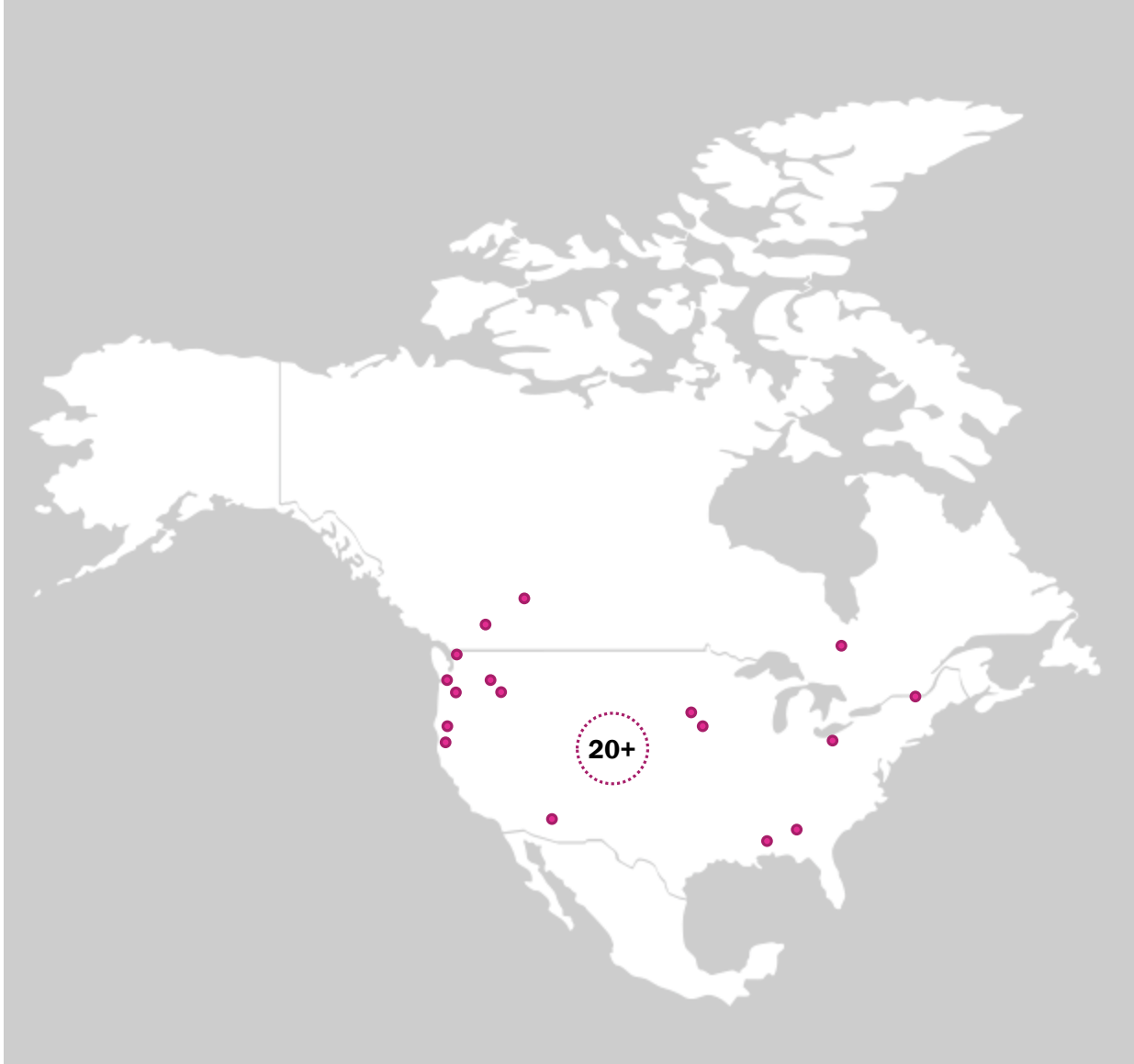


SUPPLY

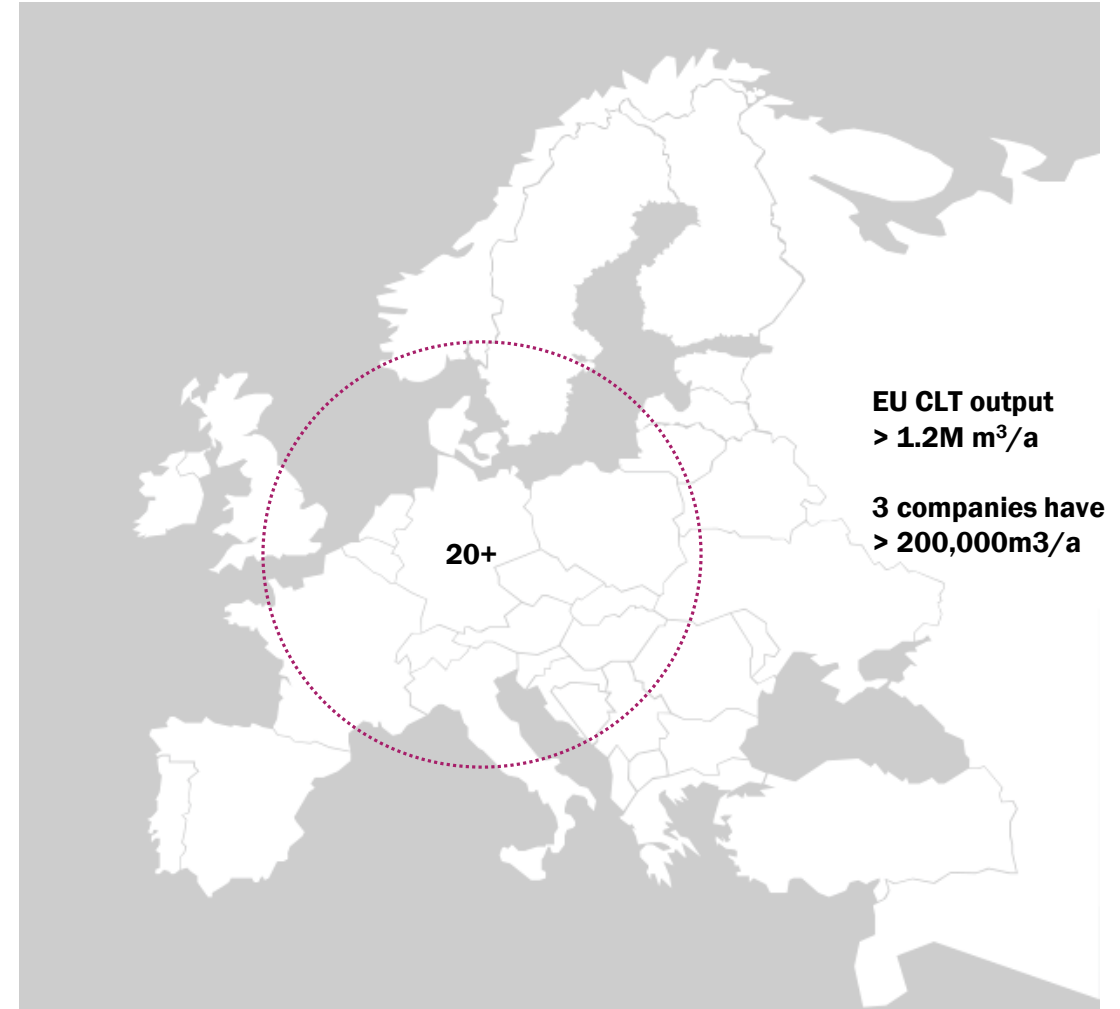
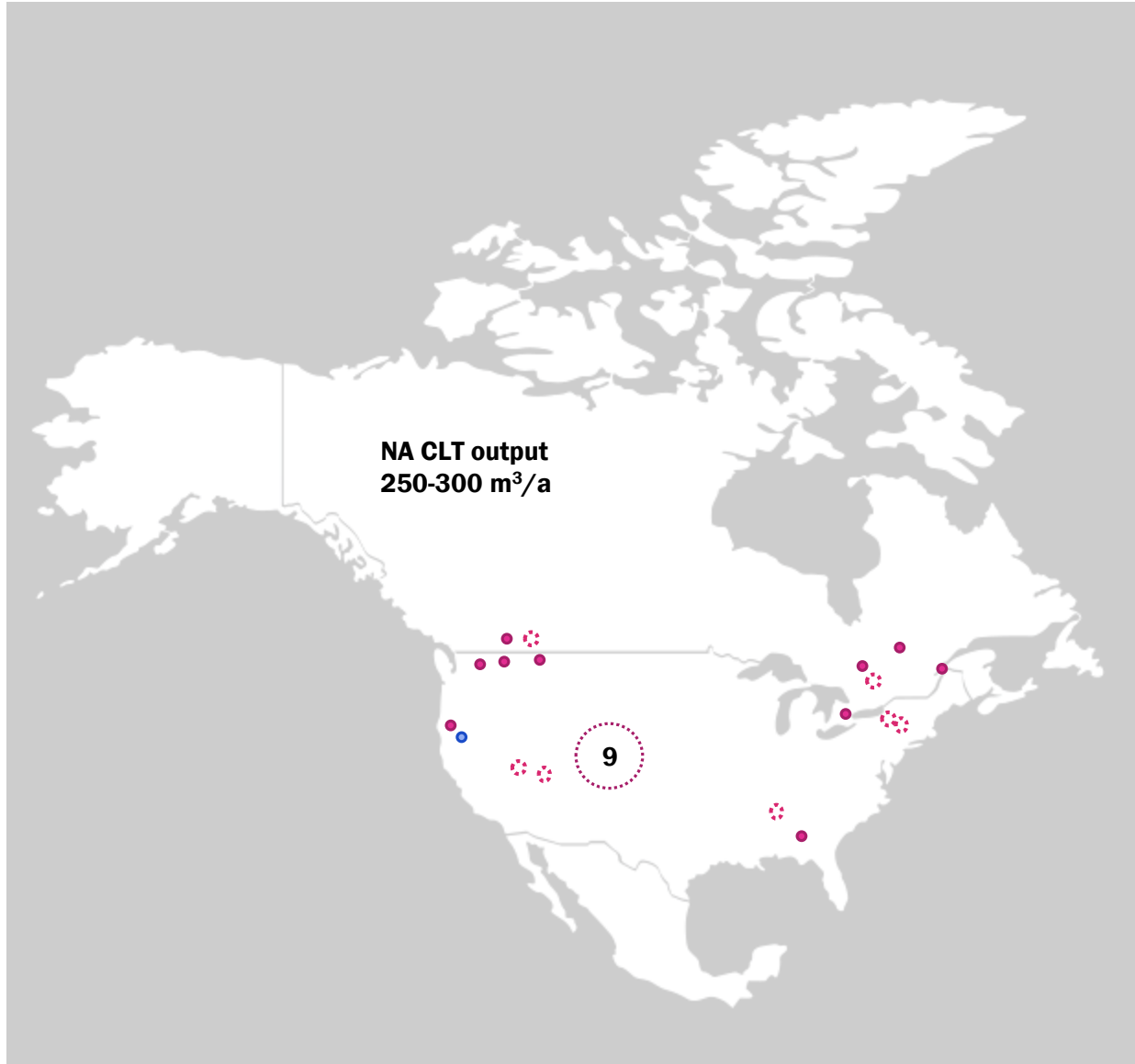
- **Nail-Laminated
Timber**
- **Glue-Laminated
Timber**
- **Cross-Laminated
Timber**



NLT/DLT SUPPLY



GLT SUPPLY



CLT SUPPLY

CLT SUPPLIERS (CAN | US | EU)

Estimated realistic supply capacity based on industry publications and conversations.

Not all suppliers are shown, only the ones relevant to US and Canadian projects.

NORTH AMERICA		Est. Current Capacity	Est. 2020 Capacity	PRG-320-18	Max. Sizes
	Structurlam Penticton, BC, CAN	50 000 m³	50 000 m³	Yes	3.0 x 12.19
	Nordic Structures Montreal, QC, CAN	50 000 m³	50 000 m³	Yes	4 x 19.5
	Katerra Spokane, WA, USA	50 000 m³	100 000 m³	Yes	3.64 x 18.24
	Smartlam Columbia Falls, MT, USA	50 000 m³	50 000 m³	Yes	3.2 x 12.19
	International Beam Dothan, AL, USA	?	?	Yes	3.0 x 15.8
	DR Johnson Riddle, OR, USA	10 000 m³	10 000 m³	Yes	3.0 x 9.7 (12.1)
	Vaagen Timber Colville, WA, USA	—	15 000 m³	Not Yet	1.2 x 18.2
	Kalesnikoff Castlegar, BC, CAN	—	15 000 m³	Not Yet	3.5 x 18.2
	Structurlam Arkansas, USA	—	?	—	3.5 x 18.2
	MPP (Freres Lumber) Lyons, OR, USA	?	?	Yes	3.64 x 14.5
EUROPE		Est. Current Capacity	Est. 2020 Capacity	PRG-320-18	Max. Sizes
	KLH Massivholz Teufenbach-Katsch, AT	120 000 m³	220 000 m³	Yes	3.5 x 16.5
	Stora Enso Bad St. Leonhard, Ybbs, AT	195 000 m³	220 000 m³	In Progress	2.95 x 16 3.95 x 16
	Binderholz Bausysteme Unternberg, AT, Burgbernheim, DE	195 000 m³	220 000 m³	In Progress	1.25 x 24 3.5 x 22
	Hasslacher Norica Timber Stall im Mölltal, AT	55 000 m³	60 000 m³	In Progress	3.2 x 20
	Rubner Holzbau Brixen, IT	7 000 m³	15 000 m³	In Progress	4 x 17
	Züblin Timber Aichach, DE	30 000 m³	30 000 m³	Not Yet	4.8 x 19.8
	W.u.J Derix Niederkrüchten, DE	12 500 m³	100 000 m³	Not Yet	3.5 x 18
	XLam Dolomiti Castel Ivano, IT	15 500 m³	15 500 m³	Not Yet	3.5 x 13.5
	Mayr-Melnhof Holz Gaishorn, AT	75 000 m³	100 000 m³	Not Yet	3.5 x 16 3.0 x 16.5
	Schillinger Holz Kusnacht, CH	50 000 m³	100 000 m³	Not Yet	3.4 x 18

CLT SUPPLY

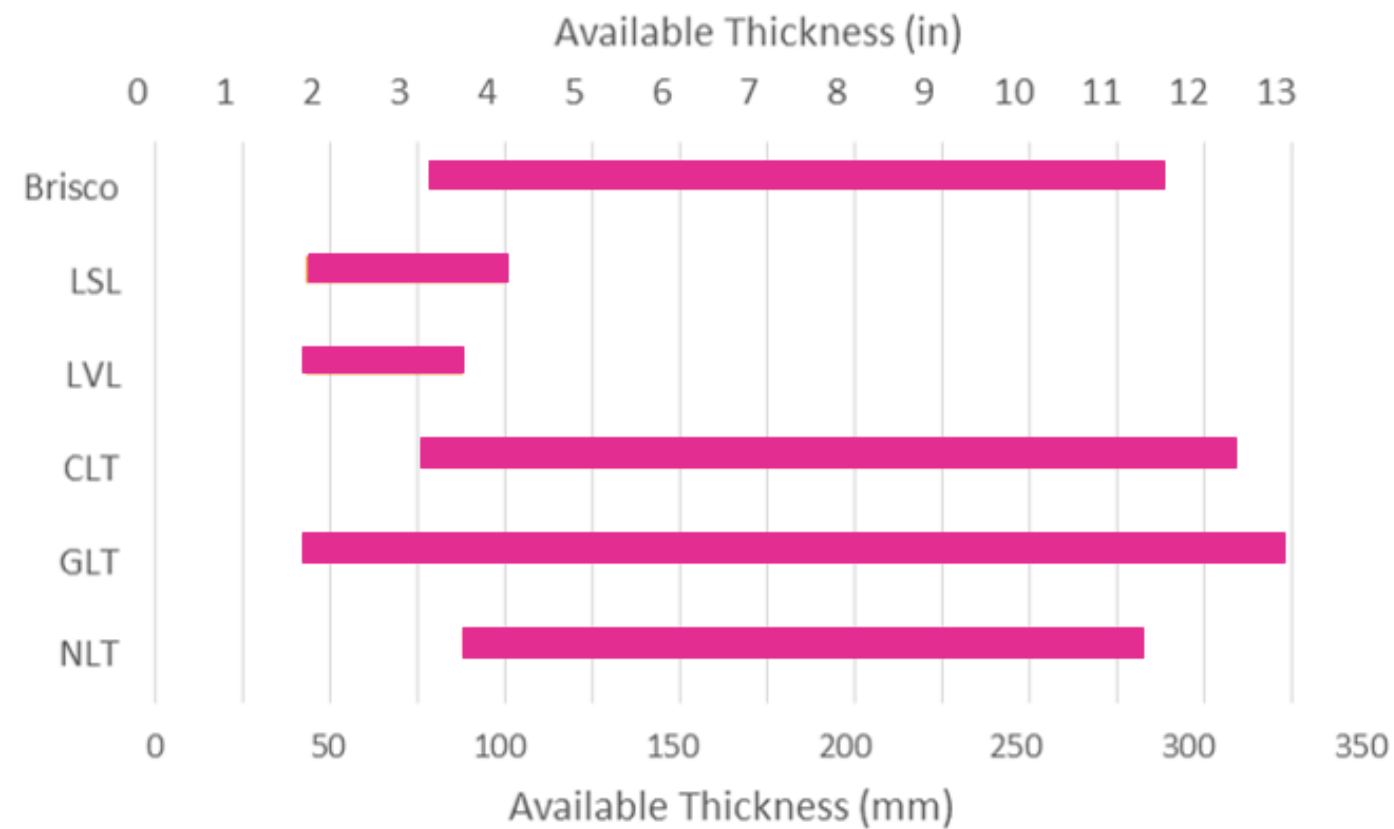
Pitfalls



Different Materials
Different Tolerances
Different Markets

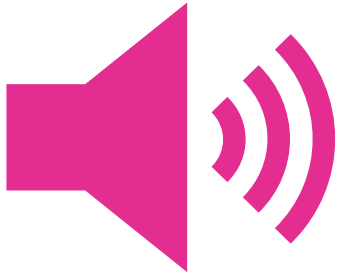


Sizes Available



Performance Requirements

Acoustics



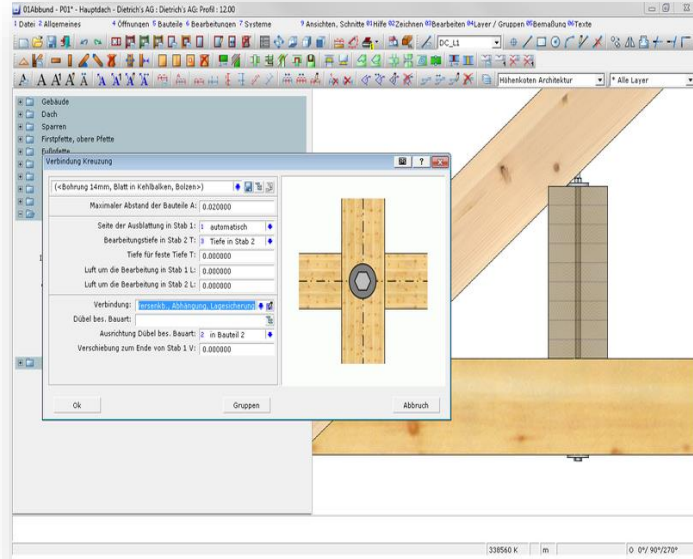
Fire



Vibration



Design for Manufacturing



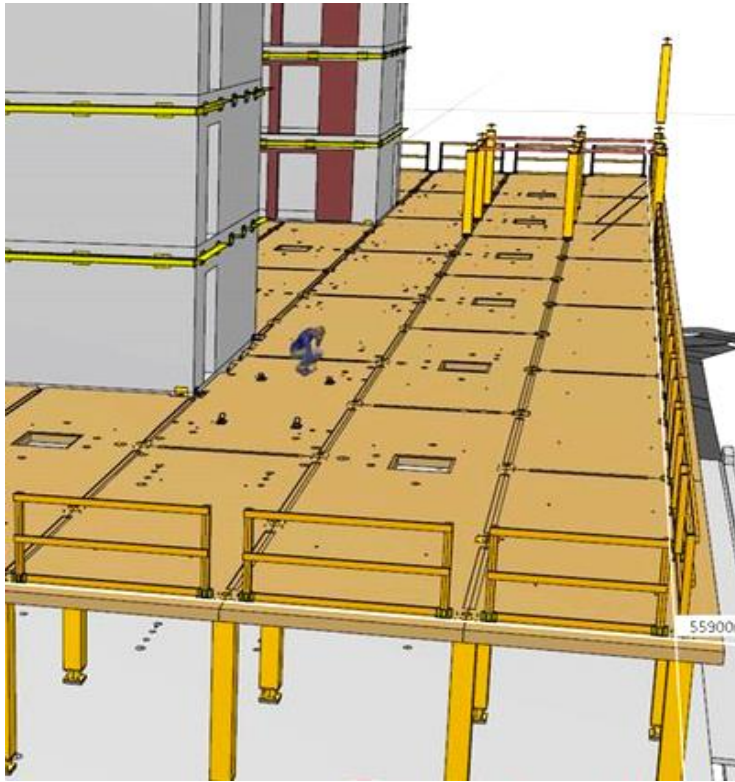
Design for Transportation

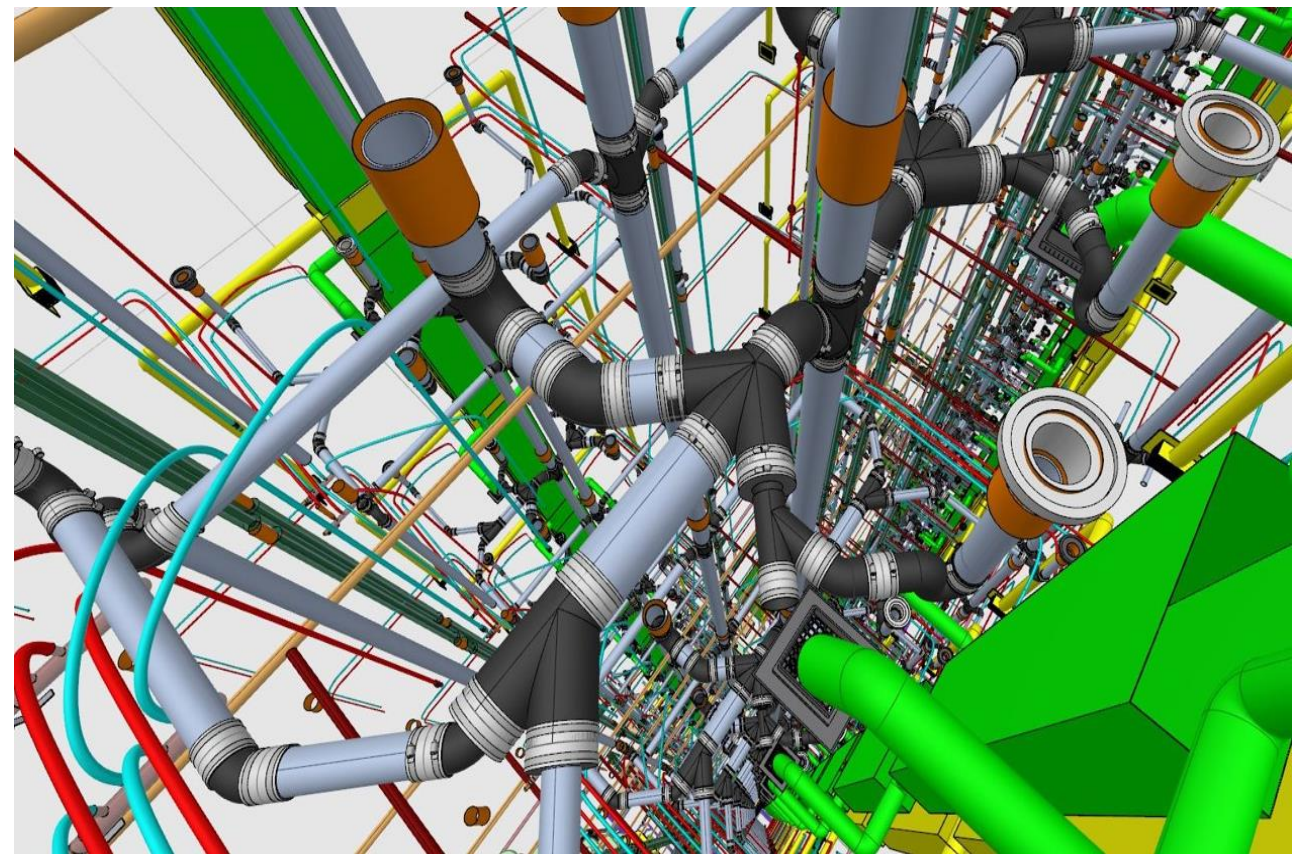
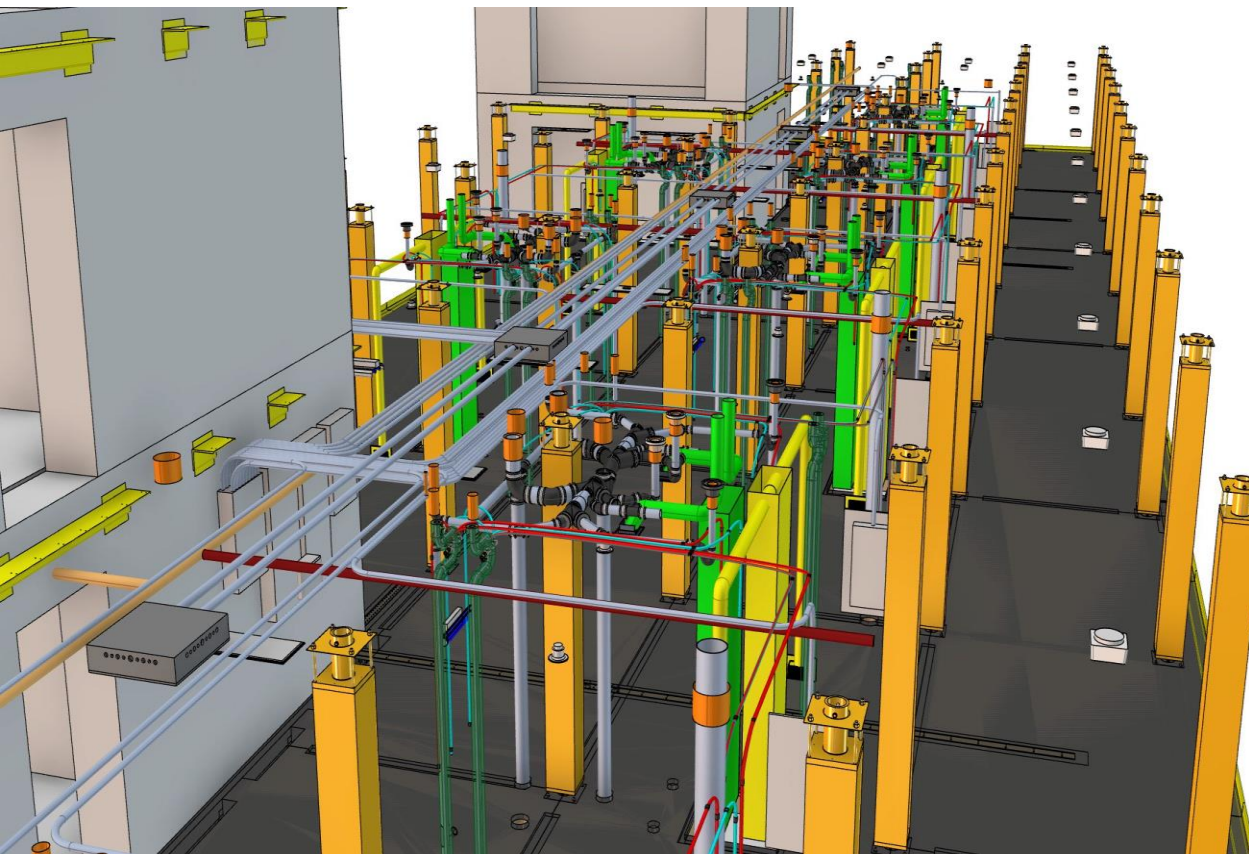


Design for Installation



Virtual Construction (BIM)





Specialty Engineering

By the Supplier or Engineer-of-Record?

OUR DESIGN PROCESS



Team

owner
designers
funding body/agency
AHJ
builder

Supply / Product

suppliers

capability
capacity
availability

material properties
availability

products

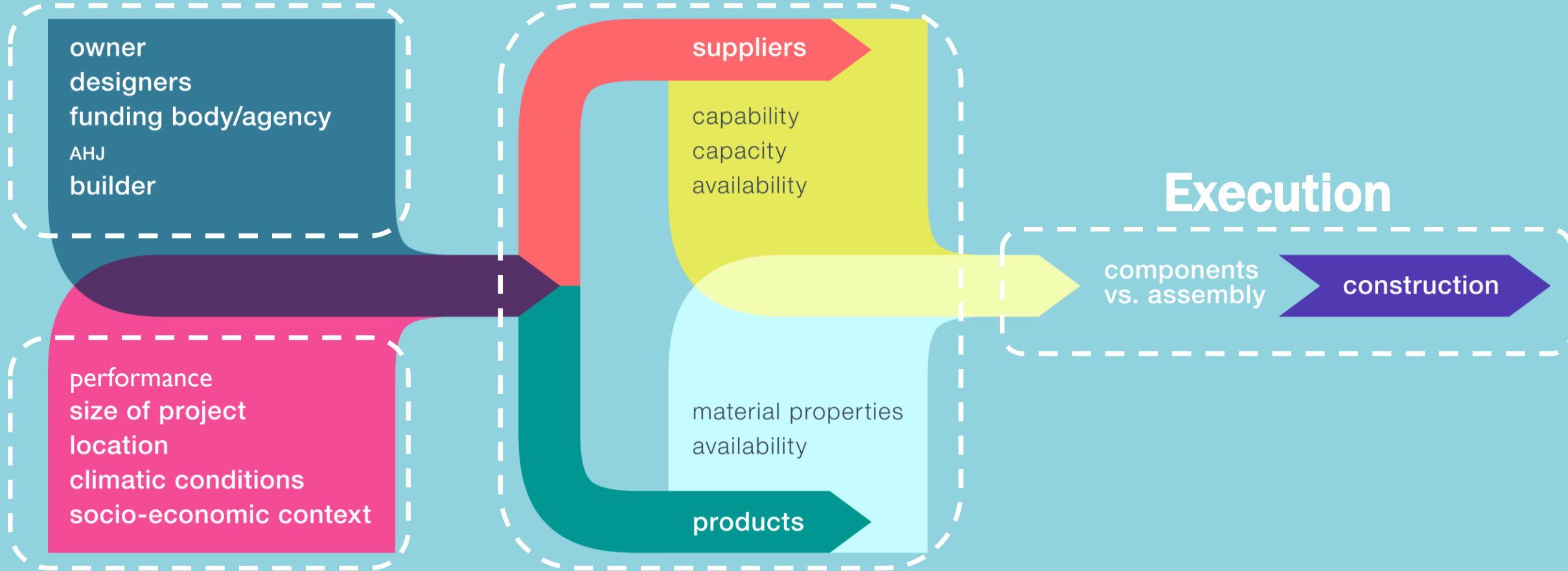
Execution

components
vs. assembly

construction

Building

performance
size of project
location
climatic conditions
socio-economic context



Main Order Supply - Overview																
Order ID	Order Date	Order Type	Order Status	Order Category	Order Sub-Category	Order Item	Order Description	Order Quantity	Order Unit	Order Price	Order Total	Order Tax	Order Discount	Order Net Total	Order Payment Method	Order Payment Status
1	2023-01-01	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro	Apple iPhone 13 Pro, 128GB, Silver	1	Unit	\$1,199.00	\$1,199.00	\$0.00	\$0.00	\$1,199.00	Credit Card	Paid
2	2023-01-05	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22	Samsung Galaxy S22, 128GB, Black	1	Unit	\$799.99	\$799.99	\$0.00	\$0.00	\$799.99	Credit Card	Paid
3	2023-01-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
4	2023-01-15	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9, 128GB, Green	1	Unit	\$699.00	\$699.00	\$0.00	\$0.00	\$699.00	Credit Card	Paid
5	2023-01-20	Standard	Completed	Electronics	Smartphones	Xiaomi Mi 11	Xiaomi Mi 11, 128GB, Black	1	Unit	\$549.00	\$549.00	\$0.00	\$0.00	\$549.00	Credit Card	Paid
6	2023-01-25	Standard	Completed	Electronics	Smartphones	Huawei P50	Huawei P50, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
7	2023-02-01	Standard	Completed	Electronics	Smartphones	Motorola Edge	Motorola Edge, 128GB, Black	1	Unit	\$499.00	\$499.00	\$0.00	\$0.00	\$499.00	Credit Card	Paid
8	2023-02-05	Standard	Completed	Electronics	Smartphones	Nokia 8.3	Nokia 8.3, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
9	2023-02-10	Standard	Completed	Electronics	Smartphones	BlackBerry KEY2	BlackBerry KEY2, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
10	2023-02-15	Standard	Completed	Electronics	Smartphones	Alcatel 1	Alcatel 1, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
11	2023-02-20	Standard	Completed	Electronics	Smartphones	Lenovo Moto G	Lenovo Moto G, 128GB, Black	1	Unit	\$149.00	\$149.00	\$0.00	\$0.00	\$149.00	Credit Card	Paid
12	2023-02-25	Standard	Completed	Electronics	Smartphones	Realme 8	Realme 8, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
13	2023-03-01	Standard	Completed	Electronics	Smartphones	OPPO Reno5	OPPO Reno5, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
14	2023-03-05	Standard	Completed	Electronics	Smartphones	Vivo V20	Vivo V20, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
15	2023-03-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6 Pro	Google Pixel 6 Pro, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
16	2023-03-15	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22 Ultra	Samsung Galaxy S22 Ultra, 128GB, Black	1	Unit	\$1,199.99	\$1,199.99	\$0.00	\$0.00	\$1,199.99	Credit Card	Paid
17	2023-03-20	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro Max	Apple iPhone 13 Pro Max, 128GB, Silver	1	Unit	\$1,299.00	\$1,299.00	\$0.00	\$0.00	\$1,299.00	Credit Card	Paid
18	2023-03-25	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
19	2023-04-01	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9, 128GB, Green	1	Unit	\$699.00	\$699.00	\$0.00	\$0.00	\$699.00	Credit Card	Paid
20	2023-04-05	Standard	Completed	Electronics	Smartphones	Xiaomi Mi 11	Xiaomi Mi 11, 128GB, Black	1	Unit	\$549.00	\$549.00	\$0.00	\$0.00	\$549.00	Credit Card	Paid
21	2023-04-10	Standard	Completed	Electronics	Smartphones	Huawei P50	Huawei P50, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
22	2023-04-15	Standard	Completed	Electronics	Smartphones	Motorola Edge	Motorola Edge, 128GB, Black	1	Unit	\$499.00	\$499.00	\$0.00	\$0.00	\$499.00	Credit Card	Paid
23	2023-04-20	Standard	Completed	Electronics	Smartphones	Nokia 8.3	Nokia 8.3, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
24	2023-04-25	Standard	Completed	Electronics	Smartphones	BlackBerry KEY2	BlackBerry KEY2, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
25	2023-05-01	Standard	Completed	Electronics	Smartphones	Alcatel 1	Alcatel 1, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
26	2023-05-05	Standard	Completed	Electronics	Smartphones	Lenovo Moto G	Lenovo Moto G, 128GB, Black	1	Unit	\$149.00	\$149.00	\$0.00	\$0.00	\$149.00	Credit Card	Paid
27	2023-05-10	Standard	Completed	Electronics	Smartphones	Realme 8	Realme 8, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
28	2023-05-15	Standard	Completed	Electronics	Smartphones	OPPO Reno5	OPPO Reno5, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
29	2023-05-20	Standard	Completed	Electronics	Smartphones	Vivo V20	Vivo V20, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
30	2023-05-25	Standard	Completed	Electronics	Smartphones	Google Pixel 6 Pro	Google Pixel 6 Pro, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
31	2023-06-01	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22 Ultra	Samsung Galaxy S22 Ultra, 128GB, Black	1	Unit	\$1,199.99	\$1,199.99	\$0.00	\$0.00	\$1,199.99	Credit Card	Paid
32	2023-06-05	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro Max	Apple iPhone 13 Pro Max, 128GB, Silver	1	Unit	\$1,299.00	\$1,299.00	\$0.00	\$0.00	\$1,299.00	Credit Card	Paid
33	2023-06-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
34	2023-06-15	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9, 128GB, Green	1	Unit	\$699.00	\$699.00	\$0.00	\$0.00	\$699.00	Credit Card	Paid
35	2023-06-20	Standard	Completed	Electronics	Smartphones	Xiaomi Mi 11	Xiaomi Mi 11, 128GB, Black	1	Unit	\$549.00	\$549.00	\$0.00	\$0.00	\$549.00	Credit Card	Paid
36	2023-06-25	Standard	Completed	Electronics	Smartphones	Huawei P50	Huawei P50, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
37	2023-07-01	Standard	Completed	Electronics	Smartphones	Motorola Edge	Motorola Edge, 128GB, Black	1	Unit	\$499.00	\$499.00	\$0.00	\$0.00	\$499.00	Credit Card	Paid
38	2023-07-05	Standard	Completed	Electronics	Smartphones	Nokia 8.3	Nokia 8.3, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
39	2023-07-10	Standard	Completed	Electronics	Smartphones	BlackBerry KEY2	BlackBerry KEY2, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
40	2023-07-15	Standard	Completed	Electronics	Smartphones	Alcatel 1	Alcatel 1, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
41	2023-07-20	Standard	Completed	Electronics	Smartphones	Lenovo Moto G	Lenovo Moto G, 128GB, Black	1	Unit	\$149.00	\$149.00	\$0.00	\$0.00	\$149.00	Credit Card	Paid
42	2023-07-25	Standard	Completed	Electronics	Smartphones	Realme 8	Realme 8, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
43	2023-08-01	Standard	Completed	Electronics	Smartphones	OPPO Reno5	OPPO Reno5, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
44	2023-08-05	Standard	Completed	Electronics	Smartphones	Vivo V20	Vivo V20, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
45	2023-08-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6 Pro	Google Pixel 6 Pro, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
46	2023-08-15	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22 Ultra	Samsung Galaxy S22 Ultra, 128GB, Black	1	Unit	\$1,199.99	\$1,199.99	\$0.00	\$0.00	\$1,199.99	Credit Card	Paid
47	2023-08-20	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro Max	Apple iPhone 13 Pro Max, 128GB, Silver	1	Unit	\$1,299.00	\$1,299.00	\$0.00	\$0.00	\$1,299.00	Credit Card	Paid
48	2023-08-25	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
49	2023-09-01	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9, 128GB, Green	1	Unit	\$699.00	\$699.00	\$0.00	\$0.00	\$699.00	Credit Card	Paid
50	2023-09-05	Standard	Completed	Electronics	Smartphones	Xiaomi Mi 11	Xiaomi Mi 11, 128GB, Black	1	Unit	\$549.00	\$549.00	\$0.00	\$0.00	\$549.00	Credit Card	Paid
51	2023-09-10	Standard	Completed	Electronics	Smartphones	Huawei P50	Huawei P50, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
52	2023-09-15	Standard	Completed	Electronics	Smartphones	Motorola Edge	Motorola Edge, 128GB, Black	1	Unit	\$499.00	\$499.00	\$0.00	\$0.00	\$499.00	Credit Card	Paid
53	2023-09-20	Standard	Completed	Electronics	Smartphones	Nokia 8.3	Nokia 8.3, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
54	2023-09-25	Standard	Completed	Electronics	Smartphones	BlackBerry KEY2	BlackBerry KEY2, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
55	2023-10-01	Standard	Completed	Electronics	Smartphones	Alcatel 1	Alcatel 1, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
56	2023-10-05	Standard	Completed	Electronics	Smartphones	Lenovo Moto G	Lenovo Moto G, 128GB, Black	1	Unit	\$149.00	\$149.00	\$0.00	\$0.00	\$149.00	Credit Card	Paid
57	2023-10-10	Standard	Completed	Electronics	Smartphones	Realme 8	Realme 8, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
58	2023-10-15	Standard	Completed	Electronics	Smartphones	OPPO Reno5	OPPO Reno5, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
59	2023-10-20	Standard	Completed	Electronics	Smartphones	Vivo V20	Vivo V20, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
60	2023-10-25	Standard	Completed	Electronics	Smartphones	Google Pixel 6 Pro	Google Pixel 6 Pro, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
61	2023-11-01	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22 Ultra	Samsung Galaxy S22 Ultra, 128GB, Black	1	Unit	\$1,199.99	\$1,199.99	\$0.00	\$0.00	\$1,199.99	Credit Card	Paid
62	2023-11-05	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro Max	Apple iPhone 13 Pro Max, 128GB, Silver	1	Unit	\$1,299.00	\$1,299.00	\$0.00	\$0.00	\$1,299.00	Credit Card	Paid
63	2023-11-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
64	2023-11-15	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9, 128GB, Green	1	Unit	\$699.00	\$699.00	\$0.00	\$0.00	\$699.00	Credit Card	Paid
65	2023-11-20	Standard	Completed	Electronics	Smartphones	Xiaomi Mi 11	Xiaomi Mi 11, 128GB, Black	1	Unit	\$549.00	\$549.00	\$0.00	\$0.00	\$549.00	Credit Card	Paid
66	2023-11-25	Standard	Completed	Electronics	Smartphones	Huawei P50	Huawei P50, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
67	2023-12-01	Standard	Completed	Electronics	Smartphones	Motorola Edge	Motorola Edge, 128GB, Black	1	Unit	\$499.00	\$499.00	\$0.00	\$0.00	\$499.00	Credit Card	Paid
68	2023-12-05	Standard	Completed	Electronics	Smartphones	Nokia 8.3	Nokia 8.3, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
69	2023-12-10	Standard	Completed	Electronics	Smartphones	BlackBerry KEY2	BlackBerry KEY2, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
70	2023-12-15	Standard	Completed	Electronics	Smartphones	Alcatel 1	Alcatel 1, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
71	2023-12-20	Standard	Completed	Electronics	Smartphones	Lenovo Moto G	Lenovo Moto G, 128GB, Black	1	Unit	\$149.00	\$149.00	\$0.00	\$0.00	\$149.00	Credit Card	Paid
72	2023-12-25	Standard	Completed	Electronics	Smartphones	Realme 8	Realme 8, 128GB, Black	1	Unit	\$199.00	\$199.00	\$0.00	\$0.00	\$199.00	Credit Card	Paid
73	2024-01-01	Standard	Completed	Electronics	Smartphones	OPPO Reno5	OPPO Reno5, 128GB, Black	1	Unit	\$299.00	\$299.00	\$0.00	\$0.00	\$299.00	Credit Card	Paid
74	2024-01-05	Standard	Completed	Electronics	Smartphones	Vivo V20	Vivo V20, 128GB, Black	1	Unit	\$399.00	\$399.00	\$0.00	\$0.00	\$399.00	Credit Card	Paid
75	2024-01-10	Standard	Completed	Electronics	Smartphones	Google Pixel 6 Pro	Google Pixel 6 Pro, 128GB, Black	1	Unit	\$899.00	\$899.00	\$0.00	\$0.00	\$899.00	Credit Card	Paid
76	2024-01-15	Standard	Completed	Electronics	Smartphones	Samsung Galaxy S22 Ultra	Samsung Galaxy S22 Ultra, 128GB, Black	1	Unit	\$1,199.99	\$1,199.99	\$0.00	\$0.00	\$1,199.99	Credit Card	Paid
77	2024-01-20	Standard	Completed	Electronics	Smartphones	iPhone 13 Pro Max	Apple iPhone 13 Pro Max, 128GB, Silver	1	Unit	\$1,299.00	\$1,299.00	\$0.00	\$0.00	\$1,299.00	Credit Card	Paid
78	2024-01-25	Standard	Completed	Electronics	Smartphones	Google Pixel 6	Google Pixel 6, 128GB, Black	1	Unit	\$599.00	\$599.00	\$0.00	\$0.00	\$599.00	Credit Card	Paid
79	2024-02-01	Standard	Completed	Electronics	Smartphones	OnePlus 9	OnePlus 9,									

Real Material Options

Prodcut	Description	Typ Size	Span Direction	TCC Connections	Production Standards	Supply NA	Species NA	Supply EU	Species EU	To Consider when comparing to NA
NLT	Regular framing members (2x, 3x) on edge fastened together with nails	Typ 4' or 8' wide. Length is limited by sawn lumber. Less than 20' is ok. Longer is difficult to get lumber. Staggered lamination layup is possible, but redcut in strenght and stiffness	One way only, unless reinforced, additional members are intorduced or TCC	Distributed connection required. Discrete connection may overstress interlaminar connections	No, need to rely on ARCH/EOR specs.	Anyone could do it. Structurecraft, Seagate, Guardian, Skanska?	Any, based on local availability. D.Fir and SPF are typ	Yes, multiple suppliers	European SPF	NLT Supply from EU does not make sense. Only small players in the market and similar cots to GLT
DLT	Regular framing members (2x, 3x) on edge and fastened together with hard wood dowels	Typ 4' or 8' wide. Length is limited by sawn lumber. Less than 20' is ok. Longer is difficult to get lumber. Staggered lamination layup is possible, but redcut in strenght and stiffness	One way only, unless reinforced, additional members are intorduced or TCC	Distributed connection required. Discrete connection may overstress interlaminar connections	No, need to rely on ARCH/EOR specs.	Structurecraft (2018), Guardian (no proof)	Any, based on local availability. D.Fir and SPF are typ	Yes, multiple suppliers	European SPF	DLT Supply from EU does not make sense. Only small players in the market and similar cots to GLT
GLT	"Glulam beams on edge"	Typ 2' wide to keep cuping to minimum. Wider is doable. Keep to 4-6' max. Length is limited by produciton facility but is typically governed by max transportation length	One way only, unless reinforced, additional members are intorduced or TCC	Distributed and discrete connection possible	Yes, APA	Nordic, Western Archrib, QB Corporation, Structurlam, Western Structures, Calvert, American Laminators, Guardian Structures -- a few will likely team up for floor panels but can handle columns	Any, based on local availability. D.Fir and SPF are typ	Merk, Hasslacher, Binder, Wiehag	European SPF	European Glulam has the same stiffness as D.Fir, but only 70-80% of strength
LSL	Timber strands glued together	Typ 4' wide due to plant logistics. Theoretically 8' is possible. Length is limited by produciton facility but is typically governed by max transportation length	Typically one way only, unless reinforced, additional members are intorduced or TCC. Theoretical 2-way action possible	Distributed and discrete connection possible	Yes, CCMC/ICC	Weyerhaeuser, LP	Aspen	No	N/A	Not beeing produced in Europe
CLT	2x members crosswise glued together. "Jumbo Plywood"	Typ 8' or 10' wide. Length is limited by produciton facility (40'-60').	One or two way span capabilites.	Distributed and discrete connection possible	Yes, APA	Nordic, Structurlam, Guardian Structures, Smartlam -- Smartlam will team up, others will likely go alone	Any, based on local availability. SPF is typ	KLH, Merk, Stora Enso, Hasslacher, Binder -- they will likely team up for this project	European SPF	European CLT supplier are more flexible in regards to lamination size. The CLT is comparable is strength and stiffness to regular NA CLT - unless NA suppliers use MSR lumber in face laminations

Detail Design & Optimization

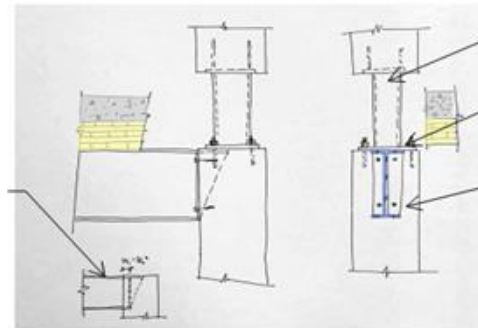
Detail 5/S-H-7.30; Steel Beam to GL Column

- Scope**
- Steel supply and installation needs to go hand in hand with wood install
 - Bid documents need to be clear - respect trade specific tolerances
- Tolerance**
- Glulam beam length will be +/- 1/8"
 - Steel beam will have more tolerance in its depth
 - Give tolerance for glulam and steel assembly (column base) together - not only glulam length
- Fabrication**
- Keep CNC time to a minimum. Hundegger K2 or sim
 - Slotting of member as shown may result in tear out, not acceptable if highly visible
- Installation**
- Steel trade is used to bolts. Consider horizontal slotted slip-critical connection one end to prevent racking of columns to fit?
 - Landing of GL column over top of 4 rods is tricky. Will need to take lots of measures to keep rods straight and square
 - Field injection of adhesive?
 - Temporary bracing of columns
- Others**
- Raise column base 4-6" above concrete for durability. Wood column will stain from mopping the floor
 - Unless steel beam is cantilevering, consider using single span beams only for "clean" detail

Suggestions:

Could notch column to receive beam end in order to allow for beam length tolerance and column width tolerance.

NOTE: Beams are typically not planed in their width!
Hand cleaning of notch after CNC machining likely required



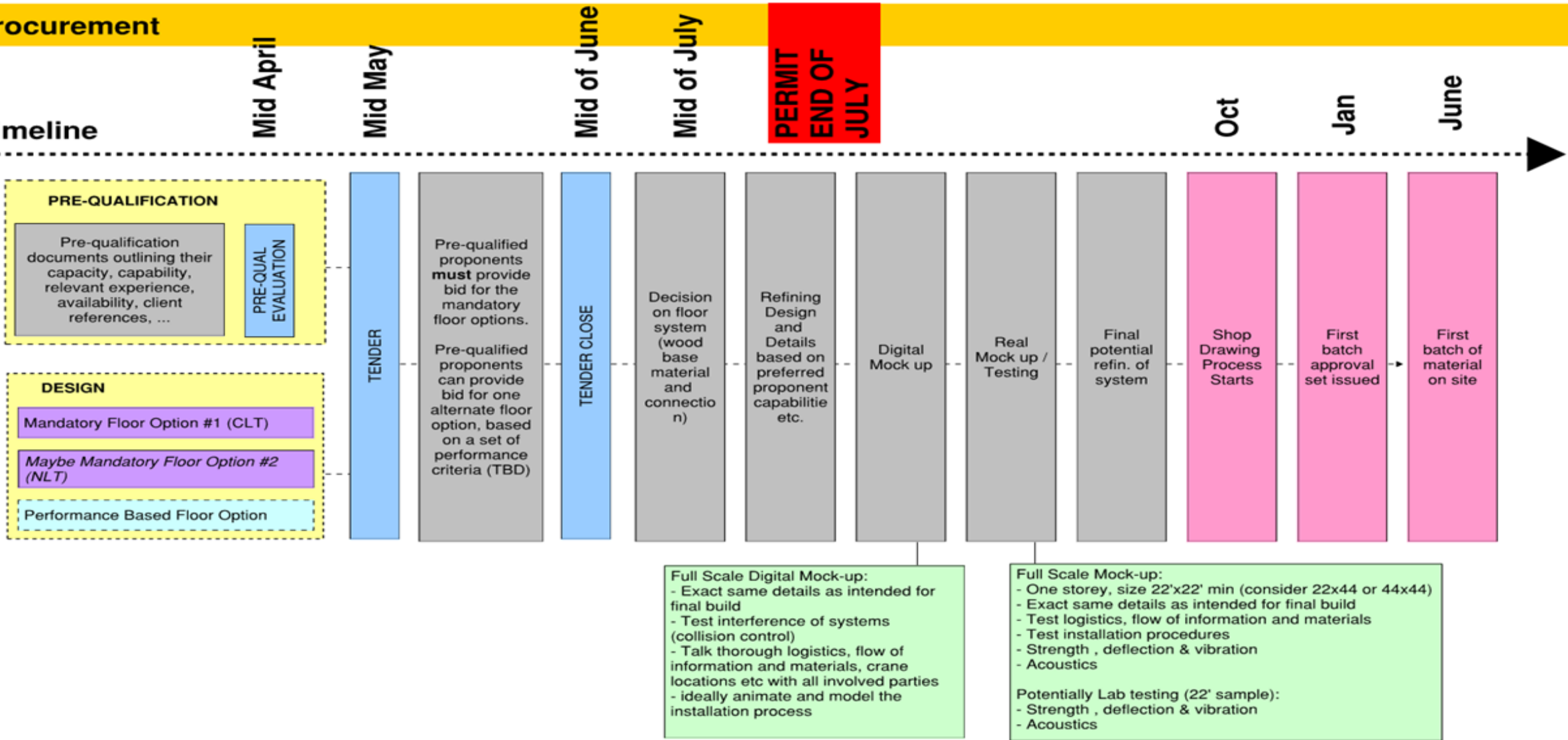
- HSS stub to keep base of GL column above concrete
- Glued-in rods to secure beam and base plate
- Extend beam top flange and cut web diagonally. Add head plate and add 4-3/8 self tapping screws
- columns do not require temporary bracing during installation



Procurement

Procurement

Timeline



HOW WE THINK

We are currently 6 engineers who are either carpenters, ran a carpenter shop or worked at a supplier's technical department – across 3 continents.

You can't switch off that side of the brain....

THANK YOU!

BERNHARD GAFNER

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ASPECT
STRUCTURAL ENGINEERS