

# NBCC 2020 CODE CHANGES

2023-11-22

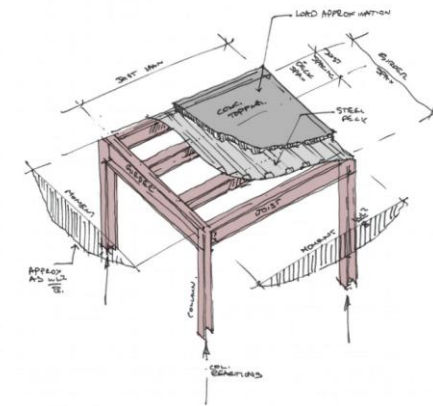
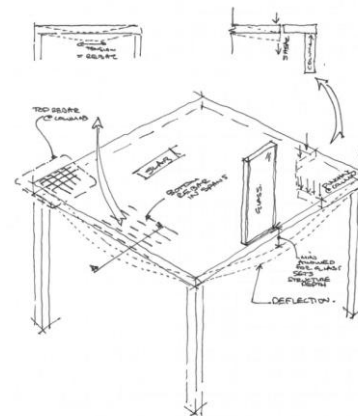
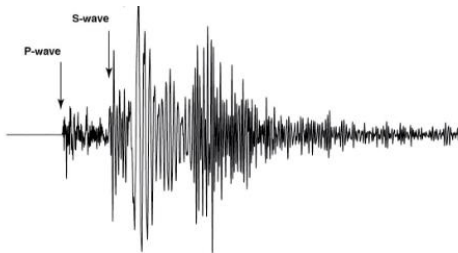
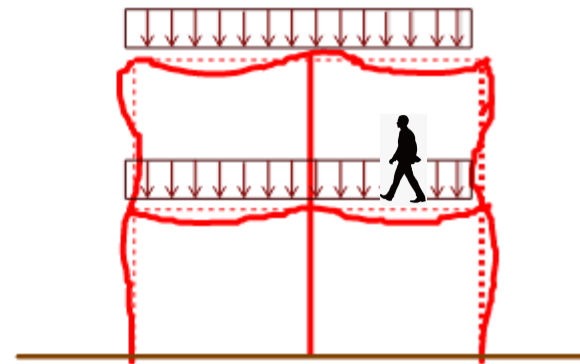
Harrison Glotman





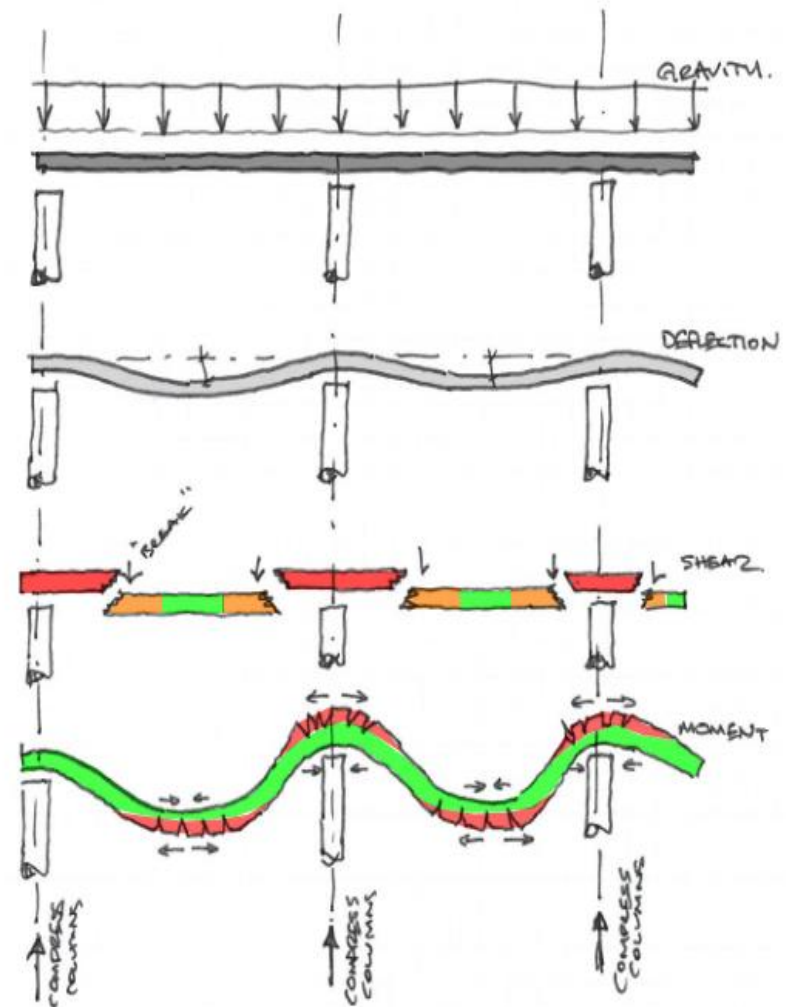
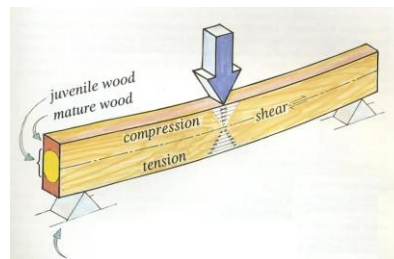


# THE FUNDAMENTALS



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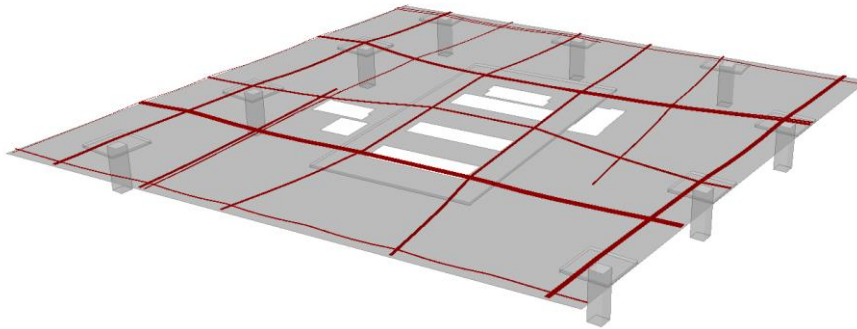
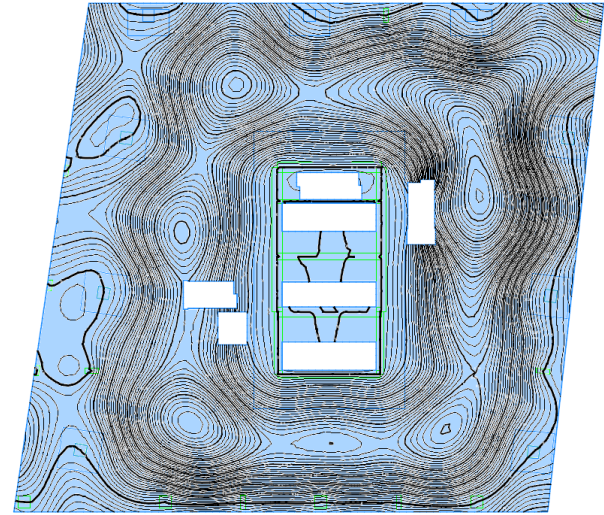
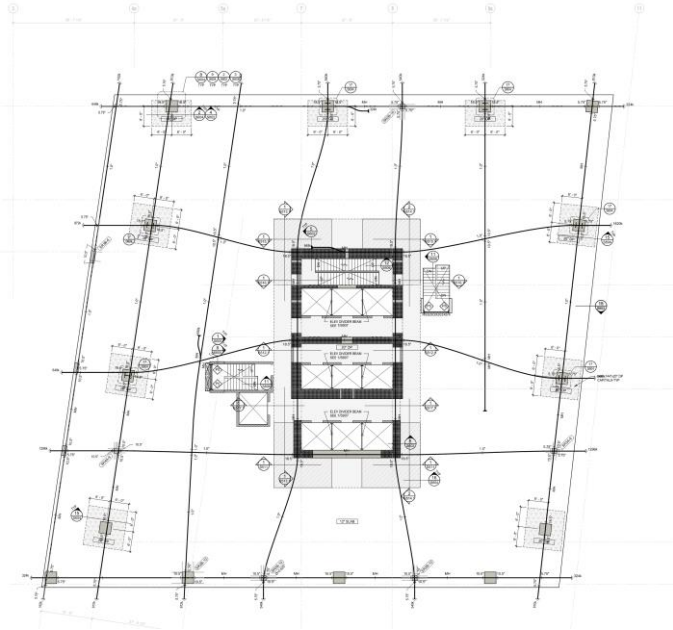
- Gravity only pushes down- Spans are gravity's **nemesis**, Columns are gravity's **friend**.
- Spanning elements Bend, Compress, Shear and Pull on materials
  - All materials have unique strength and stiffness properties prescribed by code, and are optimal for different applications.
- Analysis of each element is broken down into axial, shear, deflection and bending moment plots





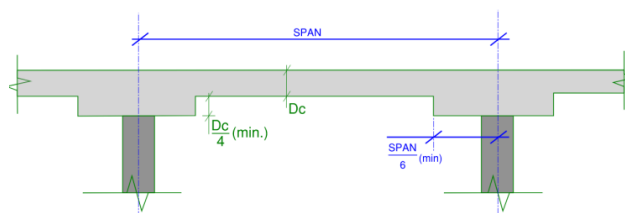


# DETAILING THE GRAVITY SYSTEM



# ROUGH SLAB THICKNESS ESTIMATES

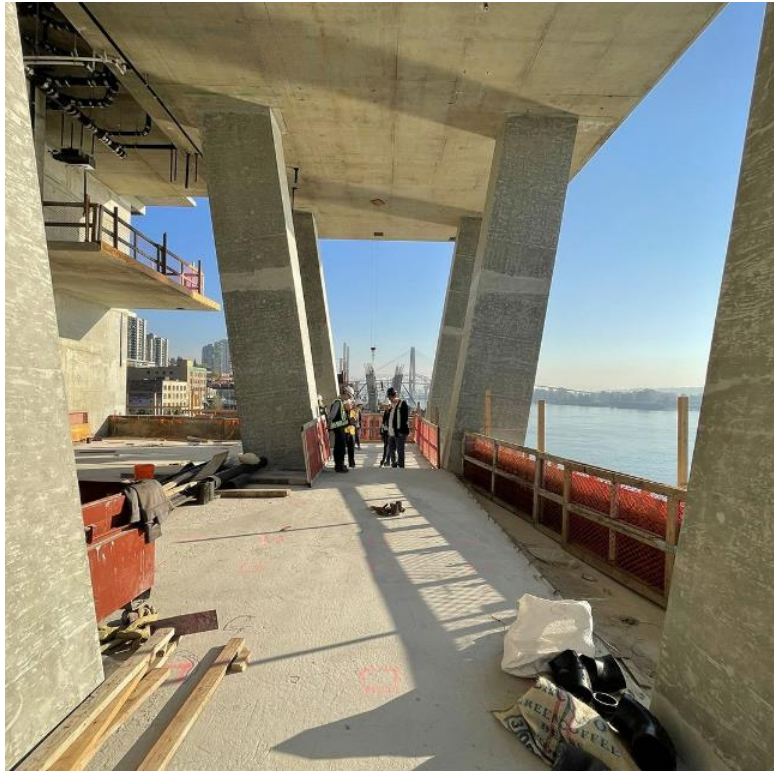
FLAT SLAB CONSTRUCTION GUIDELINES												
Span (m)		Conventional Slab			Post-Tensioned Slab			Slabs with Drop Panels			Drop Panel	
		Interior	End	Cantilever	Interior	End	Cantilever	Interior	End	Cantilever	Depth	Extent
Thickness (mm)	6.0	200	225	2000	175	200	2400	150	175	2400	300	1200
	6.5	200	225	2175	175	200	2600	175	200	2600	350	1300
	7.0	225	250	2325	200	225	2800	175	200	2800	350	1400
	7.5	225	275	2500	200	225	3000	200	225	3000	400	1500
	8.0	250	275	2675	225	250	3200	200	225	3200	400	1600
	8.5	275	300	2825	225	275	3400	225	250	3400	450	1700
	9.0	275	325	3000	250	275	3600	225	275	3600	450	1800
	9.5	300	350	3175	275	300	3800	250	275	3800	500	1900
	10.0	325	350	3325	275	325	4000	275	300	4000	550	2000
	10.5	325	375	3500	300	325	4200	275	300	4200	550	2100
	11.0	350	400	3675	300	350	4400	300	325	4400	600	2200
	11.5	350	400	3825	325	350	4600	300	350	4600	600	2300
12.0	375	425	4000	325	375	4800	325	350	4800	650	2400	



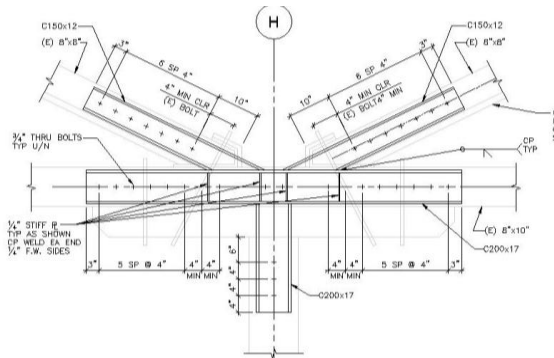


# SIZING THE COLUMNS

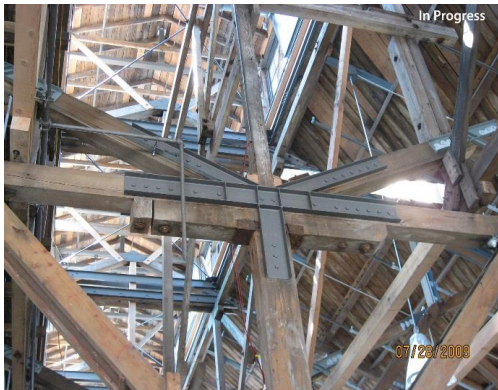
Height	Span	Column
12 Story	18'0"	14" X 48"
	24'6"	18" X 48"
	30'0"	20" X 48"
	36'0"	26" X 48"
8 Story	18'0"	12" X 36"
	24'6"	12" X 48"
	30'0"	16" X 48"
	36'0"	20" X 48"
4 Story	18'0"	12" X 24"
	24'6"	12" X 30"
	30'0"	12" X 36"
	36'0"	12" X 48"



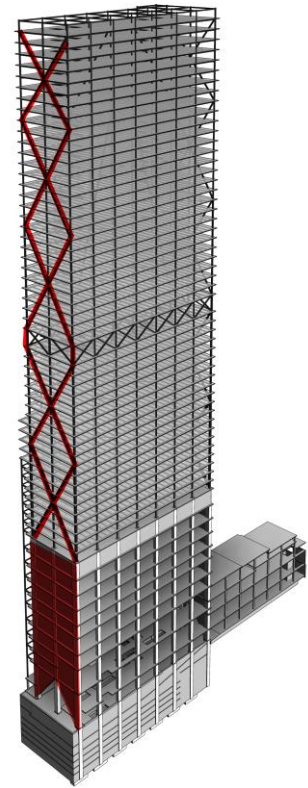
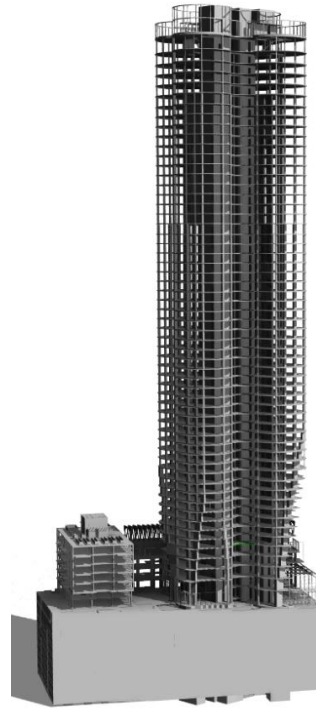
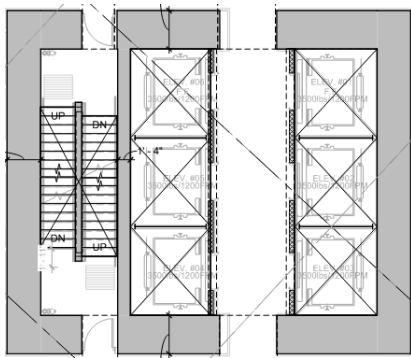
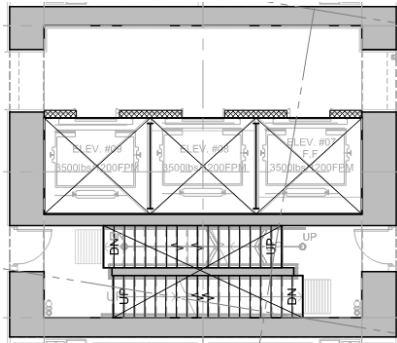




**4 TRUSS CONNECTION SUPPORT DETAIL**  
SCALE: 3/4"=1'-0"

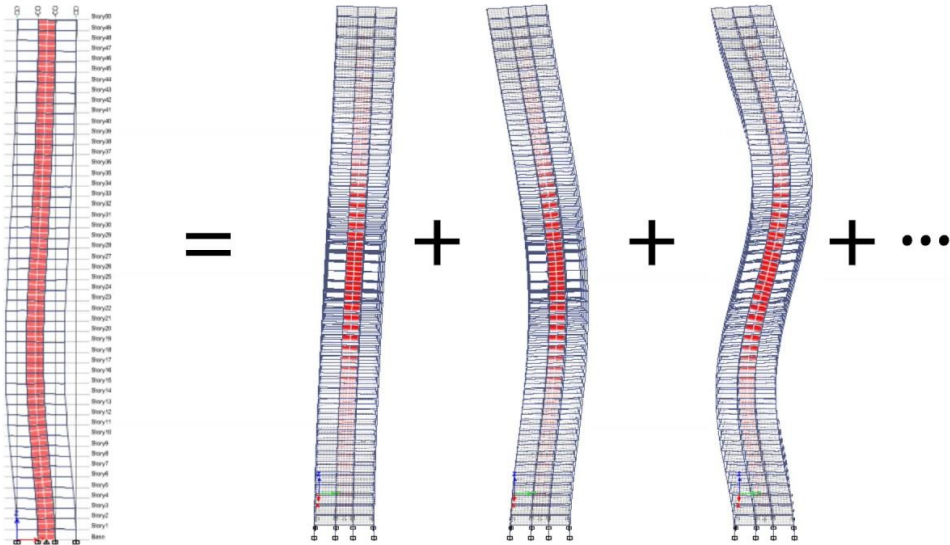


# DETAILING THE SEISMIC SYSTEM

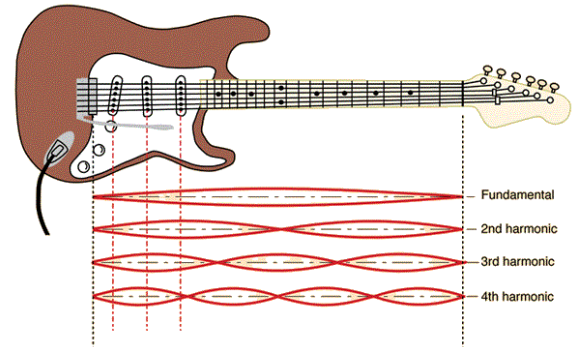




# 'GOOD' VIBRATIONS

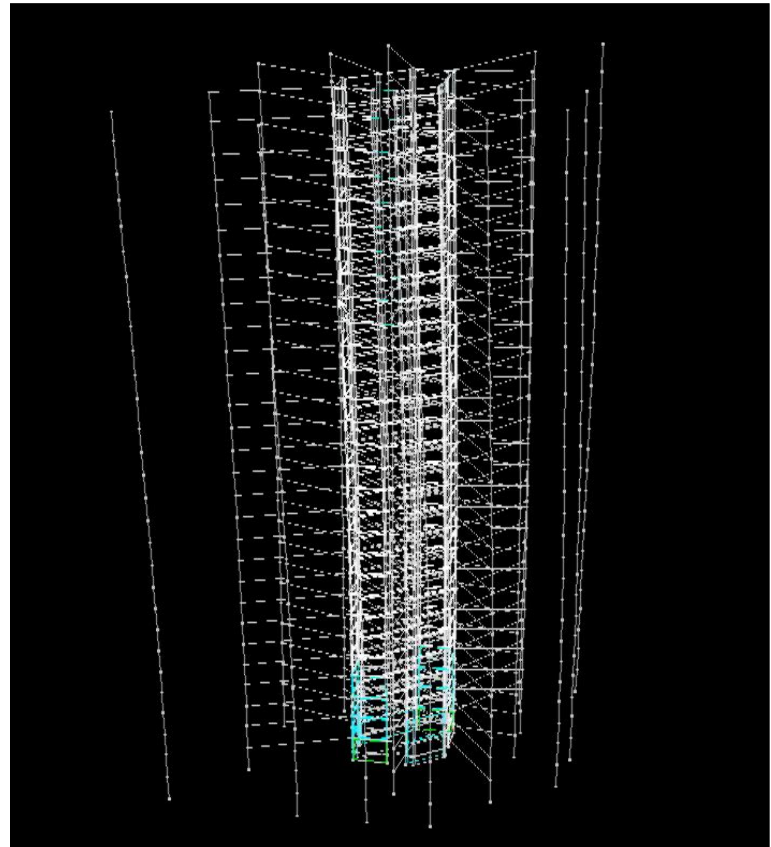
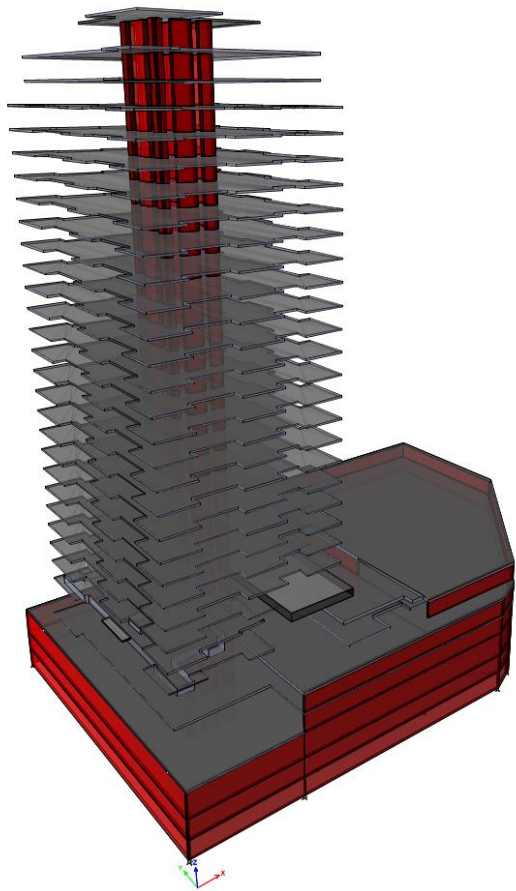


This is  $\uparrow$   
"The Period"



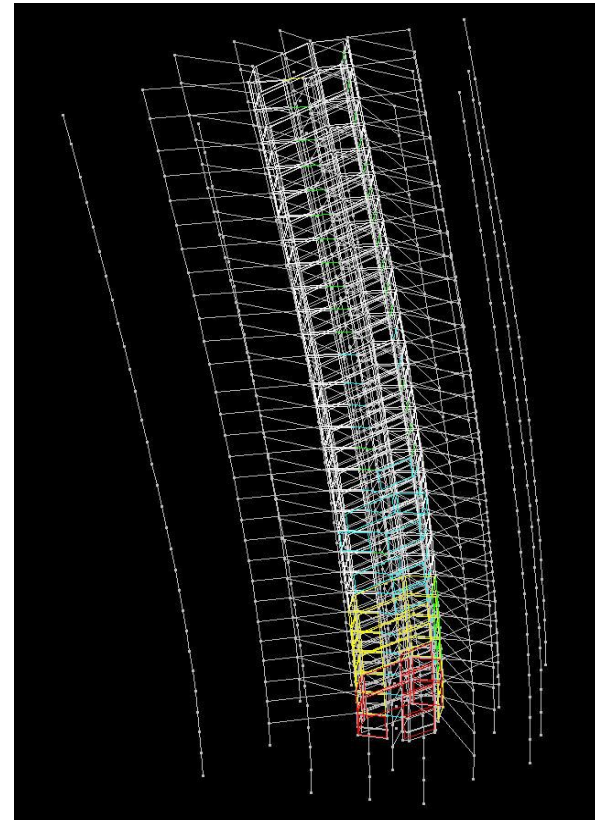
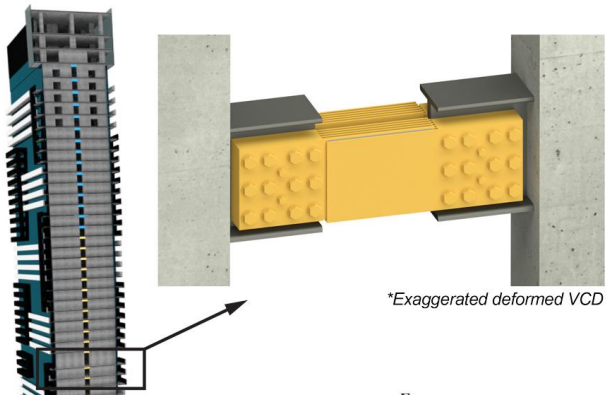
[Modes on a String - YouTube](#)

# 'GOOD' VIBRATIONS

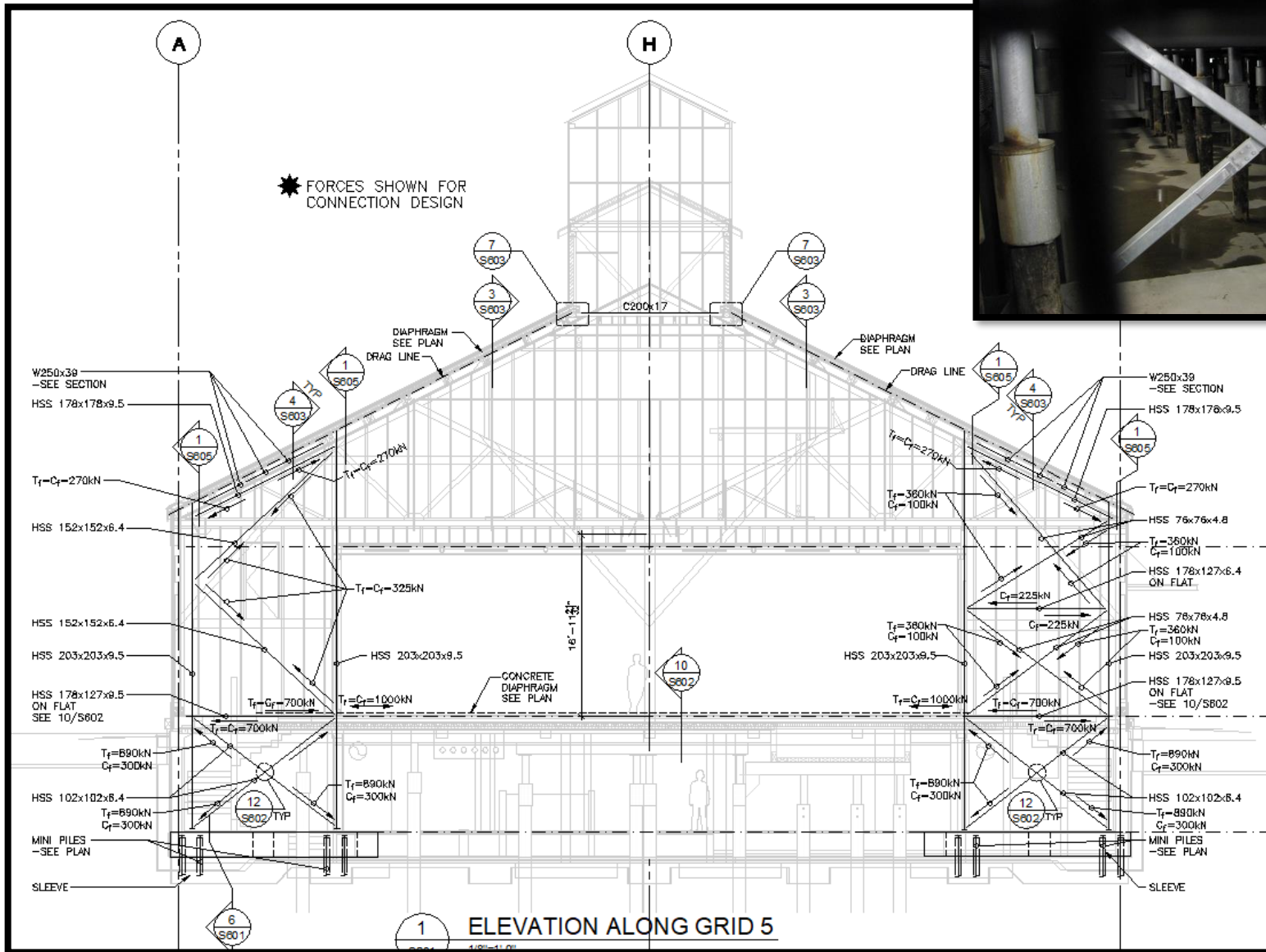




# DETAILING FOR DUCTILITY



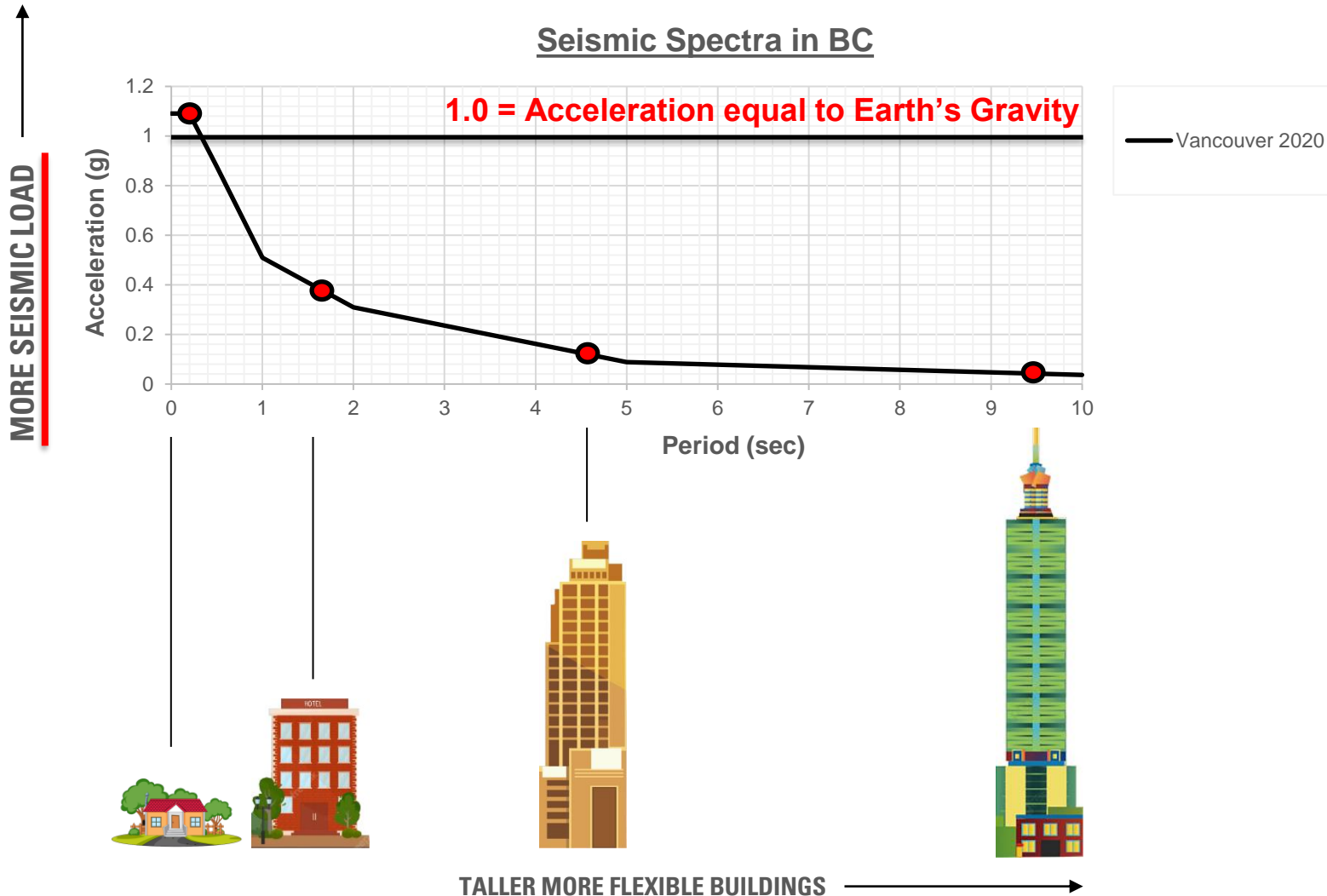
[Testing of a Full-Scale Steel Braced Frame Equipped with CAST CONNEX® High Strength Connectors™ - YouTube](#)





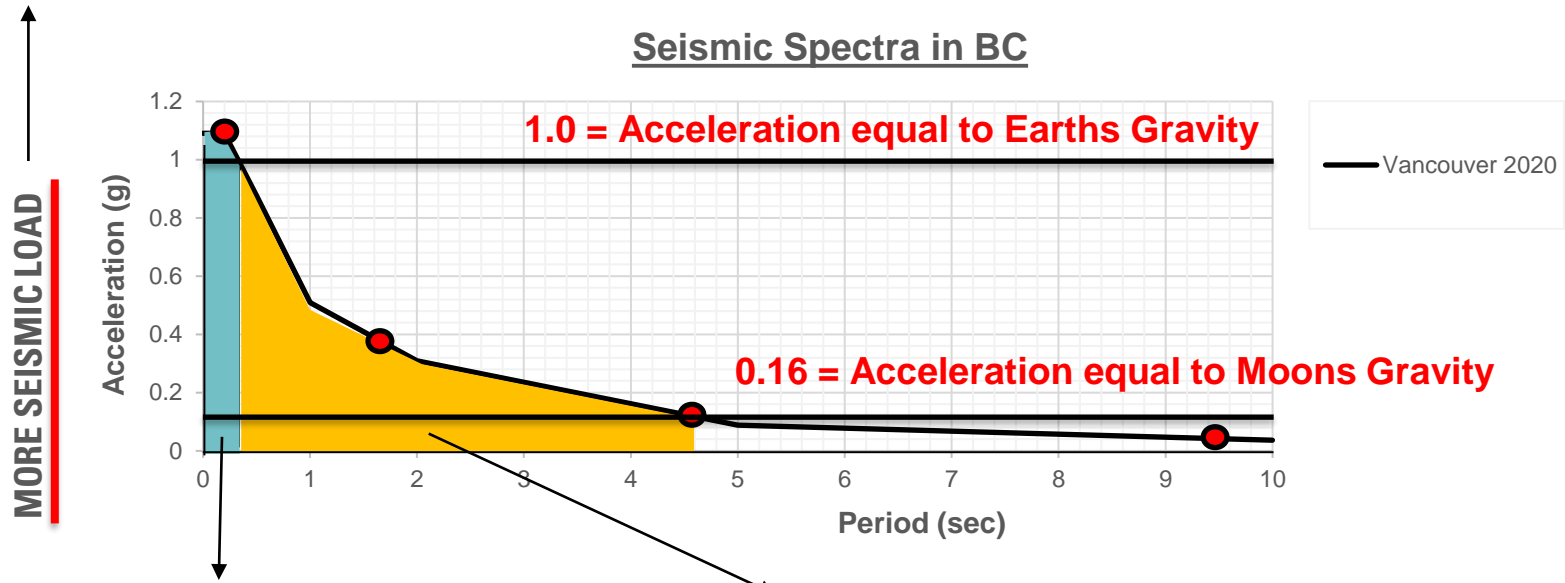
# BASICS OF EARTHQUAKE FORCES

Seismic Spectra in BC



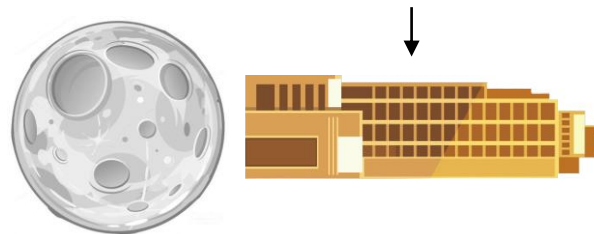
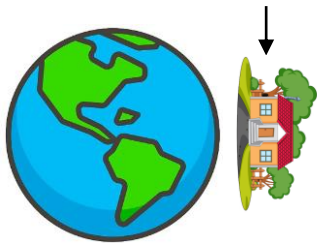
# BASICS OF EARTHQUAKE FORCES

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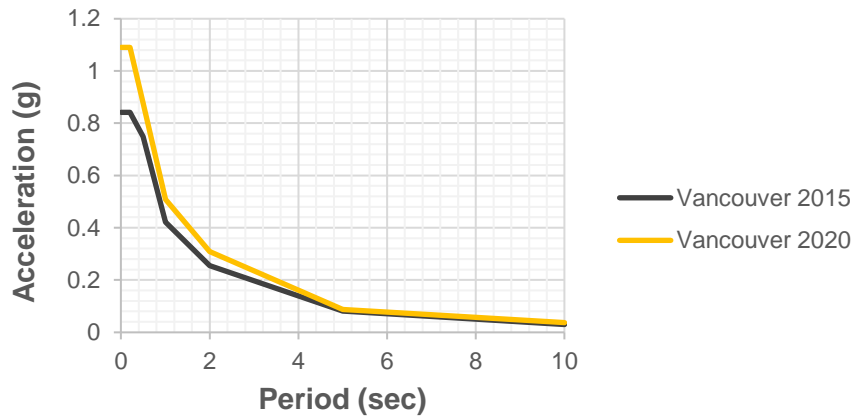
Building designed in this region– Can be tipped sideways and remain stable

Building that fall in this region – Could be tipped sideways and remain stable on the moon

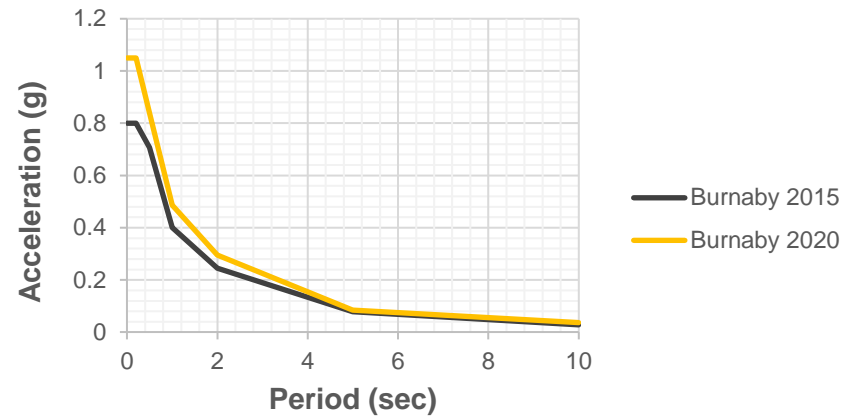


# NEW SEISMIC DESIGN LOADS

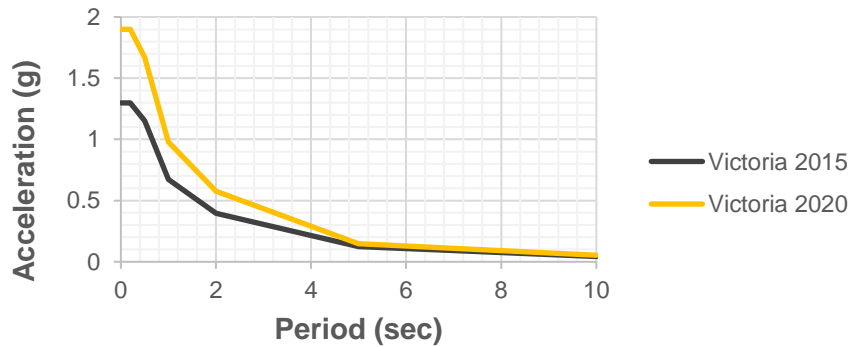
Vancouver City Hall (Site Class C)



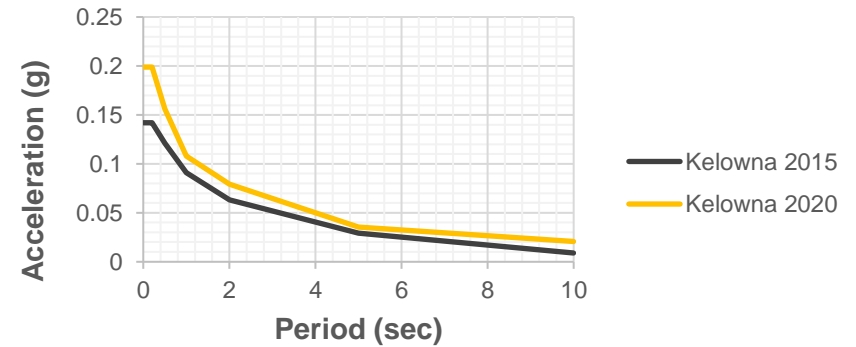
Burnaby Brentwood (Site Class C)



Victoria City Hall (Site Class C)



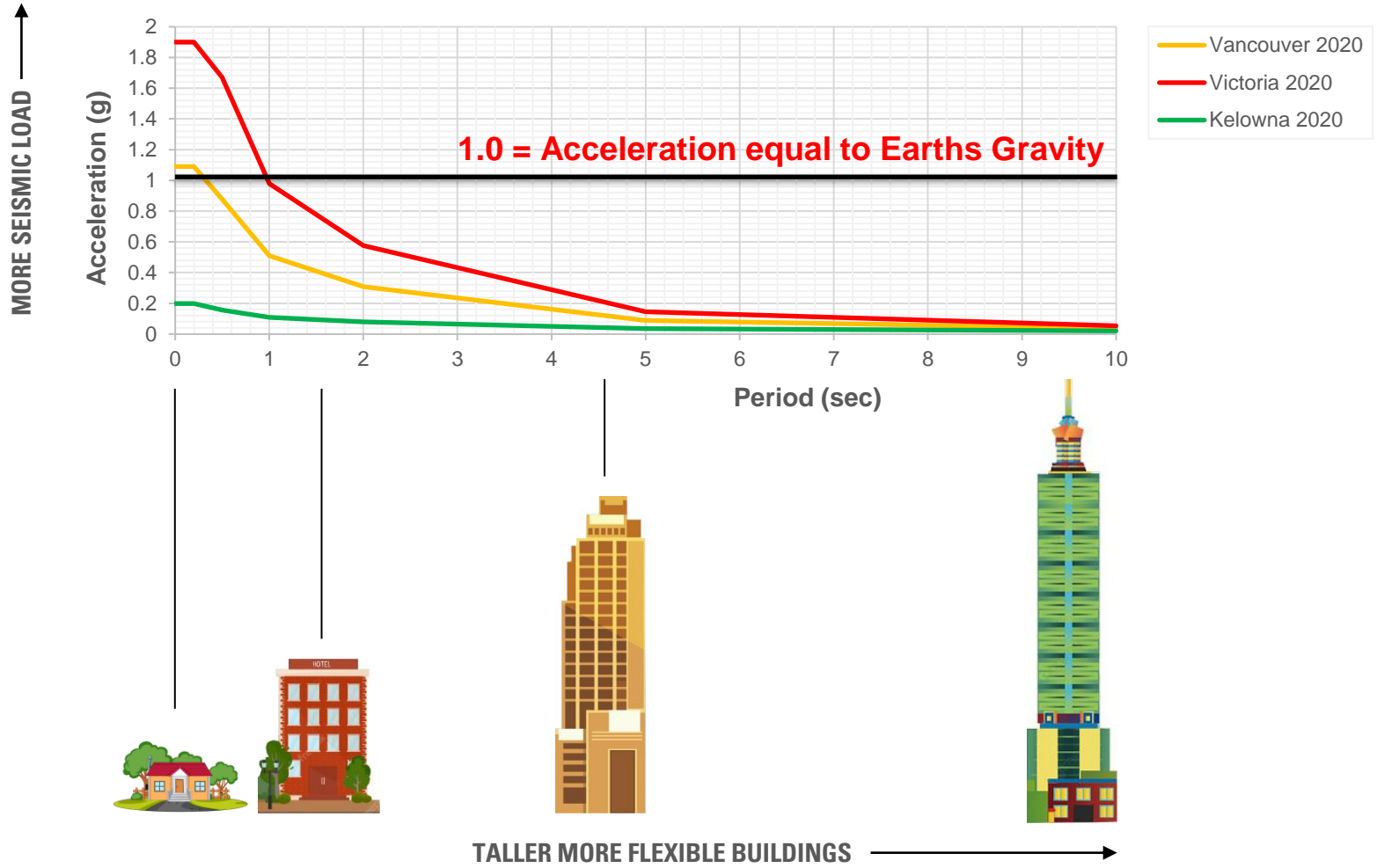
Kelowna Downtown (Site Class C)





# WAIT...HOW MUCH HIGHER IN VICTORIA!?

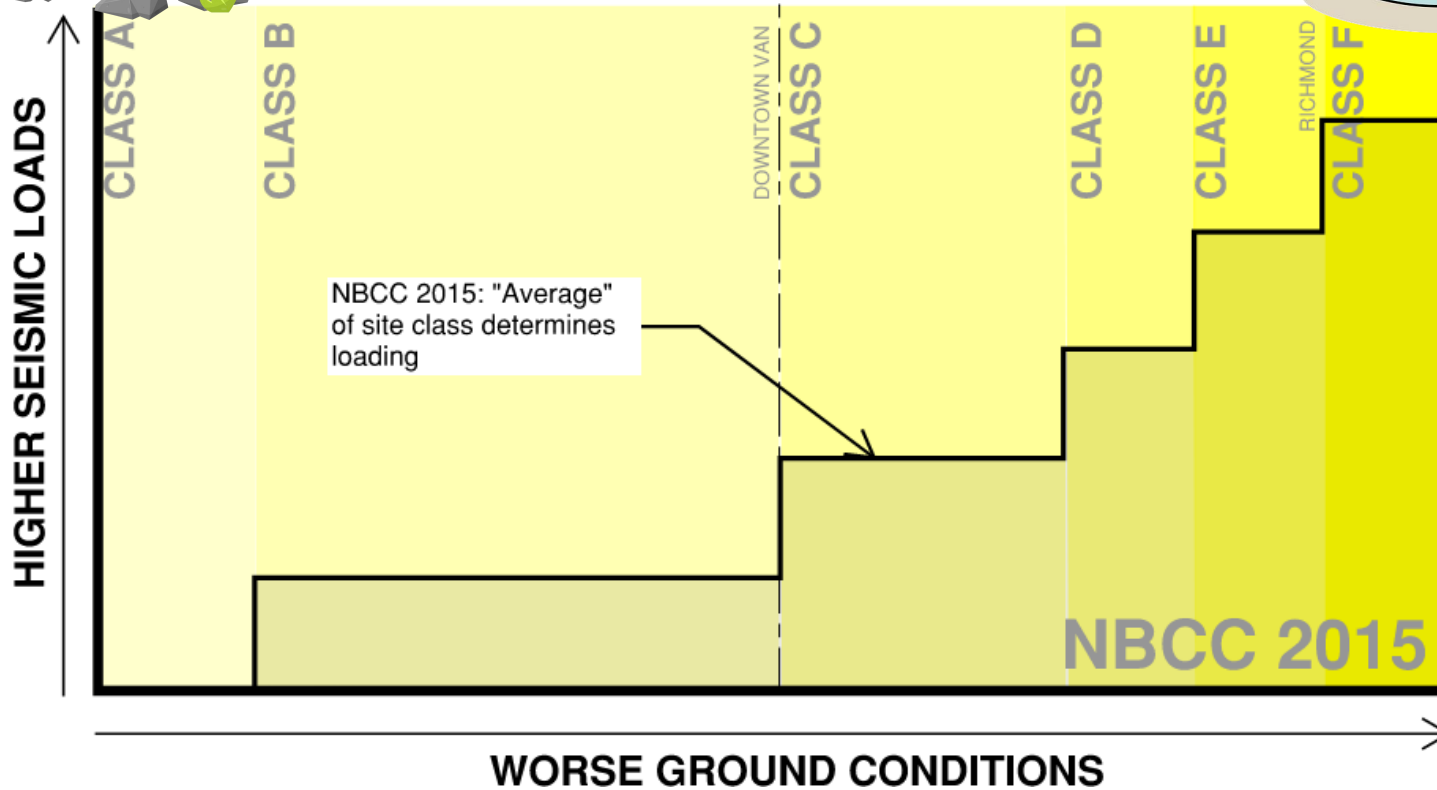
Seismic Spectra in BC



# HOW DOES MY SOIL MAKE THIS BETTER/WORSE (NBCC 2015)

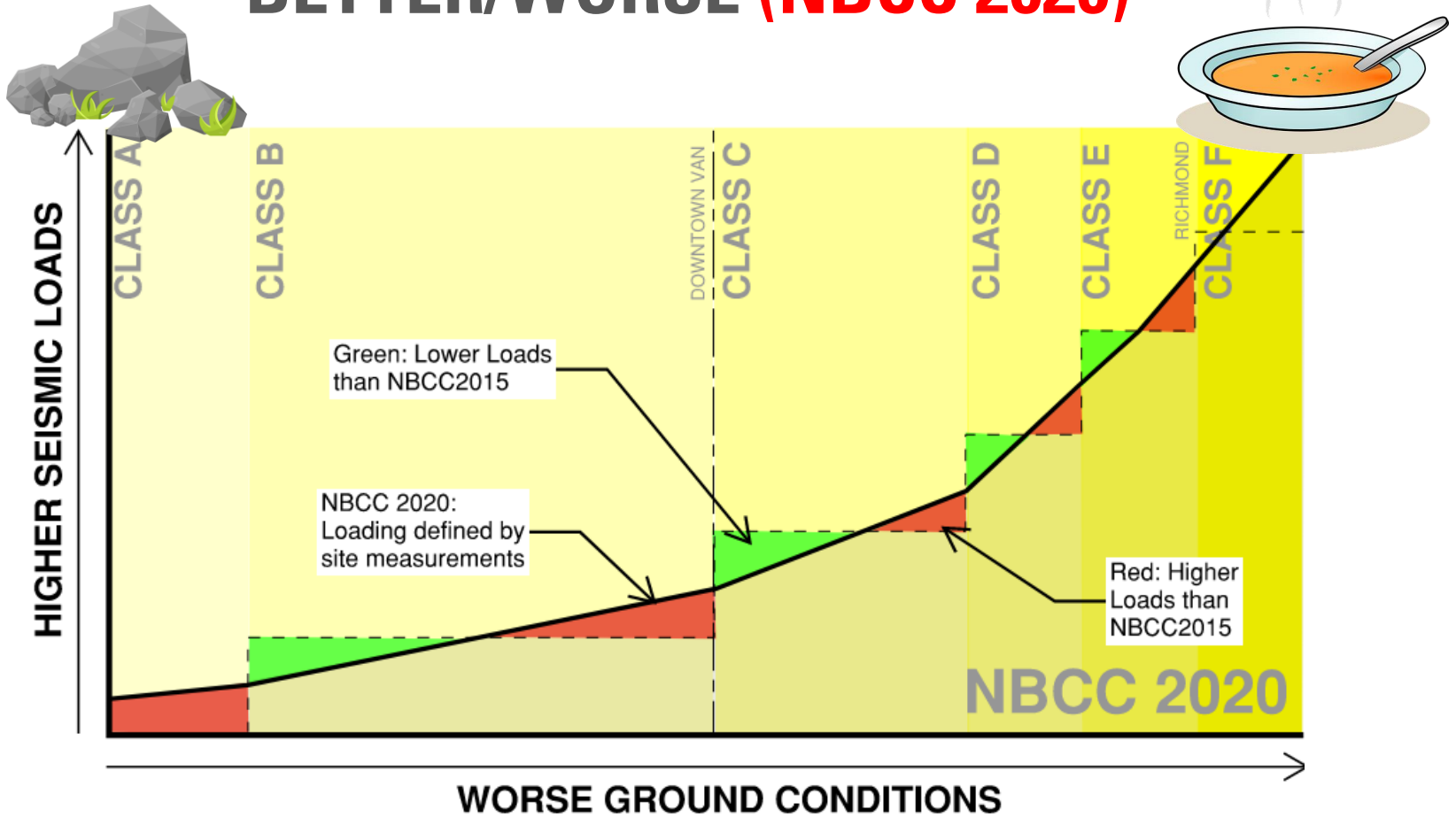


# HOW DOES MY SOIL MAKE THIS BETTER/WORSE (NBCC 2015)

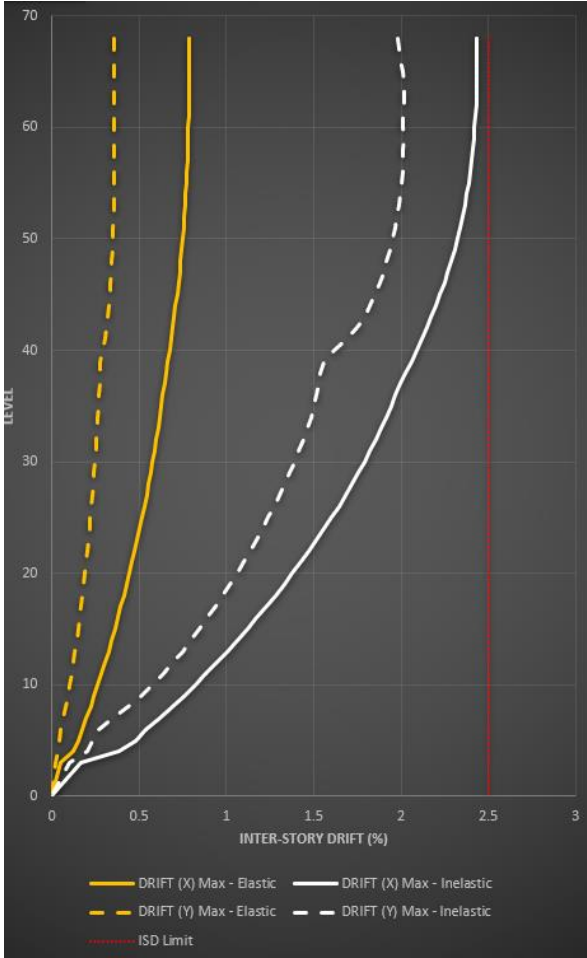
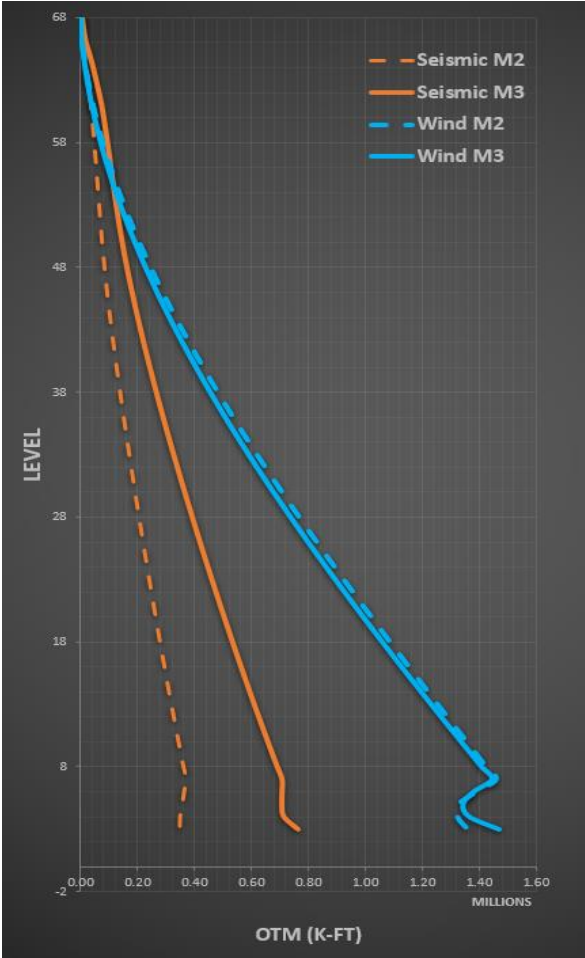




# HOW DOES MY SOIL MAKE THIS BETTER/WORSE (NBCC 2020)

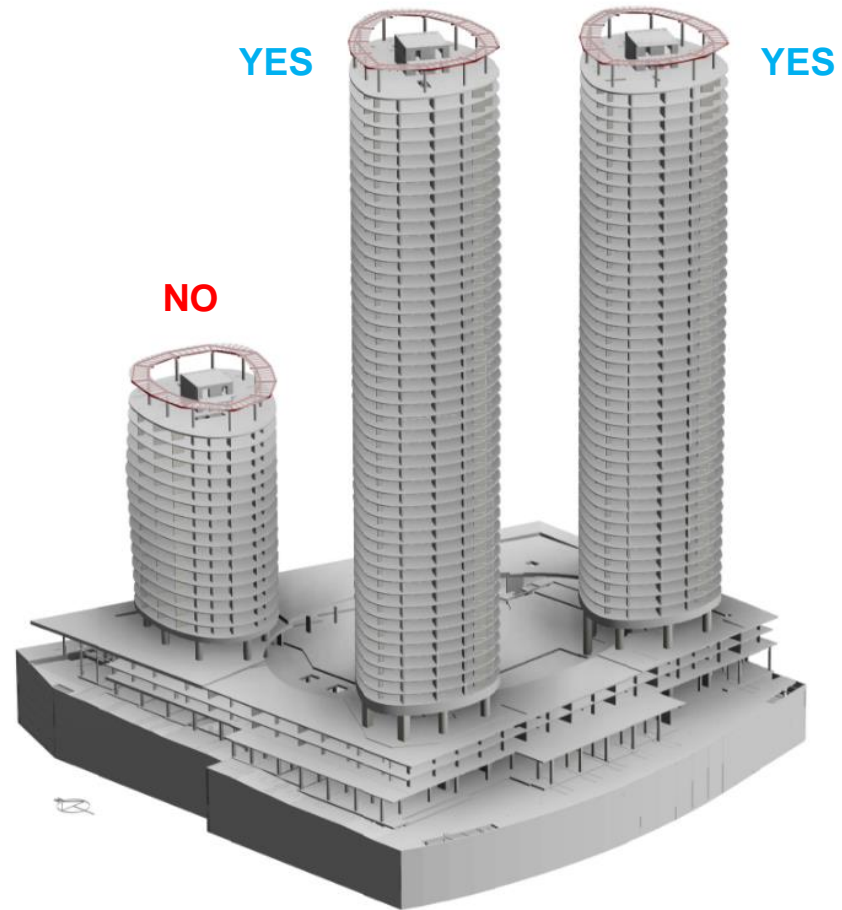


# SEISMIC VS. WIND



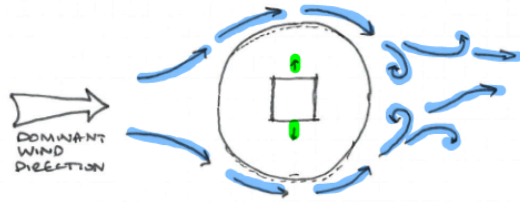
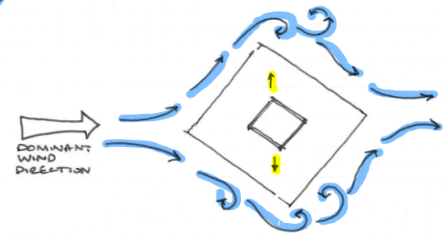
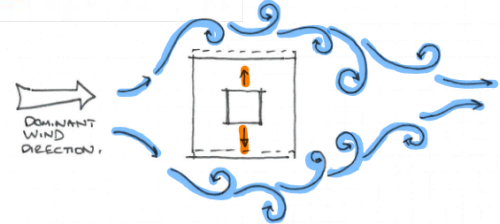
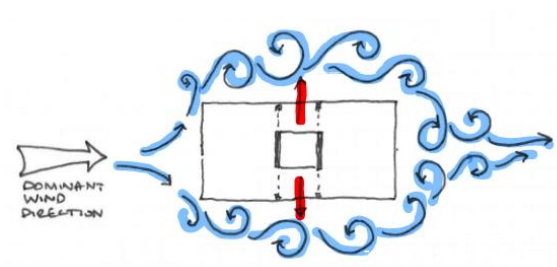
# WHEN TO GET A WIND STUDY?

- Code requires a wind-tunnel test for structures with a period  $> 4.0$  sec
- Generally, this applies for 40-storey tower +/-
- Depending on the seismic site classification (B or better), a wind-tunnel test may help realizing great savings for 30-40 storey range.
- Façade system could be a driver.





# WHAT IF WE JUST HIDE FROM THE WIND

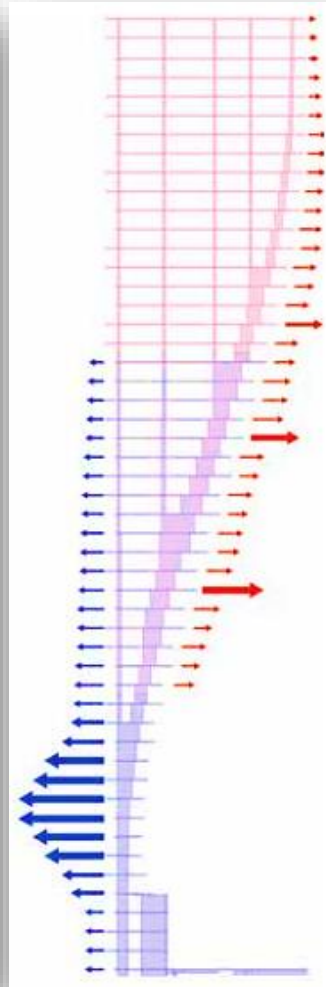
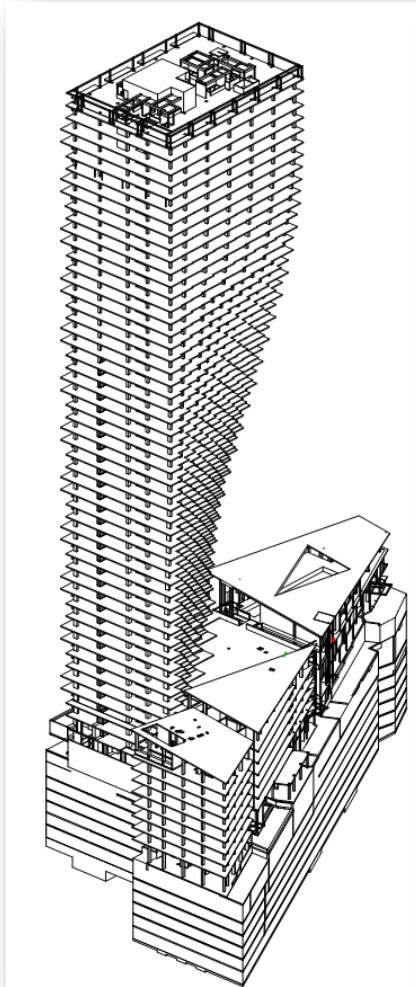


HIGH FORCE/  
HIGH ACCELERATION

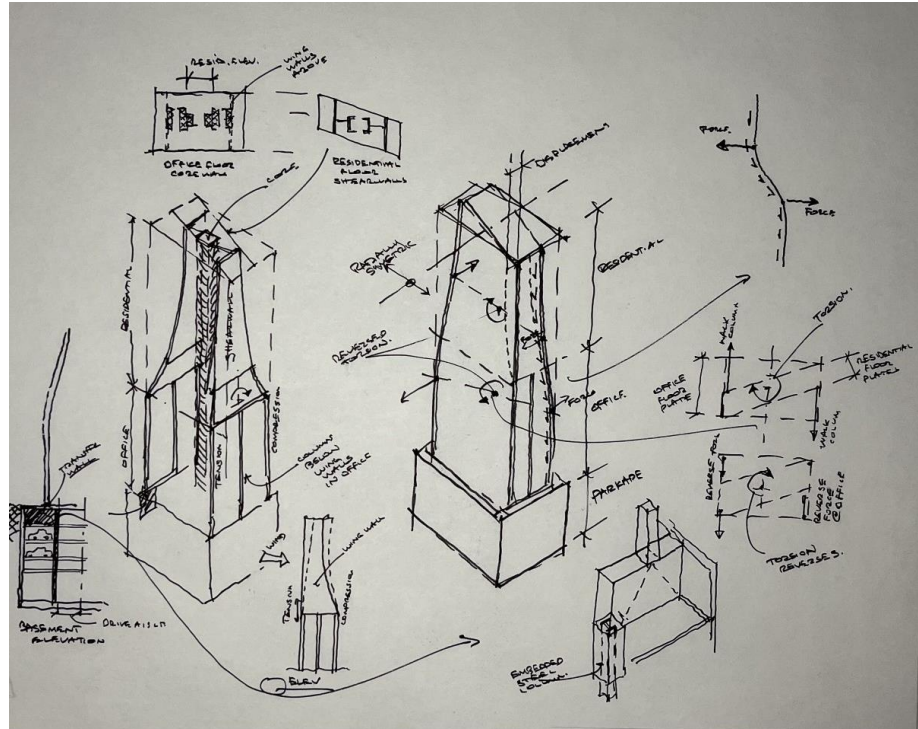
LOW FORCE/  
LOW ACCELERATION



# IS IT JUST WIND & EARTHQUAKES?

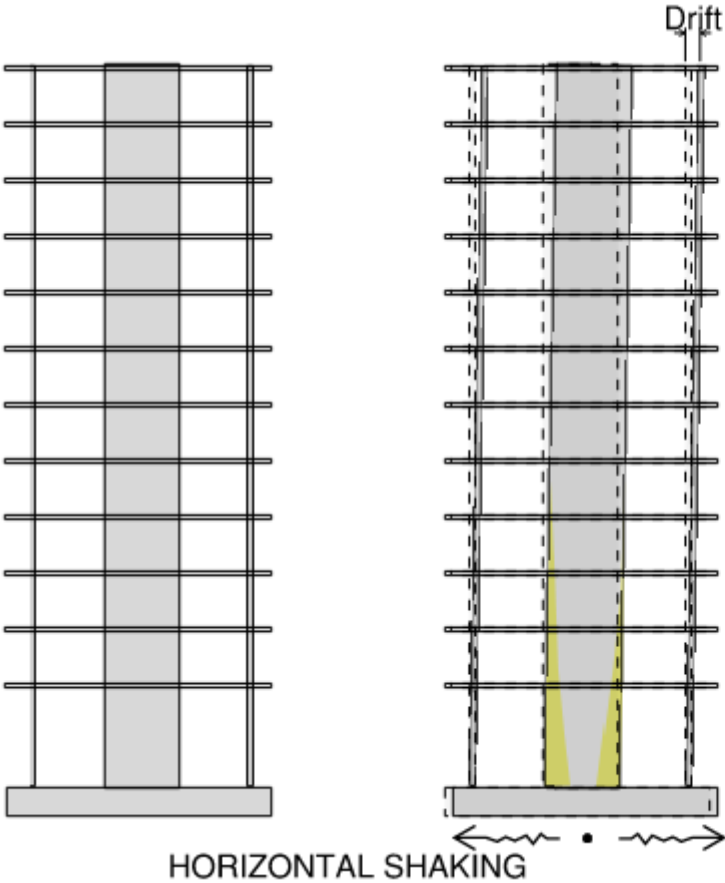


# IS IT JUST WIND & EARTHQUAKES?



<https://www.youtube.com/watch?v=1JZk95fa5SA>

# SLOPED COLUMNS ARE COOL (NBCC 2010)



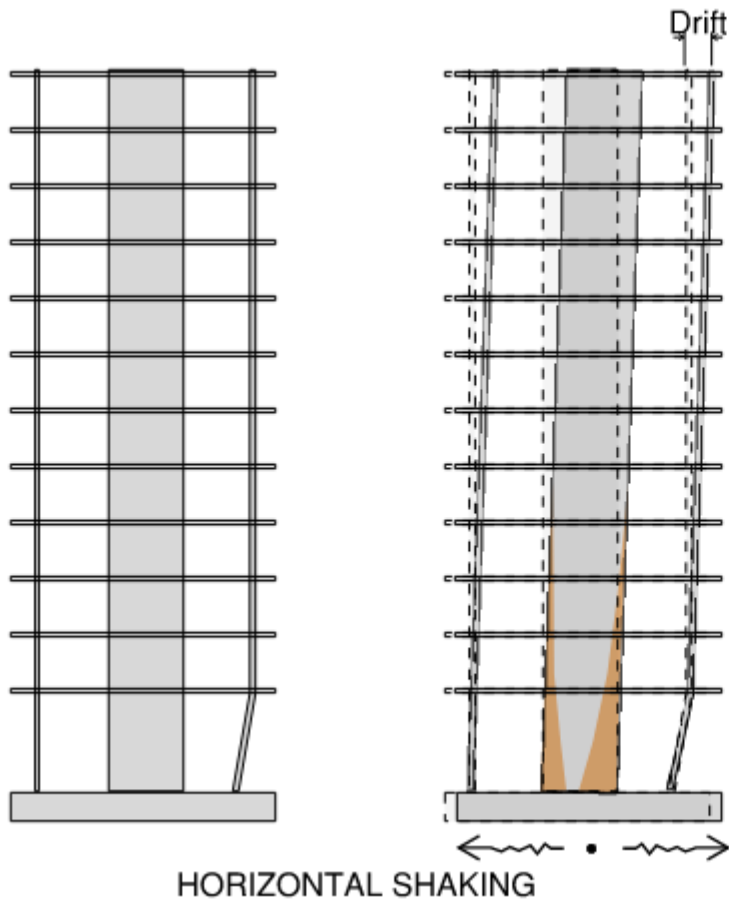
**DESIGN THE CORE WITH  
LITTLE CONSIDERATION OF  
COLUMNS**

**NBCC 2010**

Gravity Leaning forces not explicitly addressed.



# SLOPED COLUMNS ARE WERE COOL (NBCC 2015)

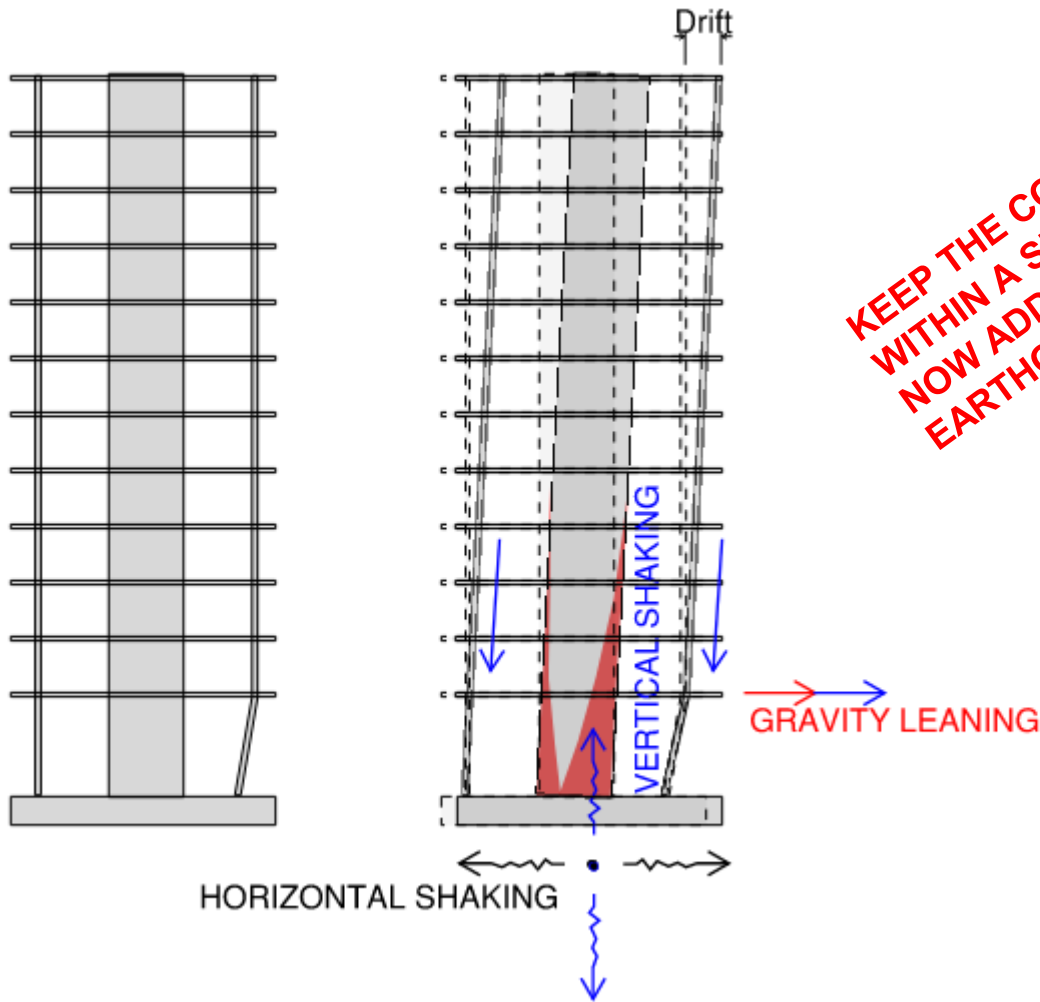


**KEEP THE COLUMN LEANING  
WITHIN A SMALL LIMIT!!**

**NBCC 2015**

Peer review for high  
gravity leaning forces

# SLOPED COLUMNS ARE DIFFICULT (NBCC 2020)



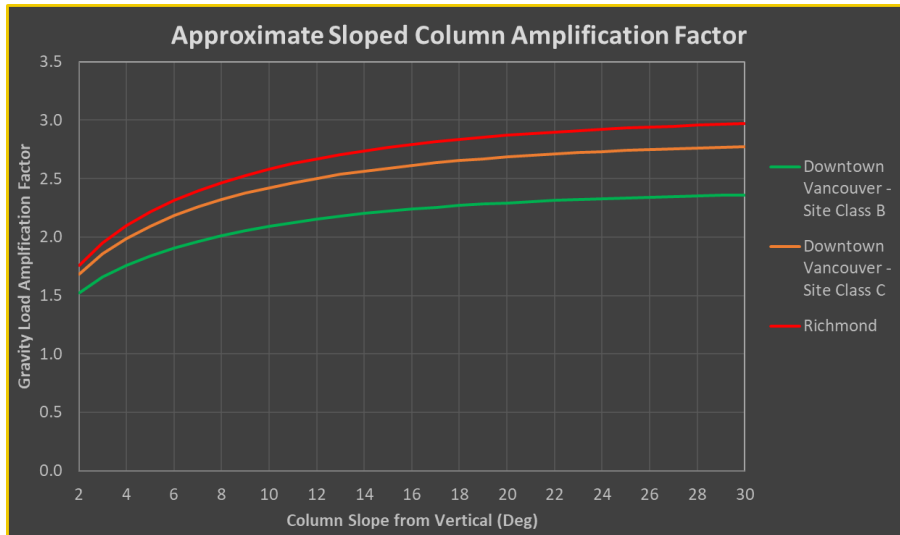
**KEEP THE COLUMN LEANING  
WITHIN A SMALL LIMIT!!  
NOW ADD VERTICAL  
EARTHQUAKE LOADS.**

## NBCC 2020

More demand on core, columns and diaphragms from vertical accelerations.

Peer review for high gravity leaning forces

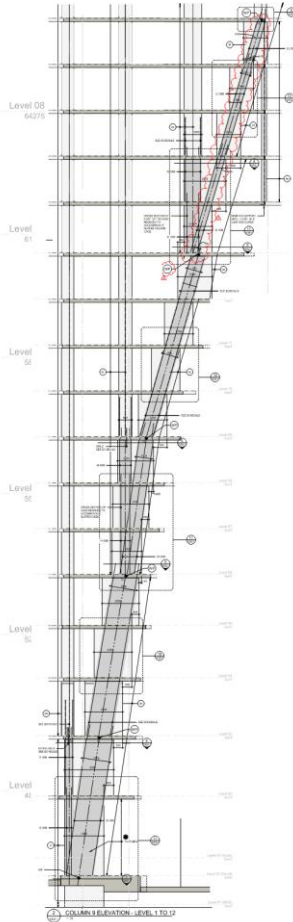
# MY PROJECT HAS SLOPED COLUMNS... WHAT CAN I EXPECT



## Columns Get **Bigger**

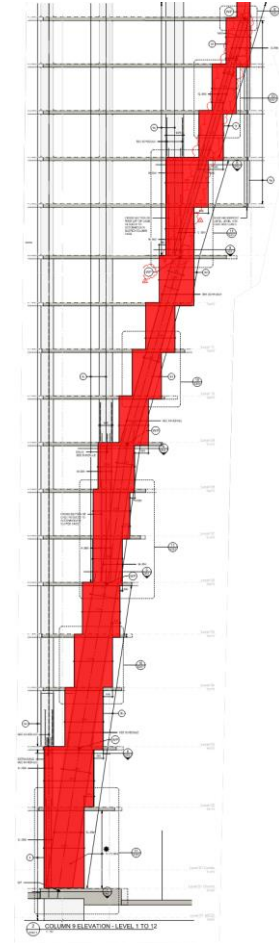
- Anything sloping more than 2% triggers a code clause that amplifies the column loads.
- Larger slope- larger column BUT, also adds more load to core. **UP TO 3x the LOAD!**
- **Peer Review** for nnbalanced sloped Structures

# DO WALKING COLUMNS COUNT?



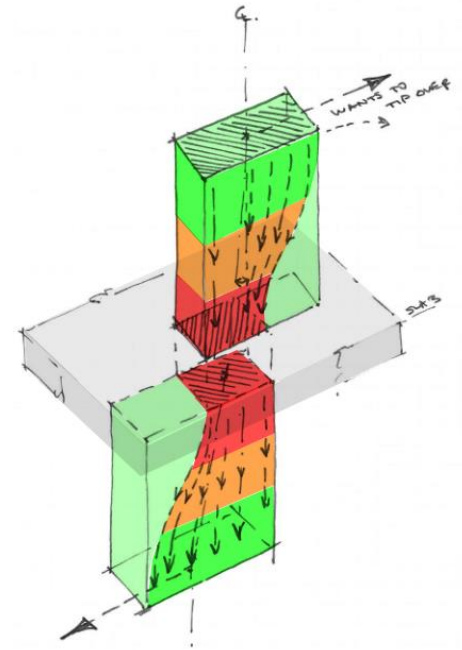
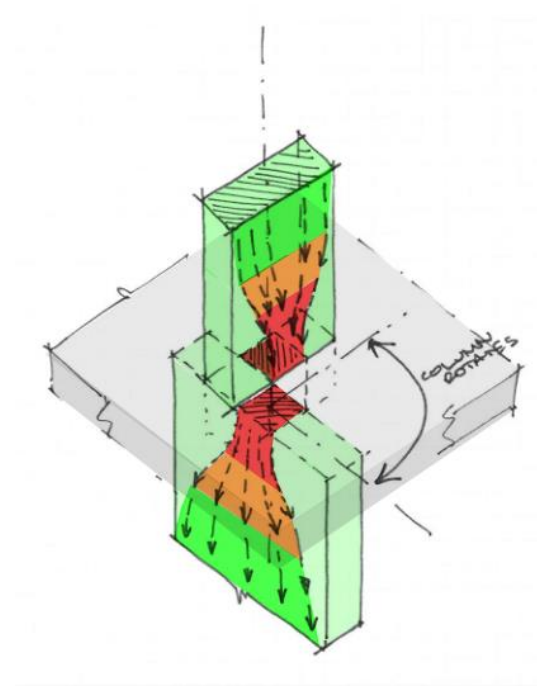
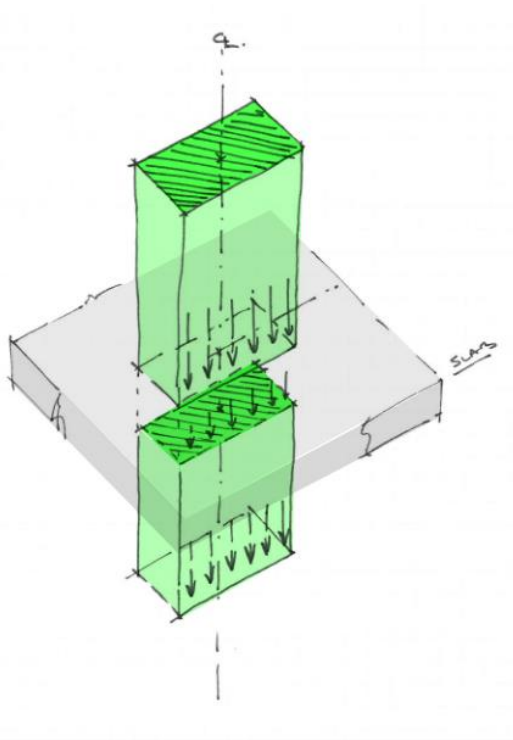
Any column that has a base offset from its position further up has an inherent **sloped load path**.

Walking columns = Sloped Columns



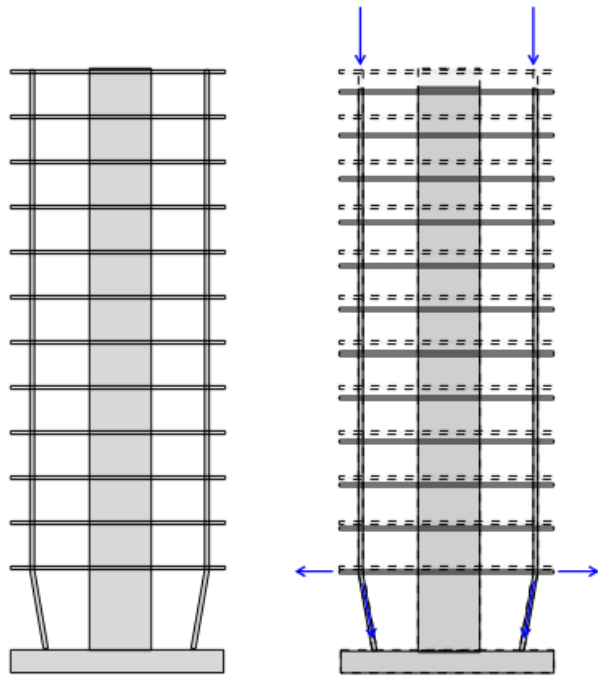


# MY COLUMNS TOTALLY ALIGN



# MY ARCHITECT NEEDS SLOPED/WALKING COLUMNS.

## WHAT SHOULD I DO?



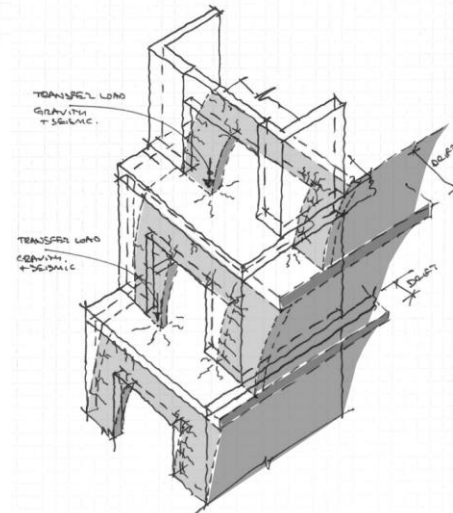
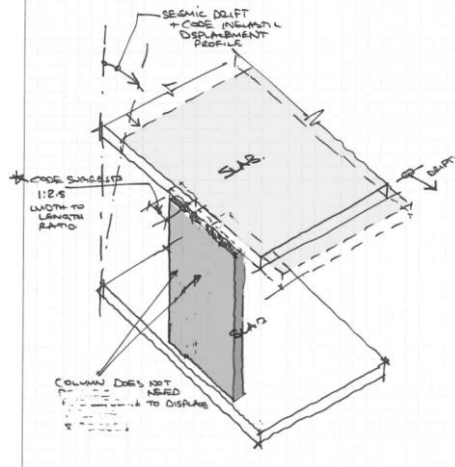
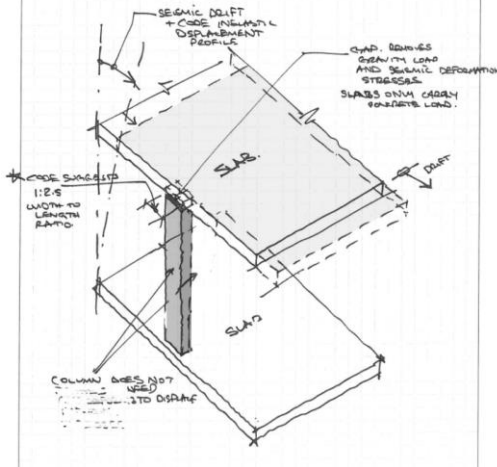
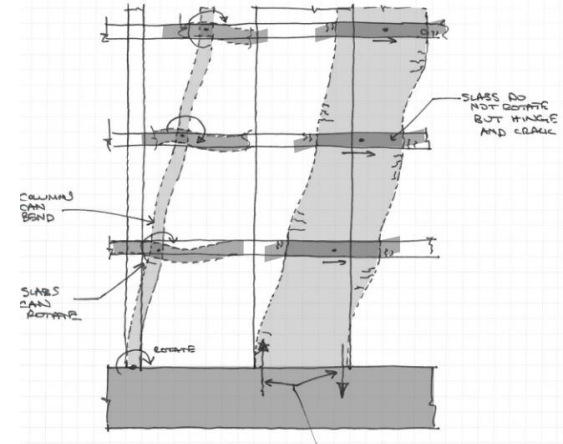
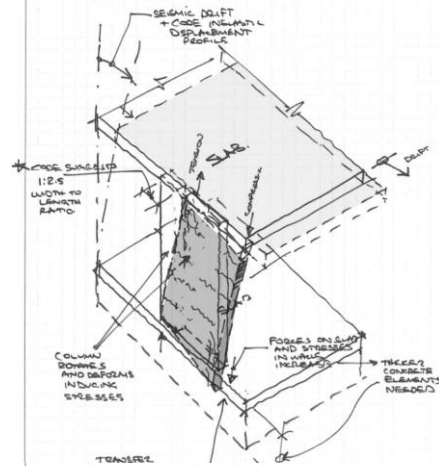
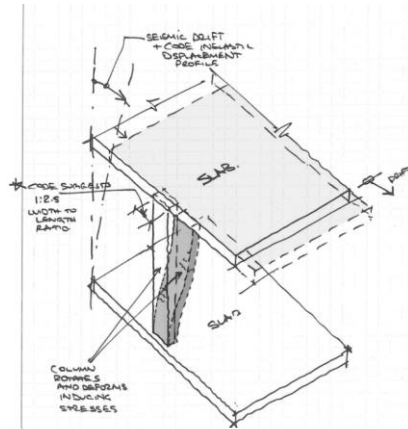
Engage us to review as soon as possible, can suggest how to:

- Balance the loads
- Proportion the core
- Road map to minimize the impacts (Cost, Space inefficiency, Construction complexity, Avoid peer review etc.)

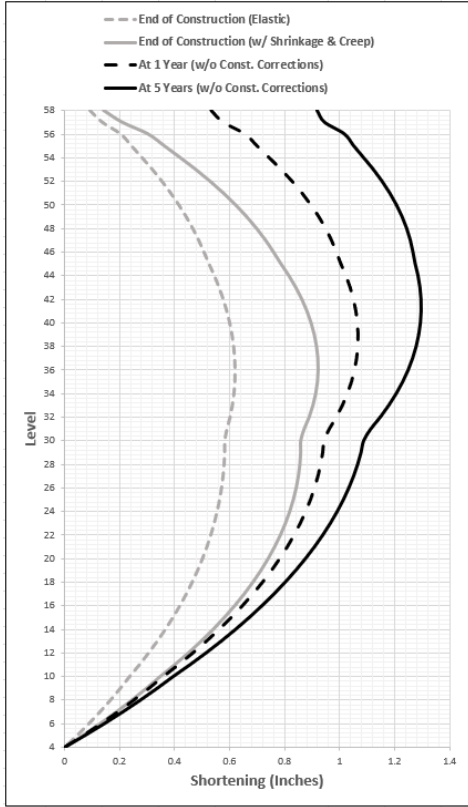
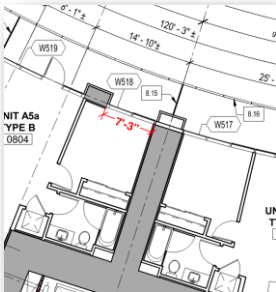
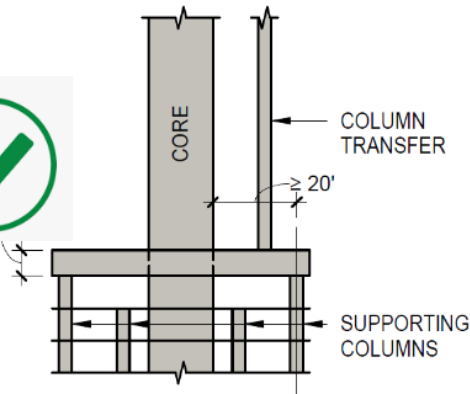
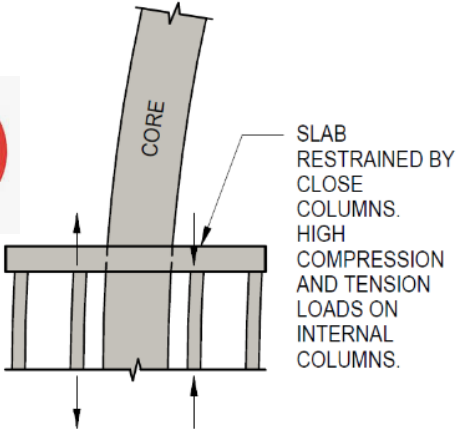
### **What's the Cheapest Thing to do?**

*Limit Slopes, offsets, walking, rotating columns, and transfers*

# WHAT HAPPENS TO MY COLUMNS AND WALLS?



# AVOID COLUMNS CLOSE TO THE CORE



Also, more costly core and foundations!

## COLUMNS SHRINK





# IS IT ALL BAD NEWS? WHAT DO WE DO ABOUT IT?



K.I.S.S.

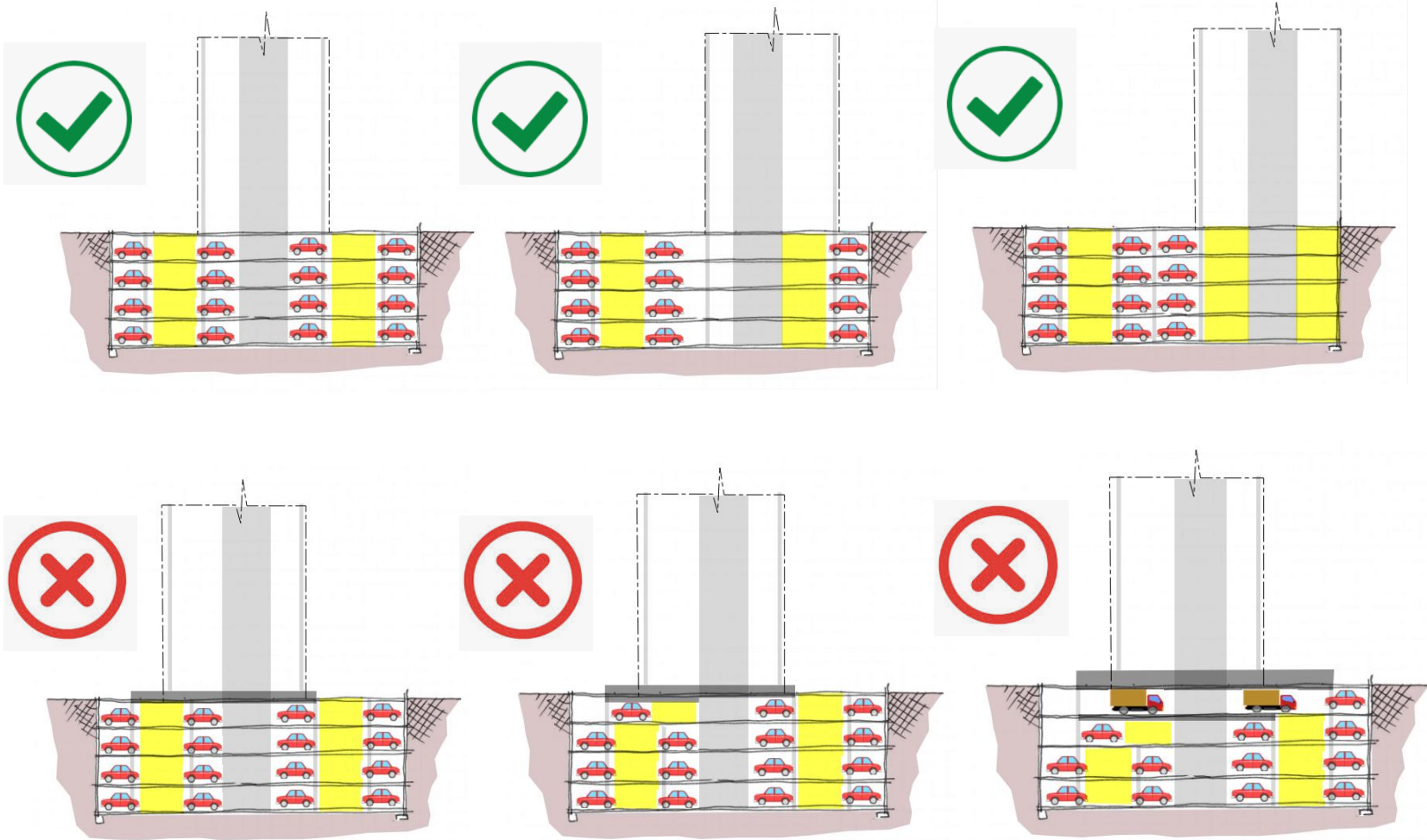
*-Limit Slopes, offsets, walking, rotating columns, and transfers*

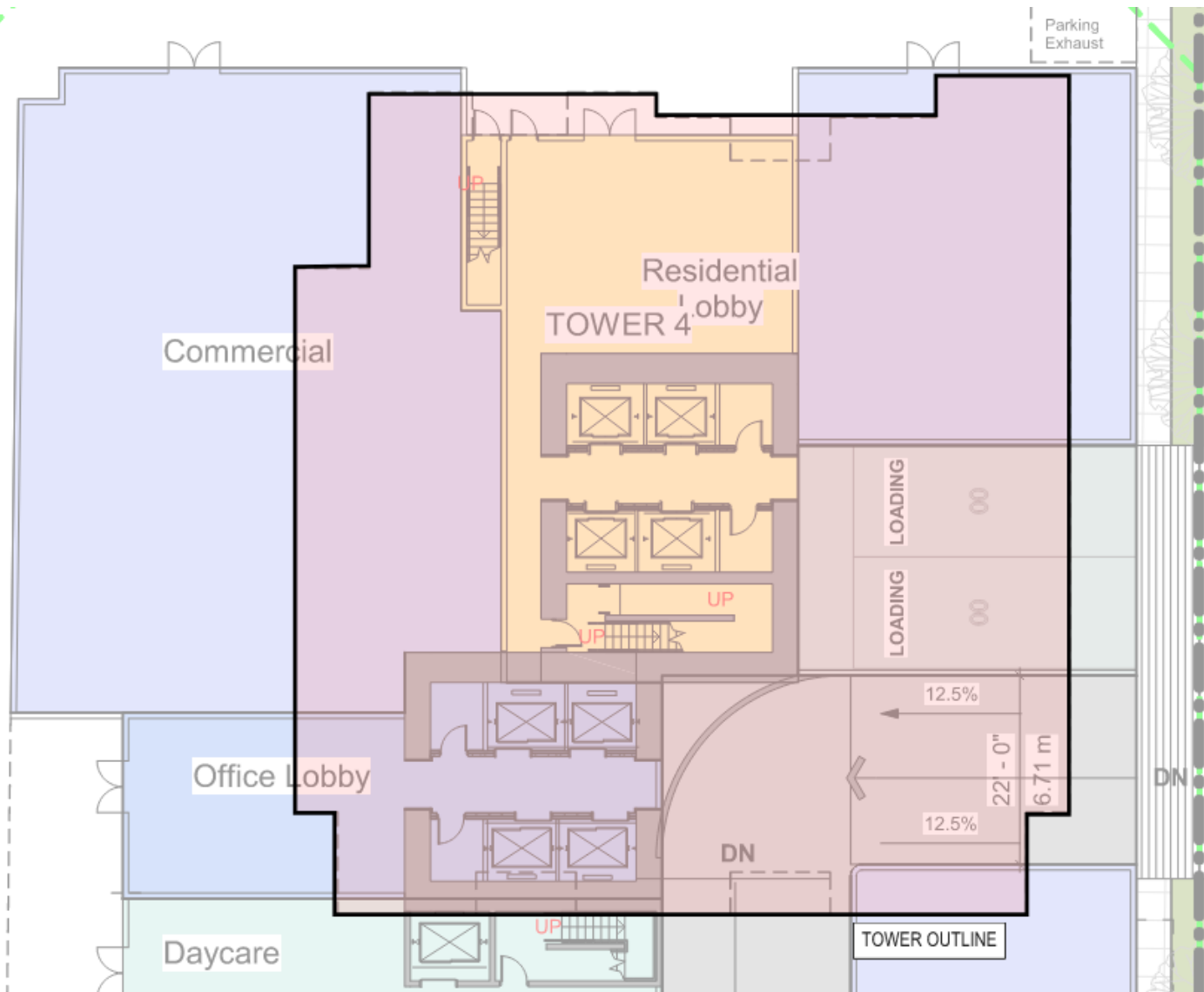
**If we want to keep it exciting...** we are well-equipped to run a peer review and non-linear analysis. We've been doing it for many years in the United States.

Good news is the simpler the structure, the better it performs from an embodied carbon and cost standpoint.

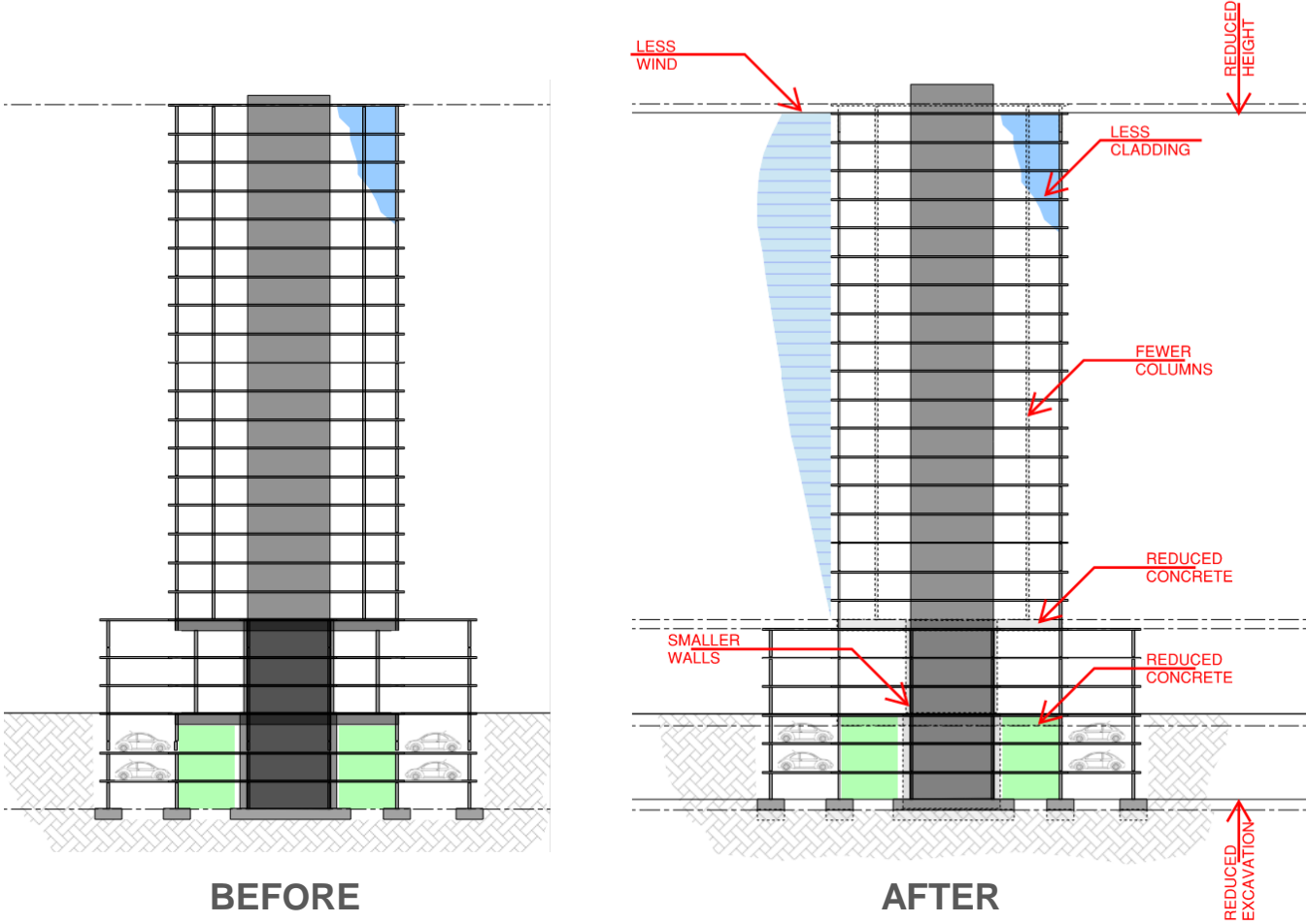
While conventional means of construction are getting more restrictive, advances are being made in mass timber and sustainability.

# ALIGNMENT – ALL ABOUT THE MASSING





# ALIGNMENT – ALL ABOUT THE MASSING





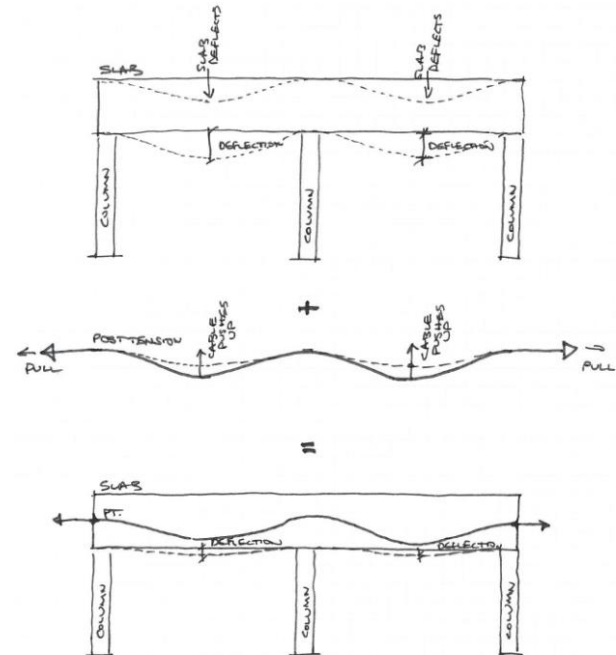
# UNLOCKING THE POTENTIAL OF PT

- **ADVANTAGES**

- Longer spans with thinner assembly
- Potential elimination of transfers
- PT is about 3x stronger than rebar, but also 3x the price

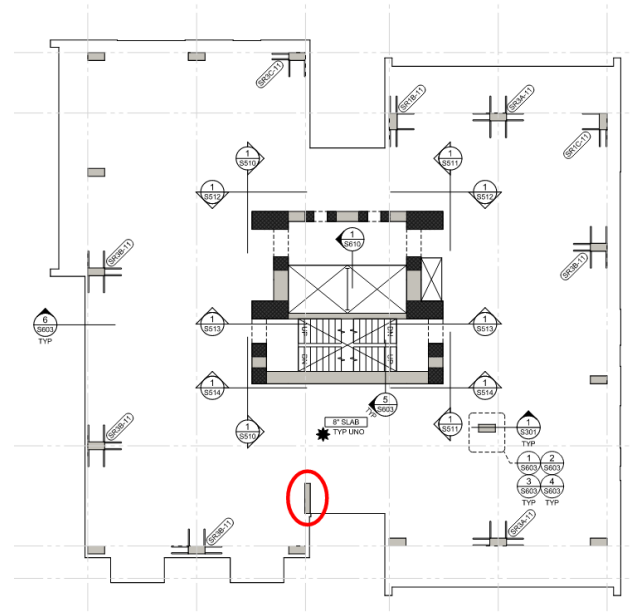
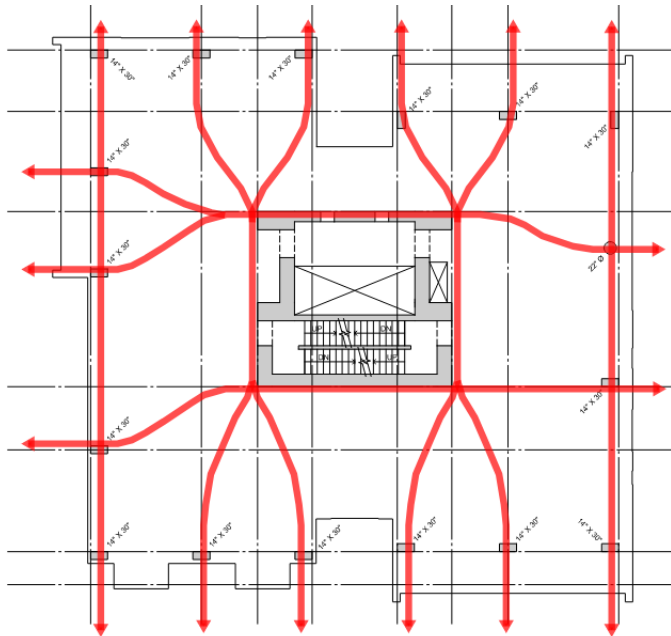
- **DISADVANTAGES**

- Future flexibility for office/commercial tenants
- In-slab duct coordination for residential
- Potentially adds a day to the schedule



# TO PT OR NOT TO PT

## Case Study (1)



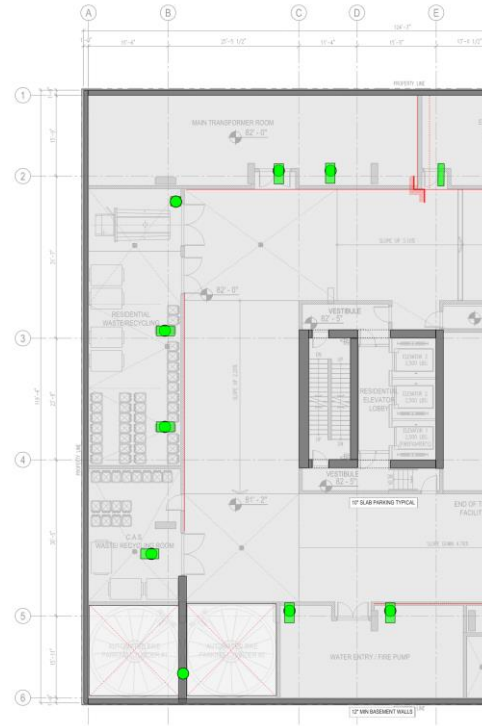
### DOES PT MAKE SENSE IN THIS CASE?

- All tower columns had to transfer due to architectural constraints.
- Only 1 extra column was required to control deflection (no impact on the unit layout)
- Extra construction time, in-slab duct conflicts, increased risks (cost, installation, etc.)



# TO PT OR NOT TO PT

## Case Study (2)

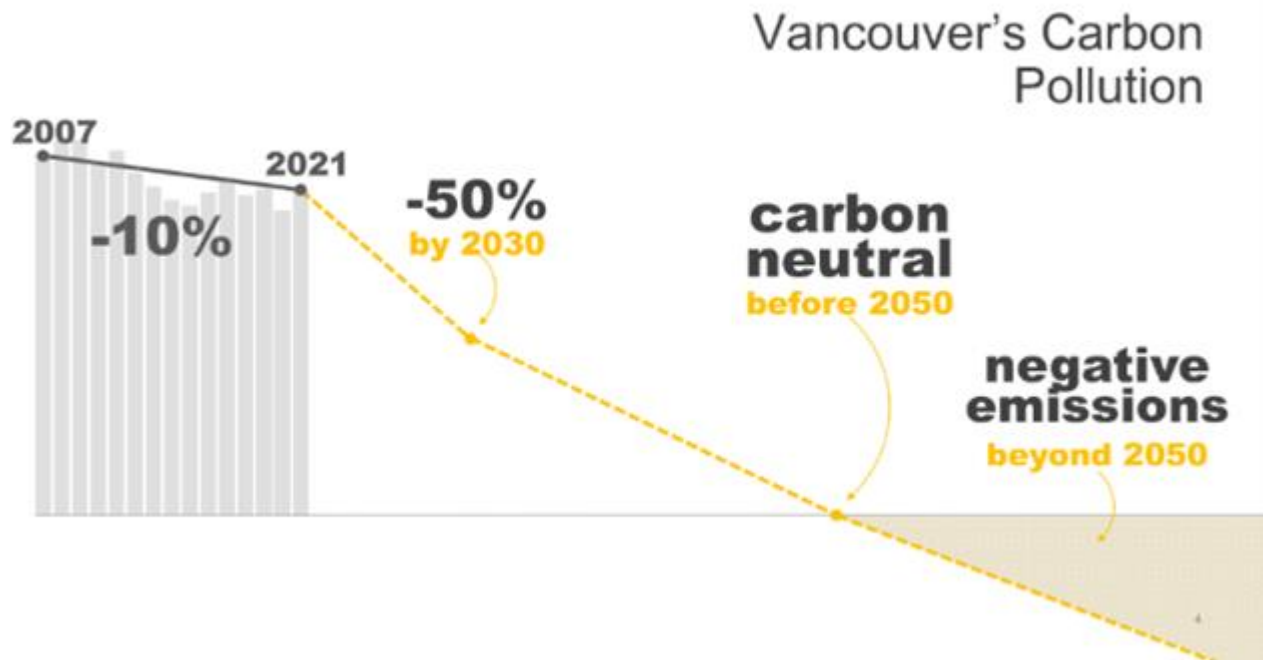


### DOES PT MAKE SENSE IN THIS CASE?

- Most transfers were eliminated.
- More space flexibility for unit planning.
- Additional construction time on the typical floors offset by the savings in transfers.



# GETTING TO NET ZERO



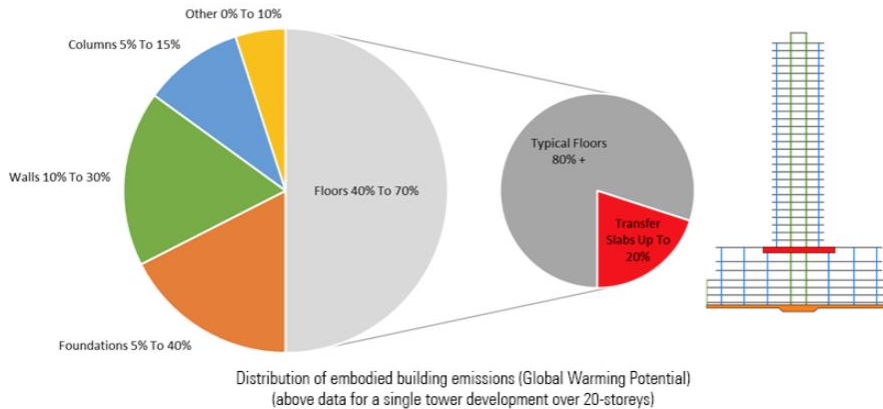
[On Track: Policy and Embodied Carbon - Glotman Simpson](#)



# GETTING TO NET ZERO

## BUT HOW?

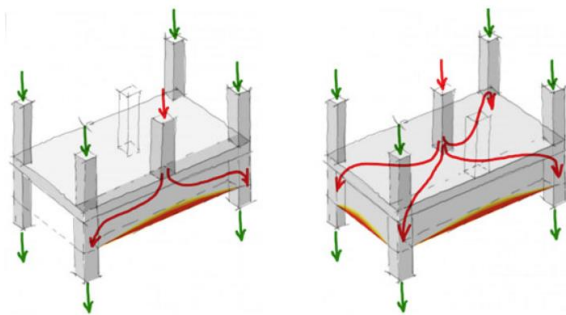
Typical GWP Distribution in High-Rise Residential Buildings



See link below to our ON TRACK series on the levers we can pull to achieve net zero by 2050

<https://glotmansimpson.com/blog/>

- Performance-based concrete and material specifications
- Eliminate transfers – unlock the potential of PT
- Optimize structural element strength and sizing (i.e. foundations, columns etc..)
- Track embodied carbon through the design



Layout of a one-way beam transfer (left) vs. a two-way slab transfer (right)

# INTEGRATED GWP PROJECT CALCULATOR

## TOTAL QUANTITY:

SLAB AREA: 765,824.0 SF

CONCRETE VOLUME: 40,317 CY

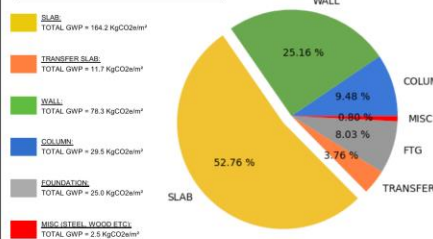
FORMWORK AREA: 1,260,409 SF

AVERAGE DEPTH: +/-17.1"

FORMWORK RATIO: +/-1.65

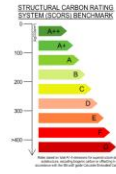
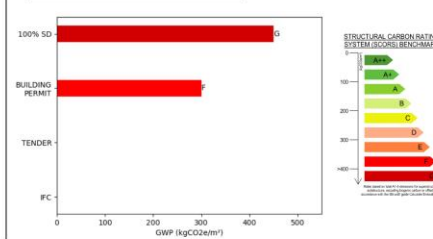
GLOBAL WARMING POTENTIAL: 311.2 KgCO<sub>2</sub>e/m<sup>2</sup>

## GLOBAL WARMING POTENTIAL PERCENTAGE BY ELEMENT CATEGORY:



\* THE GLOBAL WARMING POTENTIAL (GWP) ESTIMATE INCLUDES EMBEDDED CARBON IN THE CONCRETE AND REINFORCING STEEL. THE CONCRETE VALUES ARE BASED ON THE LOCAL MIXTURE ENHANCED AND REINFORCING COEFFICIENTS ARE BASED ON REINFORCING ADJUSTED FOR COMPARABLE PROJECTS. THESE ESTIMATES ARE INTENDED TO TRACK IMPROVEMENTS IN GWP OVER THE COURSE OF THE PROJECT. GWP WAS NOT INTENDED TO REPLACE A MORE DETAILED LCA ASSESSMENT BY THIRD PARTIES. GUTMAN SIMPSON CAN PROVIDE A MORE DETAILED BREAKDOWN OF THE GWP IF NECESSARY UPON REQUEST.

## EMBOIDED CARBON INTENSITY BY PROJECT STATUS PLOT:



## TOTAL CONCRETE VOLUME:

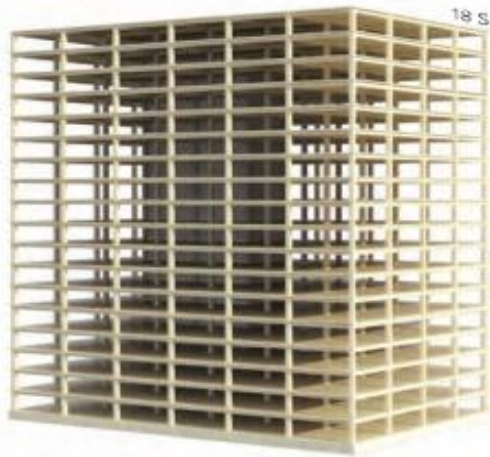
SLAB VOLUME			WALL VOLUME			COLUMN VOLUME		
LEVEL	AREA (SQ FT)	THICKNESS (IN)	LEVEL	PERIMETER (FT)	THICKNESS (IN)	LEVEL	CROSS SECTION (SQ FT)	HEIGHT (FT)
LEVEL 01	765,824.0	12.0	LEVEL 01	1,260,409.0	12.0	LEVEL 01	1,260,409.0	12.0
LEVEL 02	765,824.0	12.0	LEVEL 02	1,260,409.0	12.0	LEVEL 02	1,260,409.0	12.0
LEVEL 03	765,824.0	12.0	LEVEL 03	1,260,409.0	12.0	LEVEL 03	1,260,409.0	12.0
LEVEL 04	765,824.0	12.0	LEVEL 04	1,260,409.0	12.0	LEVEL 04	1,260,409.0	12.0
LEVEL 05	765,824.0	12.0	LEVEL 05	1,260,409.0	12.0	LEVEL 05	1,260,409.0	12.0
LEVEL 06	765,824.0	12.0	LEVEL 06	1,260,409.0	12.0	LEVEL 06	1,260,409.0	12.0
LEVEL 07	765,824.0	12.0	LEVEL 07	1,260,409.0	12.0	LEVEL 07	1,260,409.0	12.0
LEVEL 08	765,824.0	12.0	LEVEL 08	1,260,409.0	12.0	LEVEL 08	1,260,409.0	12.0
LEVEL 09	765,824.0	12.0	LEVEL 09	1,260,409.0	12.0	LEVEL 09	1,260,409.0	12.0
LEVEL 10	765,824.0	12.0	LEVEL 10	1,260,409.0	12.0	LEVEL 10	1,260,409.0	12.0
LEVEL 11	765,824.0	12.0	LEVEL 11	1,260,409.0	12.0	LEVEL 11	1,260,409.0	12.0
LEVEL 12	765,824.0	12.0	LEVEL 12	1,260,409.0	12.0	LEVEL 12	1,260,409.0	12.0
LEVEL 13	765,824.0	12.0	LEVEL 13	1,260,409.0	12.0	LEVEL 13	1,260,409.0	12.0
LEVEL 14	765,824.0	12.0	LEVEL 14	1,260,409.0	12.0	LEVEL 14	1,260,409.0	12.0
LEVEL 15	765,824.0	12.0	LEVEL 15	1,260,409.0	12.0	LEVEL 15	1,260,409.0	12.0
LEVEL 16	765,824.0	12.0	LEVEL 16	1,260,409.0	12.0	LEVEL 16	1,260,409.0	12.0
LEVEL 17	765,824.0	12.0	LEVEL 17	1,260,409.0	12.0	LEVEL 17	1,260,409.0	12.0
LEVEL 18	765,824.0	12.0	LEVEL 18	1,260,409.0	12.0	LEVEL 18	1,260,409.0	12.0
LEVEL 19	765,824.0	12.0	LEVEL 19	1,260,409.0	12.0	LEVEL 19	1,260,409.0	12.0
LEVEL 20	765,824.0	12.0	LEVEL 20	1,260,409.0	12.0	LEVEL 20	1,260,409.0	12.0
LEVEL 21	765,824.0	12.0	LEVEL 21	1,260,409.0	12.0	LEVEL 21	1,260,409.0	12.0
LEVEL 22	765,824.0	12.0	LEVEL 22	1,260,409.0	12.0	LEVEL 22	1,260,409.0	12.0
LEVEL 23	765,824.0	12.0	LEVEL 23	1,260,409.0	12.0	LEVEL 23	1,260,409.0	12.0
LEVEL 24	765,824.0	12.0	LEVEL 24	1,260,409.0	12.0	LEVEL 24	1,260,409.0	12.0
LEVEL 25	765,824.0	12.0	LEVEL 25	1,260,409.0	12.0	LEVEL 25	1,260,409.0	12.0
LEVEL 26	765,824.0	12.0	LEVEL 26	1,260,409.0	12.0	LEVEL 26	1,260,409.0	12.0
LEVEL 27	765,824.0	12.0	LEVEL 27	1,260,409.0	12.0	LEVEL 27	1,260,409.0	12.0
LEVEL 28	765,824.0	12.0	LEVEL 28	1,260,409.0	12.0	LEVEL 28	1,260,409.0	12.0
LEVEL 29	765,824.0	12.0	LEVEL 29	1,260,409.0	12.0	LEVEL 29	1,260,409.0	12.0
LEVEL 30	765,824.0	12.0	LEVEL 30	1,260,409.0	12.0	LEVEL 30	1,260,409.0	12.0
LEVEL 31	765,824.0	12.0	LEVEL 31	1,260,409.0	12.0	LEVEL 31	1,260,409.0	12.0
LEVEL 32	765,824.0	12.0	LEVEL 32	1,260,409.0	12.0	LEVEL 32	1,260,409.0	12.0
LEVEL 33	765,824.0	12.0	LEVEL 33	1,260,409.0	12.0	LEVEL 33	1,260,409.0	12.0
LEVEL 34	765,824.0	12.0	LEVEL 34	1,260,409.0	12.0	LEVEL 34	1,260,409.0	12.0
LEVEL 35	765,824.0	12.0	LEVEL 35	1,260,409.0	12.0	LEVEL 35	1,260,409.0	12.0
LEVEL 36	765,824.0	12.0	LEVEL 36	1,260,409.0	12.0	LEVEL 36	1,260,409.0	12.0
LEVEL 37	765,824.0	12.0	LEVEL 37	1,260,409.0	12.0	LEVEL 37	1,260,409.0	12.0
LEVEL 38	765,824.0	12.0	LEVEL 38	1,260,409.0	12.0	LEVEL 38	1,260,409.0	12.0
LEVEL 39	765,824.0	12.0	LEVEL 39	1,260,409.0	12.0	LEVEL 39	1,260,409.0	12.0
LEVEL 40	765,824.0	12.0	LEVEL 40	1,260,409.0	12.0	LEVEL 40	1,260,409.0	12.0
LEVEL 41	765,824.0	12.0	LEVEL 41	1,260,409.0	12.0	LEVEL 41	1,260,409.0	12.0
LEVEL 42	765,824.0	12.0	LEVEL 42	1,260,409.0	12.0	LEVEL 42	1,260,409.0	12.0
LEVEL 43	765,824.0	12.0	LEVEL 43	1,260,409.0	12.0	LEVEL 43	1,260,409.0	12.0
LEVEL 44	765,824.0	12.0	LEVEL 44	1,260,409.0	12.0	LEVEL 44	1,260,409.0	12.0
LEVEL 45	765,824.0	12.0	LEVEL 45	1,260,409.0	12.0	LEVEL 45	1,260,409.0	12.0
LEVEL 46	765,824.0	12.0	LEVEL 46	1,260,409.0	12.0	LEVEL 46	1,260,409.0	12.0
LEVEL 47	765,824.0	12.0	LEVEL 47	1,260,409.0	12.0	LEVEL 47	1,260,409.0	12.0
LEVEL 48	765,824.0	12.0	LEVEL 48	1,260,409.0	12.0	LEVEL 48	1,260,409.0	12.0
LEVEL 49	765,824.0	12.0	LEVEL 49	1,260,409.0	12.0	LEVEL 49	1,260,409.0	12.0
LEVEL 50	765,824.0	12.0	LEVEL 50	1,260,409.0	12.0	LEVEL 50	1,260,409.0	12.0
LEVEL 51	765,824.0	12.0	LEVEL 51	1,260,409.0	12.0	LEVEL 51	1,260,409.0	12.0
LEVEL 52	765,824.0	12.0	LEVEL 52	1,260,409.0	12.0	LEVEL 52	1,260,409.0	12.0
LEVEL 53	765,824.0	12.0	LEVEL 53	1,260,409.0	12.0	LEVEL 53	1,260,409.0	12.0
LEVEL 54	765,824.0	12.0	LEVEL 54	1,260,409.0	12.0	LEVEL 54	1,260,409.0	12.0
LEVEL 55	765,824.0	12.0	LEVEL 55	1,260,409.0	12.0	LEVEL 55	1,260,409.0	12.0
LEVEL 56	765,824.0	12.0	LEVEL 56	1,260,409.0	12.0	LEVEL 56	1,260,409.0	12.0
LEVEL 57	765,824.0	12.0	LEVEL 57	1,260,409.0	12.0	LEVEL 57	1,260,409.0	12.0
LEVEL 58	765,824.0	12.0	LEVEL 58	1,260,409.0	12.0	LEVEL 58	1,260,409.0	12.0
LEVEL 59	765,824.0	12.0	LEVEL 59	1,260,409.0	12.0	LEVEL 59	1,260,409.0	12.0
LEVEL 60	765,824.0	12.0	LEVEL 60	1,260,409.0	12.0	LEVEL 60	1,260,409.0	12.0
LEVEL 61	765,824.0	12.0	LEVEL 61	1,260,409.0	12.0	LEVEL 61	1,260,409.0	12.0
LEVEL 62	765,824.0	12.0	LEVEL 62	1,260,409.0	12.0	LEVEL 62	1,260,409.0	12.0
LEVEL 63	765,824.0	12.0	LEVEL 63	1,260,409.0	12.0	LEVEL 63	1,260,409.0	12.0
LEVEL 64	765,824.0	12.0	LEVEL 64	1,260,409.0	12.0	LEVEL 64	1,260,409.0	12.0
LEVEL 65	765,824.0	12.0	LEVEL 65	1,260,409.0	12.0	LEVEL 65	1,260,409.0	12.0
LEVEL 66	765,824.0	12.0	LEVEL 66	1,260,409.0	12.0	LEVEL 66	1,260,409.0	12.0
LEVEL 67	765,824.0	12.0	LEVEL 67	1,260,409.0	12.0	LEVEL 67	1,260,409.0	12.0
LEVEL 68	765,824.0	12.0	LEVEL 68	1,260,409.0	12.0	LEVEL 68	1,260,409.0	12.0
LEVEL 69	765,824.0	12.0	LEVEL 69	1,260,409.0	12.0	LEVEL 69	1,260,409.0	12.0
LEVEL 70	765,824.0	12.0	LEVEL 70	1,260,409.0	12.0	LEVEL 70	1,260,409.0	12.0
LEVEL 71	765,824.0	12.0	LEVEL 71	1,260,409.0	12.0	LEVEL 71	1,260,409.0	12.0
LEVEL 72	765,824.0	12.0	LEVEL 72	1,260,409.0	12.0	LEVEL 72	1,260,409.0	12.0
LEVEL 73	765,824.0	12.0	LEVEL 73	1,260,409.0	12.0	LEVEL 73	1,260,409.0	12.0
LEVEL 74	765,824.0	12.0	LEVEL 74	1,260,409.0	12.0	LEVEL 74	1,260,409.0	12.0
LEVEL 75	765,824.0	12.0	LEVEL 75	1,260,409.0	12.0	LEVEL 75	1,260,409.0	12.0
LEVEL 76	765,824.0	12.0	LEVEL 76	1,260,409.0	12.0	LEVEL 76	1,260,409.0	12.0
LEVEL 77	765,824.0	12.0	LEVEL 77	1,260,409.0	12.0	LEVEL 77	1,260,409.0	12.0
LEVEL 78	765,824.0	12.0	LEVEL 78	1,260,409.0	12.0	LEVEL 78	1,260,409.0	12.0
LEVEL 79	765,824.0	12.0	LEVEL 79	1,260,409.0	12.0	LEVEL 79	1,260,409.0	12.0
LEVEL 80	765,824.0	12.0	LEVEL 80	1,260,409.0	12.0	LEVEL 80	1,260,409.0	12.0
LEVEL 81	765,824.0	12.0	LEVEL 81	1,260,409.0	12.0	LEVEL 81	1,260,409.0	12.0
LEVEL 82	765,824.0	12.0	LEVEL 82	1,260,409.0	12.0	LEVEL 82	1,260,409.0	12.0
LEVEL 83	765,824.0	12.0	LEVEL 83	1,260,409.0	12.0	LEVEL 83	1,260,409.0	12.0
LEVEL 84	765,824.0	12.0	LEVEL 84	1,260,409.0	12.0	LEVEL 84	1,260,409.0	12.0
LEVEL 85	765,824.0	12.0	LEVEL 85	1,260,409.0	12.0	LEVEL 85	1,260,409.0	12.0
LEVEL 86	765,824.0	12.0	LEVEL 86	1,260,409.0	12.0	LEVEL 86	1,260,409.0	12.0
LEVEL 87	765,824.0	12.0	LEVEL 87	1,260,409.0	12.0	LEVEL 87	1,260,409.0	12.0
LEVEL 88	765,824.0	12.0	LEVEL 88	1,260,409.0	12.0	LEVEL 88	1,260,409.0	12.0
LEVEL 89	765,824.0	12.0	LEVEL 89	1,260,409.0	12.0	LEVEL 89	1,260,409.0	12.0
LEVEL 90	765,824.0	12.0	LEVEL 90	1,260,409.0	12.0	LEVEL 90	1,260,409.0	12.0
LEVEL 91	765,824.0	12.0	LEVEL 91	1,260,409.0	12.0	LEVEL 91	1,260,409.0	12.0
LEVEL 92	765,824.0	12.0	LEVEL 92	1,260,409.0	12.0	LEVEL 92	1,260,409.0	12.0
LEVEL 93	765,824.0	12.0	LEVEL 93	1,260,409.0	12.0	LEVEL 93	1,260,409.0	12.0
LEVEL 94	765,824.0	12.0	LEVEL 94	1,260,409.0	12.0	LEVEL 94	1,260,409.0	12.0
LEVEL 95	765,824.0	12.0	LEVEL 95	1,260,409.0	12.0	LEVEL 95	1,260,409.0	12.0
LEVEL 96	765,824.0	12.0	LEVEL 96	1,260,409.0	12.0	LEVEL 96	1,260,409.0	12.0
LEVEL 97	765,824.0	12.0	LEVEL 97	1,260,409.0	12.0	LEVEL 97	1,260,409.0	12.0
LEVEL 98	765,824.0	12.0	LEVEL 98	1,260,409.0	12.0	LEVEL 98	1,260,409.0	12.0
LEVEL 99	765,824.0	12.0	LEVEL 99	1,260,409.0	12.0	LEVEL 99	1,260,409.0	12.0
LEVEL 100	765,824.0	12.0	LEVEL 100	1,260,409.0	12.0	LEVEL 100	1,260,409.0	12.0

## TOTAL FORMWORK AREA:

SLAB FORMWORK AREA			WALL FORMWORK AREA			COLUMN FORMWORK AREA		
LEVEL	AREA (SQ FT)	THICKNESS (IN)	LEVEL	PERIMETER (FT)	THICKNESS (IN)	LEVEL	CROSS SECTION (SQ FT)	HEIGHT (FT)
LEVEL 01	765,824.0	12.0	LEVEL 01	1,260,409.				

# GOING TALLER WITH TIMBER

Courtesy: atelefonos, LLC



18 STORIES  
BUILDING HEIGHT 270 FT  
ALLOWABLE BUILDING AREA 972,000 SF  
AVERAGE AREA PER STORY 54,000 SF

**TYPE IV-A**



12 STORIES  
BUILDING HEIGHT 180 FT  
ALLOWABLE BUILDING AREA 648,000 SF  
AVERAGE AREA PER STORY 54,000 SF

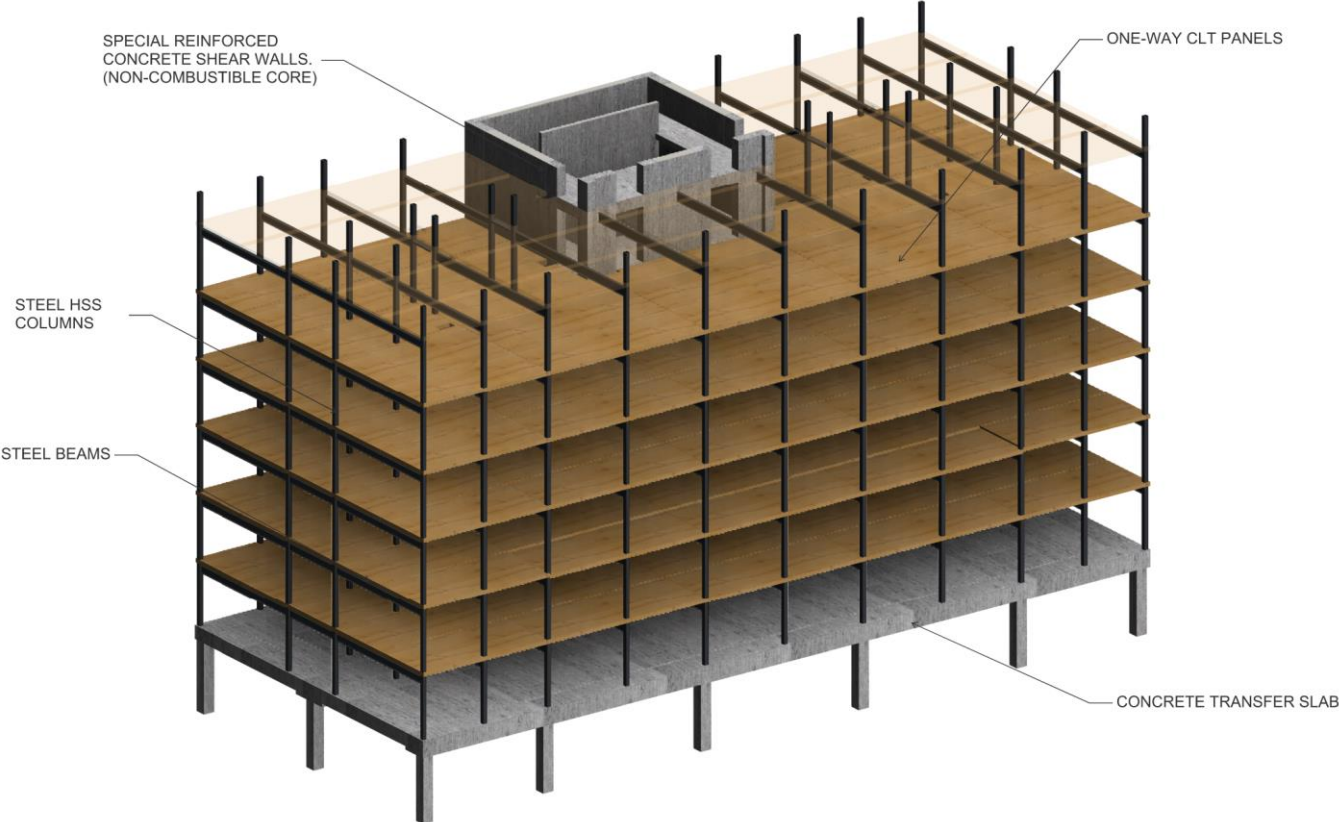
**TYPE IV-B**



9 STORIES  
BUILDING HEIGHT 85 FT  
ALLOWABLE BUILDING AREA 405,000 SF  
AVERAGE AREA PER STORY 45,000 SF

**TYPE IV-C**

# GOING TALLER WITH TIMBER





# GOING FARTHER WITH TIMBER





# THANK YOU

2023-05-12

