Mass Timber Vertical Extensions: Solving the Urban Densification Problem

By Paul Kremer

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Building Communities Above Our Cities

Urban Densification

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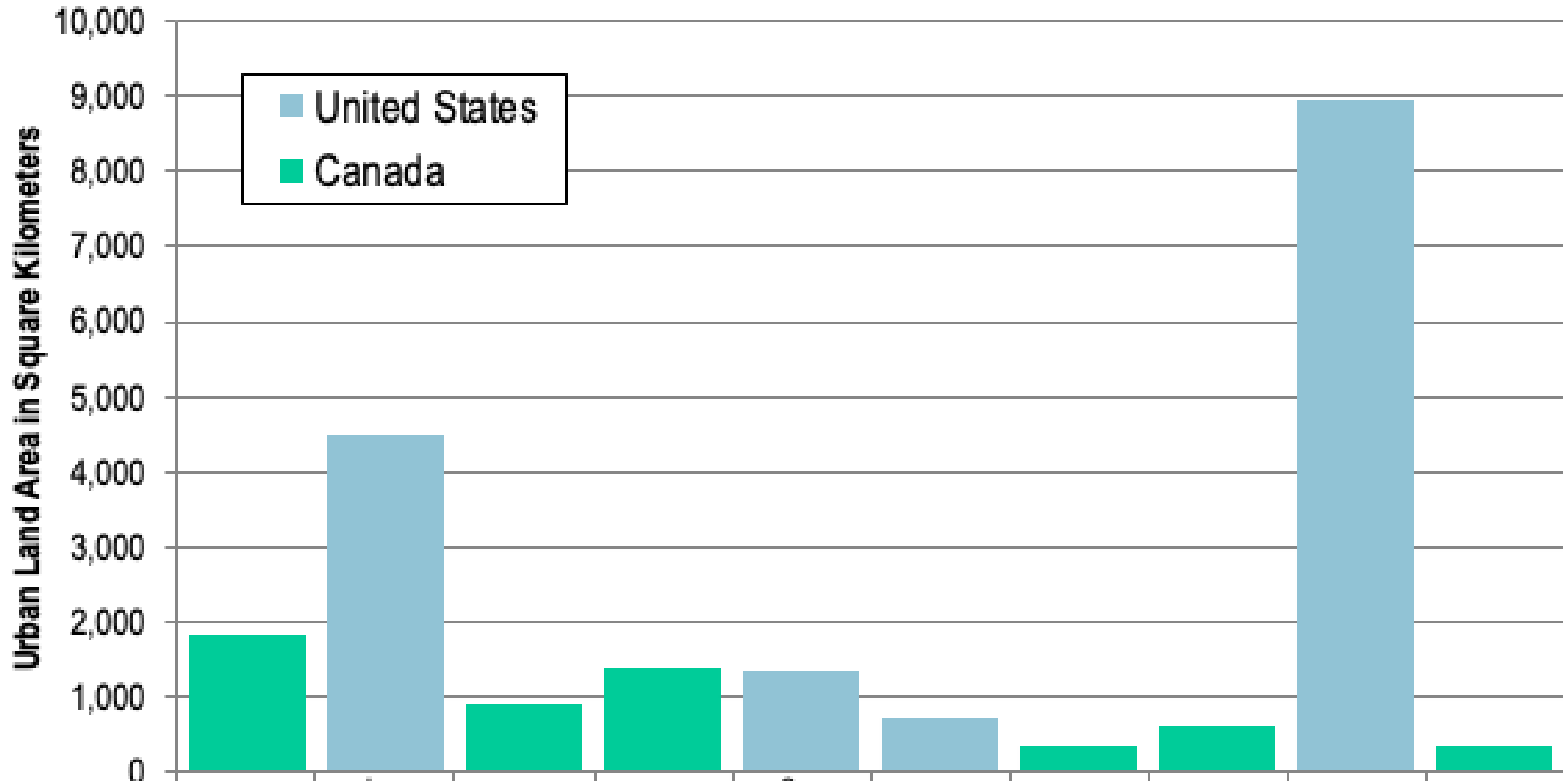
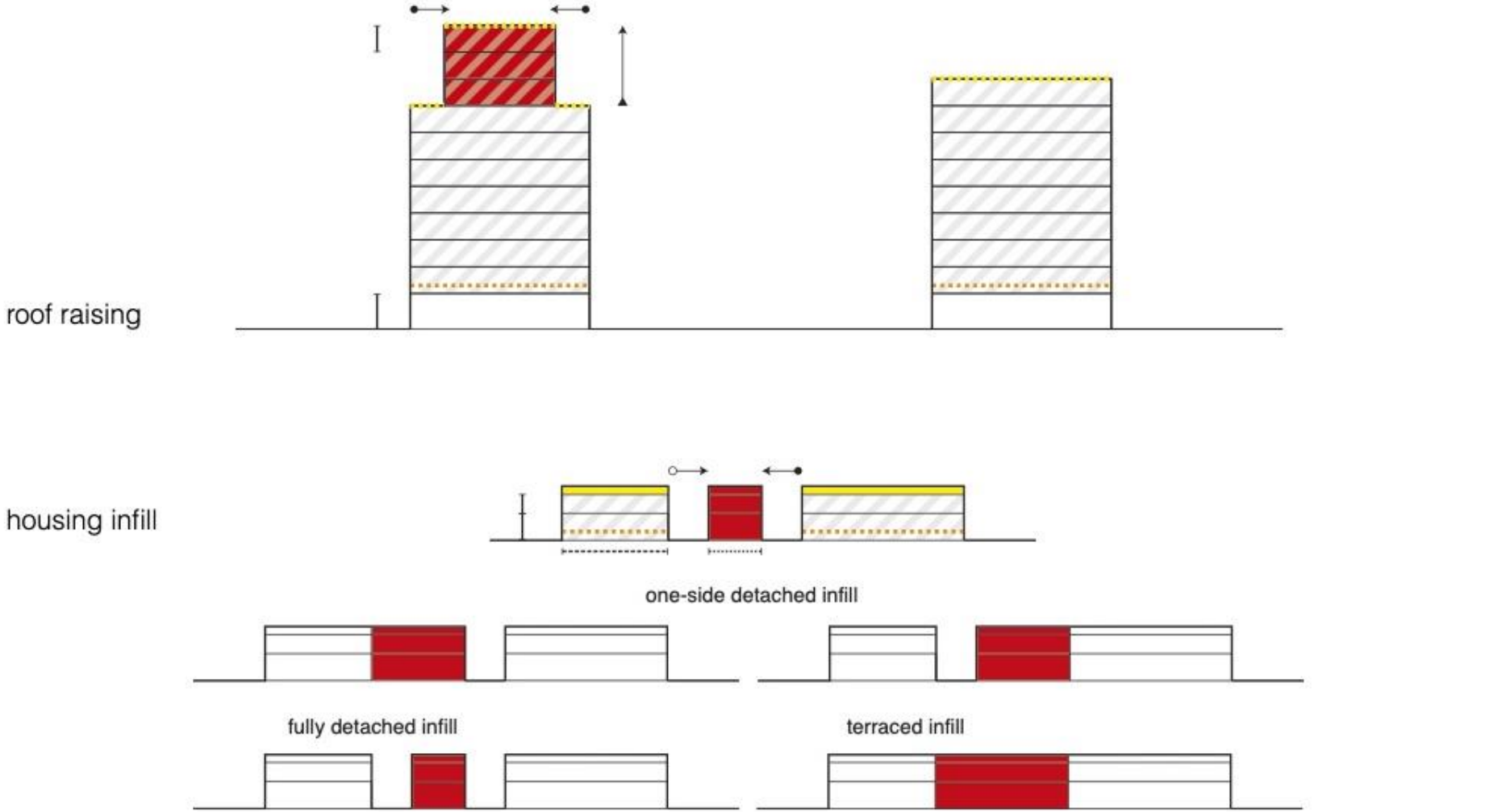
Densification Statistics North America Canada



	Toronto	Los Angeles	Vancouver	Montreal	San Francisco	San Jose	Winnipeg	Calgary	New York	Hamilton
United States	-	4,496	-	-	1,356	741	-	-	8,936	-
Canada	1,829	-	912	1,382	-	-	357	622	-	356


roof raising
housing infill
one-side detached infill
fully detached infill
terraced infill
added volume
simulated spaces/surfaces
solar radiation
energy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Crowdfunded Urban Densification
https://andrewsutton1.com/crowdfunded-urban-densification

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Crowdfunded Urban Densification

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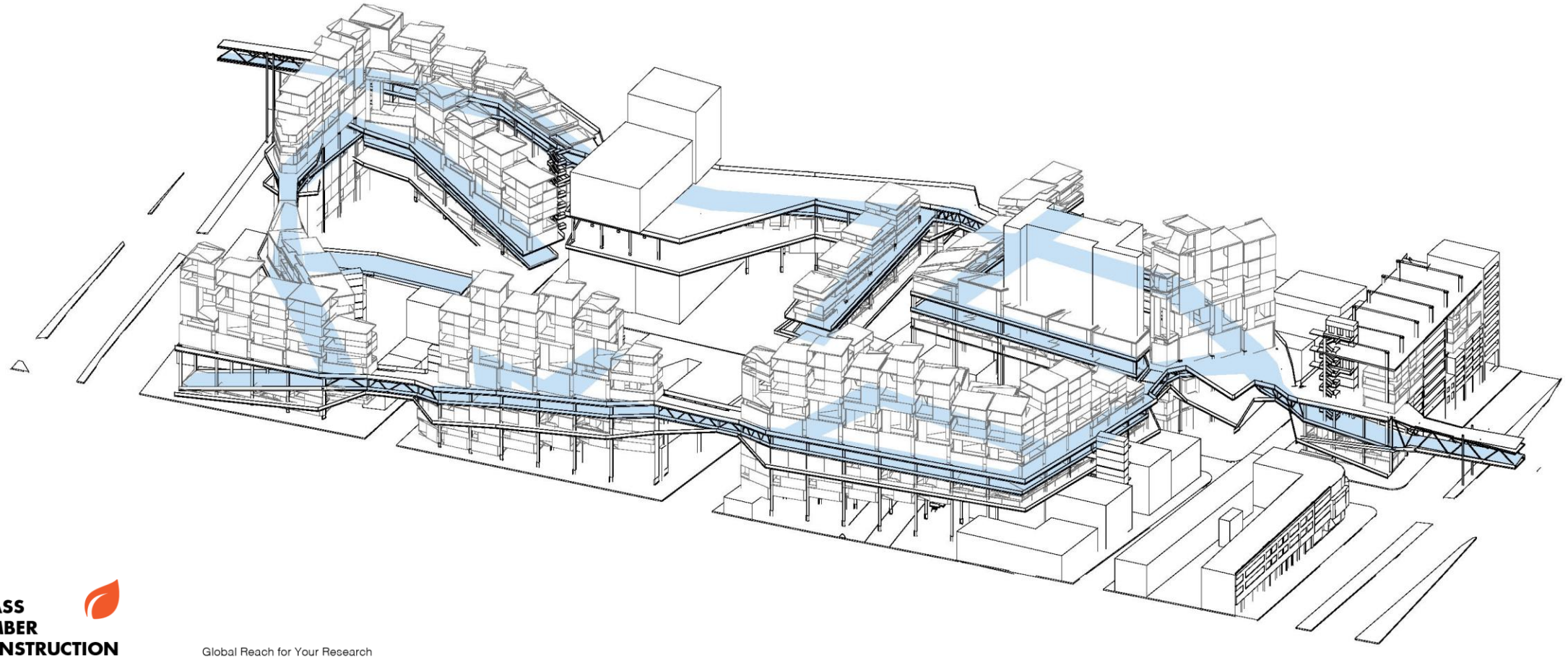
Crowdfunded Urban Densification

Proposal to crowdfund a new urban infrastructure - a pedestrian network interwoven into the existing street fabric. The network slices through the city just above the existing small-scale buildings, and right through larger scale buildings, creating a void for movement. Above and below, that void parcels are created for crowdfunded development.



https://andrewsutton1.com/crowdfunded-urban-densification

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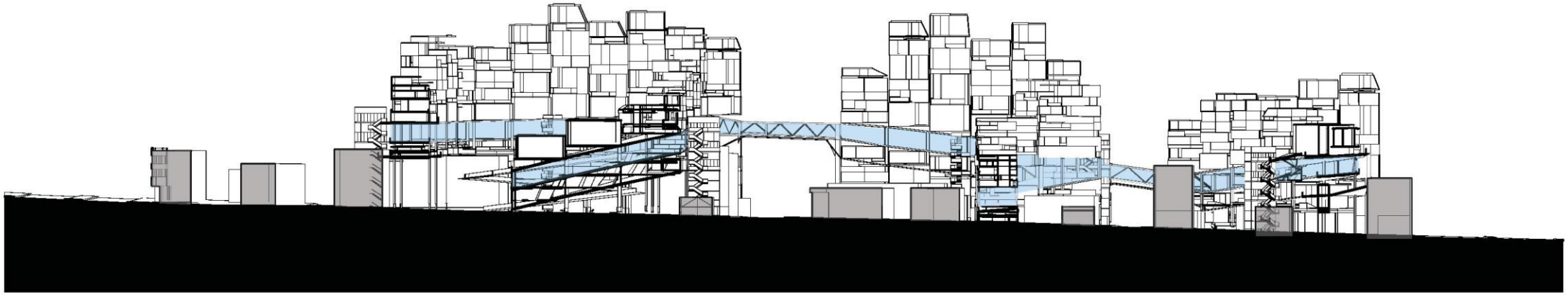
Crowdfunded Urban Densification



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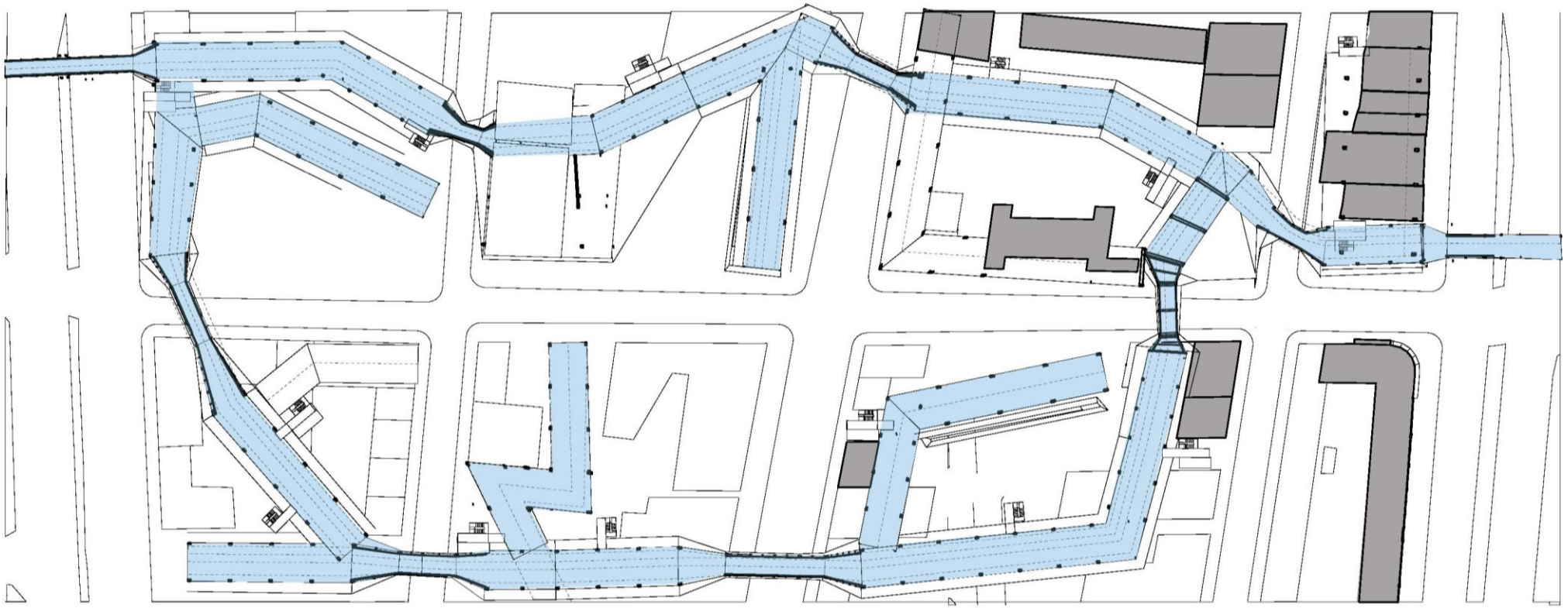
Crowdfunded Urban Densification



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Traditional Construction Vertical Extensions

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Lightweight

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Metsä

Plan B Competition

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https://www.metsagroup.com/metsawood/news-and-publications/news/2015/metsa-wood-and-michael-green-have-designed-a-wooden-version-of-the-empire-state-building/


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https://www.metsagroup.com/metsawood/news-and-publications/news/2015/metsa-wood-and-michael-green-have-designed-a-wooden-version-of-the-empire-state-building/

First Vertical Extension in Australia

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55 Southbank Project

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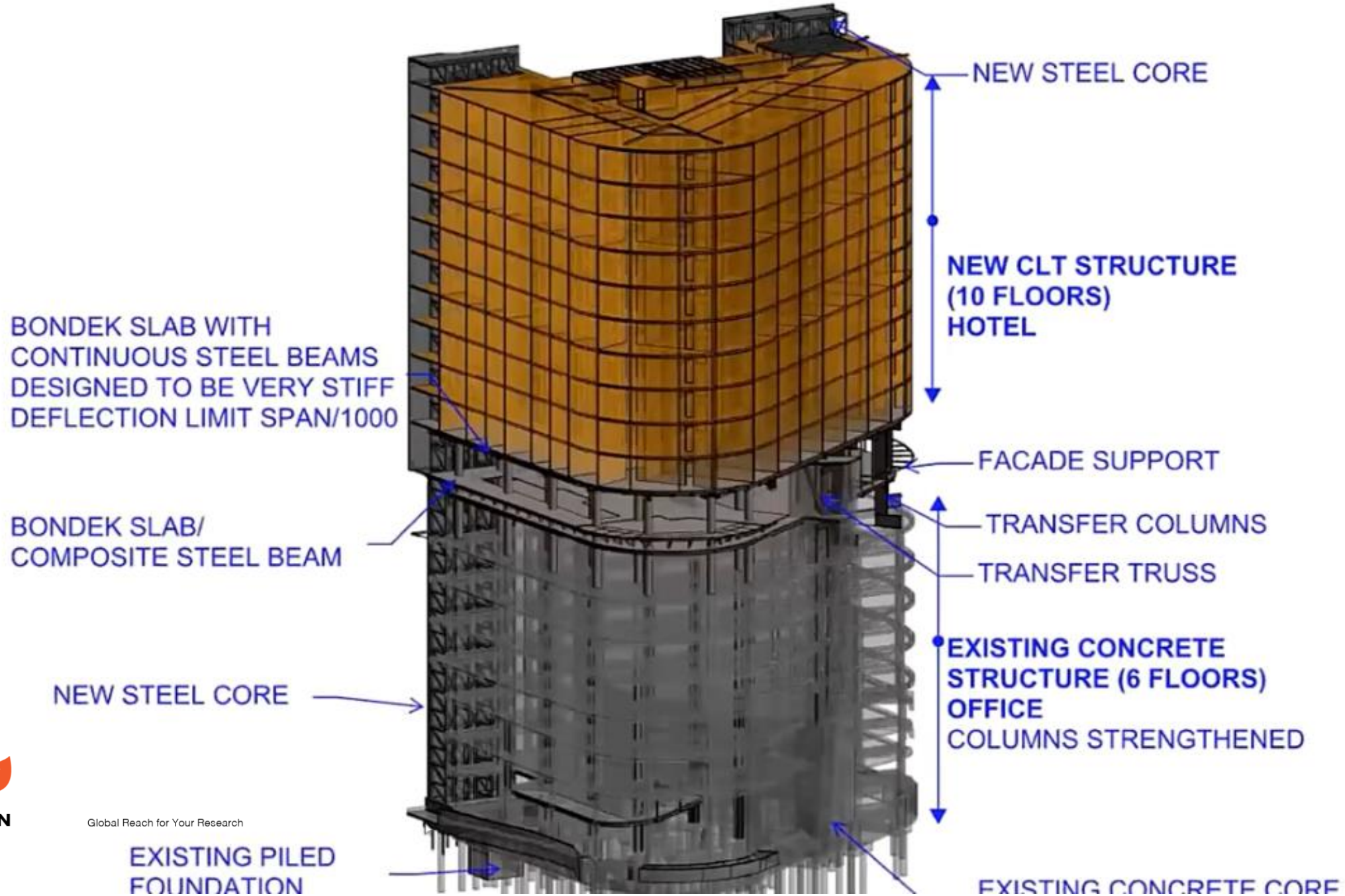
Data#3


Data#3



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Data*3

80 M Street Washington DC

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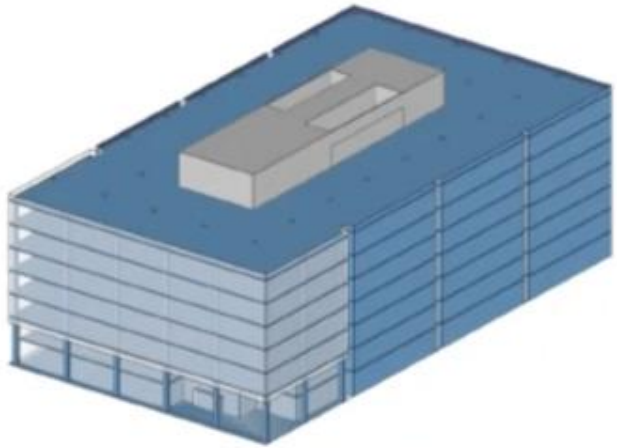
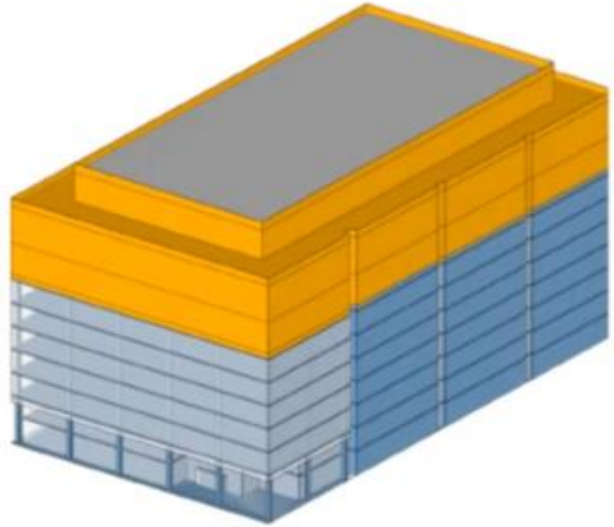
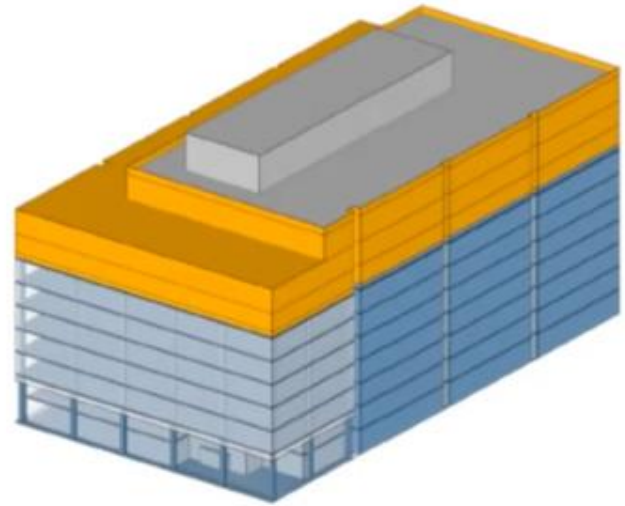


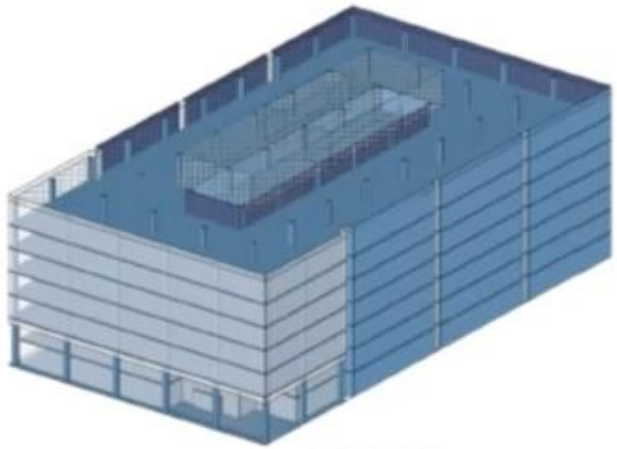
EXISTING
MAINTAIN EXISTING ROOF
MOVE MECHANICAL EQUIPMENT UP



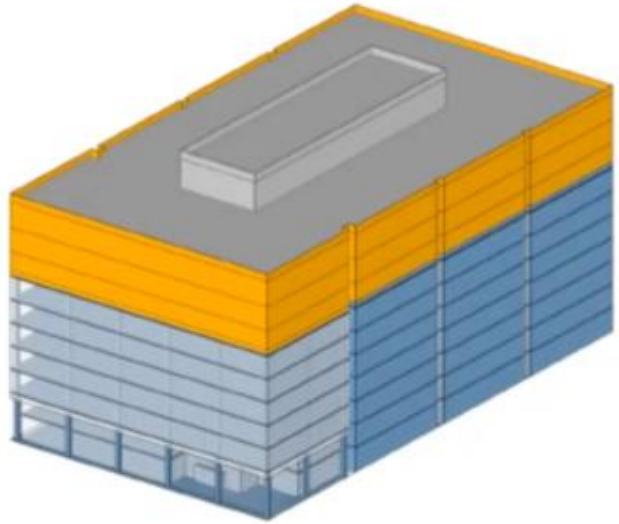
2 LEVELS
•20,000 SF HABITABLE PENTHOUSE
•80,000 SF GFA
•10,000 SF ROOFTOP TERRACE



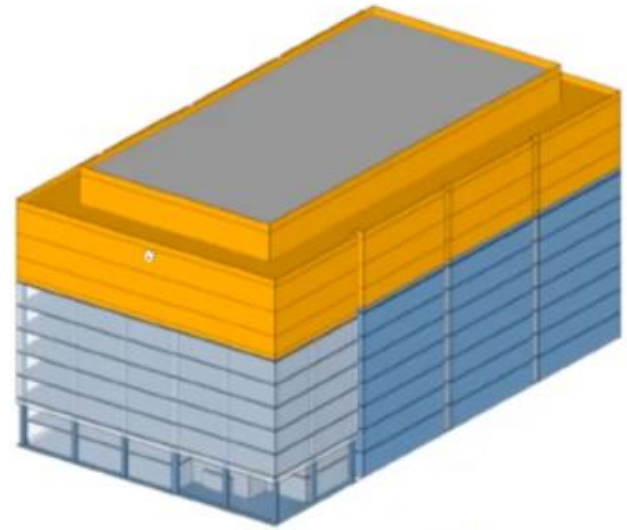
2.5 LEVELS
•MECHANICAL PENHOUSE
•108,000 SF GFA
•14,000 SF TERRACE ON LEVEL 10



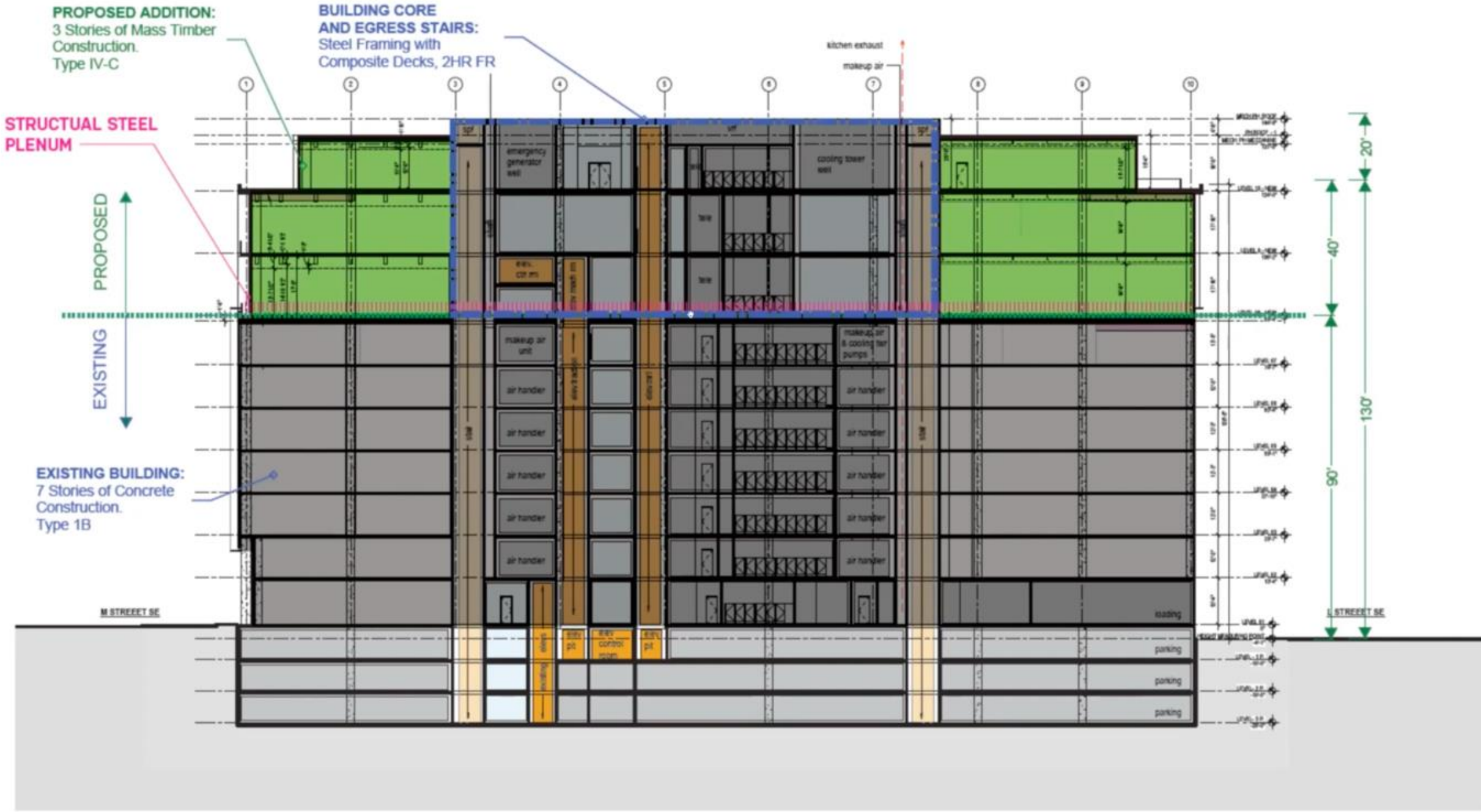
EXISTING
REMOVE PART OR ALL OF EXISTING ROOF
MOVE MECHANICAL EQUIPMENT UP

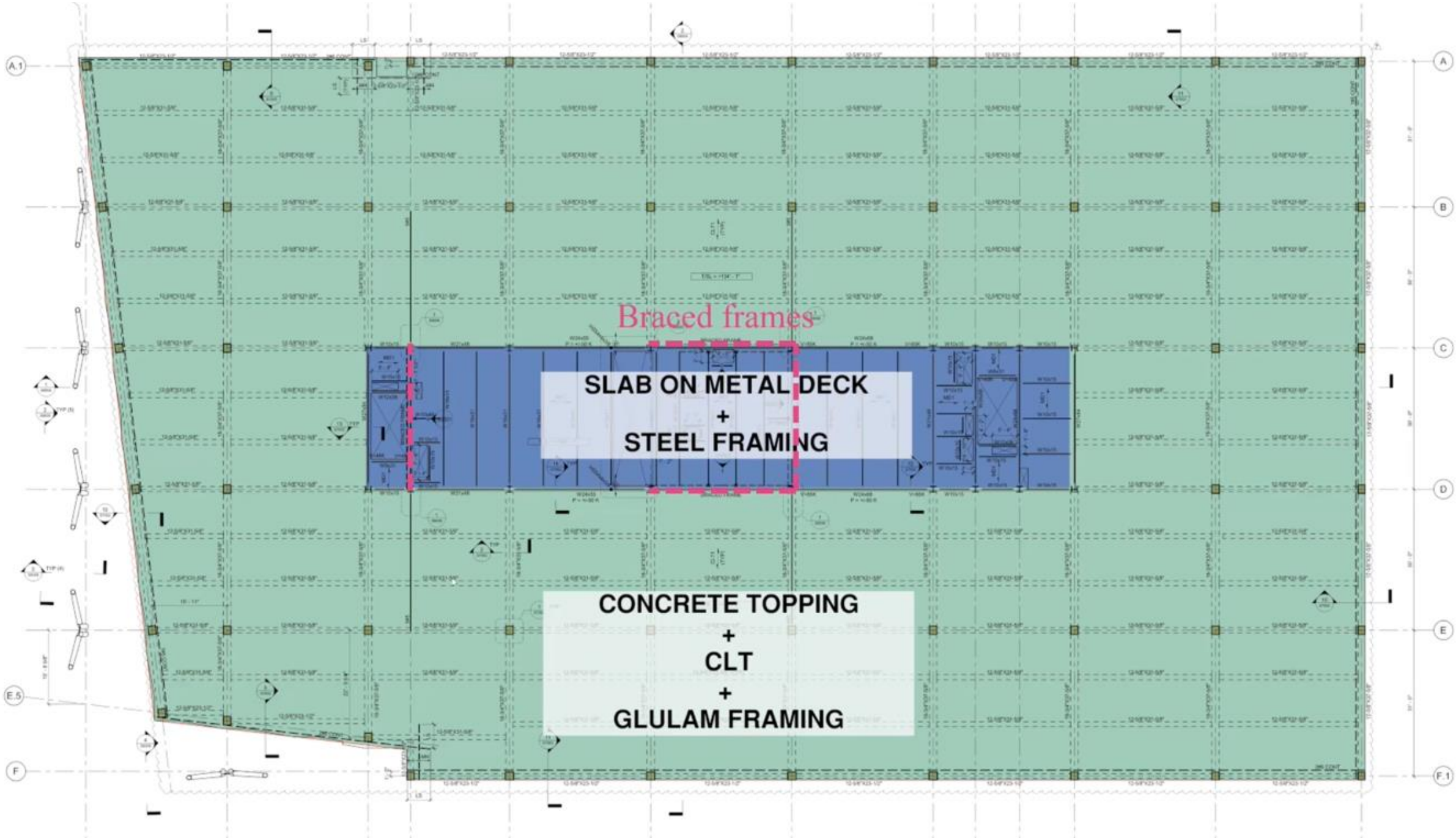


3 LEVELS
•MECHANICAL PENTHOUSE
•120,000 SF GFA



3 LEVELS
•20,000 SF HABITABLE PENTHOUSE
•120,000 SF GFA
•10,000 SF ROOFTOP TERRACE


PROPOSED ADDITION:
3 Stories of Mass Timber Construction.
Type IV-C
BUILDING CORE AND EGRESS STAIRS:
Steel Framing with Composite Decks, 2HR FR
STRUCTUAL STEEL PLENUM
PROPOSED
EXISTING
EXISTING BUILDING:
7 Stories of Concrete Construction.
Type 1B
kitchen exhaust
makeup air
emergency generator well
cooling tower well
makeup air unit
air handler
makeup air & cooling twr pumps
loading
parking
M STREEET SE
L STREEET SE
20'
40'
90'
130'


Braced frames
SLAB ON METAL DECK
+
STEEL FRAMING
CONCRETE TOPPING
+
CLT
+
GLULAM FRAMING


ROLAIR


wework

What about Communities Above Cities?

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The Melbourne Mallee

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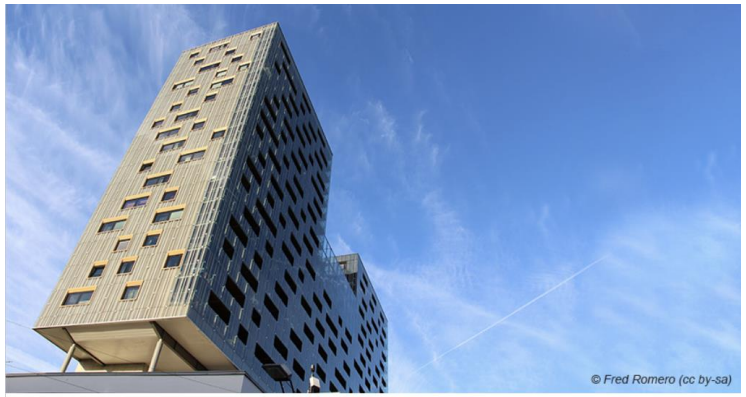
DEAKIN UNIVERSITY

Council on Tall Buildings and Urban Habitat



2020 International Research Seed Funding

Funding Sponsor: CITIC Heye Investment Co., Ltd.

Building Above Our Cities: Mass Timber Construction Creating Sustainable and Socially-Connected Communities

Principal Investigator: Paul Kremer, Deakin University

Objective: Explore how mass timber vertical extensions can work with bridging connections, at height, to form interconnected communities.

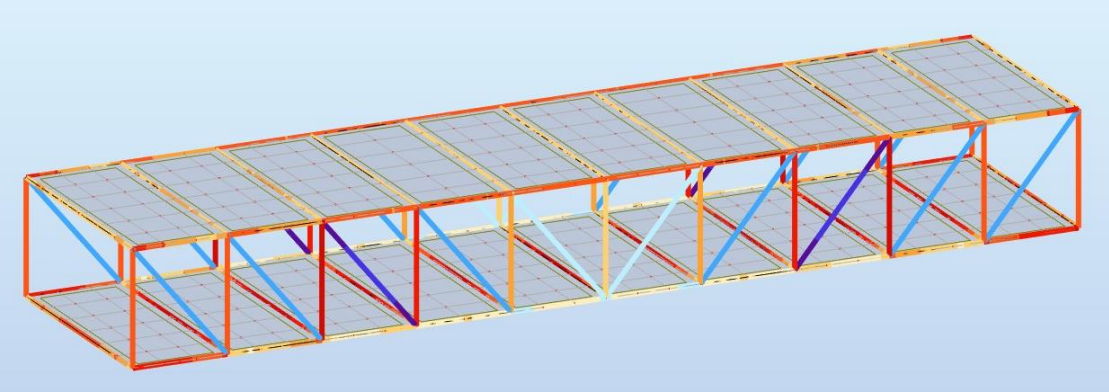
Research paper to be published in the CTBUH Journal.

The Project Team

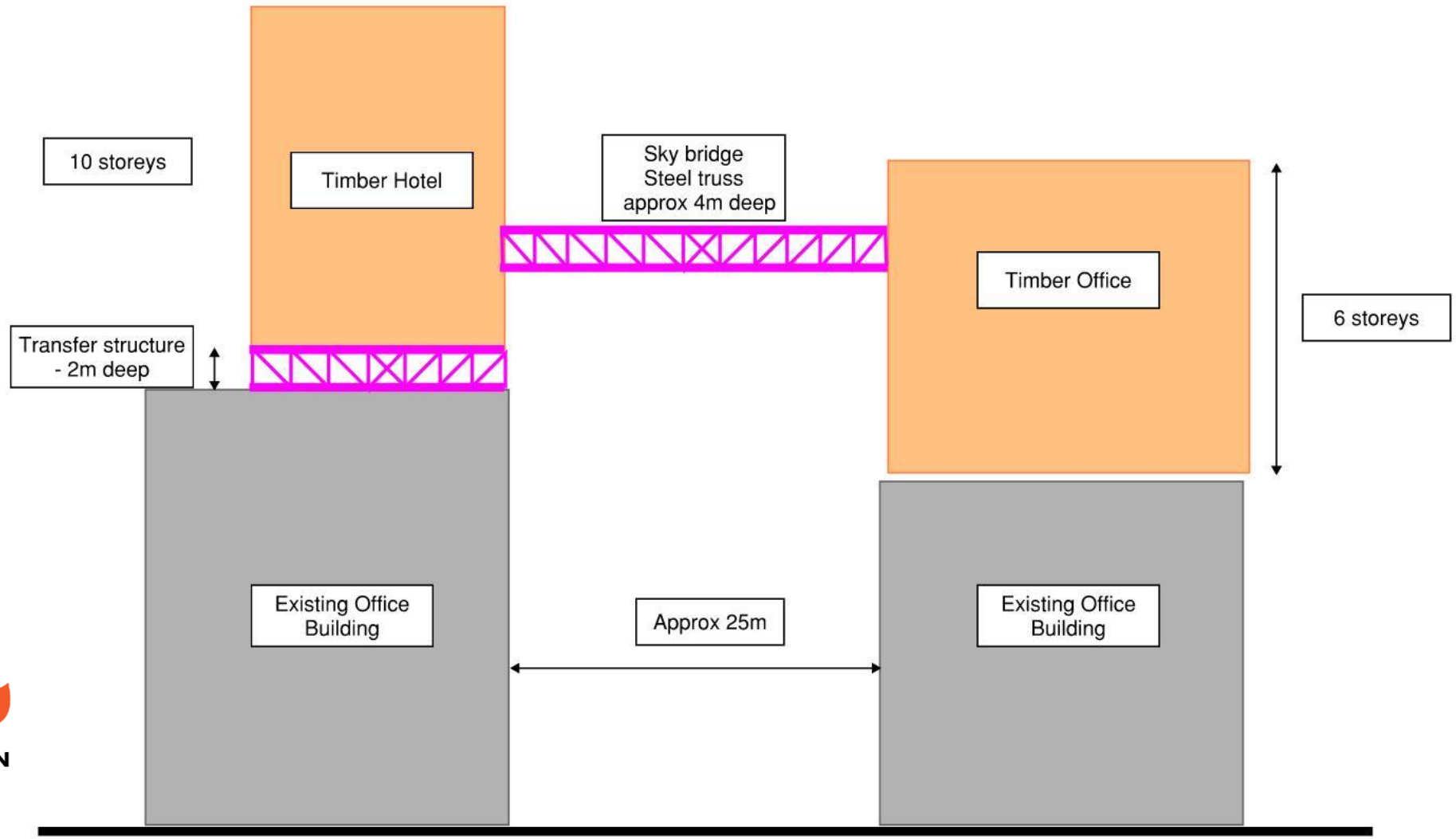
Item No.	Factor/Domain	Explainer	Proposed Score/Measure
1	**City/Country Factors**		
a	Distance between buildings	The greater the distance, the more improbable the solution will be	(m) Meters
b	Height difference between buildings	The greater the height differential, the more improbable the solution will be	(m) Meters
c	Access to Buildings	Poor or no access makes the approach unlikely	Limited, Moderate, High
d	Age of City/Buildings	New buildings offer a great chance of success	Years
e	Heritage listings	You cannot treat heritage listed buildings to suit the proposal	Yes/No
2	**Technology Factors**		
a	Construction expertise	Requires the capacity to erect the building through skills labour/management	Limited, Moderate, High
b	Access to mass timber technology	Having access to mass timber is a pre-requisite to success	Limited, Moderate, High
3	**Environmental Factors**		
a	Condition - Wind	High wind loadings beyond a certain point make the proposal untenable	Peak Wind
b	Condition - Seismic Volatility	The lower the seismic conditions, the greater the attractiveness to the proposal	Peak Activity
c	Condition - Snow	Snow loads need to be considered	Peak Loading
d	Condition - Tropical	Durability, in particular moisture, can impact the proposal	Position relative to equator
4	**Economic Factors**		
a	Cost of Land	Higher costs of land results in the proposal more attractive	Median Land Price (Cities)
b	Scarcity of Land	Limited land makes the proposal more attractive	Urban Sprawl
5	**Political Factors**		
a	Stable government	Must be a stable society to focus on the well-being of citizens, not in conflict	Political Stability Score
b	Sustainability commitment (i.e. Net Zero)	Must have a proactive reason to undertake the proposal in the first instance	Sustainable Development Score

Existing Building and New Vertical Extension Building Project Considerations

Foundation Underpinning. Given the foundations of the existing building will already exist, an important aspect in the thinking about the foundations is how are these to be accessed. It may be that extensive demolition is required to access the foundations. Considerations need to be given to what sort of equipment can work within the space to complete underpinning or strengthening works.	**Materials Handling and Storage.** Given the existing building, and its potential ongoing operation during construction, planning for ingress and egress and controlled pathways is vitally important. **Labor Services.** Where the teams of people are located to support the project build. An approach can be taken to occupy one of the levels in the existing building and transition them to the new building once the first few levels have been installed.
Existing Structure Strengthening. To ensure the desired load capacity that sits on top of the existing building will be supported, the strengthening of the building needs to be considered. It includes the potential application of additional column, beam, and wall reinforcement.	**Scaffolding.** The requirement for scaffolding on a building site is almost a universal requirement in modern society. The project team needs to ascertain if the scaffolding needs to be erected from the ground to the top of the structure or can the scaffolding be erected from the new building.
Transfer Structures. An assessment of the existing building and the new design is required to analyze if the two structures align. If they do not, then a transition between the existing and new build and may need a 'transfer'.	**Delivery.** Many cities have restrictions on materials being delivered to construction sites, be it a vertical extension or not. Considerations for the project teams include if there are limits on delivery sizes and/or times during which deliveries can be made.
Services. Given that the new extension is going to require all the services of the existing building, indeed they might require more given the changes in standards for building operations and functioning, consideration must be given to what services are required for the vertical extension.	**Cranage.** Vitally important for a vertical extension is the location of the crane/s. The crane needs to be in a location that allows for access across the site, and where it will be tied-back to the building.
Disruption to Existing Tenants. One of the suggested advantages of using a product like mass timber for vertical extensions is the ability to allow occupants to continue to use the space in the existing building.	**Prefabrication of Elements**. Project teams might consider the ease with which the site might run more efficiently if several elements are prefabricated in a staging area on or near the main site and then craned to their final destination. The approach may improve safety by reducing the need to work at heights.



Concept


10 storeys
Timber Hotel
Sky bridge
Steel truss
approx 4m deep
Timber Office
6 storeys
Transfer structure
- 2m deep
Existing Office
Building
Approx 25m
Existing Office
Building

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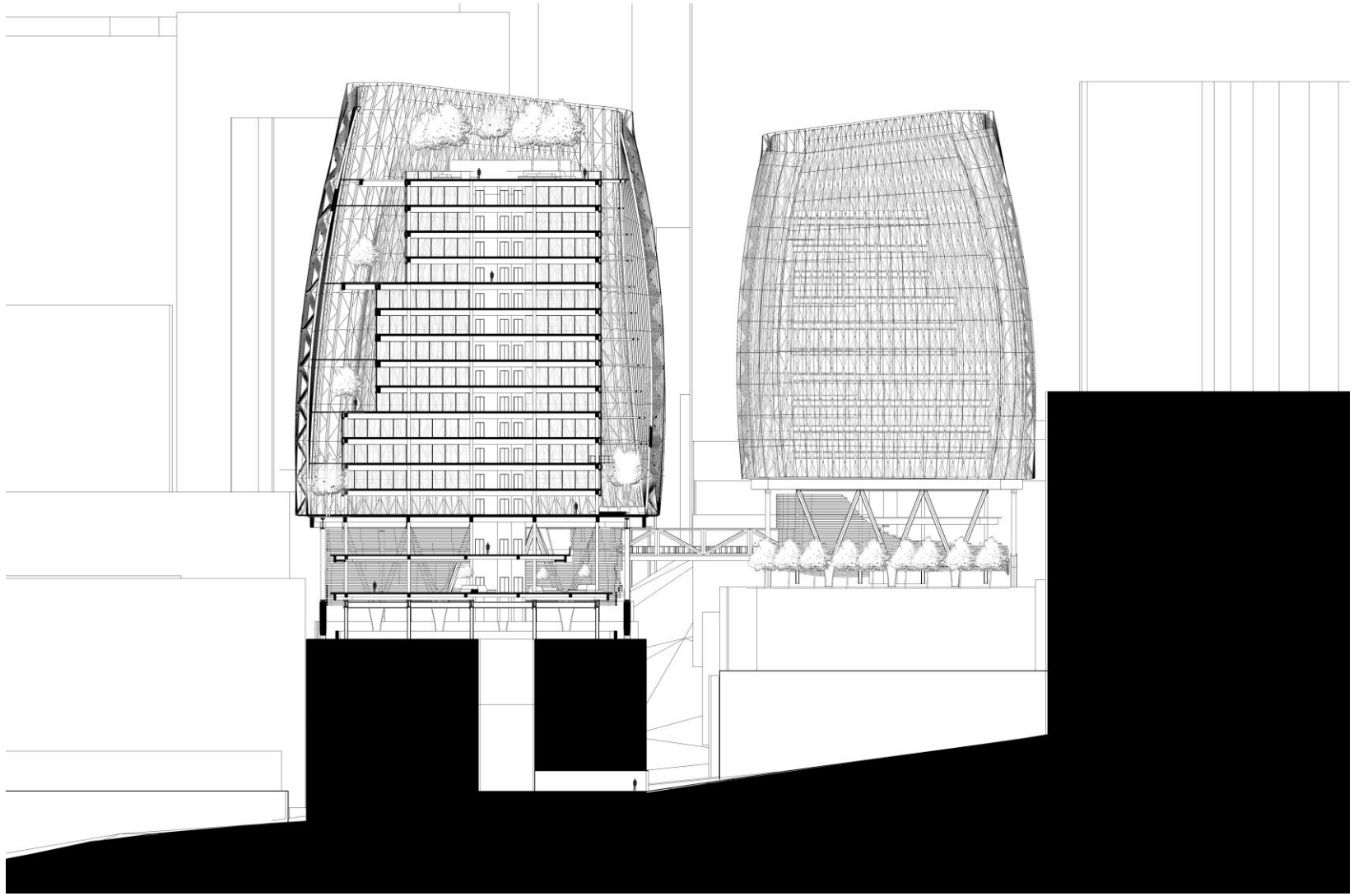

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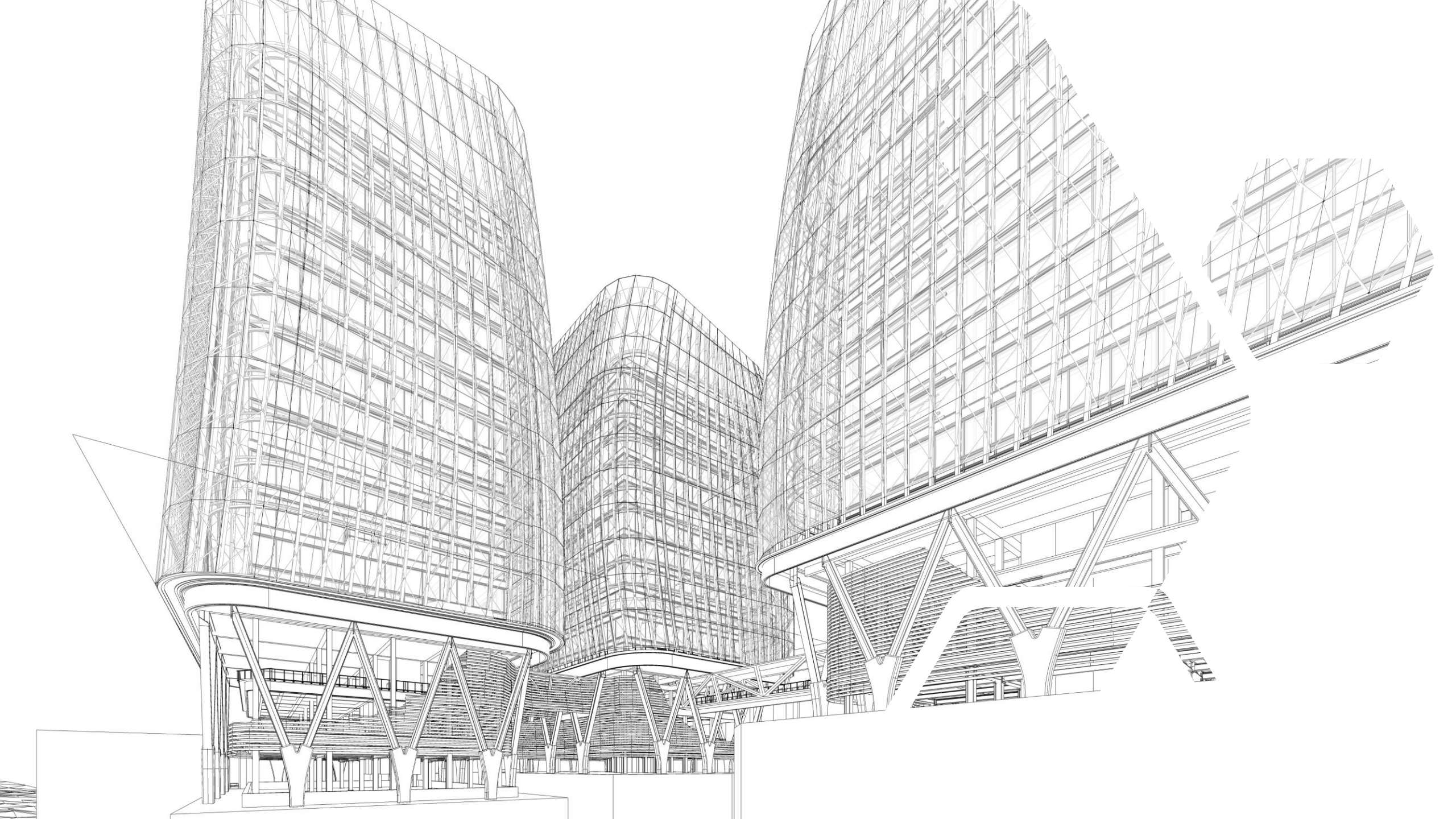
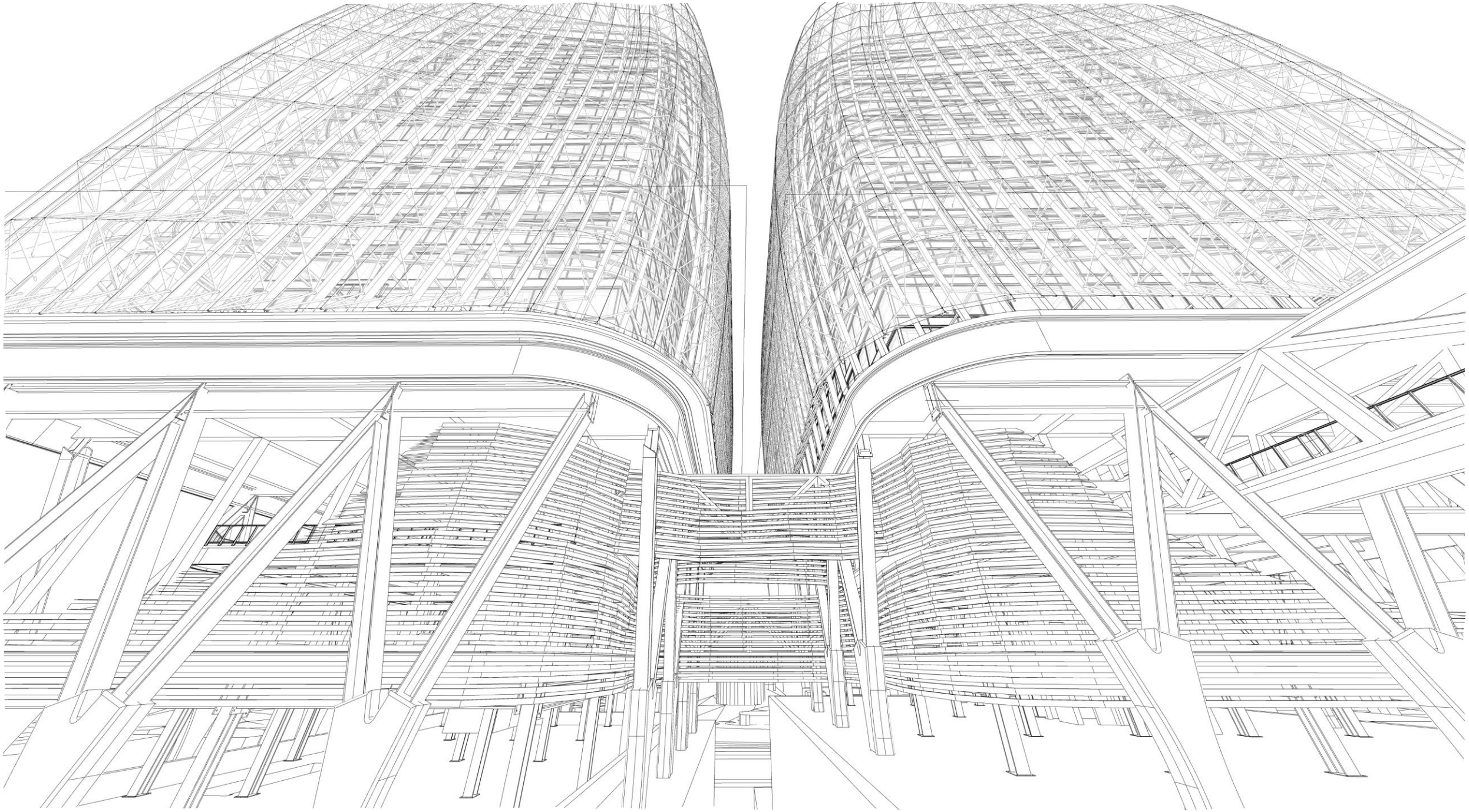
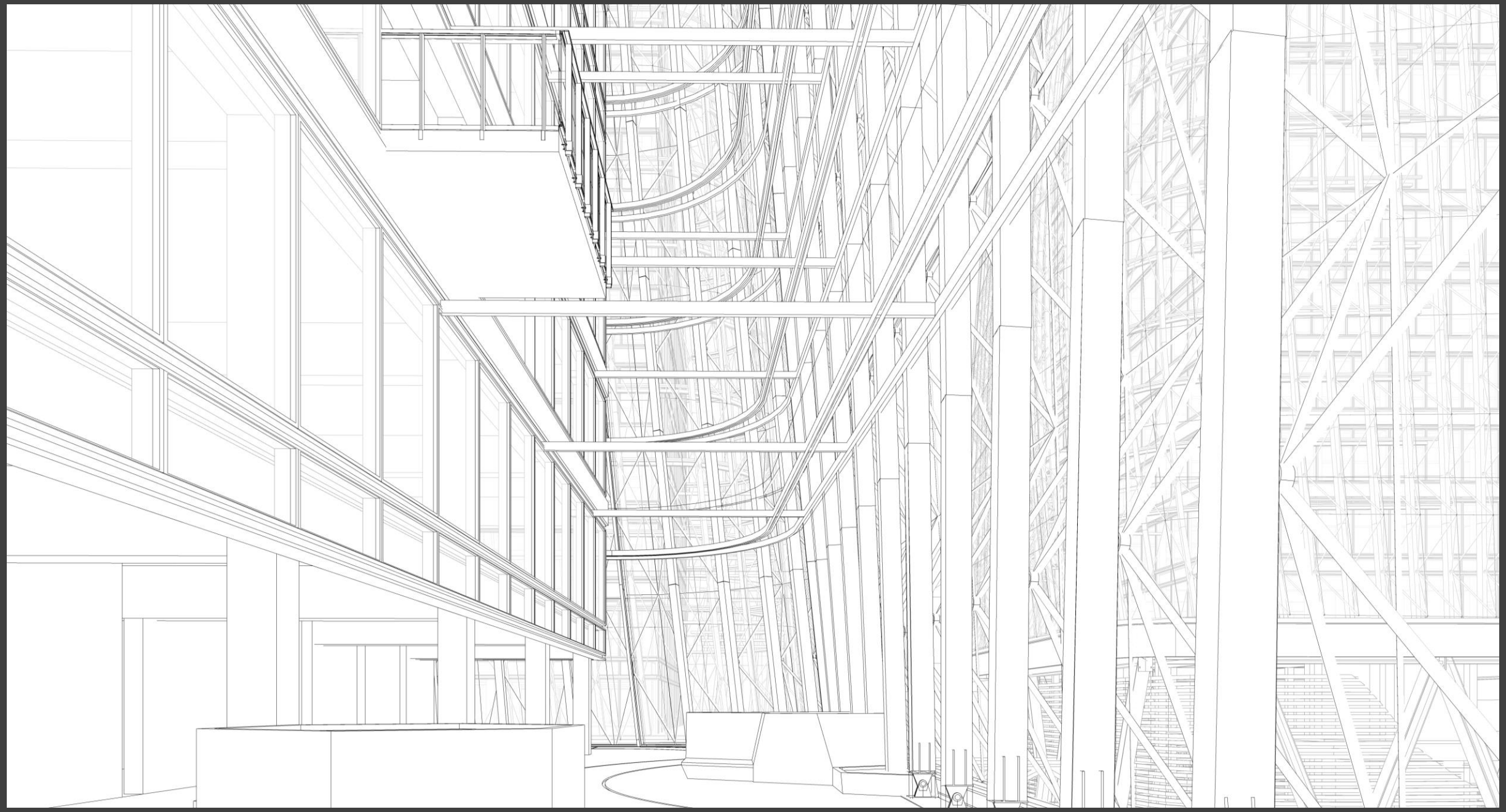
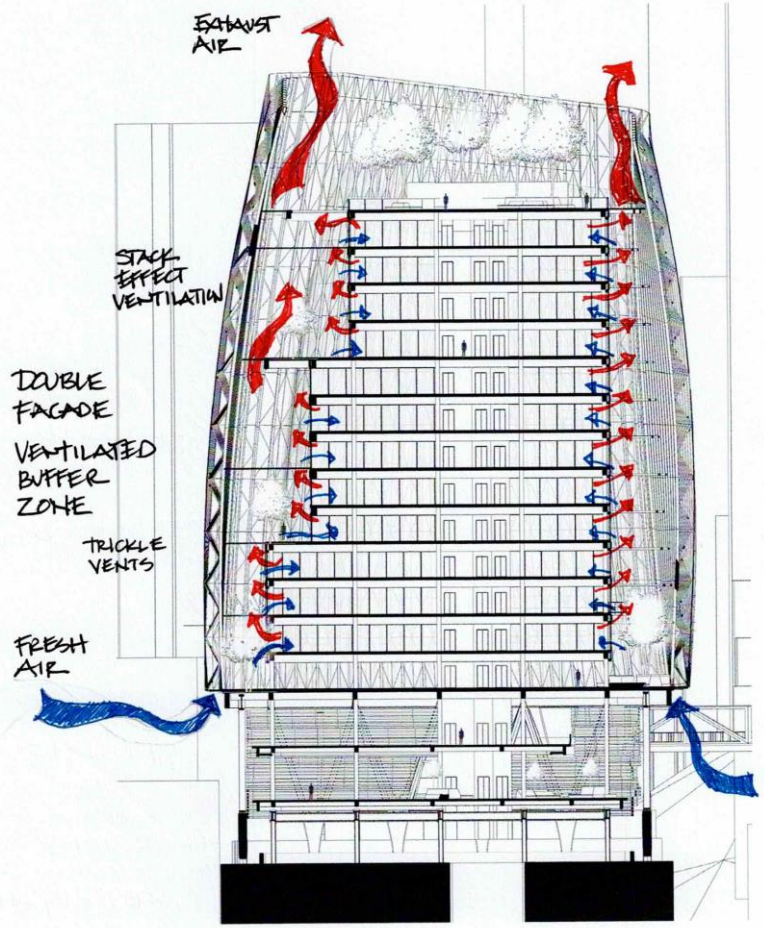
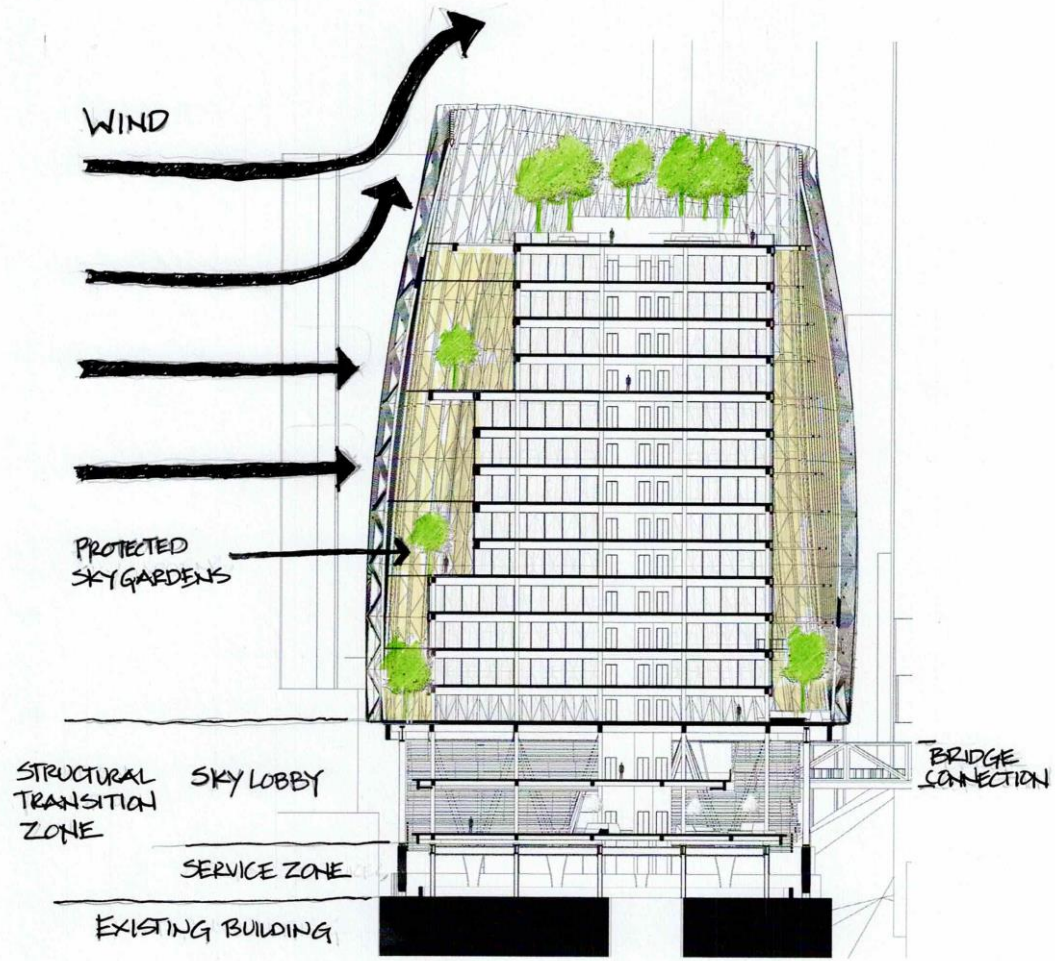
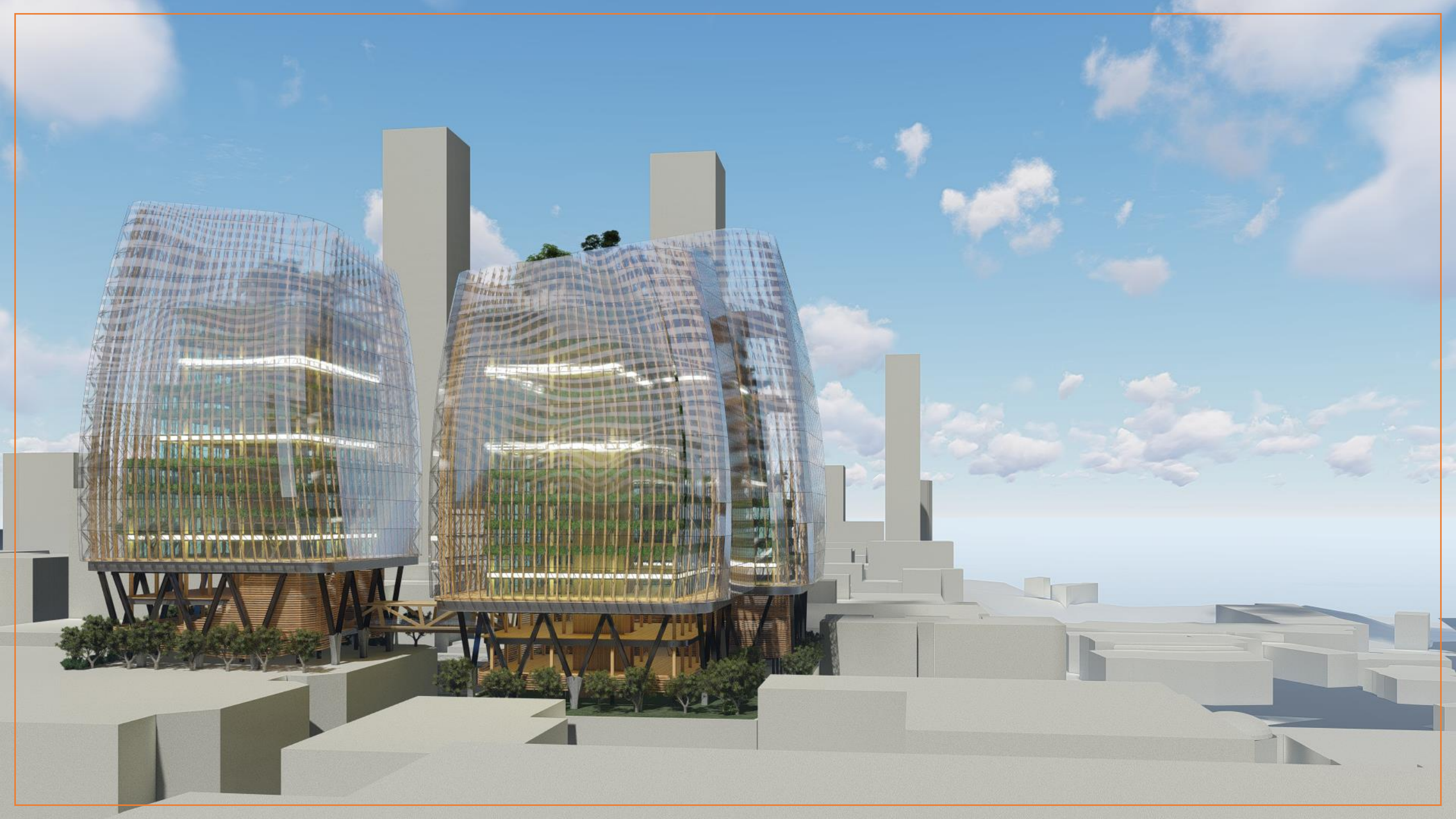


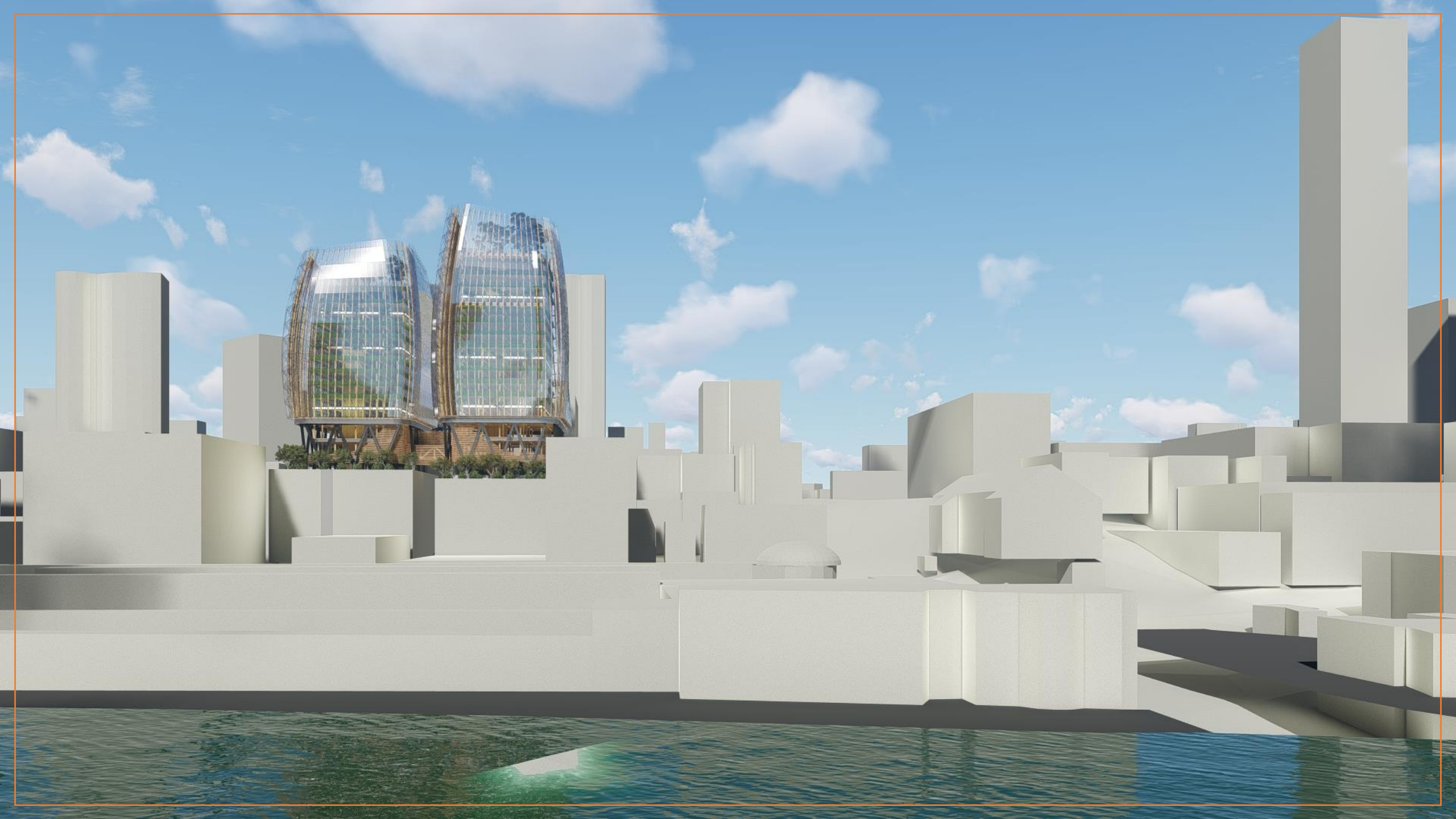


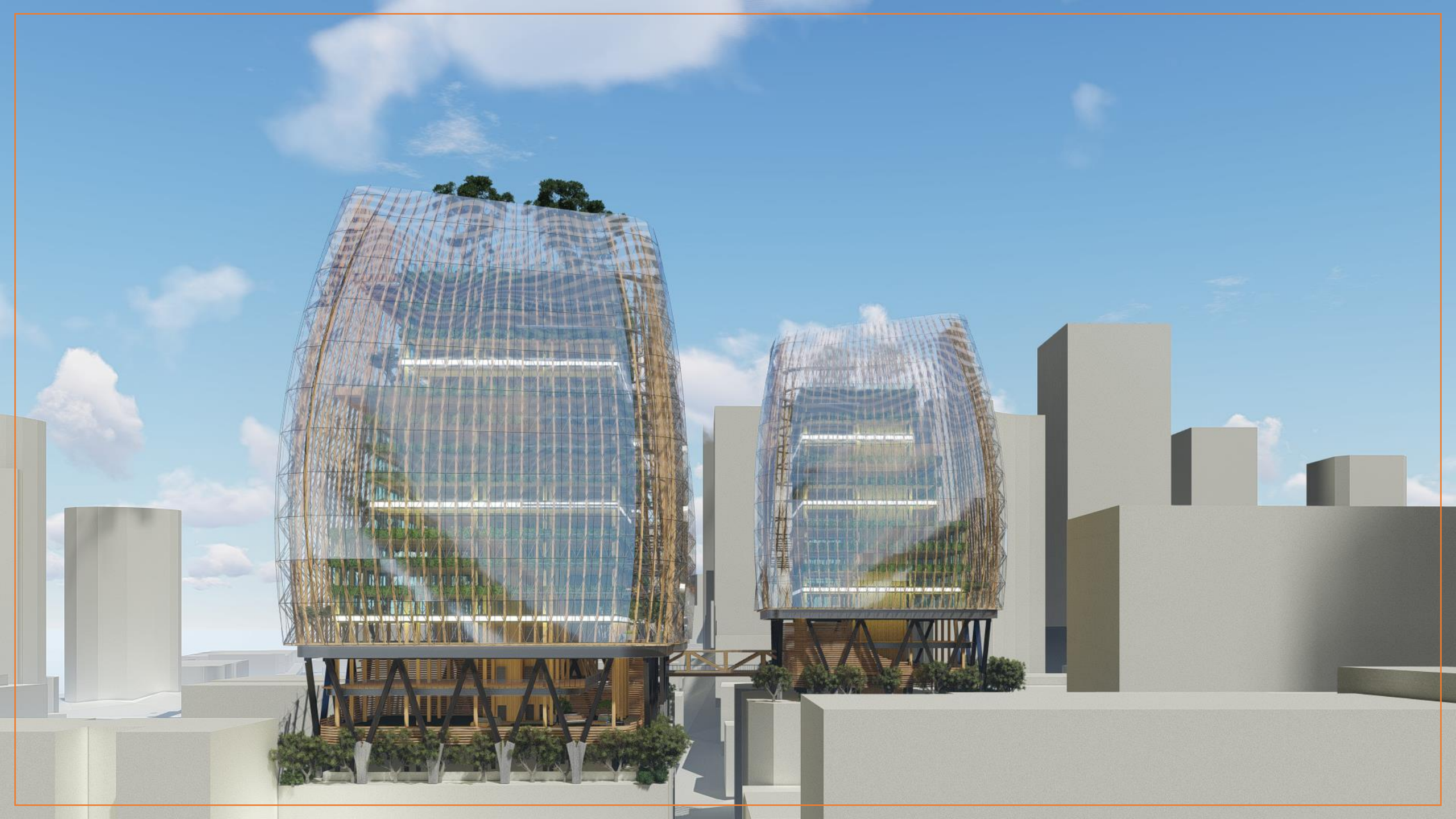



EXHAUST AIR
STACK EFFECT VENTILATION
DOUBLE FACADE
VENTILATED BUFFER ZONE
TRICKLE VENTS
FRESH AIR


WIND
PROTECTED SKY GARDENS
STRUCTURAL TRANSITION ZONE
SKY LOBBY
SERVICE ZONE
EXISTING BUILDING
BRIDGE CONNECTION







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Podcast
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The Mass Timber Construction Media Prospectus

By Paul Kremer

The mass timber construction sector is built on unity, let’s build a global community together

Assoc. Prof. Paul Kremer (Deakin University)
Research Fellow (University of Melbourne)

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