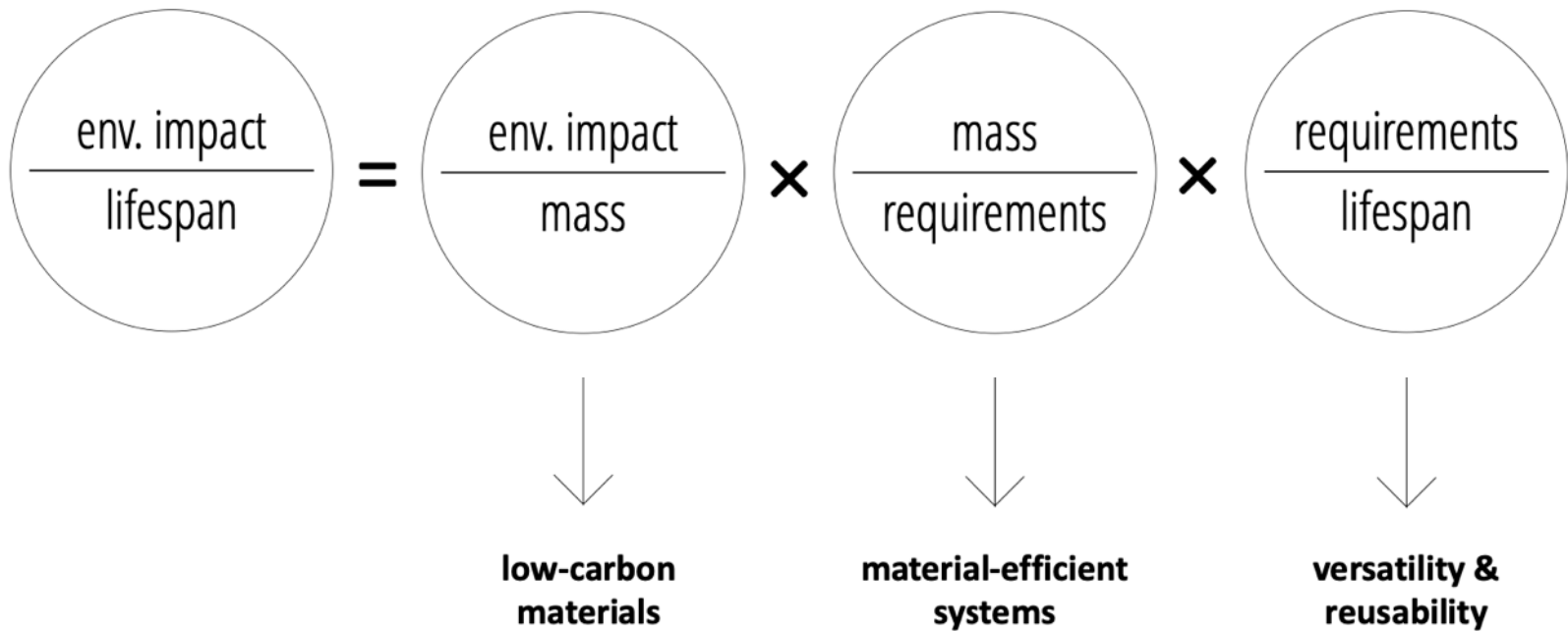


DISRUPTING CONCRETE CONSTRUCTION

Digital, sustainable, circular

Prof. Dr. Philippe Block





Strength through Geometry

Material Effectiveness

Circular Construction

STRENGTH THROUGH GEOMETRY



Photo: J. Kurt Schmidt



Photo: Iwan Baan



Photo: Anna Maragkoudaki



Reduce mass



Photo: Iwan Baan



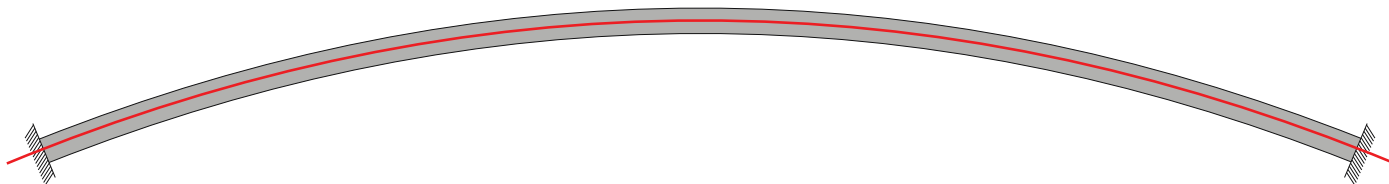
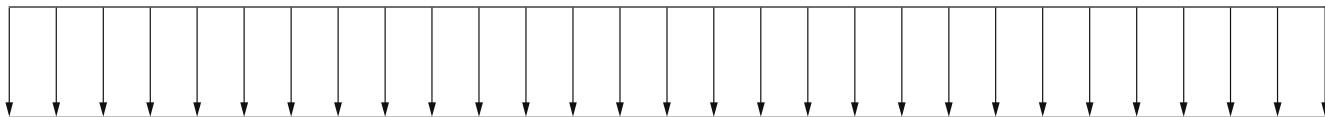
Photos: James Bellamy

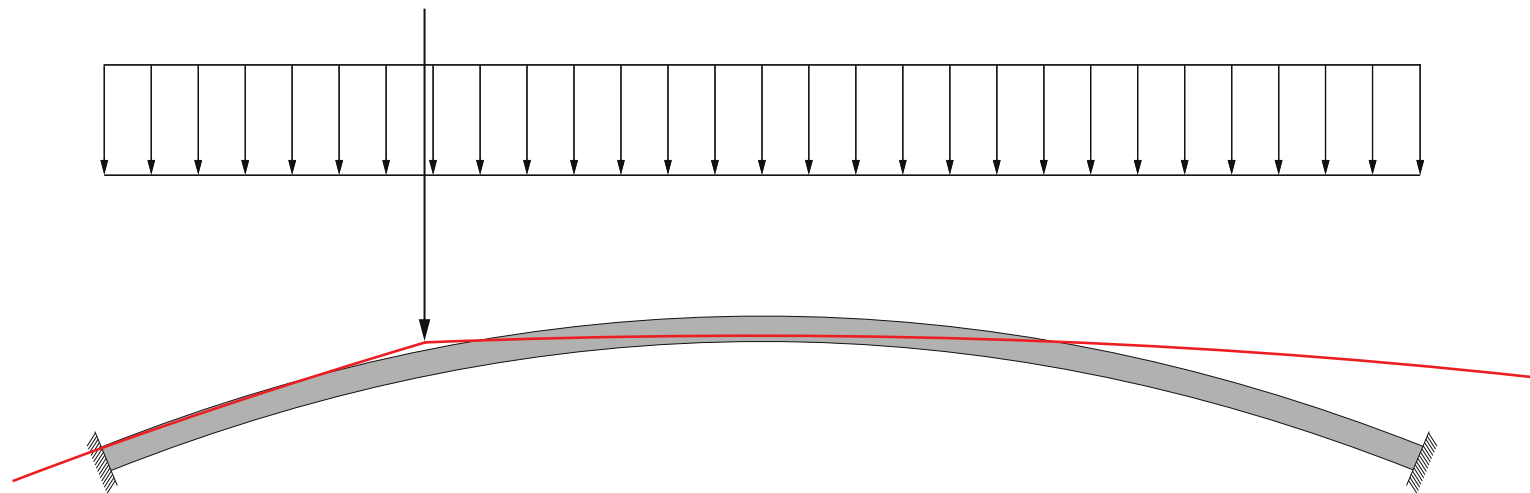


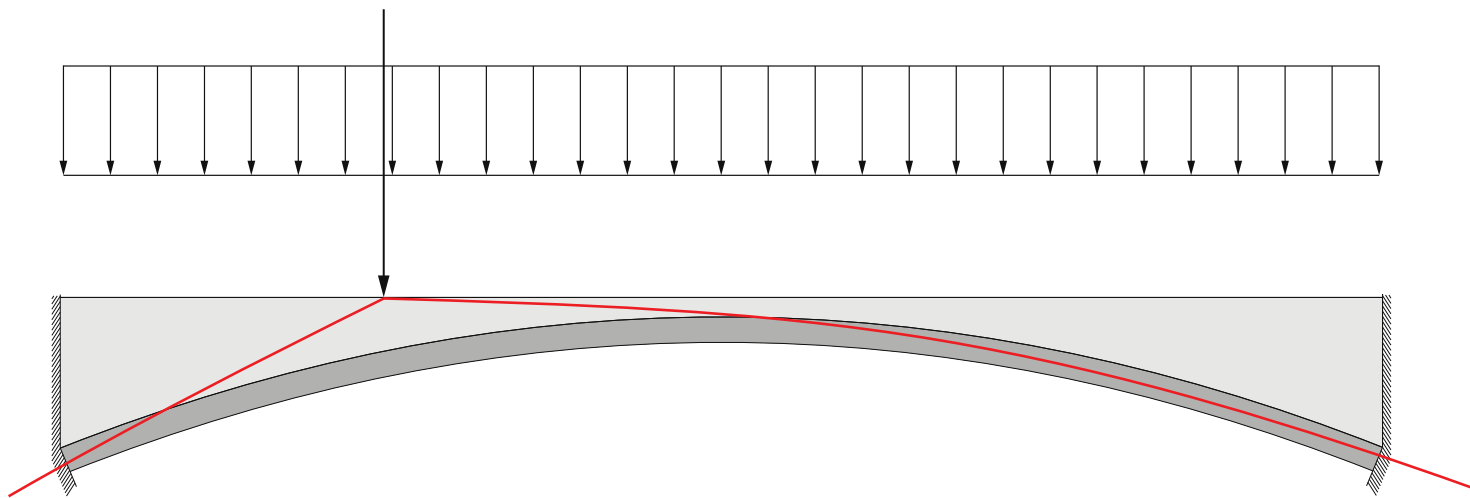
Video: James Bellamy

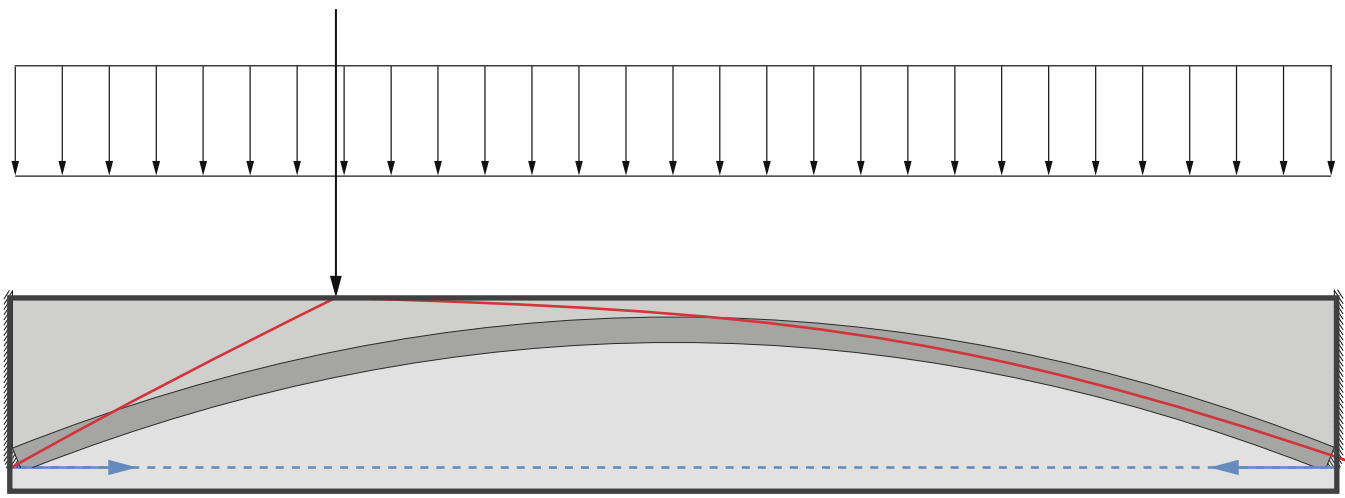


Photos: James Bellamy / Peter Rich Architects









-70 %

A photograph of a large, empty room with a brick ceiling and glass walls. The room is brightly lit, and the floor is made of light-colored stone tiles. The text "Reduce stresses" is overlaid in the center of the image in a white, sans-serif font.

Reduce stresses

A photograph of a modern interior space, likely a hallway or a large room. The ceiling is made of a grid of reddish-brown bricks. The walls are primarily composed of large glass panels with black frames, offering a view of an outdoor area with trees and a building. The floor is made of light-colored, textured stone tiles. The overall atmosphere is bright and airy.

Reduce carbon footprint

A close-up photograph of a textured, light-colored concrete wall. The wall has a rough, pebbled finish. In the lower right, a brick pillar is visible. The overall scene is dimly lit, suggesting an indoor or shaded construction site.

**Reduce
mass**

A photograph of a construction site. In the foreground, a worker in a bright orange high-visibility jacket and a white head covering looks towards the right. In the background, two workers in purple uniforms and orange hard hats are on a roof, one pouring concrete from a bucket. A large, cylindrical brick structure is under construction. Scaffolding is visible in the background.

**Reduce
carbon**



Sha Tin

沙田

Tsim Sha Tsui & Hong Kong

尖沙咀及香港

6

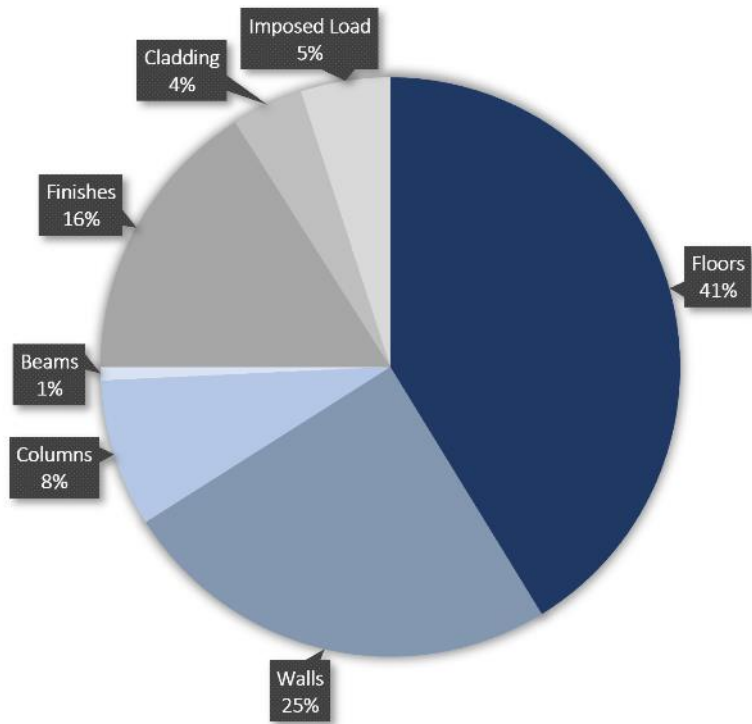
3

3

5

2B

GET IN LANE
選定
行車綫



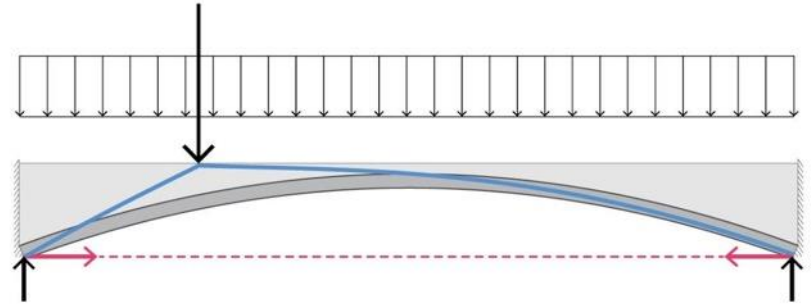
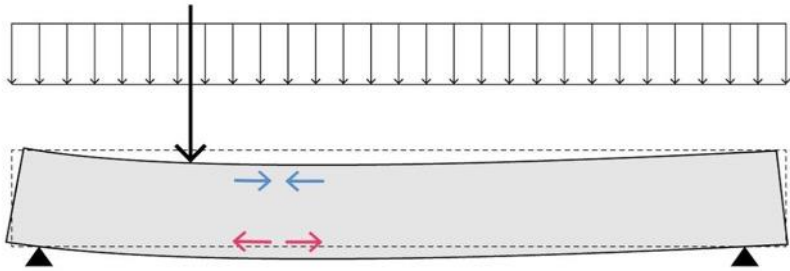


> 200 Bn m²

by 2050

MATERIAL EFFECTIVENESS





-70% concrete
-90% steel

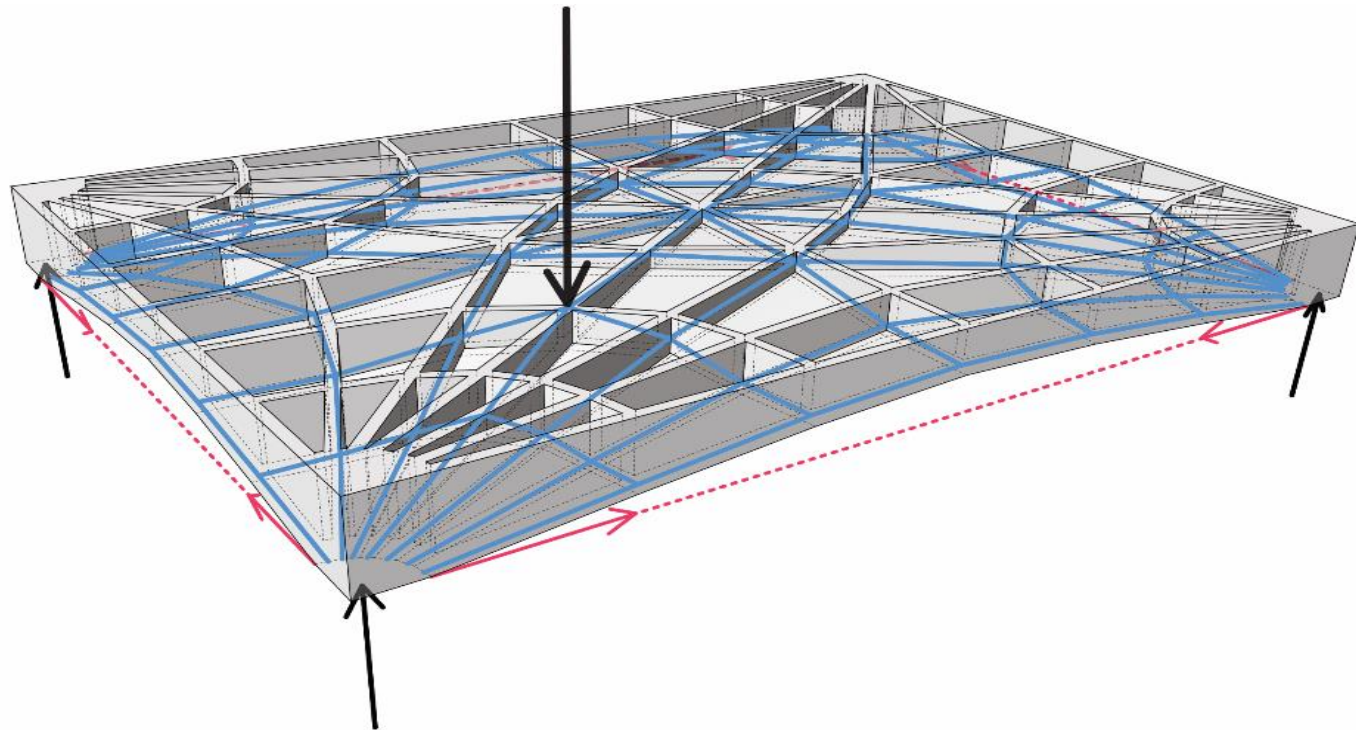
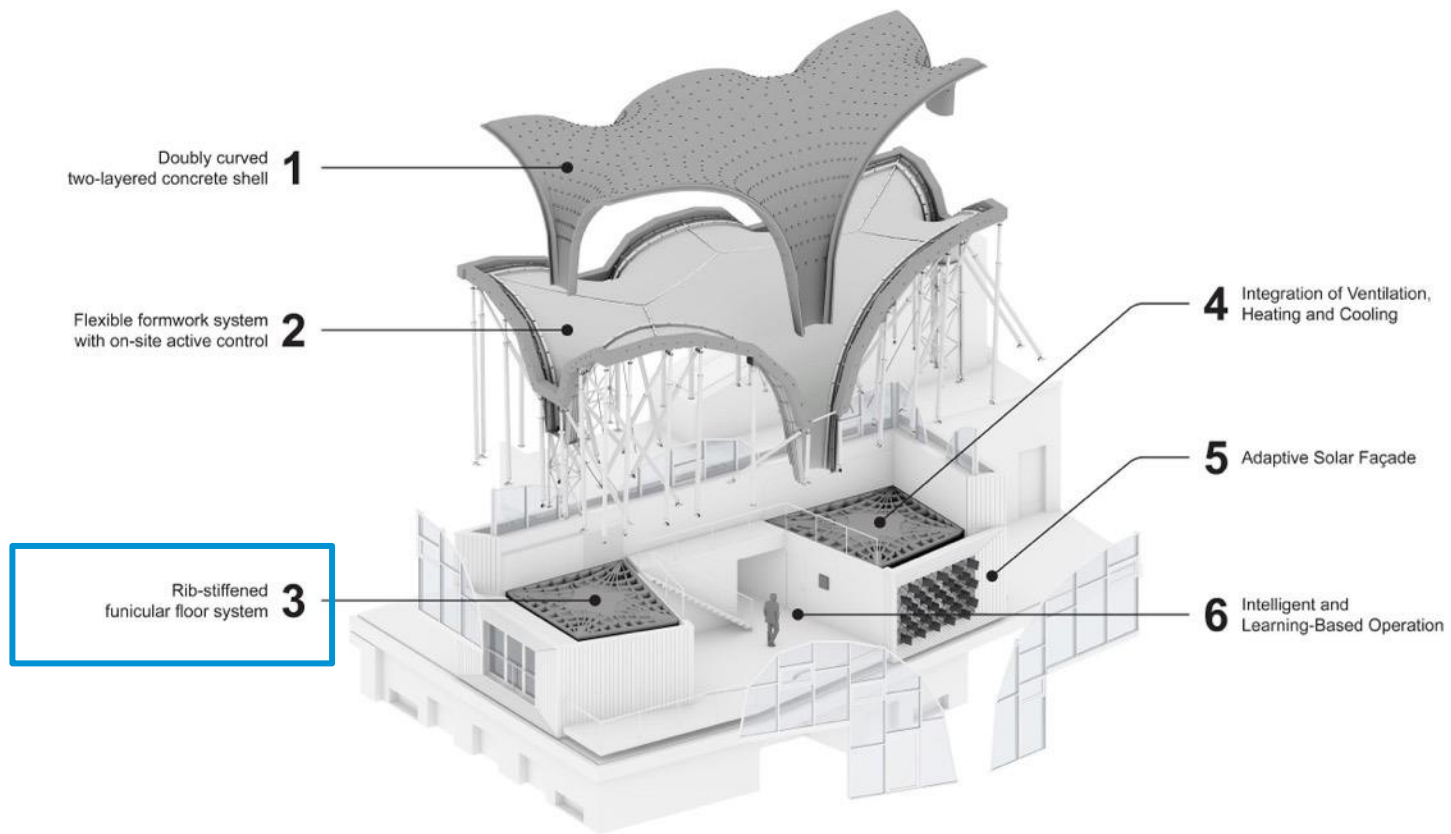
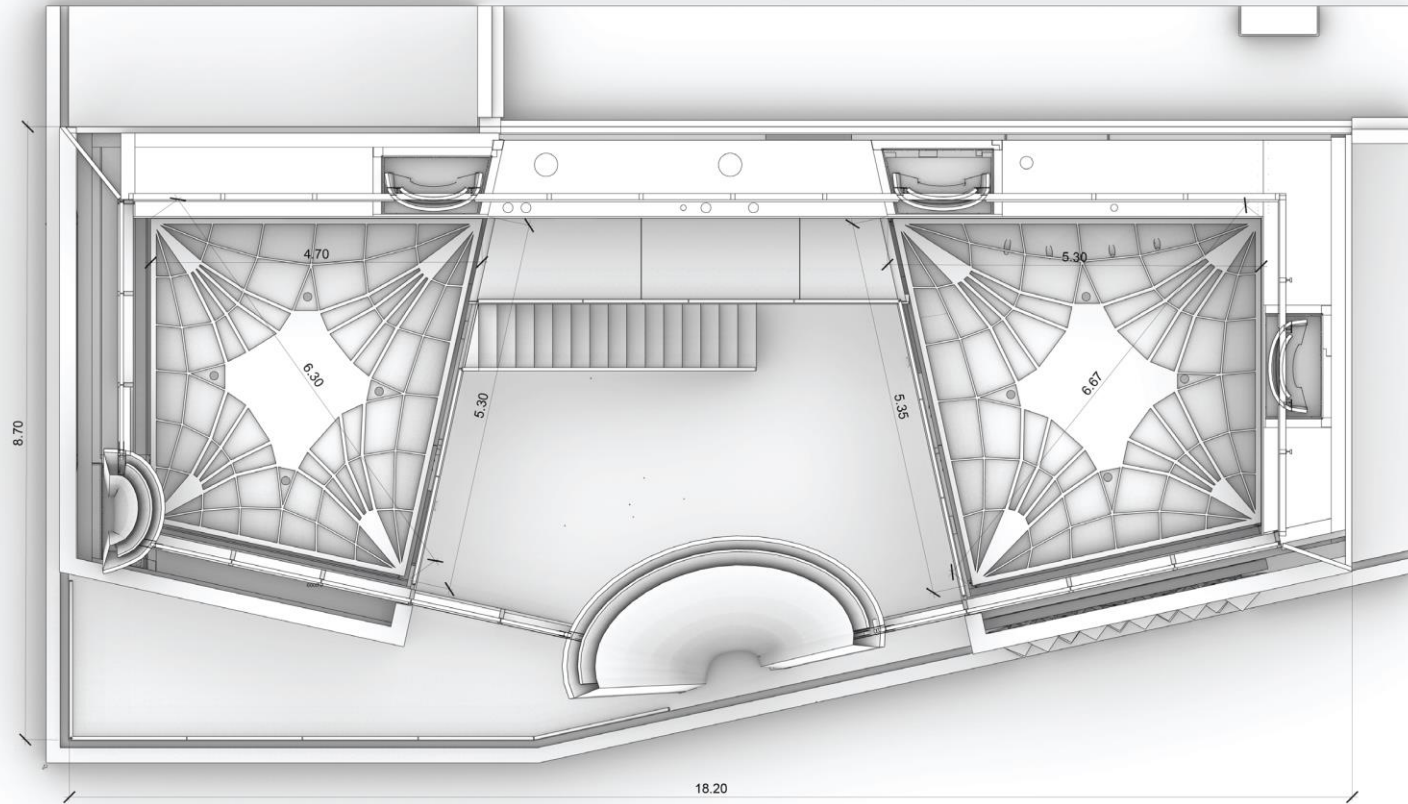
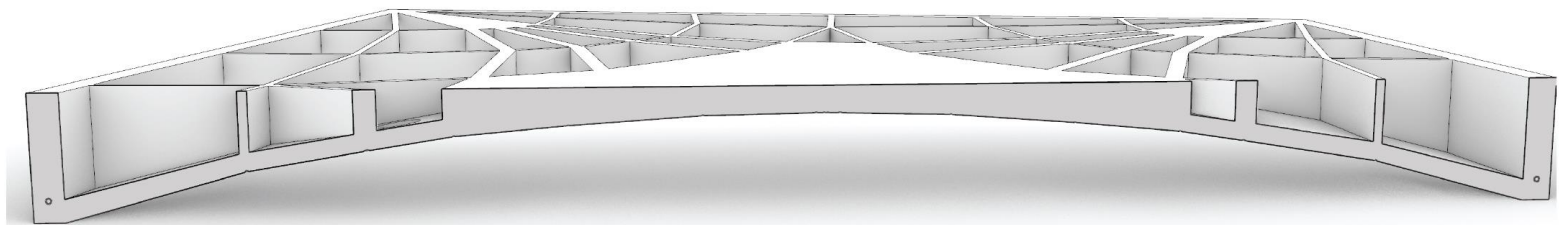




Photo: Roman Keller







3cm



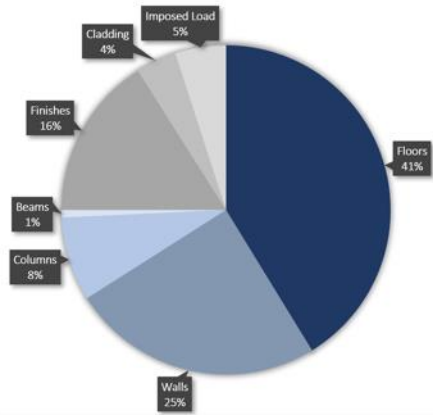


Sha Tin
沙田
6

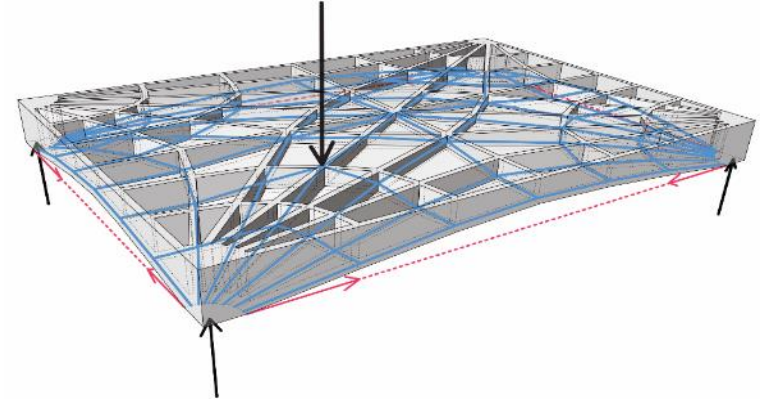
Tsim Sha Tsui & Hong Kong
尖沙咀及香港
3 52B



GET IN LANE
選定
行車綫



> 40%



-60% concrete
-80% steel



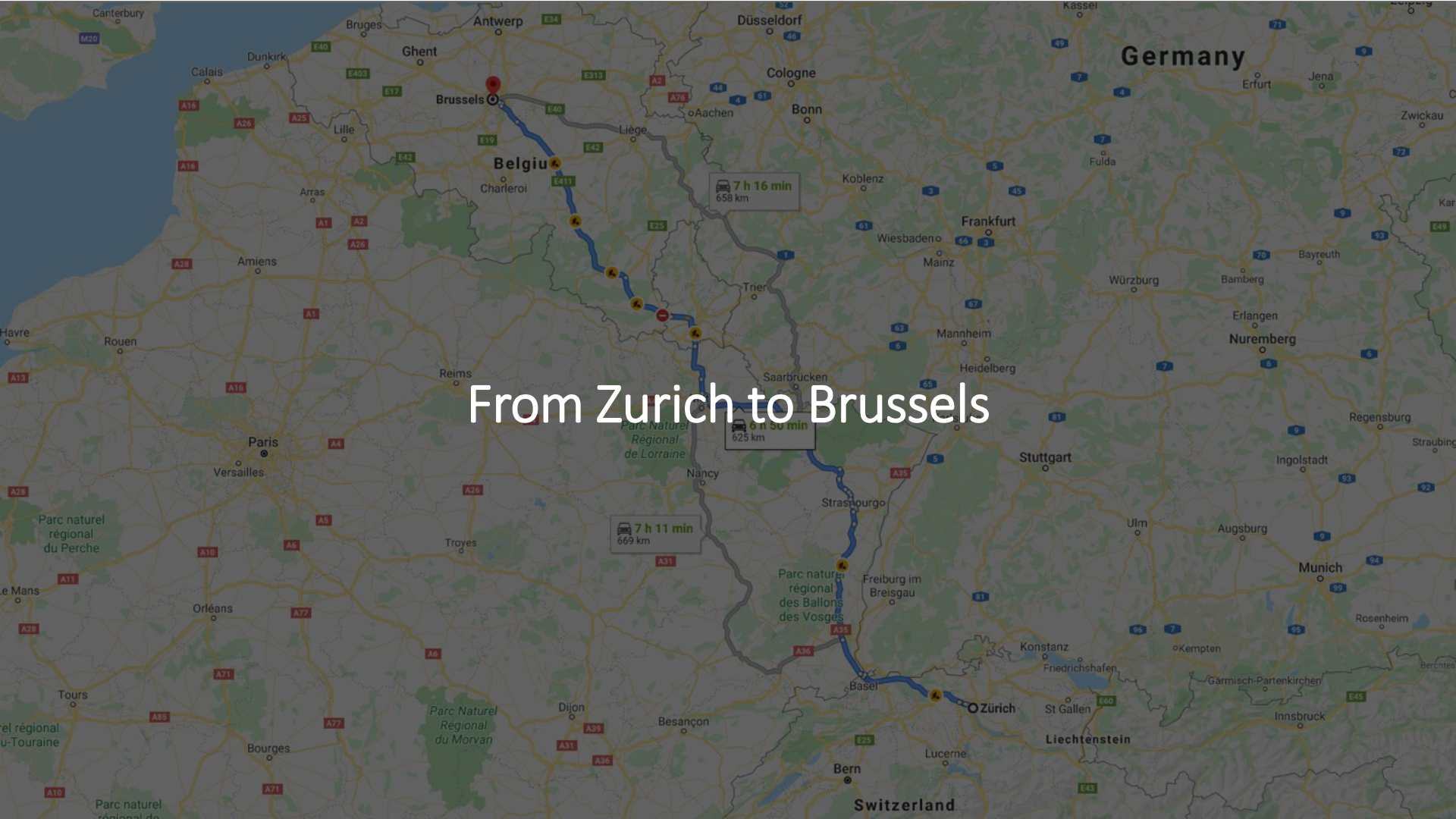
7500 cubic metres



1208



20 km per storey



From Zurich to Brussels

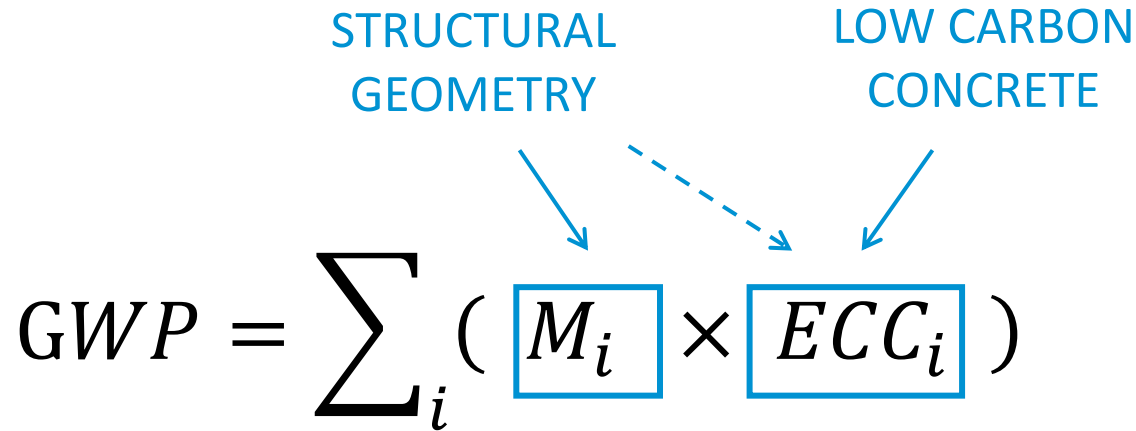
7 h 11 min
669 km

6 h 50 min
625 km

7 h 16 min
658 km

STRUCTURAL GEOMETRY

LOW CARBON CONCRETE

$$GWP = \sum_i (M_i \times ECC_i)$$


GWP = global warming potential (kgCO₂e/m²)

M = mass (kg/m²)

ECC = embodied carbon coefficient (kgCO₂e/kg)

STRENGTH THROUGH GEOMETRY

X

LOW-CARBON MATERIAL



Less mass ¹

- 60%



Lower stresses ²

- 20%



Less clinker ³

- 67%



- 90%

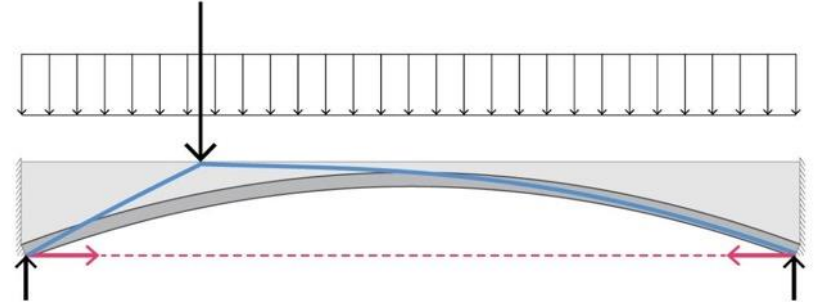
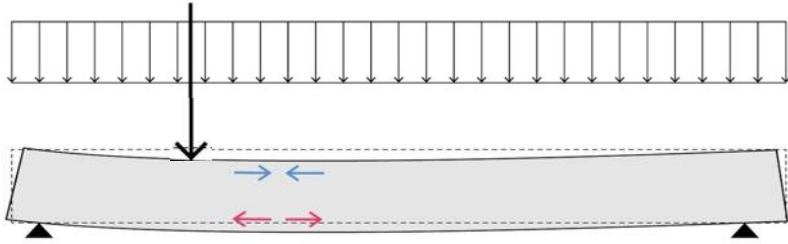


- 80%

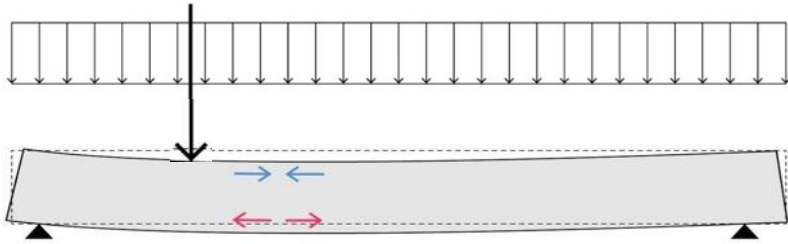
¹ Compared to RC floor slab

² C30/37 → C16/20

³ CEM I /OPC → CEM III+

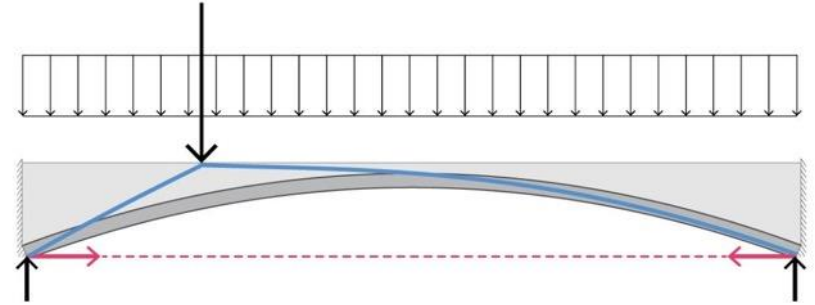


-85% GWP



50% GWP

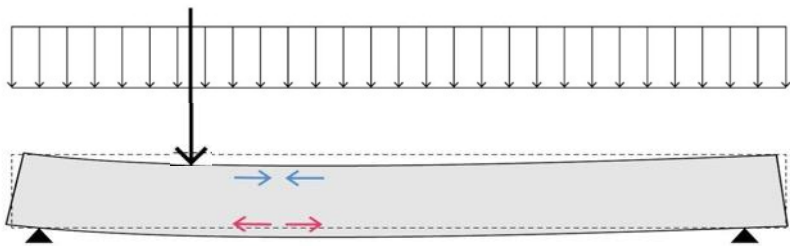
100% M



20

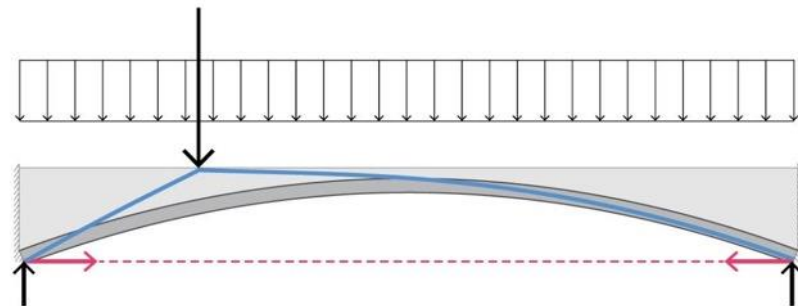
~~**15% GWP**~~

33% M



50% GWP

100% M



15% GWP

33% M

\$\$\$

CIRCULAR CONSTRUCTION



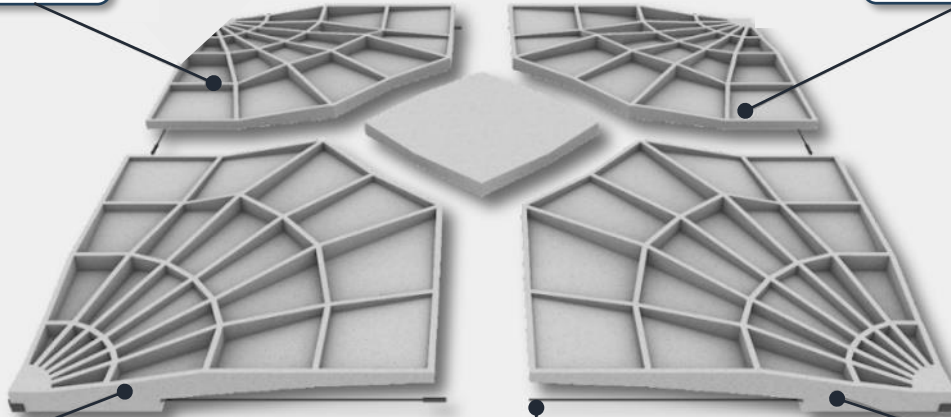
Photo: Juney Lee

The image shows a close-up, top-down view of a dark grey or black floor system. The surface is covered in a repeating, interlocking pattern of raised, rounded rectangular shapes. Each shape has a central, slightly recessed area, creating a textured, cellular appearance. The lighting is even, highlighting the three-dimensional quality of the raised ridges.

Rippmann Floor System

Prefabricated
=
Fast & safe

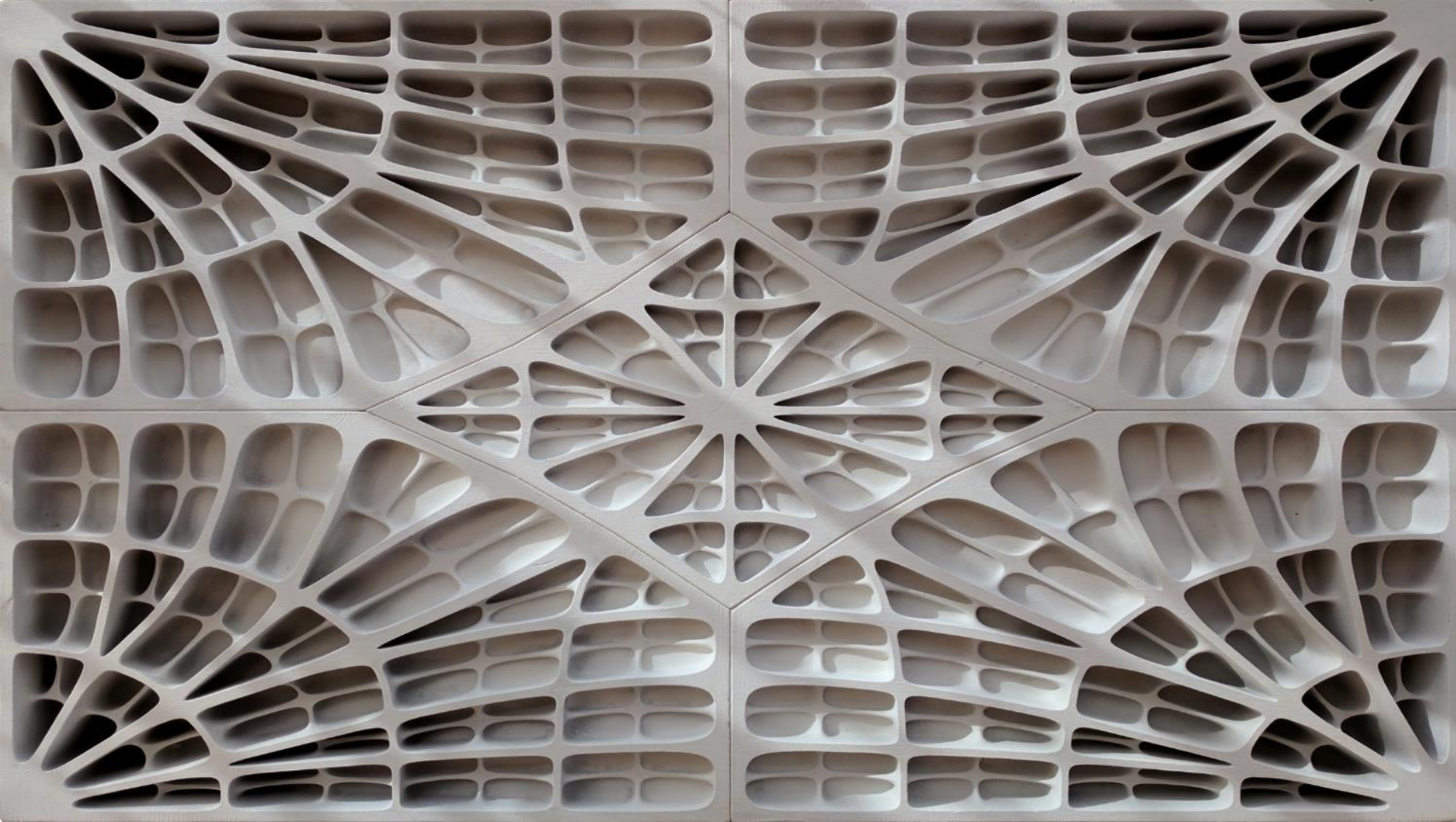
Dry-assembled
=
Easy deconstruction



Low strength
=
Low-carbon concrete

Material separation
=
Low-carbon concrete

Fully unreinforced
=
Durability



VAULTED

<https://vaulted-floors.com/>

Spin-off | **ETH** zürich









aluxbeams

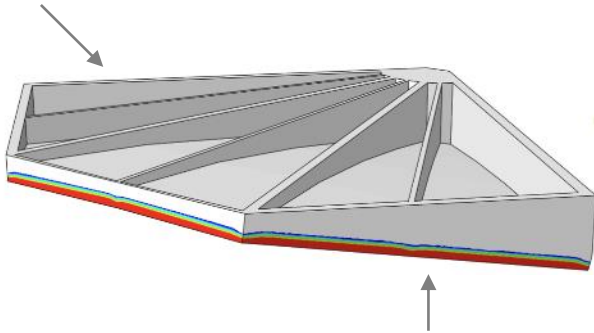
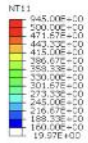
LANDIS & BAU





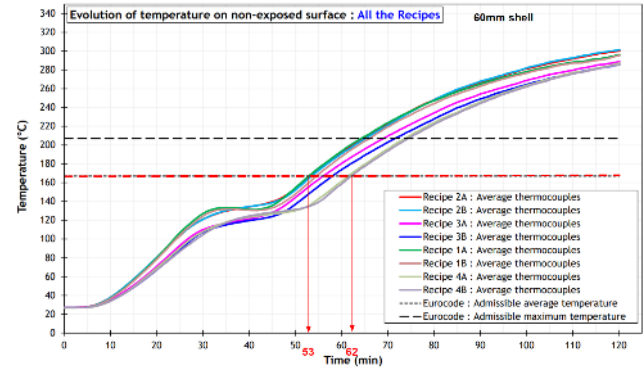
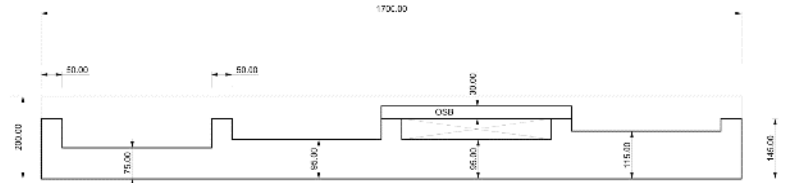
Fire safety

Load bearing
(R)

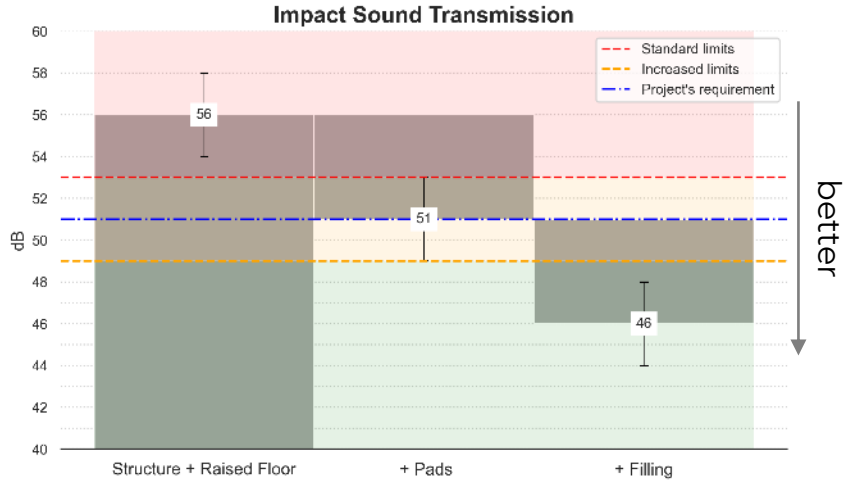
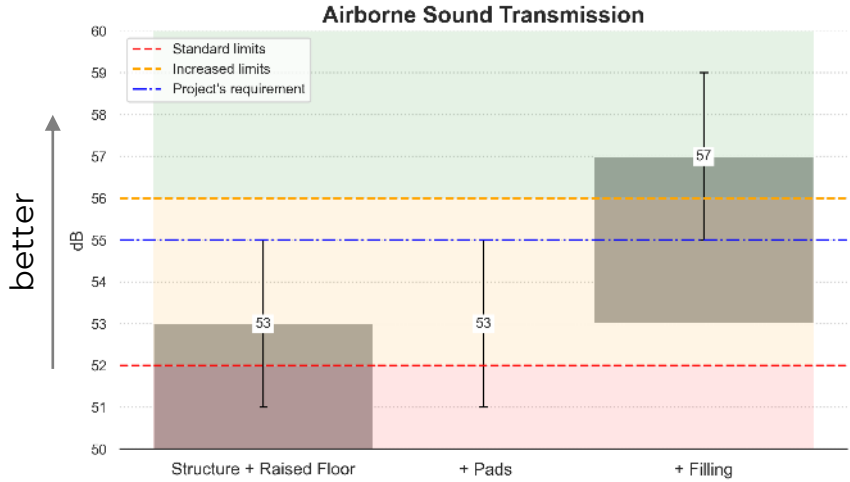


Separation
(E)

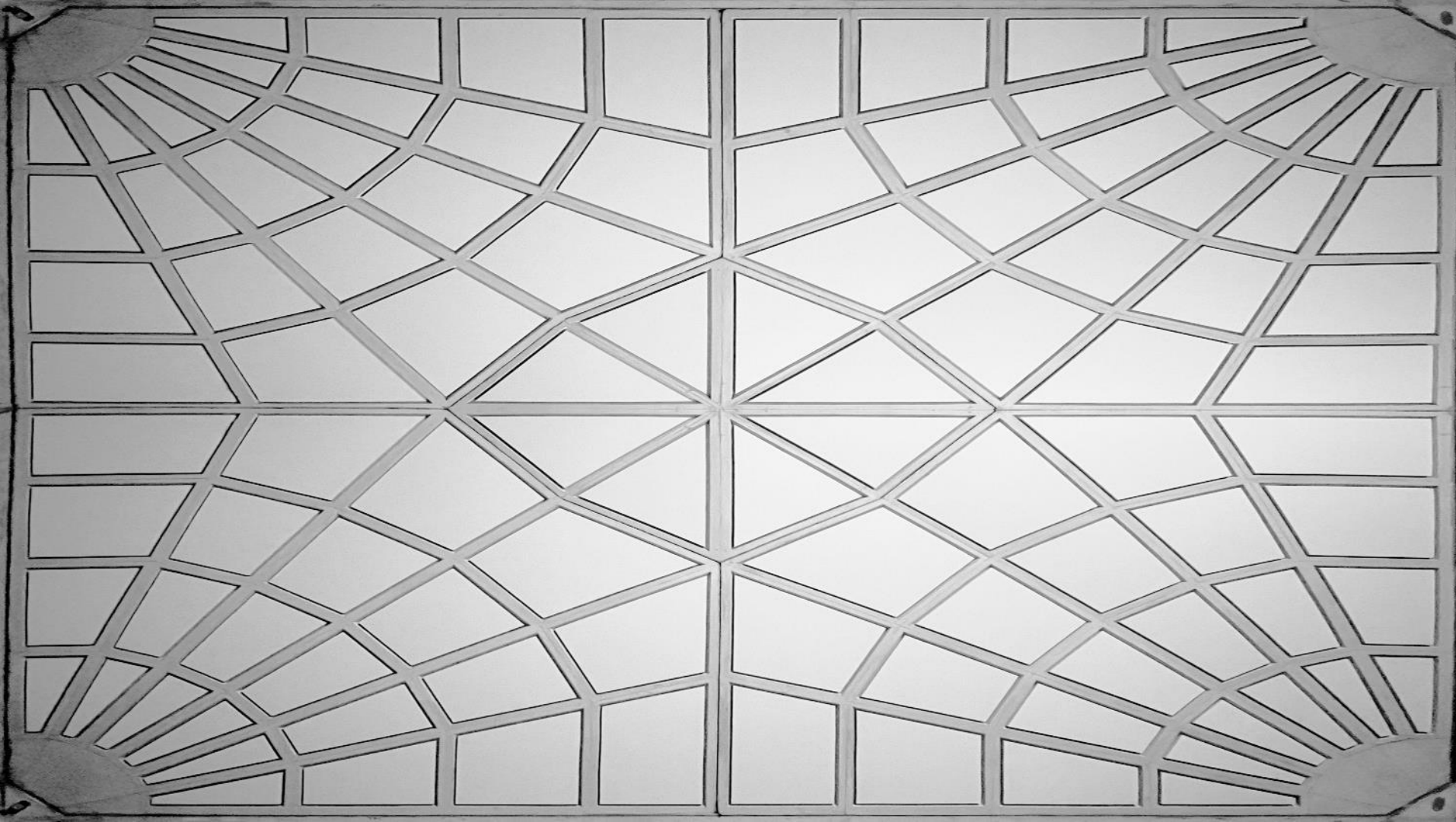
Insulation
(I)



Acoustic performance











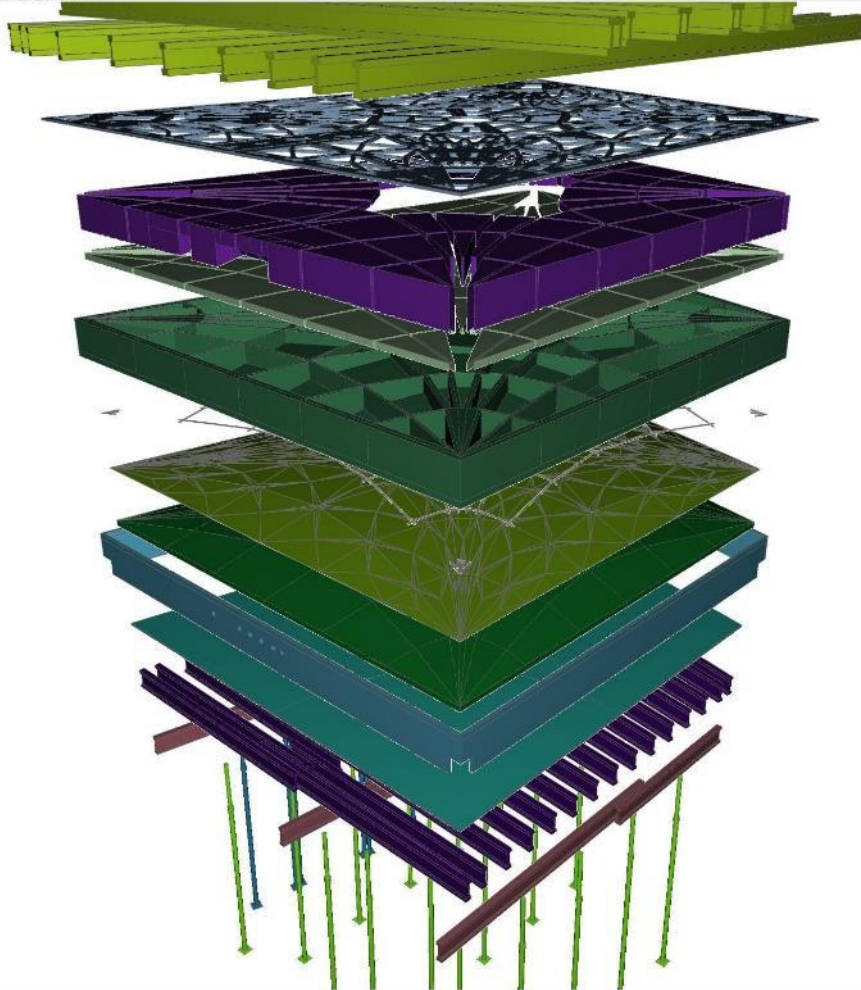
C O M P A S

<https://compas.dev/>

```
for k in range(1, len(mesh.vertices)):
    mesh.vertices[k] = mesh.vertices[k] + d * (c[0] - p[0])
    mesh.vertices[k] = mesh.vertices[k] + d * (c[1] - p[1])
    mesh.vertices[k] = mesh.vertices[k] + d * (c[2] - p[2])

if callback:
    callback(mesh, k, callback_arg)

def smooth_mesh_length(mesh, lmin, lmax, f):
    if callback:
        if not callable(callback):
            raise Exception('Callback is not callable')
    fixed = fixed or []
    fixed = not(fixed)
```



Spatial Structure

- √ Default Project (IfcProject)
- √ Default Site (IfcSite)
- √ Default Building (IfcBuilding)
 - √ Default Storey (IfcBuildingStorey)
 - RFS (IfcSlab)
 - platform (IfcBuildingElementProxy)
 - H2O_upper (IfcBeam)
 - indents (IfcBuildingElementProxy)
 - side_boards (IfcWall)
 - foam_top (IfcBuildingElementProxy)
 - foam (IfcBuildingElementProxy)
 - H2O_lower (IfcBeam)
 - props_top (IfcColumn)
 - steel_top (IfcBeam)
 - foam_bottom (IfcBuildingElementProxy)
 - lid_top (IfcBuildingElementProxy)
 - beta (IfcBuildingElementProxy)
 - props_bottom (IfcColumn)

Info

Attributes Properties

name	value
GlobalId	3DMsVq1Y98PecG3T98OMBQ
OwnerHistory	None
Name	RFS
Description	None
ObjectType	None
ObjectPlacement	None
Representation	None
Tag	None
PredefinedType	None

Explode

scale 55

> 40%

Sha Tin
沙田

Tsim Sha Tsui & Hong Kong
尖沙咀及香港



GET IN
LANE
選定
行車綫



Structural geometry

>

Reduction mass

Funicular form

>

Reduction emission

Digital fabrication

>

Reduction waste

Discrete masonry

>

Circular construction

Integrated AEFC approach

>

Economy & Productivity



<https://block.arch.ethz.ch>

<https://vaulted-floors.com>

<https://compas.dev>



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