COUNTING CARBON - THE CIRCULAR WAY

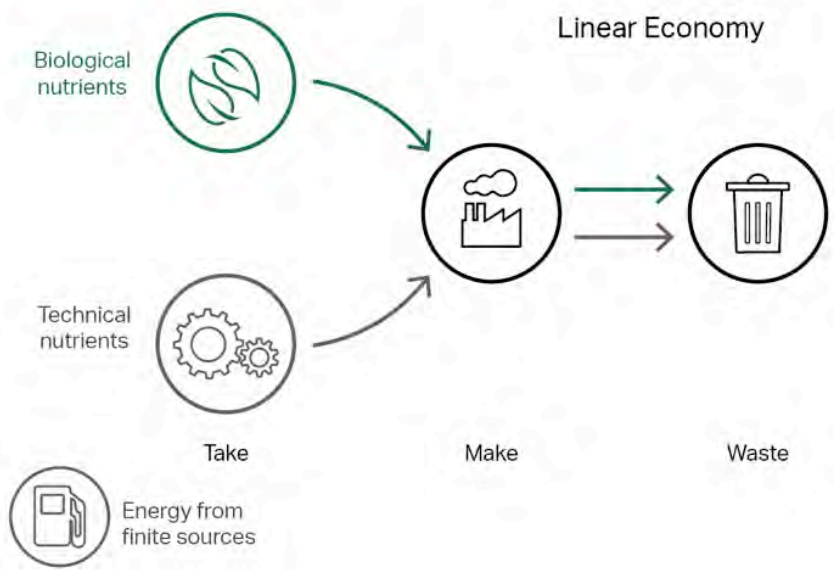
Kasper Guldager Jensen, kgj@3xn.dk, www.3xn.dk, +45 6120 1784

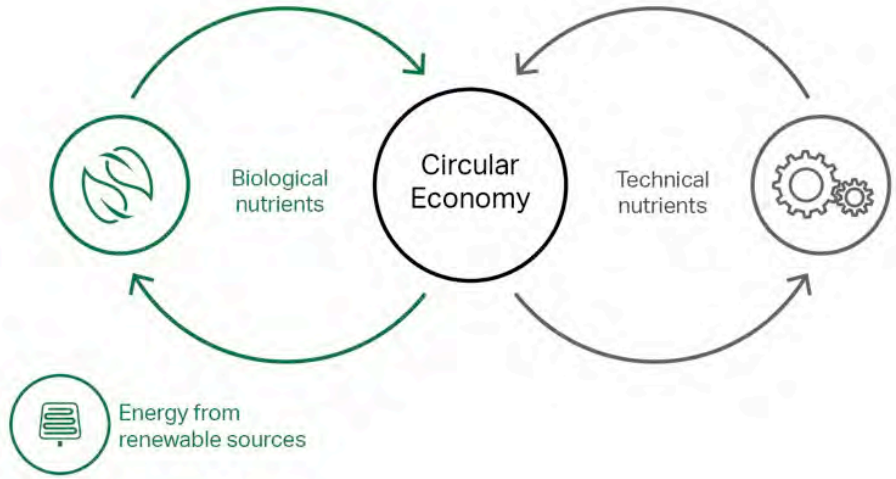
89%

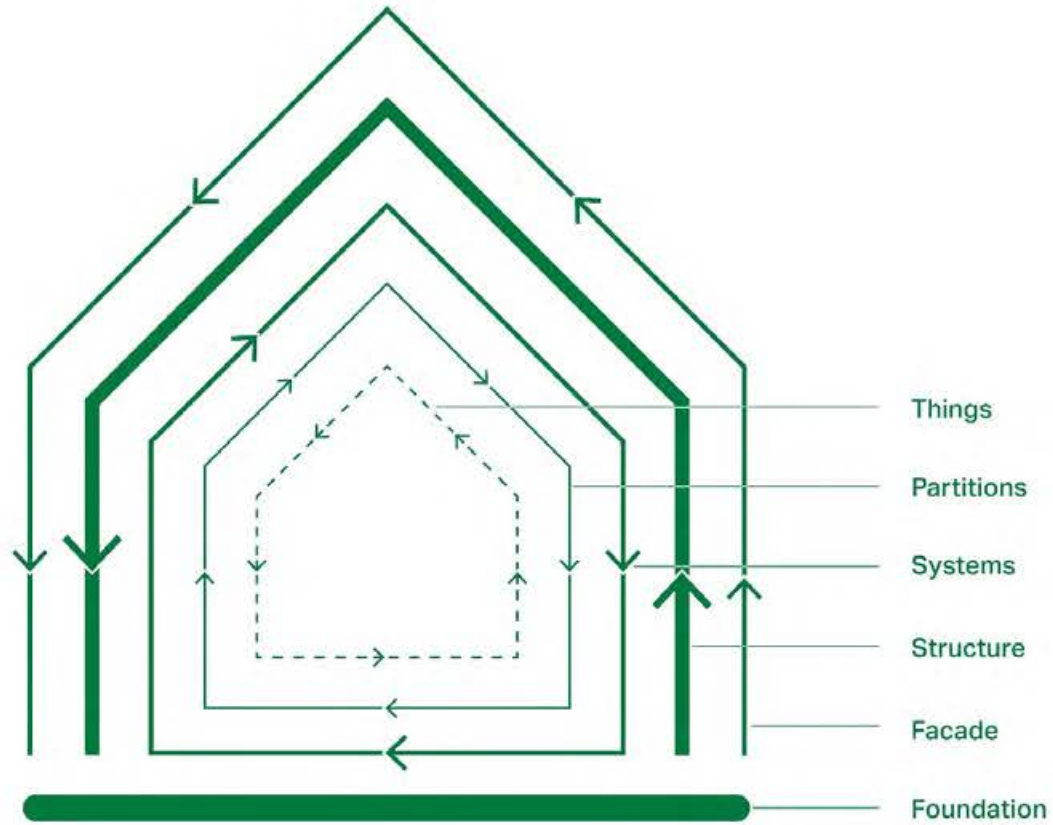

WERNER
5416T

Building a Circular Future

2%


Linear Economy
Biological nutrients
Technical nutrients
Take
Make
Waste
Energy from finite sources


Biological nutrients
Circular Economy
Technical nutrients
Energy from renewable sources


Things
Partitions
Systems
Structure
Facade
Foundation

A Building Practice with immediate and short term gains

improved flexibility

faster construction

optimized operation

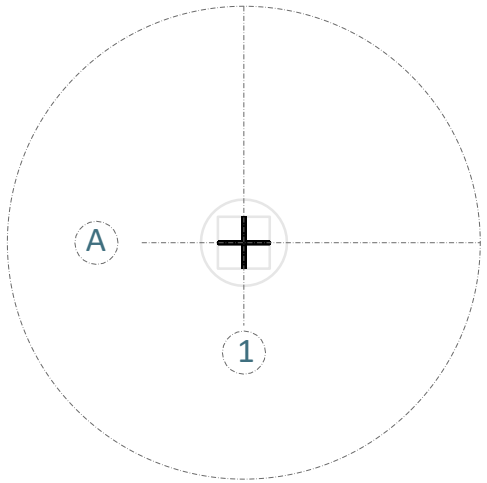
Implementation of the circular principles, not only result in long term benefits.
Positive side effects from low hanging fruits creates a better building here and now.

THE CIRCULAR ECONOMY IS ABOUT THE ECONOMY

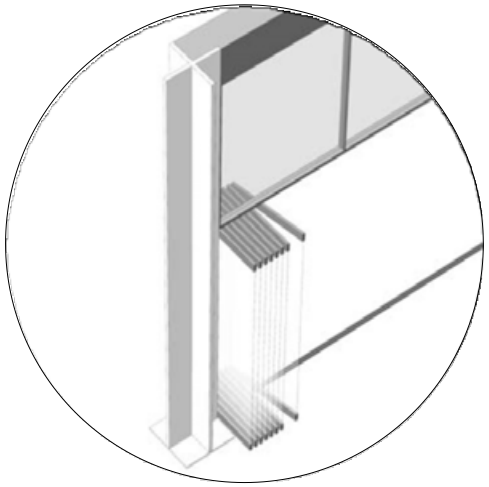

DNEY FISH MARKET

Modular Concepts

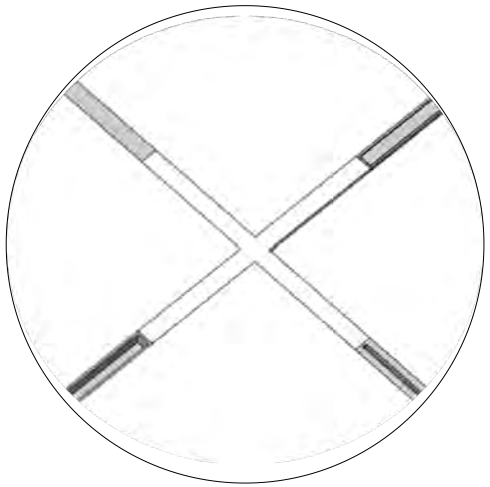
Modular features intersecting with structural column



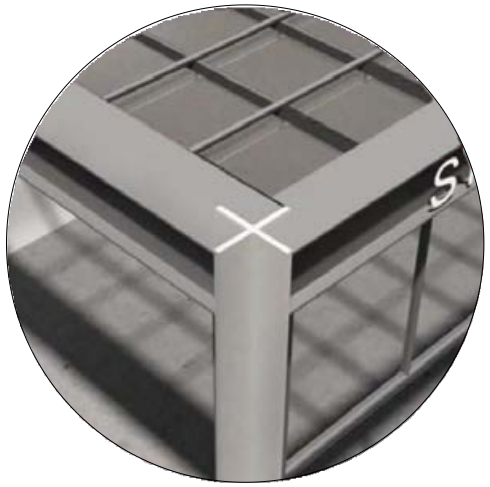
PLAN RELATIONSHIP TO GRID



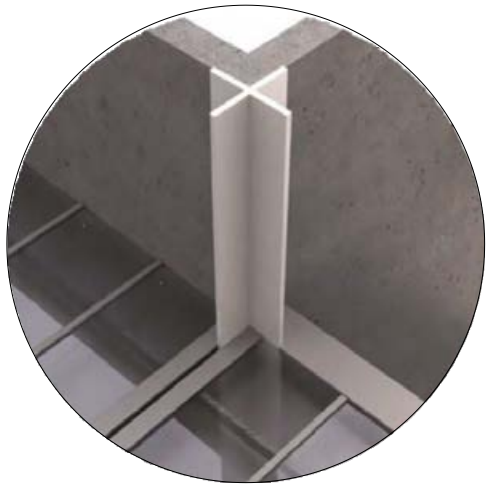
FACADE TO COLUMN CONNECTION



FLOOR WITH MULTIPLE CHANNEL TYPES

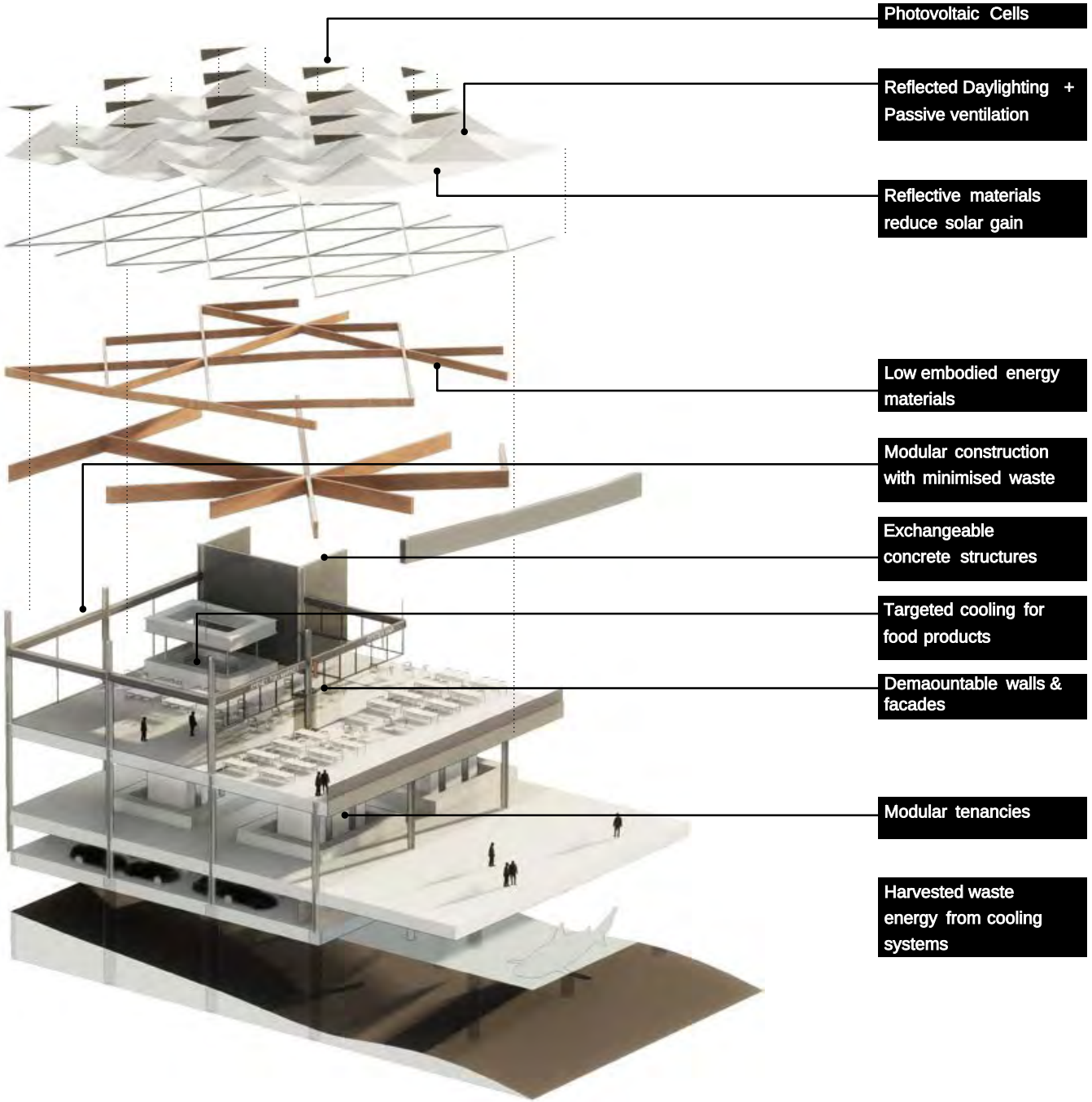


COLUMN TO SIGNAGE BEAMS & GLASS CEILING

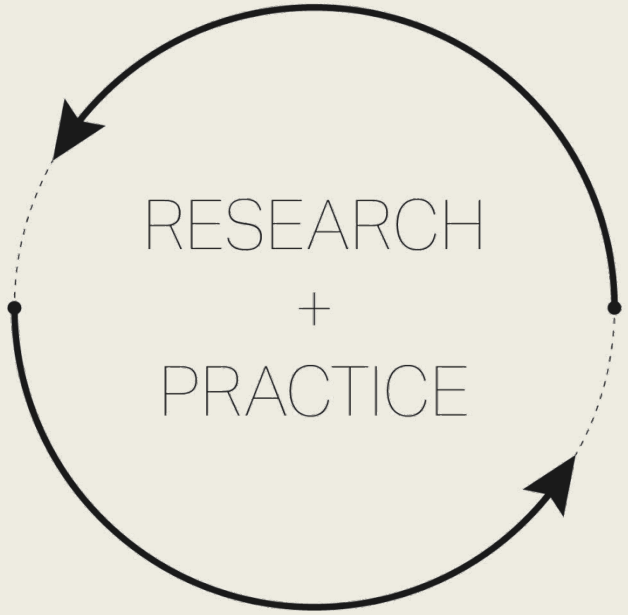


CORE TO COLUMN & ROOF CONNECTION

COLUMNS WITH INTEGRATED PROFILES FOR ROLLERS


Photovoltaic Cells
Reflected Daylighting + Passive ventilation
Reflective materials reduce solar gain
Low embodied energy materials
Modular construction with minimised waste
Exchangeable concrete structures
Targeted cooling for food products
Demaountable walls & facades
Modular tenancies
Harvested waste energy from cooling systems

3XN
architects

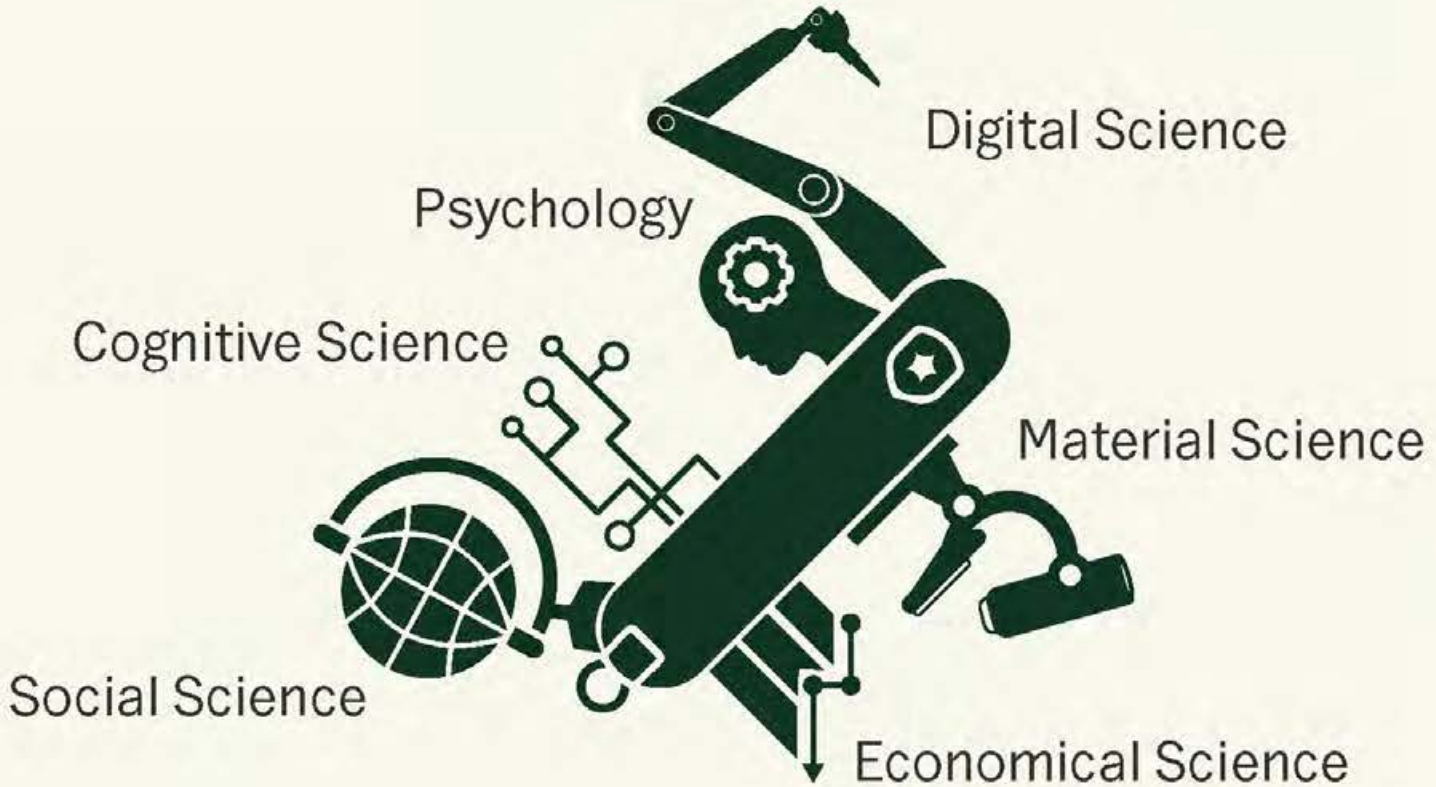


GXN
innovation


3XN architects GXN innovation. Copenhagen. Stockholm. London. New York. Sydney.
3XN

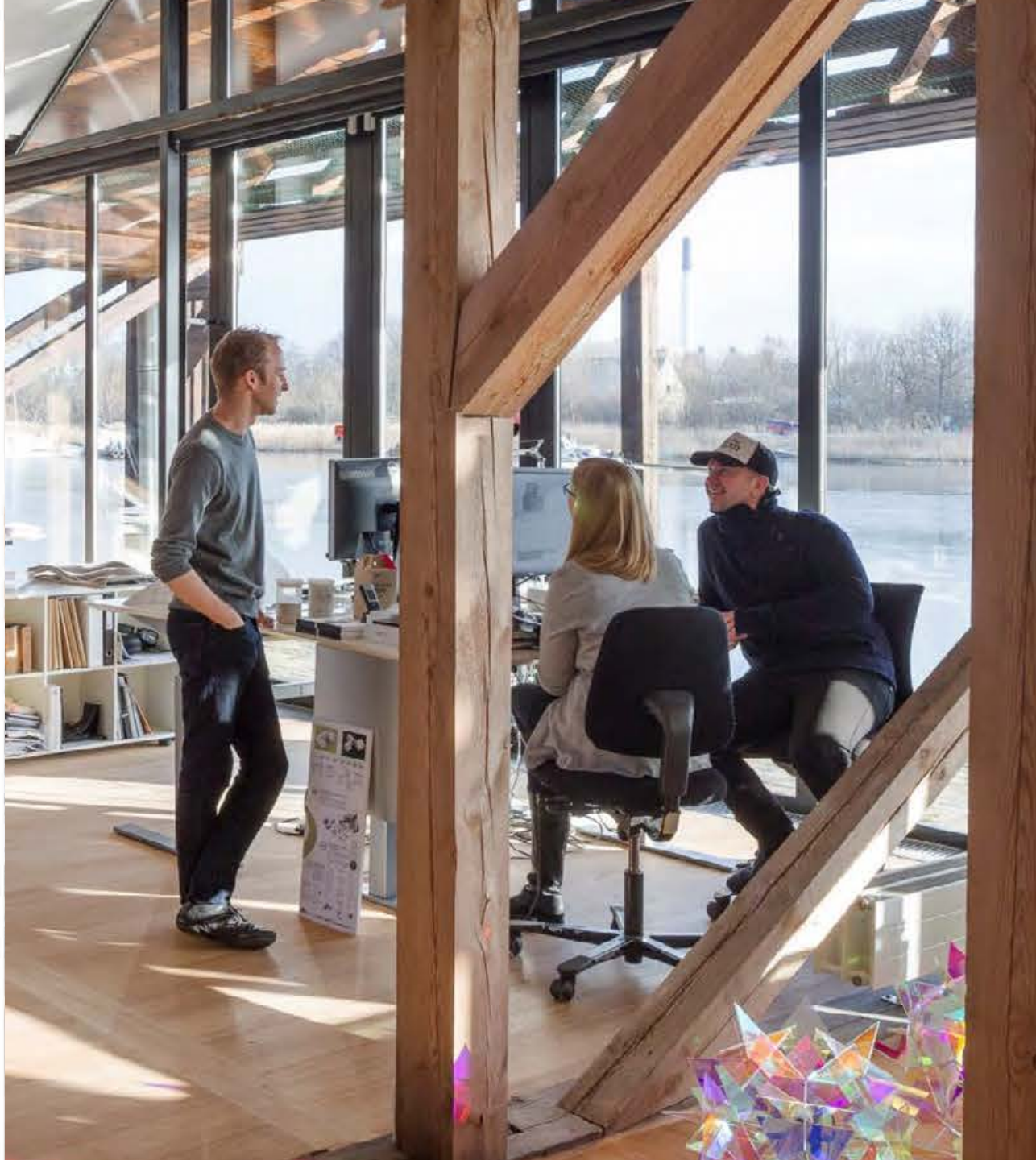

RESEARCH
PROJECT DESIGN
COMPETITION

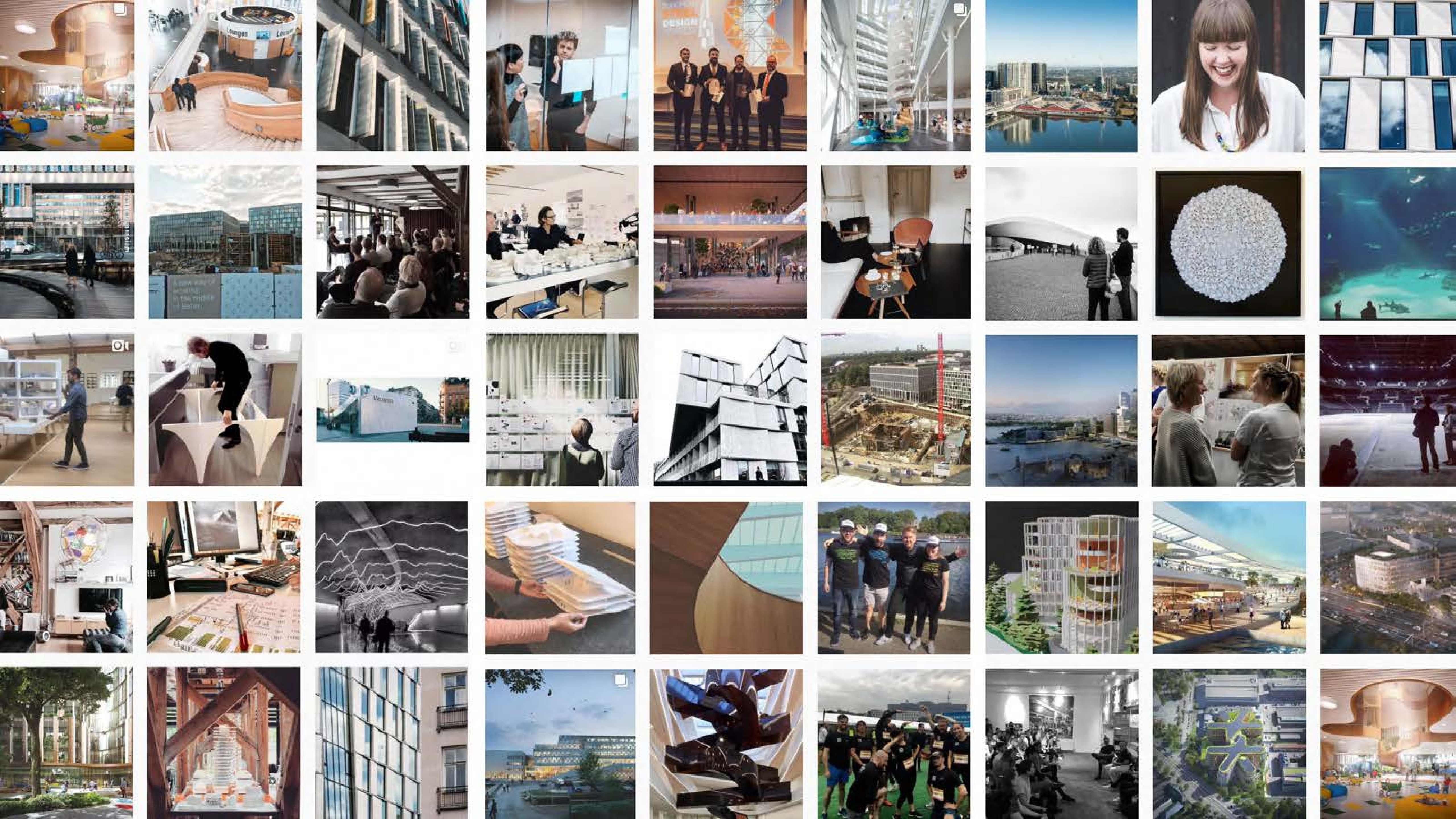
We take research into practice.*



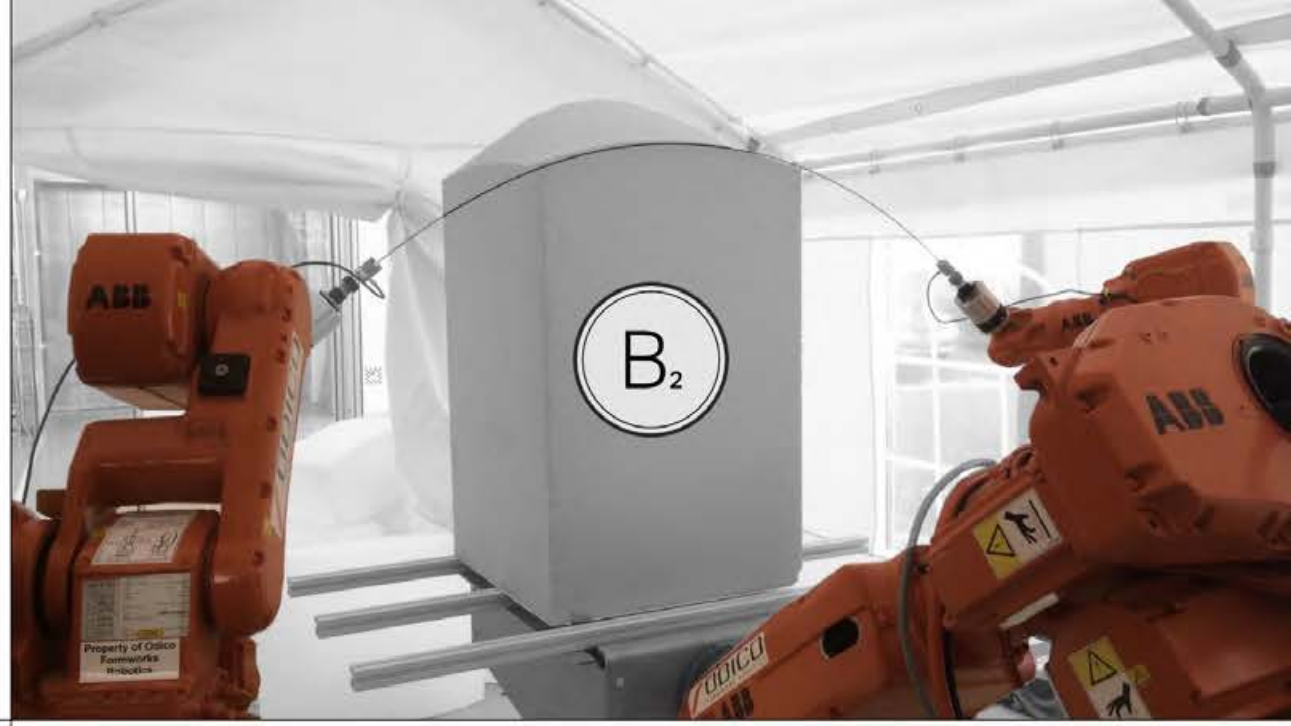
* 20 researchers and 100+ innovation projects in GXN.

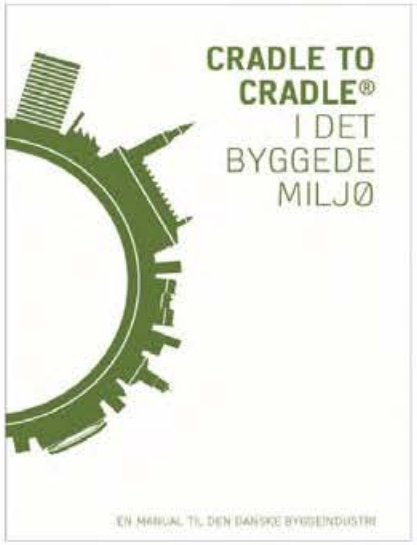
ANTHROPOLOGIST
ARCHITECTS
BIOLOGIST
BUSINESS DEVELOPERS
COMPUTATIONAL DESIGNERS
ENGINEERS
GRAPHIC DESIGNERS
INTERIOR ARCHITECTS
MODEL BUILDERS
PSYCHOLOGIST
URBAN PLANNERS




Loungen

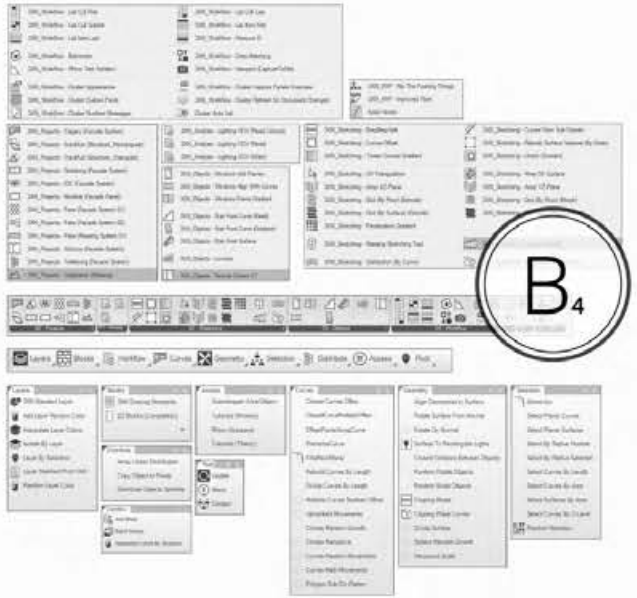

B1

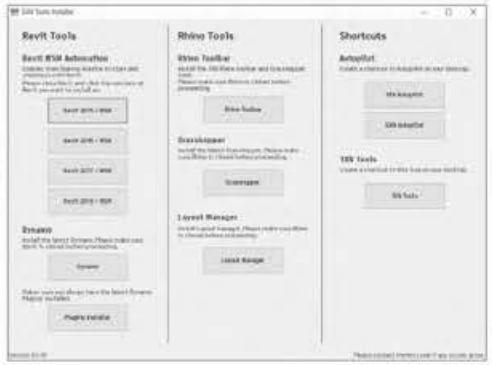

B2
ABB
Property of Oisco Formworks
ABB


CRADLE TO CRADLE®
I DET BYGGEDE MILJØ
EN MANUAL TIL DEN DANSKE BYGGEINDUSTRI


B3
From materials to new architecture


Building a Circular Future

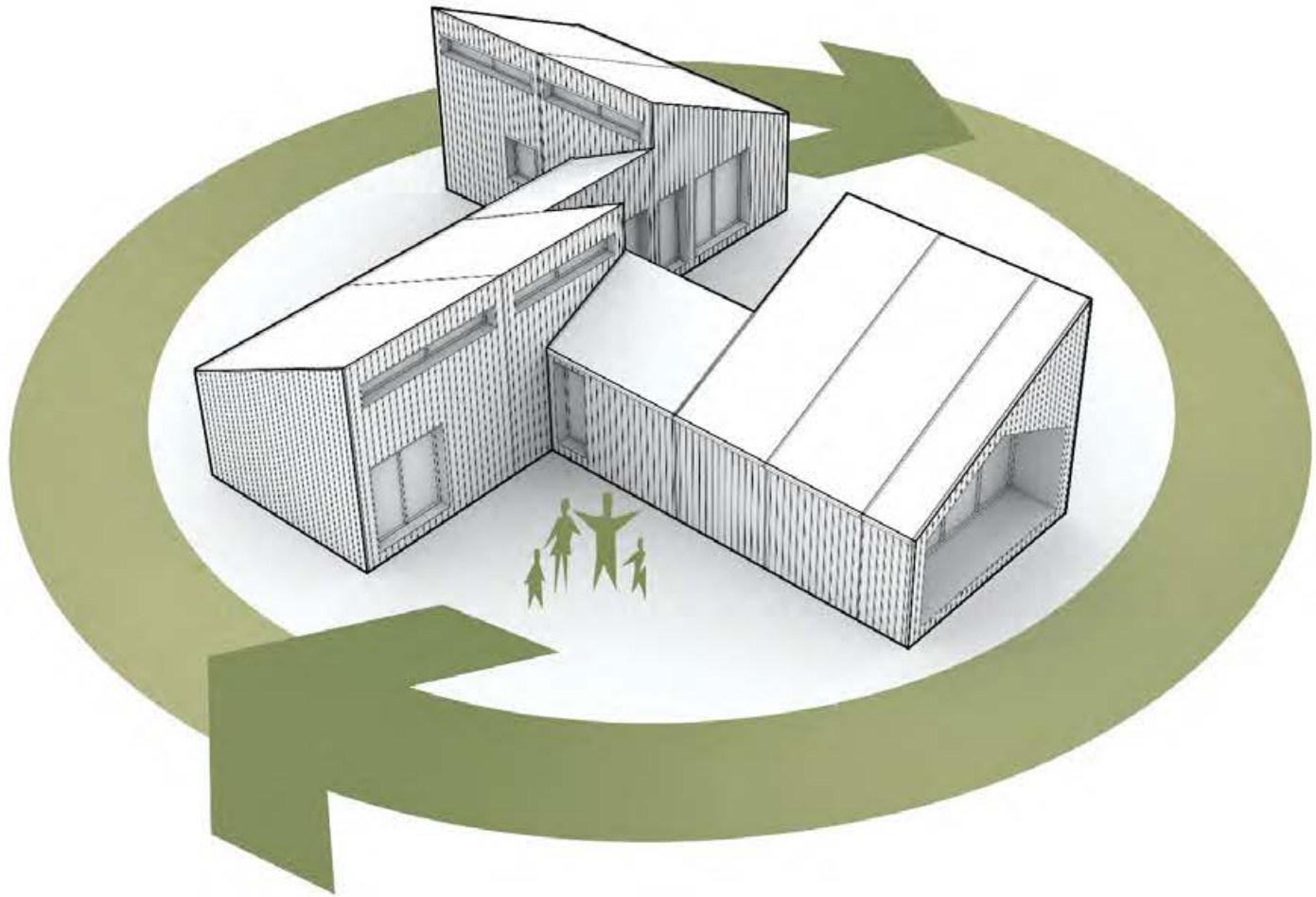

B4

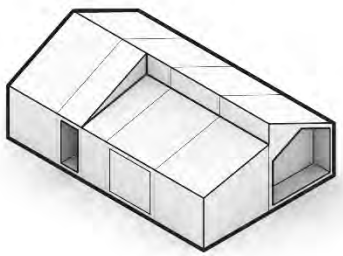

Revit Tools
Rhino Tools
Shortcuts
Dynamo
Layout Manager

WHAT IF WE CAN BUILD TOMORROW WITH THE WASTE OF TODAY?

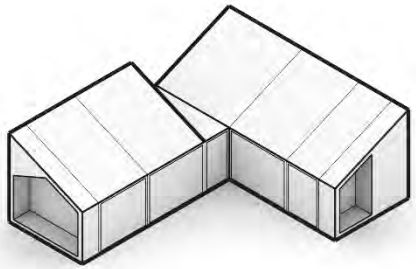

FENDT
6335
FENDT


EENTILEEN
GXN
NCC
Deloitte.
TEKNOLOGISK INSTITUT

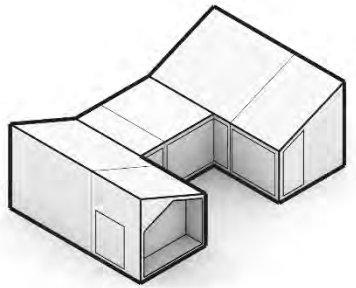




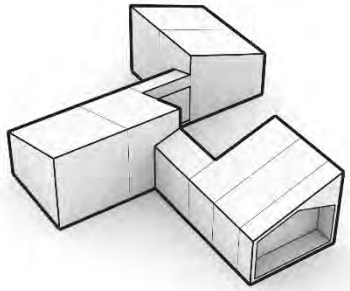
K | Kompakt | **120m²**



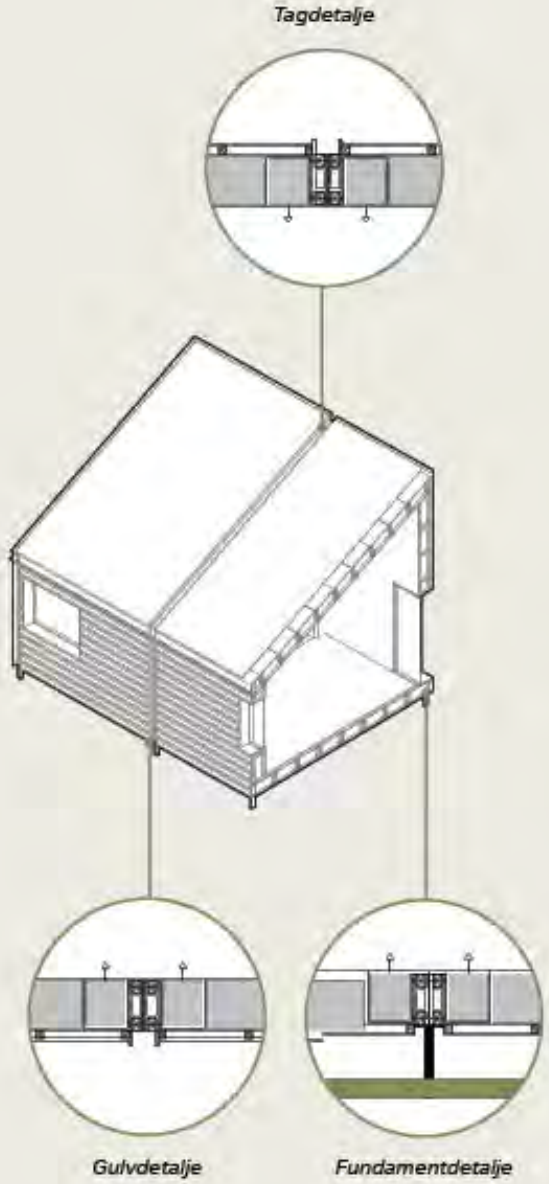
V | Vinkel | **109m²**



U | Gårdhavehus | **118m²**



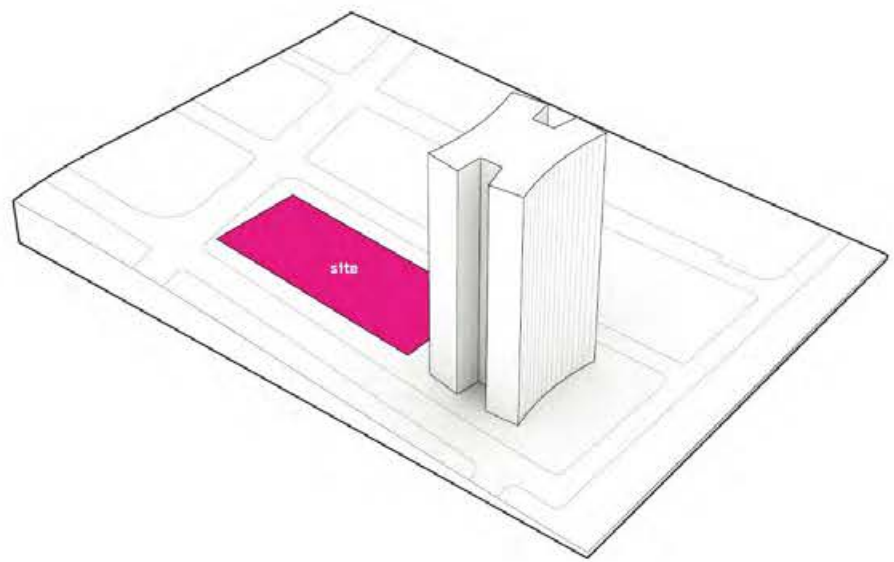
X | Åben Form | **137m²**

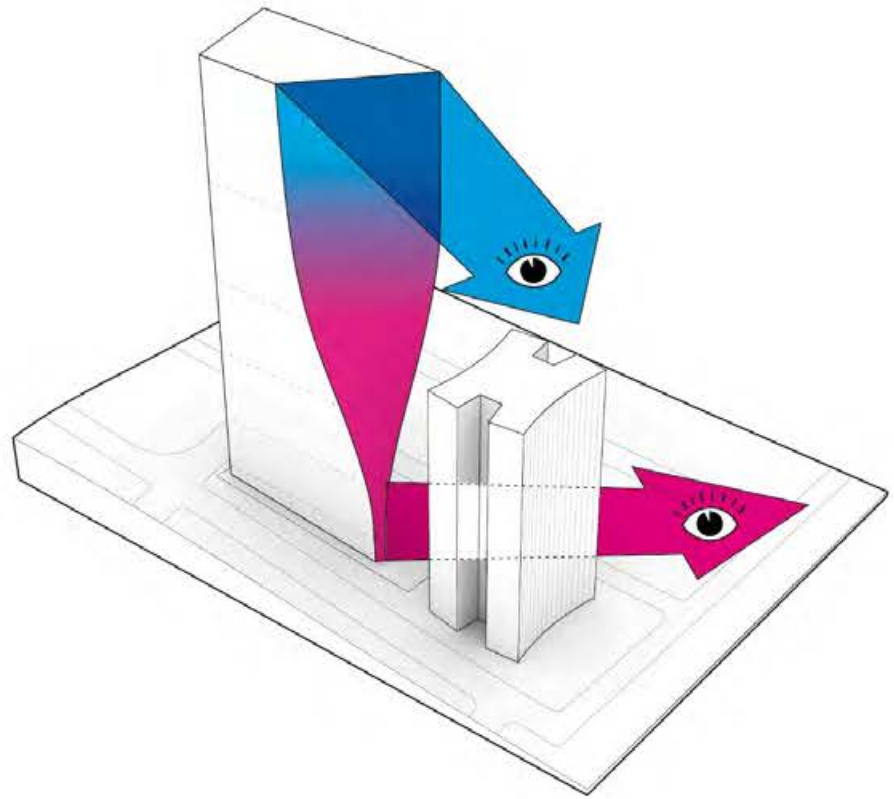

Tagdetalje
Gulvdetalje
Fundamentdetalje

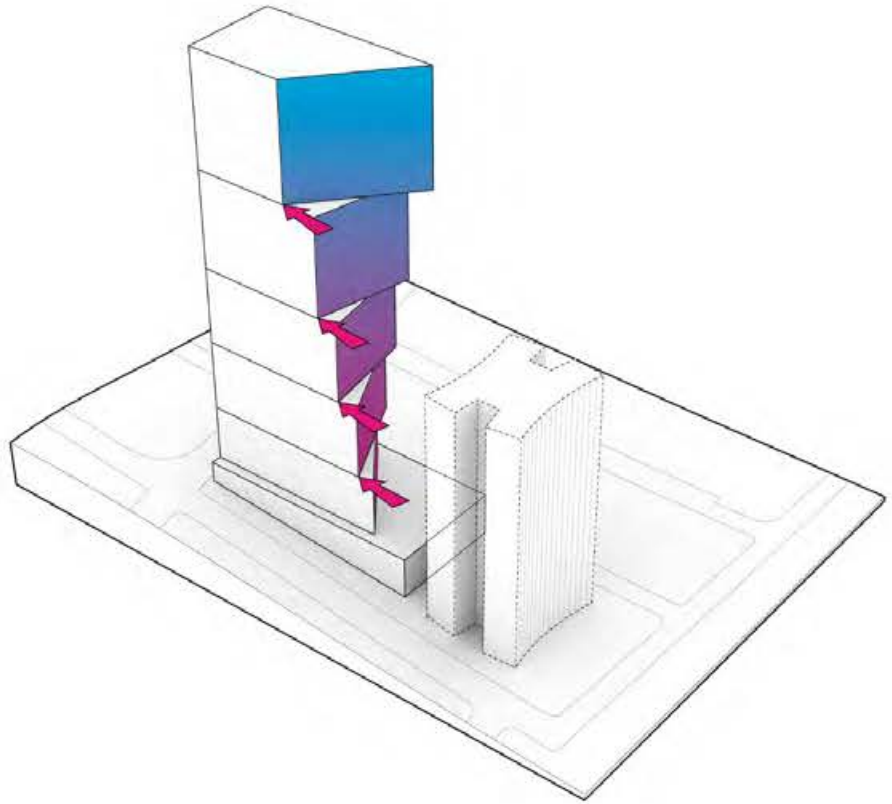
WHAT IF WE CAN CREATE CIRCULAR CITIES WITH URBAN MINING?

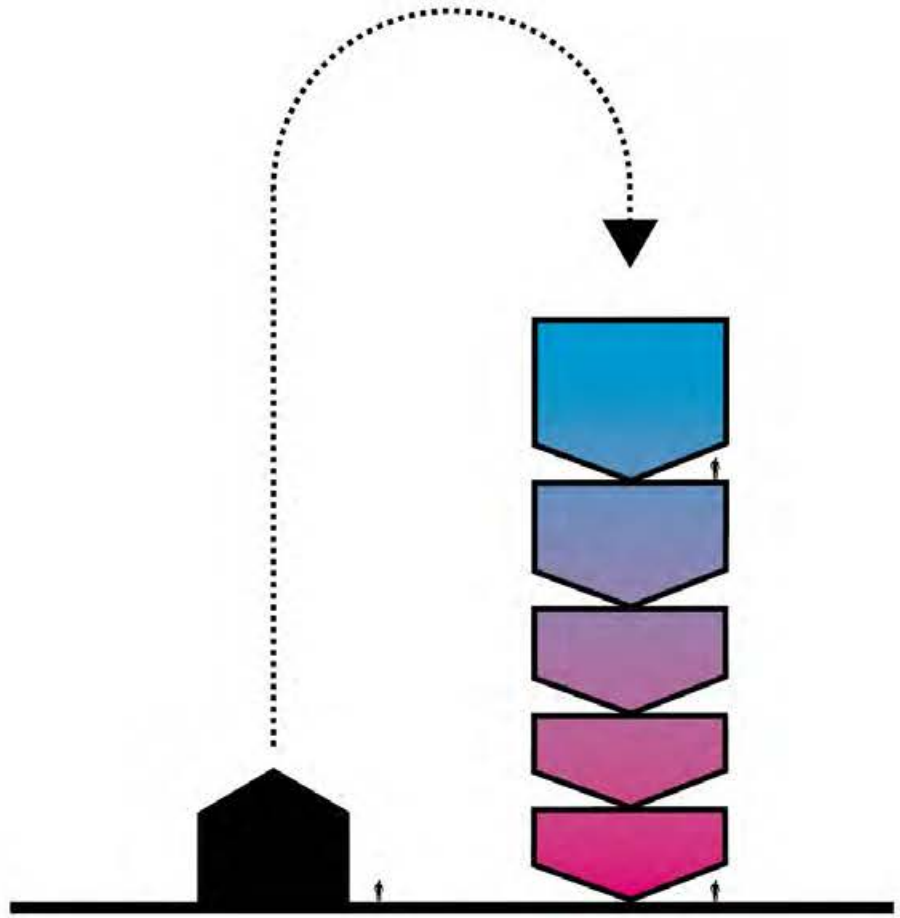

AMP
AMP


AMP

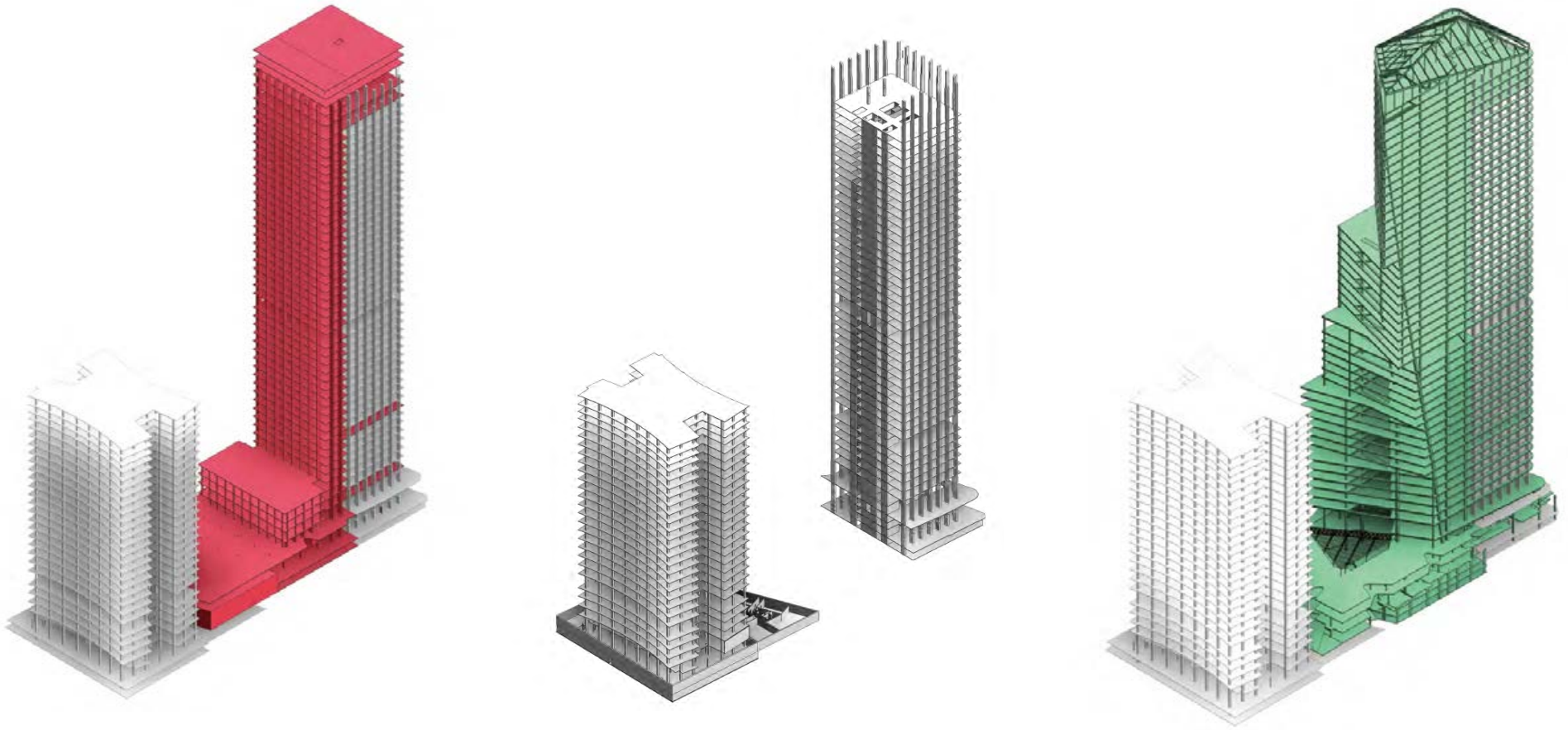

site







Human scale + City scale

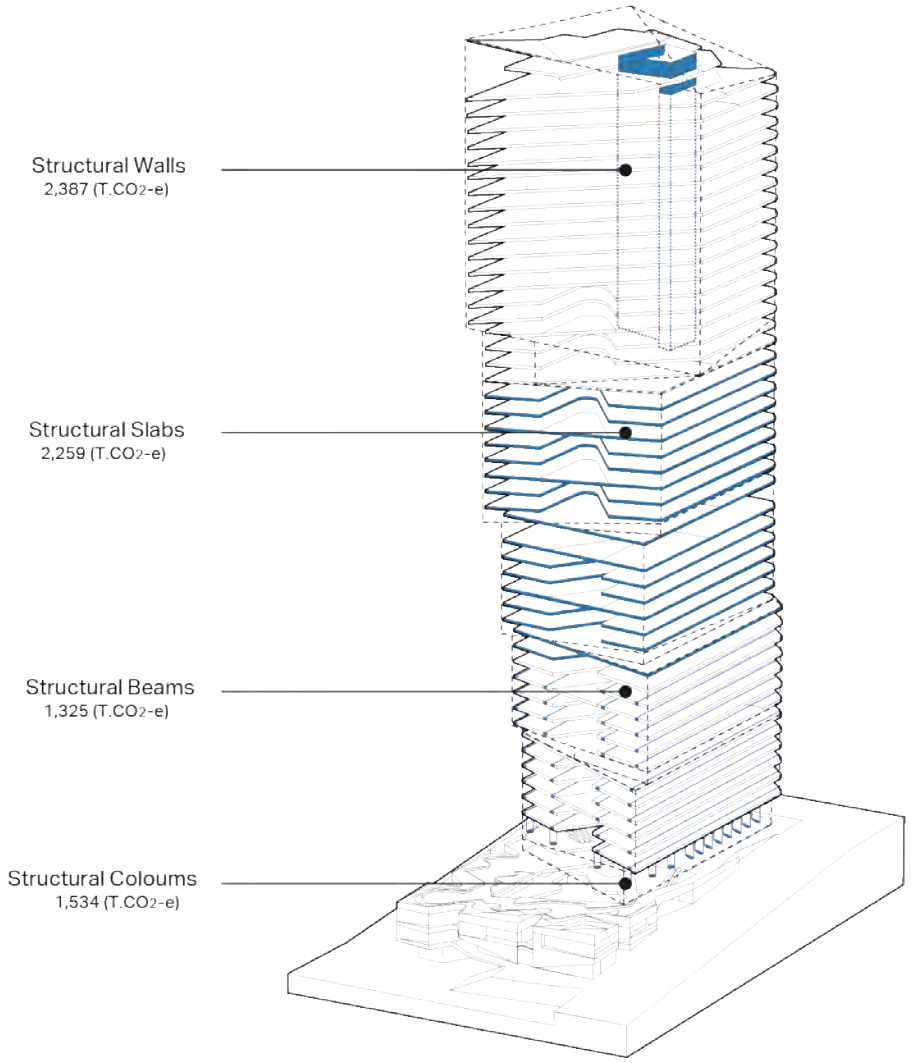


RETAINING 98%

STRUCTURAL WALLS

7.505 Tons of CO_2 *

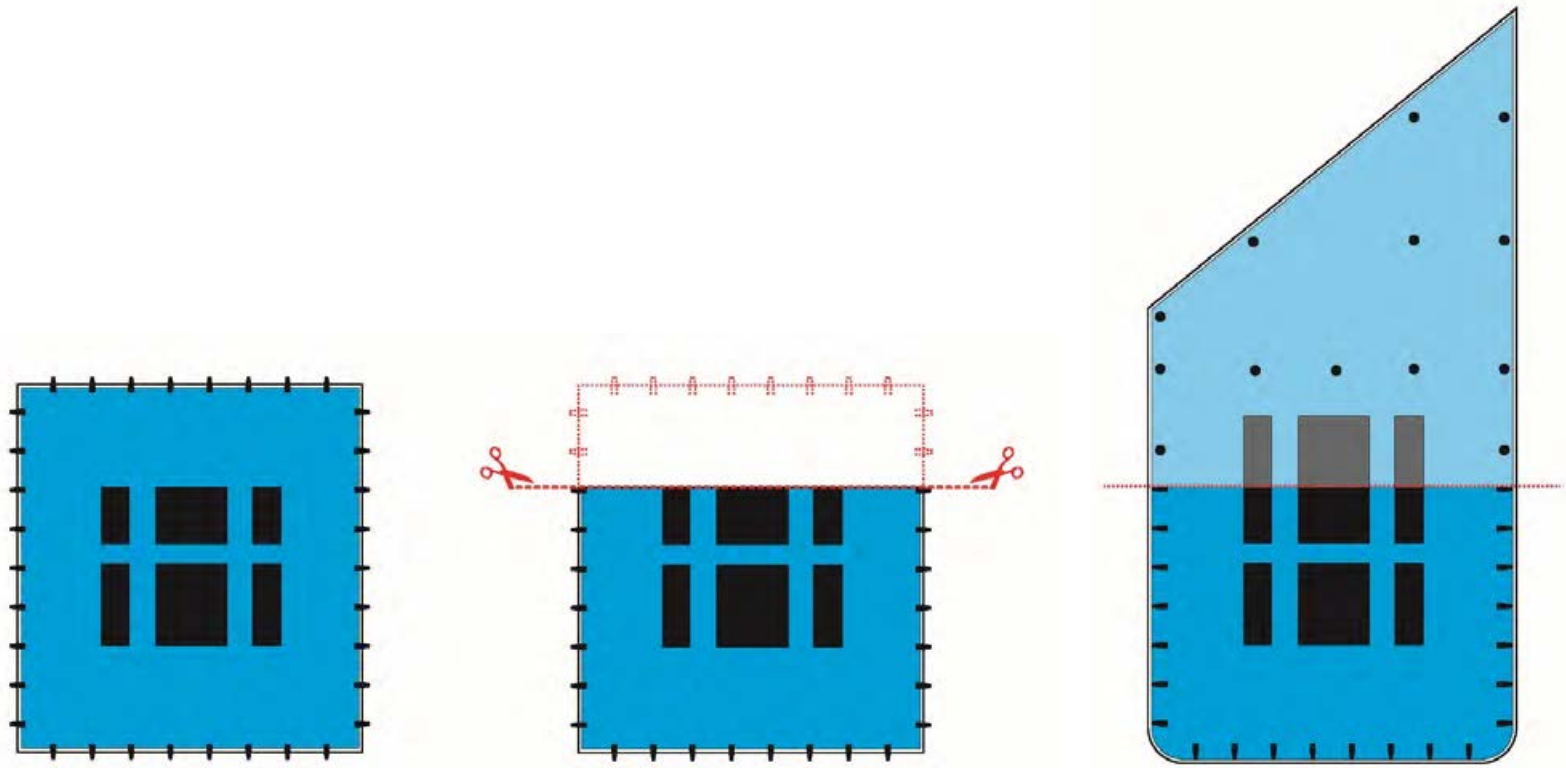
EMISSIONS SAVED



* The results are based on a published Australian data.

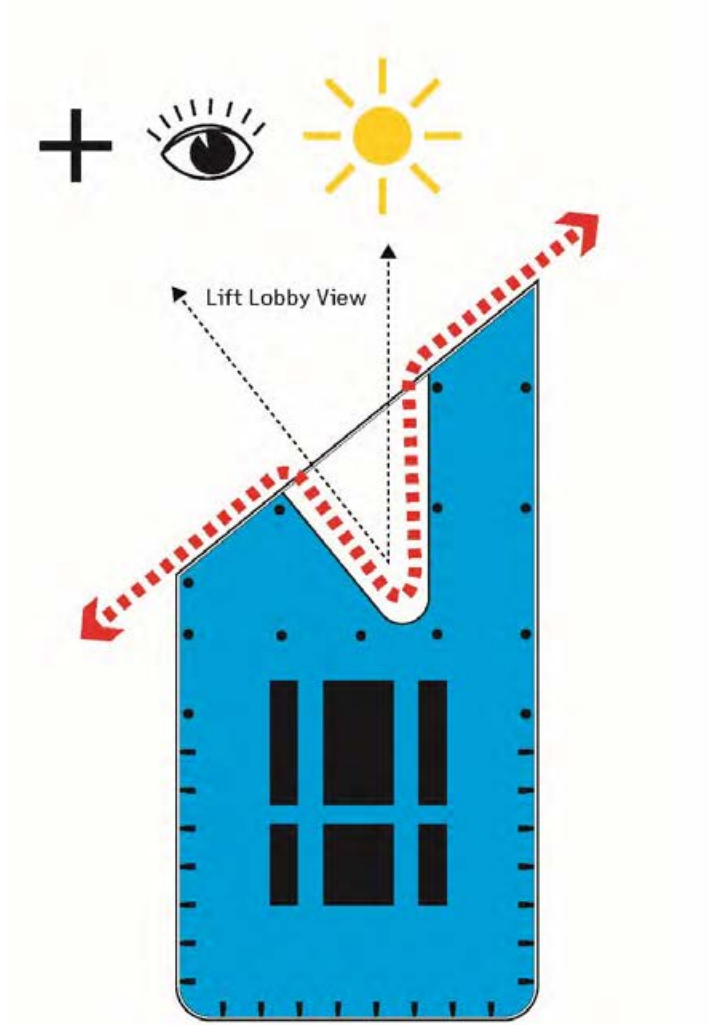
LOW CARBON LIVING CRC

3XN

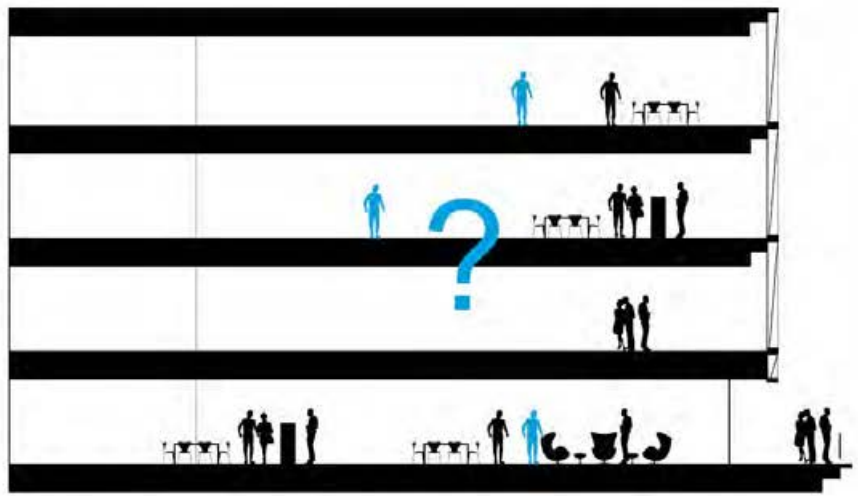


$130,000,000

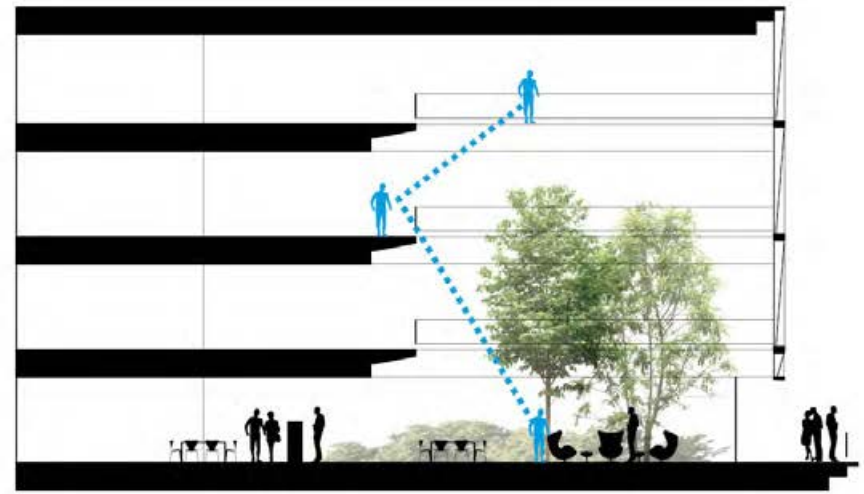
MATERIAL + TIME SAVED



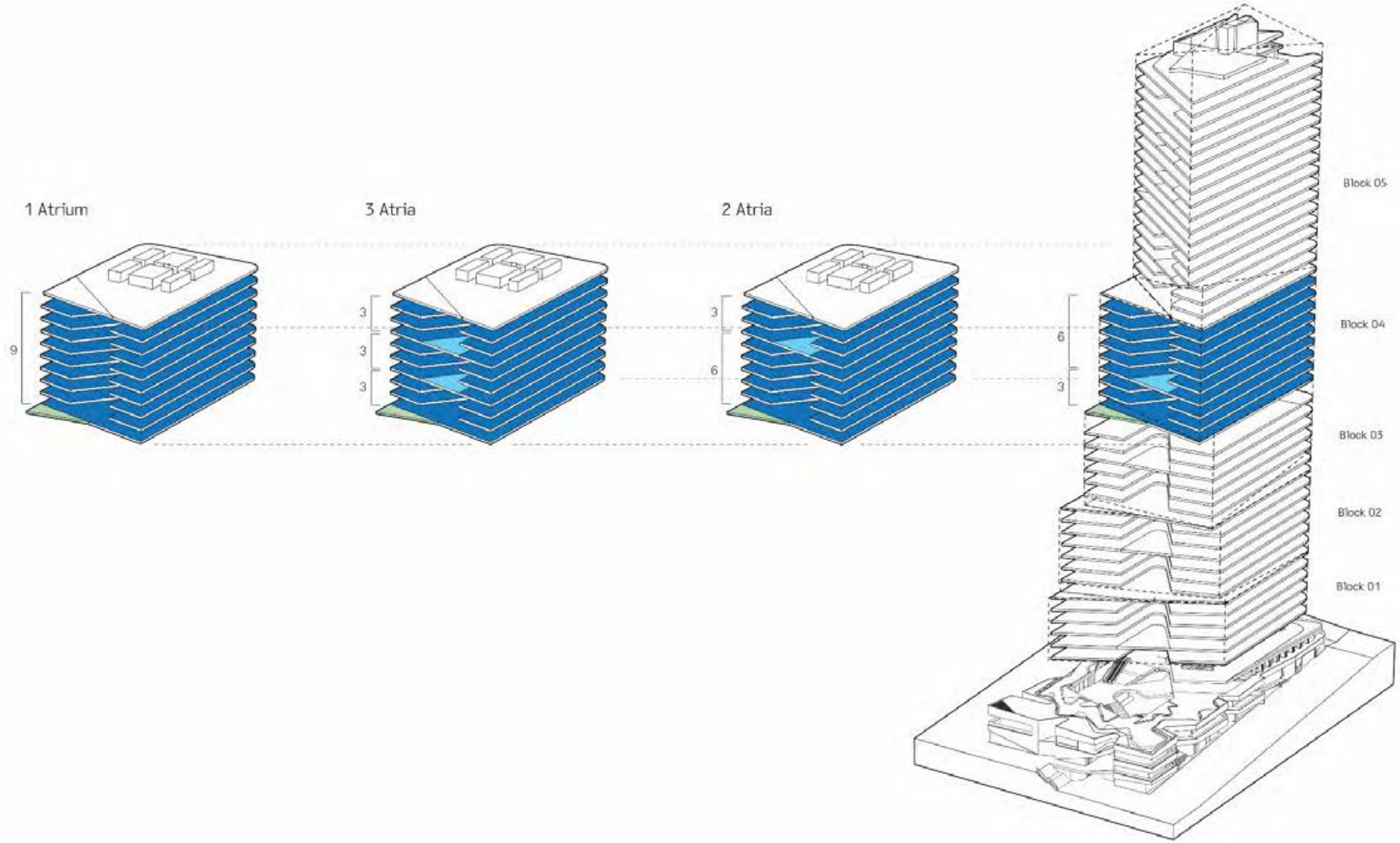
Increased Views / Daylighting



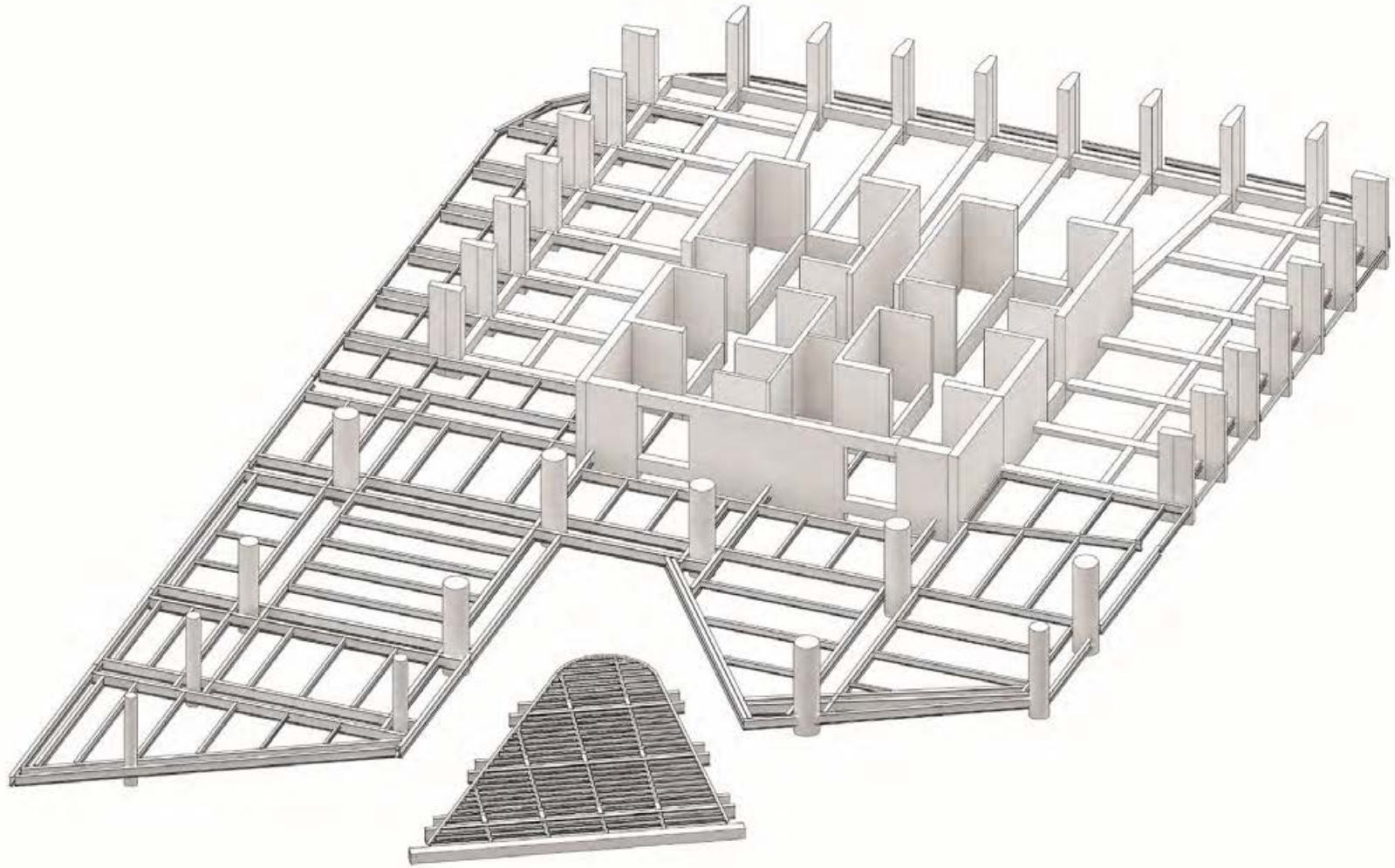
Typical High Rise

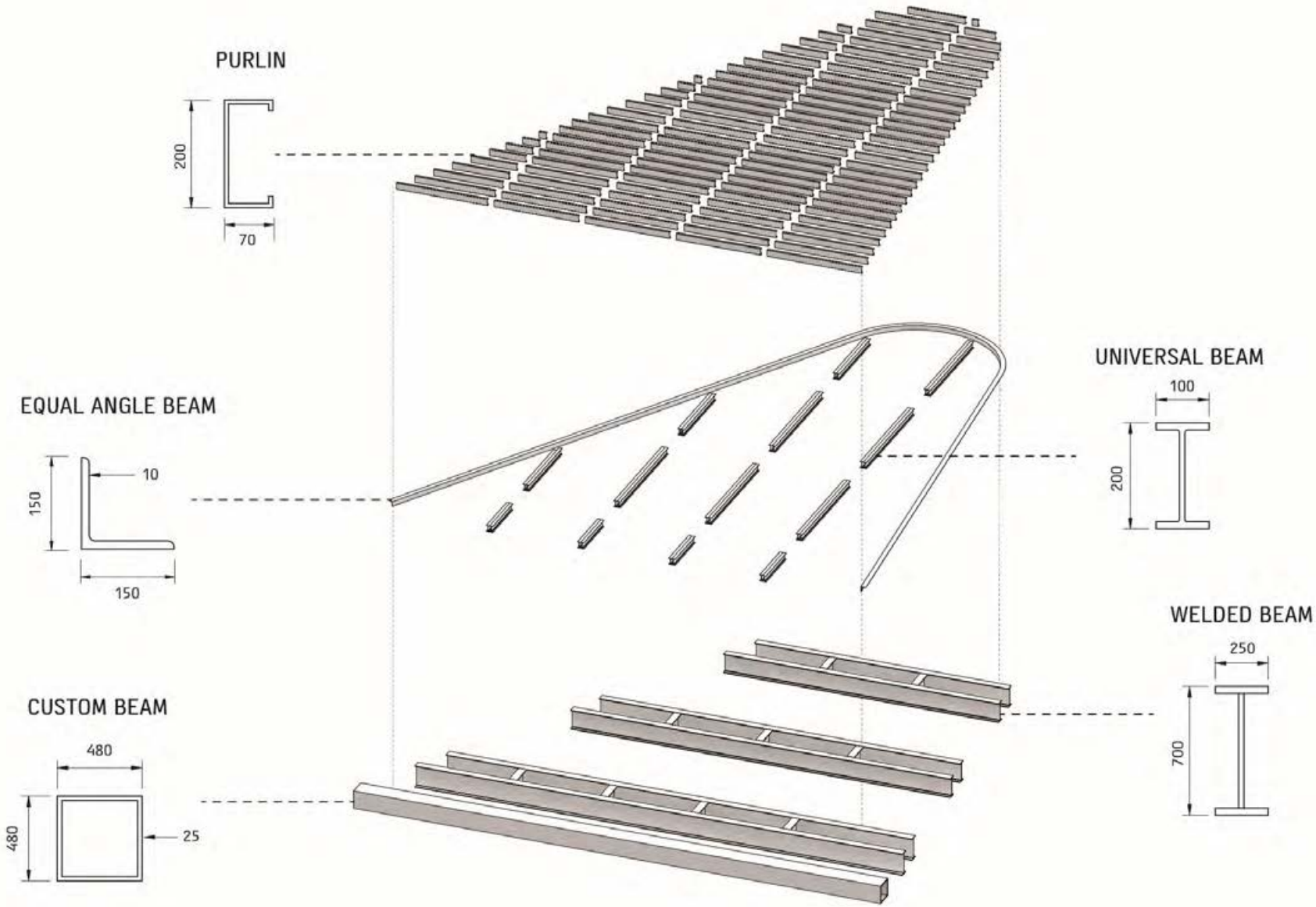


Proposal

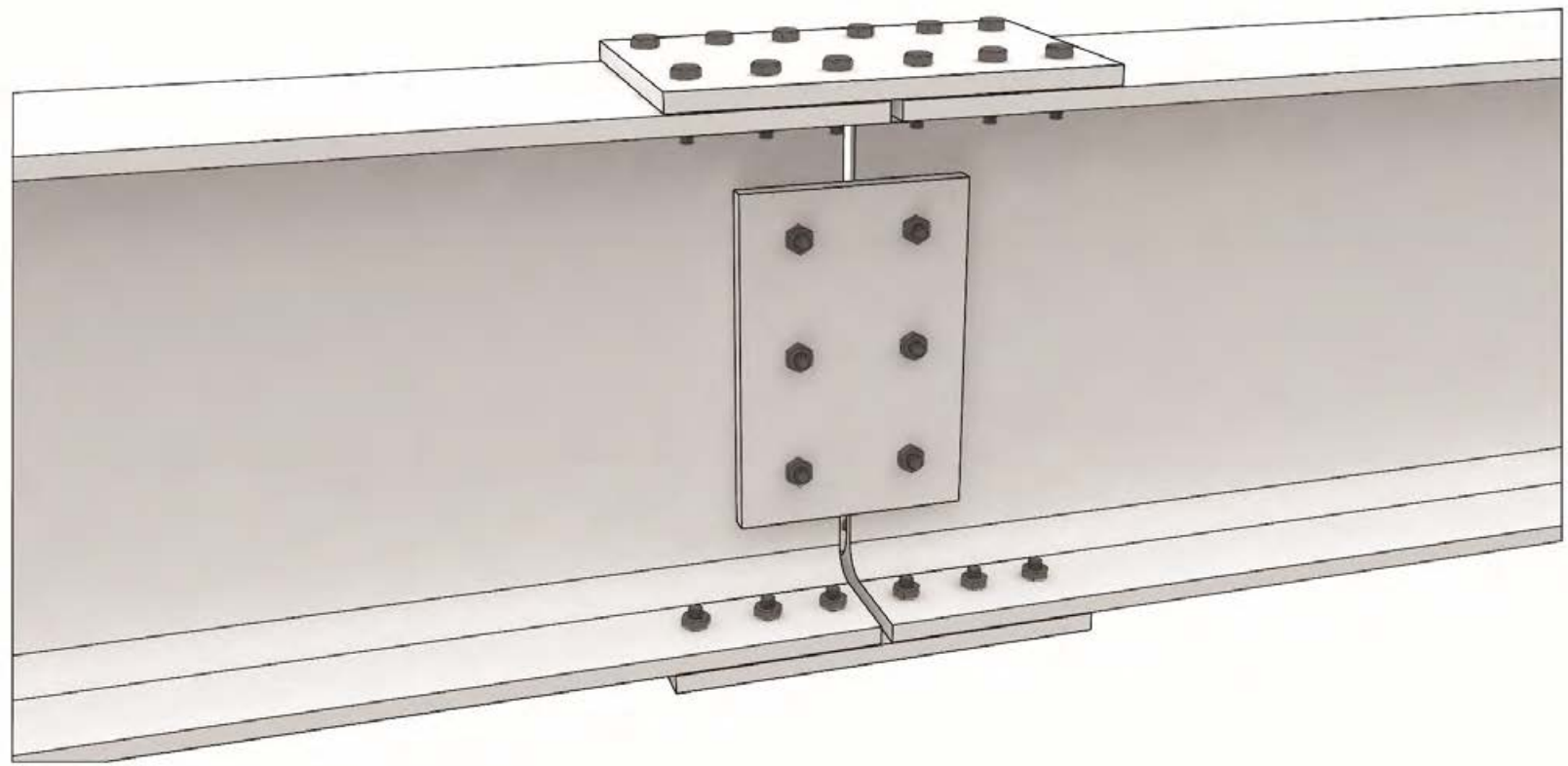

1 Atrium
3 Atria
2 Atria
9
3
3
3
3
6
6
3
Block 05
Block 04
Block 03
Block 02
Block 01

3XN




PURLIN
200
70
EQUAL ANGLE BEAM
150
10
150
UNIVERSAL BEAM
100
200
WELDED BEAM
250
700
CUSTOM BEAM
480
480
25

TYPICAL SPLICE DETAIL FOR ATRIUM INFILL PANEL AND DECON FLOOR




max 250 cm

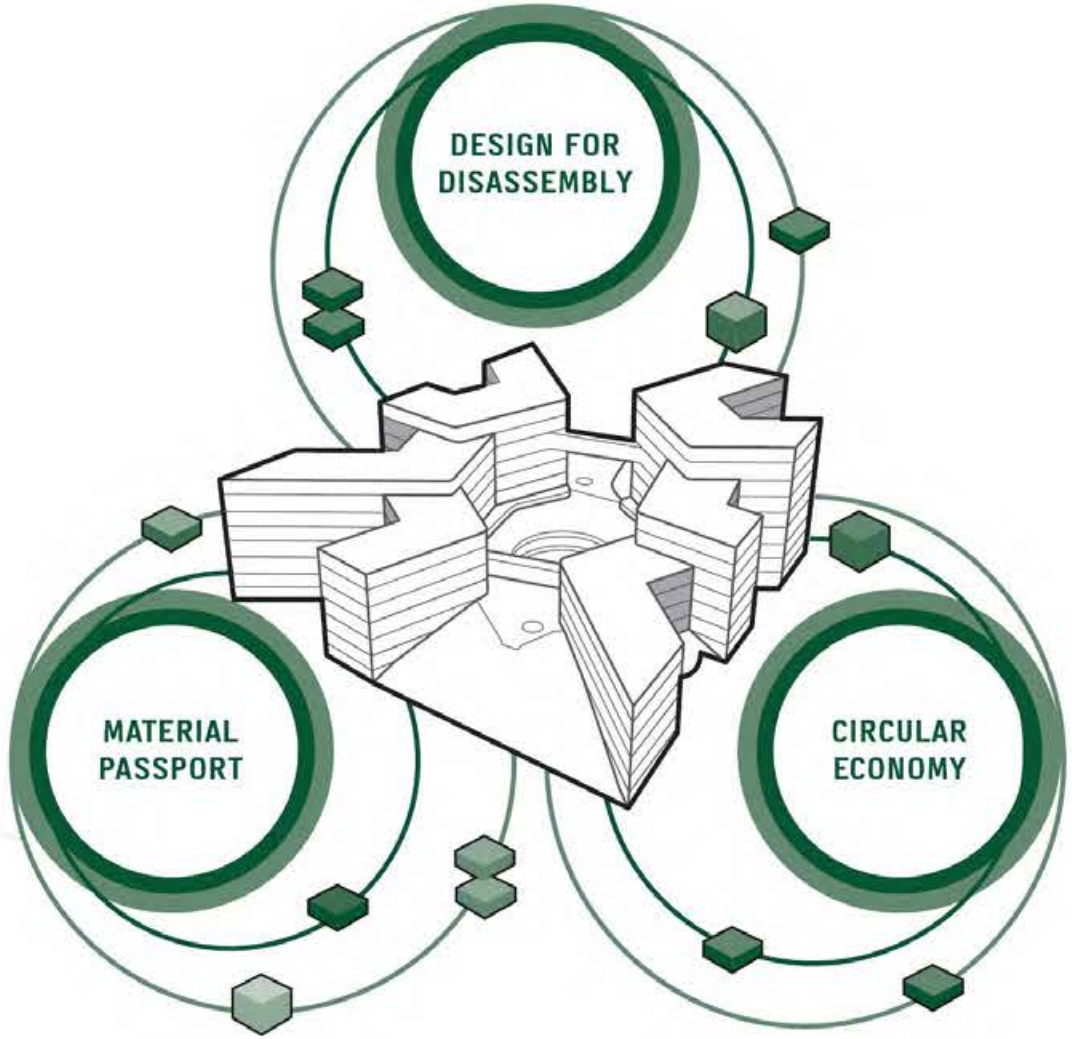

MULTIPLEX


SUMITOMO


SHARVAIN PROJECTS

WE NEED TO RETHINK
THE WAY WE MAKE THING

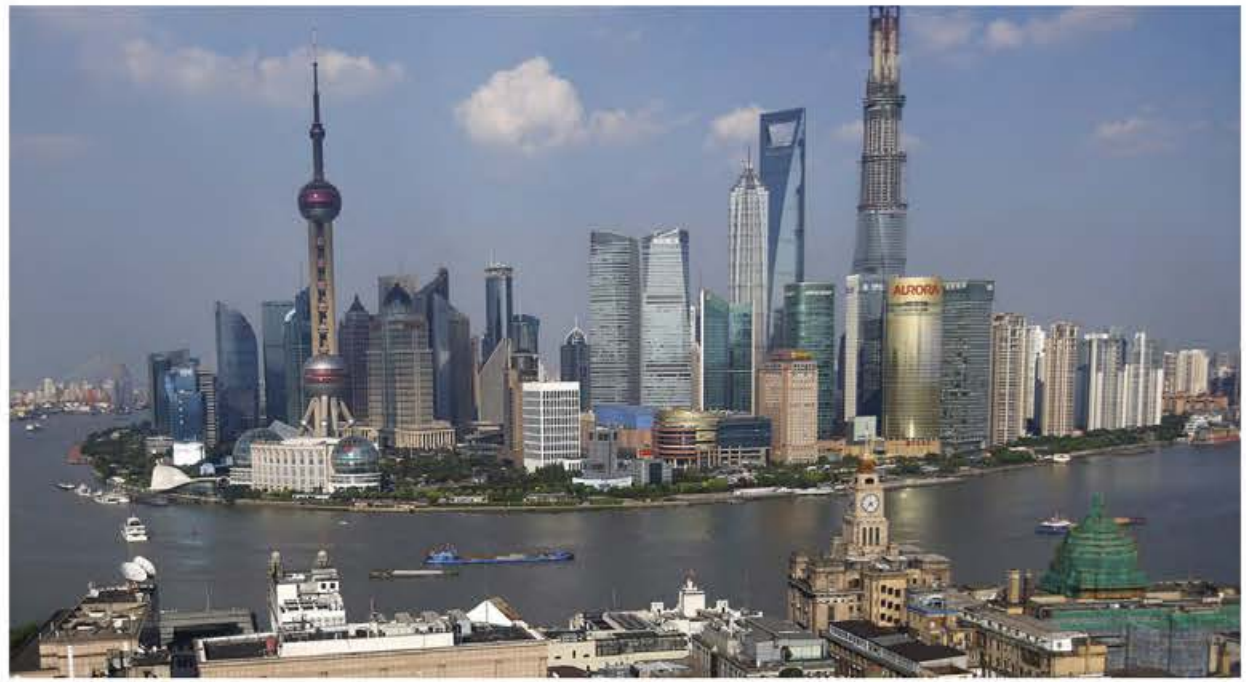
Building a Circular Future



BUILDING A CIRCULAR FUTURE

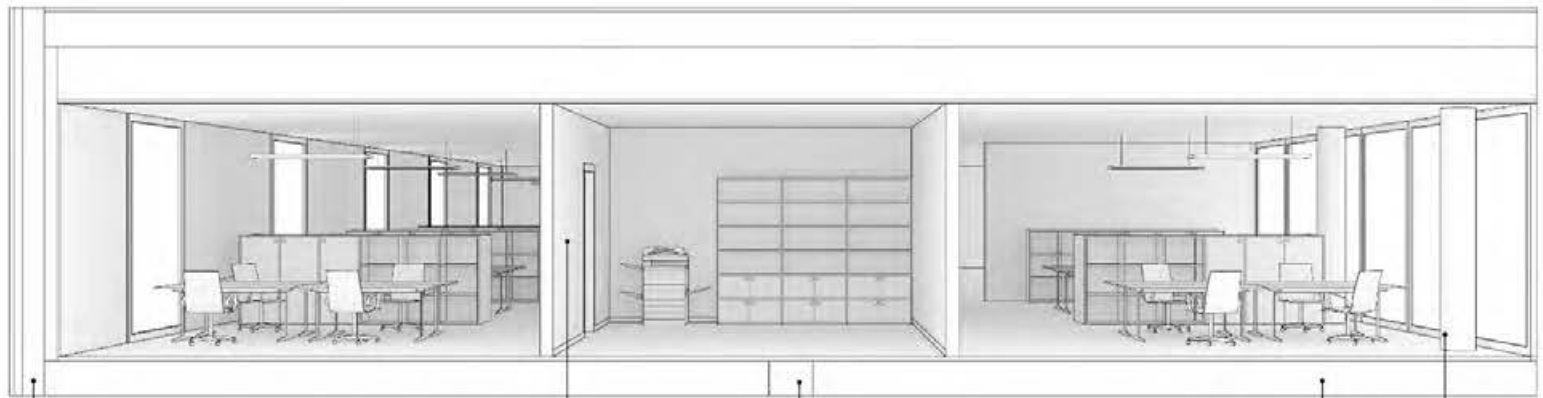

Kinpo

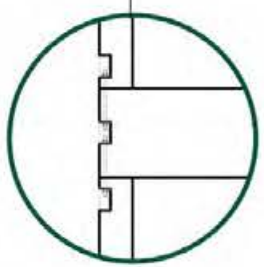
PUDONG, SHAGHAI 1987



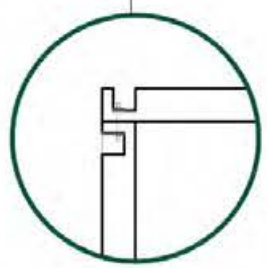
PUDONG, SHAGHAI 2013


KLAUS ALLER

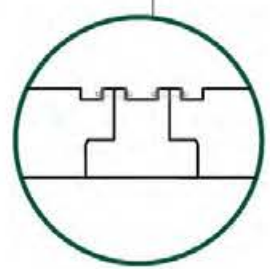




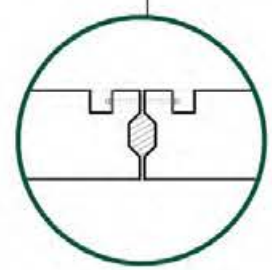
SLAB - WALL New separable joints using mechanical connections with nuts and bolts.



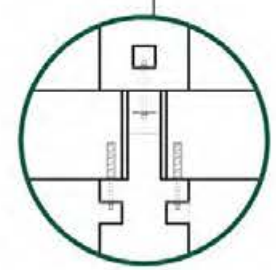
WALL - WALL New separable joints using mechanical connections with nuts and bolts.



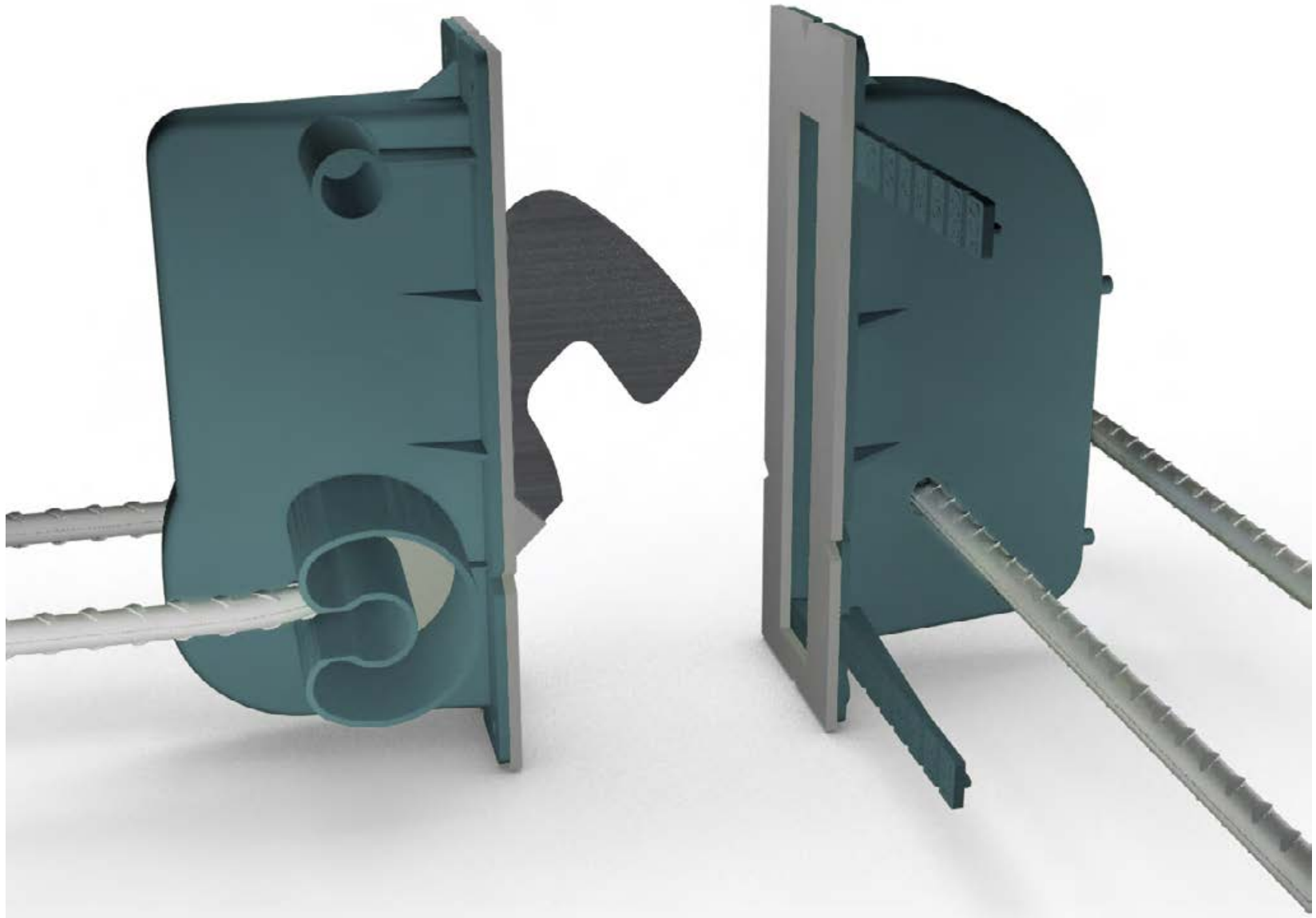
SLAB - BEAM New separable joints using mechanical connections with nuts and bolts.



SLAB - SLAB New separable joints using mechanical connections with nuts and bolts and lime mortar.



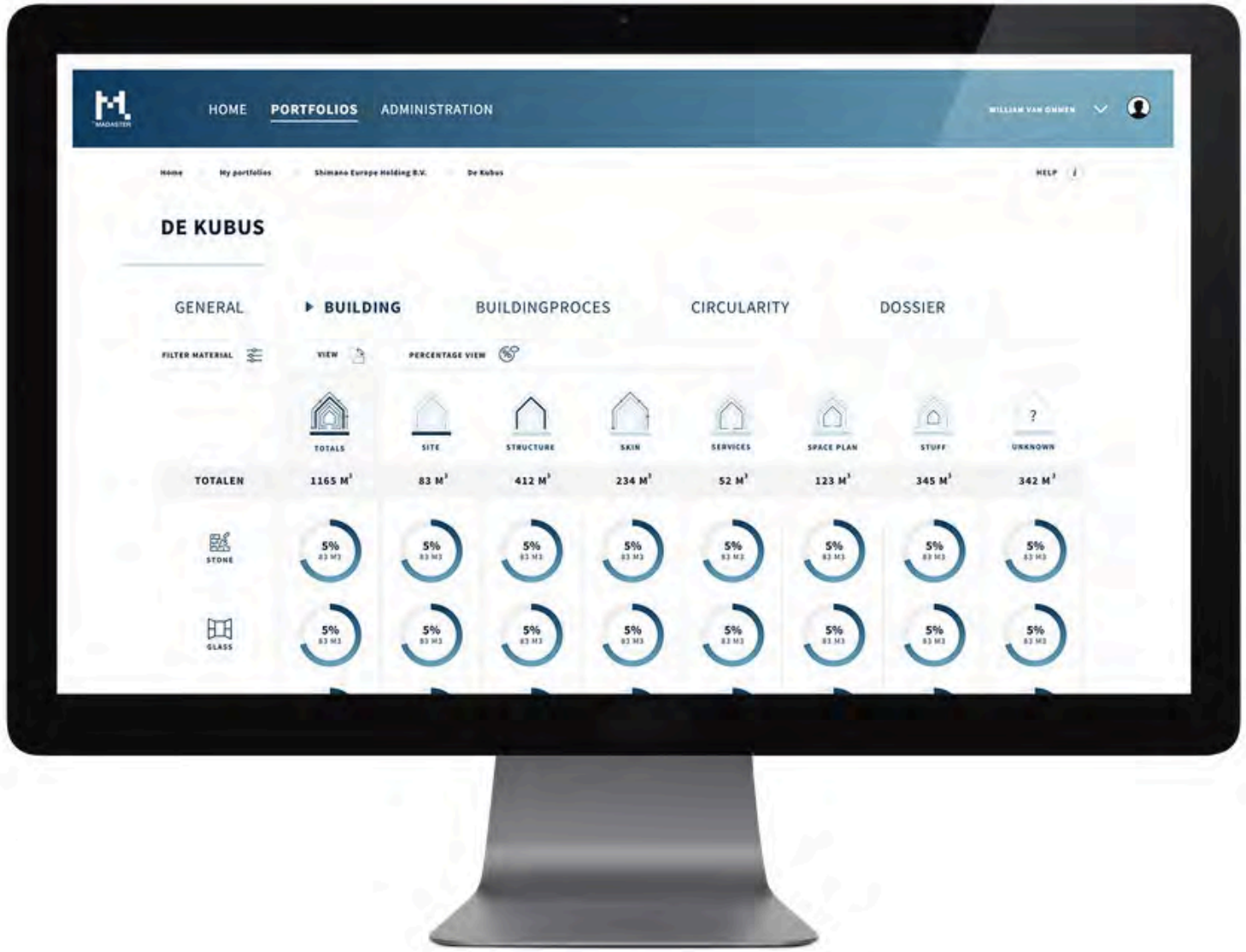
COLUMN - SLAB New separable joints using mechanical connections with nuts and bolts and lime mortar.

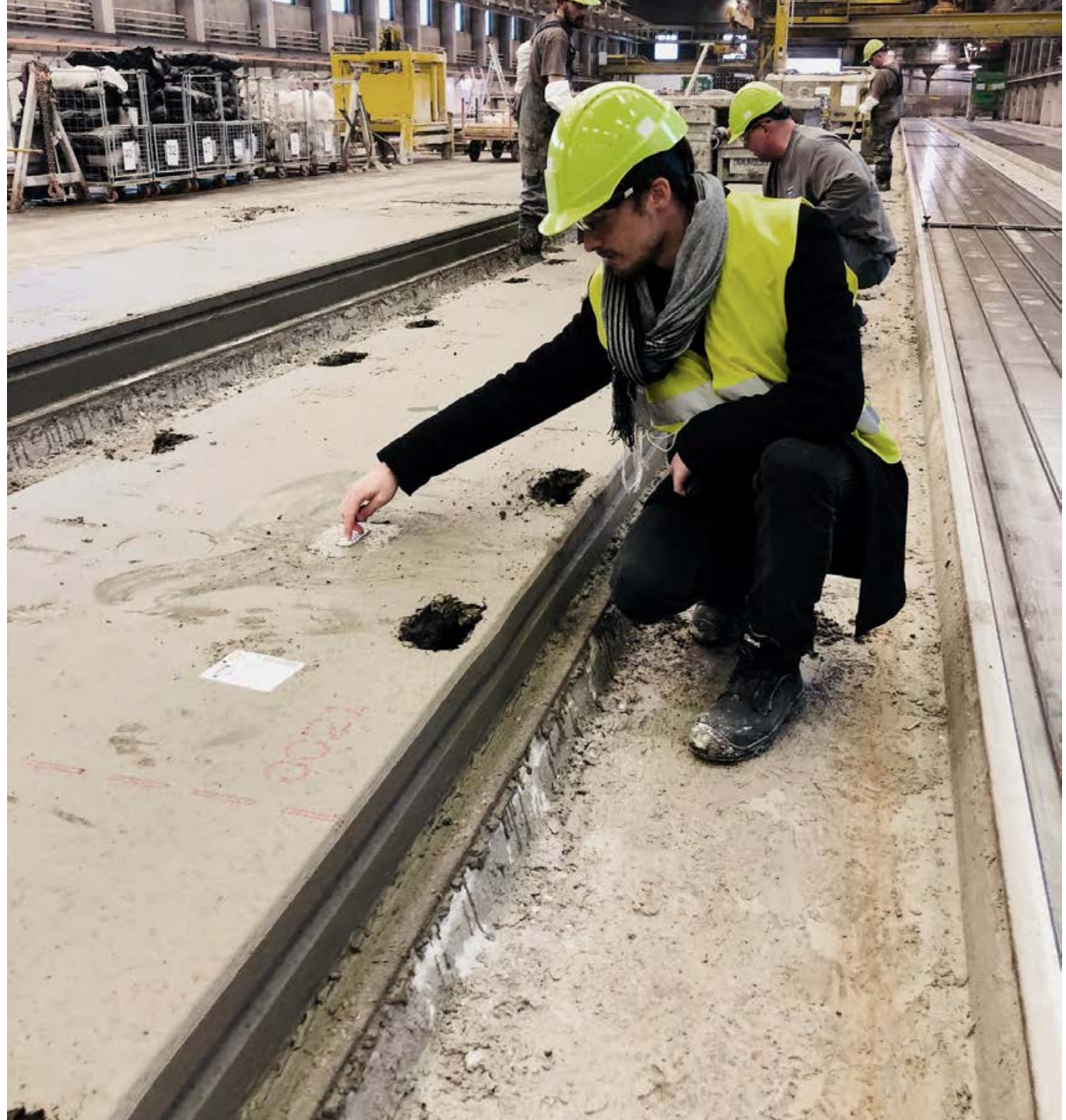


3D 4D 5D 6D

Virtuel Design & Construction


SAMSUNG


HOME
PORTFOLIOS
ADMINISTRATION
WILLIAM VAN GIMMEN
Home
My portfolios
Shimano Europe Holding B.V.
De Kubus
HELP
DE KUBUS
GENERAL
BUILDING
BUILDINGPROCES
CIRCULARITY
DOSSIER
FILTER MATERIAL
VIEW
PERCENTAGE VIEW
TOTALS
SITE
STRUCTURE
SKIN
SERVICES
SPACE PLAN
STUFF
UNKNOWN
TOTALEN
1165 M³
83 M³
412 M³
234 M³
52 M³
123 M³
345 M³
342 M³
STONE
GLASS
5%

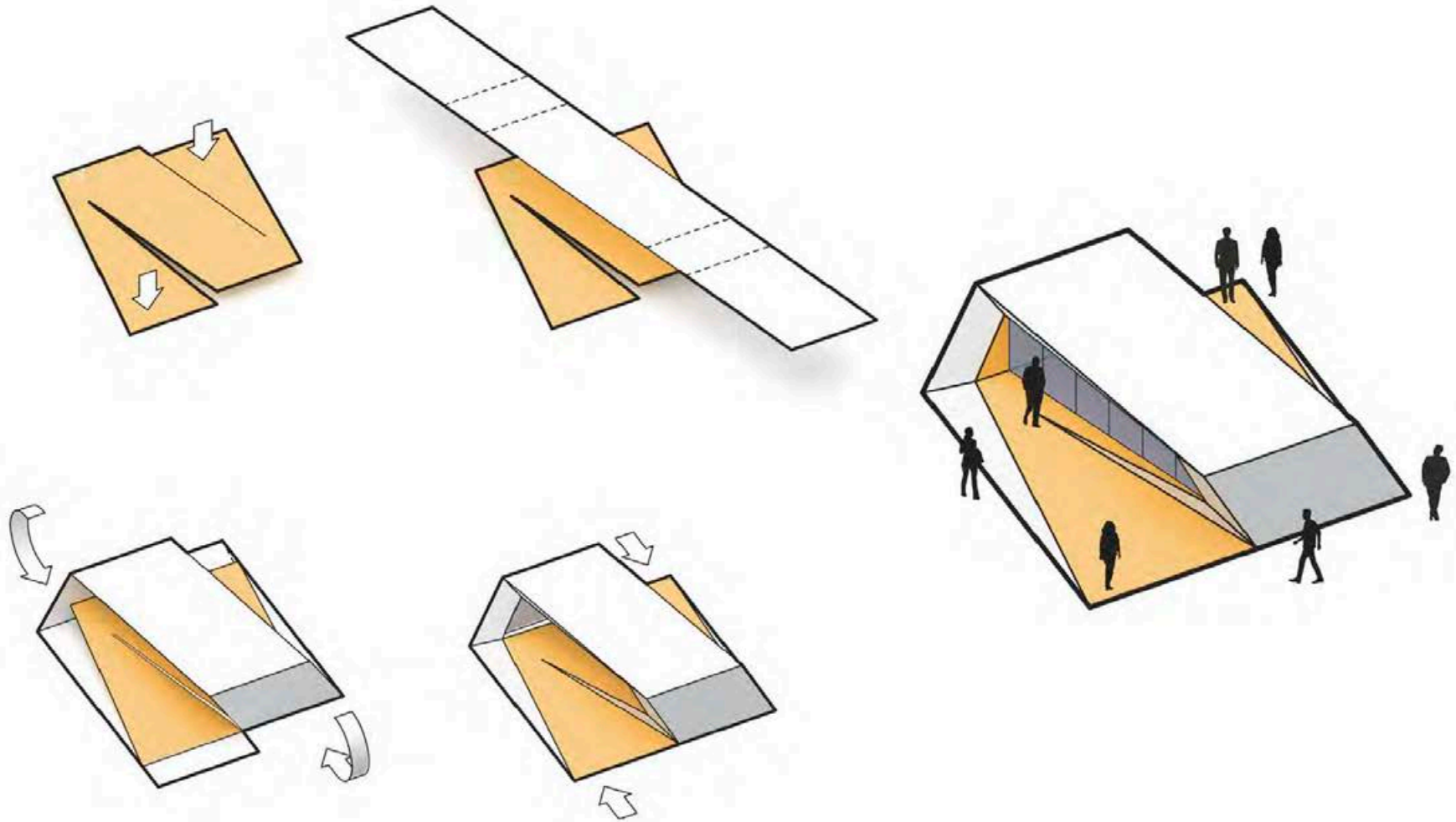



10198

Material Google

circularity lab

Google ARUP 3XN GXN ELLEN MACARTHUR FOUNDATION



WE NEED TO RETHINK
THE WAY WE CALCULATE

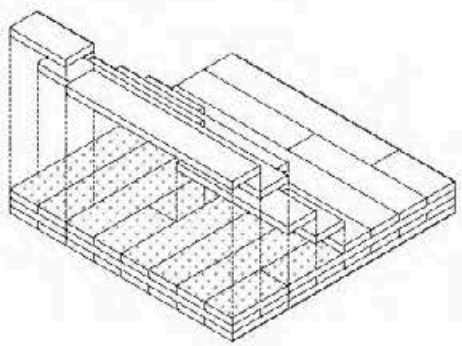
Cross Laminated Timber (CLT)

The wooden structure is built in Cross Laminated Timber, which is both a very strong and effient building material and at the same time it has a very low environmental and climate impact during production. This will also give the interior of the building a unique and characteristic expression that reflects the character of the exterior. Both the wood itself and the shape of the wooden frame ensure good acoustics and generally a healthy and comfortable indoor climate.

Bio-treated timber

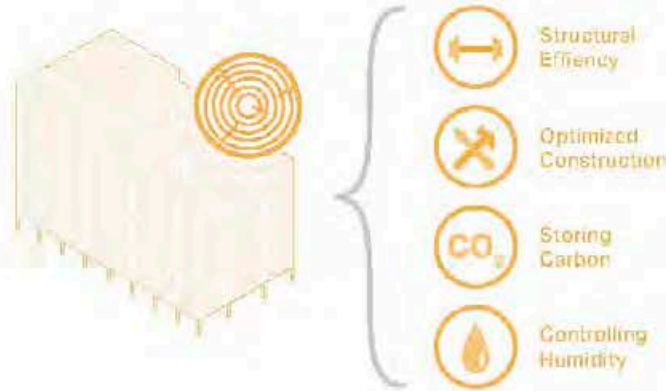
The materials we use for our buildings should be toxin free and support our health. Not just for ourselves, but also for future generations that will have to utilize the materials and solutions we develop today. Utilising a formaldehyde-free bioglue in the CTL ensures a healthy indoor climate whilst also protecting the environment. Treating the timber with a natural impregnation

Bio-treated timber used in large scale on an arena in Copenhagen, Denmark.



CLT is produced by crossing and gluing smaller pieces of wood

Value Creation



Structural Efficiency

Timber is the structurally most efficient material by weight. It thereby requires less resources to handle during the construction phase and the lighter material also requires less foundation.

(Large-Span Timber Structures — Roberto Crocetti, 2010)

Optimised construction

Timber construction only takes 2/3rds the construction time of traditional concrete buildings and require only 1/6th of the transport.

(Berlin keynote — Bente Madsen, 2010)

Storing Carbon

For every dry tonne of timber produced, 1.8 tonnes of carbon dioxide is taken from the atmosphere. Timber is a renewable material. When a tree is felled a new can grow in its place.

(Timber in the carbon economy — Timber NSW, 2018)

Controlling Humidity

Wood is breathable and can absorb and release moisture. It creates a naturally regulated indoor climate.

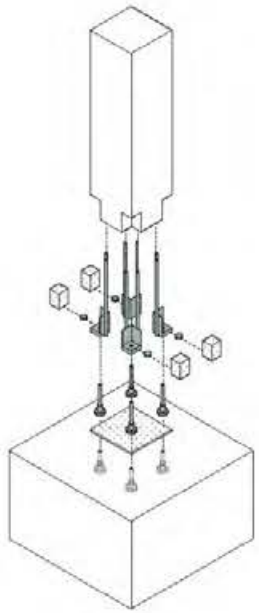
(Wood handbook — US Department of Agriculture Forest Service, 2010)

Reversible connections

Mechanical and reversible joints and easily dissolvable binders between concrete elements, are implemented to allow for easy assembly and disassembly. This is making a second life for the materials as wells as easy maintenance possible.

Upcycle concrete

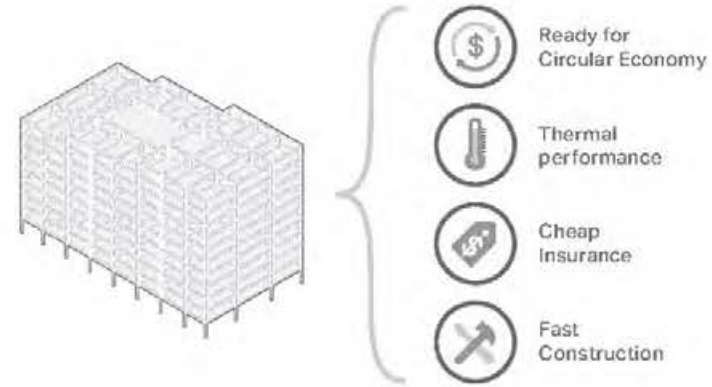
Concrete is a CO_2-expensive building material. It is among other things The production of cement that pays the environment and contributes negatively to the greenhouse effect. Cement contributes with approx. 6% of total man-made CO_2 emissions in the world



Upcycled concrete with aggregates of reused concrete.

All the concrete elements are joined by bolted steel connections, all reversible reusable in the future.

Value Creation



Ready for Circular Economy

Earn 4% of the new build value on the superstructure and envelope by designing it for disassembly.

(Building a Circular Future — GXN, 2016)

Thermal performance

Concrete acts as a heat store. This enables cost savings to be made in energy requirements with a reduction in the need for heat generation.

(A sustainable construction products dilemma — Mollearn, 2013)

Cheap Insurance

Insurance rates for concrete frame buildings are 14 to 65% less than for timber frame structures.

(Underwriters aware of the risks of wood-frame construction: Survey — Insurance Business America, 2017)

Fast Construction

Making a bolted connection takes 15 to 20 minutes – it's 3 to 4 times faster when compared to traditional concrete construction methods.

MAKE (HOW MUCH), USE (HOW LONG), REUSE (HOW MANY)

Circle House

— Danmarks første cirkulære boligbyggeri

3XN

Jeppe Kongstad Hjort

LENDAGER

Nikolaj Callisen Friis

Vandkunsten

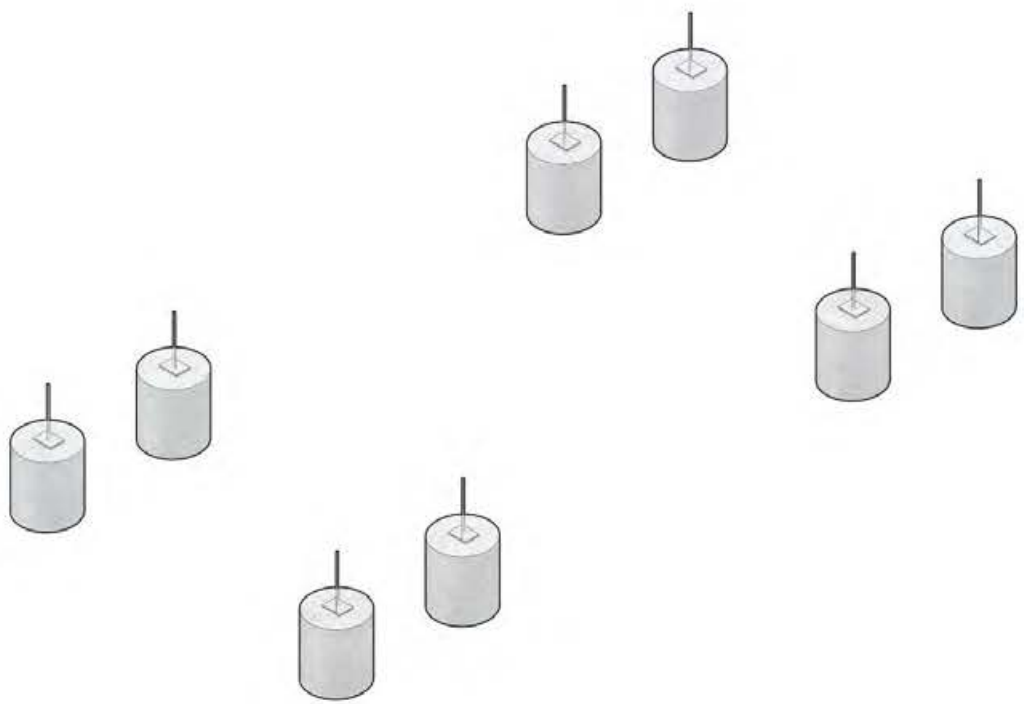
Kathrine West Kristensen

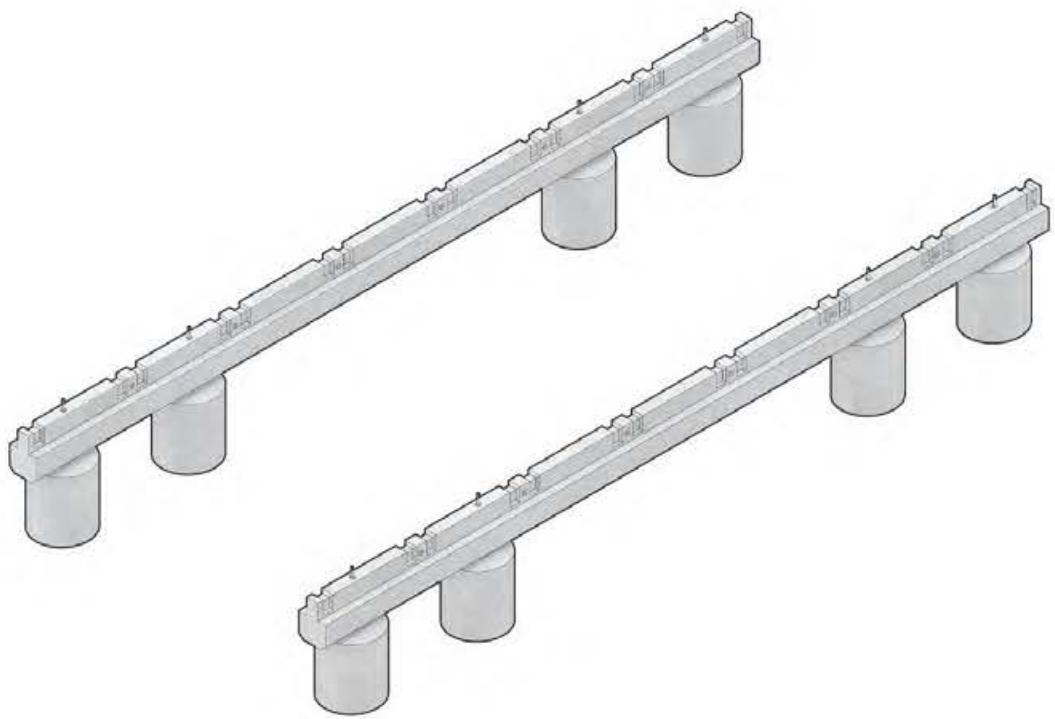
GXN

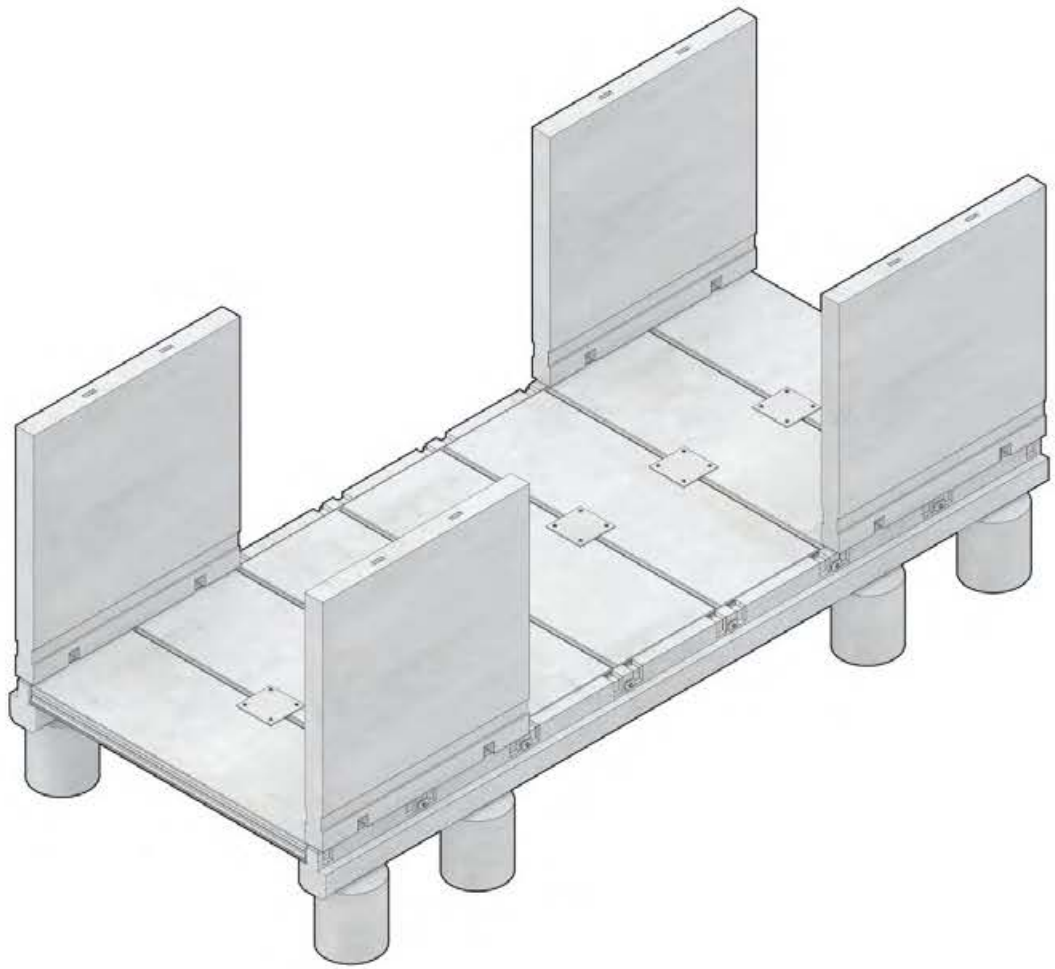
Casper Østergaard Christensen

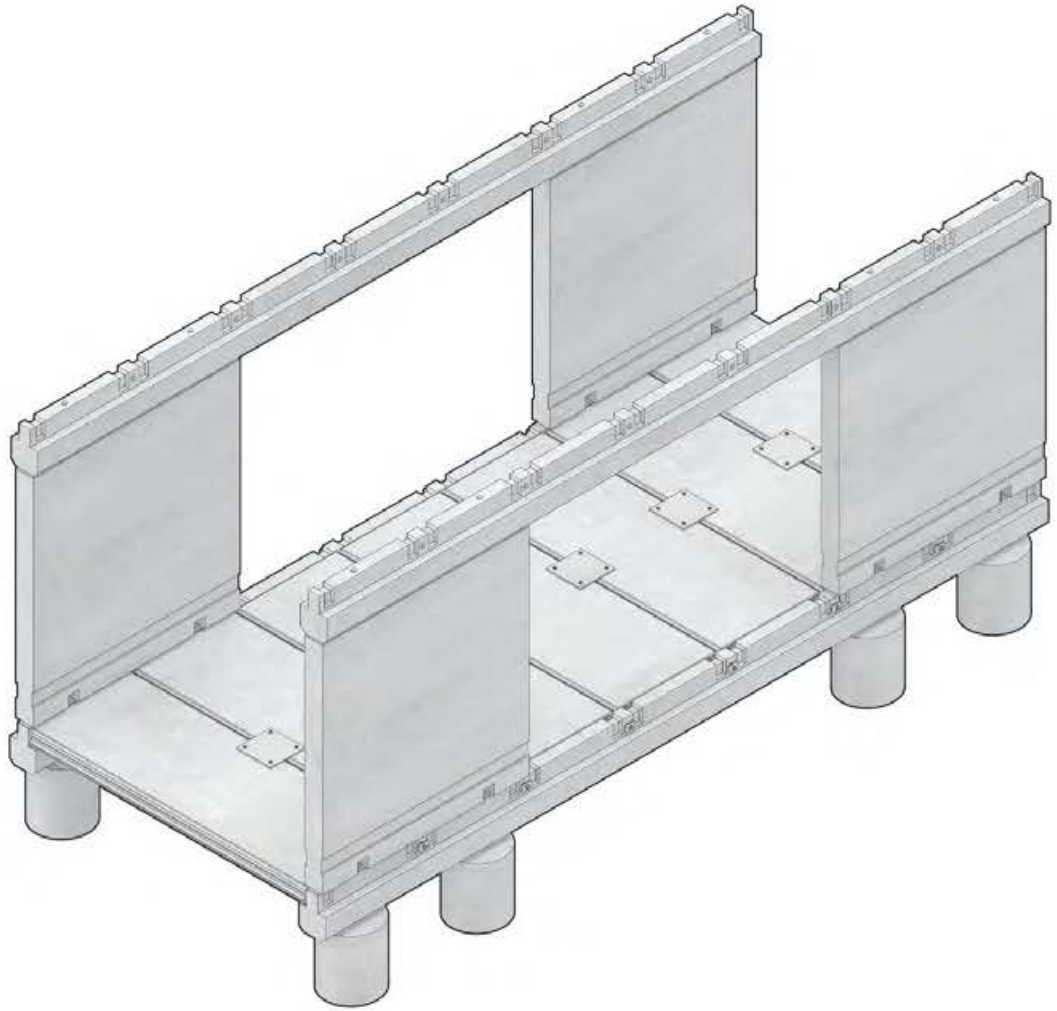
Exposition / Exterior

Wall Beam Deck

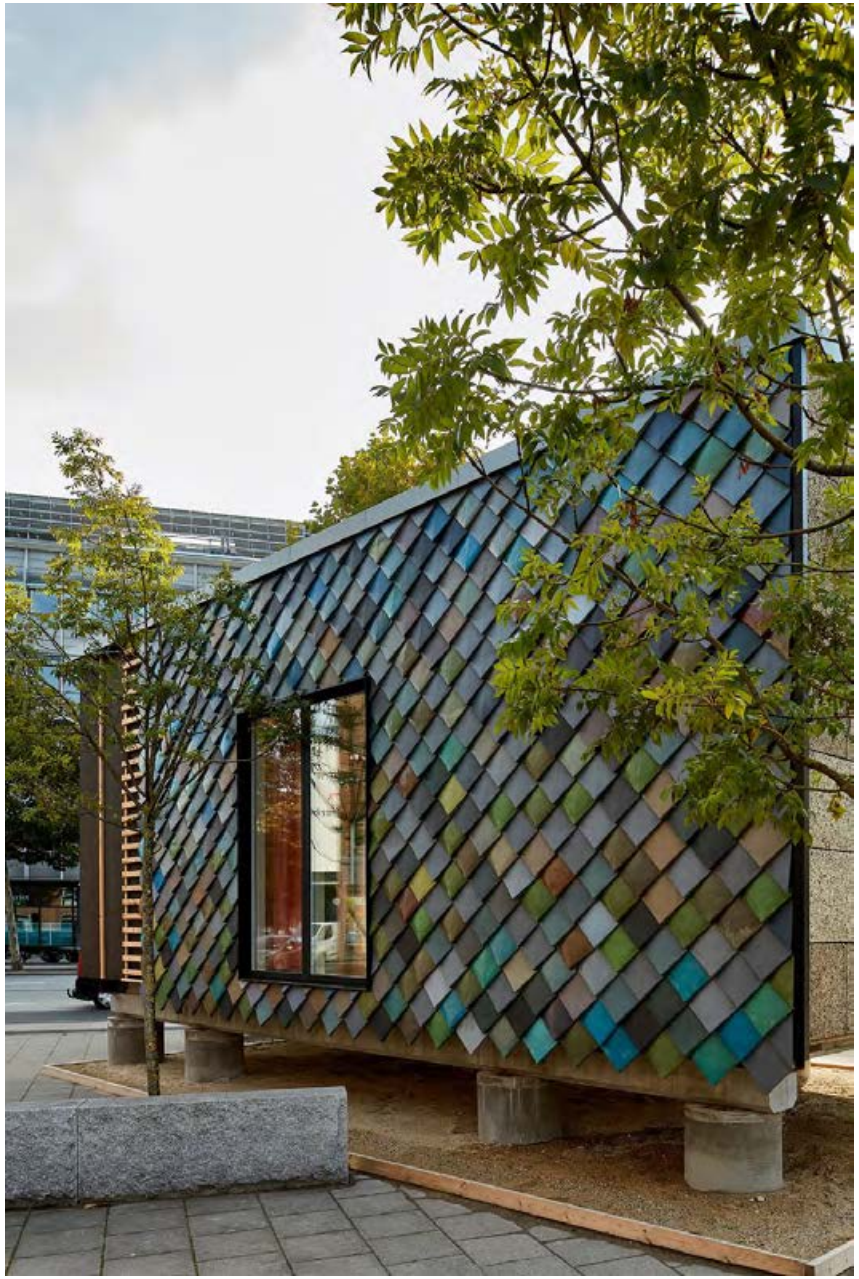








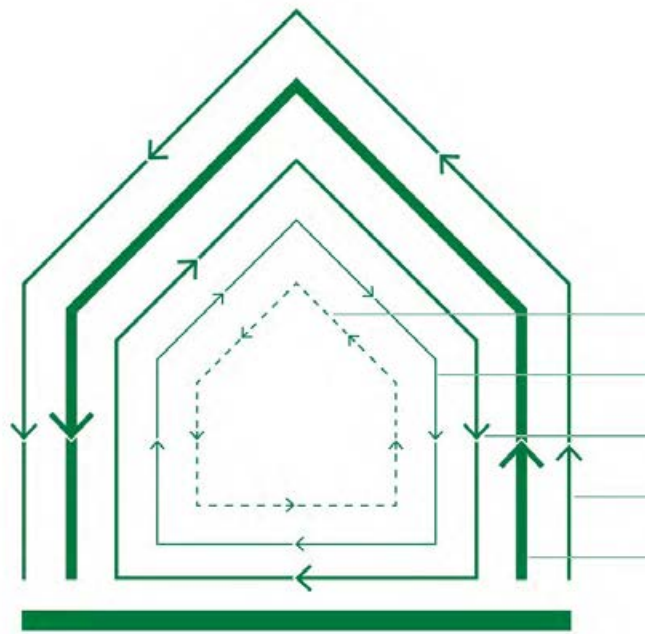

Circle House
Circle House
50-100
25-50
15-25
5-15
0-5
Circle House





Hvad indeholder udstillingen?

Udstillingen er bygget op omkring bygningens brugscyklusser. Det er fundamentalt at designe så de forskellige lag ikke overlapper hinanden og dermed forhindrer adskillelse og genbrug.



Ting 0-5 år

Inventar 5-15 år

Installationer 15-25 år

Facade 25-50 år

Råhus 50-100 år

Brugscyklus

15-25 år

— Installationer

Installationerne i vores bygninger tages let for givet og som noget permanent, fordi de er skjulte og helt integrerede. Gennem en bygnings livscyklus kræver de dog tilsyn, vedligehold og udskiftning. Ved at gøre dem let tilgengængelige og adskilbare er det muligt at optimere driftsomkostningerne og gøre det nemmere at skifte sit badeværelse.

Bygningsliv 15-25 år

Hvad nu hvis, **dine vinduer kunne skiftes med et klik?**

VELFAC 200 ENERGY skilt ad i materialefraktioner

93% af vinduets komponenter kan genanvendes

Fokus på materialerne
VELFAC 200 ENERGY består af 93% genanvendelige komponenter, som er fremstillet af naturlige materialer. Vinduet er designet så det nemt kan skilles helt ad i rene materialefraktioner med henblik på genanvendelse.

Den nemme adskillelse bidrager til, at langt størstedelen af materialerne kan indgå i en livscyklus, hvor de efter endt levetid kan genanvendes. Med fokus på recirkulering af materialerne øges andelen af materialer, der kan genanvendes løbende.

Case leverandør

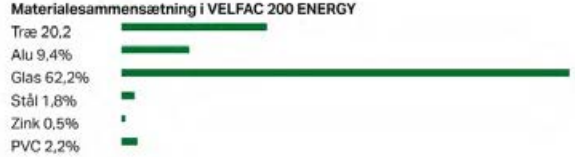
VELFAC

Kontakt: René Lohmann-Jørgensen, Arkitektkonsulent
Mail: rlj@VELFAC.dk

'Hos VELFAC tror vi på vigtigheden af at undgå unødigt spild af værdifulde ressourcer i forbindelse med vores produkters livscyklus'

— Finn Jespersen, adm. direktør Velfac

Materialesammensætning i VELFAC 200 ENERGY



Design for adskillelse
VELFAC 200 ENERGY er designet så de forholdsvis enkelt kan afmonteres fra facaden og genanvendes direkte. I fremtiden bliver det måske endnu nemmere med et klik-system, så vinduerne nemt kan indgå i flere byggerier gennem dets levetid og uden at miste værdi.

Efter sin livscyklus kan vinduerne nemt skilles ad i enkeltdele, og materialerne kan indgå i nye produkter. Det eneste specialværktøj, der kræves er en rundsav for at fjerne den termiske brydning i aluminiumsrammen.

VELFAC 200 ENERGY samlet

Brugscyklus

25-50 år

— Facade

Facaden udsættelse for vind og vejr og derfor forventes det, at facaden i løbet af en bygnings levetid bliver ændret eller i det mindste undergår større renovering. Derfor er det fundamentalt at facaden nemt kan demonteres, uden værdien forringes.

Hvad nu hvis, **du kunne skifte din facade på en weekend?**

Tegnestuen Vandkunsten har udvilket et vingebeslag til renoveringen af Gårdhusene i Albertslund Syd

Vingebeslagene er eksponeret i facaden. Foto: Torben Eskerod

Gårdhusene i Albertslund Syd hører til generationen af tæt-lav storskalaprojekter, der skød op i forstæderne i 1960'erne. Et industrielt og ensartet byggeri i en teknisk kvalitet, som har været nødvendigt at forbedre over talrige renoveringsforløb. Som led i en projektkonkurrence banede Vandkunsten vejen for en ny renoveringspraksis ved at tilføre både bæredygtighed og autonomi til Gårdhusene.

Tegnestuen har afprøvet løsninger i flere prøvehuse og ser Gårdhusenes renovering som et potentielt vendepunkt i større almene renoveringer og i dansk byggeskik generelt. Der er fokuseret på at arbejde med en markant lavere affaldsproduktion, end ved konventionelt byggeri.

Ved at bruge industrialiserede materialer og standardmål, vil materialerne lettere kunne genanvendes i andre fremtidige brugscyklusser - uden at skulle forarbejdes først - og indgå direkte i en ny sammenhæng.

'Vi skal ikke kun tale om cirkulært byggeri som nødvendigt - det skal også være smukt og funktionelt'

— Katrine West Kristensen, Arkitekt MAA

Let udskiftelig facade

En af nyudviklingerne i projektet er vingebeslaget til en af facadeløsningerne. Dette beslag holder facadeelemeter på plads, uden at skulle gennembore panelerne og er samtidig nemt at arbejde med i både montage og udskiftningsprocesser. Endda så beboerne selv kan gøre det.

Når facadepanelerne er udskiftet, kan beslaget fortsat bruges eller omplaceres. Da vingebeslaget er synligt i facaden, er det med, til at skabe ornamentik i facaden og viser en ærlighed for rå materialer, samlinger og konstruktion.

Vingebeslagene fastholder hvid facadeplade. Foto: Torben Eskerod

Case leverandør

Vandkunsten

Kontakt: Katrine West Kristensen, Arkitekt MAA
Mail: kwk@vandkunsten.com

Brugscyklus

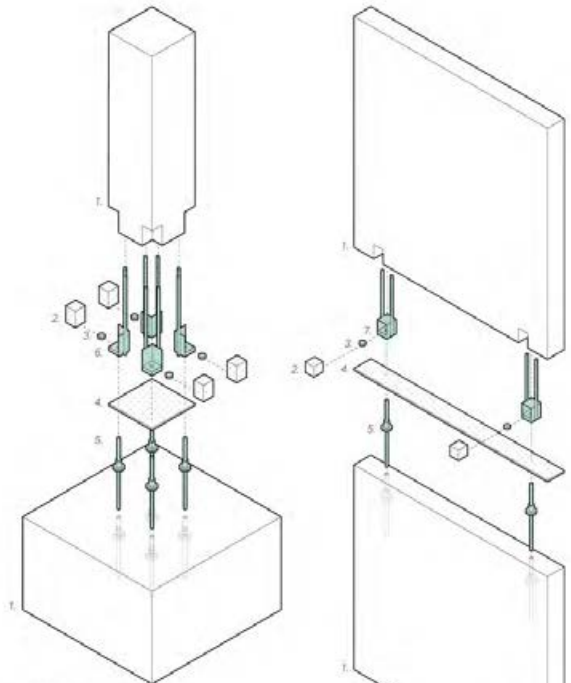
50-100 år

— Råhus

Råhuset er bygningens rygrad, så det er forventeligt at samlingerne ikke er direkte tilgængelige. Råhuselementerne har en lang levetid i forhold til bygningens øvrige komponenter, så det er vigtigt at disse elementer kan adskilles og genbruges i andre bygninger.

Bygningens levetid 50-100 år

Hvad nu hvis, **du kunne skille hele dit hus ad med en svenskenøgle?**



1. Betonelement
2. Kalkmørtel eller cover-gip
3. Møtrik
4. Understøbningsmørtel
5. Ankerbolt med gevind
6. Peikko søjlesko
7. Peikko vægsko

Mekaniske samlinger til betonbyggerier

Det finske firma Peikko er en kommerciel producent af mekaniske samlinger til betonelementer. Samlin-gerne muliggør adskilles i fremtiden. Deres væg- og søjleskosystem består af sko der støbes ind i præfa-brikerede betonelementer, og ankerbolte der støbes ind i fundamenter eller andre betonelementer. Elementerne samles on-site og fastgøres til ankerbolte med møtrikker og særlige AL-skiver som boltsam-ling. Efter monteringen fyldes beslagene og samlingerne med mørtel så de ikke længere kan skilles ad.

Alle kan få gavn af Peikkos løsninger – det gælder både elementfabrikker, bygherrer, rådgivende ingeniører, udviklere og arkitekter.

Peikko har stort fokus på produktudvikling. De har introduceret mange nye og innovative løsninger til markederne gennem årene, der har forbedret måden at bygge på. Et godt eksempel på en sådan løsning er søjleskoen, der sikrer en robust samling af betonsøjler. Peikko deltager aktivt i arbejdet omkring standardiseringsarbejdet på europæisk plan og i større internationale forskningsprojekter.

Peikkos produkter gør kundernes byggeproces hurtigere og lettere. Produktudviklingen starter med udgangspunkt i kundens eller markedets behov. Målet er at påvirke byggeprocessen i hele bygningens livscyklus lige fra valg af teknisk løsning, igennem byggefasen og i hele byggeriets levetid.

'Fremtidens elementbyggeri skal monteres og demonteres sikkert og enkelt med boltede samlinger'

— Jonas Høg, Diretør, Peikko

Montering af præfabrikerede betonelementer til elevatorskakt.

Case leverandør

peikko

Kontakt: Jonas Høg, Direktør Bygningsingeniør
Mail: jonas.hog@peikko.com

Montering og justering af elementerne kan enkelt gøres med en svenskenøgle.

THANK YOU!

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