# Marmormolen, Copenhagen: "Paving" a "Services Highway" Using Steel Beams

**Riccardo Pedroni** Associate Engineer, Ramboll



# MARMORMOLEN 'PAVING' A 'SERVICES HIGHWAY' USING STEEL councilor on an BEAMS

**RICCARDO PEDRONI** Associate Engineer Ramboll Denmark



#### MARMORMOLEN

Client: AP PENSION Architect: HENNING LARSEN ARCHITECTS Engineer: RAMBOLL Contractor: PIHL

HH

#### **OVERVIEW** A HIGH PERFORMANCE BUILDING

A sublimely beautifully designed building adds quality to the neighborhood and the city

Energy might be

back to the grid.

harvested through

PV's and delivered

Roof terrace allows

users to easily enjoy

environment saving

space on the ground

fresh air and a natural

Plants and soil is integrated to support biodiversity. Microorganisms, insects and birds will thrive.

> Façade with **Opaque** panels provides low G&U Value allows natural daylight, low artificial lighting, low solar gain

Designed for disassembly prepares the buildina components for reuse in the future

**High Performance** Thermo wheels for HVAC assures less energy demand

A compelling atrium encourages users to walk through the market hall

<41 kWh/m2/y

complies with 2025 BR

**Energy Requirements** 

Bio tank separates, recycles and avoids bio waste

The building works as a noise barrier between a main road and a residential area greenfield land

on a brownfield site rather than on

Rainwater is

irrigation

harvested for

greywater and

The building is located By using timber as the is stored in the building rather than emitted

The ground floor will be structural material carbon open to the public and offer social space and services

Use of renewables such as Ground Source Heat Pump for H&C makes the building standalone from the grid

14





#### **MEP DISTRIBUTION**



STRUCTURES



STRUCTURES + MEP



HOW DOES IT WORK



#### THE RESULT



#### **CHALLENGES**

#### **SLAB DIMENSIONING**

#### VIBRATION

RF	180mm	200mm	220mm	240mm	260mm	280mm	SDL=2.5 kpa 2.5% Damping
Area > RF8	40%	30%	22%	13%	9%	8.4%	
Area > RF20	13%	8%	5%	2%	1.8%	1.3%	

## DEFLECTION

Δ	180mm	200mm	220mm	240mm	260mm	280mm	Criteria Span = 6.4m	
Winst	30	23	16	11	10	9	L/300=21	
Wnet, fin	38	29	20	15	13	11	L/250=26	
<u>Wfin</u>	47	36	25	18	16	13	L/150=43	

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layer	thickness	type	layer	thickness	type												
1	30.0 mm	L	1	40.0 mm	L	1	30.0 mm	L	1	40.0 mm	L	1	40.0 mm	L	1	40.0 mm	L
2	20.0 mm	С	2	40.0 mm	С	2	30.0 mm	L	2	40.0 mm	L	2	40.0 mm	L	2	40.0 mm	L
3	30.0 mm	L	3	40.0 mm	L	3	30.0 mm	С	3	20.0 mm	С	3	30.0 mm	С	3	40.0 mm	С
4	20.0 mm	С	4	40.0 mm	С	4	40.0 mm	L	4	40.0 mm	L	4	40.0 mm	L	4	40.0 mm	L.
5	30.0 mm	L	5	40.0 mm	L	5	30.0 mm	С	5	20.0 mm	С	5	30.0 mm	С	5	40.0 mm	С
6	20.0 mm	С				6	30.0 mm	L	6	40.0 mm	L	6	40.0 mm	L	6	40.0 mm	L
7	30.0 mm	L				7	30.0 mm	L	7	40.0 mm	L	7	40.0 mm	L	7	40.0 mm	L





#### **CHALLENGES** DIAPHRAGM ACTION – ET3 STRATEGY





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220

220

-3370

170

170

-2020

## CHALLENGES



