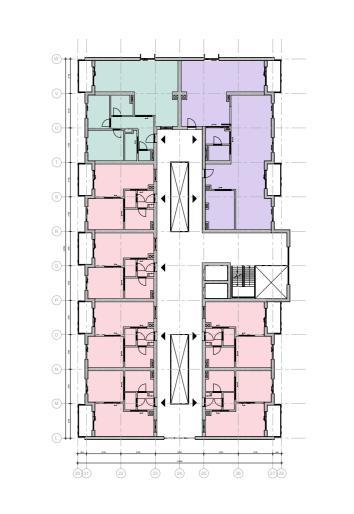
RESIDENTIAL BUILDING



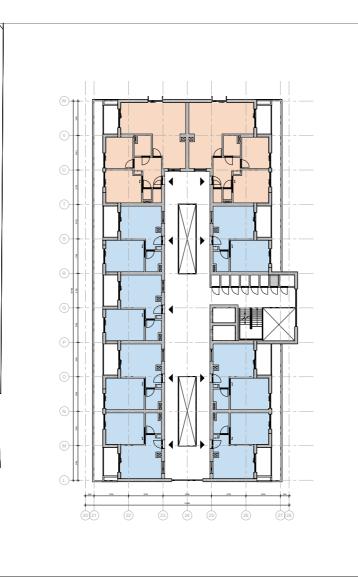
Image: space s

Ground floor

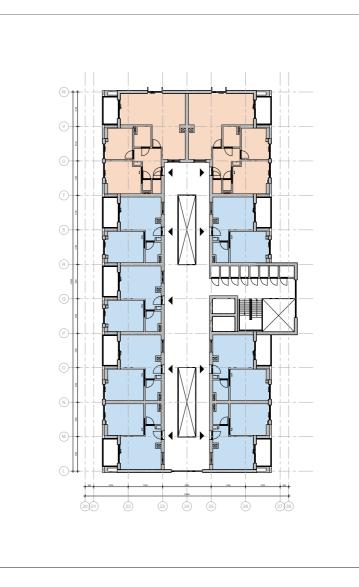




First floor

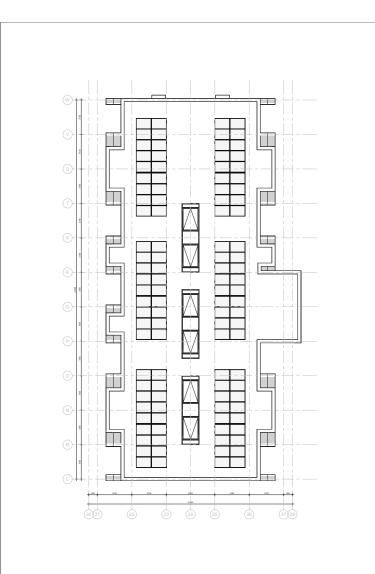


Second floor



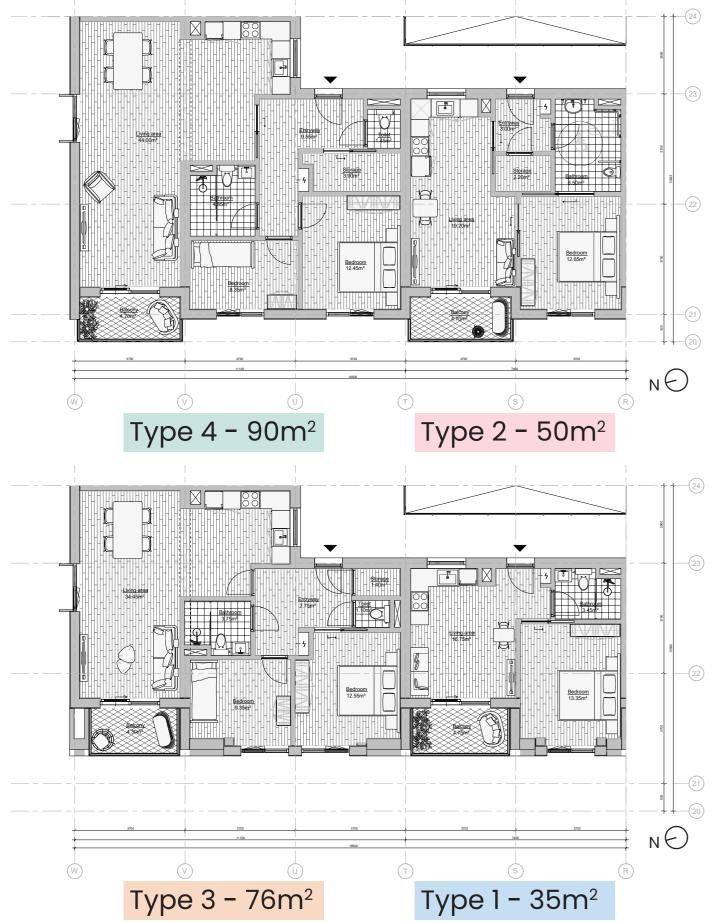
Third floor





С И







East







North

South



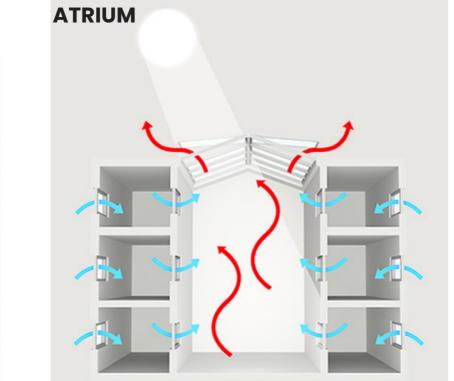
A solar chimney is a passive system that improves indoor climate and air quality by using natural forces instead of mechanical installations. It consists of a vertical shaft that connects interior spaces to the outside.

As solar radiation heats the air inside the shaft or atrium, the warm air rises and exits through skylights, creating a natural stack effect. This upward movement draws in cooler, fresh air through lower façade openings, enhancing ventilation.

The result is improved air quality, a more stable indoor climate, and reduced reliance on mechanical systems, supporting an energyefficient building design.

SOLAR CHIMNEY GLASS DARK WARM ABSORPTIVE AIR SURFACE COOL

VENTILATION OPENING



										0	Δ	D-BE
	CONSTRUCTION											
	TARWEWUK											
Method	STRUCTURE	STRUCTURE	STRUCTURE		STRUCTURE					STRUCTURE		
wiethou	Columns	Disk construction	Monolithic	Haristati	FLOOR					ROOF		
	A structural framework that is independent of the infill. There is a complete distinction between load- bearing and separating elements.		There is a unity between load- bearing and separating materials; walls are both load-bearing and separating.									
	SIZUTION CONSTRUCTION	LOAD BEARING WALLS	TUNNEL		Prefab concrete (Hollow core slab / semi-orecast slab)	IN SITU CONCRETE	WDDD	STILL		Heliend	Plat	free form
	POSITIVES	POSITIVES	POSITIVES		POSITIVES	POSITIVES	POSITIVES	POSITIVES		POSITIVES Shape of the inside	POSITIVES	POSITIVES
	Does not require complicated formwork.	Facades are non-load-bearing; large openings are possible. Floor areas are less restricted compared to	Cost-effective in large quantities		Faster installation	Stong	Sutainable	for balconies etc		Shape of the inside and outside is perceivable.		Can be an e. architecture feature
	Needs little space on the construction site	the walls, but be mindful of the buckling length.	Fast construction time		consistent quality	fire-resistant	esthetics	venatile in design		Water drainage	To create a rooftop landscape.	optimally adapted to design
			Smooth finish for walls and floors. Concrete load-bearing walls and floors meet noise disturbance		reduced on-site labor	versatile in design	versatlie in design			sunorientation The building become	Can be used as a functional surface.	enders possibilities with CAD
	NEGATIVES	NEGATIVES	requirements. NEGATIVES		NEGATIVES	NEGATIVES	NEGATIVES	NEGATIVES		less stiff. NEGATIVES	possible. NEGATIVES	NEGATIVES
		This building method is relatively closed an										
	Floor areas are structure-defining.	space-defining: openings are possible but limited by the materials used.	Only applicable in large repetition.		Transportation costs	Labor-intensive		needs fire proofing		No direct view; no street connection. Loss of voluminous	Determining for architecture.	Difficult construction
		Walls must be rigidly fixed.	Rigid structure. Requires great uniformity		limited flexibility in design	long curing time requires formwork		thin		space.	Heatstress	often expensive Restriction with possible material
			Gear spatial formation (tunnel)			requests comments.						presses maneral
	Sorts Concrete	Sorts Concrete	Serts Concrete		Concrete							
	in situ Prefab	prefab on site	Prefab In Situ		Slabs in situ Semi precast slab							
	Prestressed	UNPC (ultra high performance concrete) Cellular concrete			Prefab hollow slab							
	Wood Solid Timber	Wood Solid wood beams and panels			WDDD Sold timber -beams							
	Glulam (Glued Laminated Timber) Q.T	CLT LVL (laminated veneer lumber)			CLT LVL + Glutam							
	LVL Steel	Bricks			timber box element floor >lignatur	spans 4-8m / depth 120-320mm						
	I or H profiles HSS (Hollow Structural sections)				>ignatur >kielting Steel							
	Composite steel-concrete columns				Grated steel composite steel deck floor							
Materials	s				Companier Iden arck riste							
	Columns	Disk construction	Monolet	NOTIS	PREFAG HOLLOW SLAG	SEMI PRECAST SLAB	IN SITU CONCRETE	WOODEN SLAB/CLT	HOLLOW WOOD SLAB	STEEL		
ONCRETE	POSITIVES	POSITIVES	POSITIVES		POSITIVES	POSITIVES	POSITIVES	POSITIVES	POSITIVES	POSITIVES	(RA)	
	High compressive strenght	High compressive strenght	High compressive strenght		Lightweight - 1800kg/m ³	Flexible design combined with pipes and openings.	High compressive strenght	Sustainable material: Wood is a renewable material and stores CO ₂ -	High strengtht to	High strenght to weight ratio	and to 140 Algorithm	
	For resistant	Fire resistant	Fire resistant		Fast construction time	Strong and monolithic combined with pressure layer.	Fire resistant	Lighter than concrete-450kg/m ³	Sustainable material: Wood is a renewable material and stores CD	Lone spans possible		All Shirts Markey
	Durable NEGATIVES	Sound-dampening. NEGATIVES	Durable NEGATIVES		Strong Sustainable	less cast materials good sound and thermal isolation	Durable Heavy loads possible	Fast construction time Good insulation: Natural thermal insulation and moisture-regulating.	Pipes can be integrated into holes. Fast construction time			Little and a little in
	Heavy	linger	Prefab only in small scale	4m high-2,55 wide, 18,75 m lone (truck)	Pipes can be integrated into holes.	Adjustments possible on-site.		Potential aesthetic quality: wooden finish.	Good thermal insulation - insulation value.		110	and the second s
	High Co2 footprint with production	High Co2 footorint with production	Heh Co2 footorint with production		Good sound and thermal insulation through channels.	The possibility to embed pipes in the top layer.			Potential aesthetic quality: wooden finish		100 A	ayou July Star
	Needs a cast (formwork)	Less fexble	ngid		1200x260 + 10 m spanning (VBI)	8-10 m maximum spanning	5-10 m maximum spannle (niet te vinden)	g S,4m - 6 m optimal (up to 7)	Optimal 7,5 m	9m maximum	90	- 1 B B contrense
	and a second participation of		Needs water sealment		1						80	Contraction of the second
000	POSITIVES	POSITIVES			NEGATIVES	NEGATIVES longer building time then hollow slab.	NEGATIVES	NEGATIVES	NEGATIVES	NEGATIVES	70	and contenting the state
	Renewable material	Renewable material			Transportation costs: Due to th prefab process, there are	curing time e heavier (2403kg/m ³) then hollow slab,	Heavy - 2400kg/m ³	Acoustics/vibrations.	Acoustics/vibrations.	Acoustics are bad Requires corrosion	(Ys-#1)	
					loristical costs.	needs more support	High Co2 footprint	Fire resistance	Fire resistance Wood expands and contracts with	protection	40	APPENDING APPENDING
	Warm esthetics	Warm esthetics			An additional pressure layer is	during building process more support is			moliture, so proper waterproofine is			H H H (() ()
	Lightweight	Lightweight High tensile strength.			An additional pressure layer is needed for heavy loads.	during building process more support is needed	Needs proper curing	Wood expands and contracts with molisture, so proper waterproofing is necessa Higher costs than concrete.	molsture, so proper waterproofing is		30 +0	Man CHART
		Lightweight			An additional pressure layer is needed for heavy loads.	during building process more support is needed	Needs proper curing		molisture, so proper waterproofing is ry. necessary.		30	
	Lightweight NEGATIVES	Lightweight High tensile strength. NEGATIVES Sensitive to moluture; impregration		Overdimensioning is possible	needed for heavy loads.	during building process more support is needed	Needs proper curing		molisture, so proper waterproofing is ry. necessary.		30	Man CHICK
	Lightweight NEGATIVES Moisture Requires fireproofing treatment	Lightweight High tendle davegih. MEDATIVES Senative to molature, imprografion meeded. Requires fregoroding treatment BROCK			needed for heavy loads.	during building process more support is needed		Higher costs than concrete.	molisture, so proper waterproofing is ry. necessary.		30	
15.	Lightweight NEGATIVES Maisture Requires freproofing treatment POSITVES High strength to weight ratio	Lightweight High tensile transpit. <u>NECKTVS5</u> Sentitive to moliture; impregnation received. Requires fragmoning treatment <u>IREOS5</u> FOOTINES wurdenballe			needed for heavy loads.	needed		Higher costs than concrete.	molisture, so proper waterproofing is ry. necessary.	Almost name	30	
81.	Lightweight NEGATIVES Mainture Requires fireproofing treatment POSITIVES	Lighburght High tensis drongth. NEGATIVES Sensitive to molitare; impregnation needed. Requires fingeroofing treatment BRODS POSTINES			needed for heavy loads. Acoustics For contact insulation in a room ab	needed	value of s 54 dB in the case of s	Higher costs than concrete.	mohlure, so proper waterproofing is yn neessawy. Higher costs than concrete.	Almost none	30	
TTEEL	Lightweight NEGATIVES Mainture Requires Ensproofing treatment POSTIVES Night incompletion weight ratio Finable in design	Lightweight High tracile wingth. NECKTISS Sendbut to molture; improgration reeded. Requires freproofing twatment IRCOS POSTINGS watchangle Michairu-erstet.			needed for heavy loads. Accessites For control mutation is a room ab Nigh Classificatie wighten BOCTS Klass Approven	needed	ration of a SA dB in the case of a	Nghr cett he correte.	mohlure, so proper waterproofing is yn neessawy. Higher costs than concrete.	Almost none	30	

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EARING STRUCTURE

To determine the most suitable structural materials, a materialapplication matrix was created, comparing options based on sustainability, performance, and architectural expression. This helped relate material qualities directly to the design.

As a result, the residential buildings use concrete for its durability, fire resistance, and acoustic benefits. To reduce environmental impact, recycled materials from on-site demolition will be incorporated. The strict grid layout supports an efficient disk construction system.





Sustainable concrete production requires both material innovation and process adaptation. Since recycling concrete only becomes energy-efficient when the material is sourced within approximately 25 kilometers, the concrete for this project will be produced on site using granulate from demolished buildings. This significantly reduces the need to transport new materials, while giving demolition waste a second life.

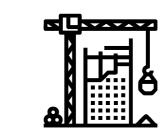
By replacing natural aggregates like gravel and sand, the approach preserves raw resources, minimizes CO₂ emissions, and lowers the project's environmental footprint.

This strategy supports a circular material cycle and reflects a responsible urban development mindset. Symbolically, it also creates a sense of continuity, where fragments of the old site are reimagined as part of the new architecture.

demolish buildings



crushed into granulate



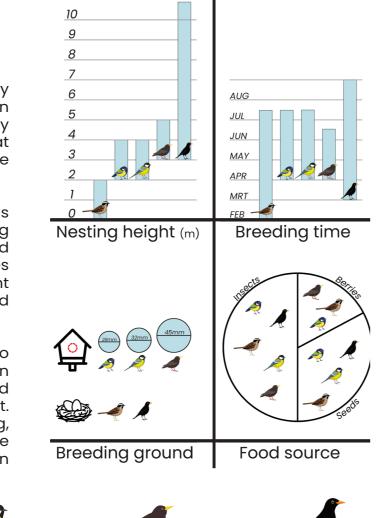
granulate mixed into new concrete



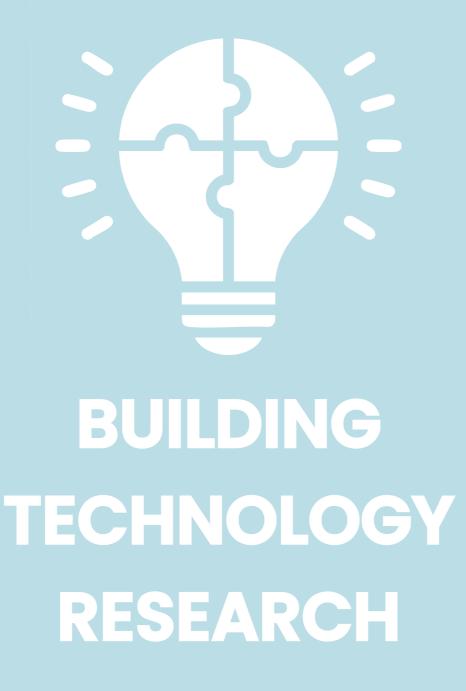
A well-functioning ecosystem supports biodiversity and fosters a resilient urban environment. In designing the multigenerational housing community in Tarwewijk, a key focus is creating a habitat that attracts and sustains local bird species while enhancing the quality of outdoor spaces.

To achieve this, I explored the most common birds in Tarwewijk using data from Vogelbescherming Nederland, which provides an overview of local bird populations based on zip code. Their tool generates a list of frequently observed species, offering insight into which birds are naturally present in the area and how the design can cater to their needs.

From this research, I selected five bird species to integrate into the plan. These species were chosen based on their prevalence in the neighborhood and their ecological role in supporting a balanced habitat. Each of these birds has specific nesting, foraging, and sheltering requirements that will influence the choice of vegetation, structural elements, and green interventions in the project.





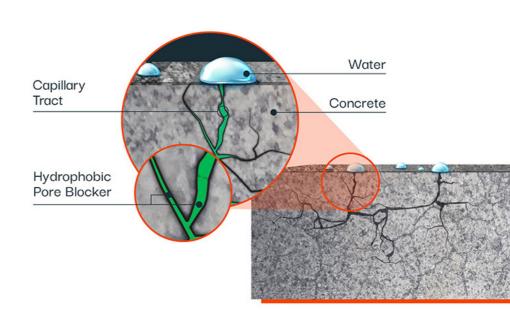


HYDROFOBIC ADMIXTURE

To ensure long-term durability while maintaining sustainability, both the recycled concrete and rammed earth in this project are enhanced with hydrophobic admixtures-additives that repel water from within the material itself.

Recycled Concrete:

Because recycled concrete is more porous than traditional mixes, an integral hydrophobic admixture (e.g. Hycrete Endure WP) is used. Mixed into the concrete at the batching stage, it lines the capillaries internally-preventing moisture ingress while still allowing the structure to breathe.



This reduces corrosion, freezethaw risks, and eliminates the need for extra waterproofing layers, keeping the material circular and low-maintenance.

Rammed Earth:

RAMMED EARTH

For the exposed rammed earth walls of the community center, a penetrating siliconebased admixture (e.g. Tech-Dry Plasticure) is applied. It bonds with the surface minerals, forming an invisible waterrepellent layer that protects against rain, splashes, and erosion, without compromising the natural appearance or vapor permeability of the earth.

Waterproofing concrete



For the bricks research, I explored three distinct types of bricks with various benefits and applications.

The Click Brick system is an innovative solution that focuses on horizontal installation. The bricks are connected using stainless steel clips and cavity anchors, making them removable and reusable. This system stands out for its flexibility and sustainability, as it eliminates the need for mortar, reducing waste during construction and being remountable.

Eco Bricks are designed with a reduced volume, making them 35% smaller than traditional bricks, with a width of just 65mm. The production process requires less energy and fewer resources, contributing to a reduction in CO₂ emissions. Additionally, the efficiency in packaging and transportation helps reduce the environmental impact by allowing more bricks to be transported per load, thereby reducing transport movements, pallets, and coverings.



Click Brick system



Rammed earth is a low-impact construction technique where layers of gravel, sand, silt, and clay are compacted in formwork to create solid, monolithic walls. The soil is often sourced locally, minimizing transport and CO₂ emissions. To ensure durability, walls must be protected from moisture-with raised foundations, roof overhangs, and proper drainage.

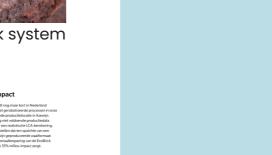


Thanks to their high thermal mass, rammed earth walls absorb heat during the day and release it at night, stabilizing indoor temperatures and reducing energy use.

An advanced variation, SIREWALL, adds internal insulation, reinforcement, and vapor control, achieving high energy efficiency (RSI 5.8) while preserving the natural appearance and breathability

of earth construction.





Langformaat bricks are ideal for certain applications where faster installation is a priority. The longer size of these bricks allows for quicker processing, as they can be easily inserted without the need to adjust the joint thickness.

Eco Brick facts



Vattenfall supplies district heating to two areas in the southern part of Rotterdam. One of these areas includes Tarwewijk. The network is already connected to the gymnasium on the design site. This existing connection provides an opportunity to integrate the new development into the district heating system, further expanding its use within Tarwewijk.

Heat sources:

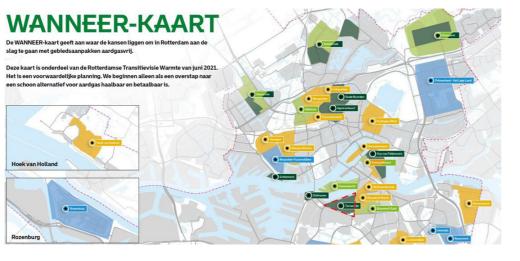
1. Waste Incineration Plant - At the AVR waste incineration facility (Rozenburg), residual waste is burned to generate steam. This steam is used to heat water for the district heating network in the Rotterdam region.

2. Residual Heat from Industry - Waste heat from the Shell refinery in Pernis is repurposed to supply dirstict heating in the Rotterdam area.

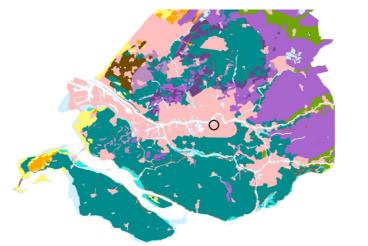
The 'wanneer-kaart' illustrates the phased transition to district heating throughout the whole of Rotterdam. Tarwewijk is part of the group advised to begin a district-wide transition approach before 2025 (dark green). Therefore, connecting to the district heating network aligns with the Municipality of Rotterdam's vision for sustainable energy development.

District heating network Vattenfall in Rotterdam

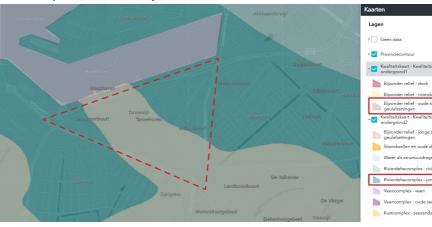




Soil map of southwest of The Netherlands



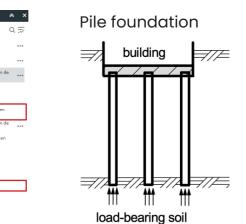
Soil map of Tarwewijk



SOIL AND FOUNDATION

The soil of the Netherlands is shaped by centuries of water influence, with low-lying areas dominated by clay, peat, and sand. Rotterdam's subsurface is primarily soft peat and clay, making it especially vulnerable to land subsidence.

In Tarwewijk, the subsurface consists of flow belts and channel deposits (peach) and the river delta complex with young sea clay (turquoise). Due to peat oxidation, soil compression, drainage, and resource extraction, the ground is sinking.



Because of the soft, compressible soil in Tarwewijk, a pile foundation is the most suitable solution. The weak peat and clay layers lack the bearing capacity needed for shallow foundations, making deeper, more stable support essential for long-term structural integrity.