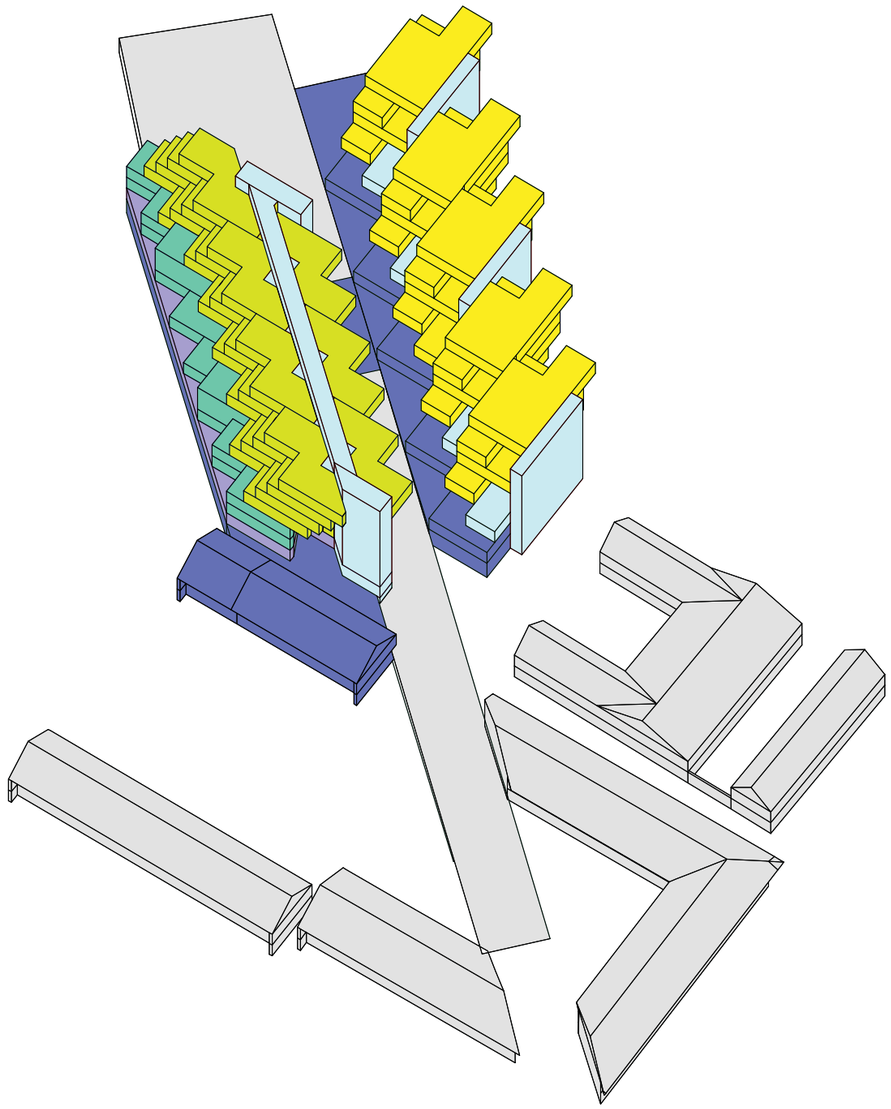


# Midrise Multiple residentials

| Submission Date | Submission Date |
|---|---|
| Student Name (Nick Name)<br>/Student Number/ Email Address | Natthaphat Chtananwut (Moss)<br>6538037425/ Natthaphat.c@cuinda.com |

# PROJECT CRITERIA


| | |
|---|---|
| Building program | Aging Housing |
| Scale | Midrise Multiple residentials<br>High density |
| Unit Number | 60 - 70 Dweller |
| Location | 248 Chiang Mai Rd, Khlong San, Bangkok 10600 |
| Project site | 22,000 |

(Demolishing the existing building)

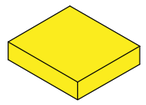
## Projects Short Description

The number of senior patients in Thailand has been steadily rising as the country transitions into an aging society. As this trend continues, long distances from home to hospital have become a significant barrier for elderly individuals, especially when attending appointments or dealing with emergencies. To address this issue, Taksin Hospital has proposed housing projects designed to accommodate residents living closer to the hospital and to provide essential social care services.

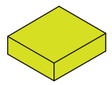
# Design requirement

## Unit requirement

INDEPENDENT LIVING UNITS



>120 SQM
>15 Unit

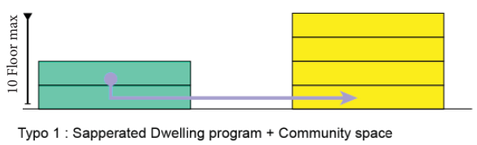


>90 SQM
>20 Unit

RESIDENTIAL CARE FACILITY

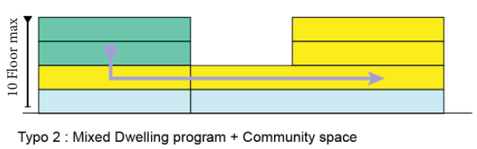
>25 SQM
>20 Unit

## *Suggestion Building program*



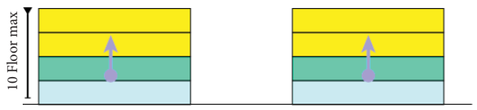

Typo 1 : Sapperated Dwelling program + Community space

This typology suggests separate program buildings which required less building foorprint, yet necessitating a solution to enable fast and easy commuting between them for staff.




Typo 2 : Mixed Dwelling program + Community space

This typology offers a better solution for staff to commute between buildings with large community spaces. However, it requires a larger building footprint to achieve the desired number of units.



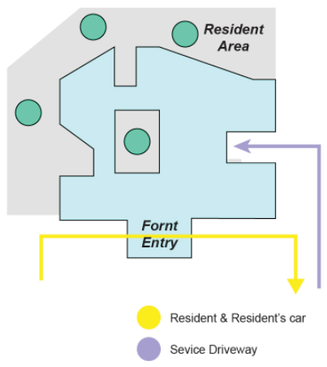

Typo 2 : Mixed Dwelling program + Community space

This typology offers a mixed-program setup, allowing for better circulation within the building. However, it may require more staff depending on the number of buildings.


## *Suggestion Entrance*

Vehicle and Padestrian Traffic

- Provide a clearly identifiable front entry, visible from the street and place to stop and drop off and pick up a resident.
- Provide a safe and clearly identifiable pedestrian access
- Required to separate the service driveway and back-of-house service access from public and resident/ pedestrian paths.
- Car parking should be designed to be flexible to meet the changing needs into the future
- Providing at least 100 Parking.

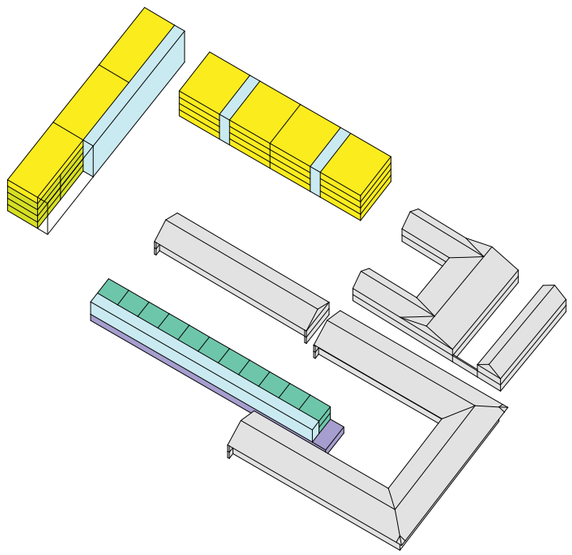



Front-of-house

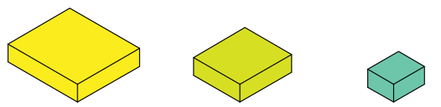
Each residential unit is designed to maintain a clear visual connection with the temple located on the opposite side of the river. This to enhances the serene atmosphere, enriching the living experience, particularly for senior residents within this housing project.

# Phase 1 : Overview

## Baseline :



### Unit Number



162 SQM
19 Unit

90 SQM
24 Unit

30 SQM
22 Unit

### Highlight Strength

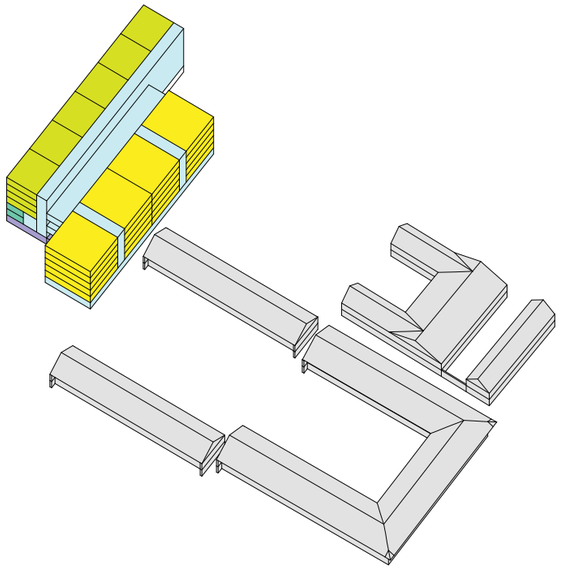
1.The design building layout responds to the design requiredment.

### Highlight weakness

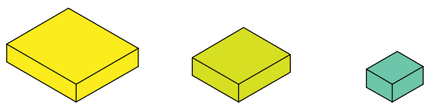
1.Three separate, mid-rise buildings increase solar radiation exposure

2. Higher heat absorption challenges energy efficiency and comfort

## Protrotype 1 :



### Unit Number



162 SQM
20 Unit

90 SQM
24 Unit

30 SQM
22 Unit

### Highlight Strength

1. Reducing the number of buildings minimizes total roof area

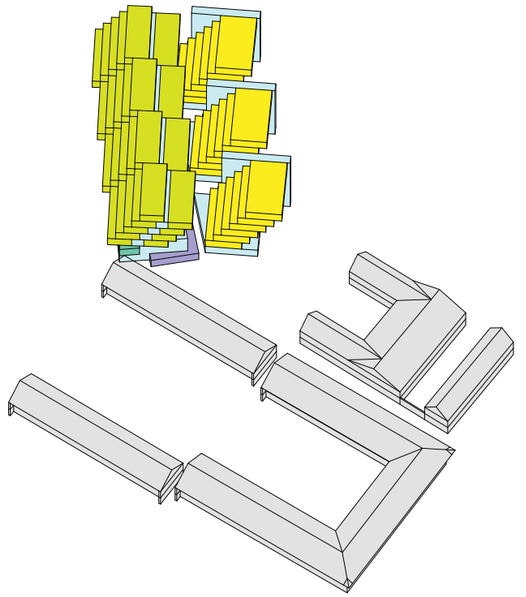
2. Less roof area decreases solar radiation absorption

### Highlight weakness

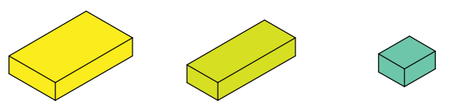
1. Orientation of the longest sides along the NE and SW axis exposes most facades to direct sunlight.

2.  Mid-rise design results in a large roof area, amplifying solar gain.

## Protrotype 2 :



### Unit Number



135 SQM
30 Unit

90 SQM
32 Unit

30 SQM
20 Unit

### Highlight Strength

1. Orientation strategies reduce excessive solar radiation while achieving target solar gain

2. Design creates ventilation channels

3. Stairs-like structure allows solar access to overshadowed areas

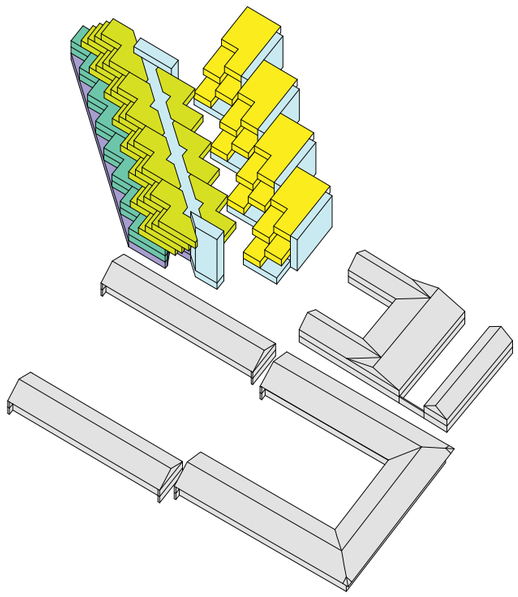
### Highlight weakness

1. Lacking claear access

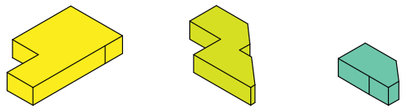
2.Blocked Views

3. Center wind corridor was too narrow.

## Protrotype 3 (Seclection) :



### Unit Number



145 SQM
16 Unit

90 SQM
27 Unit

45 SQM
22 Unit

### Highlight Strength

1. Proposal meets design requirements and target solar radiation through strategic orientation

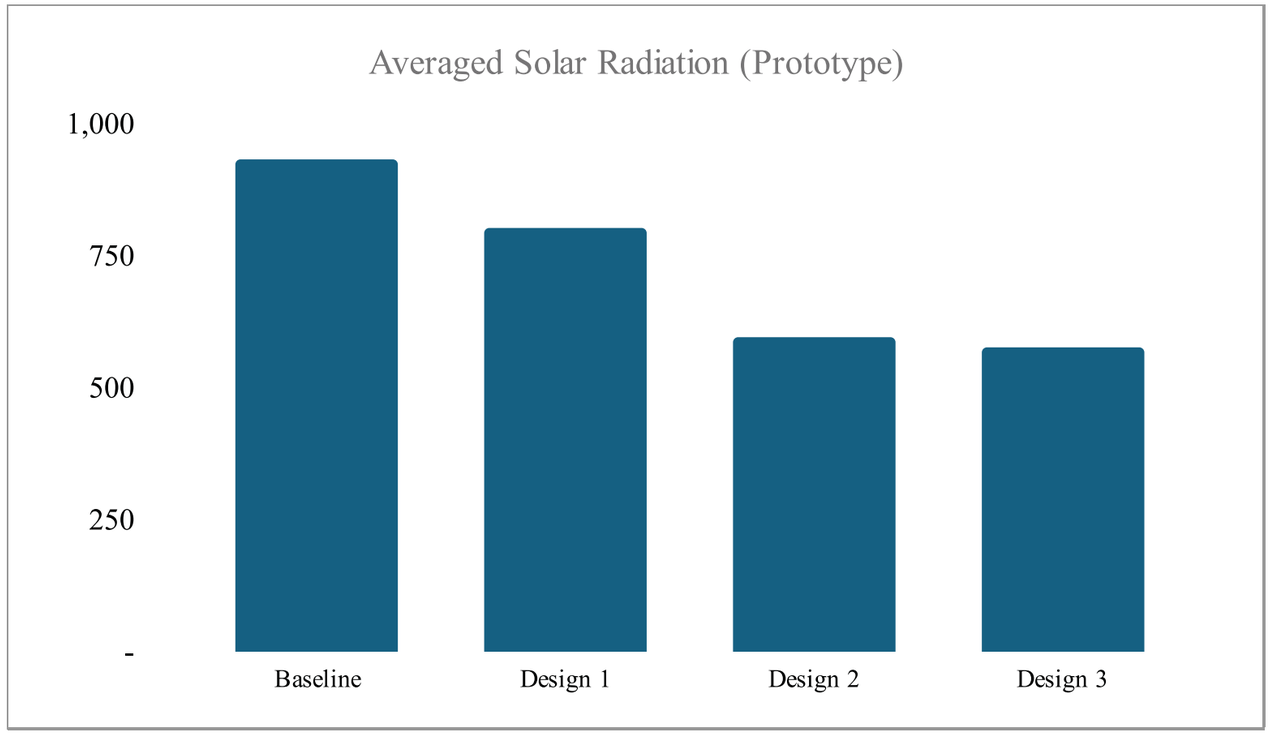
2. Widened wind corridor improves main access route from entrance to residences

3. Enhances overall functionality and accessibility

### Highlight weakness

1. Large rooftop area

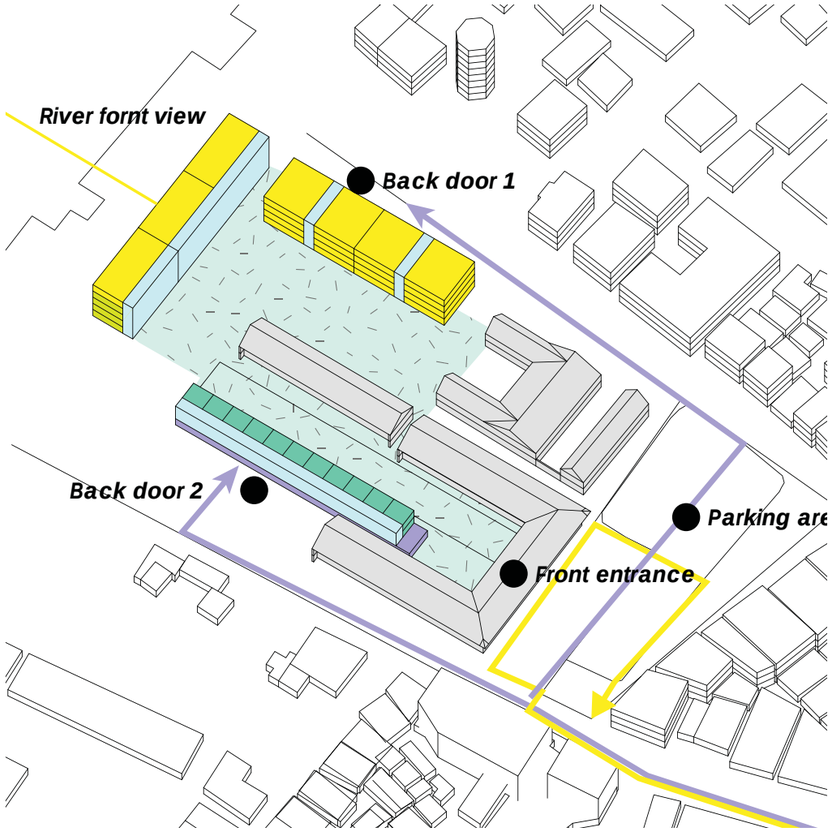
| Summary | |
|---|---|
| | Averaged Solar Radiation (kWh/m2/year) |
| Baseline | 934 |
| Design 1 | 802 |
| Design 2 | 597 |
| Design 3 | 576 |



# Phase 1 : Prototype

Baseline

## Design Strategies

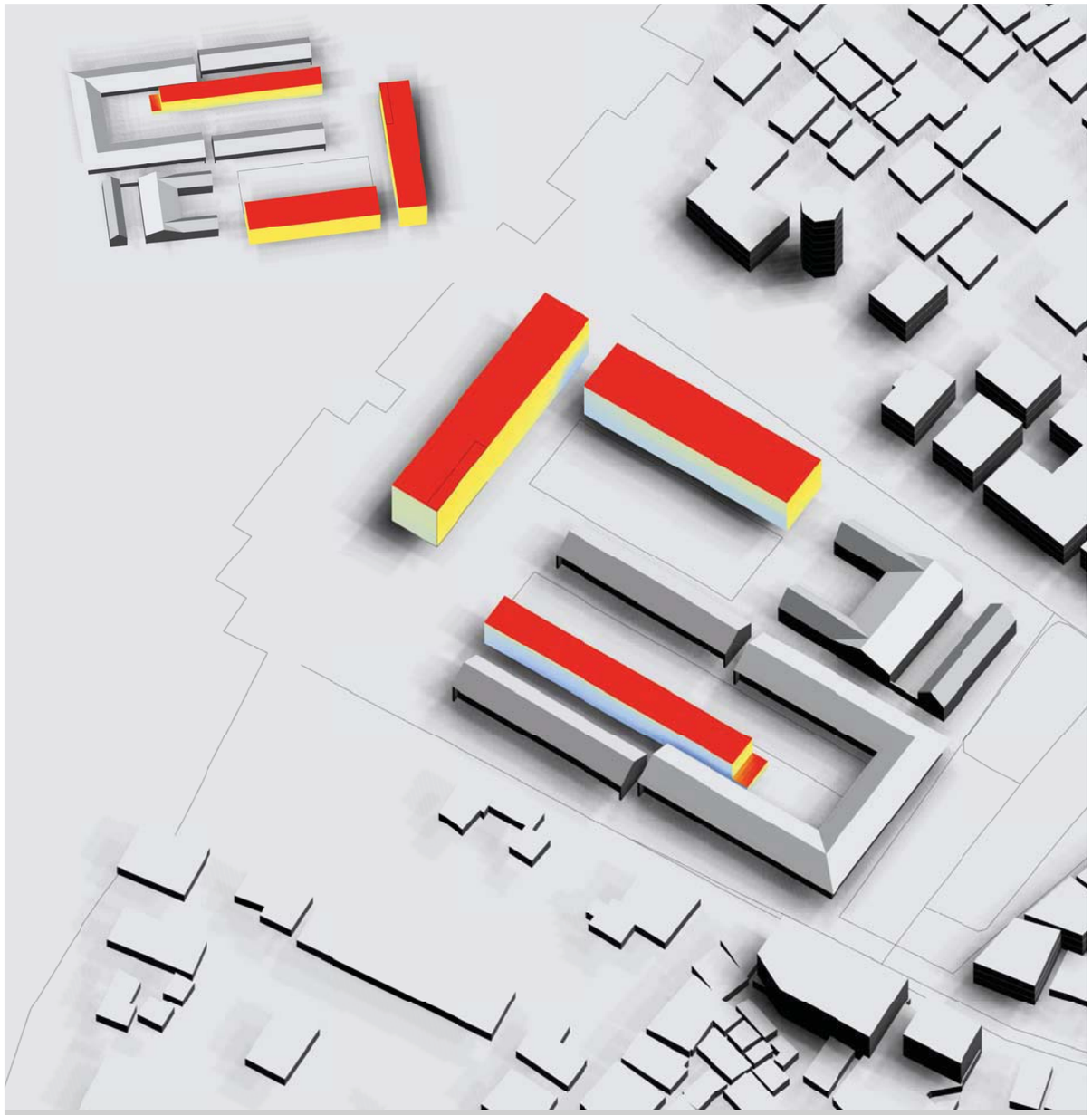



### Highlight weakness and realization

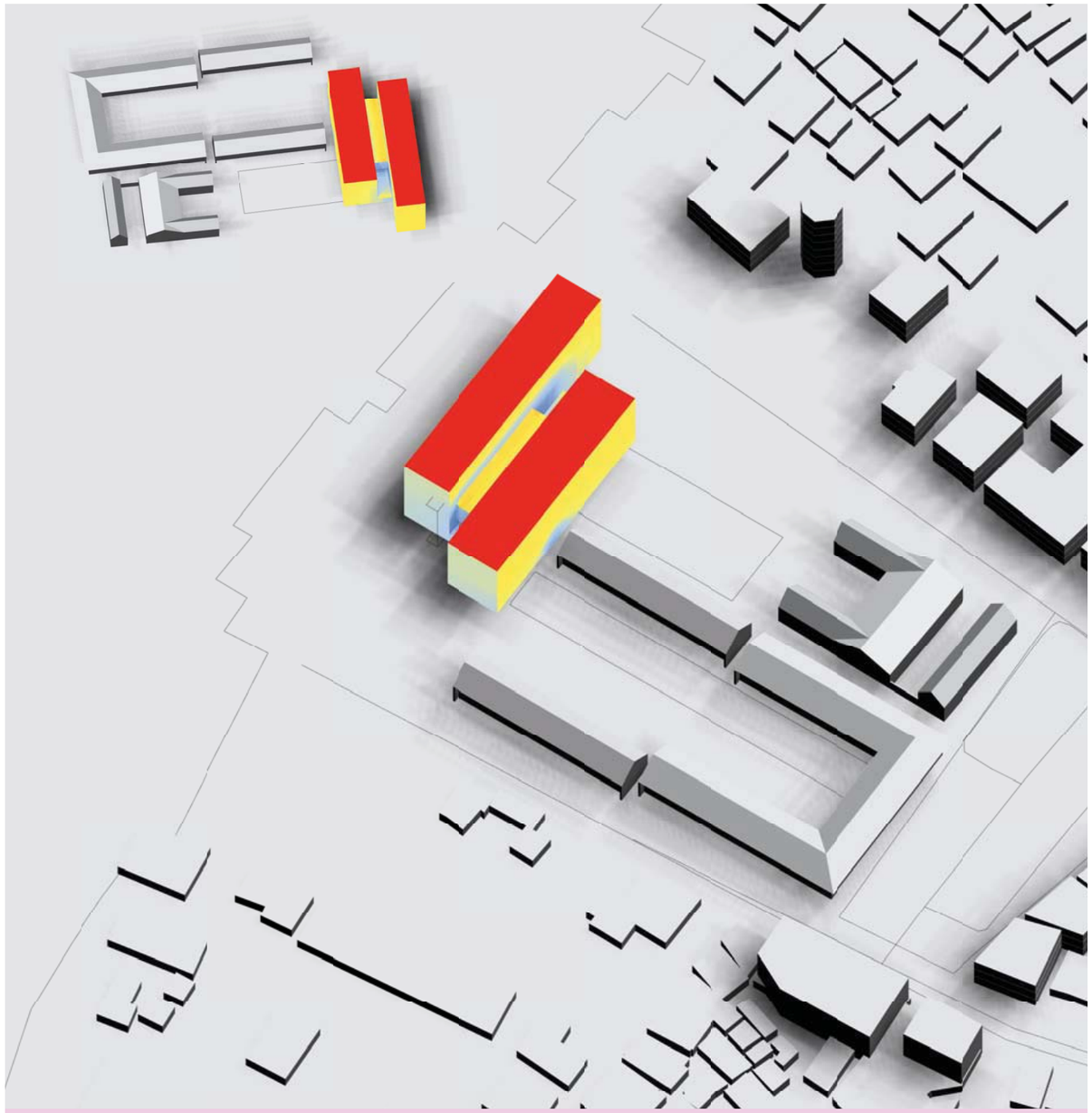
Although the proposal addressed the design requirements, ***three saperated buildings, its distance, and their mid-rise characteristics*** have collectively contributed to higher solar radiation exposure throughout the day. This results in increased heat absorption by the buildings, challenging the overall energy efficiency and comfort of the living spaces.

### Goal to achived

Try to responds challange toward mid-rise chareacteristic and ***achived traget solar radiations.***



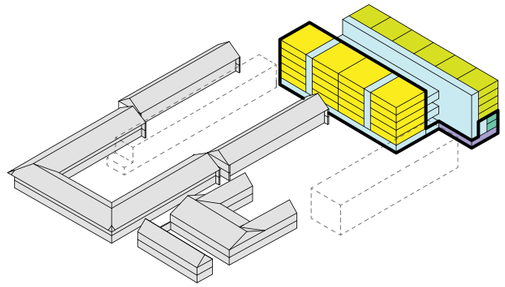
| Baseline | | |
|---|---|---|
| Total Building Surface Area | 7,145 | m2 |
| Annual Solar Radiation | 6,671,000 | kWh/year |
| Averaged Total Solar Radiation | 934 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Fail** | |



| Design 1 | | |
|---|---|---|
| Total Building Surface Area | 6,825 | m2 |
| Annual Solar Radiation | 5,475,300 | kWh/year |
| Averaged Total Solar Radiation | 802 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Fail** | |

Prototype 1

## Design Strategies

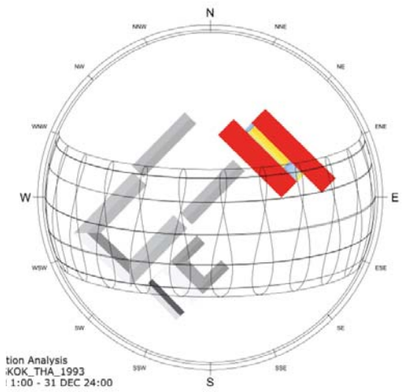


### Highlight Strength

By reducing the number of buildings, the total roof area is minimized, which in turn decreases the overall amount of solar radiation absorbed per day. This reduction in roof surface area helps lower heat accumulation, improving the building's energy efficiency and thermal comfort.

### Highlight weakness

With the building's longest sides oriented along the NE and SW axis, most of the facade is exposed to direct sunlight throughout the day, increasing the amount of solar radiation absorbed. The extensive roof area, a result of the Mid-rise design, further contributes significantly to the overall solar gain, as the larger surface area is more susceptible to heat accumulation from direct sunlight.




### Goal to achived

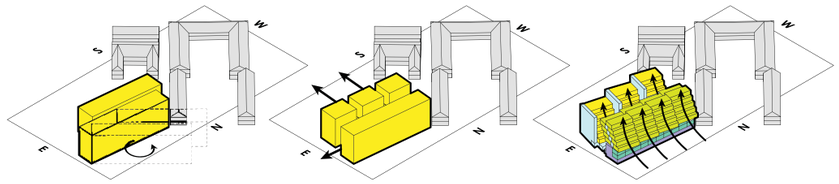
Try to responds challange toward ***Building orientation*** and ***achived traget solar radiations.***

# Phase 1 : Prototype

## Prototype 3

### Design Strategies

To achieve the target for total solar radiation gain, the strategies of building and unit orientation were employed to enhance the amount of shadow casting generated by the proximity of the buildings.




Building orientation

The building's longest side is oriented toward the north and south to avoid direct sunlight from the west and east.

Building modification

By adding a wind corridor in the middle part of the building, the overall roof area is reduced, while the amount of building facade that casts shadows is increased.

Unit orientation

This allows for more shadow casting, but at the same time, it increases the amount of roof-like areas (terrace) in the structure.

### Highlight Strength

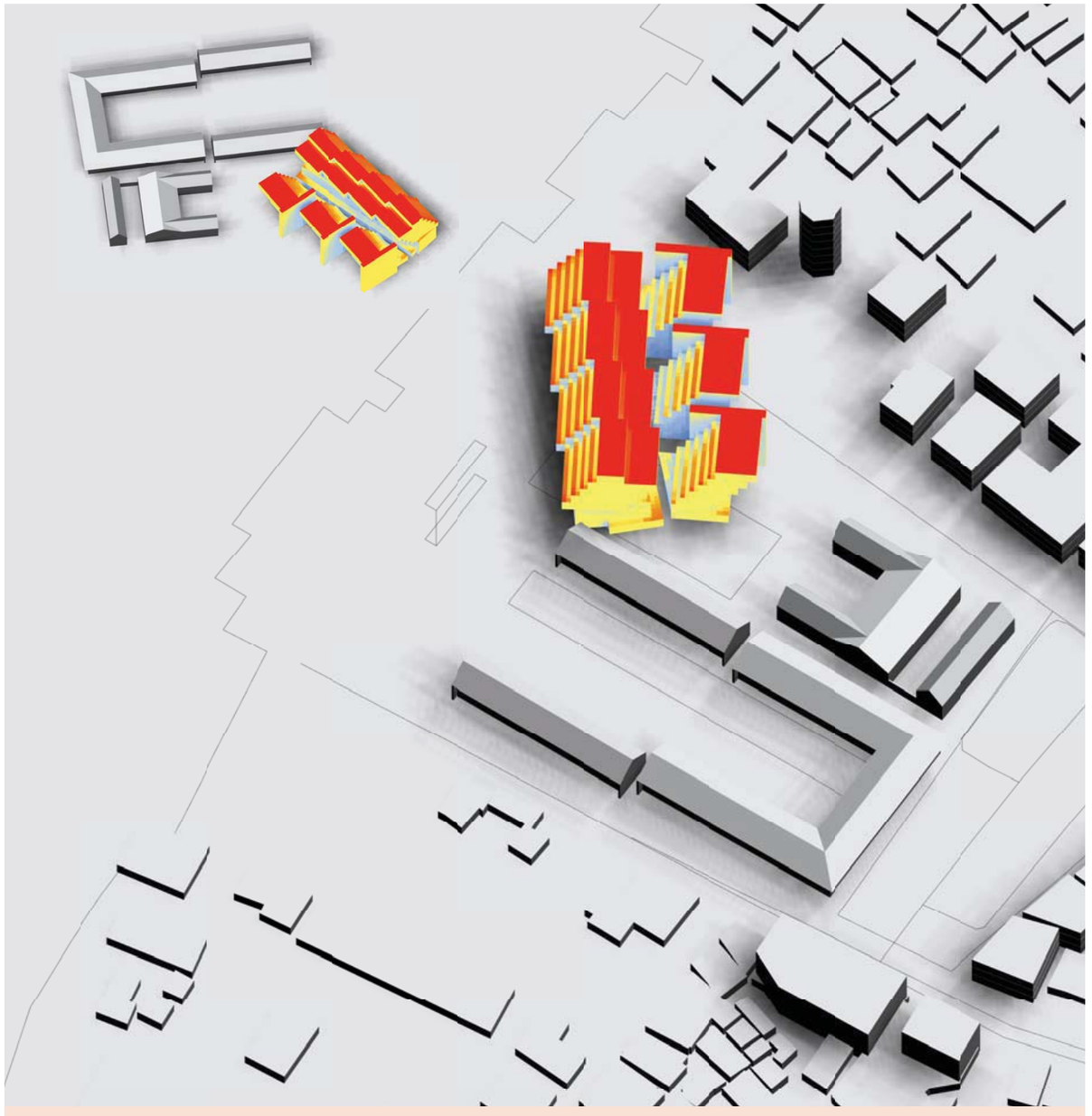
These building and unit orientation strategies help the low-rise building complex decrease excessive solar radiation while achieving the target solar gain. Additionally,it create channels for ventilation and Stairs-like structure allow solar access in areas overshadowed by adjacent buildings.

### Highlight weakness

Although it could achieve the target solar radiation, however This building prototype fale responds to design requirement :
1. Lacking claear access (residential unit - fornt door)
2.Blocked Views: The orientation obstructs the visual connection between each unit and the nearby temple.
3. Center wind corridor was too narrow, limited activity and usability of space.

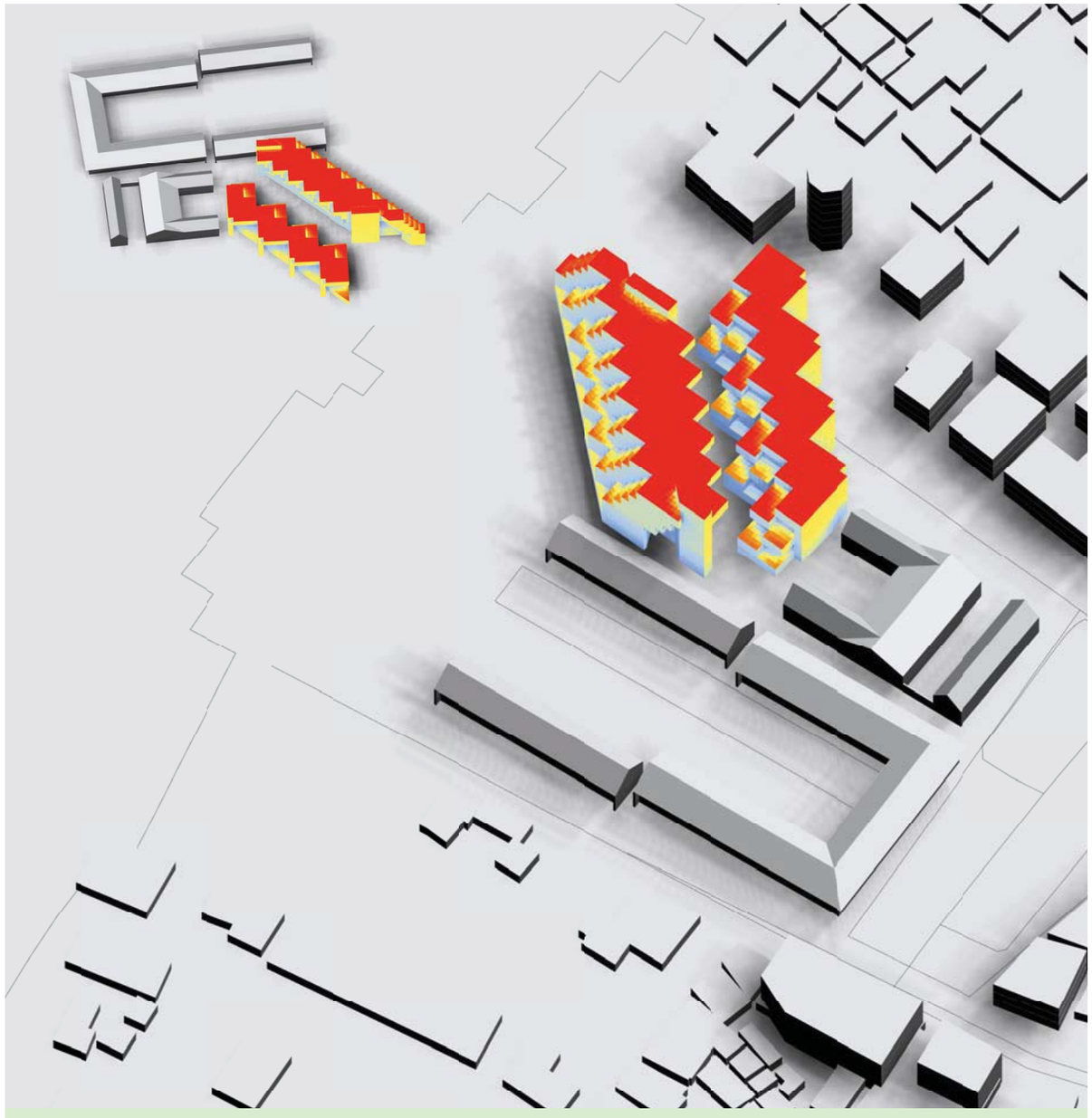
### Goal to achived

***Achiving the design requiredment*** while balance ro design the number of solar radition.



**Design 2**

| | | |
|---|---|---|
| Total Building Surface Area | 10,932 | m2 |
| Annual Solar Radiation | 6,529,200 | kWh/year |
| Averaged Total Solar Radiation | 597 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Successful!** | |



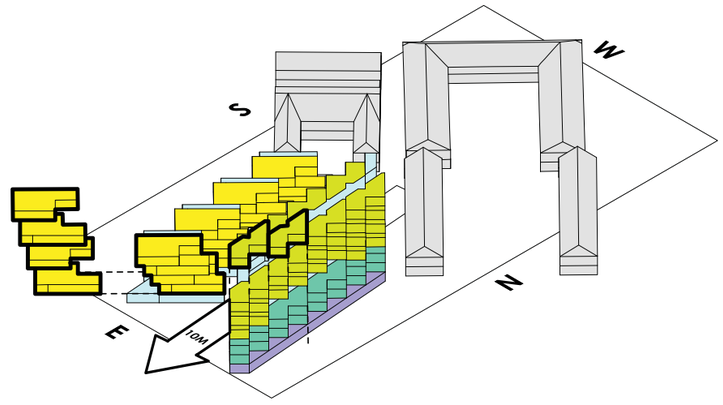
**Design 3**

| | | |
|---|---|---|
| Total Building Surface Area | 11,606 | m2 |
| Annual Solar Radiation | 6,688,800 | kWh/year |
| Averaged Total Solar Radiation | 576 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Successful!** | |

Prototype 4

## Design Strategies

This proposal aim to
1. Recliam visual connection between residential unit and the temple on aother side of river.
2. Increasing the width of wind corrior to make this open space more useable.
3. Maintian the number of average total solar radition.




Building modification

Increasing the width of the wind corridor (Which decreasing the surface area casting shadows from building distance.)

Unit orientation

This help three thing :
1. Visual connection
2. Balancing smount of directs sunlight building would recieve.
3. Better ventilation

## Highlight Strength

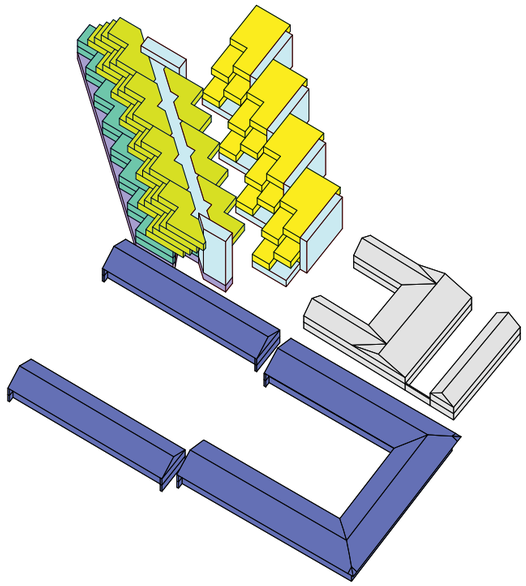
This building proposal could achieve both the design requirements and the target solar radiation through strategic building and unit orientation. The widening of the wind corridor creates a clearer main access route from the main entrance to the residences, enhancing overall functionality and accessibility.

## Highlight weakness

Although the building could achieve both goals, minimizing the total rooftop area would further help decrease significant portions of solar radiation.

# Phase 1 : Overview

## Baseline :



### Unit Number

145 SQM
16 Unit

90 SQM
27 Unit

45 SQM
22 Unit

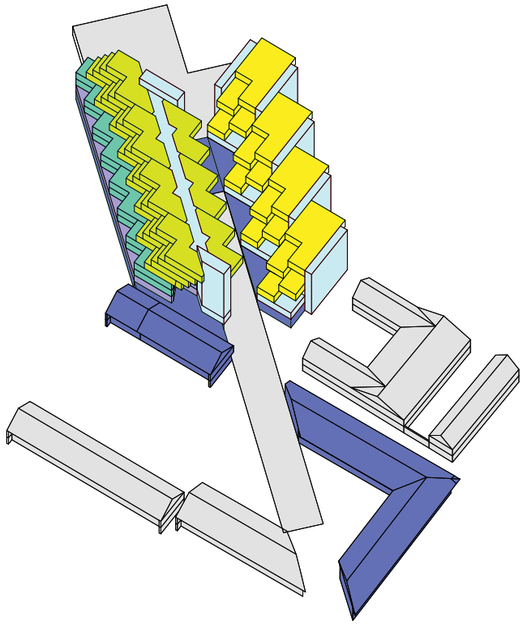
### Highlight Strength

1. Proposal meets design requirements

### Highlight weakness

1. Large rooftop area

## Protrotype 1 :



### Unit Number

145 SQM
20 Unit

90 SQM
27 Unit

45 SQM
22 Unit

### Highlight Strength

1. New cut from entrance to center wind corridor enhances connection between old building, residential area, and riverfront

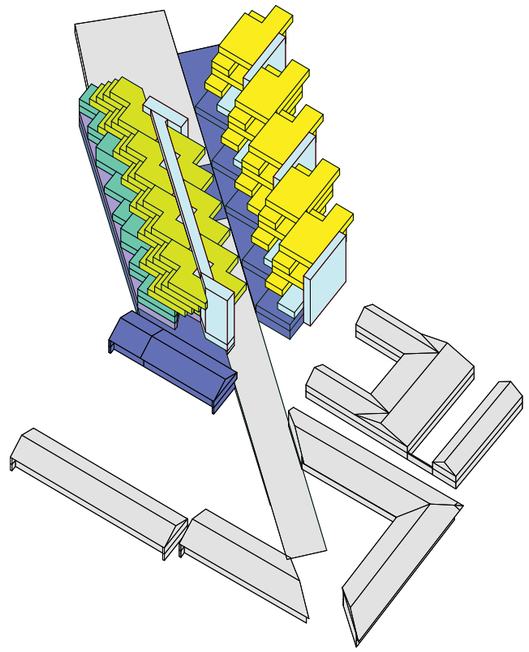
2. Fosters unity and accessibility within the space

3. Relocating common space to ground floor reduces direct solar gain

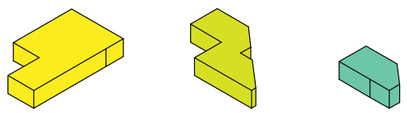
### Highlight weakness

1. Large rooftop area

## Protrotype 2 (Seclection):



### Unit Number



145 SQM
16 Unit

90 SQM
25 Unit

45 SQM
26 Unit

### Highlight Strength

1. lesser amount of total roof top surface

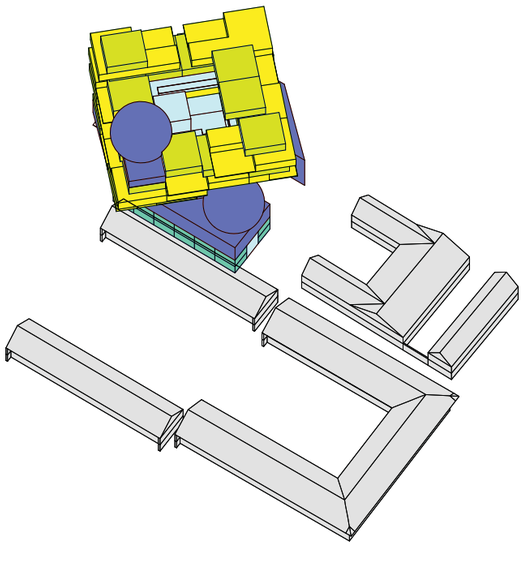
2. More casting shadow from unit orientaion

3. With a similar total building surface area (117,000 sq m) with the 1 property, this proposal is far more efficacious in balancing solar radiation.

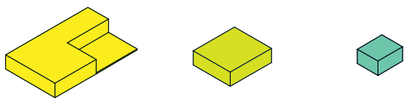
### Highlight weakness

1. The stair building typology appears to increase the area exposed to direct sunlight.

## Protrotype 3 :



### Unit Number



170 SQM
17 Unit

90 SQM
26 Unit

45 SQM
24 Unit

### Highlight Strength

1. Shaded center courtyard area.

2. Compect building and program design.

3. Form more playful.

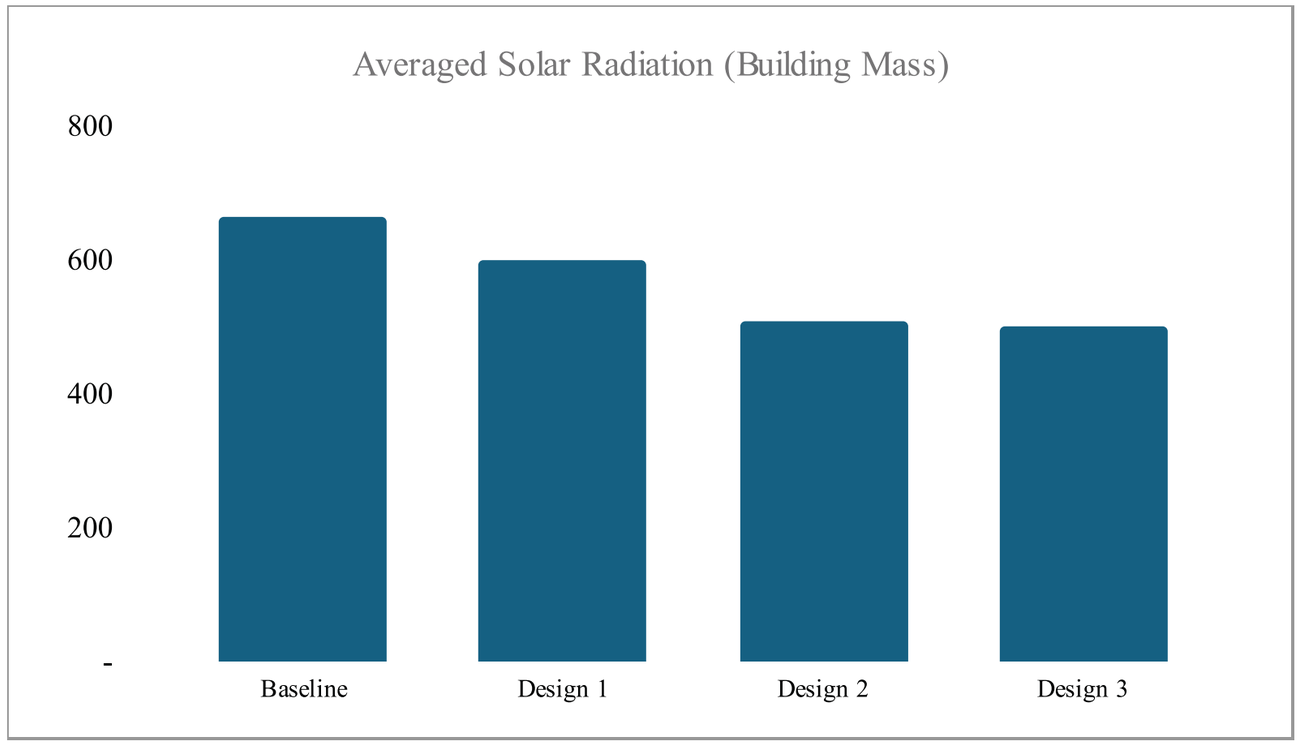
### Highlight weakness

1. poor living quelity for resident in ground floor due to lacking of natural light.

2. Only north-facing unit could access to riverfornt view.

3. huge total roof top area.

| Summary | |
|---|---|
| | Averaged Solar Radiation (kWh/m2/year) |
| Baseline | 663 |
| Design 1 | 598 |
| Design 2 | 509 |
| Design 3 | 498 |

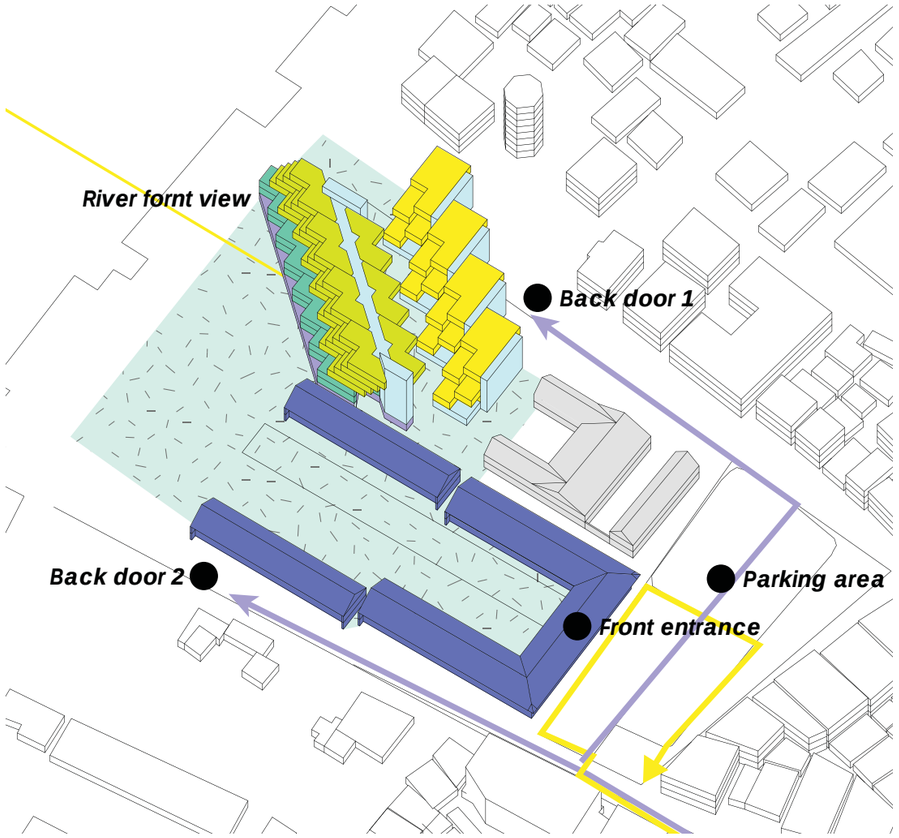


# Phase 2 : Building Mass

Baseline

## Design Strategies

The idea is to reused existing building as a common spaces.

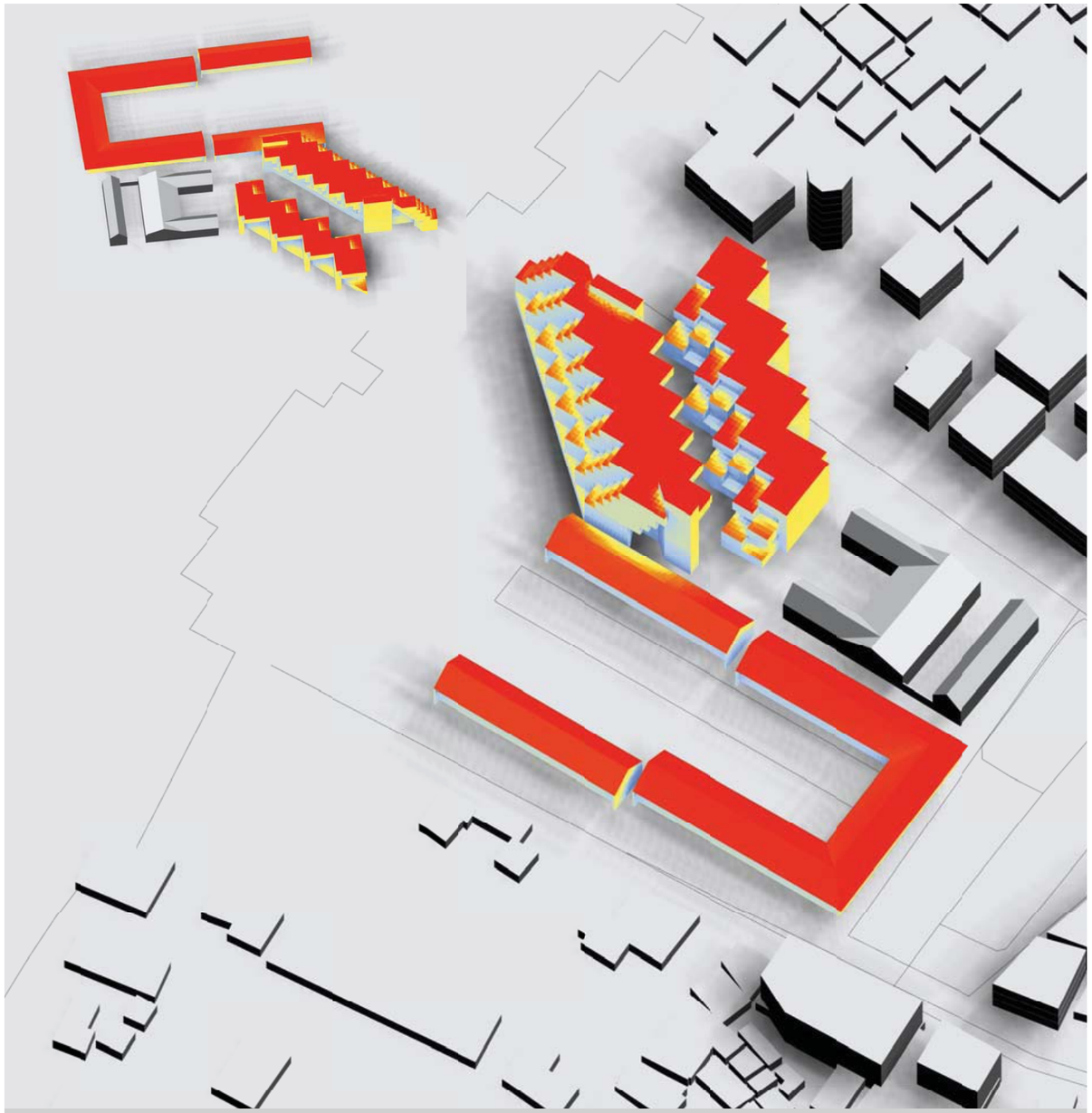



## Highlight weakness

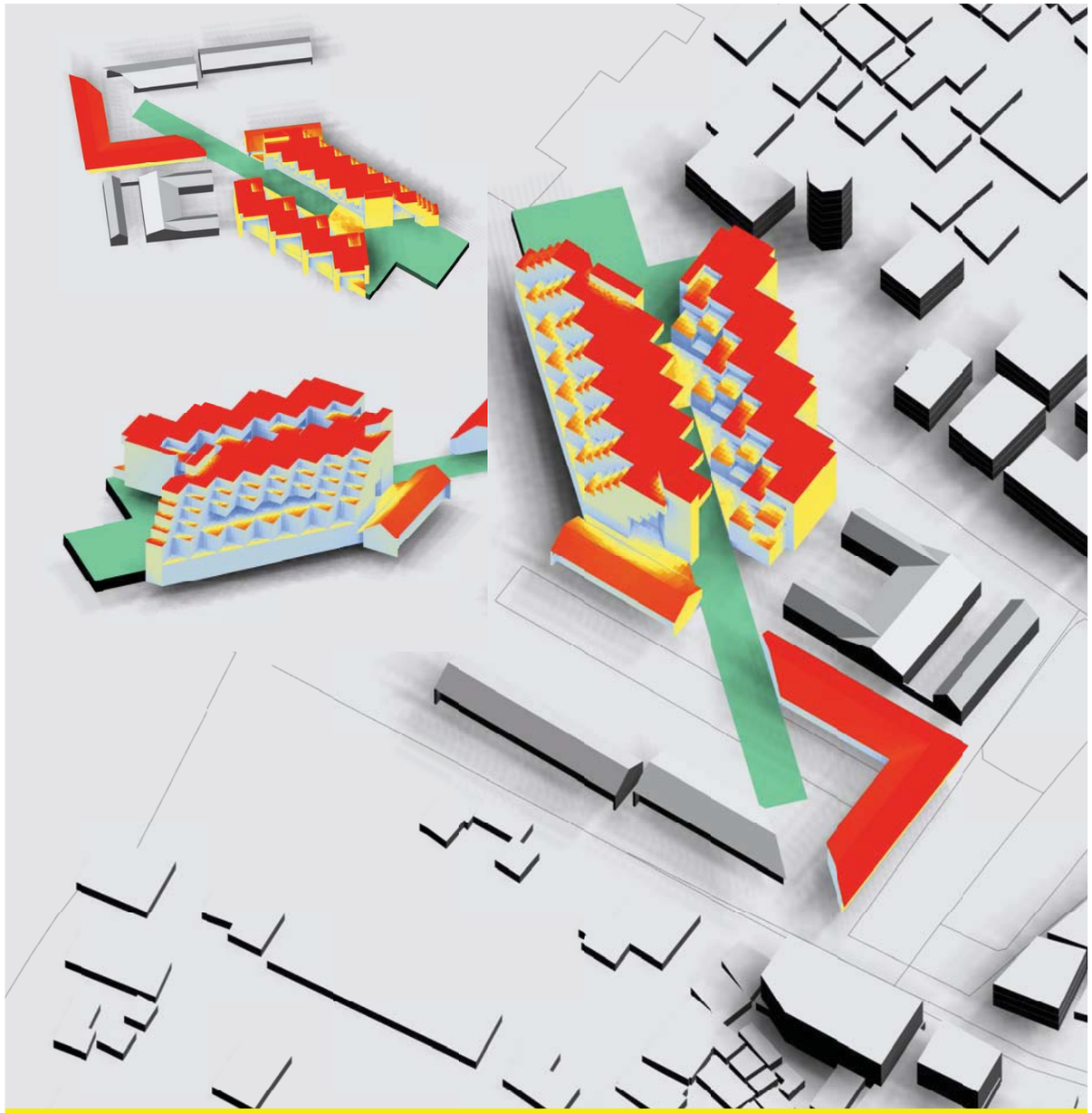
Although the proposal responds to the design requirements, it still encounters the same problem related to the large total rooftop area, given the number of buildings and their Mid-rise characteristics. This results in high values of solar radiation throughout the day

## Goal to achived

Try to responds challange toward total roof top area and ***achived traget solar radiations.***



| Baseline | | |
|---|---|---|
| Total Building Surface Area | 18,366 | m2 |
| Annual Solar Radiation | 12,172,000 | kWh/year |
| Averaged Total Solar Radiation | 663 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Fail** | |



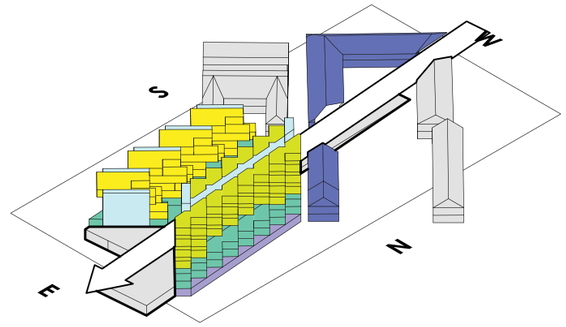
| Design 1 | | |
|---|---|---|
| Total Building Surface Area | 17,246 | m2 |
| Annual Solar Radiation | 10,318,000 | kWh/year |
| Averaged Total Solar Radiation | 598 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Successful!** | |

Proporsal 1:

## Design Strategies

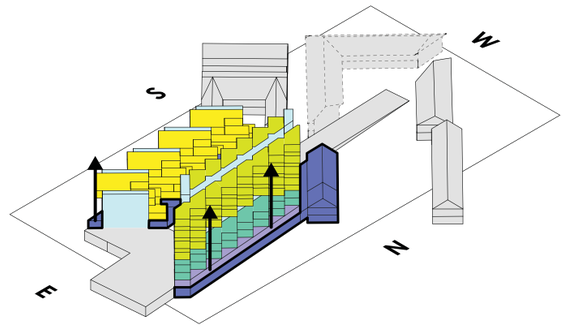
Introducing, new cut, ramp and design Terrain

1. Enchance clearer connection between front door and main living area.
2. Balancing building high (Ground-building)




Relocated common space in decreasing total roof top area.

Placing the common space under new building.




### Highlight Strength

By introducing a new cut from the entrance to the center wind corridor, a strong connection is established between the old part of the building, the residential area, and the riverfront area, fostering a sense of unity and accessibility within the space. Additionally, relocating the common space to the ground floor of the new building helps decrease the amount of direct solar gain throughout the year, contributing to a more comfortable living environment while optimizing energy efficiency.

### Highlight weakness

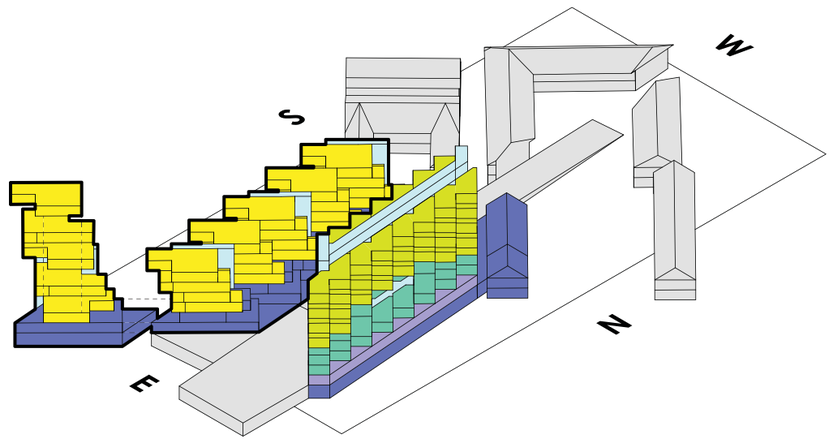
Although, building could achived both goal, yet, by minimizing amount of total roof top area this could help decreasing greater protions of solar ration.

# Phase 2 : Building Mass

Proporsal 2:

## Design Strategies

Minimizing total roof area by :




Relocated Common space

Unit orientation and overlaping

### Highlight Strength

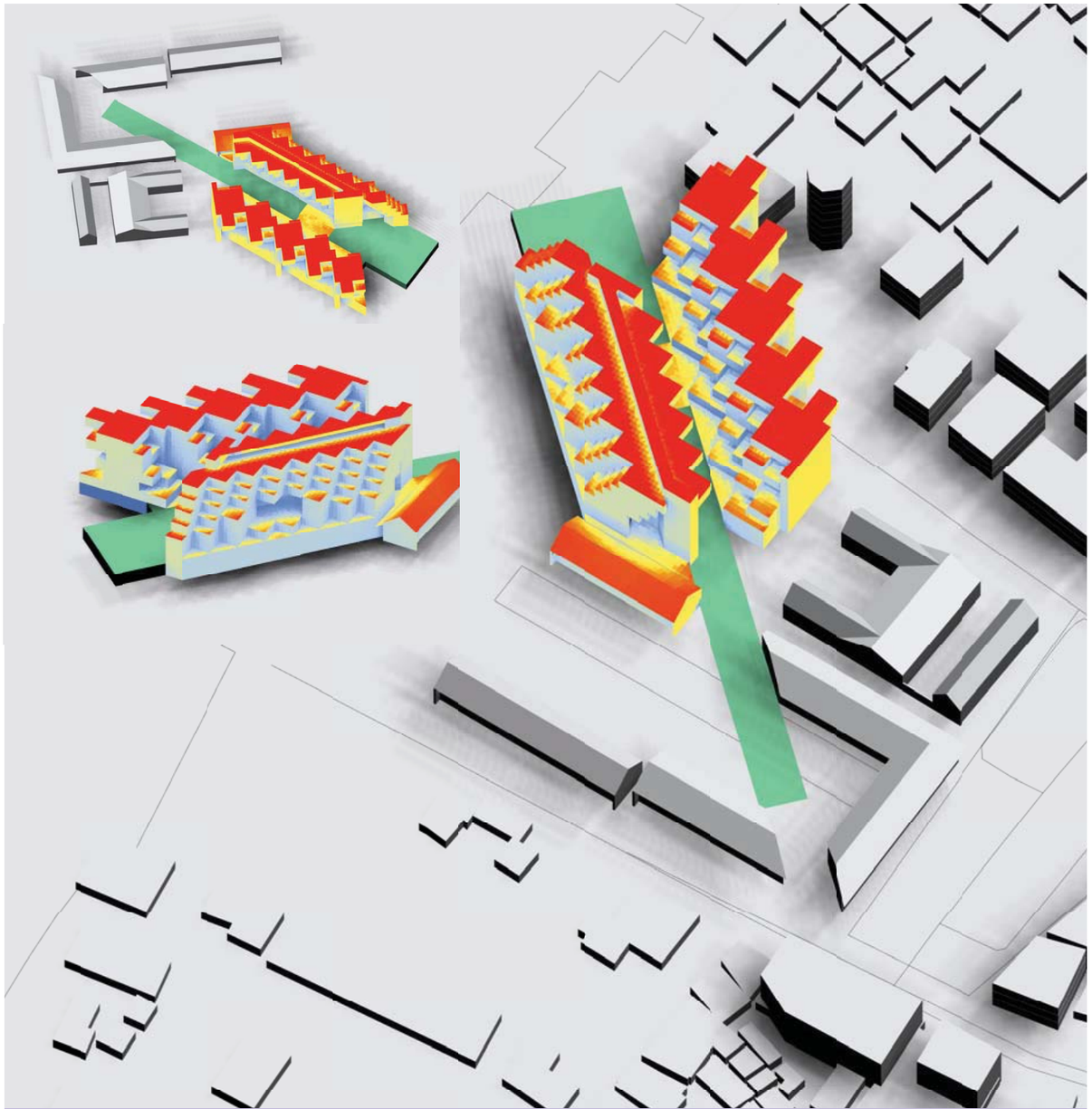
This proposal significantly reduces the total rooftop surface area, which in turn lowers solar gain. The strategic orientation of the units enhances shadow casting, further minimizing direct sunlight exposure. Notably, while maintaining a similar total building surface area of approximately 17,000 square meters as the initial proposal, this design offers a far more efficient balance of solar radiation.

### Highlight weakness

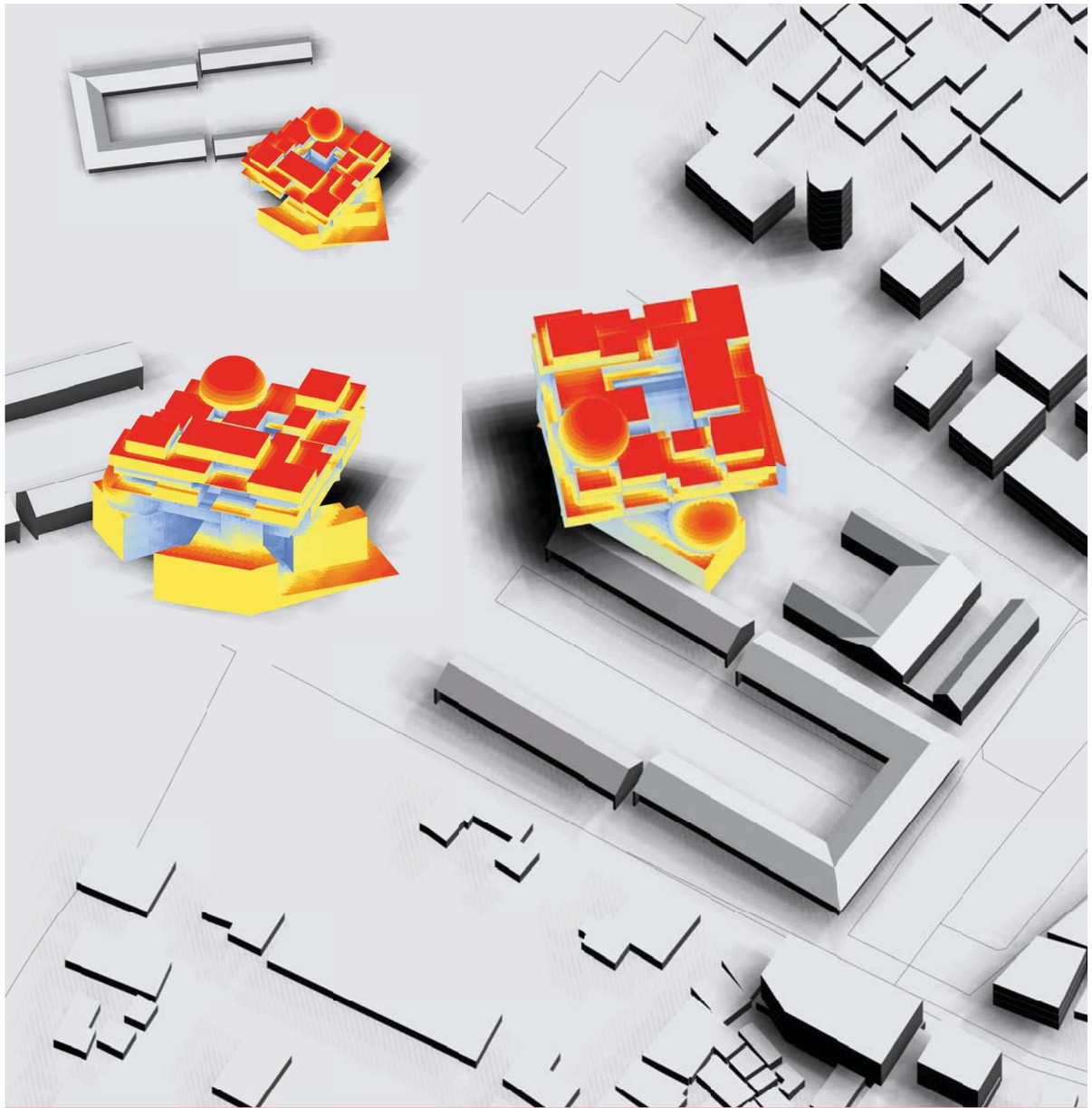
The stair building typology appears to increase the area exposed to direct sunlight.

### Goal to achived

1. Decreasing a amount of direact sunlight cause by l stair building typology.



| Design 2 | | |
|---|---|---|
| Total Building Surface Area | 17,403 | m2 |
| Annual Solar Radiation | 8,850,000 | kWh/year |
| Averaged Total Solar Radiation | 509 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Successful!** | |



| Design 3 | | |
|---|---|---|
| Total Building Surface Area | 13,904 | m2 |
| Annual Solar Radiation | 6,927,700 | kWh/year |
| Averaged Total Solar Radiation | 498 | kWh/m2/year |
| Target Solar Radiation | 600 | kWh/m2/year |
| Result | **Successful!** | |

Proporsal 3 (Design experiment):

## Design Strategies

### Highlight Strength

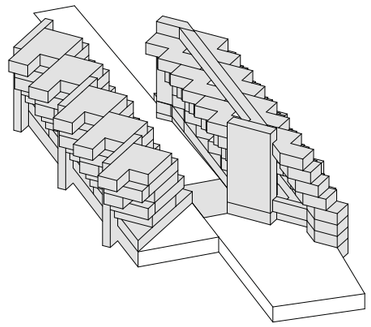
1. Shaded center courtyard area.
2. Compect building and program design.
3. Form more playful.

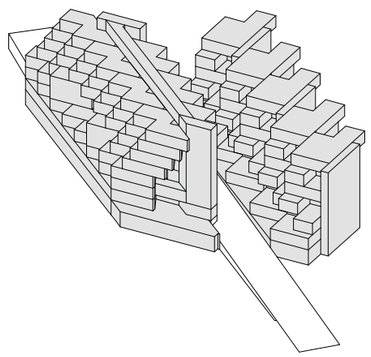
### Highlight weakness

1. poor living quelity for resident in ground floor due to lacking of natural light.
2. Only north-facing unit could access to riverfornt view
3. huge total roof top area.

# Phase 1 : Overview

## Baseline :





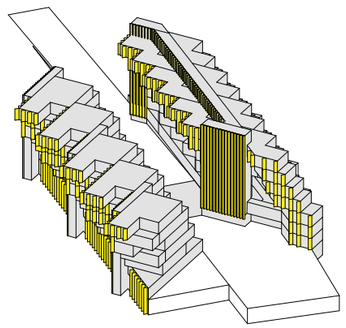
### Highlight weakness

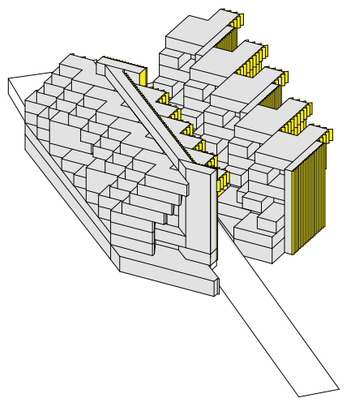
1. The stair building typology seems increasing area that would receive the direct sunlight.

2. Southern facade of building recieved large amount of solaradiation.

Total Building surface area
***18,554.8 SQ M***

## Proporsal 1 :





### Highlight Strength

1. Lower solar radiation gain on building surface

2. Vertical shading facilitates easier hot air passage than horizontal shading

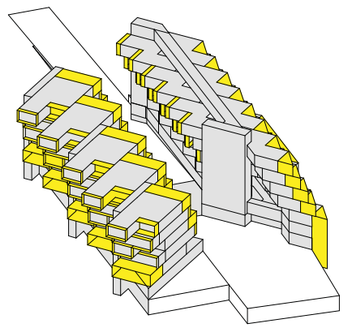
### Highlight weakness

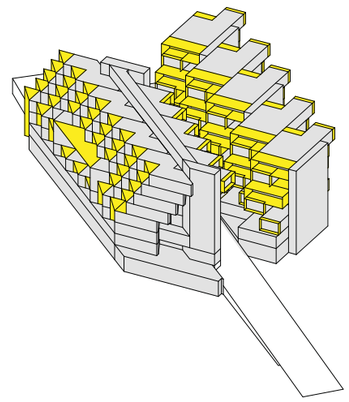
1. Didn't sloving amount of direct sunlight caused by stair building typology.

Total shading surface area
***3020 SQ M***

***16%*** of Total building Surface area

## Proporsal 2 :





### Highlight Strength

1.Lower solar radiation gain on building surface

2. Horizontal shading is crucial for reducing heat in low-rise housing typology

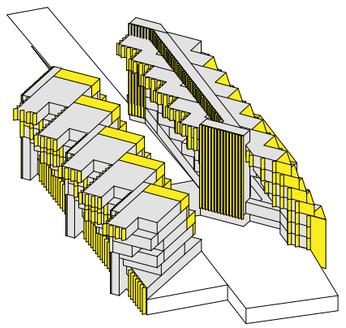
### Highlight weakness

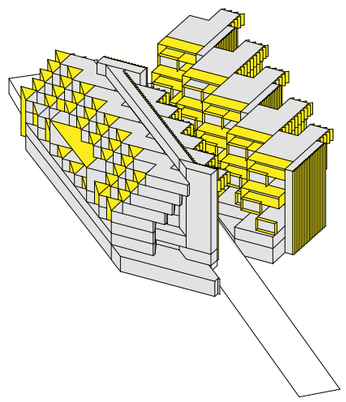
1. More shading surface needed than the first prototype for equivalent solar radiation
2. Some units receive less natural light
3. Horizontal shading limits ventilation

Total shading surface area
***3764.5 SQ M***

***20%*** of Total building Surface area

## Proporsal 1 + 2 :





### Highlight Strength

1. Much lower solar radiation gain on building surfaces.
2. Highlight what shading is important and which could be minimized.

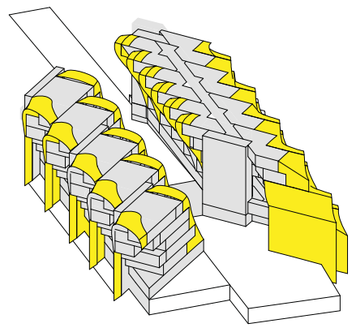
### Highlight weakness

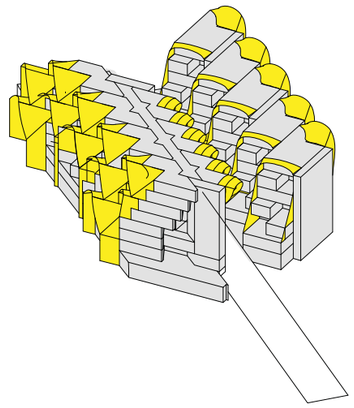
1. exeeding maximum number of shading area surface. (Over 30%)
2. Unsloving hot air ventilation on each residential unit.

Total shading surface area
***5196.5 SQ M***

***28%*** of Total building Surface area

## Proporsal 3 :





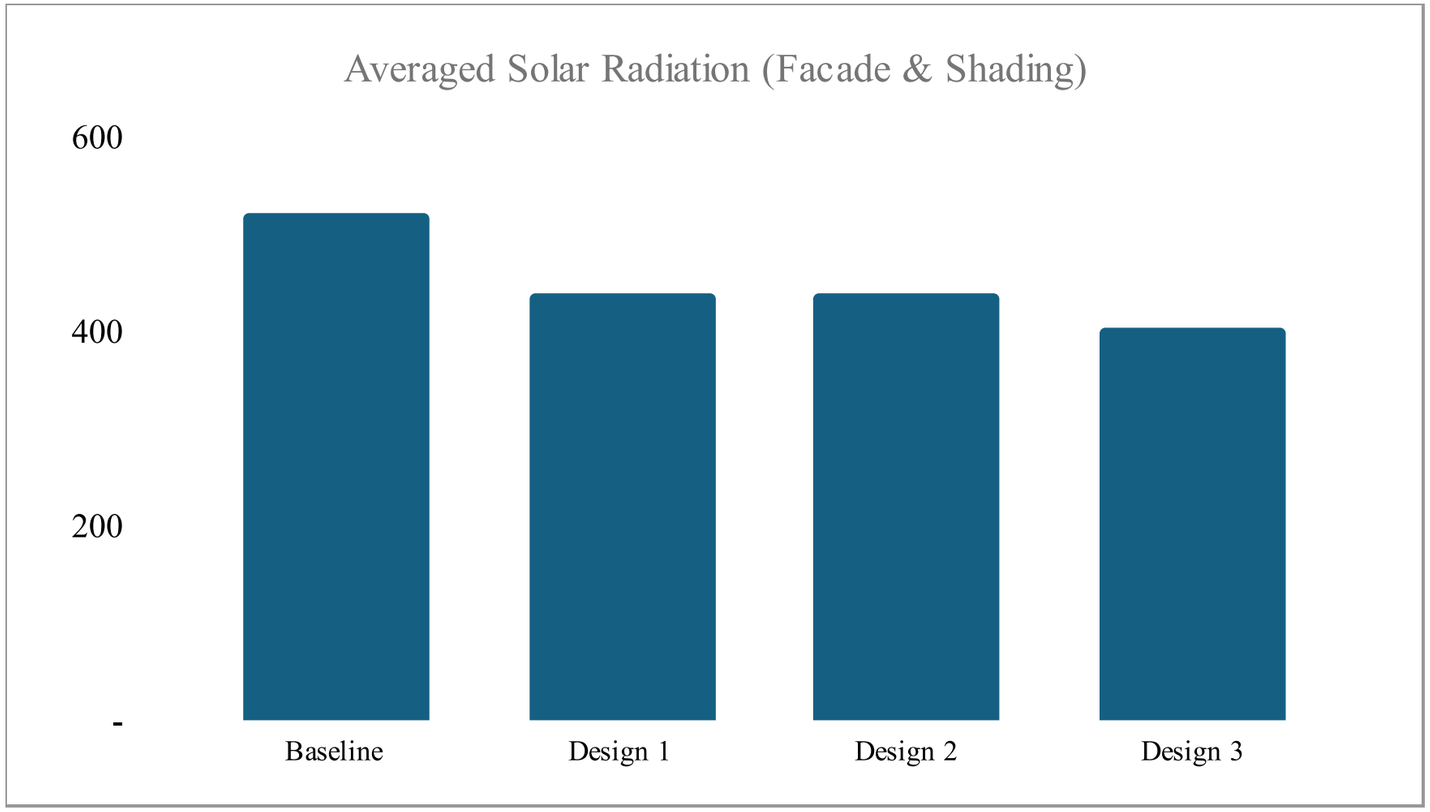
### Highlight Strength

1. Reduced total facade surface area achieves similar shading efficiency
2. Facade design facilitates hot air ventilation
3. Each unit offers clear views and enhanced privacy
4. Aesthetically pleasing overall design

Total shading surface area
***3573 SQ M***

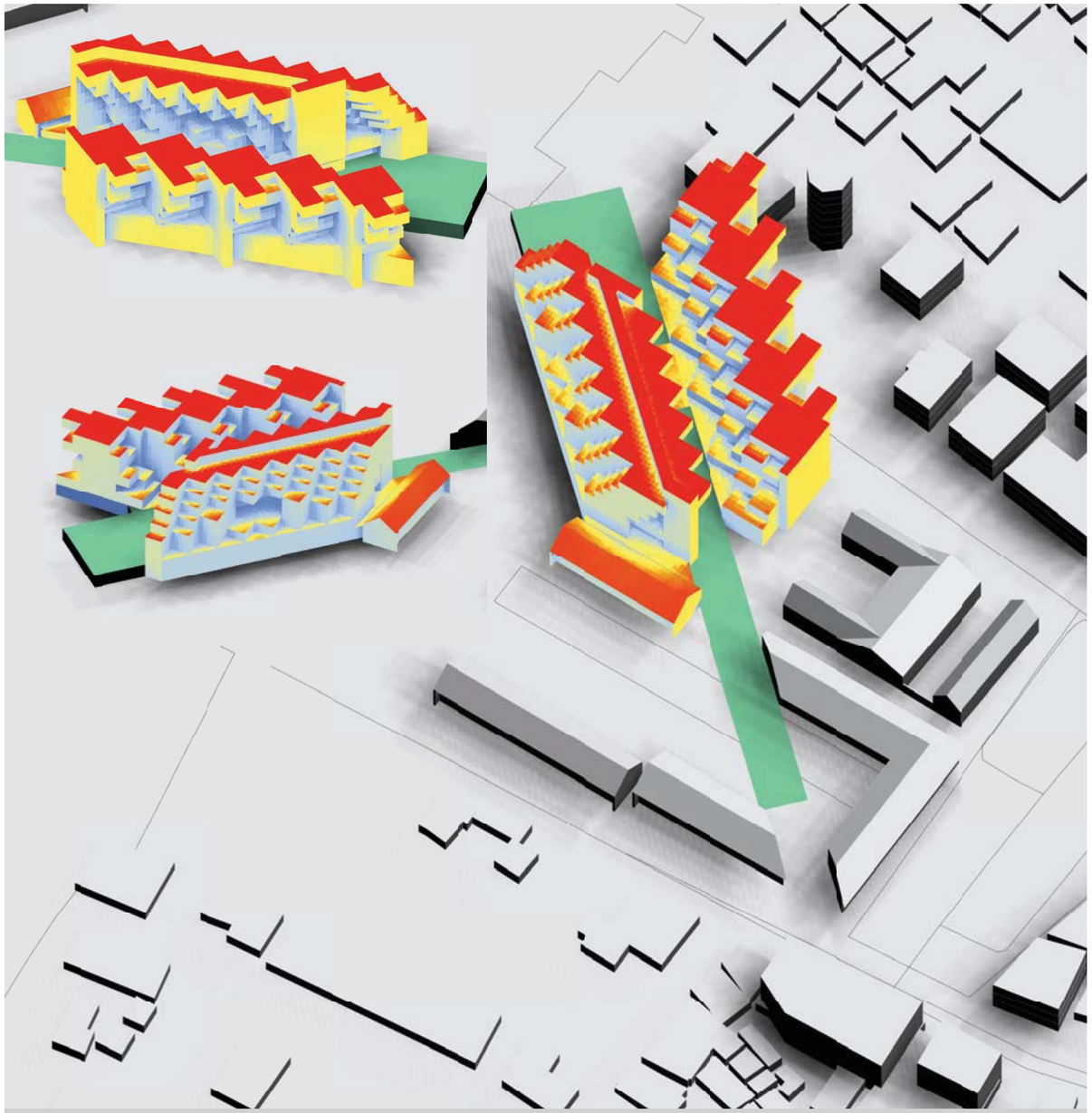
***19.2%*** of Total building Surface area

| Summary | |
|---|---|
| | **Averaged Solar Radiation (kWh/m2/year)** |
| **Baseline** | 523 |
| **Design 1** | 438 |
| **Design 2** | 438 |
| **Design 3** | 405 |



# Phase 3 : Façade and Shading

Baseline



| Baseline | | |
|---|---|---|
| Total Building Surface Area | 18,417 | m2 |
| Annual Solar Radiation | 9,631,900 | kWh/year |
| Averaged Total Solar Radiation | 523 | kWh/m2/year |
| Target Solar Radiation | 500 | kWh/m2/year |
| Result | **Fail** | |

### Highlight Strength

1. A lesser amount of total roof top surface
2. More casting shadow from unit orientation
3. With a similar total building surface area (117,000 sq m) with the 1 property, this proposal is far more efficacious in balancing solar radiation.

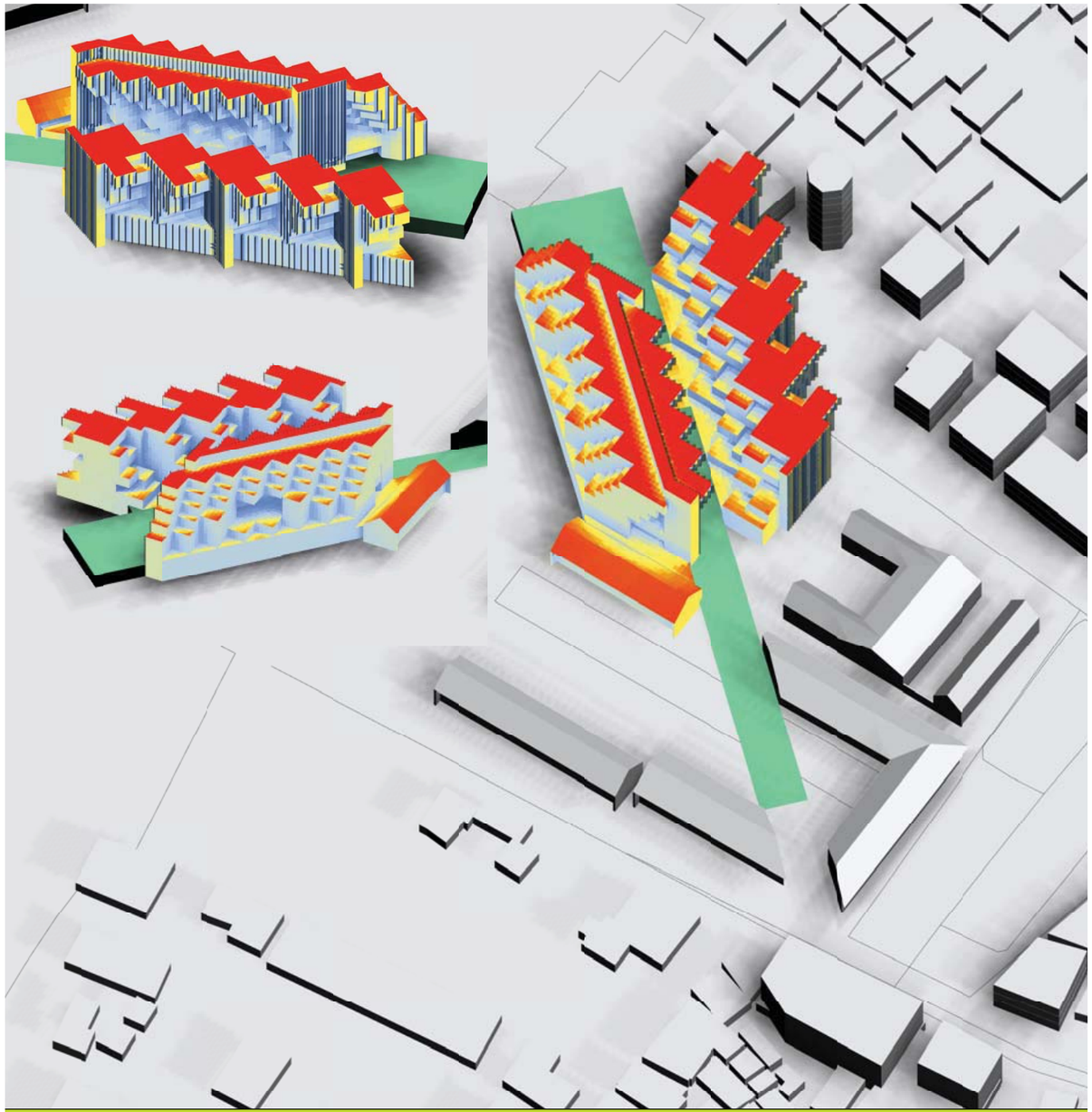
### Highlight weakness

1. The stair building typology seems increasing area that would receive the direct sunlight.

### Goal to achived

1. Decreasing a amount of direact sunlight cause by l stair building typology.

# Phase 3 : Façade and Shading



| Design 1 | | |
|---|---|---|
| Total Building Surface Area | 18,417 | m2 |
| Annual Solar Radiation | 8,060,200 | kWh/year |
| Averaged Total Solar Radiation | 438 | kWh/m2/year |
| Target Solar Radiation | 500 | kWh/m2/year |
| Result | **Successful!** | |

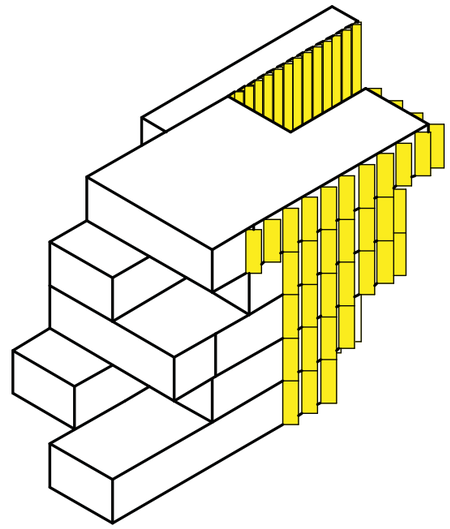
Proporsal 1

Total shading surface area
***3020 SQ M***

***16%*** of Total building Surface area

## Design Strategies

Experiment on vertical shading (facing east-west direction) target on high solar radiation area (Southern facade of building)



### Highlight Strength

1. Lower solar radiation gain on the building surface.
2. The vertical shading allows hot air to pass through more easily compared to herizontal shading.

### Highlight weakness

1. Didn't sloving amount of direct sunlight caused by stair building typology.

### Goal to achived

1. Decreasing a amount of direct sunlight caused by stair building typology.

# Phase 3 : Façade and Shading

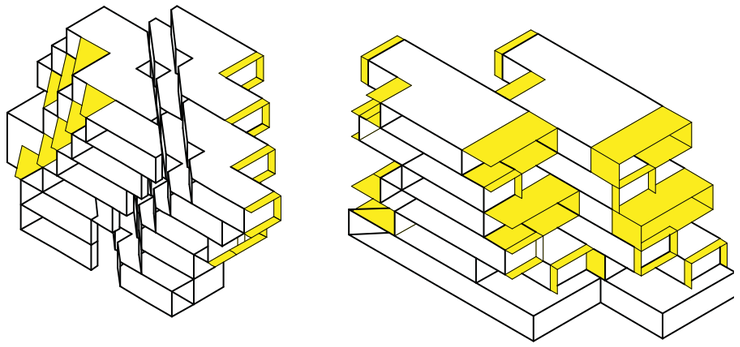
Porprosal 2

Total shading surface area
***3764.5 SQ M***

***20%*** of Total building Surface area

## Design Strategies

The experiment aims to minimize direct sunlight exposure caused by the stair building typology through the implementation of both horizontal and vertical shading solutions.





## Highlight Strength

1. Lower solar radiation gain on the building surface.
2. Express the importance of horizontal shading in low-rise housing typology.

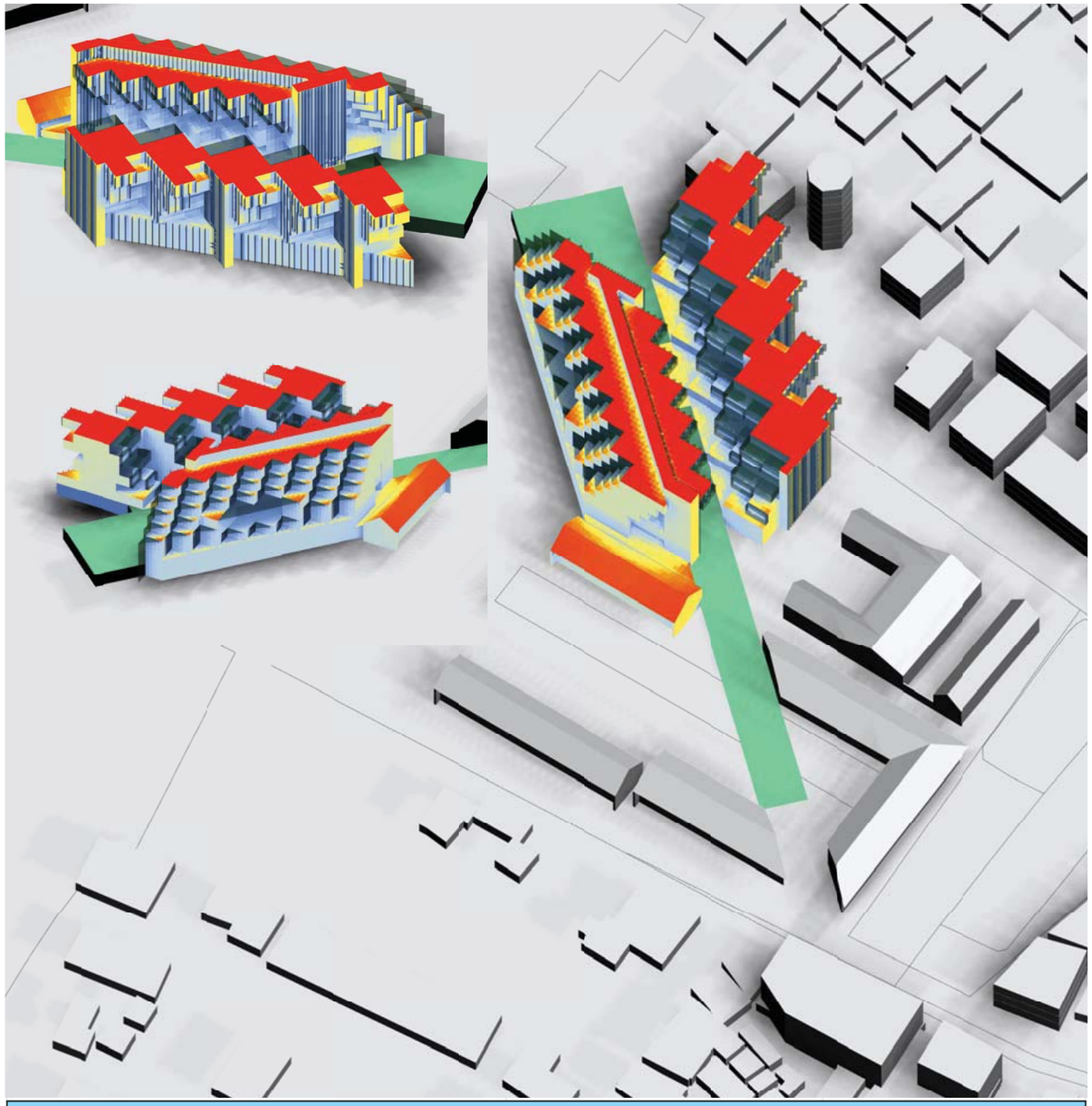
## Highlight weakness

1. Take more shading surface (compare to 1st Prototype) to achieve the same amount of total solar radiation.
2. Some units receive less natural light, especially the studio unit area.
3. Horizontal shading has a decreasing ability to ventilate.

## Goal to achived

1. Decreasing amount of facade area
2. Alternative apporch for hot air ventilation

| Design 2 | | |
|---|---|---|
| Total Building Surface Area | 18,417 | m2 |
| Annual Solar Radiation | 8,068,500 | kWh/year |
| Averaged Total Solar Radiation | 438 | kWh/m2/year |
| Target Solar Radiation | 500 | kWh/m2/year |
| Result | **Successful!** | |



| Design 2 | | |
|---|---|---|
| Total Building Surface Area | 18,417 | m2 |
| Annual Solar Radiation | 7,552,500 | kWh/year |
| Averaged Total Solar Radiation | 410 | kWh/m2/year |
| Target Solar Radiation | 500 | kWh/m2/year |
| Result | **Successful!** | |

## Proporsal 3 (2+1 : see the full potential)

Total shading surface area
***5196.5 SQ M***

***28%*** of Total building Surface area

### Design Strategies

Using this to create base line and understanding the maximum shading potencial.

### Highlight Strength

1. Much lower solar radiation gain on building surfaces.
2. Highlight what shading is important and which could be minimized.

### Highlight weakness

1. exeeding maximum number of shading area surface. (Over 30%)
2. Unsloving hot air ventilation on each residential unit.

### Goal to achived

1. Decreasing amount of facade area
2. Alternative apporch for hot air ventilation

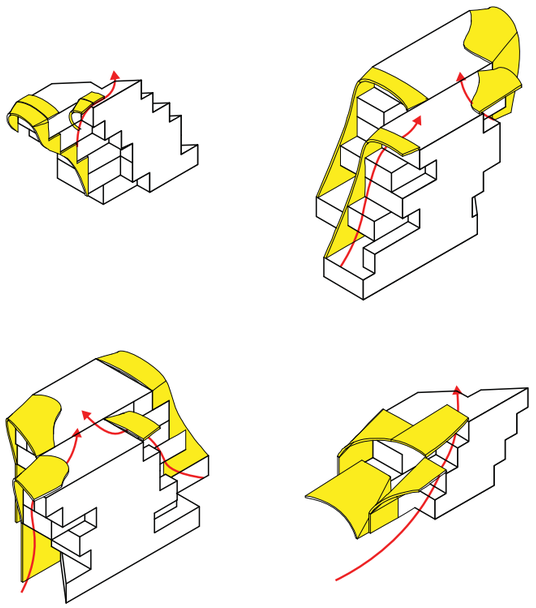
Porprosal 4

Total shading surface area
***3573 SQ M***

***19.2%*** of Total building Surface area

## Design Strategies

The experiment focuses on minimizing direct sunlight exposure from the stair building typology by utilizing both horizontal and vertical shading techniques.



### Highlight Strength

1. Less facade's total surface area was used, with the similar result of shading efficiency.
2. The facade allows for hot air ventilation.
3. Every unit gets a clear view and better privacy.
4. Much more esthetically pleasing.

### Highlight weakness

Although the building facade is still applied, the extensive roof area significantly contributes to the high levels of solar radiation.

### Goal to achived

1. potential to reducing amount of sunlight recieved from the roof top shading design.

| Design 3 | | |
|---|---|---|
| Total Building Surface Area | 18,555 | m2 |
| Annual Solar Radiation | 7,506,200 | kWh/year |
| Averaged Total Solar Radiation | 405 | kWh/m2/year |
| Target Solar Radiation | 500 | kWh/m2/year |
| Result | **Successful!** | |

# Phase 4 : Concludsion and Design consideration

## Design Conclusion

Throughout the design development process, the Mid-rise characteristic presented a significant challenge in achieving the target solar radiation reduction. This is largely due to the expansive rooftop area created by the inability to expand residential units vertically. Additionally, the design requirements set forth by the developer posed further challenges, as the proposal needed to accommodate the needs of residents while minimizing solar heat gain.

To reduce solar radiation, building orientation and unit arrangement became crucial in maximizing shadow-casting effects created by the buildings themselves. These strategies were thoroughly tested during the prototyping and massing phases and were essential in meeting design requirements, particularly in connecting with the seafront area.

During façade development, while the final proposal achieved effective results—such as minimizing solar gain with reduced shading surface area, allowing for hot air ventilation, and meeting aesthetic goals—the large rooftop areas continued to contribute significantly to solar radiation. Consequently, roof design emerged as an important factor in Mid-rise residential complexes.