Group 13

Cassus Syria - Research

Culture & Demographics

What are the characteristics and traditions of the Syrian population?

21.32 million inhabitants

15.3 million people in need

90% live below the poverty line
65% live in extreme poverty

12.1 million people have no certainty that they will always have food

60% of young people do not have a job

87% Muslim
10% Christian
3% other

546,723 children between the ages of 5-15
176,954 children between the ages of 15-18

23% between the ages of 5-11 do not attend school
45% between the ages of 11-15 do not go to school
46% between the ages of 15-18 do not go to school.

Trauma:
Millions of Syrians have experienced severe trauma due to the war, leading to psychological issues like PTSD, depression, and anxiety. Urgent mental healthcare and psychosocial support are needed for those affected. Ongoing research aims to better understand the war's impact and develop effective interventions for their mental well-being.

Culture:
Religion plays a significant role in Syria, highlighting the importance of having a prayer space. Syria has a rich culture of ceramics, embroidery, and traditional dances like the dabka. The architecture in Damascus reflects the country's history, with remnants from the Romans and Turks, including beautiful bathhouses and villas. However, the civil war has resulted in the destruction of much of the cultural heritage. Cooking is also central to Syrian culture, with dishes like hummus, tabbouleh, and kibbeh now commonly found in Dutch supermarkets. In Syrian households, women typically have a prominent role, taking care of the children and managing household tasks.


Figure 1.1


Figure 1.2


Figure 1.3

Architecture Syria

What are the unique features of the architecture in Syria and how has it contributed to the cultural identity of the country?

Hellenistic Architecture 30 v.Chr:
This is the Roman architecture when Syria was part of the Roman Empire. Important elements are:

Figure 1.9

Ottoman Architecture 1500 – 1920:
This is an Islamic empire. With different architectural traditions, including the Byzantine, Islamic, Persian and Seljuk influences. Important elements are:

Figure 1.10

Islamic Architecture in Syria, the present:
Islamic architecture reflects the ideals of Islamic culture, emphasizing spirituality, harmony, and beauty. Important elements are:

Uw alineatekst

Figure 1.11

enge

Building physics

How does climate impact building physics, and what strategies can be implemented to design energy-efficient buildings?

Cross ventilation/stack ventilation:

Cross-ventilation is the circulation of fresh air through a building via strategically placed openings. Stack ventilation utilizes rising warm air for air circulation.

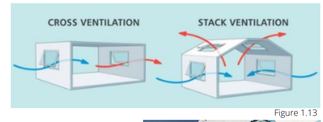


Figure 1.13

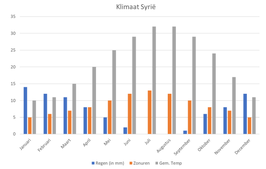
Mashrabiya

The mashrabiya is a traditional window shutter used to control sunlight and airflow. It promotes natural ventilation and can be adjusted through movable panels and adjustable louvers to modify the amount of light and ventilation.


Figure 1.14

Zonnestudie

Northern Syria experiences hot and dry summers (around 35°C) and mild winters (5-15°C). The region receives rainfall between November and March 460-650mm per year), making it green. However, droughts have caused water shortages,agricultural difficulties, and biodiversity loss in Northern Syria.



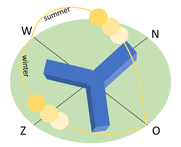


Figure 1.15

School buildings in Syria

What does the education system in Syria look like, and how are the schools/classrooms structured?

What do the schools/classrooms look like?

- Many L-shaped structures
- Classrooms along a corridor structure
- Classroom dimensions: 6 x 7.2 meters
- 5 to 6 seats in a row
- Classrooms are oriented towards the east or south.


Figure 1.15

3 elements that are important in a school:

- a mashrabiya
- a recessed facade on the south side
- a spacious area upon entry

Location

What is the spatial layout of the location and what amenities are located around this location?

Location:

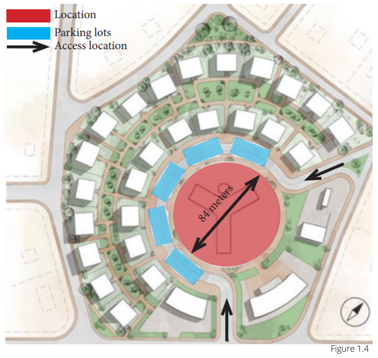


Figure 1.4

The roads:

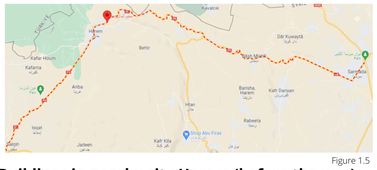


Figure 1.5

Buildings in nearby city Harem (before the war)


Figure 1.6 Figure 1.7 Figure 1.8

The area where we are designing the school is adjacent to the village of Harem in Syria. In the village, many buildings are characterized by their stone or concrete appearance. A significant number of these buildings are apartment complexes with 3 to 5 floors. What is striking is that buildings in Syria are often constructed using "real" materials. The stones are actually stone and showcase detailed craftsmanship. Unfortunately, the war has caused many of these buildings to lose their charming appearance. Contemporary buildings primarily consist of old concrete structures.

New buildings in Syria are mostly constructed using reinforced concrete. For interior and exterior walls, aerated concrete (cellular concrete) is often used. There is typically a gap between the concrete wall and the external aerated concrete wall. Nowadays, thermal insulation is implemented by constructing two parallel walls with an air gap or insulation material in between.

All transportation to the school is carried out via Road 56. This means that the inbound and outbound routes are also managed through Road 56. The relevant stretch of road is located between the villages of Saline and Sarmada. The road has two lanes for two-way traffic. Since the road is quite remote, it is often quiet, allowing for smooth flow of freight traffic.

Above the location is the Turkish city of Reyhanli, which serves as a small transit hub for goods and materials. They would enter the region via the Turkish highway M45. Since the school's region does not have enough or suitable materials, the necessary construction materials need to be imported from other districts.

Climate & environment

What environmental factors are present in Northern Syria, and how can we take them into account when designing the school?

Hot and dry summers with temperatures reaching around 35 degrees Celsius, or even higher. Mild and wet winters, generally ranging between 5 and 15 degrees Celsius, occasionally dropping to freezing point, but rarely.

In northern Syria, precipitation mainly occurs during the winter months, from November to March, resulting in a green environment. However, the region also experiences frequent drought periods, leading to water shortages, agricultural challenges, and biodiversity loss.

	maximum temperatuur	minimum temperatuur	uren zonneschijn per dag	dagen neerslag per maand	hoeveelheid neerslag per maand
januari	10°C	0°C	5	14	♦♦♦♦
februari	11°C	1°C	6	12	♦♦♦
maart	15°C	3°C	7	11	♦♦♦
april	20°C	6°C	8	8	♦♦
mei	25°C	9°C	10	5	♦
juni	29°C	12°C	12	2	NIHIL
juli	32°C	14°C	13	0	NIHIL
augustus	32°C	14°C	12	0	NIHIL
september	29°C	12°C	10	1	NIHIL
oktober	24°C	9°C	8	6	♦
november	17°C	4°C	7	8	♦♦
december	11°C	1°C	5	12	♦♦♦

0-5 mm = NIHIL | 6-30 mm = ♦ | 31-60 mm = ♦♦ | 61-100 mm = ♦♦♦ | 101-200 mm = ♦♦♦♦ | meer dan 200 mm = ♦♦♦♦♦

Figure 1.12

The ground in the area

- Steppe vegetation: The area is often characterized by grasslands with scattered shrubs and low trees.
- There are a lot of olive trees nearby.
- The soil at this location consists of two layers. The upper layer mainly comprises organic material, making the soil fertile. The underlying layer consists of minerals such as clay, sand, and silt.
- There is a high risk of earthquakes in the area, and there has been a recent earthquake as well.

Building materials from the area

- Clay: Local, natural building material with good thermal properties.
- Bricks: Widely used, available building material of varying price and quality.
- Concrete blocks: Strong, durable building material with variable price and size.
- Cement: Essential binder with moderate price.
- Wood: Used for frames, roofs, and doors; price and availability vary.
- Stones: Natural stones like limestone and sandstone, price depends on quality and finish.

Conclusion

How do we create a design for a school that respects the local culture while providing an inspiring environment for education and community engagement?

Culture & Demographics: When designing a primary school in Syria, it is crucial to consider the specific needs and challenges resulting from the war. Providing educational opportunities, psychosocial support, and preserving cultural aspects can contribute to the well-being and development of students in this difficult context.

Location: The school near Harem, Syria, is surrounded by stone or concrete structures that showcase skilled craftsmanship (now destroyed by war and earthquakes). Modern construction methods utilize reinforced and aerated concrete for insulation. Road 56 and the proximity to Reyhanli, Turkey, make importing construction materials easier.

Architecture Syria: The architecture of Syria has different styles. We are going to process the most common elements in our building: arches, decorative elements, mashrabiya and the courtyardyard. We want to make a combination of traditional architecture and modern architecture

Climate & environment: In conclusion, Northern Syria has a warm climate with hot and dry summers, mild winters, and a small amount of rainfall occurring primarily during the winter months. However, the region has also experienced drought periods, leading to water shortages, agricultural challenges, and biodiversity loss. we want to create a school where the students can learn comfortably

Building physics: The climate has a significant influence on our design considerations. Despite the dry and warm climate experienced during the summer months, there are still several possibilities to achieve natural .we have options to naturally ventilate and ensure comfort for the building's occupants.

School buildings: The education system is similar to the Dutch system, with students of the same age attending for nine grades. However, religious education plays a more prominent role. Syrian schools generally follow a consistent structure, unlike in the Netherlands. We strive to align with Syrian guidelines but rely on Dutch guidelines when necessary.

Group 13

Cassus Syria - Concept

Vision & PVE

Based on the conclusions

Qualitative Program of Requirements (PvE)

- Creating a safe environment.
- 1200 students, with 2 shifts from 8:00 AM - 12:00 PM and 12:00 PM - 5:00 PM.
- The building also serves as a community center, located in a separate wing.
- Client requirements/spaces: 1 library, 2 laboratories, a playground, 3 administrative rooms, classrooms, a Mashrabiya, an indoor courtyard, south-facing recessed facade.
- Additional spaces: a prayer room, storage rooms, play/break areas, computer room, community center, reception, gymnasium.
- Multiple entrances to separate the school and community center.
- Classrooms accommodating 25 to 35 students.
- Utilizing cross ventilation.
- 3 staircases, located at the end of each wing from the classroom door, and 1 staircase in the core.
- Creating a canopy for student gathering.

Quantitative Program of Requirements (PvE):

- Classrooms (17 classrooms), 35 persons = 45 m2 each
- Community center: 0.8 m2 per person, 200 persons = 160 m2
- Library: 70 persons (2 classes) = 120 m2
- Laboratory: 70 persons (2 classes) = 120 m2
- Computer rooms (2 computer rooms) = 60 m2
- Administrative spaces:
- Meeting rooms = 15 m2
- Teachers' room = 30 m2
- Administrative room for teachers = 10 m2
- Toilet groups (3 stalls, 1x1m2 each) total 12 m2
- Prayer room (1 classroom)
- Sports hall: 1.3 m2 per person, 70 persons (2 classes) = 75 m2 + Storage 20 m2
- Courtyard.

Vision: Creating a school building that respects the local culture, provides a safe environment for education, and encourages community engagement.

Building physics solutions

Energy:

Solar water heaters:

Solar water heaters are a practical solution. They use solar collectors to capture sunlight, heating a special fluid that is pumped into a storage tank. These systems are efficient, reach high temperatures, and typically last about 20 years. Solar water heaters provide a sustainable and reliable source of hot water, even during colder months.

Figure 2.1

WTW:

An earth heat exchanger utilizes buried pipes to regulate ventilation supply air, minimizing temperature fluctuations. It harnesses the stable ground temperature to warm incoming air in winter and cool it in summer. The constant ground temperature pre-adjusts the air flowing through the pipes, enabling more efficient heating in winter and cooling in summer for the building.

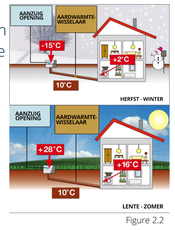


Figure 2.2

Wastewater (helofytenfilter):

A septic tank, also called a cesspool or pit, is a basic wastewater treatment system that purifies household wastewater using biological processes. The tank's contents should be emptied into a ditch, gravel bed, or drained through a drainage system.

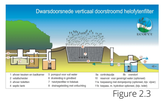


Figure 2.3

Ventilation:

Cross-ventilation in North Syria improves air quality, cools in summer, and removes moisture in winter without artificial systems.

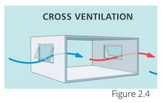


Figure 2.4

Material choices

Structural work: Concrete poured in situ

Advantages
-Strength and durability
-Flexibility
-High production speed

Disadvantages
-not suitable for small projects
-environment effects (CO2)

Frames: Wooden frames

Advantages
- Longlivety
- Freedom of design
- Easy Repairability

Disadvantages
- Requires regular maintenance
- more expensive than other material
- sensitivity to moisture

Floor finish: Ceramic tiles

Advantages
- easily to clean
- durability
- versatility in design

Disadvantages
- Cold surface
-installation complexity
- fragile

Interior wall finish: Clay plaster

Advantages
- Natural material
- Sound-absorbing
- good heat insulation

Disadvantages
- Sensitive to wear
- Long drying time
- Sensitive to moisture

Facade finish: Natural stone

Advantages
- eaesthetically appealing
- Resistant to (extreme) weather conditions
- requires little maintenance

Disadvantages
-Heavy in weight
-installation complexity
-can be more expensive than other facade finishes

Insulation: Sheep Wool

Advantages
- Availability
- Environmentally friendly
-Good insulating properties

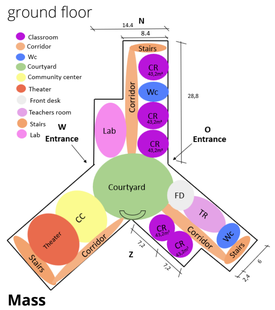
Disadvantages
-Pest susceptibility
-poor Fire resistance

variant 1

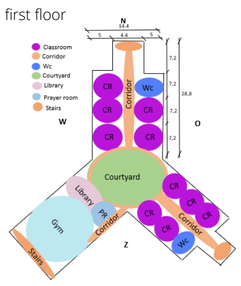
Based on the conclusions

Spot plan

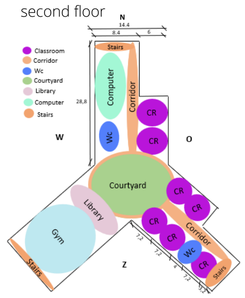
ground floor



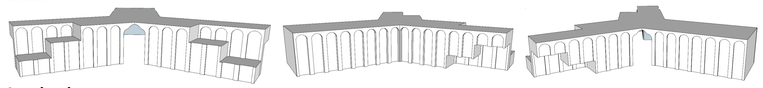
first floor



second floor



Mass



Inspiration

Figure 2.5

Figure 2.6

Figure 2.7

Figure 2.8

Figure 2.9

Explanation design

In this variant we used a staircase from top to bottom and bottom to top. We did that for the shadow effect. in the middle is the courtyard with the iwan on the ground floor where the back faces south and the opening to the north. the courtyard is provided with a gallery where all wings come together.

Review design

variant 1	-2	-1	+1	+2
shadow				
logical layout				
openness in the facade				
building regulations, escape routes				
architecture of the country				
airflow in the building				
materials used from the surroundings				

score: 5

Earthquake stability

Lighter materials lessen the load and stress on a structure during earthquakes. They have greater capacity to absorb vibrations and forces due to their natural lightness and flexibility. When constructing taller buildings, reducing mass becomes crucial to minimize vulnerability to earthquake damage.

Minimize torsion in buildings during earthquakes by using tight corner connections, stability walls, provisions at the center of gravity, and avoiding wall openings in corners.

A **rectangular and symmetrical design** evenly distributes forces, promoting stability and reducing torsion during earthquakes. Maintaining a regular shape in the design enhances balance and facilitates optimal force distribution.

To enhance structural **integrity** and mitigate uneven force distribution, position **large openings symmetrically**. Incorporating expansion joints helps alleviate stresses and prevent earthquake damage. Minimizing torsion is critical, which can be achieved through a balanced and symmetrical building design.

Limit length-to-width ratio: It is advantageous to restrict the length-to-width ratio of the building to a maximum of 3:1. A slender building can be more susceptible to torsion and instability during earthquakes, so it is ideal **to have a more compact form**.

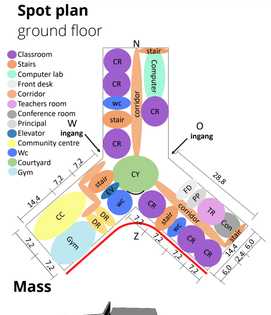
Earthquake dampers are designed to reduce the impact of seismic activity on buildings. They absorb and dissipate energy and vibrations, thereby reducing the structural load. Installed between the foundation and superstructure, these dampers utilize various mechanisms like friction, fluid pressure, or viscous damping to minimize vibrations.

variant 2

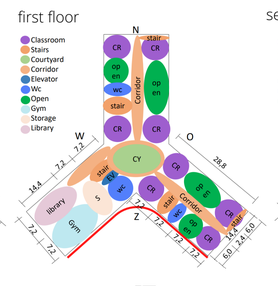
Based on the conclusions

Spot plan

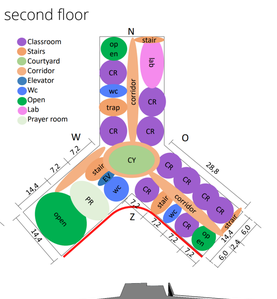
ground floor



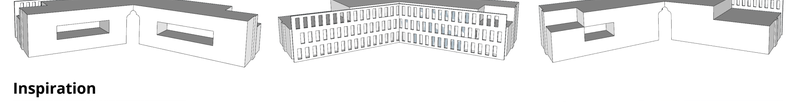
first floor



second floor



Mass



Inspiration

Figure 2.10

Figure 2.11

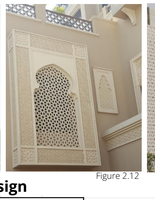


Figure 2.12

Figure 2.13

Explanation design

In this variant, we have chosen to add more openness to the facade. We have achieved this by removing spaces and transforming them into balconies. This immediately creates break areas for the children. Furthermore, in the design, we will install a facade on the south side that provides shade. Additionally, we will place mashrabiyas at the end of the corridors to allow for airflow throughout the building.

Review design

variant 2	-2	-1	+1	+2
shadow				
logical layout				
openness in the facade				
building regulations, escape routes				
architecture of the country				
airflow in the building				
materials used from the surroundings				

score: 12

Chosen design & Explanation

We have applied the Harris profile to both designs. The first variant scored 5 points, while the second variant scored 12 points. We will proceed with developing variant 2, as it achieved the highest score.This variant has more shading due to the projecting wall. Stairs located 20m from the entrance door are the standard in Syria. The gymnasium is smaller than variant 1 and is situated on the ground floor. Furthermore, the openings in the facade are approximately similar to each other. The designs are created in modern Syrian architecture. Mashrabiyas have been used for airflow throughout the building. The materials used are sourced locally.

Conclusion

How do we create a design for a school that respects the local culture while providing an inspiring environment for education and community engagement?

Conclusion building physics

We have used Cross-ventilation. This is often applied in Syria. We have ensured that there is an airflow throughout the building by placing mashrabiya at the ends of the corridors and creating an open courtyard in the middle. Furthermore, we have installed two windows opposite each other in each classroom. We have taken earthquake resistance into account. We have also found a sustainable solution for clean and dirty water.

Conclusion constracter

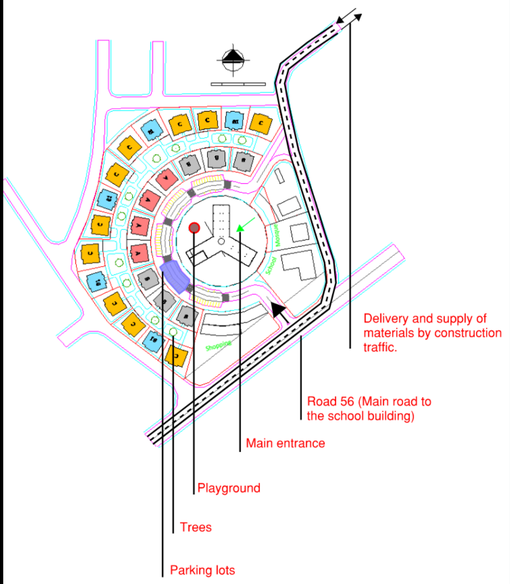
We have chosen materials that are commonly available in Syria and that the Syrians are familiar with during construction. We have also taken into account the sourcing of materials. Most of the materials come from Syria or local suppliers. Furthermore, we are aware that there are not many construction vehicles in Syria, and much of the work is done manually. This aspect has also been taken into consideration.

Conclusion design

Design 2 has been chosen as the preferred option due to its higher score, increased openness in the facade with balconies, a shading south facade, and mashrabiyas for airflow. It aligns with the modern Syrian style using local materials and has similar facade openings.

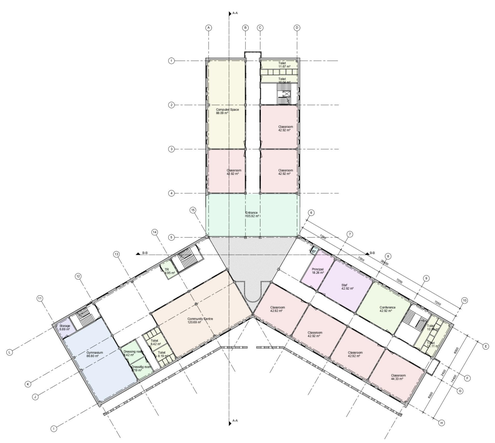
Location

In the location drawing, you can see the conceptual design for the school project to be constructed. The drawing indicates the main road for entering and exiting the construction site. The orientation of the school building is also depicted. The main entrance is situated on the North-East side of the school building, while the outdoor playground for students is located on the North-West side. Parking facilities are available surrounding the school building. Additionally, the project includes the construction of other residential units for refugees alongside the school building.

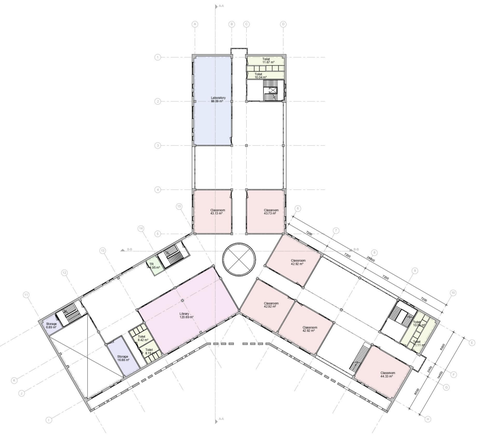


Floorplans

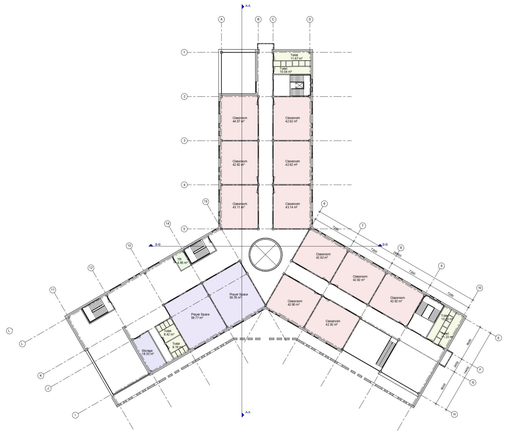
ground floor 1:500



first floor 1:500



second floor 1:500

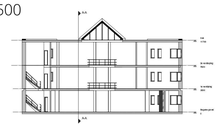


south facade 1:500

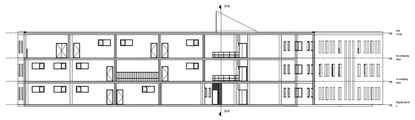
east facade 1:500

west facade 1:500

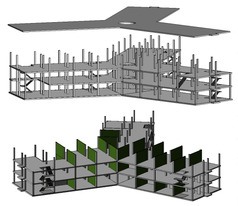
section B-B 1:500



section A-A 1:500

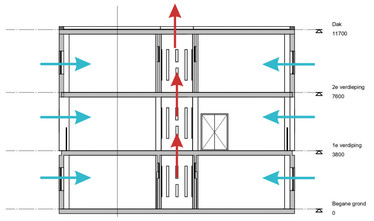


construction 3D



The school building is supported by concrete columns, carrying vertical loads, and reinforced with stability walls to withstand horizontal forces like wind and seismic activity. This combination of structural elements ensures stability and strength, protecting the building from external pressures.

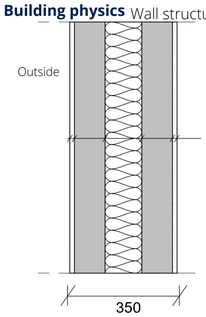
Ventilation



In the classrooms of our school, we apply cross-ventilation as an effective method to naturally ventilate the space. When the airflow from the classrooms reaches the corridors, it is further facilitated by the presence of mashrabiya screens. The openings in the mashrabiya allow for easy airflow, creating a natural draft that spreads fresh air throughout the corridors. At the same time, it helps to exhaust warm or humid air, ensuring a healthy and pleasant environment.

Building physics

Wall structure: 1:10



Natural stone	15	mm
aerated concrete	100	mm
Insulation	120	mm
aerated concrete	100	mm
Clay plaster	15	mm

Material	Width (M)	λ-Value [W/mK]	R-value. [m²k/w]
Natural stone facade finishing	0.015	3,5	0.004
autoclaved aerated concrete	0.1	0.16	0.63
Sheep wool insulation	0.12	0.035	3.43
autoclaved aerated concrete	0.1	0.16	0.63
clay plaster wall finishing	0.015	1.7	0.01
TOTAL	**0.365**		**4,71**