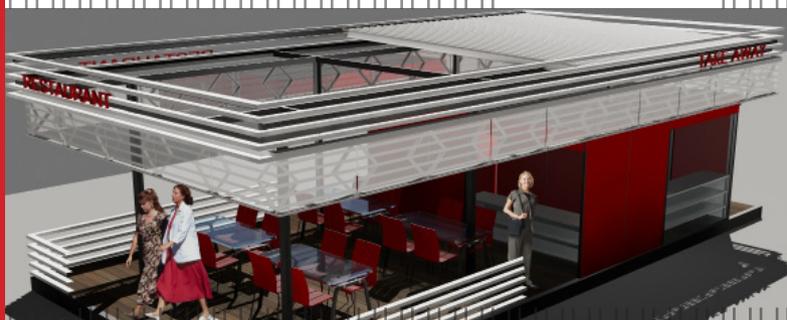
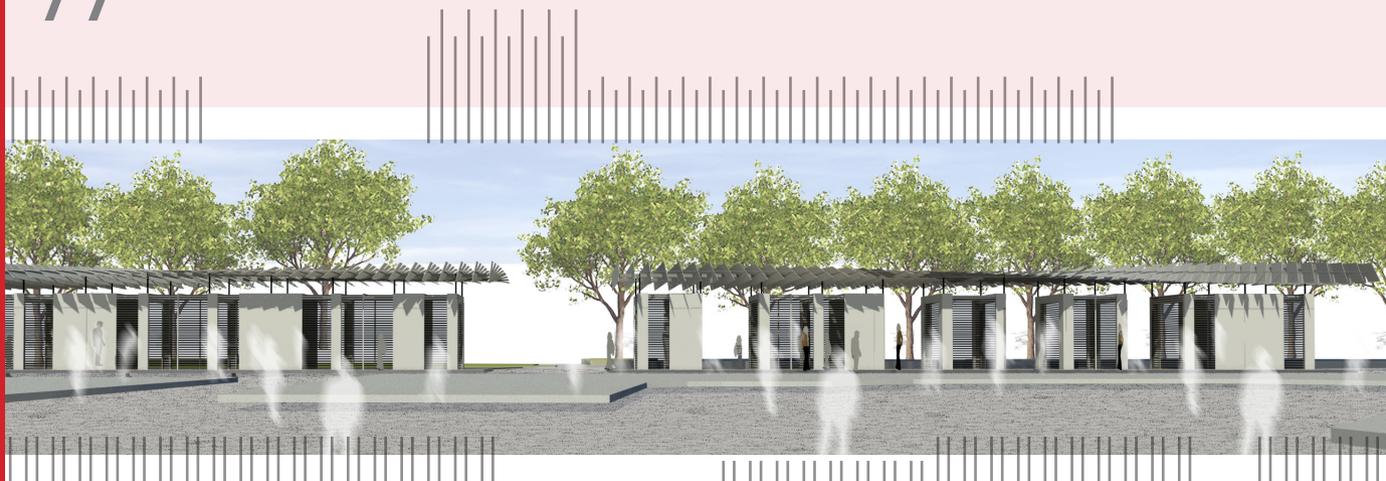
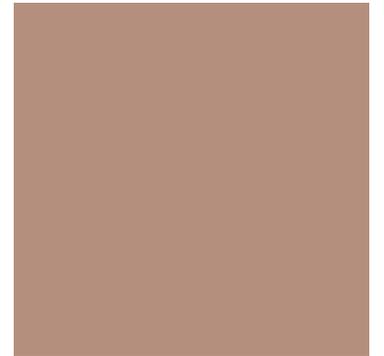


// International Design Studio

// **2009** Design for Disassembly:
Design and Build Multipurpose Transformable Pavilions



**International
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Studio 2009**





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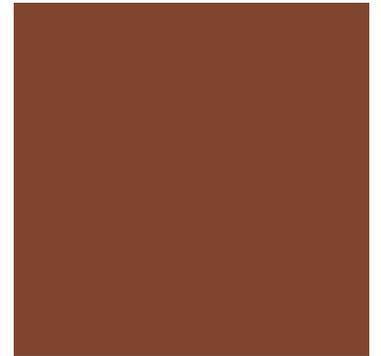


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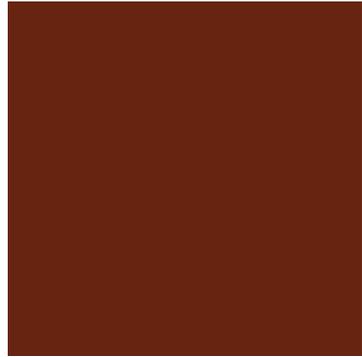


**Design for Disassembly:
Design and Build Multipurpose Transformable Pavilions**

**International
Design
Studio 2009**



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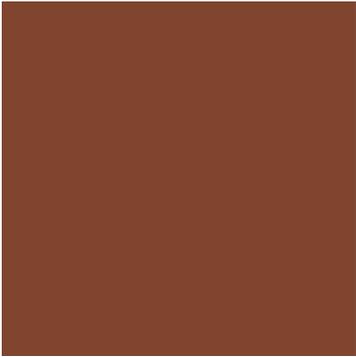
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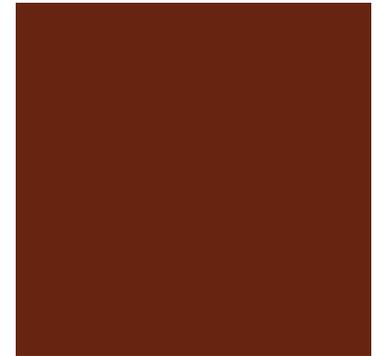
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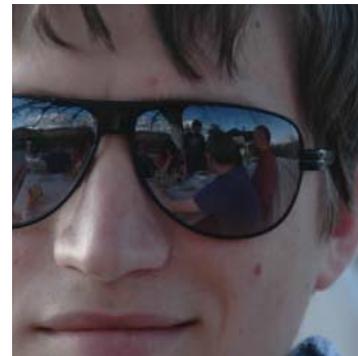
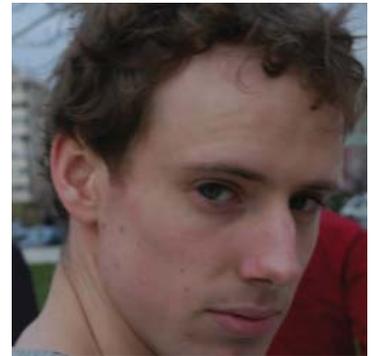


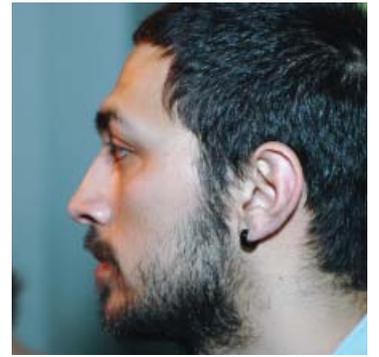


Design for Disassembly:
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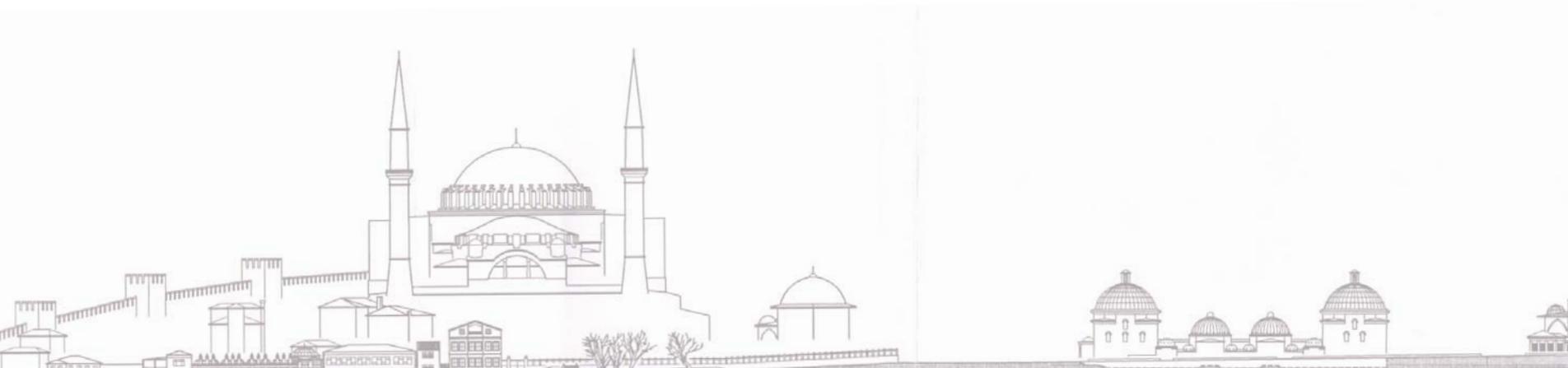




In 1993 an area in front of the nearby Sultanahmet Mosque (the Blue Mosque) was bulldozed in order to install a public toilet, uncovering several rows of seats and some columns from the Hippodrome. Investigation did not continue further, but the seats and columns were removed and can now be seen in Istanbul's museums. It is possible that much more of the Hippodrome's remains still lie beneath the parkland of Sultanahmet.

Chapter 0

/introduction



Foreword

Project presented in this publication is a result of an international cooperation between University of Twente from Enschede, Yildiz Technical University from Istanbul and University of Sarajevo. During this International Master Course, students of architecture and industrial design from the three universities have designed a transformable multi purpose pavilions in international and multidisciplinary teams.

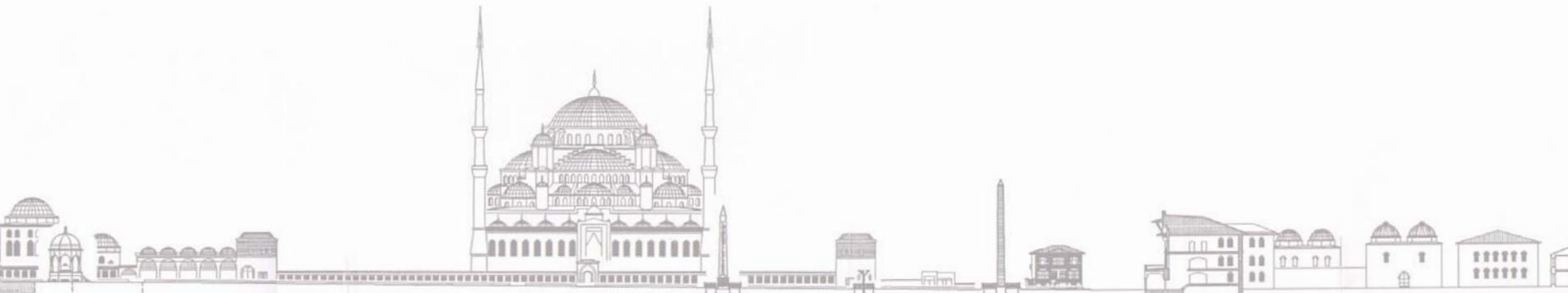
The result of this cooperation is design of three flexible systems for multi-purpose pavilion whose parts could be dismantled, replaced or reused in different configurations. Pavilions are developed for the Municipality of Istanbul and will be used during the summer on the location of the former Hippodrome from roman period.

This cooperation is a follow up of five years of joint workshops, supported by the innovation platform Twente (Pioneering/work group IDF), the Netherlands Embassy in Sarajevo, Ministry of VROOM, Rijksbouwmeester, Berlage Institute and a successful cooperation with University of Sarajevo and Yildiz technical University.

This program aimed at integrating issues of flexibility, multi functionality, energy and material reduction, reuse into one design for design strategy.

The collaboration of three universities on this program will continue in coming years.

dr. Elma Durmišević





Introduction to the workshop framework

Background

Dynamic changes in use of buildings will require fundamentally different way of design and construction in the future. This international design and construction studio focused on design and construction of a Flexible Exhibition Pavilion which can be transformed for different purposes and whose systems and components could be reconfigured and reused again for different purposes.

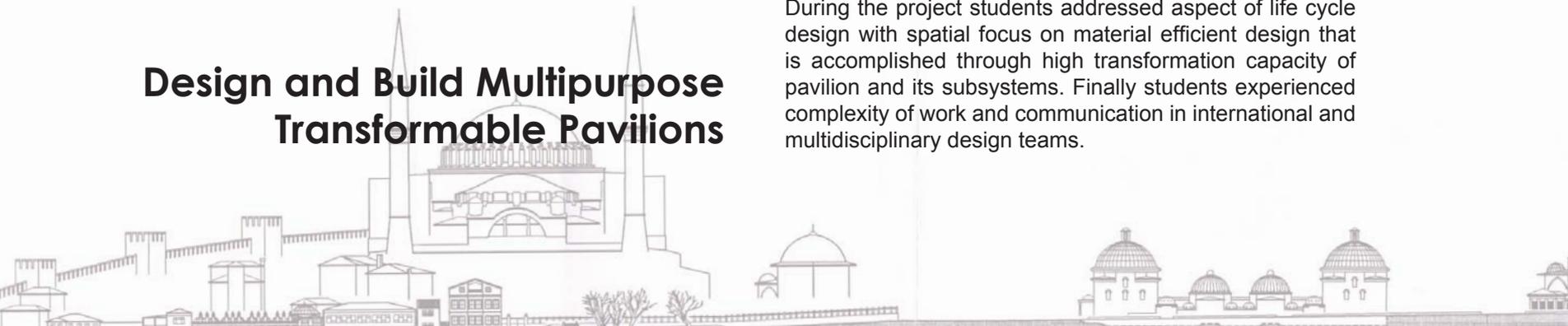
The project addressed issues of flexibility, design for disassembly and use of ICT in design and construction.

Total of 24 students from three universities (Istanbul, Sarajevo, Twente) worked in mixed teams for a period of four months. The collaboration was structured around the workshops in Istanbul, Sarajevo, Enschede (University Twente) and regular video and skype conferences.

Goals

During the project students addressed aspect of life cycle design with spatial focus on material efficient design that is accomplished through high transformation capacity of pavilion and its subsystems. Finally students experienced complexity of work and communication in international and multidisciplinary design teams.

Design and Build Multipurpose Transformable Pavilions



Design tasks and project requirements

The design task for the project was divided on three levels namely urban, building and system level.

Framework and requirements

Design a pavilion that has capacity to be transformed from one use scenario to another on a weakly base without demolition and additional material use. Both, multi-functionality of space and components should be taken into account. Pavilion should accommodate different functions and its components should be removable and reusable in different situations or configurations.

It should also be possible to contract the structure to a minimum space of 100m² and to extend the structure up to additional 100% while taking into account physical and environmental conditions of the site.

Required use scenarios that need to be incorporated into design:

use pavilion as exhibition space, restaurant, bookshop, take away restaurant.

Organization communication and role of individual students

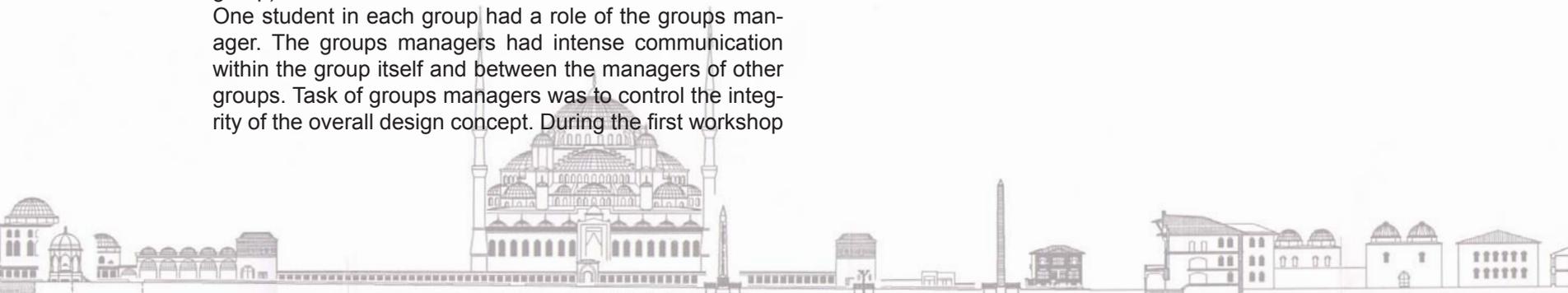
The students worked together in three international groups (two students from each university, total 6 students per group).

One student in each group had a role of the groups manager. The groups managers had intense communication within the group itself and between the managers of other groups. Task of groups managers was to control the integrity of the overall design concept. During the first workshop

in Istanbul each group worked on the master plan for the whole area of the former hipodrom. This area accommodates 3 million people during one month in summer. The main challenge was how to provide clear communication lines without obstacles and how to distribute visitors along the whole area. After the master plan has been agreed upon the area has been divided into three zones. Each group has been given one zone to work on for the further development. Group One was dealing with the central zone and had to design the information pavilions for the entrance area, exhibition area with integrated solar panels and shading elements and seating area at the end of the central zone. Group 2 had a task to develop a system for flexible pavilions that can be integrated along the park side of the site. Group 3 designed the system for flexible pavilions along the wall of the Blue mosque. At the end of the workshop in Sarajevo three groups presented spatial and technical configuration of their concept. Pavilion should be assembled in 2010 in Istanbul.

The aim of further international collaboration of the three faculties of Industrial design and architecture would be to improve integrated design process, framework for the collaboration with industry and develop further the life cycle design and design for disassembly approach.

dr. Elma Durmišević



Design for Disassembly of Buildings

Background

One can argue that conventional construction methods are in large part responsible for the degradation of the environment, due to the tonnes of waste materials that become burdens to society. Demolition in general can be defined as the process whereby the building is broken up, with little or no attempt to recover any of the constituent parts for reuse. Most buildings are designed for such end-of-life scenario. They are designed for assembly but not for disassembly and recovery of components. Different functions and materials comprising a building system are integrated (during construction) in one closed and dependent structure that does not allow alterations and disassembly. The inability to remove and exchange building systems and their components results not only in significant energy and material consumption and increased waste production, but also in the lack of spatial adaptability and technical serviceability of the building.

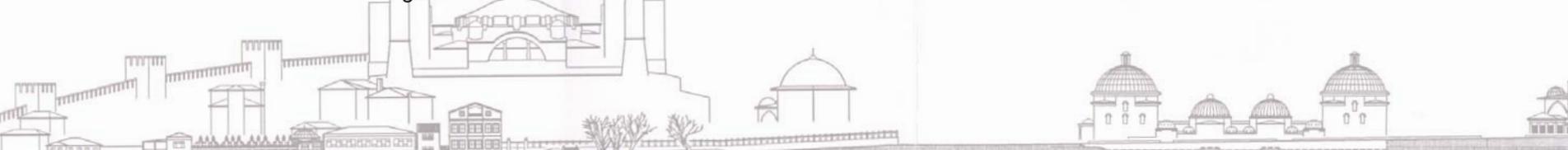
One long-standing conviction held by many is that buildings last longer when made of more durable materials. However, everyday demolition practice proves the opposite. Buildings are designed to last 70 -100 years yet , today buildings with an age of 15 years are demolished to give a way to new construction. Developers and real estate managers warn that there is a miss-match between the existing building stock and the dynamic and changing demands with respect to the use of buildings and their systems. 50% of investments in building construction in the Netherlands

are spent on adaptation and 42% of new construction is due to the replacement of demolished buildings. Besides, European building industry accounts for 40% of the waste production 40% of the energy consumption and CO2 emissions and 50% of material resources taken from the nature are building related (CSB 2007).

If the building sector is to respond to global environmental and economic challenges it needs to adopt new ways of construction. The questions are:

- Why not design building structures for remanufacturing and reconfiguration in place of demolition and down-cycling?
- Why not design buildings and systems that can serve multiple purposes?
- Why not design buildings that can be utilised as a resource pool for a new construction?
- Why not consider waste and demolition as a design error?

Rather than destroying structures and systems while adapting building to fit into new requirements, it should be possible to disassemble sections back into components and to reassemble them in new combinations. This means that we must consider how we can access and replace parts of existing building systems and components, and accordingly, how we can design and integrate building systems and components in order to be able to replace them later on.



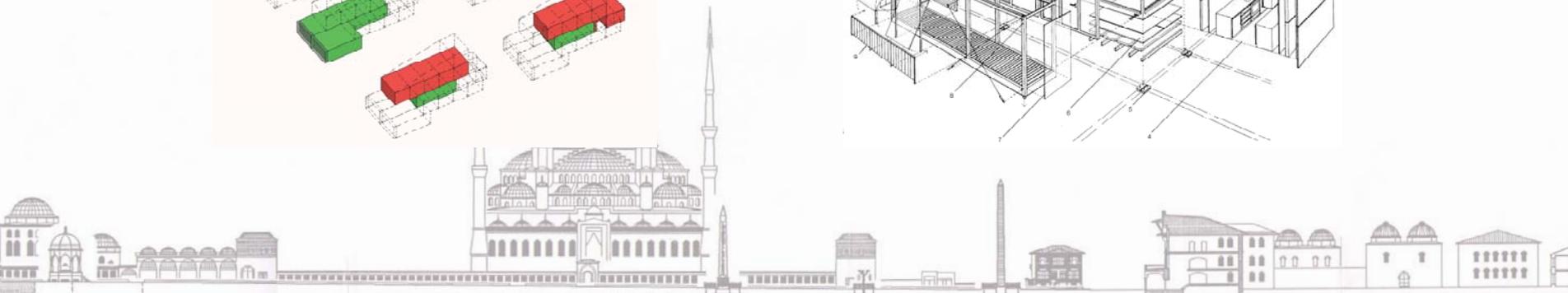
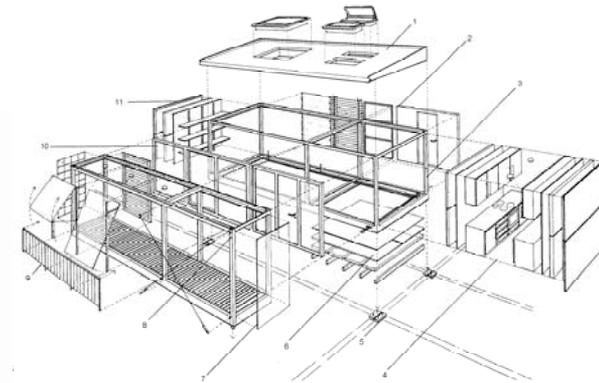
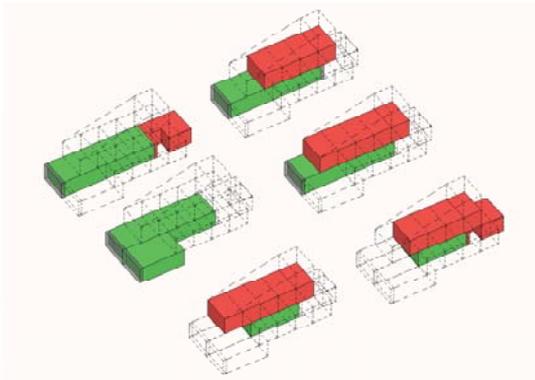
Towards re-configurable building structures

The key question is how to develop a design strategy able to replace existing fixed building structures that are not designed for disassembly, adaptability, and material recovery, with open/dynamic structures that can be reconfigured and whose parts can be easily disassembled. The moment when buildings start to transform is the moment when structures can be reconfigured and reused, or simply demolished and sent to waste disposal sites. At that moment, the nature of the technical composition of building is crucial for the life cycle of buildings and materials. It is not only a type and durability of material(s) but more importantly an arrangement of materials that determines the life cycle of buildings and their products.

The design for disassembly aim at design of transformable building structures made of components assembled in a systematic order suitable for maintenance and reconfiguration of variable parts. This concept affects design of all material levels that are accounted for technical composition of buildings and accentuates interdependent relation between

transformation process and disassembly technologies. Considering this, one can say that this concept introduces three dimensions of transformation in the buildings namely spatial, structural and material transformation. The key to each dimension of transformation and ultimately towards a three dimensional transformable building, is disassembly. By adoption of the concept of design for disassembly(DfD), spatial systems of a building become more amenable to modifications and change of use. New steps in exploitation of structure by reuse and reconfiguration can be achieved, and conscious handling of raw materials through their reuse and recycling is stimulated.(Durmisevic 2006)

Main characteristics of buildings designed for disassembly are (i) Separation of material levels, which correspond to independent building functions, (ii) creation of open hierarchy of distinct sub assemblies, (iii) use of independent interfaces as intermediary between individual components, (iv) application of parallel instead of sequential assembly/disassembly processes, and (v) use of dray - mechanical connections in place of chemical connections.(figure Hilversum)



In order to achieve this a fundamental change in architect's perception of buildings is needed in terms of :

- Conceiving building not as a static but a dynamic and open structure that can easily adopt to the changing requirements
- Extending the transformation capacity of buildings and systems by considering the whole life cycle of the building and building systems.
- Treating building materials as a long-term valuable assets through their whole life cycle by utilising reconfiguration, reuse and remanufacturing options on building, system and material level
- Considering waste and demolition as a design error
- Decoupling fixed function-material relationship in buildings by design of re-configurable systems
- Involving construction industry into the whole life cycle of the building and building systems

Design considerations with respect to DfD for high Transformation capacity involve:

- Setting the boundary conditions for transformation and specification of the long and short term use scenarios.
- systematisation of elements according to the functional groups and their use life cycle,
- formation of a hierarchy of components that fits into a desired functional decomposition,
- definition of types of connections that support desired functional, and technical decomposition, and
- life cycle coordination that respects disassembly sequences, technical, and functional decomposition.

Conclusions

A typology of technical composition of a building is a measure (indicators) of building sustainability. A major shift towards greener design and engineering involves shift from design of close building systems and assemblies towards design of open and dynamic building assemblies made of independent and exchangeable building components and systems. Different use requirements correspond to different arrangement and hierarchy of building components. Therefore different sub-assemblies are independent from each other and are connected via base element of the assembly, similar to the composition of computer programs made of independent modules that can be independently upgraded, reconfigured, and added to the existing software. Such a concept allows for future alterations to external screening, and to internal partitioning. It allows for services to be independent of the fabric, to provide for accessibility, servicing, and alteration. It creates the precondition for reuse and recycling and opens the way for designs of greater diversity and richness of architectural expression.

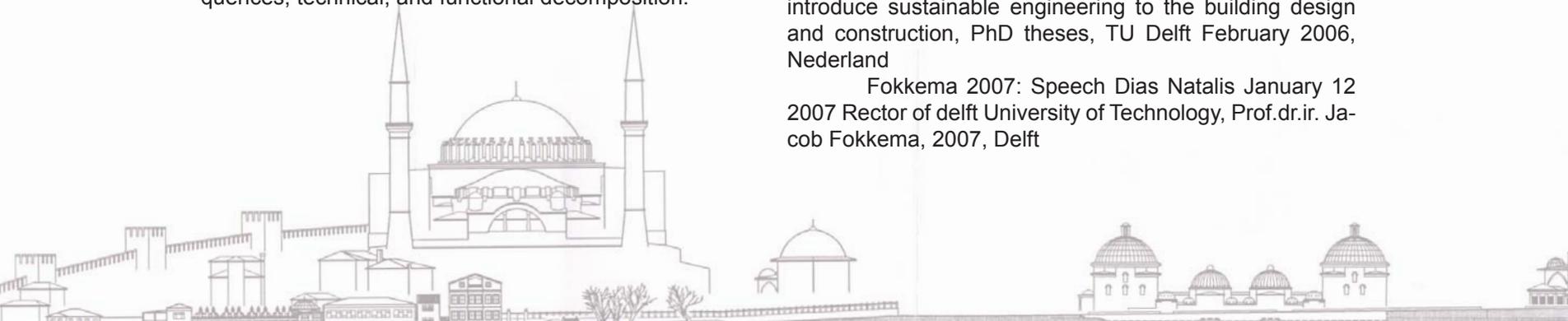
Dr. Elma Durmišević

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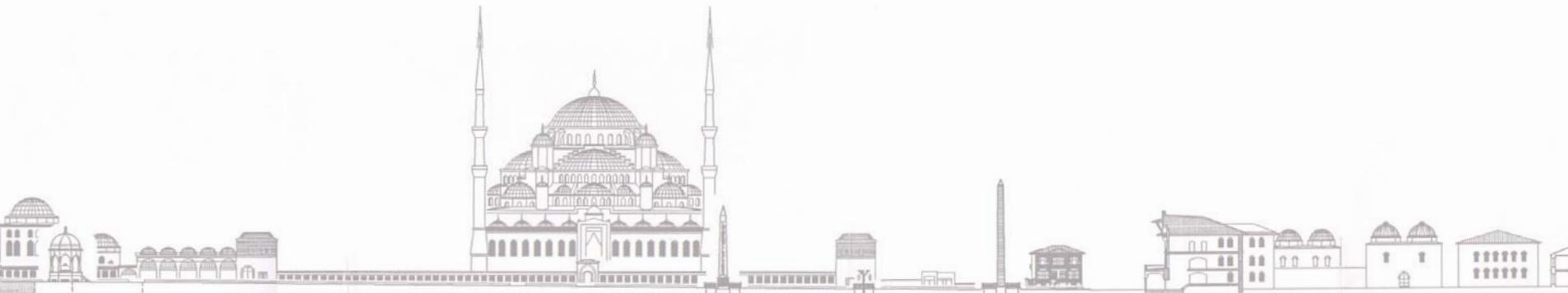


Multi-criteria design matrix

Prior to the design of the pavilion a Multi-criteria design matrix has been discussed with students. This matrix consists of main design criteria and sub criteria on one side and weighting of the criteria and sub-criteria on the other side. Criteria and weights are result of the program analyses. The discussion about each criteria and sub-criteria helps to understand the scope of the program and the essence of design tasks.

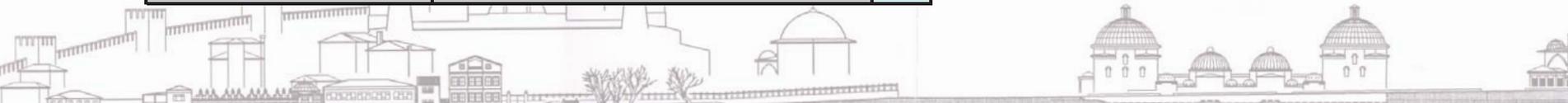
During the conceptual design phase student have been asked to develop three alternative design solutions and to evaluate them according to the Multi-criteria design matrix. This evaluation has been used as criteria to chose the final solution. This cycle from design in alternatives, evaluation to the choosing the final solution has been repeated number of times during each design phase.

dr. Elma Durmišević



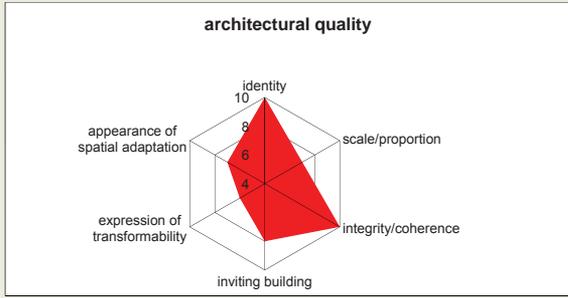
MCDM 23	criteria and importance	BuildDesk
Project: Transformable and Multipurpose Pavilion (master course 2009)		
By: Elma Durmisevic		1-jul-05

CRITERIA	weight	SUBCRITERIA	weight
Architectural quality	9	identity	9
		scale/proportion	9
		integrity/coherence	9
		inviting building	10
		expression of transformability	3
		appearance of spatial adaptation	4
		Flows of people	10
Multi-Functionality	8	spatial efficiency (adoptability to different functions)	6
		accessibility	9
		safety/security	10
		possibility to install equipment	4
		suitability for the internal flexibility	4
		easy to maintain	4
Transformability	10	easy transformation from one use concept to another	6
		possibility to separate or combine two or more pavilions	5
		extendibility	5
		transformation of open area into a closed area and opposite	5
		adaptability to the weather conditions and day-night configuration	10
		reliability of the integration/connection between components	7
		flexibility integration of systems (building and HVAC)	7
		transportability of the components/systems	3
		potential of industrial production of the components/systems	6
		Sustainability	7
renewable energy from building systems	7		
stimulus for low energy user behaviour	6		
low environmental impact of used materials	7		
water saving provisions	5		
re-usability of disassembled components	6		
Garbage disposal	6		
Comfort and health	8	thermal comfort (winter)	
		thermal comfort (summer)	10
		indoor air quality	10
		ease of usability of the pavilion and its systems	5
		visual comfort	10
		cleanness	10
Constructability and handling of components	10	high level of industrialisation/prefabrication for fast assembly,dissasemb	3
		easy to assemble, disassemble and reassembly	3
		transportability of the components/systems	3
		easy to store	2
		easy reconfiguration of prefabricated components for reuse	2
Cultural identity and local context	9	integration of cultural behavior aspects to the design	9
		integration of cultural esthetic qualities	10
		local climat conditions	4

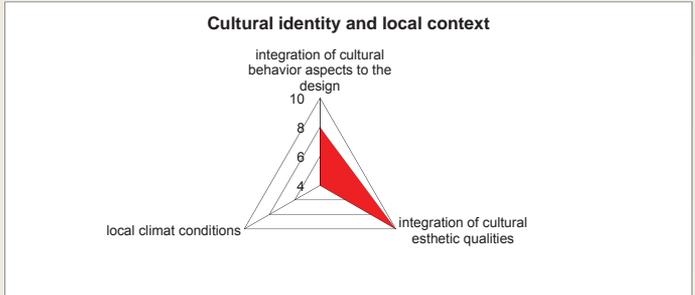
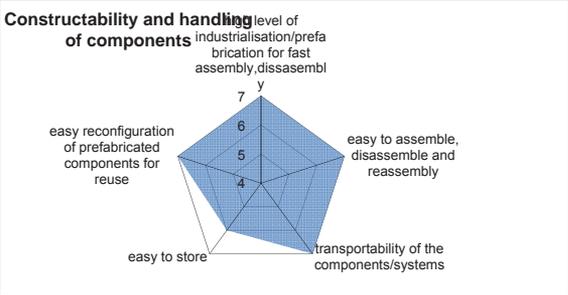
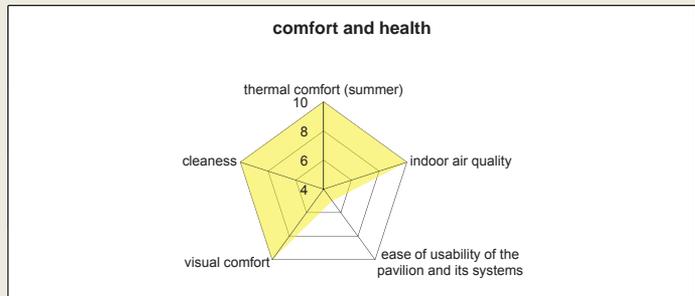
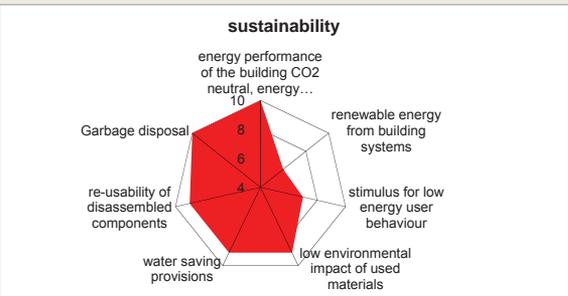
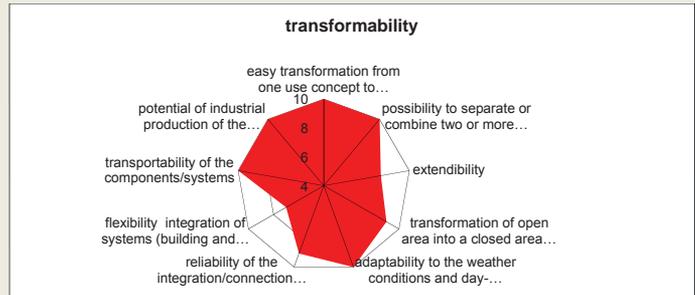
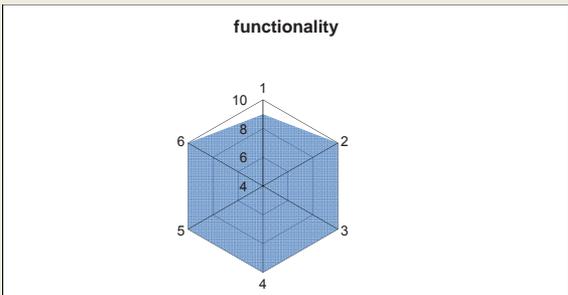




MCDM 23	criteria and importance	BuildDesk
Project: Transformable and Multipurpose Pavilion (master course 2009)		
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Summary of main criteria	weight	weight	weight
Architectural quality	9	6	10
Multi-Functionality	8	10	4
Transformability	10	9	5
Sustainability	7	4	5
Comfort and health	8	10	10
Constructability and handling of components	10	7	6
Cultural identity and local context	9	7	10



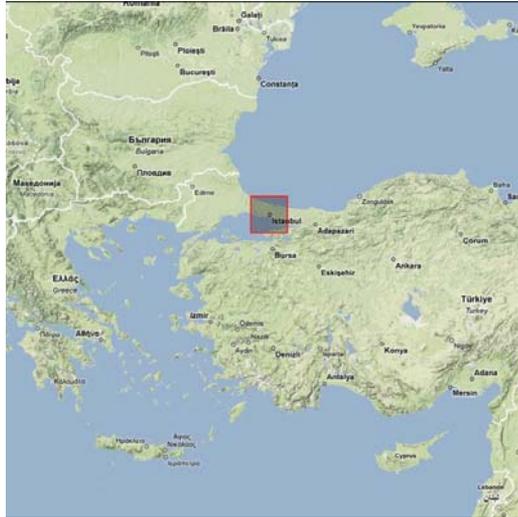




In 324, the Emperor Constantine the Great decided to move the seat of the government from Rome to Byzantium, which he renamed Nova Roma. This name failed to impress and the city soon became known as Constantinople, the City of Constantine. Constantine greatly enlarged the city, and one of his major undertakings was the renovation of the Hippodrome. It is estimated that the Hippodrome of Constantine was about 450m long and 130m wide. Its stands were capable of holding 100,000 spectators. Nowadays the hippodrome still attracts this much visitors a day, during a specific month of the year...

Chapter 1

/urban_analysis

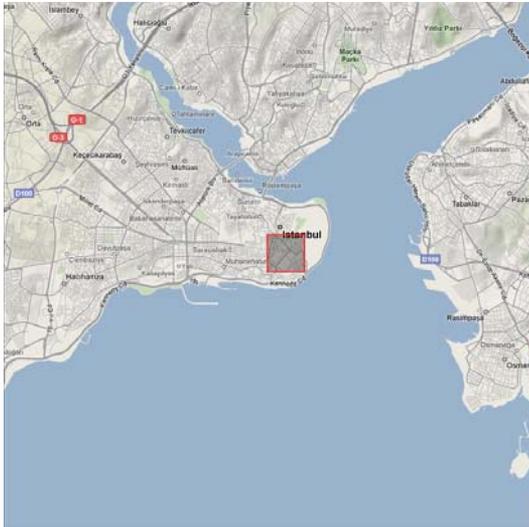


Current situation of the Square

The Sultanahmet Meydanı, further called Sultan Ahmet Square, is located in the Eminönü neighborhood. Eminönü is one of the oldest neighborhoods of Istanbul, located in the center of Old City area. From March 2009 Eminönü merged with Fatih Municipality, in this report we will refer to it as Eminönü. The municipality was always an important site since the Byzantine times until today, it was the hub of ancient Constantinople. The city started to grow from this point and there are several tourist sites in the area such as Ottoman mosques, palaces, old bazaars, churches, and several museums. Some of the important historical and touristic monuments within its boundaries are: Sultanahmet Square (ancient Hippodrome) with the Serpentine Column and Stone Obelisk and Egyptian Obelisk, Hagia Sophia, Topkapi Palace, Blue Mosque, Spice Bazaar and the Grand Bazaar. [source: www.greatistanbul.com].

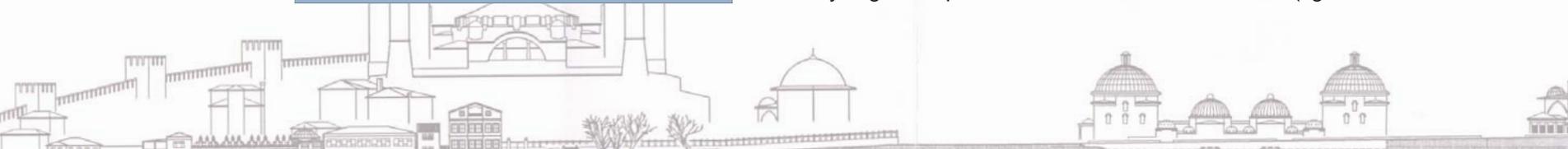
The Sultan Ahmet Square used to be the hippodrome of Constantinople which was a circus that was the sporting and social centre of Constantinople, capital of the Byzantine Empire and the largest city in Europe. Today it is a square with only a few fragments of the original structure surviving. (source: Wikipedia)

The Sultan Ahmet square is surrounded by several touristic and historic attractions such as the Hagia Sophia and the Blue Mosque, as can be seen in the street map (of figure 1). The square roughly measures 70m wide by 400m in length. The square can be reached by foot, car and a tramway service through several streets at the corners of the square.



The axis of the square

Analyzing the square several axes can be defined (figure



2). First there are three axes (1, 2 and 5) that are parallel to the length of the square. These axes have no boundaries when facing their direction, but are limited at the sides of the axes, by buildings at one side, the Square park at another side and the blue mosque at the third side. Second there are two axes (3&4) which are set at right angles with the first two axes. Axis 3 passes from the triangular square through the German fountain to the Hagia Sophia. This axis has clear physical boundaries facing its direction but the view to the Hagia Sophia is not obstructed from point A, making the Hagia Sophia a clear gravity point. Another important gravity point in the area is the Blue Mosque. This Mosque is walled and has a clear entrance at point B. The fourth axis is in line with this entrance and on this line a very good view of the blue mosque is obtained, making it a point of attraction. This last axis also passes the middle of the Square from where you have a 360° view of the whole Square.

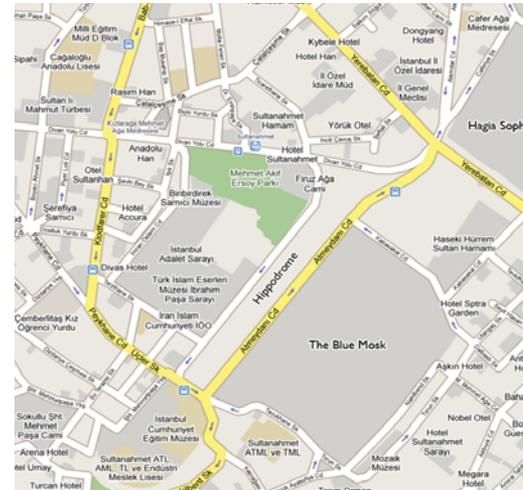


figure 1 street map

During Ramadan

During Ramadan the Square is used as a market and festival area. Ramadan is an Islamic religious observance that takes place during the ninth month of the Islamic calendar; the month in which the Qur'an, according to tradition, was revealed to the Prophet Muhammad. It is the Islamic month of fasting, in which participating Muslims do not eat or drink anything from true dawn until sunset. Since it is a festival of giving and sharing, Muslims prepare special foods and buy gifts for their family and friends and for giving to the poor and needy who cannot afford it; this can involve buying new clothes, shoes and other items of need. There is also a social aspect involved the preparing of special foods and inviting people for the Iftar meal (the meal to open the fast). In many Muslim and non Muslim countries with large Muslim populations, markets close down in the evening to en-



figure 2 axis of the square



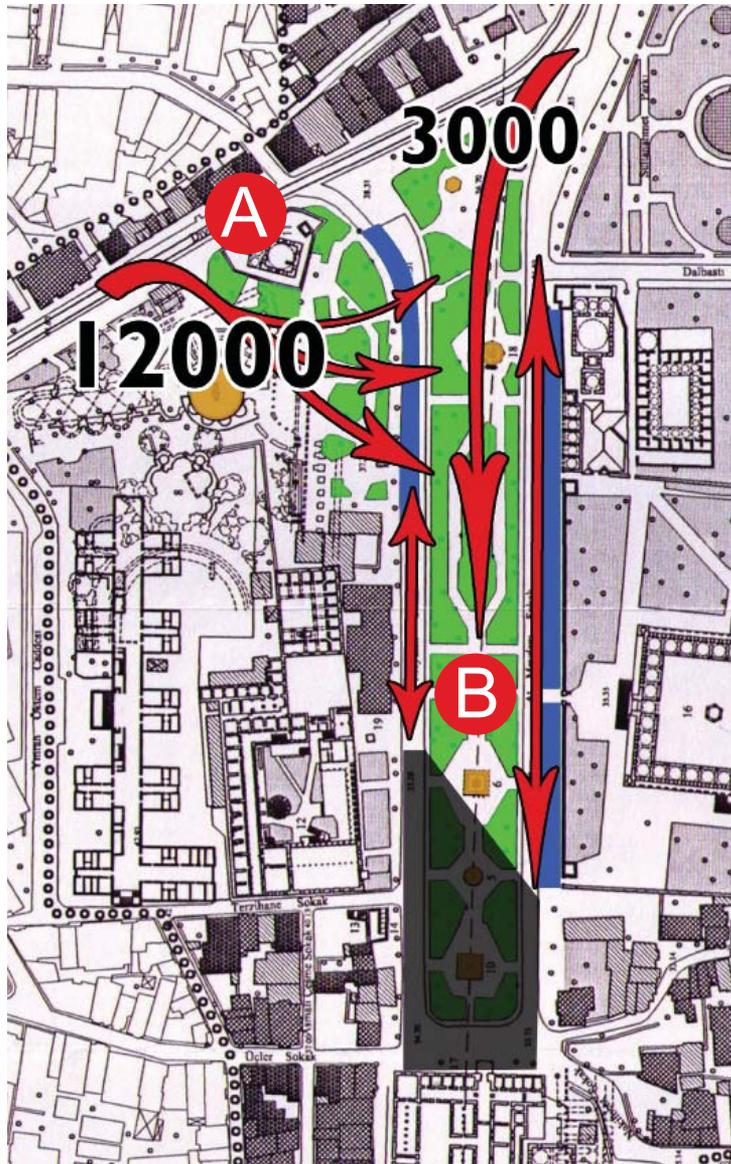


figure 3 flow of visitors

able people to perform prayers and consume the Iftar meal – these markets then re-open and stay open for a good part of the night. Muslims can be seen shopping, eating, spending time with their friends and family during the evening hours. The Sultan Ahmet Square is one of the biggest markets erected especially for the Ramadan in Istanbul.

Flows of people during Ramadan

It is estimated by the municipality of Eminönü that during the Ramadan month 3 million people visit the Sultan Ahmet Square. They will reach the square mostly by foot or tram. At Iftar, the square is very crowded at locations where market stands can be found. This is one of the main issues addressed by the municipality, the safety of the visitors is in concern and there is no good overview of the area. During a short session the flow of people is estimated and schematically presented in figure 3. With an average total of 100.000 visitors a day it was estimated that at peak hour 15.000 people will enter the square. It was also estimated that about 25.000 people will fit on the square at the current floor plan.

As can be seen in figure 3, it is assumed that most people will enter the square by tram and passing the area between the tram station (A) and the Square (B). From this entrance square the visitors will choose to go right (to the blue mosque) or left (to the Hagia Sophia and German Fountain) at the hippodrome square. During Ramadan people will first go to pray at the Blue Mosque, some people will first pay a visit to the fountain or the Hagia Sophia.

The current layout of the market stands, as shown in figure 3, creates several points of attention at the square and visitors will go to these stands to eat or buy gifts, as marked in blue. The problem that arises is that the area where you can't find any stands is quite desolate and not inviting to go to, as shaded in grey. The flows of people is therefore mostly concentrated around these stands and the Blue

Mosque.

Problems on urban scale

The previous paragraphs mention some of the current problems on the urban scale of the Sultan Ahmet Square and can be listed as follows:

- A large amount of visitors creates an unsafe situation, for themselves and for fire regulations;
- The surface area of the square is not fully used, leaving desolate spots in contrast to overcrowded areas;
- During Ramadan the entrance blocks the flow of people to other areas of the square;
- The total image of the square is one that has been littered, filled with smoke and smells;
- The pavilions are not uniform, they do not fit together.

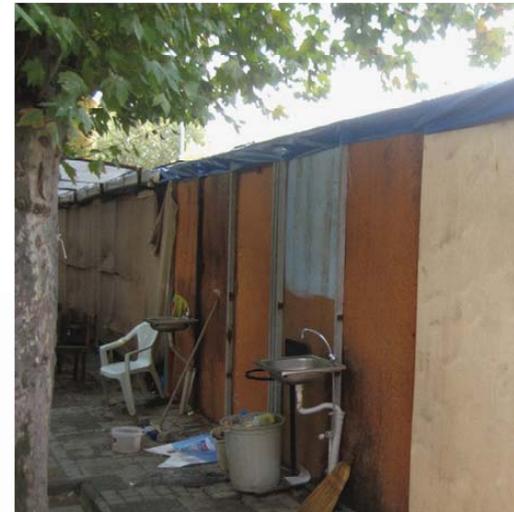


During the rest of the year

The market is erected only during Ramadan. This means that the other eleven months of the year the square is mainly used as a touristic and historical attraction where a lot of buses full of tourists and visitors pass through. The square is a good starting point for a stroll through the old town of Istanbul. Some small shops are permanently based around the square selling souvenirs and food.

Climate of Istanbul

In summer months are warm and humid with very little rain especially between July-August, winter months can be cold and wet with some snow but not that much ex-



three images of the current situation
Ramadan festival



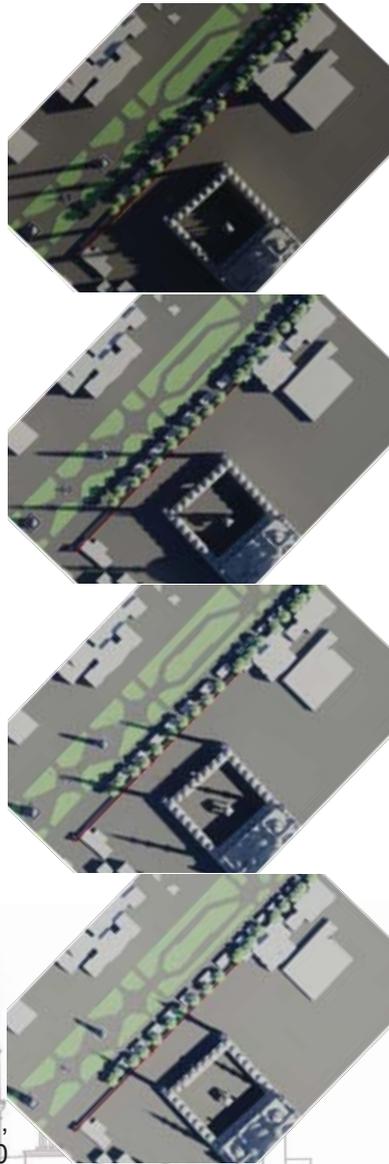


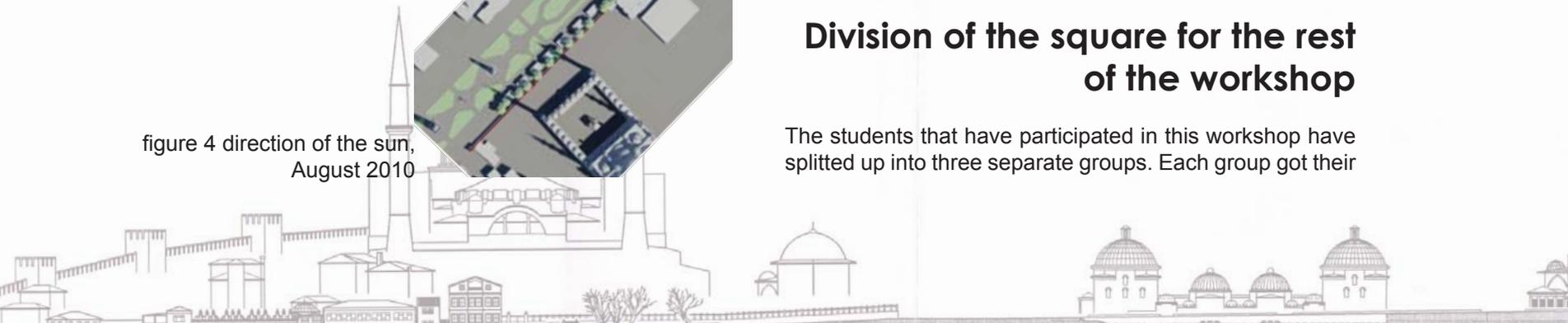
figure 4 direction of the sun,
August 2010

trema as some other areas of Turkey. Spring and autumn are mild. Istanbul is so huge as an area and it has so many topographic diversities that you can experience several different sub-climates in the same city. The district Eminönü is bordered to the Bosphorus Strait and surroundings are dominated by the Mediterranean climate (dry summers and mild and rainy winters). During the summer months, air temperature can go up to 30^o Celsius. During winter months, the temperature is around 10^oC with much colder nights. It snows occasionally but it's not more than 10-12 days in a total winter period. In the springtime, especially between April-May and September-October, there is a very comfortable climate with around 15-25^oC. Average temperature in Istanbul, in a year, is around 14^o with an average relative humidity of 76%. Average rainfall is 787 millimeters a year. 35% of the rainfall occurs in winter, 23% in spring, 14% in summer, and 28% in autumn. Generally, northeastern winds prevail in Istanbul (Poyraz in Turkish), with a long term average of 3,2 meters/second. Summers are dominated by northeastern winds (Poyraz), winters by northwestern (Karayel) or northern (Yildiz) or southwestern (Lodos) winds, also see figure 5. Most foggy period for Istanbul is from March to May. [source www.greatistanbul.com]

The average hours of sun in Istanbul is 1454 a year [source: based on Thomas Huld and Marcel Suri PVGIS © European Communities, 2001-2007]. In figure 4 the direction of the sun according to the square is shown for the next Ramadan festival in August 2010.

Division of the square for the rest of the workshop

The students that have participated in this workshop have splitted up into three separate groups. Each group got their



tasks for designing the Square. As the previous paragraphs already anticipated a bit the Square area can be divided into three parts: the Main Square, the Entrance and the Wall see figure 6.

Square

In figure 6 the area 2.3 and 4 marks the Sultan Ahmet Square with its Serpentine Column, Stone Obelisk, Egyptian Obelisk and German fountain. The Square couples all areas together. Visitors use the Square to eat their meal and sit and enjoy its surroundings. At the moment the square design does not meet these needs totally, and has potential to be developed accordingly. The Square has its own 'entrance', area 2. It is not assumed that the majority of the visitors will enter the square through this entrance during Ramadan, but it will be in the other month when mostly tourists will visit the Square, and busses park at the Hagia Sophia.

Entrance

Area 1 in figure 6 can be seen as the main Entrance for pedestrians to the Sultan Ahmet Square. At the top of the 'triangular shaped' square the tram station is located. From here visitors will walk down the stairs to the hippodrome and pass the amphitheater. At the end of the triangular square the visitors will arrive at the first row of market stands which are parallel to one of the two major streets of the hippodrome square. This whole street is also part of the entrance area design. An impression of the Entrance can be found on the next page. During Ramadan market stands are setup according figure 3. These stands sell food, books and souvenirs.

Wall

The Blue Mosque is surrounded by a wall. The wall is not one massive element, but contains several openings

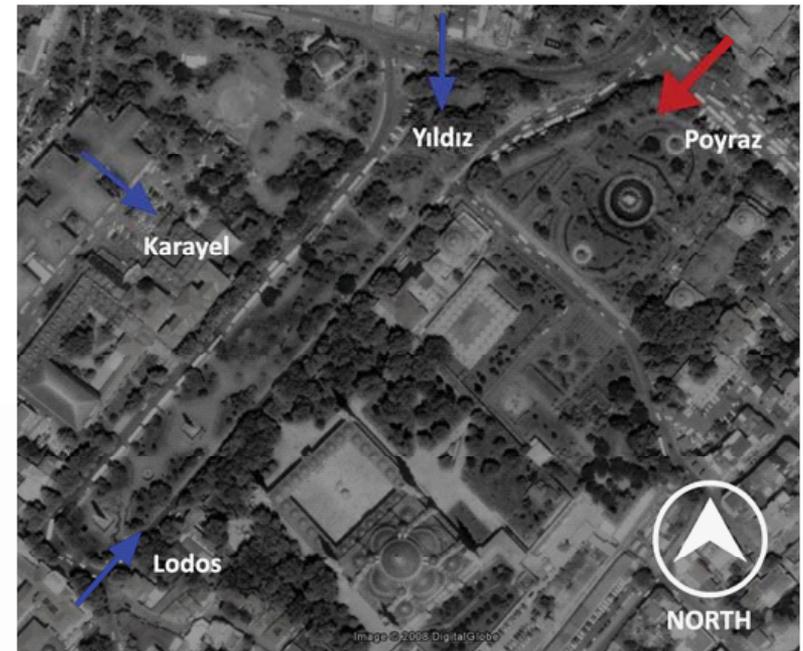
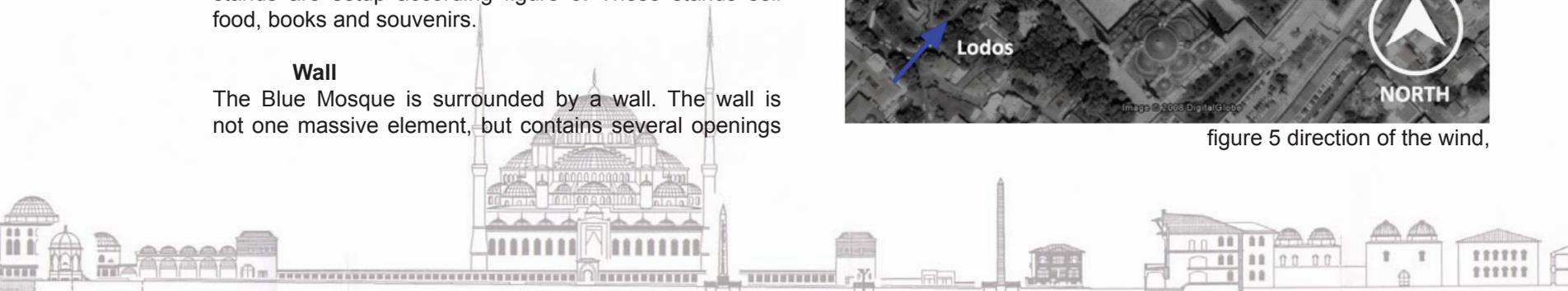


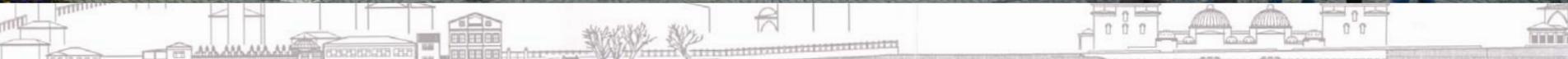
figure 5 direction of the wind,



which can be seen as glassless windows with a view on the mosque. During Ramadan the market stands create a space between the wall and the stands (see next page). The stands sell the same goods as the stands of the Entrance. On the courtyard of the mosque there is a traditional book market. The entrance of the mosque is a clear gravity point attracting most visitors to the mosque for praying. Future goals for square design

After the analysis of the current situation of the square the groups together with the professors stated the goals in which the new total square design should hold onto. Also the Municipality of Eminönü had some demand regarding safety, cleanness, fast assembly of the pavilions, uniformity and historical context, which was already explained in the introduction chapter. The earlier stated problems regarding flow of the visitors and activation will be seen as opportunities to solve in the new design:

- A large amount of visitors creates an unsafe situation, for themselves and for fire regulations,
- The design should be safe and spacious during the whole festival.
- The surface area of the square is not fully used, leaving desolate spots in contrast to overcrowded areas,
- The inactivated, grey area in figure 3 should be acti-



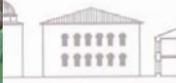
- vated and used as festival terrain by the visitors.
- During Ramadan the entrance blocks the flow of people to other areas of the square,
- The flow of people should not be blocked on busy junctions.
- The total image of the square is one that has been littered, filled with smoke and smells,
- Create a clear street map and design pavilions in such a way that littering, smell and smoke will be reduced.
- The pavilions are not uniform, they do not fit together.
- The pavilions from the Entrance and the Wall should be uniform and also fit into a bigger picture with the Main Square as central area.

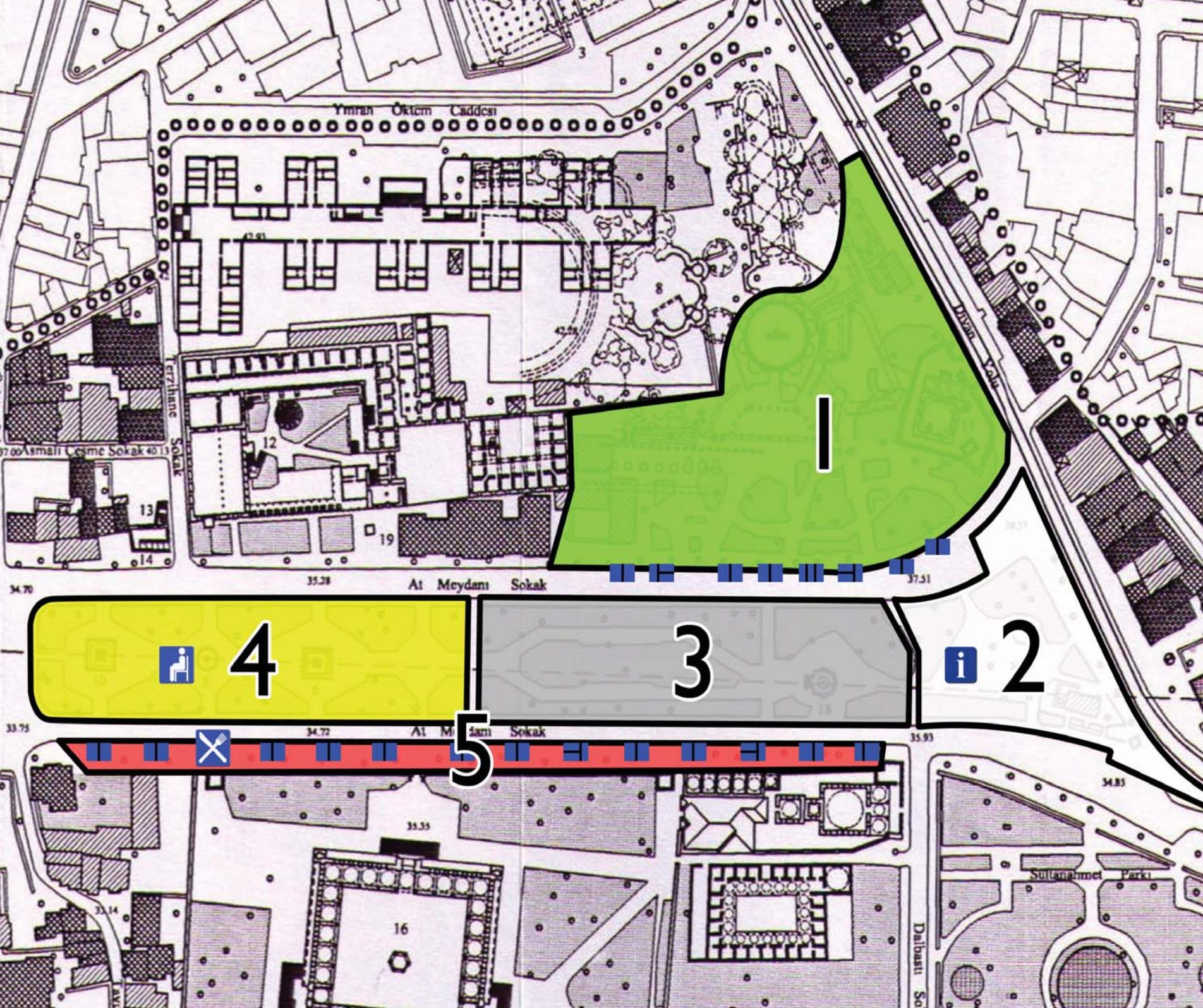
Result

In figure 6 the Square, Entrance and wall are marked in several areas. Area 1 is the entrance, visitors will enter this area by tram. The idea of this area is that people need to move to the other 4 area's, and not block this path. The layout of area 1 is permeable and open, so visitors can see quickly where they can walk to.

Area's 2,3 and 4 are part of the Square. At area 2 there will be an information stand and will be considered as the entrance area for the park before and after Ramadan festival. Area 3 is a kind of pedestrian high way. People can reach the Blue Mosque and area 3 is the connection between all other 4 area's. Area number 4 is a seating area, people can buy food in area 1 and 5 and eat it at area 4 or they can bring their own food and eat it there. It is supposed to be a relaxing environment and partly shaded.

The pavilions situated along the wall are drawn in area 5. Because of the bigger area, it is possible to establish restaurants over here. In this area you will find the entrance of the blue mosque, this should be clearly visible and easy accessible.





Ymran Öktem Caddesi

ezizhane Sokak

37.00 Asmalı Çesme Sokak 40 13

34.70

35.28

At Meydanı Sokak

37.31



4

3



2



5

34.72

Al M... Sokak

35.93

33.75

33.35

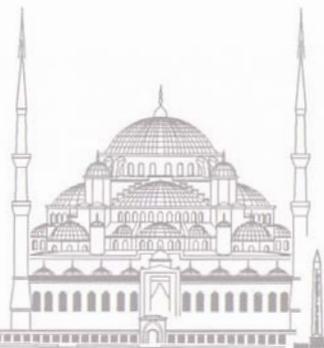
16

34.85

Sultanahmet Parkı

Daibasi So...

figure 6 division of the Sultan
Ahmet square



Outro to next chapter

Chapter 2 will introduce you to the concept designs of the three groups. The groups used this urban analysis as a basis to continue design on a smaller scale. The analysis of the flows will partly define the actual width of the pavilions and the pattern they were placed onto the site. The functions a pavilions has an influence on the flows also. On smaller scale also criteria such as flexibility and demountability will be part of the design. The way every group manages these criteria will now come to order.





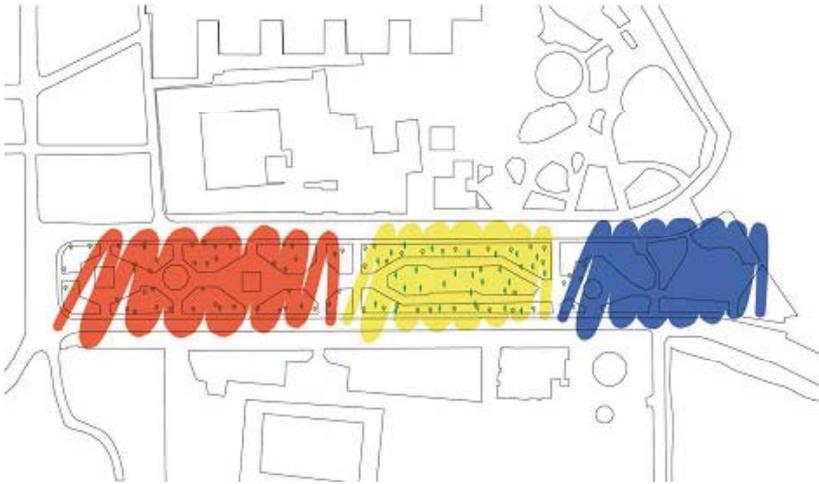
When Constantinople was sacked during the Fourth Crusade, the hippodrome was looted by the invaders. The four copper horses of the Hippodrome Boxes for instance, were taken to St Mark's in Venice. To make things worse, the Ottomans were not at all interested in horseracing. The hippodrome was forgotten, and although it has never been build over, it fell into ruin. As civilization piled up its dust over the centuries, the level of the hippodrome's surroundings rose.

Chapter 2

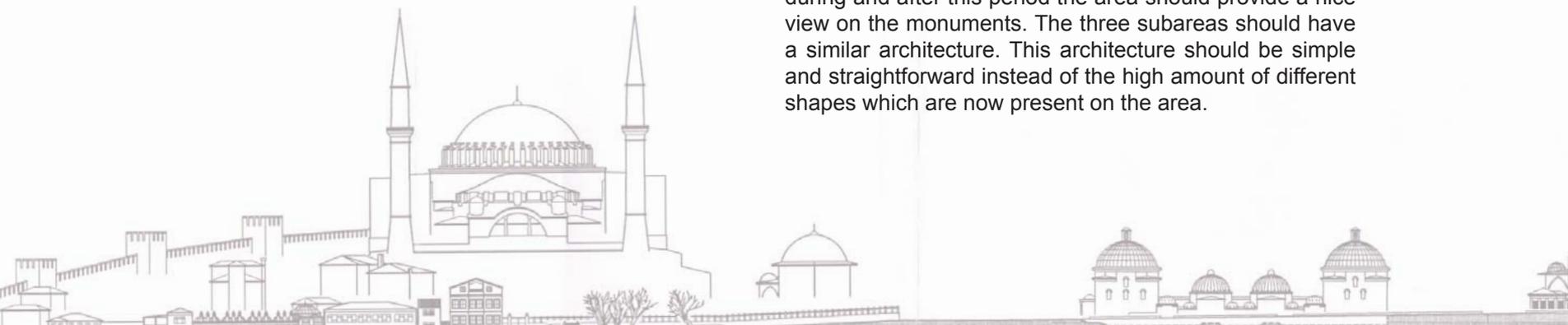
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Group One, the square

Urban context



The middle area of the square is the highway of the site, therefore the design goal for this area is to create an optimal flow of people as well as a structured layout. The middle area is subdivided into three separate areas as can be seen in the picture below; the entrance area (blue area), the highway area (yellow area) and the seating/monument area (red area). These three areas are translated into three sets of demands. The first set of demands has the function to provide information and offer a nice and clear entrance to the highway area as well as provide an area to move across the park area of group two to the wall area of group three. The second set of the demands concerns the highway area. It serves as a highway as is derived from its name, therefore the capacity of this area should be high enough for a big flow of people. In addition to that the possibility to cross from the metro station in park area to the entrance of the Blue Mosque in the wall area is very important. Another functional demand is to provide shelter against direct sunlight and generate energy for the pavilions of group two and three. The last set of demands concerns the seating/monument area which should be very transparent and not competing with the monuments for attention. This area should be used as a seating area during the Ramadan festivities, during and after this period the area should provide a nice view on the monuments. The three subareas should have a similar architecture. This architecture should be simple and straightforward instead of the high amount of different shapes which are now present on the area.

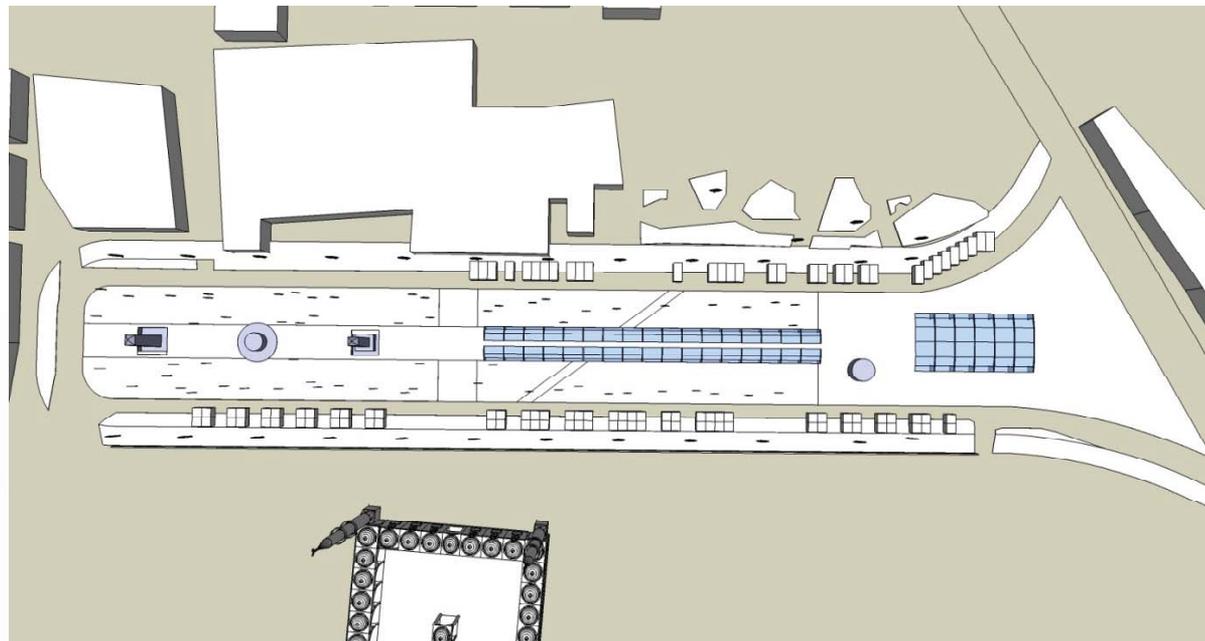
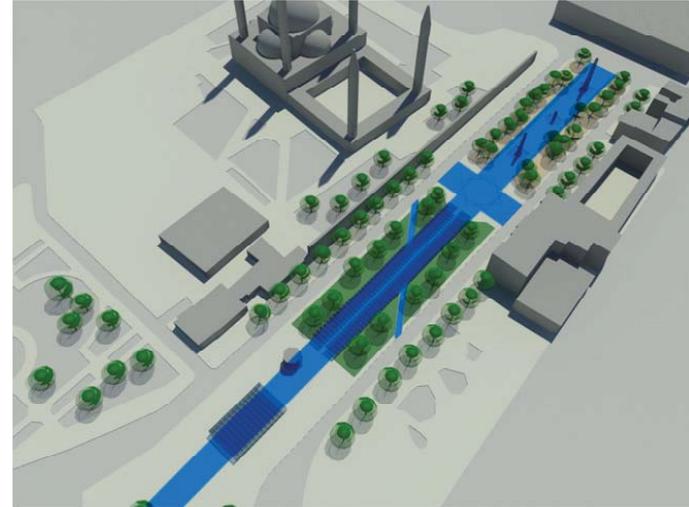


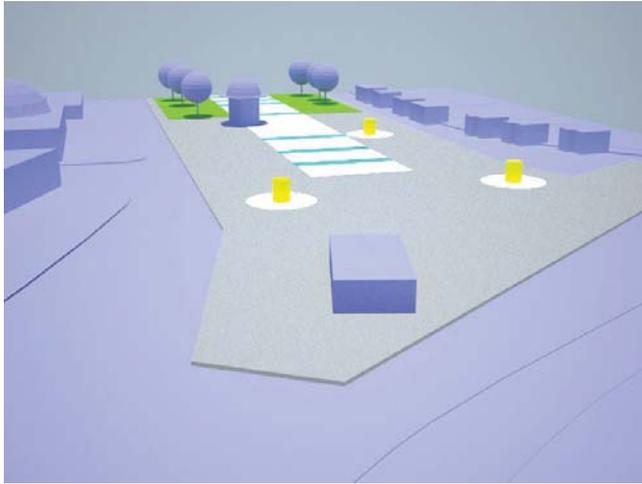
Design proposals middle area

With the demands in mind concerning the simple and straightforward architecture with one uniform and simple style the next proposal is created.

Proposal

The creation of one central highway path in the length of the park and one highway crossing in the front of the Blue Mosque. In addition, there is a diagonal path placed to provide a quick route to the blue mosque from the direction of the metro station. All structures should add to these two main axis.



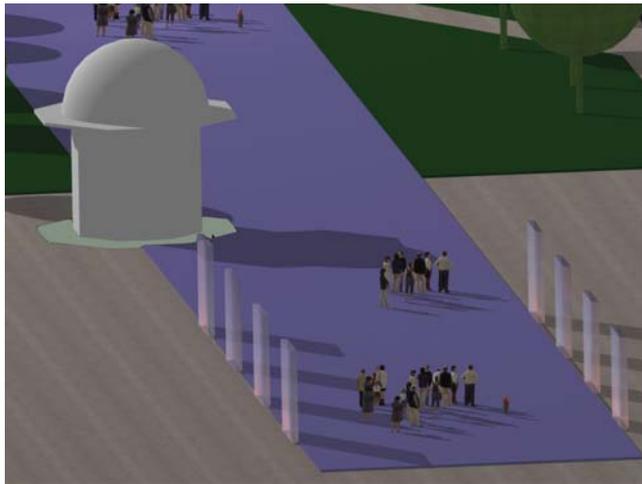


Design proposals entrance area

The entrance area is normally the place where most people enter the hippodrome area from the metro station or the Hagia Sophia, or cross the square from one side to the other. Therefore it is very important to have an open structure. In addition, there is the wish to be able to provide information in this area. These two wishes are conflicting because providing info would require space while it is preferred not to use any space in this area so people can cross the square easily. The next proposals are made considering both wishes:

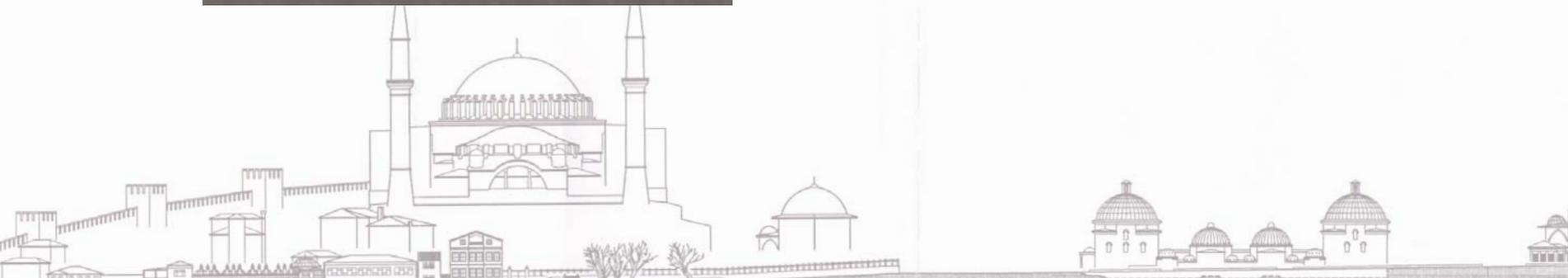
Proposal 1 The three kiosks

This proposal contains a very open structure to provide an optimal flow of people. Only three kiosks are placed on the square to provide information. The pavement of the central area continues into the square to invite people into the highway area.



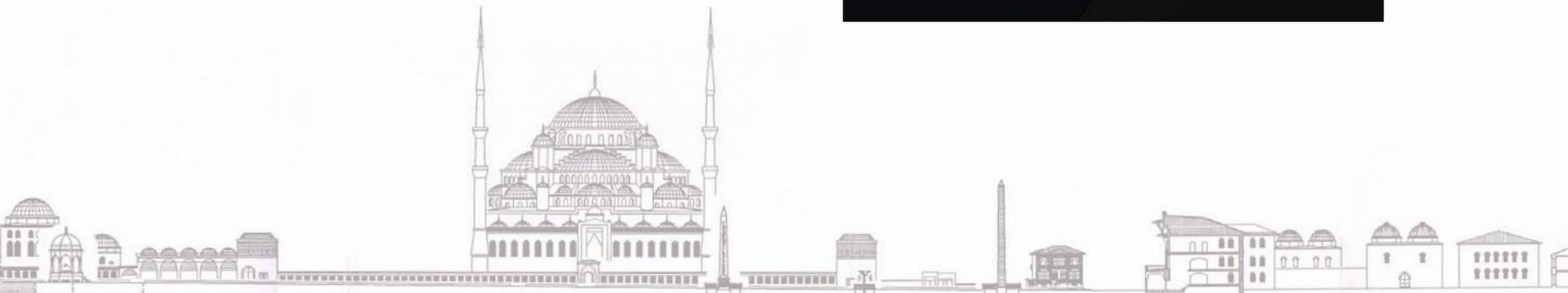
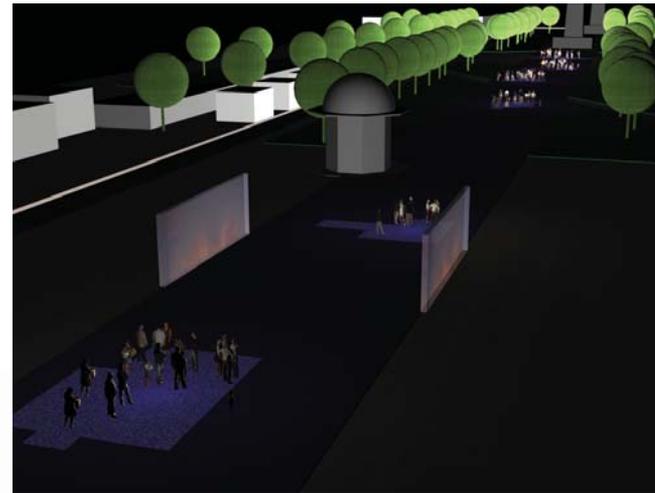
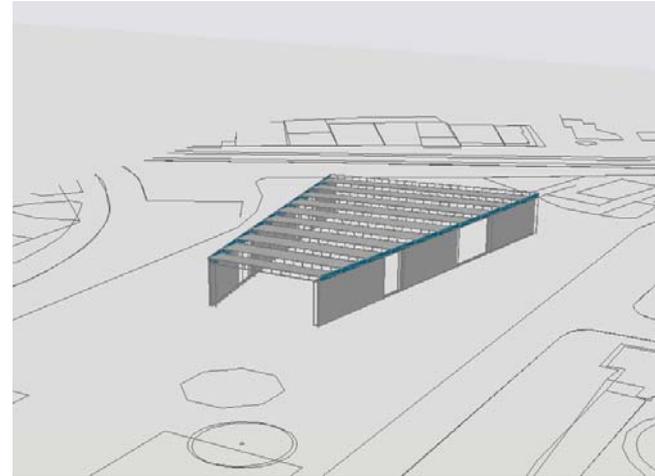
Proposal 2 Line of Panels

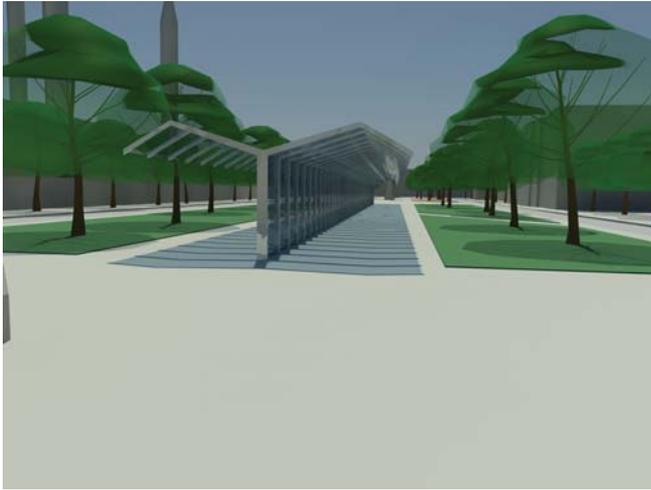
This proposal also contains a very open structure to provide an optimal flow of people. Eight panels are placed on the square to provide information, they can be moved around with ease. The pavement of the highway area continues into the square. In addition the panels are placed on the borders of this continuation of pavement to strengthen the 'Axis' design. The pavement used in this concept is interactive, meaning that when people stand on it there will be a response like lights coming from below or other special effects.



Proposal 3 Flexible structure

This proposal contains a flexible structure. Instead of providing an open structure, this structure can be closed or opened whenever the user wants. The panels are movable alongside the rails. These walls provide information, the roof provides shelter and has the possibility to provide energy. The flow of the people is guided through the shape of the structure and can be adjusted by moving the walls.



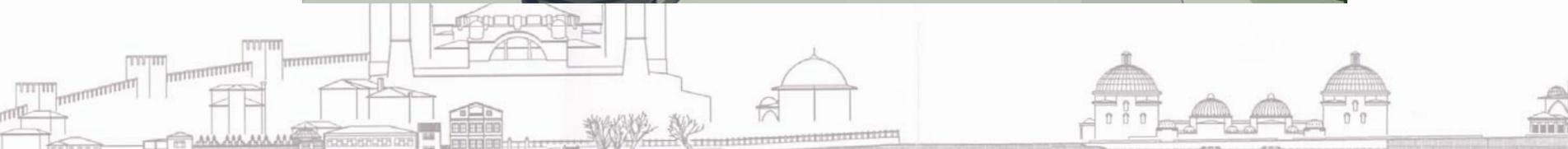


Design proposals highway area

The design of the highway area has some key focal points which should receive additional attention. The area should provide enough space for a big flow of people, and in addition it should provide shelter against sun and provide energy for the pavilions. With these wishes four proposals are made:

Proposal 1 Light structure

This proposal contains a light structure which divides the people flow two one way flows. The structure always provides shelter in the middle of the area and contains enough surface for solar panels. The view on the Blue Mosque and Hagia Sophia are good at one side, but bad from the other side, plus the view on the obelisks is completely blocked while walking this path.



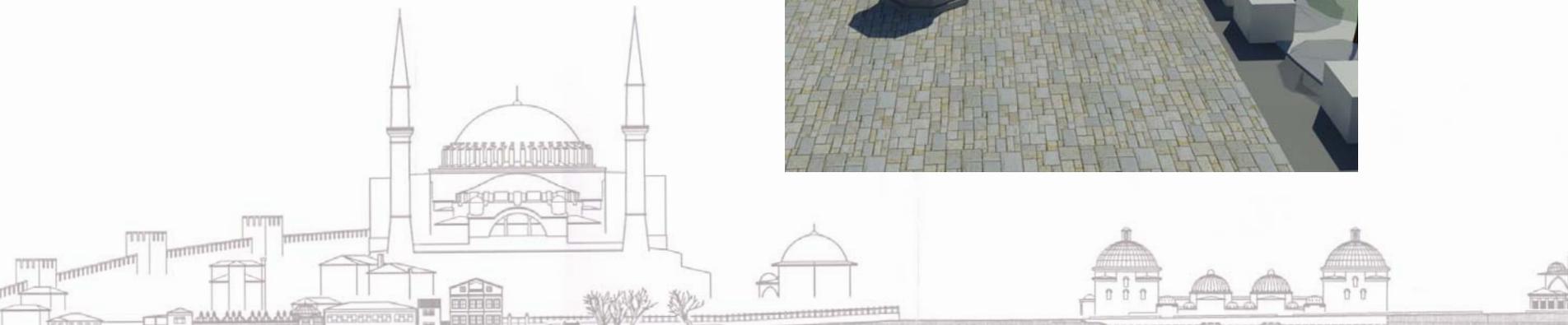
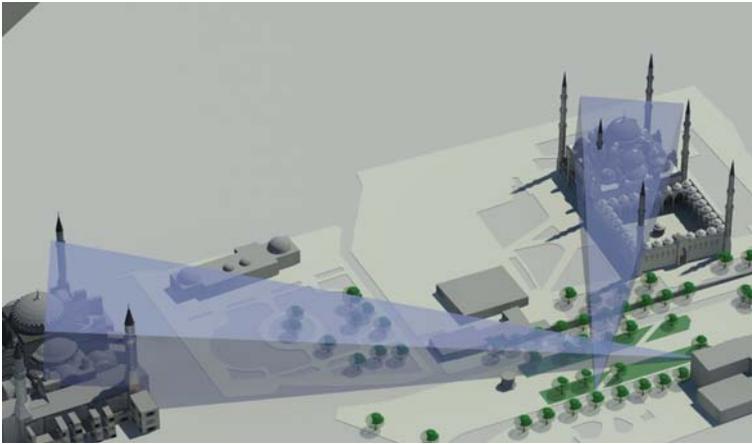
Proposal 2 Opening up

This proposal divides the structure in two parts one left and one right part which both provide shadow and shelter against rain and wind. The view on the obelisks is fantastic as the structure gradually opens up while moving closer to the Obelisks. The shadow is on both sides of the path, but not in the middle of the area. The structure is on both borders which provides the people enough space to flow through the area.



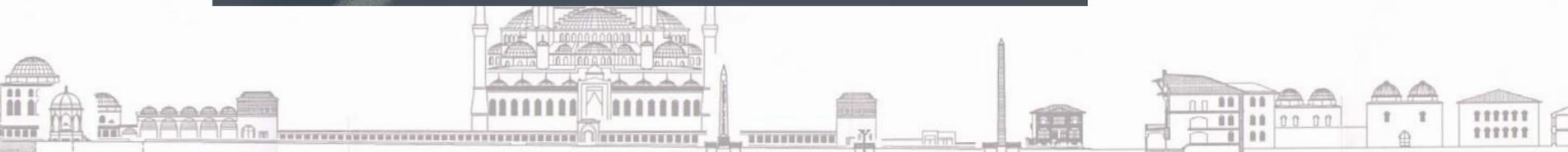
Proposal 3 Nice views

This proposal has a design based on the most beautiful views on the Blue Mosque and the Hagia Sophia. The structures is left out and only cross paths are created. The area is perfect for all possible flows of people. It is not providing any energy or shelter.



Proposal 4 Geometric patterns

This proposal is created to make an interesting play of shadows on the ground. Both the squares and the Islamic patterns of the roof structure are created by using parametric design. The structure provides shelter from both sun and rain and provides enough surface area for solar panels. The view on the obelisks is lost and the view of the Blue Mosque and Hagia Sophia are only left intact at the left side of the path.





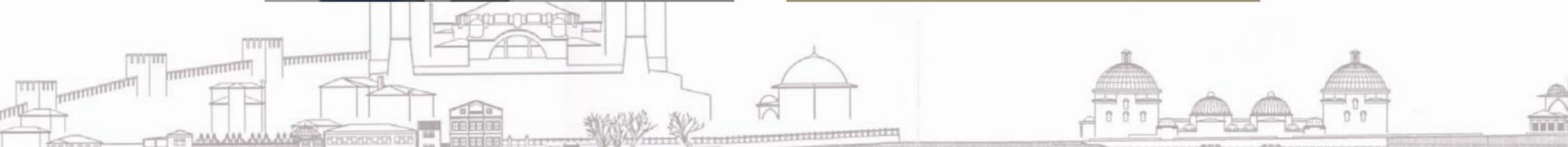
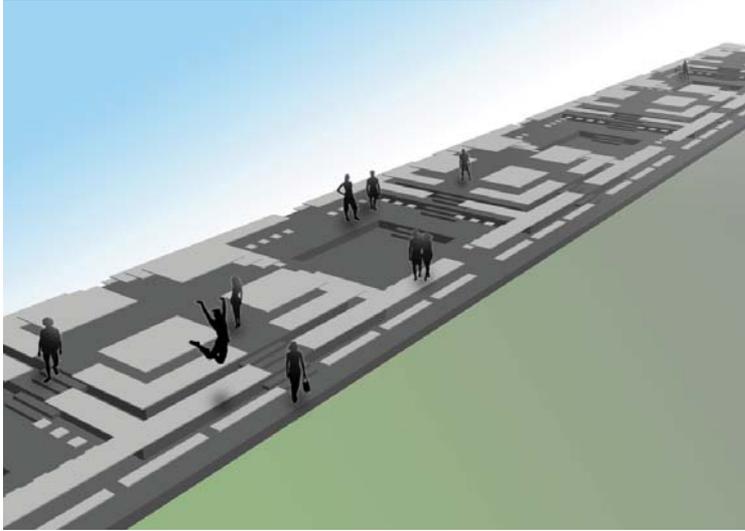
Design proposals seating/monument area

Proposal 1 Landscape

This proposal is focused on creating a multi-level seating landscape. The idea is to create several levels of height which can be used as either a table or chair. The principle of multi-functionality is used here. The elements do not have a fixed function until somebody is using it as a table or chair. The landscape does look nice even when it is not in use and is not competing with the monuments.

Proposal 2 Barracks

This proposal is focused on flexibility. By using simple decks and standard tables and chairs the capacity of the area can be changed quickly and the maximum capacity is high. The design is simple and not competing with the monuments. On the other hand it is not adding architectural quality and maybe even seems like a military or school like setup.



Proposal 3 Lounge

In this proposal several options for seating are used. There are normal tables with benches, tables for standing and lounge pools. These elements make the area look more exiting and suitable for everyone. The elements are not competing with the monuments and are in the same shape language as the general design. They also provide a relaxing overall mood.

Proposal 4 Greenery

The last proposal is using a simple table – bench combinations substituted with greenery. This combination of elements make the area more inviting and alive even when there are no people. The design is not competing with the monuments and is in line with the general design.

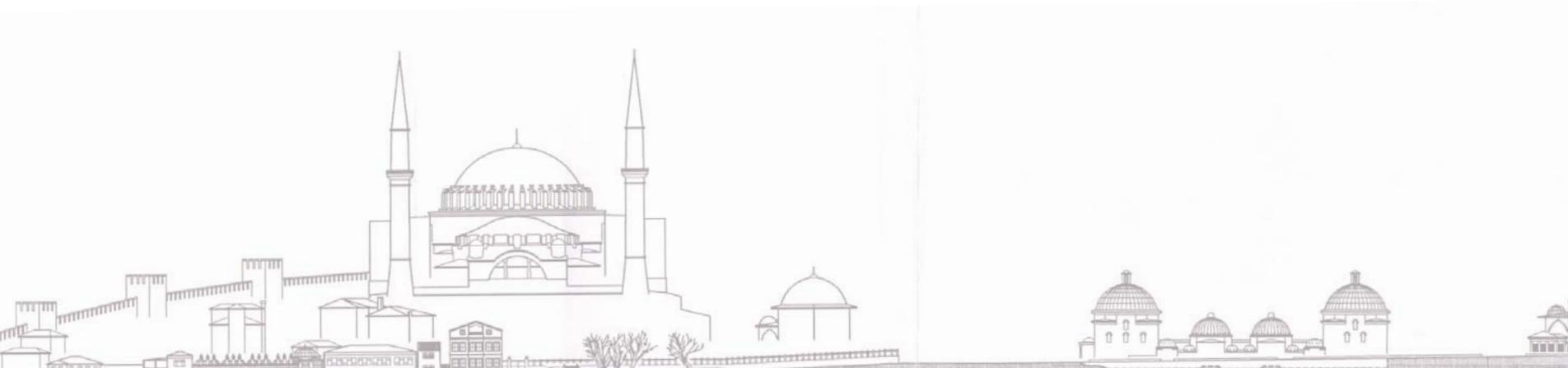


Comparing the proposals

Comparing proposals for the entrance area

	Kiosks	Panels	Structure
architectural quality	-	+	+/-
multi-functionality	+	+	+
transformability	-	+/-	+
sustainability	+/-	+/-	+/-
comfort and health	+	+	-
constructability and handling of components	+	+/-	-
cultural identity and local context	+	+/-	-
potential	+/-	+	-

The Kiosk proposal is not good enough on architectural quality, transformability and cultural identity and local context. The Panels proposal is better on these points because they can be adjusted to the desired colors and information. Both Kiosks and Panels score a '+' on comfort by providing enough space for the flow of people. The Structure concepts blocks a significant part of the flow and scores a '-'. The Panels proposal is declared as the most viable direction and will be developed into concepts.





Comparing proposals for the highway area

	Light structure	Opening up	Nice views	Geometric patterns
architectural quality	-	+	+/-	+
multi-functionality	+/-	+/-	+/-	+/-
transformability	-	+/-	+/-	-
sustainability	+/-	+/-	+/-	+/-
comfort and health	+	+	+/-	+
constructability and handling of components	+	+	+/-	-
cultural identity and local context	-	+	+	+/-
potential	+/-	+	+/-	-

The Light structure proposal scores low on architectural quality and cultural identity and local context because it significantly blocks the views on the monuments. The Opening structure proposal scores high on nearly every criterion. The Nice Views proposal has a strong score on every criterion. The Geometric Patterns proposal scores low on Constructability and Transformability. The two strongest proposals are the Opening Proposal and the views proposal. Of these two the opening up proposal scores higher, and will be further developed.

Comparing proposals for the seating area

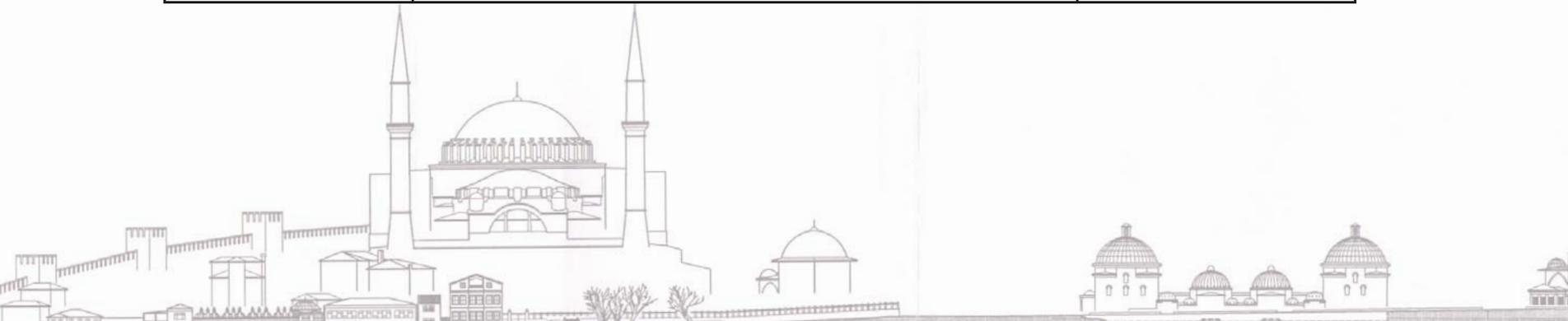
	Land-scape	Barracks	Lounge	Greenery
architectural quality	+	-	+/-	+
multi-functionality	+	+	+	+/-
transformability	-	+	-	-
sustainability	+/-	+/-	+/-	+/-
comfort and health	+/-	-	+	+
constructability and handling of components	-	+	+/-	+/-
cultural identity and local context	+	-	+/-	+
potential	+/-	-	+	+

The Landscape concept scores low on Transformability and Constructability. The Barracks score low on architectural quality, comfort and cultural identity. The Lounge and Greenery both score low on Transformability. The Greenery however scores a little higher than the Lounge.

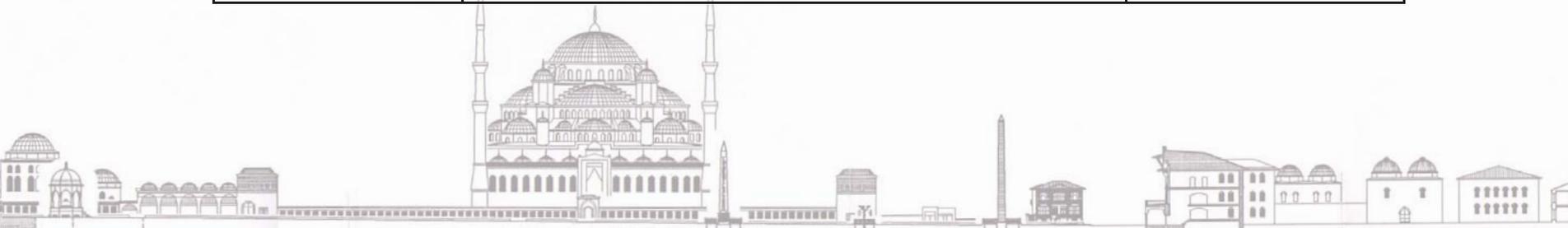


Chosen scenario

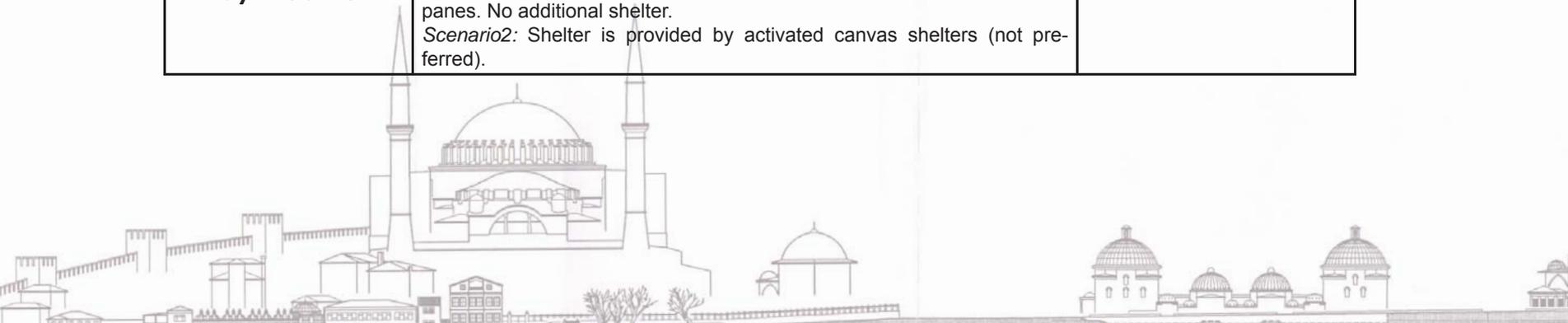
Situation	Scenarios	Considerations
<p>Day [Ramadan]</p>	<p><i>Main Users:</i> Tourists and Shopkeepers. <i>Primary Function:</i> Provide information and an exciting environment, allowing cultural interaction. <i>Scenario:</i> Visitors can relax on the square while enjoying the monuments and the scenery. A relaxed mood is central. Music plays while visitors enjoy an ice-cream or a snack from one of the fastfood bars who sit in the seating area. Where strategically placed benches and tables in the shadow allow for a cool place to sit, while others are placed for optimal placement for large amounts of people. Or a stroll through the central hallway, where semi-transparent solar panels and a partially open roof allow the choice to enjoy the sun. While still having a cool environment due to the use of water in the hallway. In this hallway, exhibition objects (maybe performance schedules as well) accompanied by historic and cultural information displayed on transparent panes. Information about the square, the monuments, the festival (could be temporary) and maybe even information about the eco-approach of the square. The entrance area serves as a information center, manned by personnel. Tourists can get information, booklets and tourists guides here. If they are interested, they can get information about the festival, including performance schedules. The pavilion also offers some shadow for the personnel and visitors and displays a clock with a highlighted area to show when the people can start eating. The Pavilion might also offer:</p> <ul style="list-style-type: none"> - a tourists map of the area, highlighting the monuments - a detailed history of the square - a general history of Istanbul - a general explanation of the usage of the square during the different seasons of the year. (also including the festival) 	<p><i>The central area is more travelled by tourists than the entrance area since people will travel directly from the busses or the metro towards the Blue Mosque, and should thus provide fast information. Sidenote: Open connection from metro to diagonal line to Blue mosque</i></p> <p><i>Mylar sheets between glass panes can provide replaceable transparent information sheets.</i></p> <p><i>Information provided by the entrance pavilion is more extensive than the information in the central hallway. Detailing important periods in the history of Istanbul and the influence of that era on the square.</i></p>



<p>Day [No Ramadan]</p>	<p><i>Main Users:</i> Tourists. <i>Primary Function:</i> Provide information and an exciting environment, allowing cultural interaction. <i>Scenario:</i> Visitors can relax on the square while enjoying the monuments and the scenery. A relaxed mood is central. No music plays. Visitors enjoy an ice-cream or a snack from one fastfood bar (maybe at entrance area?). They can sit in the seating area. Where strategically placed benches and tables in the shadow allow for a cool place to sit. Or a stroll through the central hallway, where semi-transparent solar panels and a partially open roof allow the choice to enjoy the sun. While still having a cool environment due to the use of water in the hallway. In this hallway, exhibition objects accompanied by historic and cultural information displayed on transparent panes. Information about the square, the monuments and maybe even information about the eco-approach of the square. The entrance area serves as a information center, manned by personnel. Tourists can get information, booklets and tourists guides here. The pavilion also offers some shadow for the personnel and visitors and displays a clock. The Pavilion might also offer:</p> <ul style="list-style-type: none"> - a tourists map of the area, highlighting the monuments - a detailed history of the square - a general history of Istanbul - a general explanation of the usage of the square during the different seasons of the year. (also including the festival) 	<p><i>Main differences:</i></p> <ul style="list-style-type: none"> - No music playing (?) - Set up of the seating area. - Information is season-based - Clock is normalised
<p>Evening [Ramadan]</p>	<p>The square is crowded, at the seating area the area set up for the tourists is quickly transformed to accommodate more festival visitors. Lights integrated in either the shadow-structures or the floor, provide lighting appropriate for the available fading natural light (Measureable by time/light strength in the solar panels). The central hallway has music playing and is lit with appropriate lighting to keep the area visible. When the moment nears that the people can start eating, the lights change color and the music slowly starts playing louder. Until the exact moment, and the lights flare briefly. The Entrance area has an information center, shaped to guide the flow of people. It shouldn't block the view. During the night exhibitions can be shown on a big screen above the entrance area (on a smart glass/projector screen). At the pavilion people can find information about the festival, this area is also lit nicely and will have the same light effects.</p>	<p><i>Lights/Shadow could be generated by smart glass. Being opaque during the day, and generating light from LEDs through the glass during the day.</i></p> <p><i>Electric grid should be integrated in the floor panels so the lights can actually work. Also meaning the floor panels must be connected to a power source.</i></p>

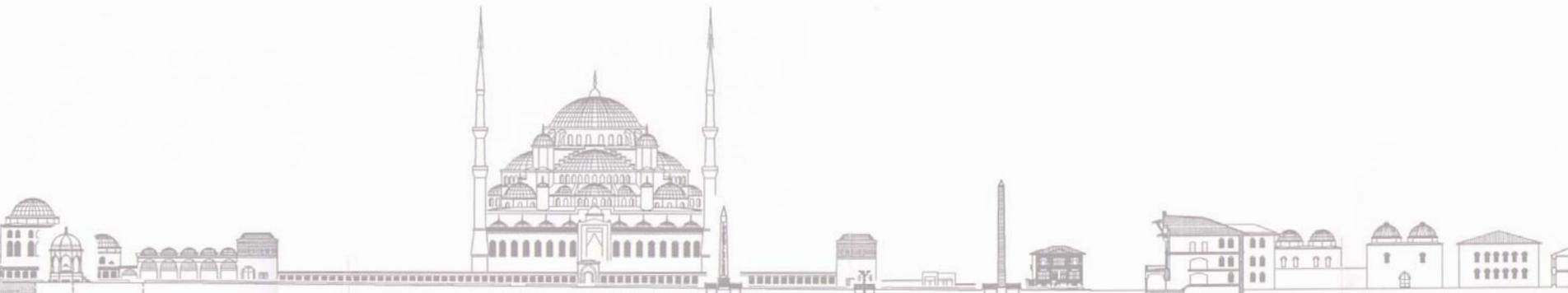


Evening [No Ramadan]	<p>The square is faintly lit (not as excessive as during the festival, but enough to keep it safe), the seating area is the same as during the day (focusing on small seating area's which emphasize the view on the environment. Lights integrated in either the shadow-structures or the floor, provide lighting appropriate for the available fading natural light. The central hallway is lit with appropriate lighting to keep the area visible. The Entrance area has an information center which is closed during the night. It shouldn't block the view. During the night exhibitions can be shown on a big screen above the entrance area (on a smart glass/projector screen). At the pavilion people can find information about the cultural environment, this area is lit, possibly decorative.</p>	<p><i>Differences:</i></p> <ul style="list-style-type: none"> - Tourist seating - No Music - Season based information - Normalized Clock - Normal lighting
Night	<p>The square is faintly lit (not as excessive as during the festival, but enough to keep it safe), the seating area is the same as during the day (focusing on small seating area's which emphasize the view on the environment. Lights integrated in either the shadow-structures or the floor, provide lighting appropriate for the available fading natural light. The central hallway is lit with appropriate lighting to keep the area visible. The Entrance area has an information center which is close during the night. It shouldn't block the view. At the pavilion people can find information about the cultural environment, this area is lit, possibly decorative.</p>	
Sunny Weather	<p><i>Scenario 1:</i> The structures are stationary. <i>Scenario 2:</i> The structures are built to provide maximum shadow in key places. <i>Scenario 3:</i> The structures move to follow the sun's movements.</p>	
Rain Weather	<p><i>Scenario 1:</i> Shelter is provided by moving shadow panes. When a certain threshold is reached, they will close the roof. <i>Scenario 2:</i> Shelter is provided by canvas, positioned so the water runs of it. <i>Scenario 3:</i> Shelter is provided by stationary solar panels. Meaning there is no change in the normal situation.</p>	<p><i>For sideways rain please check "Windy Weather".</i></p>
Windy Weather	<p><i>Scenario 2:</i> Shelter is provided by the exhibition panes and the information panes. No additional shelter. <i>Scenario 2:</i> Shelter is provided by activated canvas shelters (not preferred).</p>	



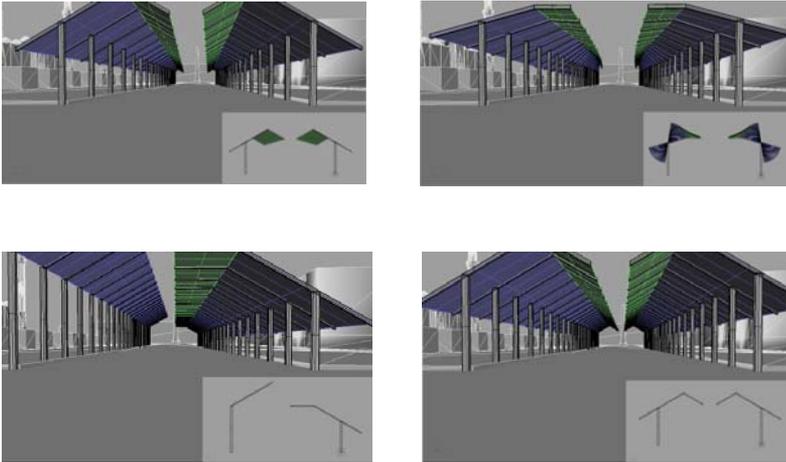


Shadow Generation	<p><i>Scenario 1:</i> Shadow is provided by opaque solar panels. <i>Scenario2:</i> Shadow is provided by semi-transparent solar panels. <i>Scenario3:</i> Shadow is provided by smart-glass panels directly linked to the solar panel output. Thus always providing the perfect amount of shadow. <i>Scenario4:</i> Shadow is provided by a glass/e-paper combination. Possibly providing shading with patterns in it. <i>Scenario5:</i> Shadow is provided by generic roofing (not preferred) <i>Scenario6:</i> Shadow is provided by textile. Possibly wet canvas to cool area. <i>Scenario7:</i> Shadow is provided by running water on glass panes.</p>	
Information/Inter-activity (Hallway)	<p><i>Scenario 1:</i> Static information engraved in glass panes. <i>Scenario 2:</i> Static information combined with replaceable Mylar sheets. <i>Scenario 3:</i> On-Demand E-Paper information. <i>Scenario 4:</i> Transparent paper.</p>	
Information/Inter-activity (Entrance)	<p><i>Scenario 1:</i> Static information engraved in glass panes. <i>Scenario 2:</i> Static information combined with replaceable Mylar sheets. <i>Scenario 3:</i> On-Demand E-Paper information. <i>Scenario 4:</i> Smart Glass Display (needs room for projector) <i>Scenario 5:</i> Touchscreen/Computers (not preferred)</p>	
Power Generation	<p><i>Scenario 1:</i> Opaque Solar Panels <i>Scenario 2:</i> Semi-Transparent Solar panels <i>Scenario 3:</i> Wind mills (not preferred)</p>	
Festivals/Performances	<p>The seating area is changed into part stage, part seating for the audience. Unique items can be developed for this. Or Shelter/Light combo's can be used as flexible lighting for the stage.</p>	



Entrance area

For the entrance area the proposal of panels is accepted. It is decided to not continue with the interactive floor and to turn the panels 45 degrees so that people who are entering the area face the panels. The panels are placed on the edges of the long axis to strengthen the line in the design.



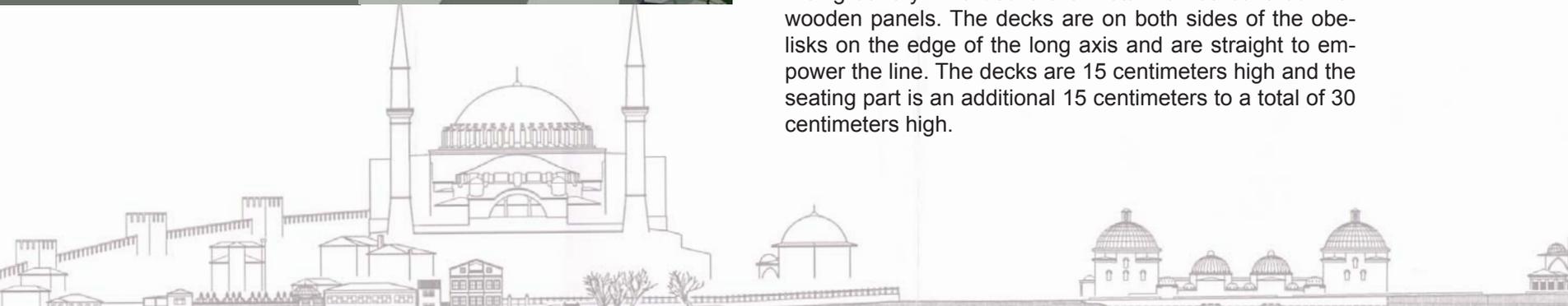
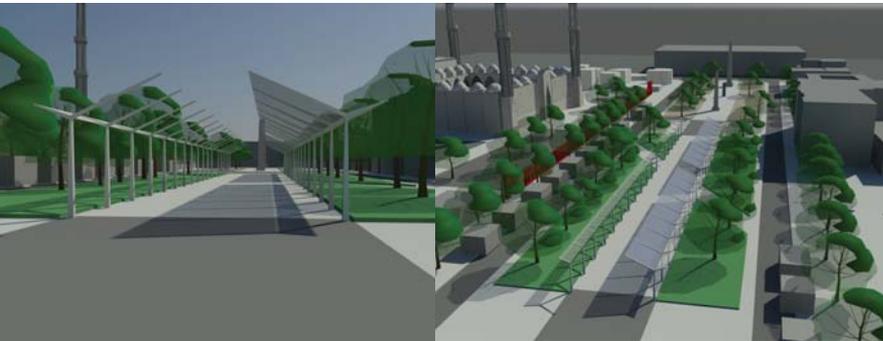
Concept 1 is based on the Opening Up Proposal. Columns are placed at intervals along the path. Joints on top are connected to diagonal beams. These beams can be rotated. Between these beams glass plates and solar panels are fixed. Certain parameters are entered in a script and several concepts are generated as can be seen above.

Concept two

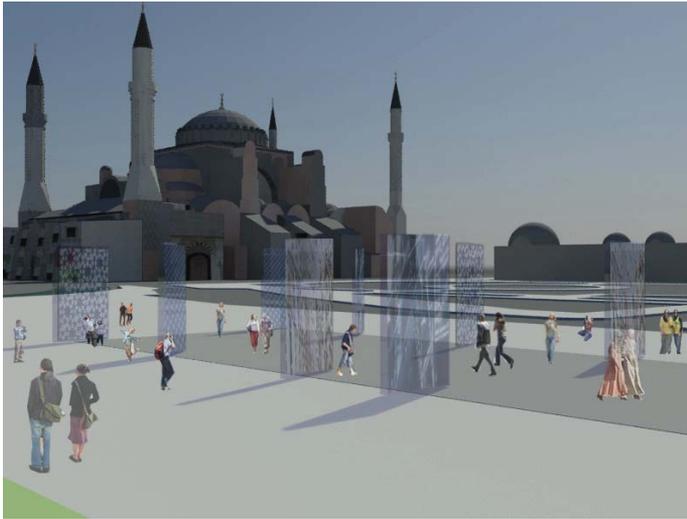
Concept 2 is optimized for the specified times of the day where the sun is most intense. On the left side columns with light elements are placed at intervals. At the right side columns with shadow elements are placed, to provide shadow in the middle zone starting at noon. The panels provide solar power to the other areas.

Seating area

The seating area will contain normal table-bench combinations and lounge areas. These elements will be alternated with greenery. The decks are metal frames covered with wooden panels. The decks are on both sides of the obelisks on the edge of the long axis and are straight to empower the line. The decks are 15 centimeters high and the seating part is an additional 15 centimeters to a total of 30 centimeters high.



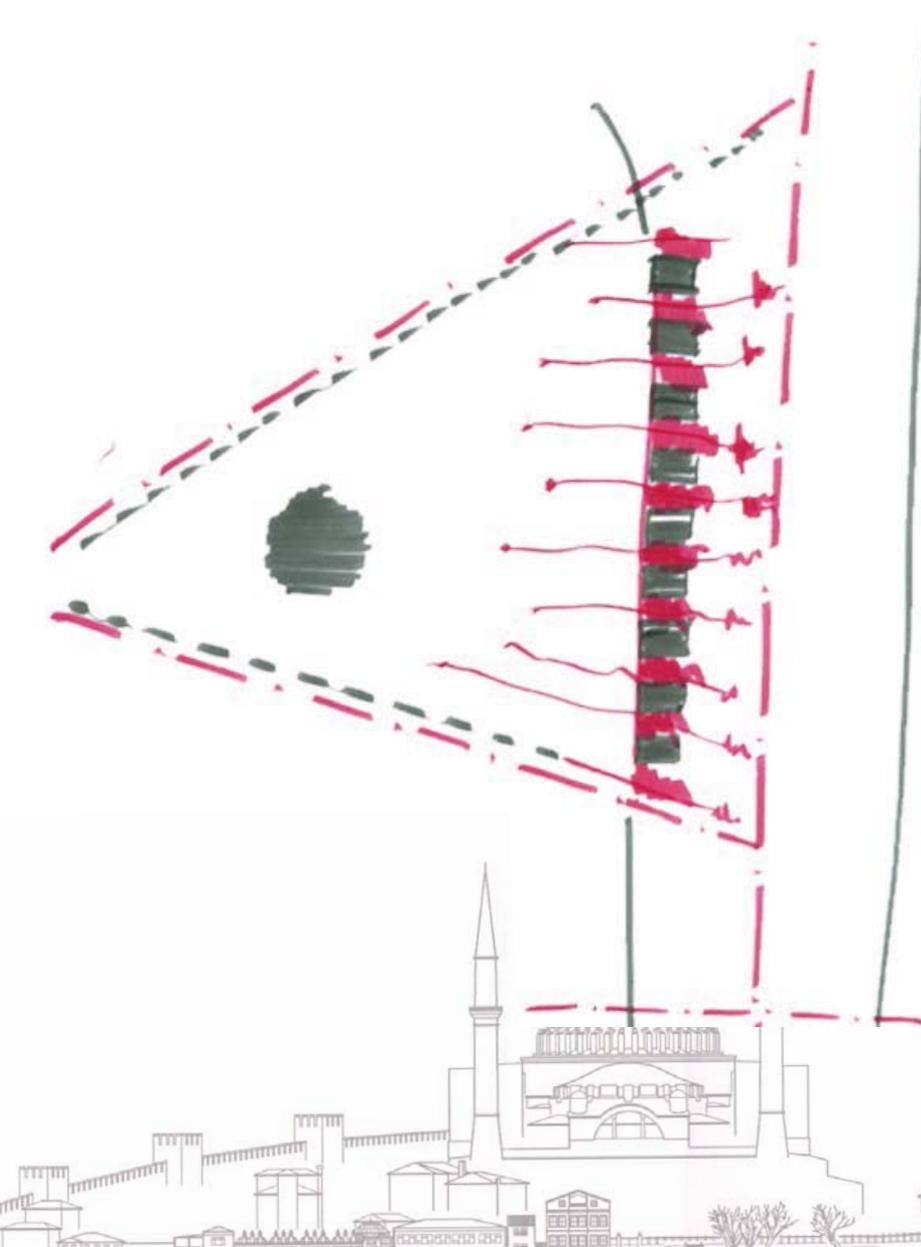
Final Concept



Group Two, the entrance

Urban context

The park area is the main entrance to the site; therefore the design goal for this area is to create an optimal flow of people. This is translated into the demands that the pavilions should be visually and physically permeable. People must be able to have a look at the pavilions in this area and buy some goods over here, but they mainly need to keep on moving. As the picture below illustrates the pavilions will be placed in a certain rhythm enabling this flow. Next to this flow from the park to the site there are several flows of traffic moving in front of the pavilions. During the day cars drive on the road in front of these pavilions, while after five o'clock in the afternoon the road becomes a pedestrian zone. Besides the restrictions of this urban plan, the pavilions need to be able to function within another urban context as well. The layout of the pavilions should be adjustable to the site when you setup the area, but the user should be able to respond to a change in site usage or weather at any time.

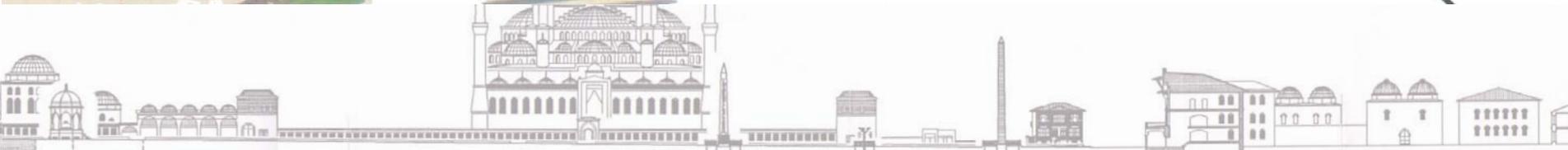
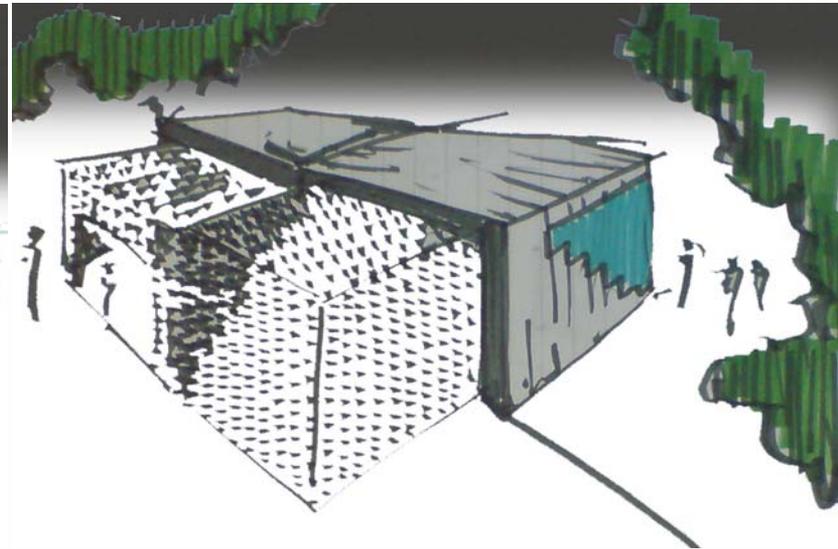
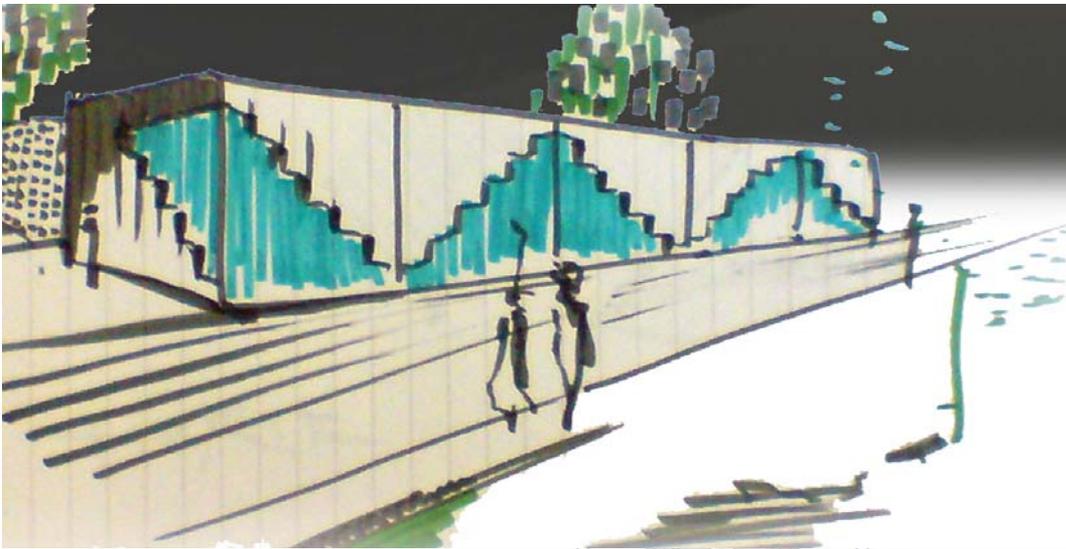


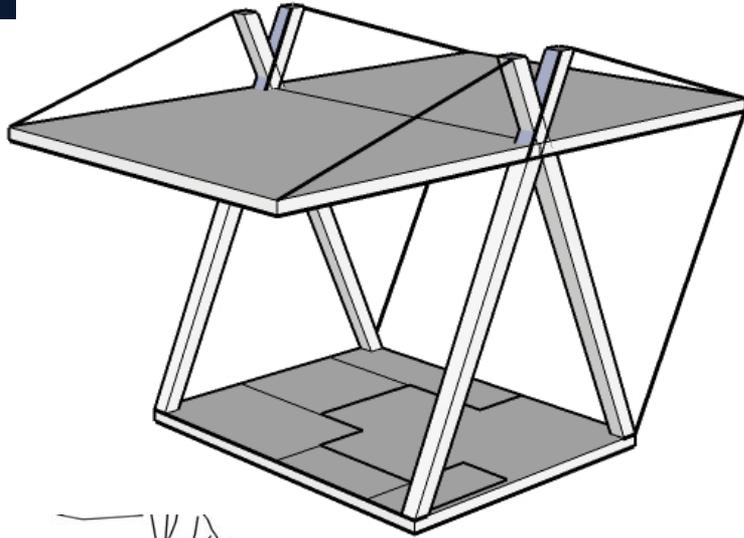
Design proposals

With all the demands regarding transformability in mind several concepts have been proposed. Each having its own solutions for the required transformability, this paragraph will discuss the three basic concepts named; open & closed, plain & easy and static & dynamic.

Proposal 1 Open & Closed

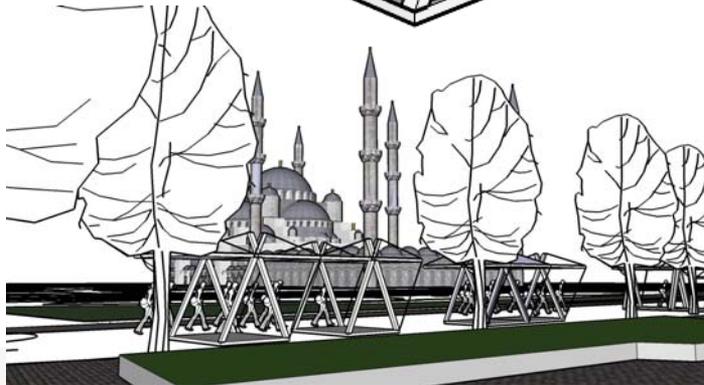
These pavilions consist of a box in a box structure, allowing the pavilions to adapt to different levels of crowd density by pulling out a new volume creating structure. These pavilions can be coupled or put separately on the site.





Proposal 2 Plain & Simple

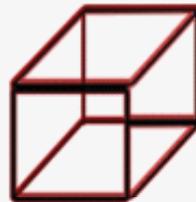
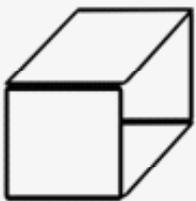
This concept promotes flexibility by creating a very simple structure allowing the user to quickly adapt his pavilion by setting up a new structure. It is also very open and therefore contributing to the visual permeability of the area.



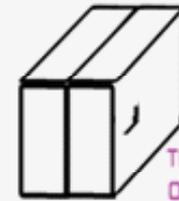
Proposal 3 Static & Dynamic

This abstract idea describes pavilions being built by two different types of systems; a core, containing services and an encore, creating a volume in which these services can fulfill their role.

Comparing the proposals



THE SERVICE AREA



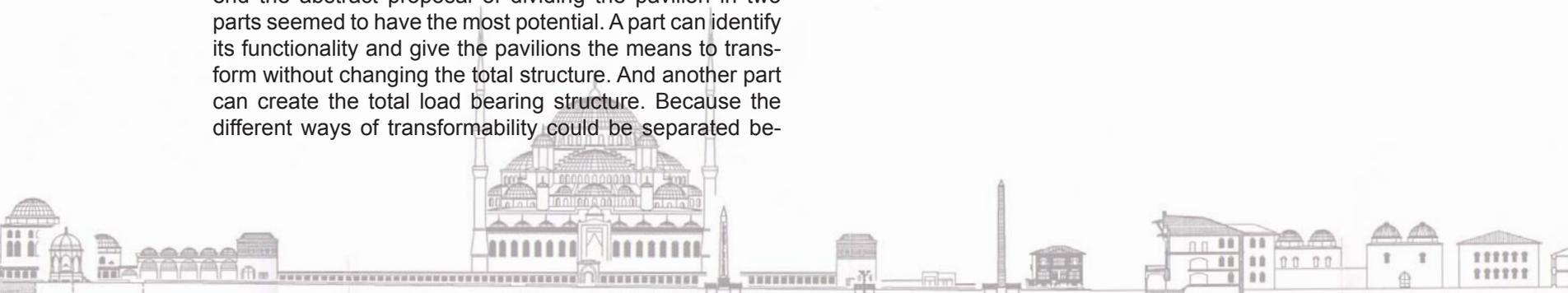
THE STORAGE OF SURFACE PANELS



The three proposals are compared on the following criteria:

	open & closed	plain & easy	static & dynamic
architectural quality	+/-	+	+
multi-functionality	+	+	+
transformability	-	+/-	+
sustainability	+/-	+/-	+/-
comfort and health	+/-	+/-	+/-
constructability and handling of components	+	-	+/-
cultural identity and local context	-	-	-
potential	-	-	+

Because the concepts were presented in totally different ways, comparing the proposals was hard. Each proposal had certain advantages and disadvantages and many things were yet unknown. The box in a box proposal had the disadvantage of having an inflexible and large structure, but transforming it seemed to be not that hard. Concept Plain & Easy had the ease of assembly and disassembly however building a totally new structure to adapt the user to a weather change seemed not handy. In the end the abstract proposal of dividing the pavilion in two parts seemed to have the most potential. A part can identify its functionality and give the pavilions the means to transform without changing the total structure. And another part can create the total load bearing structure. Because the different ways of transformability could be separated be-

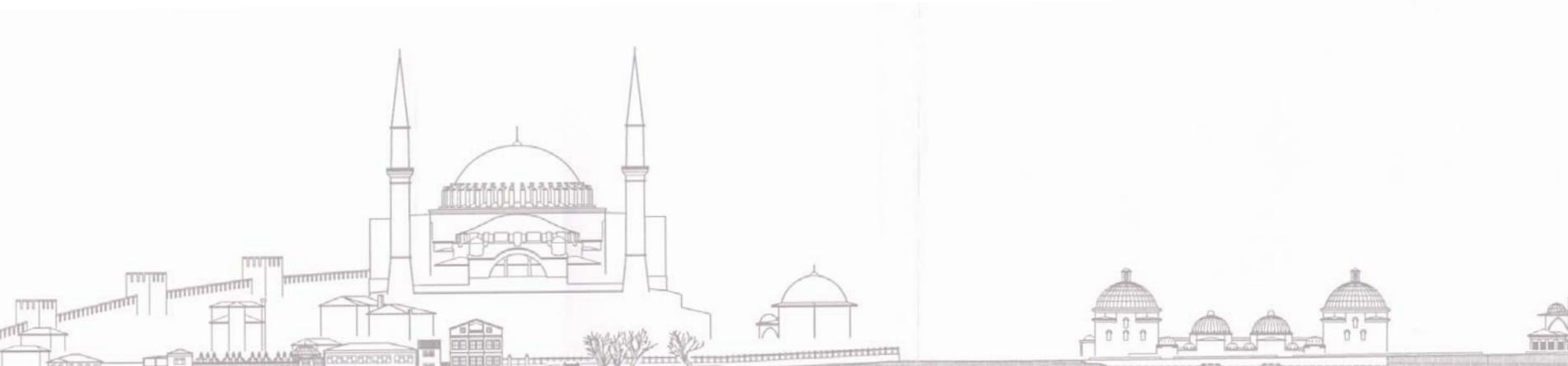
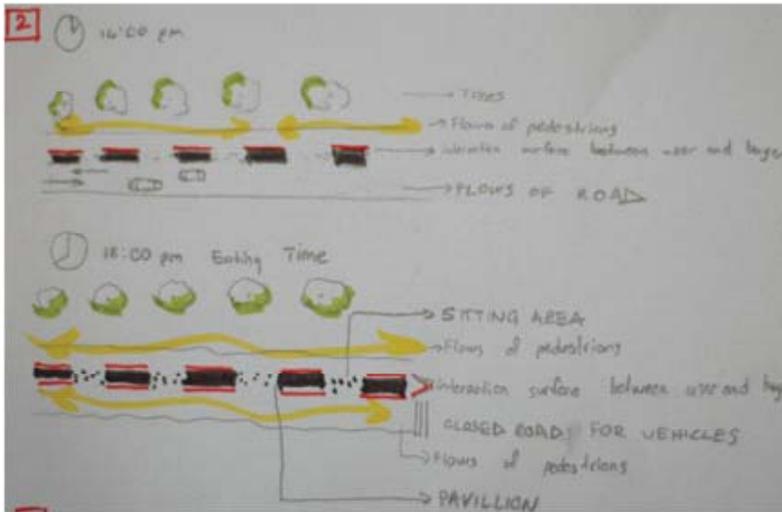


tween different independent parts, a high degree of flexibility can be easily attained.

Chosen Scenarios

Besides defining the starting point for our technical solutions, scenarios have been written to elaborate on the use of the site during the festivities. The chosen scenario is depicted in the figure on the left side.

The pavilions are placed in the centre of the road, three meters from the square side of the road. Cars will be able to pass the pavilions during the day and the pavilions will form a boundary between the pedestrians moving on the park side and the cars driving on the square side of the pavilions. This will give the visitors of the site a move safe feeling during the day. The pavilions remain unconnected to allow people to move through the pavilions to the centre square. The moment the road becomes closed for cars, visitors will be able to walk on both sides of the pavilions. The pavilions can open to both sides now. The mass of people moving around on the road near the park will be split in two parts, giving people a less crowded feel in this area. The pavilions will also be better accessible when placing them this way.



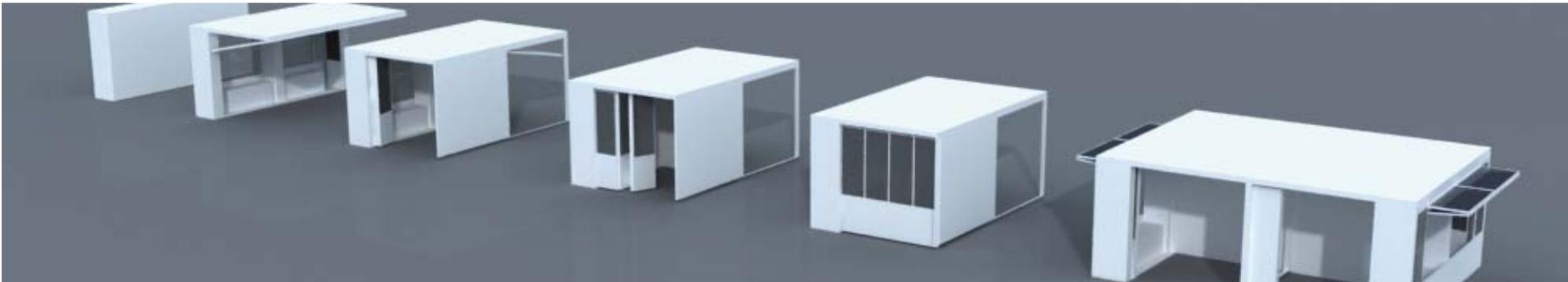
Chosen Structure

To continue developing the chosen proposal, static & dynamic, an optimal definition needed to be found of the core and encore. Each form of needed flexibility needed to be assigned to or the core or the encore. The different scenario's which require the pavilion to be flexible are:

- Different site plans
- Different functions
- Weather changes
- Different density of people
- Closing/opening of the pavilion

To find solutions for these problems different concepts have been generated, exploring the possibilities of the core and encore.

Different concepts



It's all in the core

The core is represented as a suitcase, this case can be opened and unfolded, this is a pretty extreme example of the core and much flexibility gets lost in such a concept. The advantage is the fact that the moment the core gets on the right spot, it will be very easy to setup the pavilion.





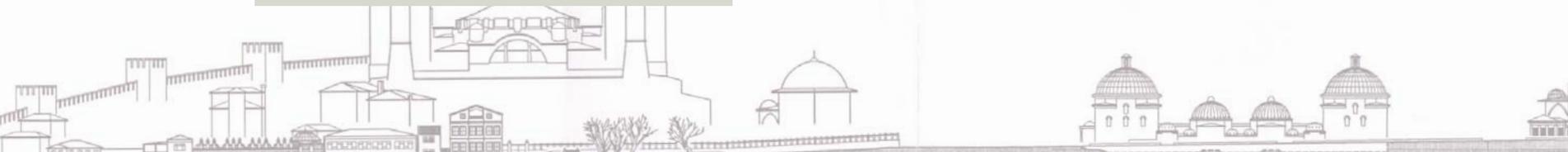
Decks all around

The encore, a single deck system, allows a very flexible creation of space. The use of one unit to create the whole volume generating structure works very restricting though. This deck unit has to be very complex to be able to be a roof, a floor and a wall in the same way three or two different elements would be.



The cube

Foldable façade elements, the encore, characterize these pavilions. These elements allow the user of the pavilions to adapt to a change in weather conditions or to change the facing of the pavilions. These pavilions however don't work as a coherent system enabling much flexibility on an urban or pavilion scale.





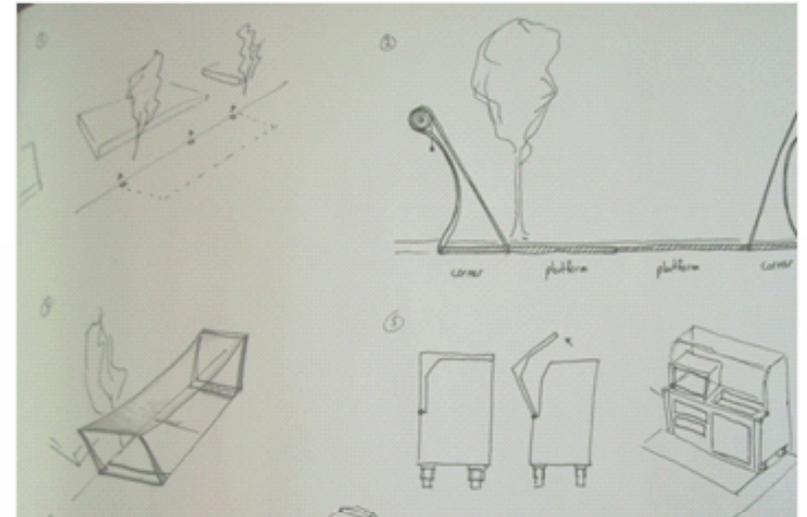
Fold and turn

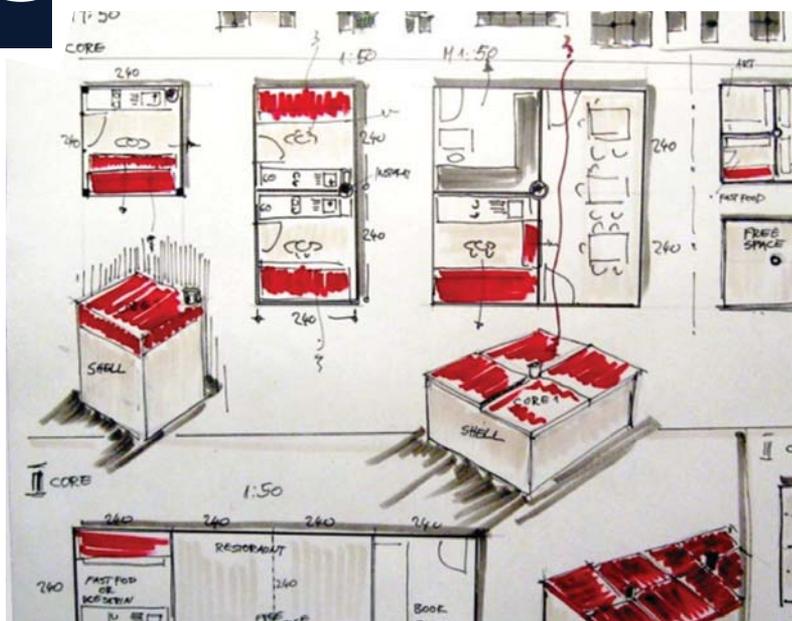
These pavilions consist of a cubic frame; this frame supports a façade which can be folded to become a display area, a deck or a roof. The cube must provide the possible interactions with the furniture within it. This incorporation of functionalities is good; however this encore concept generates too much flexibility. Many possibilities will not be used by the owner of the pavilions.



Tent

Encore and core are well separated in this concept. The encore defines only an open roof and floor structure while the cores are independent service units which are moved in the volume created by the encore. These cores can be closed and positioned on their own and they define the functionality of the volume. The roof and floor structure however is flexible in only one direction, because the roof consists of a fabric which is pulled over a deck system, making it not suitable for every site.





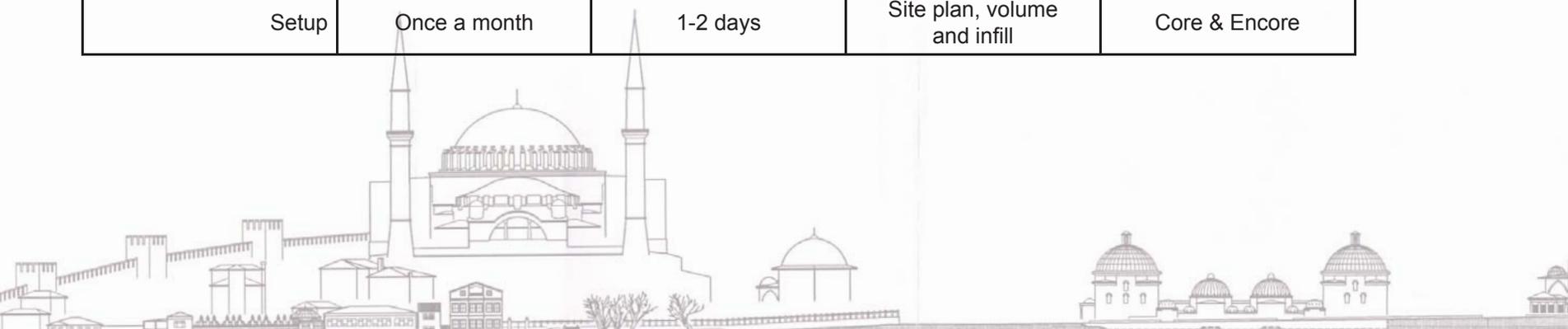
Twist

The roof system of this design is very flexible; it consists of a central column and four panels who can rotate around this column. This column will carry the installations. But again, this concept also generates too much flexibility in a wrong area.

A new definition

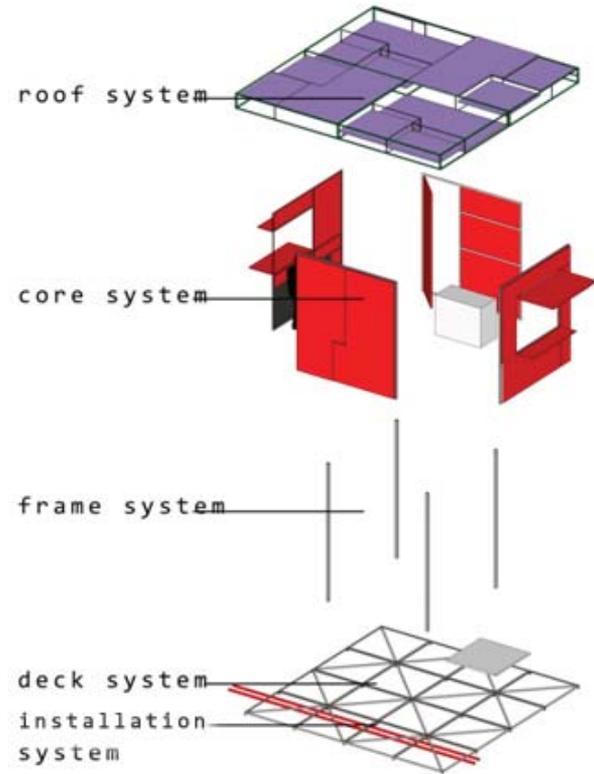
After trying different ways of an encore structure and a core infill, the right definitions became clear. The relation between the required flexibility, the components and the frequency of transformation are clearly defined in the following scheme;

Initiator	Frequency	Duration of adaptation	Defines	Done by
Weather	Any minute	Max 1 minute	Comfort zone	Encore
Closing/Opening	Once a day	5-30 minutes	Approach	Core
Setup	Once a month	1-2 days	Site plan, volume and infill	Core & Encore



The frequency of the needed transformability defines how easy it should be to transform the pavilions on this level. So changing the enclose in such a way it fits nicely on the site, or setting up the infill by placing core elements on the floor must be done easily. But the people still have one or two days to setup these pavilions, so complex solutions that make pavilions fit to the site really quickly aren't necessary. The enclose must be a simple structure providing a solid floor and a roof that can be built in one or two days. This structure however needs to be able to adapt to the weather conditions nearly instantly.

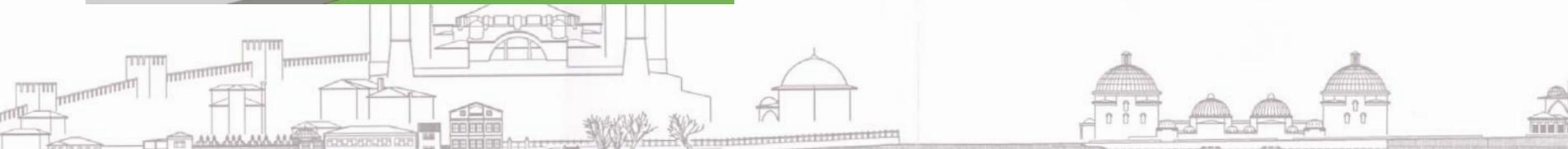
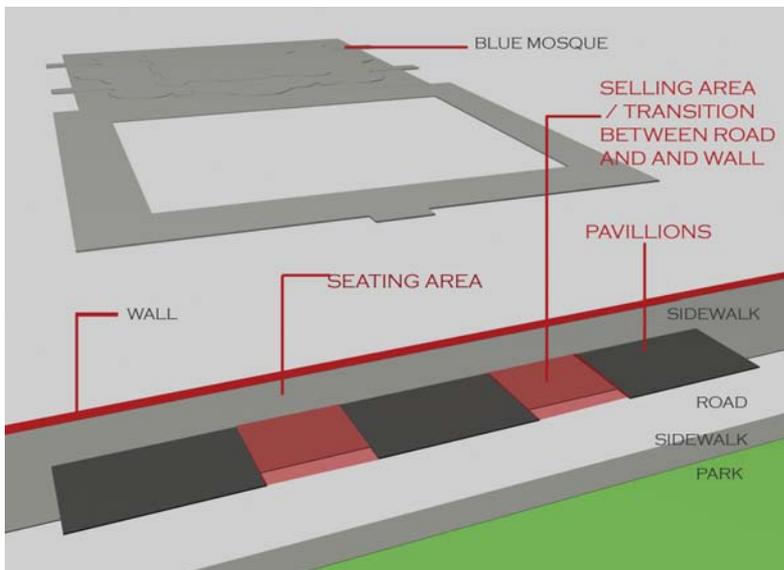
During this one or two days setup time the core elements need to be put into the pavilions as well, they have to be connected to the services of the town and need to be standing in the right positions. The moment they are connected and stand on the right position they don't need to be moved for about a month. All needed functionalities must be included within the cores. These core units must have the ability to be closed and locked at night, preferably this will take about five minutes.



Group Three, the wall

Urban context

The pavilions near the Blue Mosque's wall is facing with two problems initially. The first problem is that the wall is related to one of the most important historical building of Istanbul. Therefore, to establish the relations between wall and pavilions, three urban scenarios are developed for the site. All urban scenarios can be realized with the construction system of the pavilions, but the most suitable one is chosen to be the proposal for the municipality. The second problem is the density of people on the site during the Ramadan. Besides, the density of people at the entrance of the Blue Mosque also has high during the rest of the year. Consequently, there will be an extra pedestrian way between pavilions and the wall to reduce the effects of the density. However, there is a risk to have a tunnel effect between pavilions and the wall. To avoid this effect, semi open seating areas and transitions will be used between pavilions.

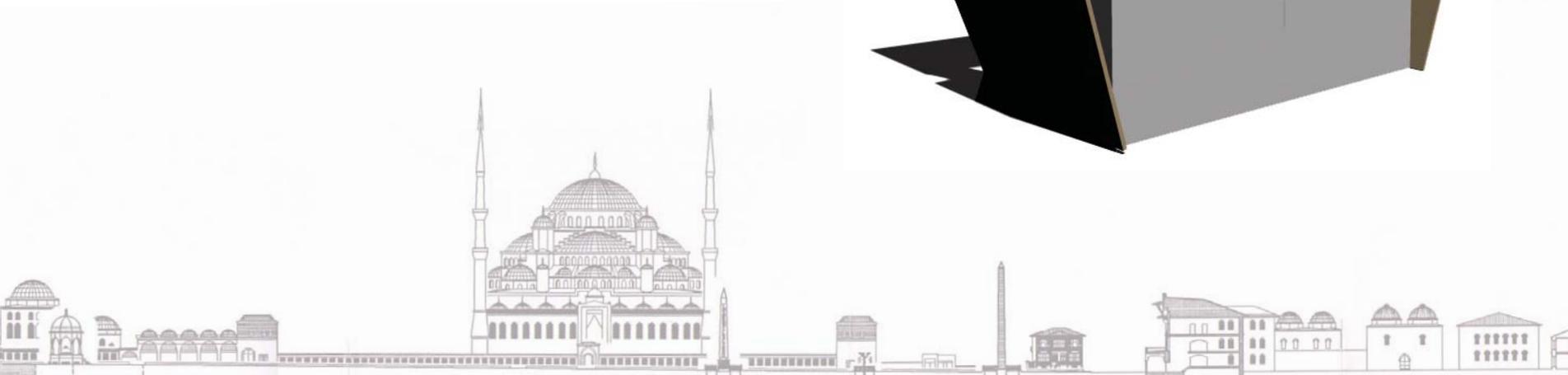
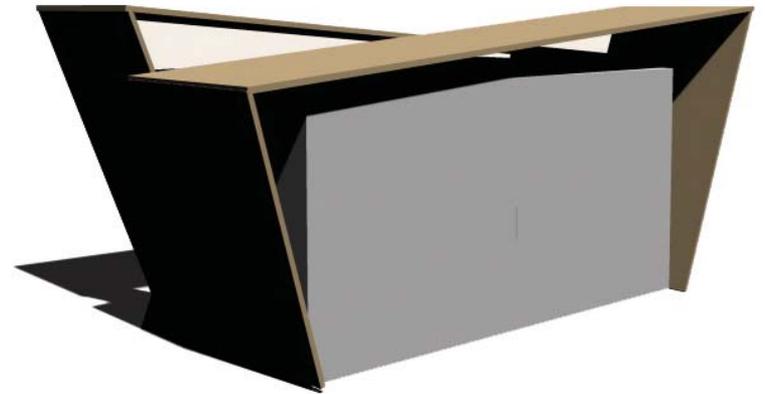


Design proposals

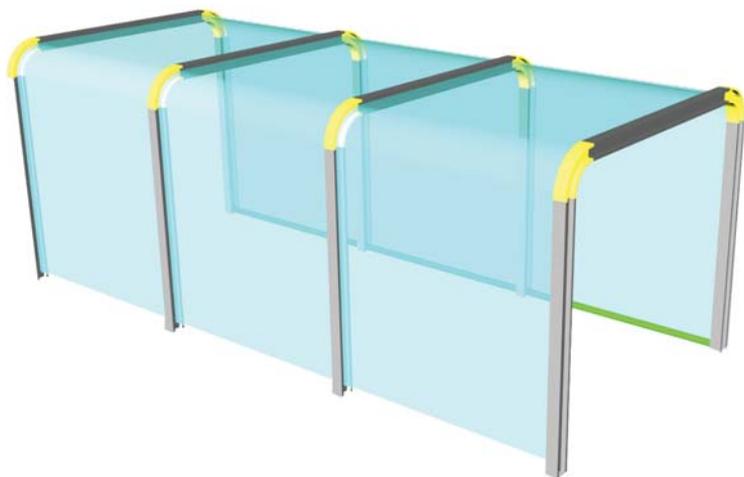
In the beginning of the process, three proposals are developed. The proposals are in line with the first urban decisions and evaluated by using the multi criteria analysis.

Proposal 1: Box in Box

The pavilion concept is based on two minor pavilion spaces which can be extruded from one major pavilion space. The minor element is designed as a box in modular system 2x2 meters. An additional element creates a flexible shell which covers the pavilion space. These spaces can be combined to use for one function or can be used separately for different functions. The shell is designed to accommodate technical installations during the winter, and it shades pavilions during the summer.



Proposal 2: Rail&Roller Concept

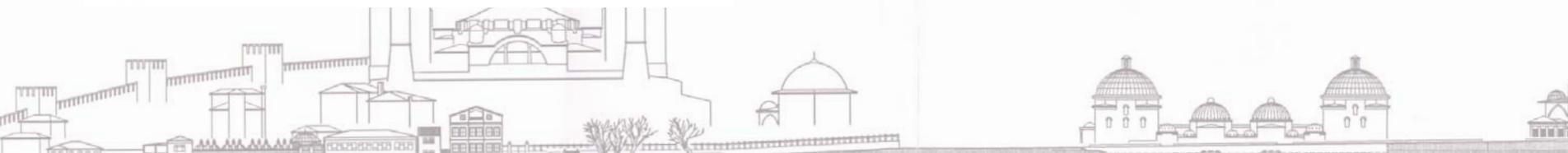


This modular concept is based on 1 meter components of rails and a roller of plastic film. Other parts of pavilion are connection parts which are L-shaped corner units and T-shaped post-beam connections. Using these elements the pavilion structure can expand in all 3 dimensions. Connecting I, L and T-shaped elements rails are established. The roller is rolled out to establish the plastic skin of the pavilion. The plastic film is considered to be perforated in hot weather and double layered in cold weather.



Proposal 3: Modular Pavilion

Pavilion is based on a module size of 60x60 cm. This size is suitable for different arrangements and sizes of internal and external spaces. Standard sized pavilion is flexible and can be divided up to 5 shop. Open spaces in between pavilions establish a calm space for users. A calm alley is defined between pavilions and the courtyard of the Blue Mosque in contrary of the more crowded street in hippodrome.





Comparing the proposals

The three proposals are compared on the following criteria:

	Box in Box	Rail&Roller	Modular Pavilions
architectural quality	-	-	+
multi-functionality	+/-	+/-	+
transformability	+/-	+	+/-
sustainability	+/-	+/-	+/-
comfort and health	+	+/-	+
constructability and handling of components	+	-	+
cultural identity and local context	-	-	+
potential	-	-	+

Box in box proposal is not conforming the cultural identity and local context. Besides, the constant structure of the concept, has no potentials to provide solutions for different functions. Concept Rail&Roller is not appropriate for construction due to the problems in constructability and handling of components. Also, this proposal is not compatible with its surroundings for such a historical place. The modular pavilion concept has more potential to provide solutions for the criterias with its components and flexibility. The minimum panel dimension is arranged to meet the minimum functional needs, also the components are easy to transportable and assemble. As a result of the evaluation, the modular pavilion concept is chosen to be developed.

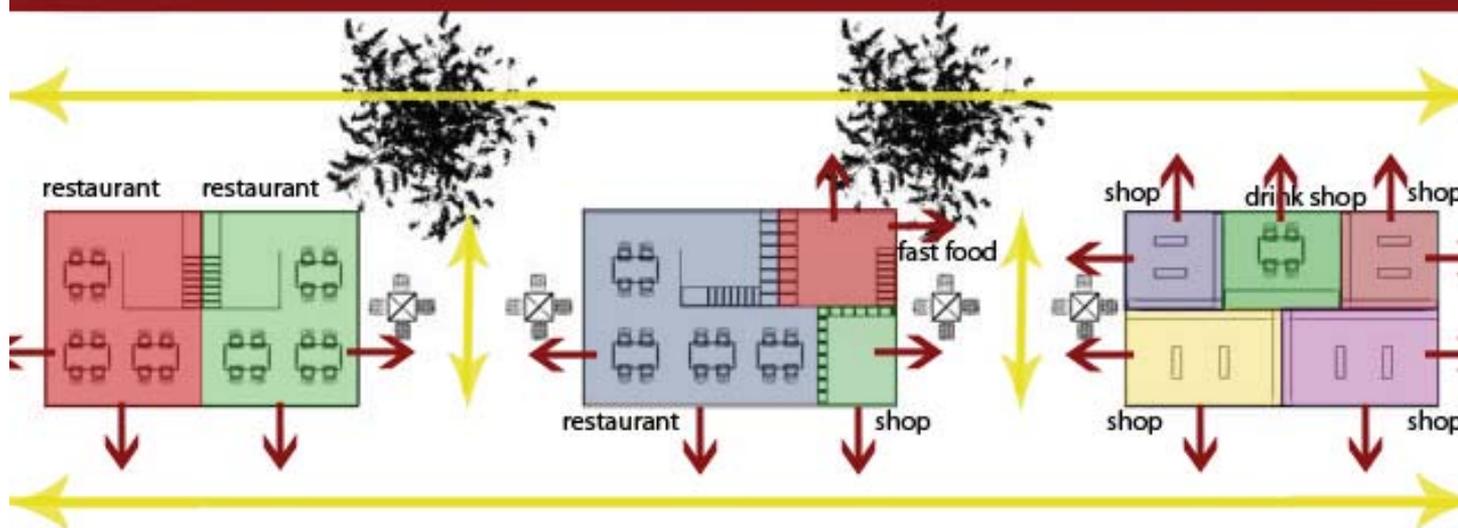


Chosen Scenarios

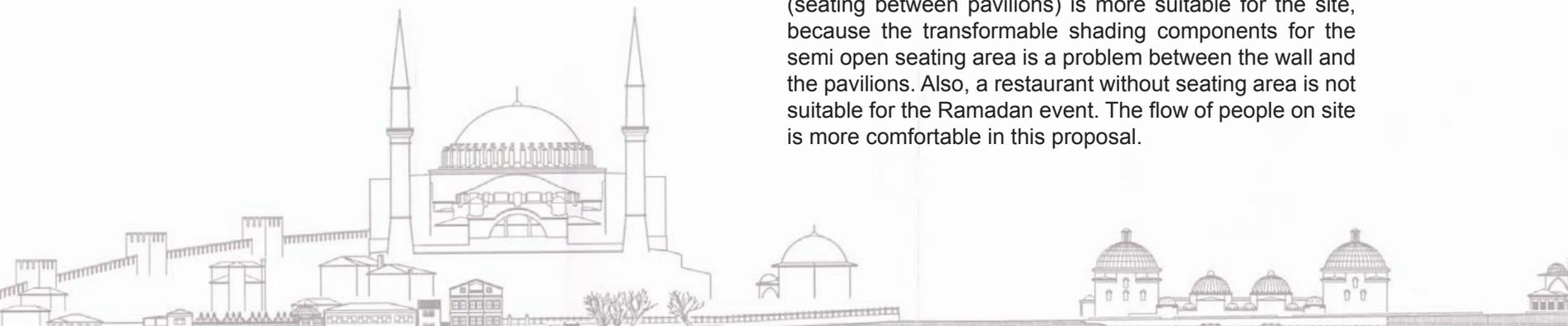
Urban Level

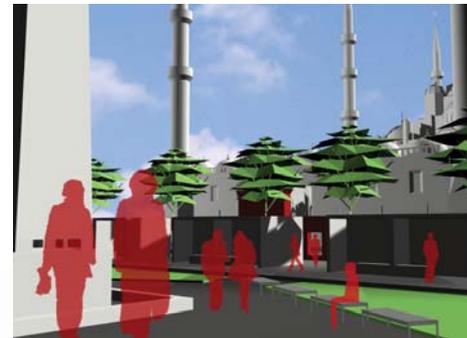
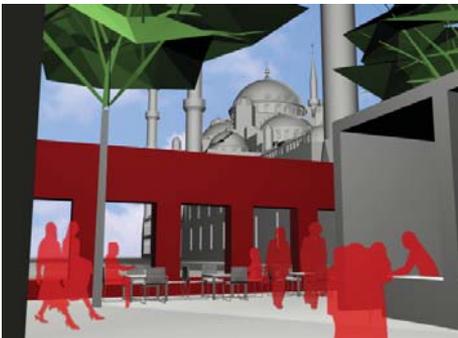
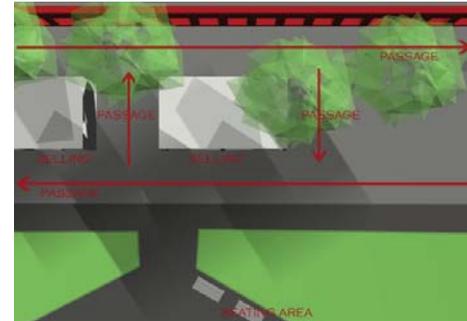
Before working on the structural system of the pavilion, the urban scenarios are developed to find the best solution for the site. The pavilions will be developed to be used in different events and places in Istanbul. Therefore, the system of the pavilions will provide solutions for all scenarios but the most suitable proposal will be an advise to the municipality.

WALL



As a result of the evaluation, the second urban proposal (seating between pavilions) is more suitable for the site, because the transformable shading components for the semi open seating area is a problem between the wall and the pavilions. Also, a restaurant without seating area is not suitable for the Ramadan event. The flow of people on site is more comfortable in this proposal.





Proposal 1: Seating near the wall:
There are no pedestrians near the wall and all seating areas are realized on the wall side. Between the pavilions, there are transition ways and all the selling activity is also from this side.

Proposal 2: Seating between the pavilions:
There is a pedestrian way near the wall, also transition ways between the pavilions. The seating areas are between the pavilions and selling activity is realized from all sides of the pavilions.

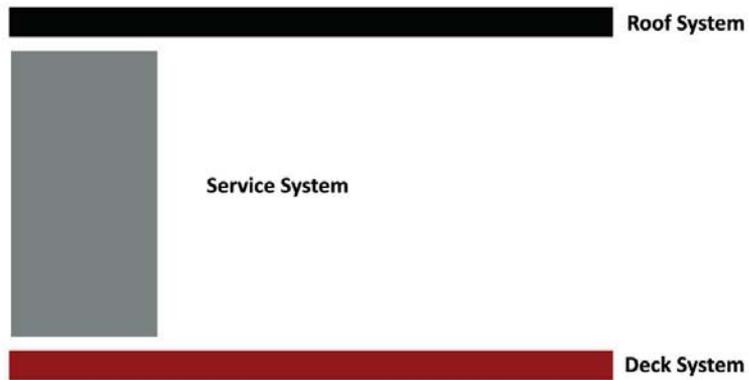
Proposal 3: Seating on the park:
All seating areas are on the park, so areas near the wall and between the pavilions are only for transition. Selling activity is realized from left and right sides of the pavilions.





Chosen Structure

For the modular pavilions proposal, a vocabulary is developed for the system of the pavilions. This vocabulary defines the components of the pavilion, thus the different functional variations can be realized.



The structure system consists of three parts:

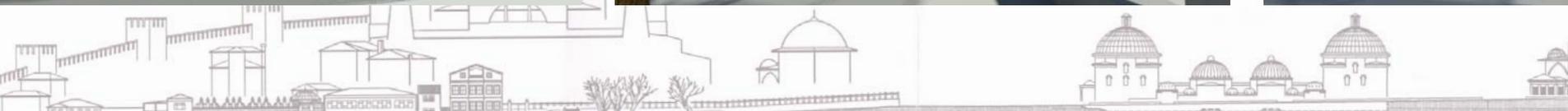
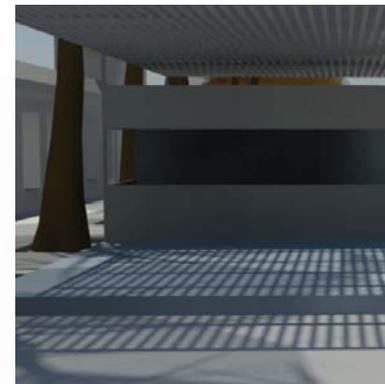
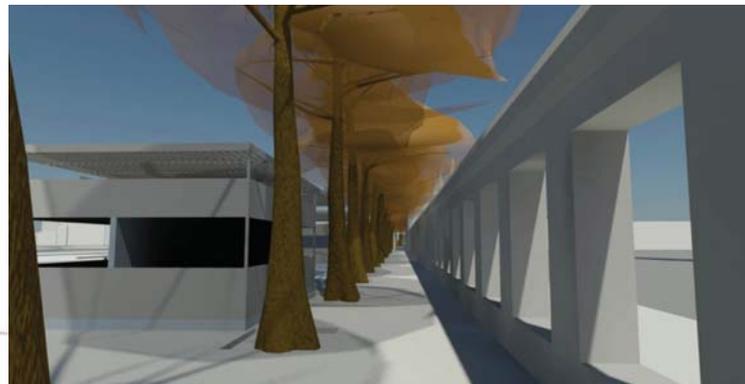
The Deck System: partitional&comfort function

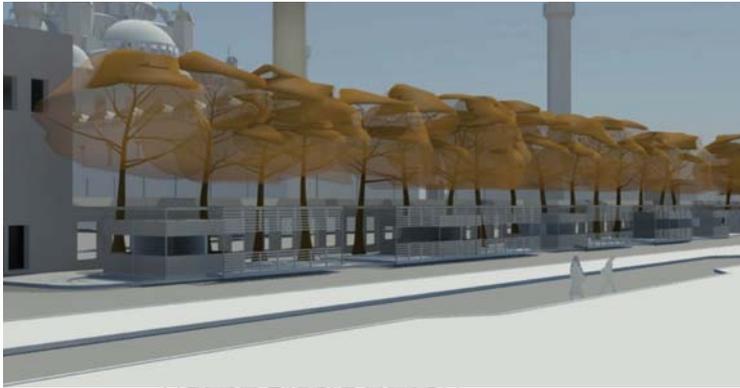
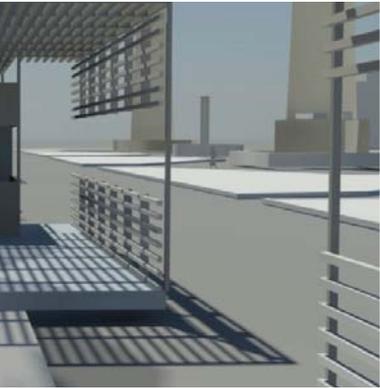
The Service System: provide services, day/night

The Roof System: weather&environmental conditions

According to this flexible structure system, some design alternatives are produced. The first proposals with the system is mentioned with the renders below.

The system proposals are evaluated by detailed weather analysis (sun positioning, wind) of the site for further development.









The biggest and oldest of the ramadam festivals is the one held at the square next to the Blue Mosque. During the whole month of Ramadan, the area is transformed into a big market place, packed with more than hundred stands selling food and beverages as well as all kinds of paraphernalia. In each day of the Ramadan month, thousands of visitors cram the square before the sunset and wait until the time that daily fasting would be over. After the meals are eaten, shopping and enjoyment of various cultural activities begin. The activities include religious panels addressing different aspects of Ramadan and Islam as well as artistic performances.

Chapter 3

/final_design

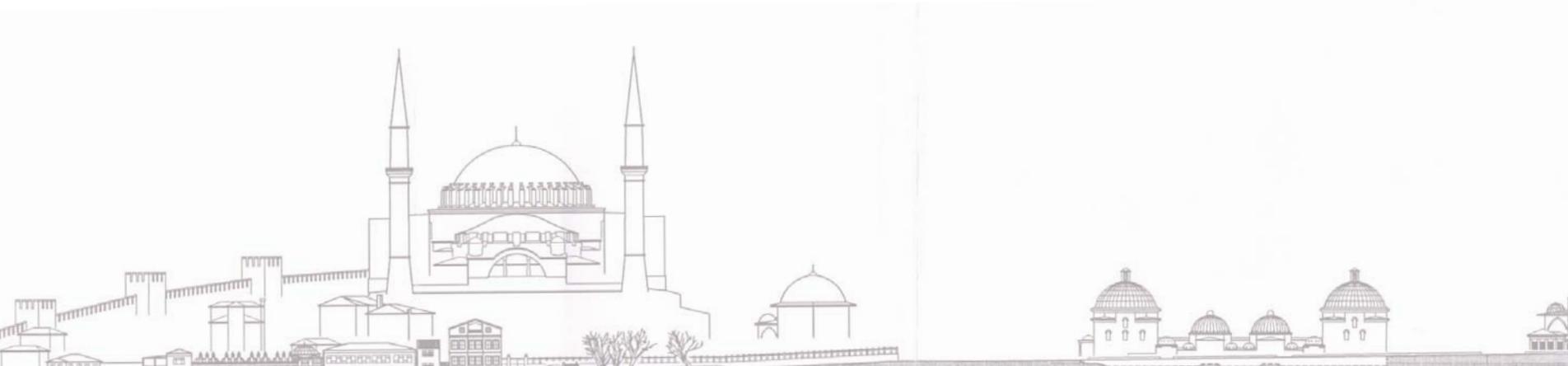


Introduction

The previous chapters showed the work of the groups towards their final designs. The urban analysis was interpreted by the groups and was a starting point for designing the concepts showed in chapter 2.

This chapter continues with the sub criteria of the Multi/criteria design matrix. The groups used these criteria as a basis for scoring their concepts and later as a checklist to see if the design has taken most criteria into consideration.

First the seven sub-criteria are shortly summarized, followed by an overview of the work done so far. Then the three groups will present their final design according to the sub-criteria. This chapter will be concluded by an overview of the final designs.





Architectural Quality

- identity
- scale/proportion
- integrity/coherence
- inviting building
- expression of transformability
- appearance of spatial adaptation
- flow of people

Multi Functionality

- spatial efficiency (adaptability to different functions)
- accessibility
- safety/security
- possibility to install equipment
- suitability for the internal flexibility
- easy to maintain

Transformability

- easy transformation from one use concept to another
- possibility to separate or combine two or more pavilions
- extendibility
- transformation of open area into a closed area and opposite
- adaptability to the weather conditions and day-night configuration
- reliability of the integration/connection between components
- flexibility integration of systems (building and HVAC)
- transportability of the components/systems
- potential of industrial production of the components/systems

Sustainability

- thermal comfort (winter)
- thermal comfort (summer)
- indoor air quality
- ease of usability of the pavilion and its systems
- visual comfort
- cleanliness

Comfort and Health

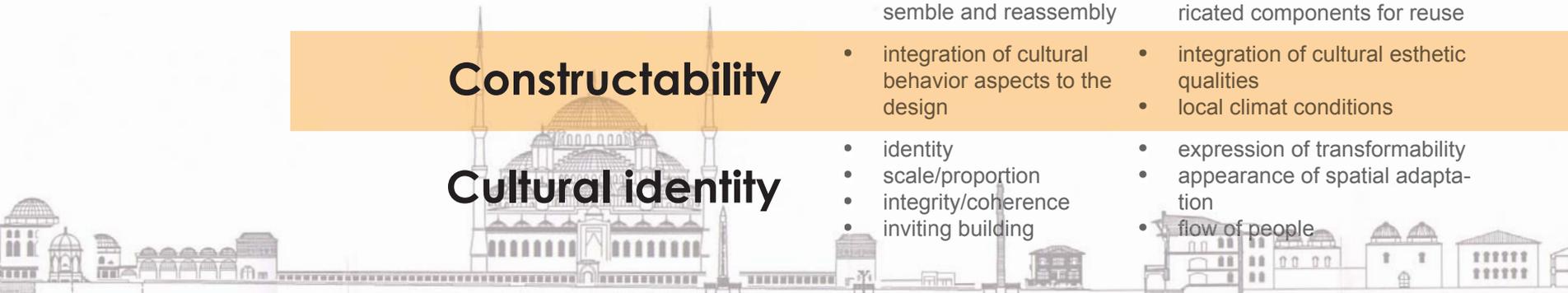
- high level of industrialisation/prefabrication for fast assembly, disassembly
- easy to assemble, disassemble and reassembly
- transportability of the components/systems
- easy to store
- easy reconfiguration of prefabricated components for reuse

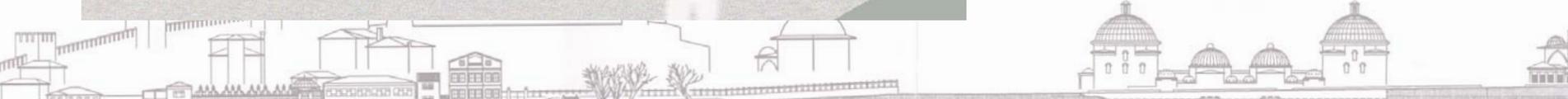
Constructability

- integration of cultural behavior aspects to the design
- integration of cultural esthetic qualities
- local climat conditions

Cultural identity

- identity
- scale/proportion
- integrity/coherence
- inviting building
- expression of transformability
- appearance of spatial adaptation
- flow of people







Overview

This overview shows the transparent entrance area to the right where small pavilions are displaying wares to nearby pedestrians. But not only will the people come from this side, on the bottom of this picture the entrance square is filled with people moving along or watching the information screens. The central area charges the area with electricity and allows the people to move in the shadow during the hot afternoon hours. At night people will buy something to eat near the mosque wall and take a seat at the comfortable seating zone at the back of square. Relaxing, eating and watching the nearby festivities the people will enjoy the comforts and beauty of this remarkable spot in Istanbul.



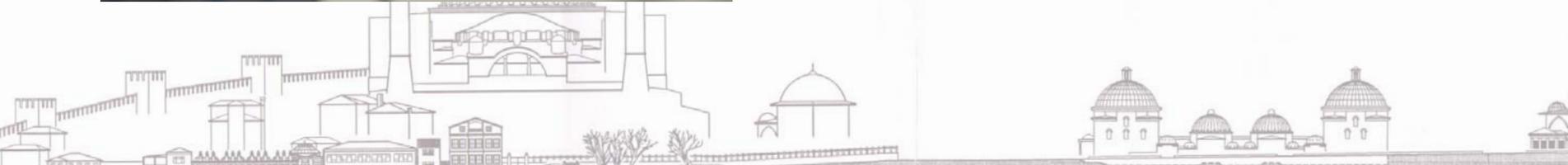


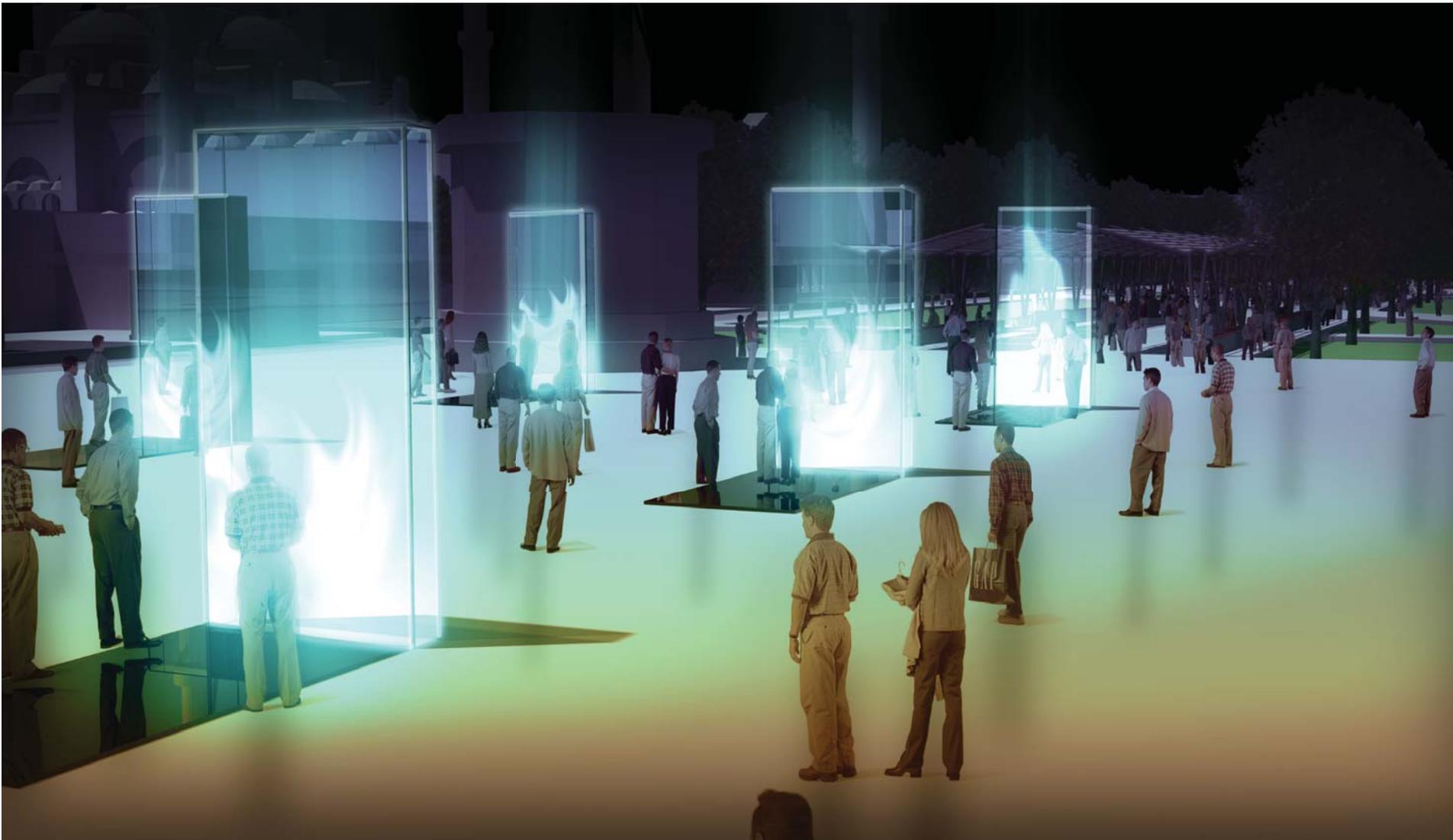
Group 1, the square

The Sultanahmet square is divided into three zones that follow different functions. Each function is situated on different parts of the park, but still have the longitudinal continuity. Considering the flow of the people and needs of different users, each zone has its story.

Zone 1. The first area is the main entrance zone. It welcomes all users from different directions. The focal points are digital panels that provide information about the available facilities in the park in general and its surrounding historic environment. The final concept consists of 6 screens that interact with the visitors. During the day, they are providing different information for specific time of the day; in the morning there is information about the historical surroundings, in the afternoon Ramadan fasting and in the night they give audio and visual effect for entertainment. The focus of this design was minimising the number of components. They are made out of a steel frame with screens on both sides, and on top it's covered with mirrors.

Zone 2. Because of the high intensity of the Sun, the middle zone has shading elements which are also fitted longitudinal in two symmetrical rows. The height is defined by measurements of people who are underneath so they have a clear view of each corner to the obelisc. The construction of these elements is based on a steel frame with solar panels that can rotate according to different Sun positions. The location of the foundation is on the ground level. This foundation also serves a secondary function as a seating element.







Architectural quality

Zone 3. The purpose of 3th zone is to provide seating for all users, but especially during the Ramadan Festival. Benches are situated on decks (platforms) that have a direct view on the obelisks. The decks are easy to assemble and disassemble. Shading is provided with existing trees, and for ambiant atmosphere low lightning is located on the edges of the decks.

Identity

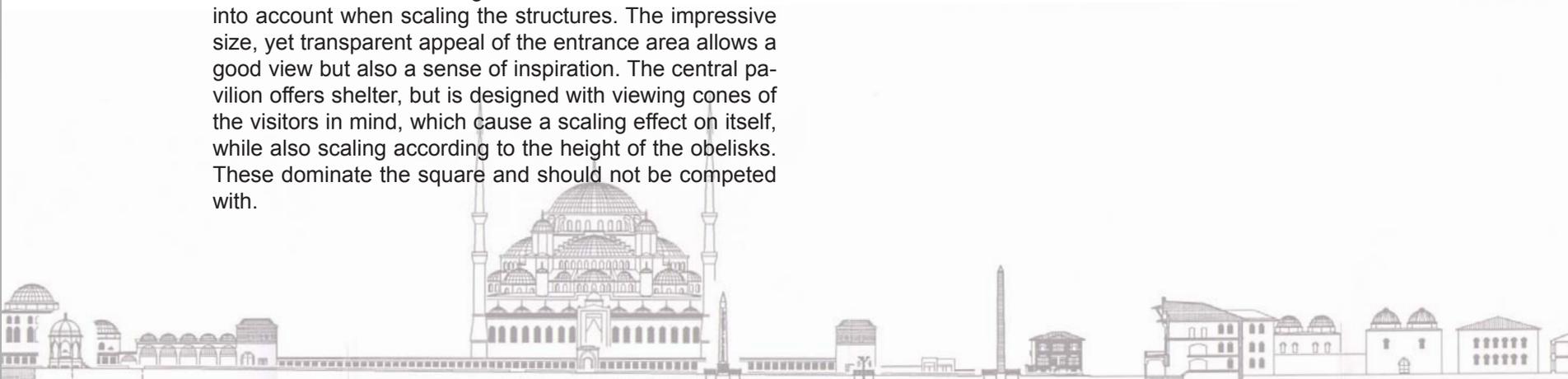
Because of the importance of the historical monuments and its surroundings, the key demand was not to be intrusive with new design. For this a certain humbleness is required in the eventual design of the entire area. By using a minimal amount of components, and using simple materials this humility is attained.



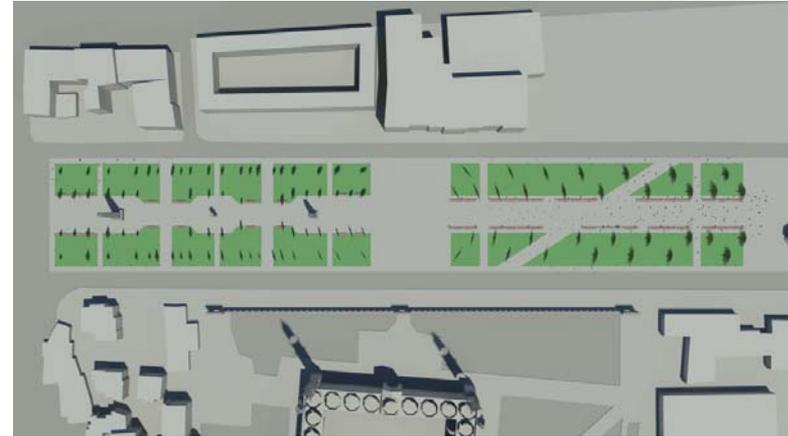


Scale

Considering the surroundings of the area, scale is a major issue with the central design. People require shelter from the sun, rain and wind. But also require a clear view on the historic surroundings. These demands are taken into account when scaling the structures. The impressive size, yet transparent appeal of the entrance area allows a good view but also a sense of inspiration. The central pavilion offers shelter, but is designed with viewing cones of the visitors in mind, which cause a scaling effect on itself, while also scaling according to the height of the obelisks. These dominate the square and should not be competed with.

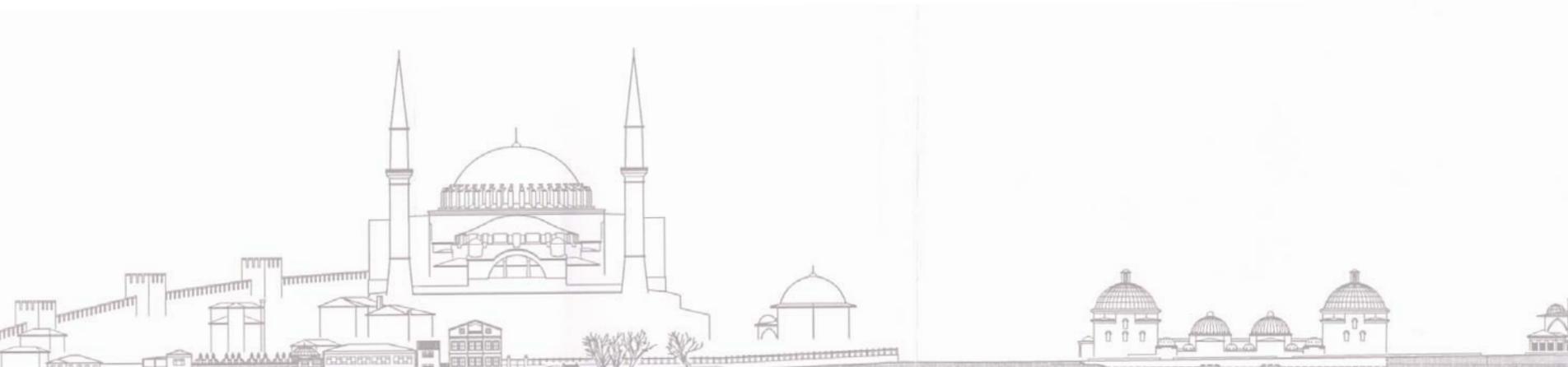


Architectural quality



Flows of people

The position of all the elements is derived from the analysis of the flow of people. Connecting axis points where the density of people is the most compressed, the locations are derived to form a suitable pathway over the square.



group 1 The square

Expression of transformability

Most of the structures are not transformable, but still can have a several functions. The appearance of these are light and easy to maintain. After the Ramadan Festival all parts can be easily disassembled. After doing that, there is still a beautiful park with benches and lighting. Transformability could also be expressed in changing images, as found on the screens.



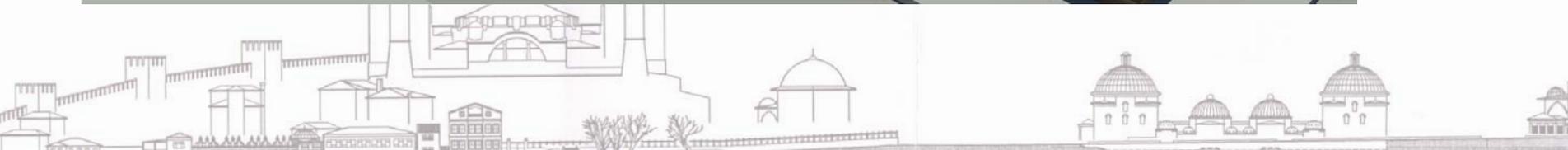
Multifunctionality

Accessibility

Ramps ensure accessibility for disabled people interesting in partaking in the festivities. Since the park is a public area everyone has accessibility around the clock.

Installing equipment

All elements in this area are lightweight structures. The foundations are placed above the ground so all new equipment can be easily installed. Some elements can be interchanged (like benches and tables) without additional effort.

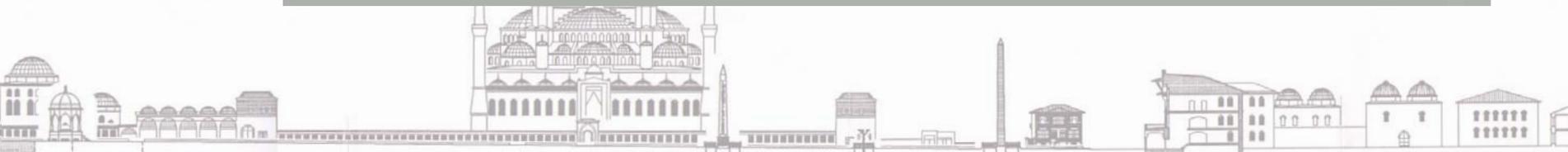


Sustainability

In the highway area and the seating area sustainability is taken into account. The highway provides solar energy to the pavilions of the other groups and to panels of the entrance area. These solar panels, which are used as a roof, are both for energy generation and for providing shadow. The seating area is designed in such a way that it can easily be recycled. There are no fixed connections between different materials so the materials can be recycled or re-used separately.

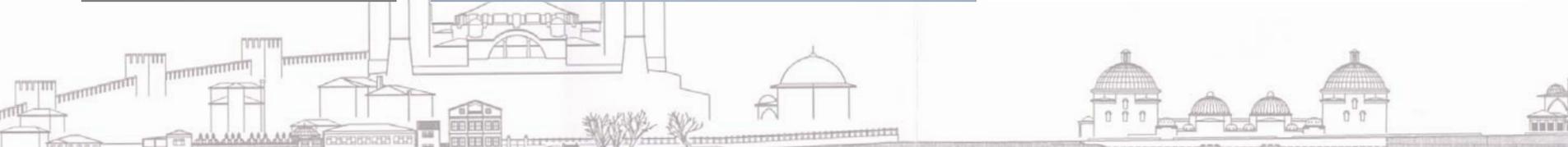
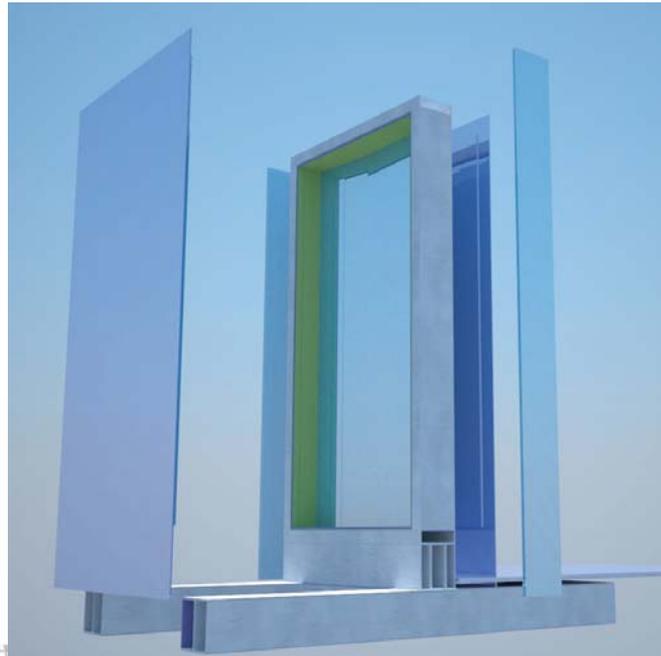
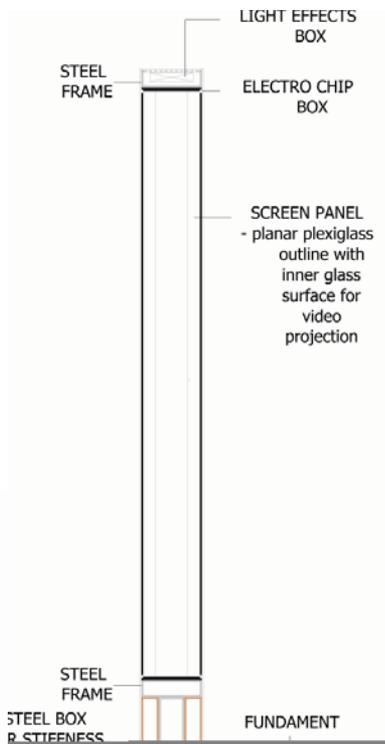
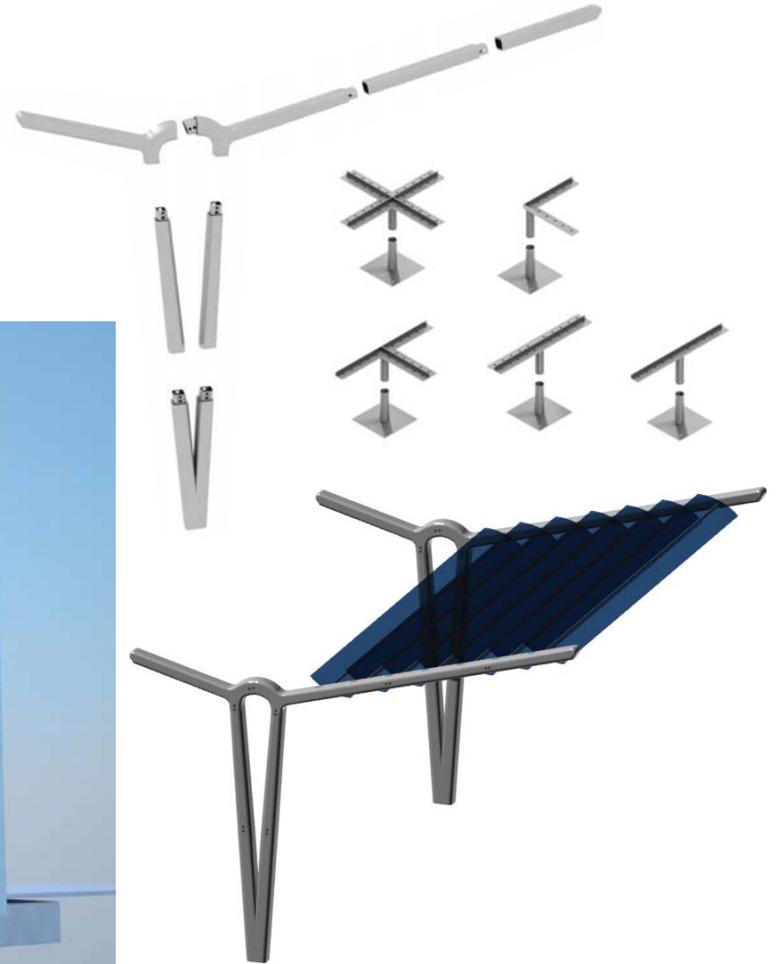
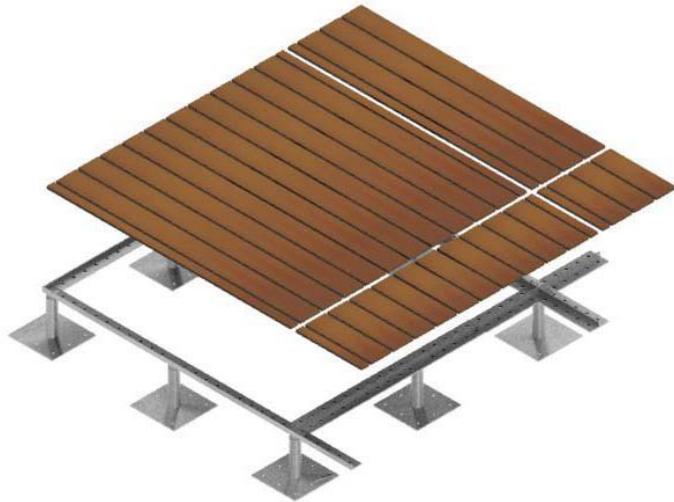
Comfort and Health

The lounge part in the seating area can be considered as one of the elements that provides comfort, specially for elderly. All structural elements are accessible by anyone. The shelter provides a comfortable atmosphere where needed.



Constructability

The density of the screens and solar panels is extremely high and should be carefully treated during disassembly and transport. All parts are adjusted to human physical limits as set by appropriate instances so they can be easily carried by two persons, or when needed with some extra lifting materials.



Cultural identity



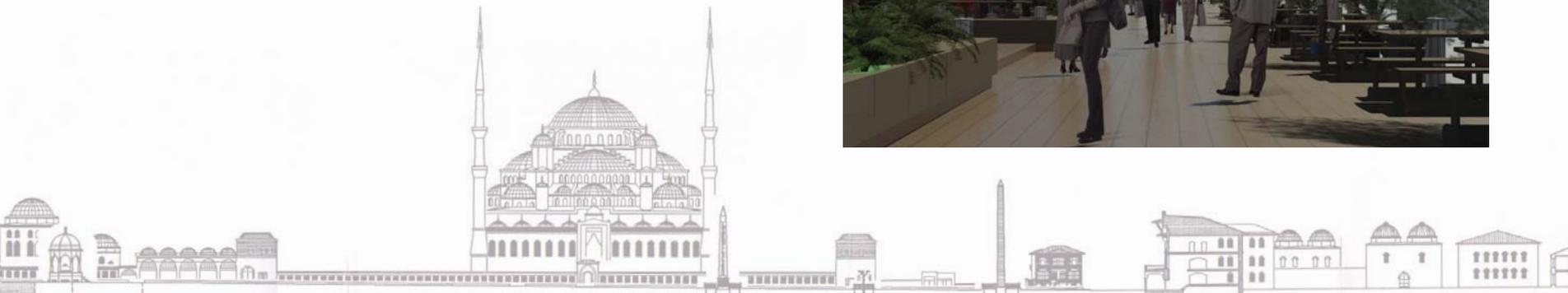
Cultural behaviour

The locals are very social people, as can be seen in the pictures of the old situation. Gathering in tea rooms to discuss life. This tradition can be continued in the seating area, offering various seating arrangements for various occasions.



Local esthetics

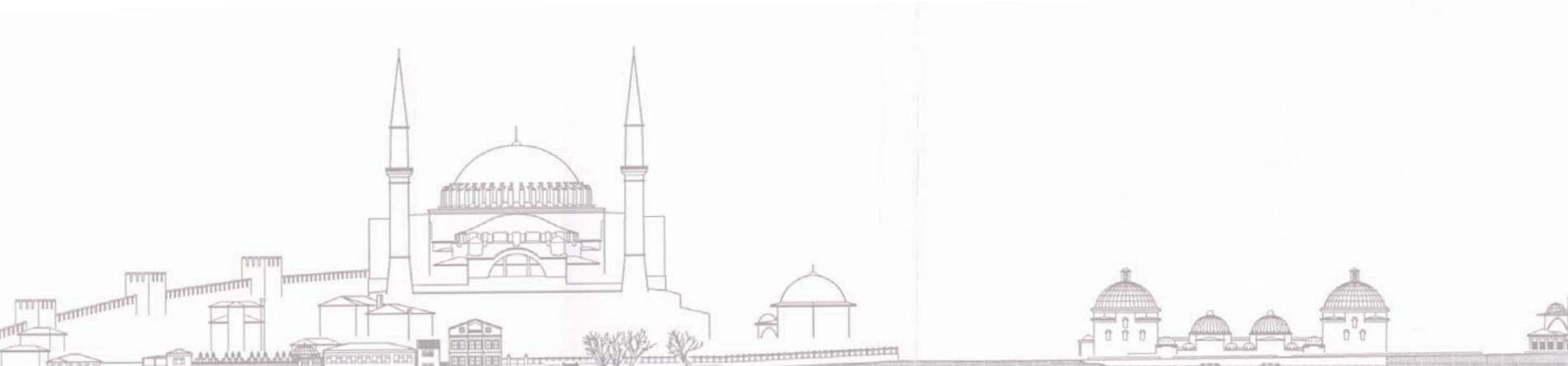
Local aesthetics aren't directly incorporated into the design. Instead the environment itself is used as decoration. The open structures and emphasis on viewing cones on the historic surroundings offer this feature.





Group 2, the entrance

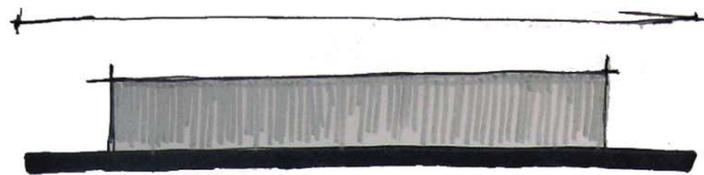
Being the main entrance area the focus point remains the transparency of the pavilions on this area. The final design tries to protect the user in a good way but also make room for enough people to pass through this area to the rest of the square. The previous chapter introduced the concept with a core and an encore, this concept has been developed and all aspects will be discussed in this chapter.



concept — **symbiosis** — horizontal characteristics of urban layout
&
vertical architectural elements of Hagia Sophia & Sultan Ahmet mosque

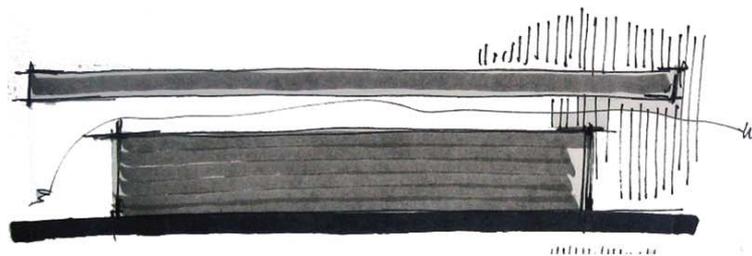


HORIZONTAL vs VERTICAL
PHYSICAL vs SPIRITUAL



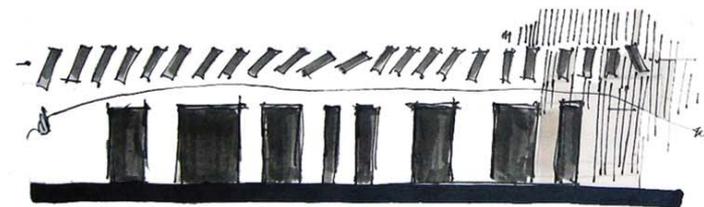
- ROOF
- SPACE
- CORE
- DECK

HORIZONTAL LINES



- ROOF
- SPACE
- CORE
- DECK

HORIZONTAL VOLUMES



- ROOF
- SPACE
- CORE
- DECK

VERTICAL FRAGMENTING OF HORIZONTAL VOLUMES



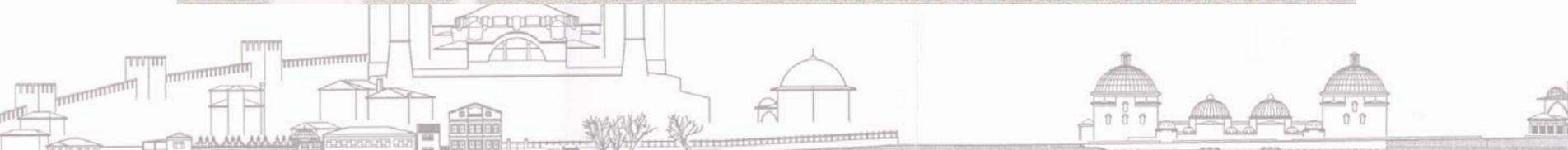
Architectural quality

Identity

Because of the great historical context the design of the pavilions should not distract the attention of the visitors. They should look neutral but still have their own identity. To achieve this, the pavilions are all connected by this strong roof, giving the face a clear identity. The reflection of the light upon the twisting roof gives the pavilions a warm ambience. Not only the roof but also the vertical rhythm of the façade gives the pavilions a consistent identity whilst leaving room for the shop owner to show his inventory. To maintain a neutral design all these elements are constructed using very basic shapes and light colors. The horizontal lines return in the surrounding buildings, whilst the vertical patterns are reflected by the mosque.

Scale

The core parts of the pavilions are quite small, the gaps in between the cores provide the feeling of space for the people inside, but also allow the people to connect with the happenings outside. This way the pavilions are scaled in such a manner that the people who are in the pavilions will not experience the pavilions as being crowded, and the people outside the pavilions will not see the pavilions as sight hindering objects. Through the holes in the roof, the encore, the canopy of the trees covering the pavilions will be visible; this way whole the area will be a semitransparent space, perfectly scaled for this site.





Flows of people

The pedestrians can interact with the pavilion owners from nearly every side of the pavilions. In the entrance area people will be able to move through and walk around the pavilions very easily. The fact that there will no seating in this area will also help to keep the people moving. On a whole, the pavilions leave very much open space, enough for the estimated amount of people on the square to safely shop, eat and drink around these pavilions.

During the night, when the pavilions are closed, people can still move around these pavilions, they are lit by lamps from the inside and the whole scene provides a cozy area to move around.

Expression of transformability

Sliding and rotating panels give the pavilions a feel of adaptability. But also the fact that the roof and floor are loosely coupled to the cores generates an expression of transformability. Everything can be made beneath this roof, depending on the site, the needed functions but the creativity of the user as well.



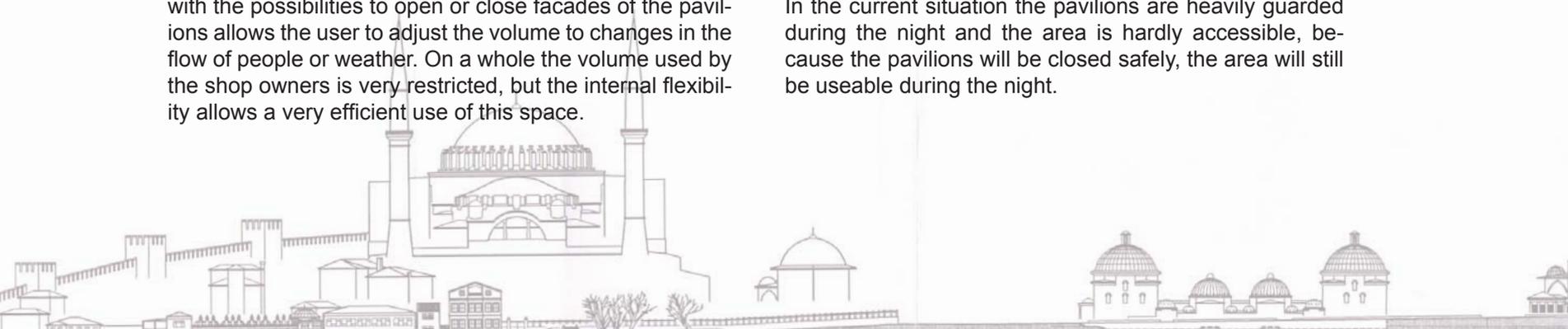
Multifunctionality

Spatial efficiency

As stated in the architectural quality the fact that the cores are loosely coupled to the roof and floor system gives the user a tool to adapt the space to its needs. This combined with the possibilities to open or close facades of the pavilions allows the user to adjust the volume to changes in the flow of people or weather. On a whole the volume used by the shop owners is very restricted, but the internal flexibility allows a very efficient use of this space.

Accessibility

Good to note over here is the fact that the pavilions create an accessible area during the day, as well as during the night. This will allow a possible new usage of the space. In the current situation the pavilions are heavily guarded during the night and the area is hardly accessible, because the pavilions will be closed safely, the area will still be useable during the night.

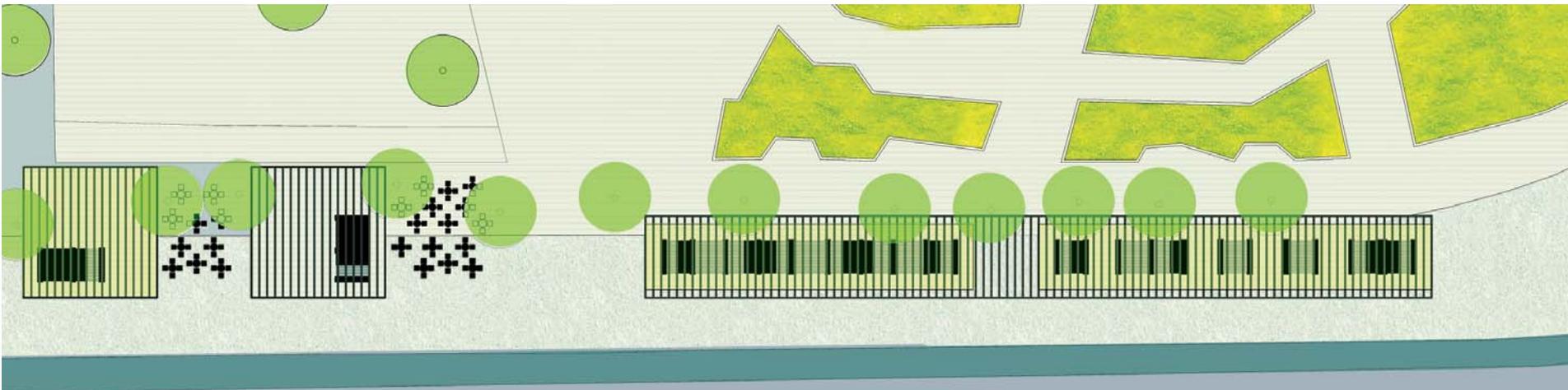


Installing equipment

One of the main elements in the core is the service wall. This service wall will provide the necessary interfaces for the equipment used by the shop or restaurant owner.

Internal flexibility

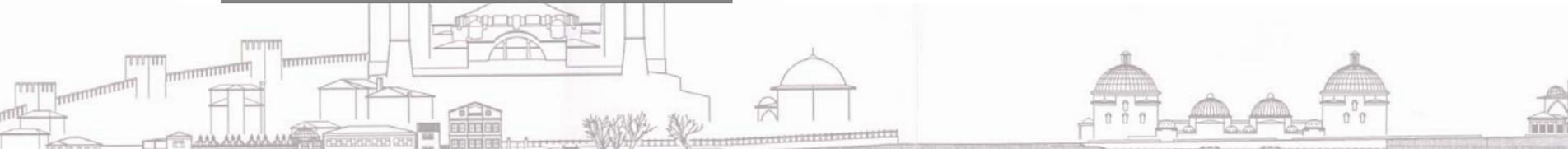
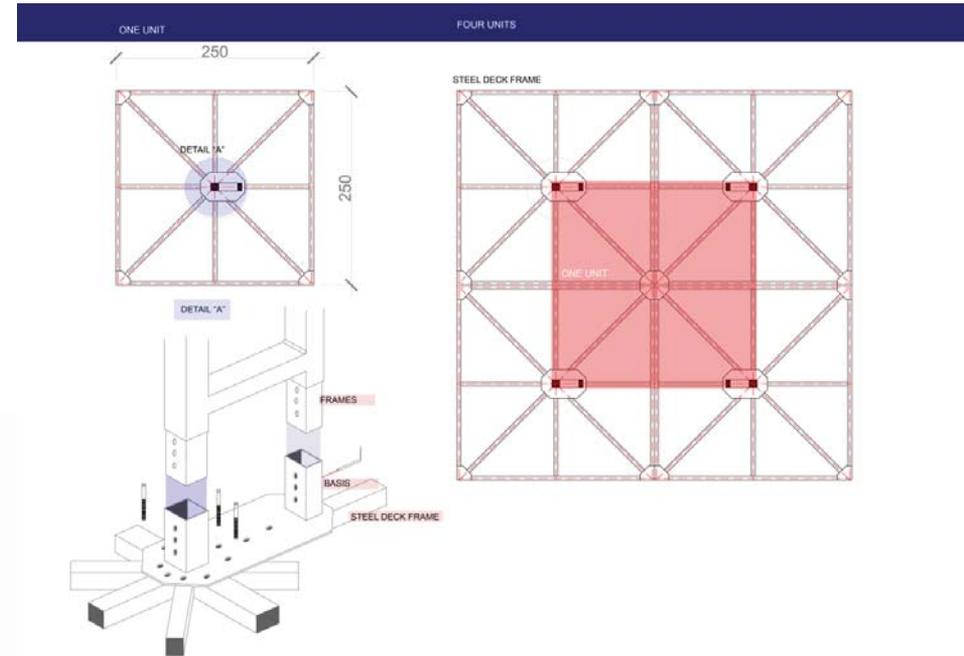
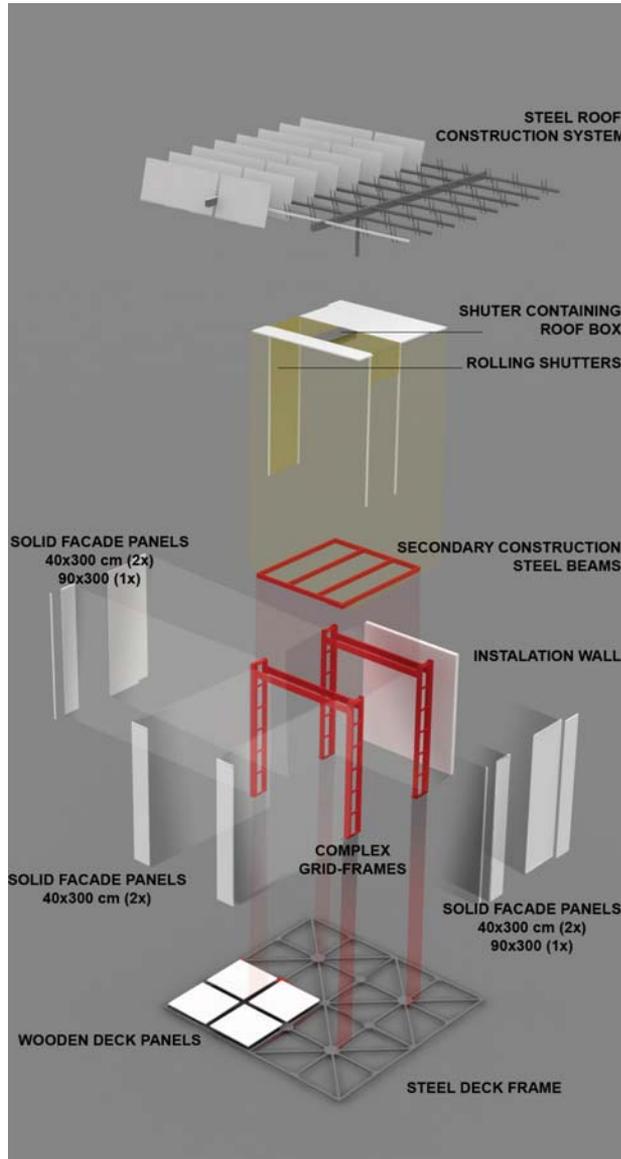
The only constraint seems to be the grid of the columns, but a pavilion owner can escape this grid by just opening the bars and move some things to the deck outside the core. If the shop owner needs some more space besides this solution he can simply add a core and furnish it according to his wishes. In such cases the service wall will allow the user to switch the functionality of a core very fast by plugging in his equipment.



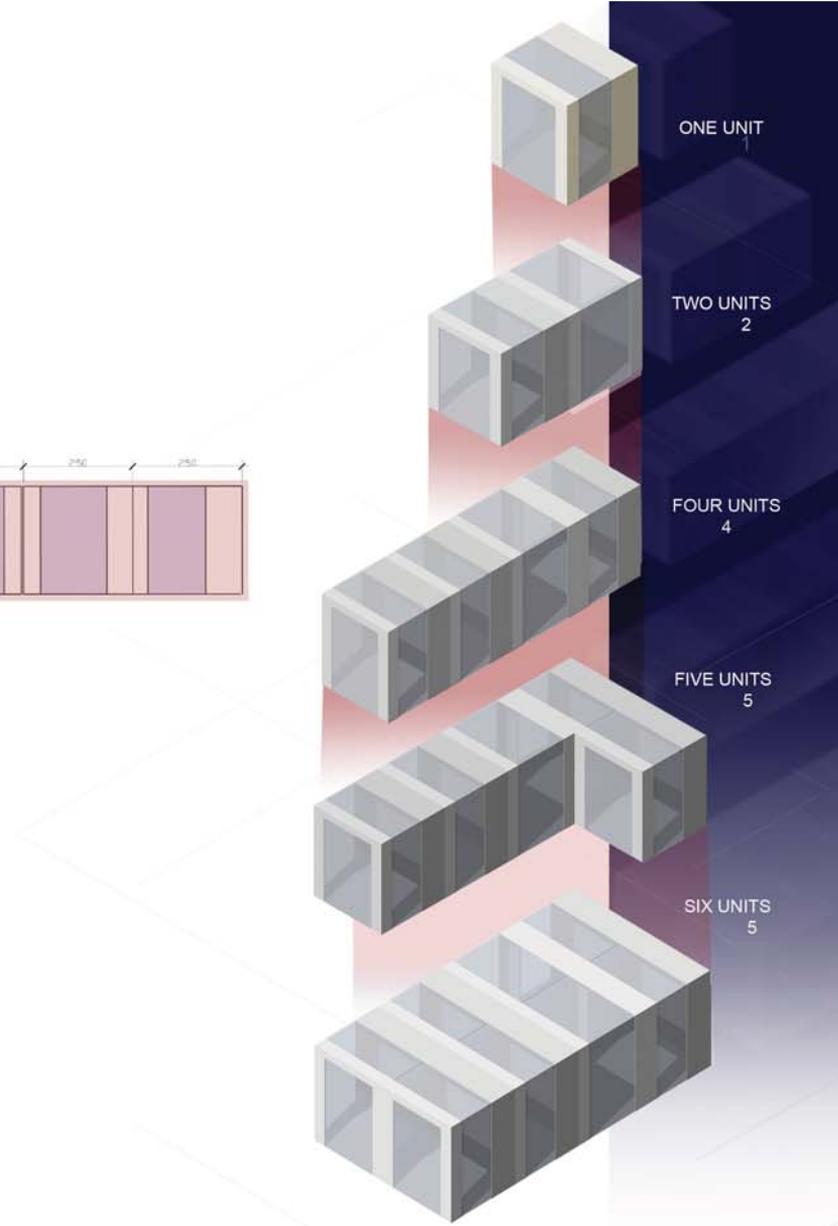
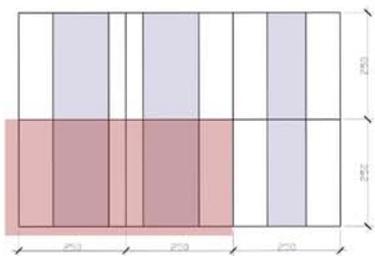
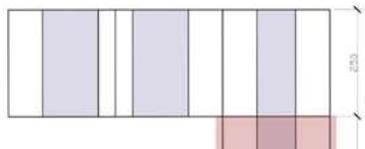
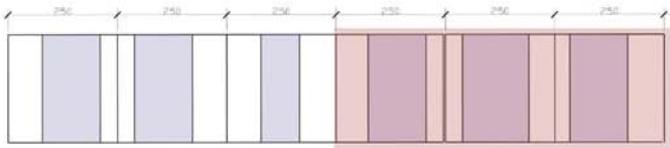
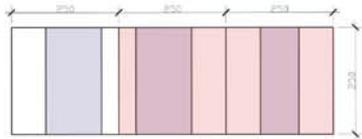
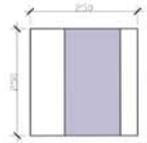
Transformability

Everyday transformations

The possible configurations and assembly sequences are shown in the pictures on this page. But the pavilions can not only be perfectly adjusted to the site and the required functionalities, also quick adaptations to the weather can be done very easily. The roof can be closed by activating the motor which drives the roof to prevent heat or rain entering the pavilions. To protect the content of the pavilions at night, the bars can be slid down and locked. Leaving a very open and clean deck system behind.



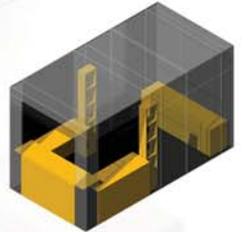
group 2 The Entrance



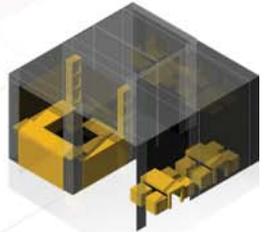
ARTS & CRAFTS



KITCHEN - TAKEAWAY



KITCHEN - TAKEAWAY
STAND ALONE FUNCTIONAL
UNIT



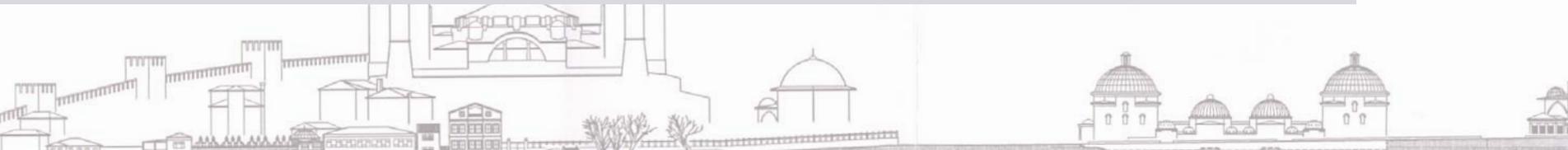
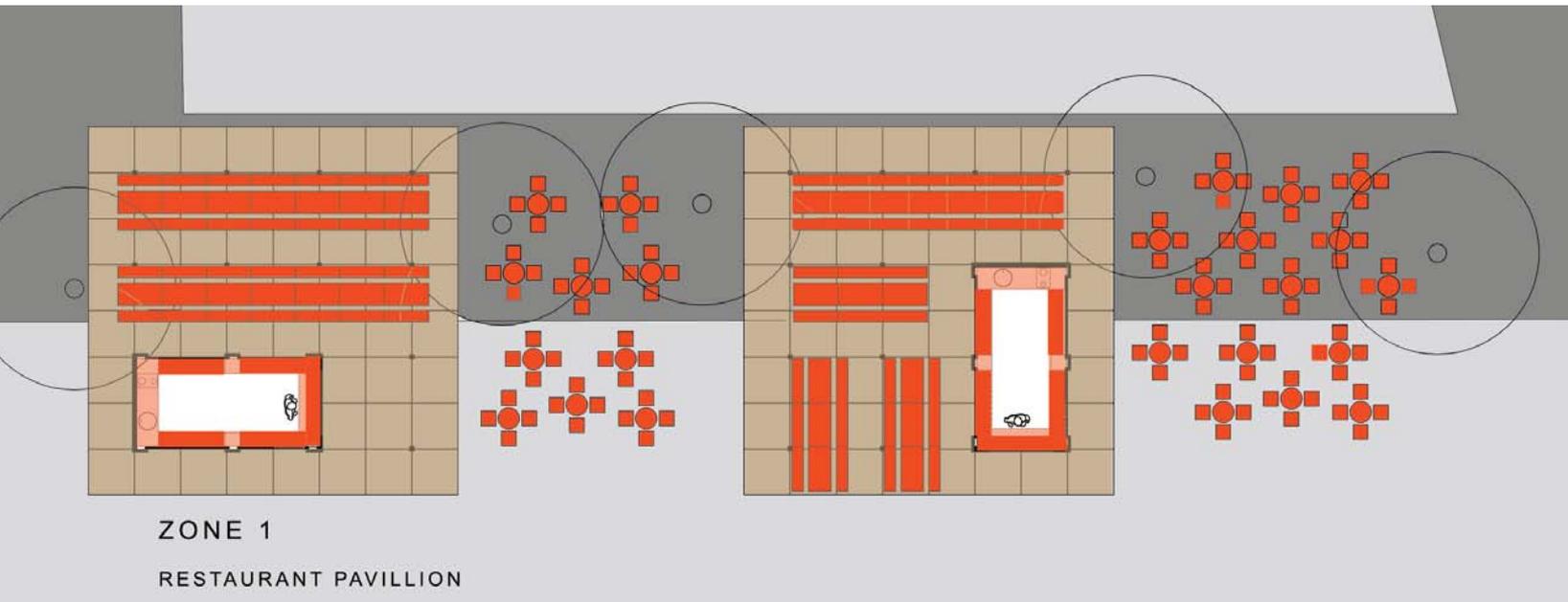
Sustainability

Sustainability

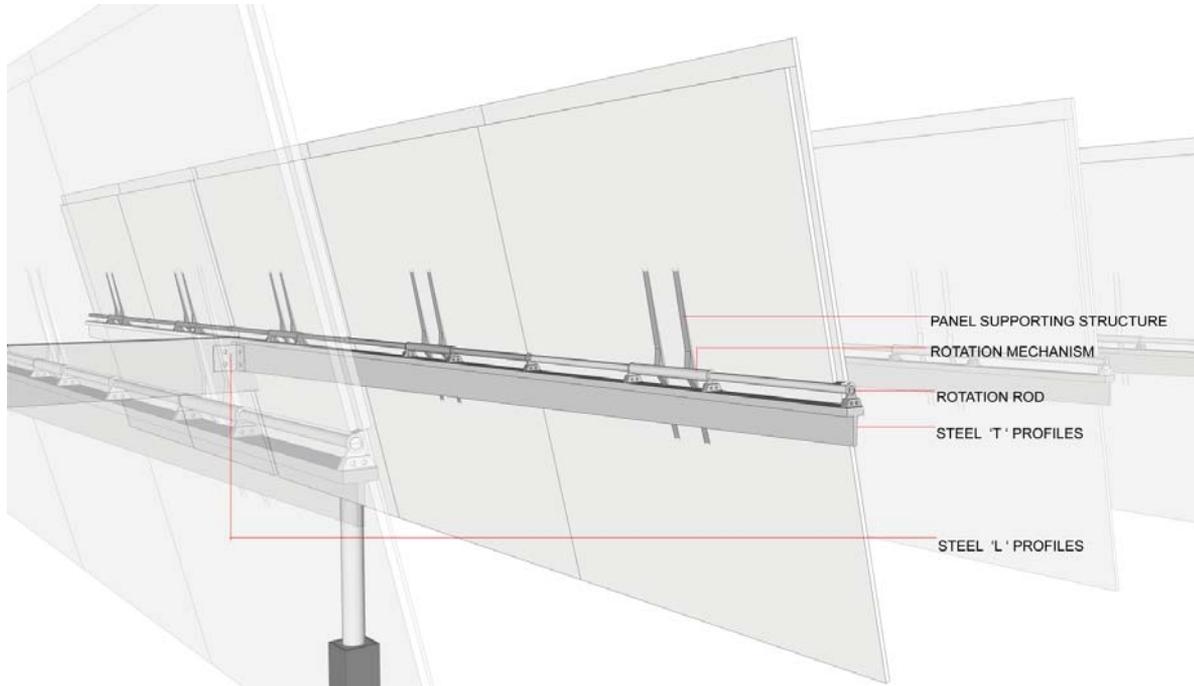
The principle of design for disassembly obviously allows a structure to remain functional for a longer period. This idea has been worked out well with these pavilions because of the temporary base on which these pavilions will function on a certain location. All materials and parts of the pavilions are heavy and solid and will remain functional during the long lifecycle of the pavilions. The recycling of the materials isn't taken into account when designing the pavilions, this would be the next step in improving the sustainability of the pavilions.

Comfort and Health

A tropical roof structure blocks the direct sunbeams and will prevent the pavilions from overheating. The upper roof can be closed or opened according to the climate in the pavilions. Because of the open structure enough fresh air will enter the pavilions at all times.

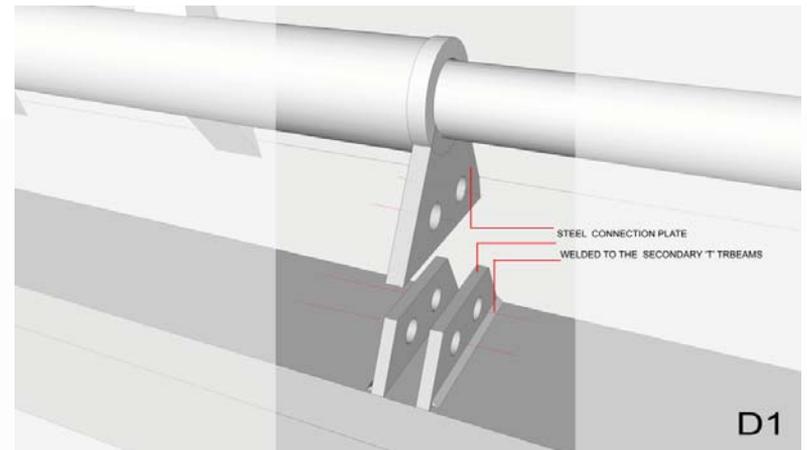


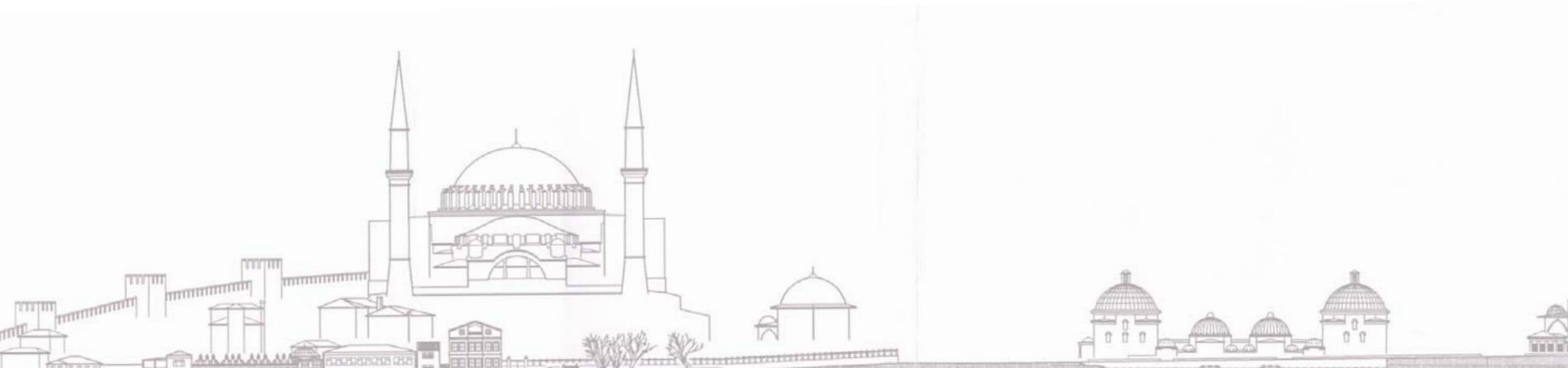
group 2 The Entrance



Constructability

As shown in the pictures before, the pavilions are rather easy to assemble. In general two people will be able to build a pavilion when all the elements are on site. All the connections will be screw connections allowing easy and non damaging disassembly. At first the steel floor frame will be setup, after that the vertical beams will be put into place. The moment this all stands up, the façade elements can be screwed against the frame and the installations wall can be put in and connected to the city services. At the end the roof elements can be set on top of it. When everything stands right up, the pavilion system is strong enough to face heavy winds and earthquakes.



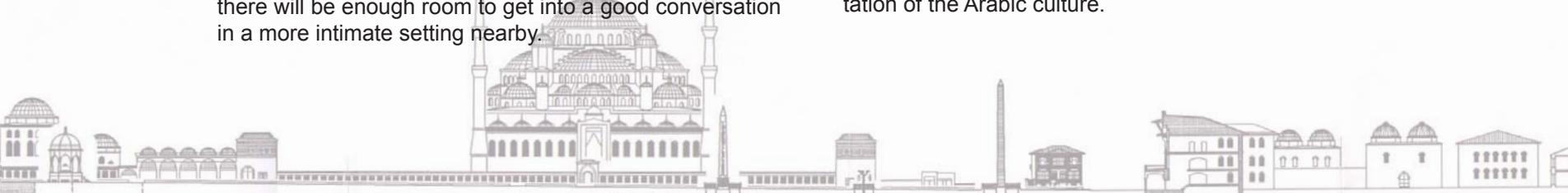




Cultural identity

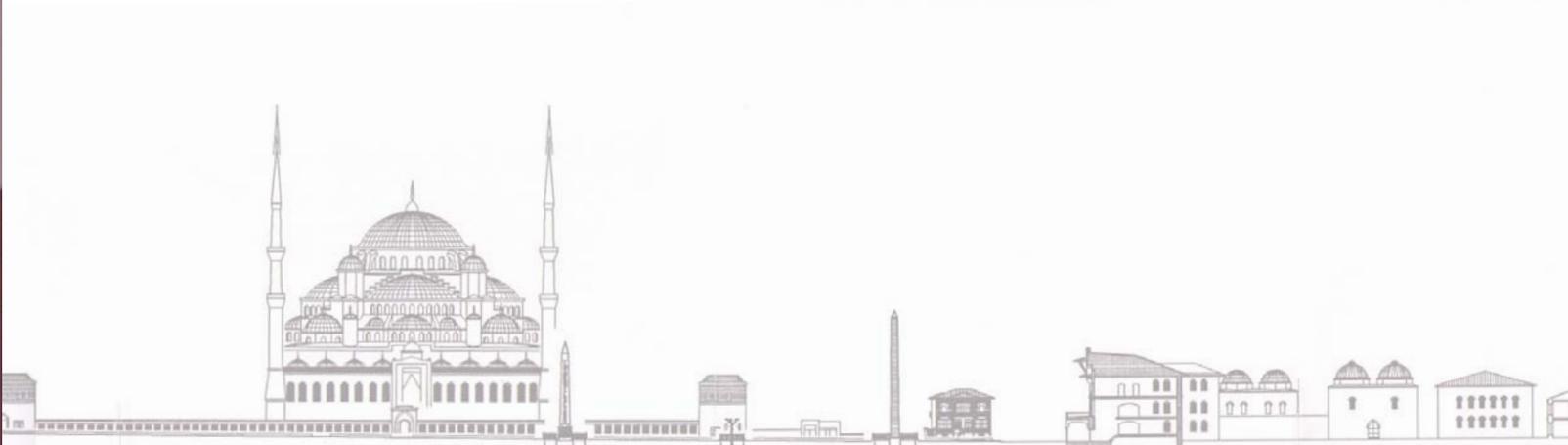
The openness of the pavilions will fluently work with the social behavior of the local people. This entrance area will have its similarities with the bazaar, just an open market place where people walk past, buy and chat. With the seating area just ahead, or in the park near the pavilions there will be enough room to get into a good conversation in a more intimate setting nearby.

The pavilions without the furniture and goods are quite simple and not very Arabic, but they only provide a neutral platform on which all kinds of cultural elements can be placed. This way the pavilions will provide means for the local community to give a unique and up to date representation of the Arabic culture.





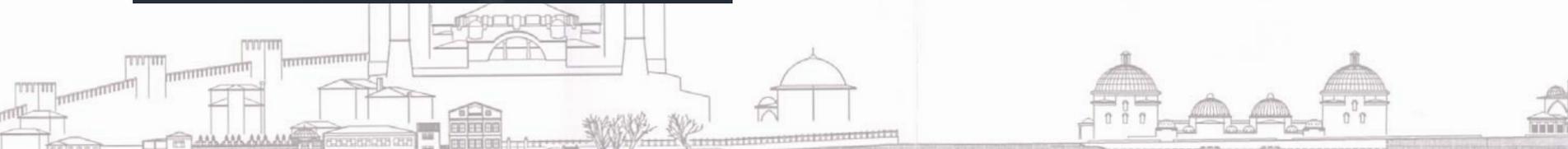
group 2 The Entrance





Group 3, the wall

After the decision of the pavilion structure system and urban level, the most appropriate design is chosen to be detailed according to the architectural identity, multifunctionality, transformability, sustainability, comfort&health and constructability issues. The pavilions have a neutral impact and don't compete with the historical environment because they are designed for human scale. All functional requirements can be provided within the modular components. In the design process, the security, comfort and health have solutions that can be used in different events and conditions. The assembly, disassembly and maintenance are done fast and easy, therefore the system provides the solutions for sustainability.



Group 3, the wall



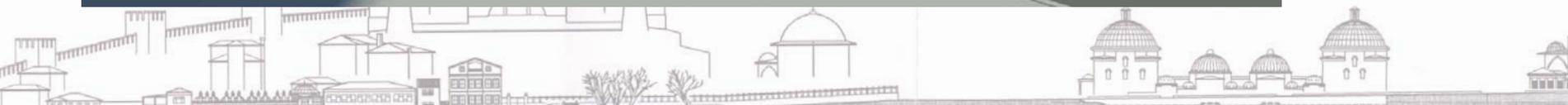
Architectural quality

Identity

The see-through design of the pavilion gives a neutral impression which does not interfere with its surroundings. Besides, the strong geometry of the site reveals the pavilions. The balance of the solid service units and transparent semi open spaces reminds the abstract geometry of the environment.

Scale

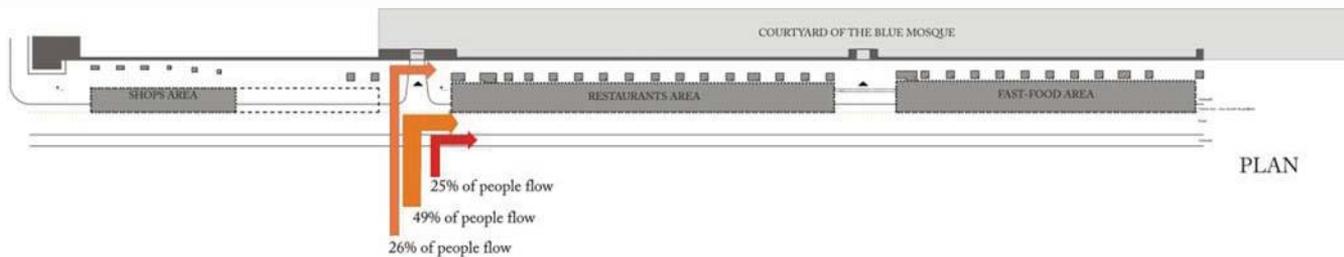
The dimensions of the pavilion structure is decided in a relationship with the functional requirements. Thus, the scale of the pavilion gives the neutral impression and pavilions don't compete with its surroundings.





Flows of people

The square is very crowded during the Ramadan festivities. The flow of people near the wall can be seen in the picture below. The decisions of the urban level allocates the crowd of people by using extra pedestrian way between the wall and the pavilions. The transitions between the pavilions are easing the pedestrian traffic. The renters can choose if they will use the display and selling areas on the road side, wall side or between pavilions.



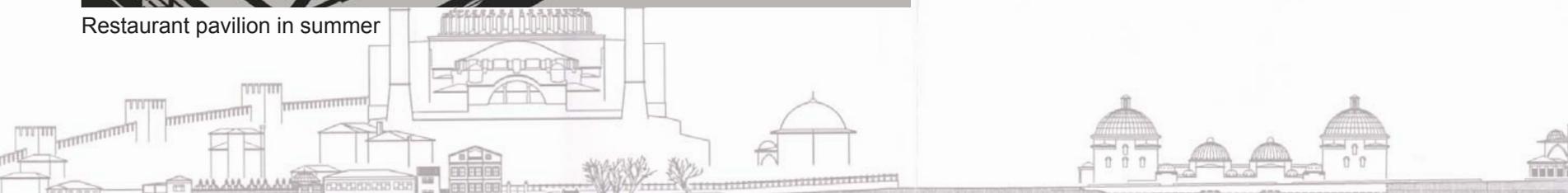
Architectural quality

Expression of transformability

The structural system provides an easy way of transforming both exterior and interior. Placement of system components, semi open and closed spaces are totally free to fit the renters wishes. However, within the whole system the characteristics of transformability changes. The roof and shading structure have a transformable textile system to provide quick solution for daily weather conditions. The service system has transformable shutter panels to provide security when the pavilion closed at night. The deck system provides main base system for flexibility and transformability.



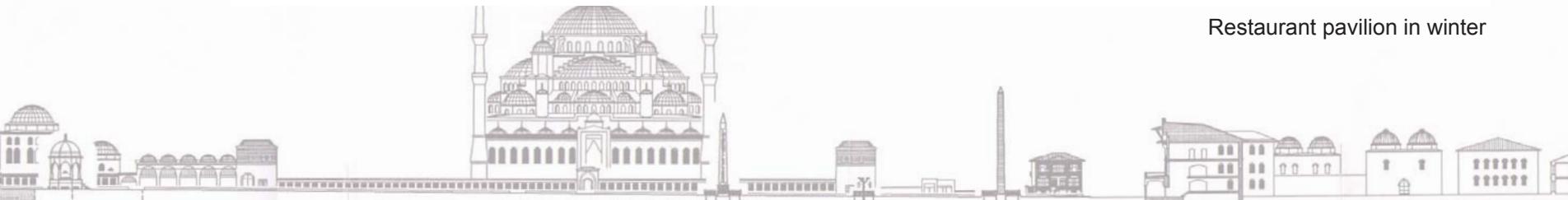
Restaurant pavilion in summer



Group 3, the wall



Restaurant pavilion in winter





Multifunctionality

Spatial efficiency

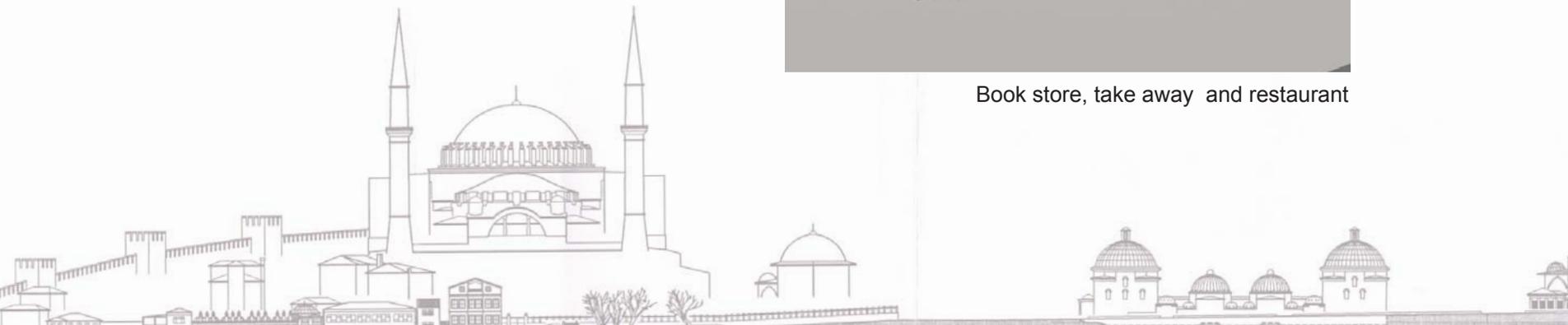
The pavilion structure is designed to allow modifications for different requirements. The panels have different functions and they can be chosen according to the needs of the user.



2 take away, 1 book store and 1 arts&crafts



Book store, take away and restaurant

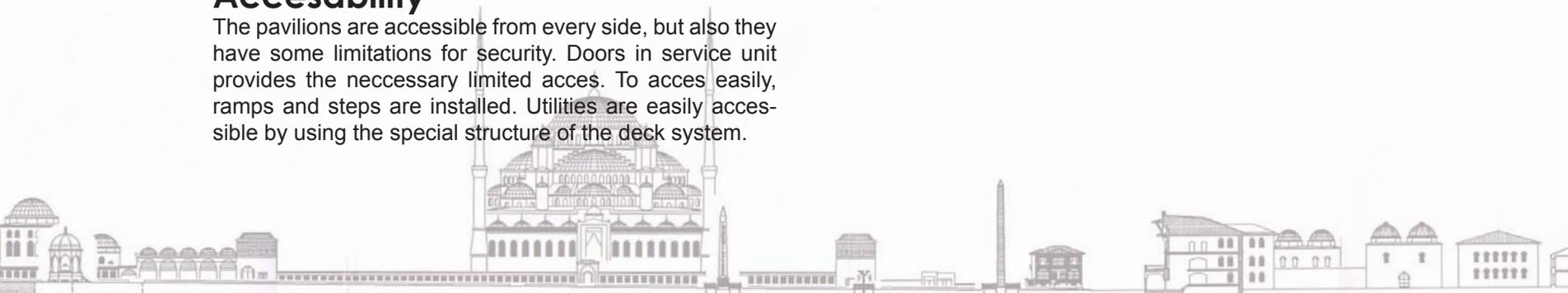


Group 3, the wall

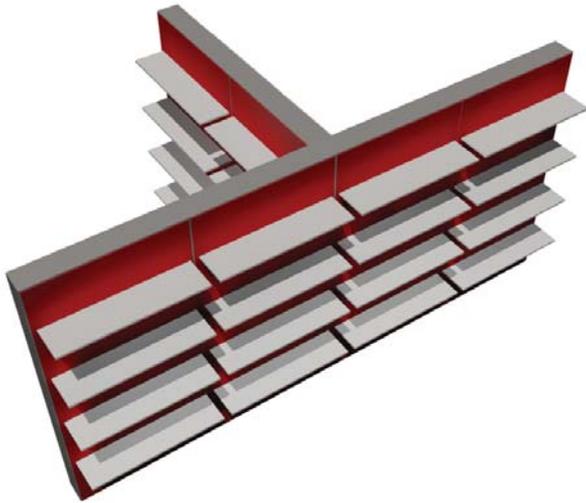


Accesability

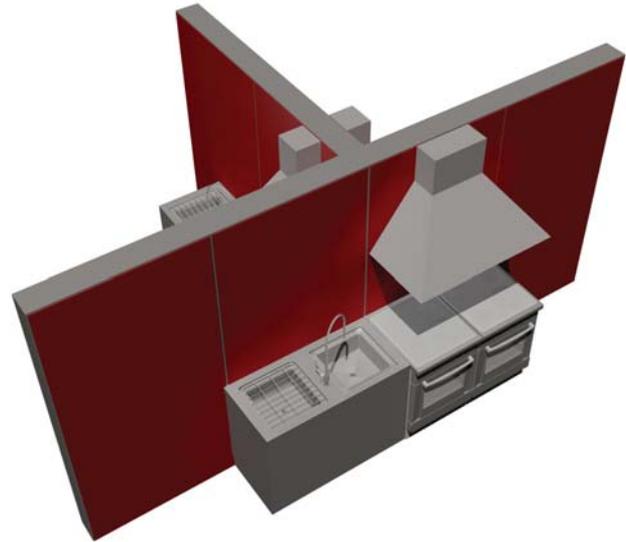
The pavilions are accessible from every side, but also they have some limitations for security. Doors in service unit provides the necessary limited acces. To acces easily, ramps and steps are installed. Utilities are easily accesible by using the special structure of the deck system.



Multifunctionality



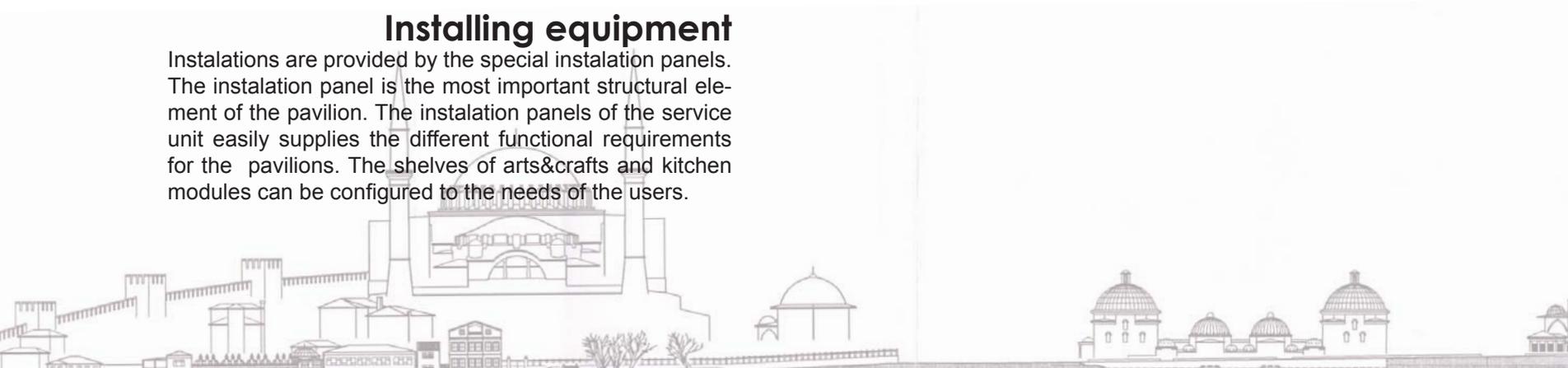
Instalation panels with display shelves



The instalation panels with kitchen modules

Installing equipment

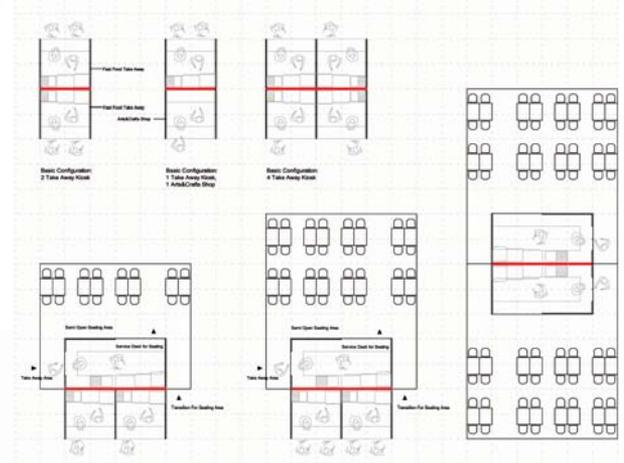
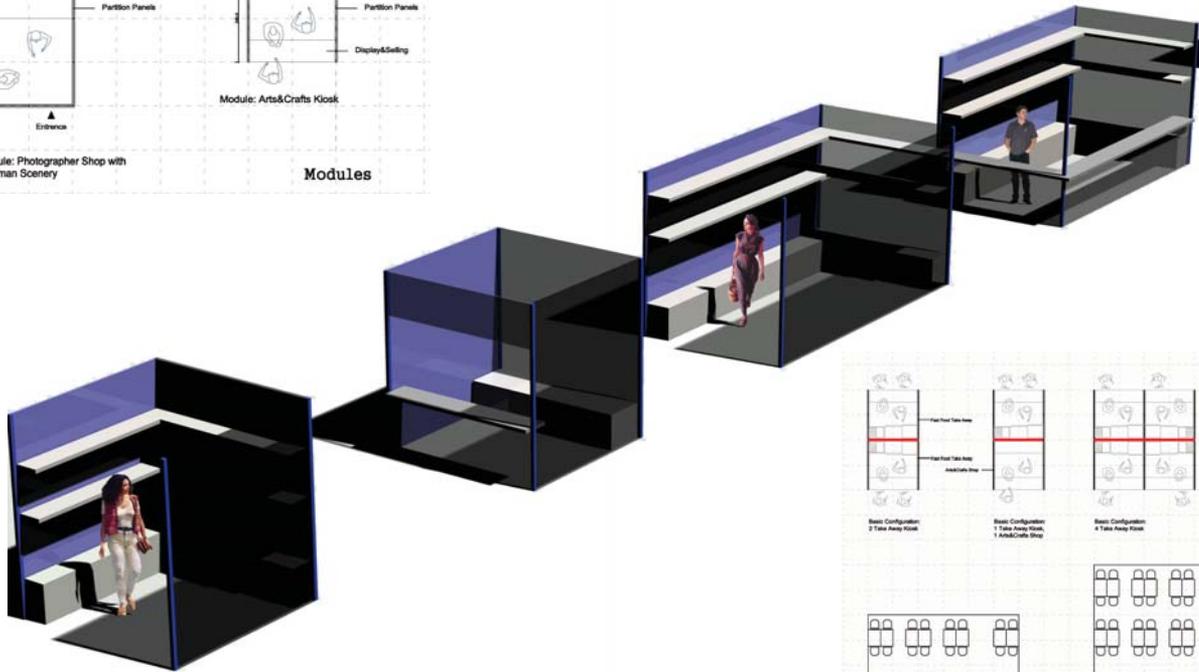
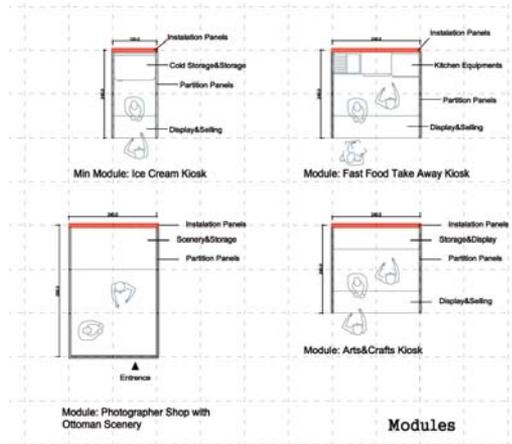
Instalations are provided by the special instalation panels. The instalation panel is the most important structural element of the pavilion. The instalation panels of the service unit easily supplies the different functional requirements for the pavilions. The shelves of arts&crafts and kitchen modules can be configured to the needs of the users.



Group 3, the wall

Internal flexibility

All panels have their own structure. Thus, it's possible to create bigger or smaller spaces by moving panels in decided module size as shown below.





Transformability

Different use concepts

The pavilions can be easily installed for different functions as souvenir, arts&crafts, fast food, desert, restaurants and photographers that are needed on Ramadan festivities. Also they can be assembled for other different events as fairs and regular events in Istanbul during the year.

Separating and combining

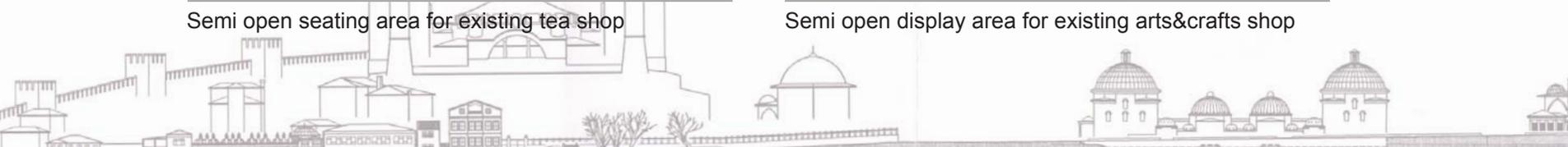
The components of the pavilion are modular and there are specific ones to provide requirements, thus user can choose the pavilion type and dimensions or between the limitations of architectural quality and uniformity. They can chose the component that will be used.



Semi open seating area for existing tea shop



Semi open display area for existing arts&crafts shop



Group 3, the wall

Everyday transformations

For the local climate conditions, the roof system is designed to be easily closed and opened by textile during the day if needed. Also the shadings on the facade are designed with the same idea of transformation.

Event setup

The quick setup is really important for Blue Mosque, because the area is an important historical place in Istanbul. According to the details and the modular system advantages, the event setup becomes easier and faster than the existing pavilions.



Pavilion view during the day



Pavilion view during the night





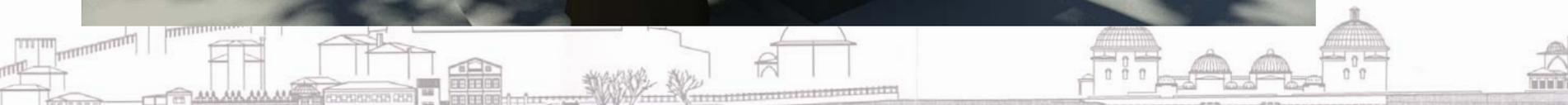
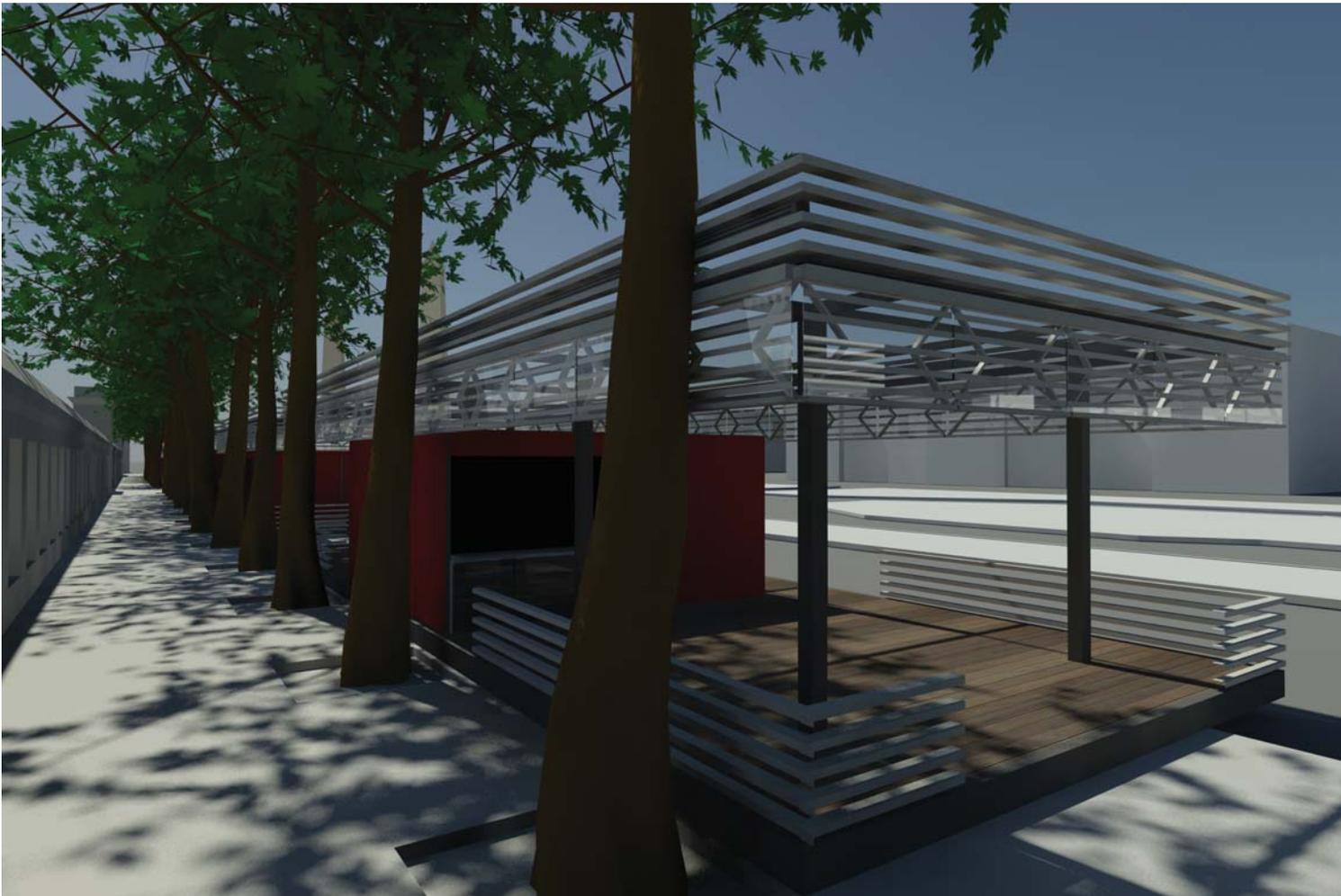
Sustainability

Energy

The moduler system and components assemble, disassemble and repair easily, thus the components of the system can be used in different functions until they complete their lifecycles. The construction and destruction phase of the structures causes the main energy consumption, therefore the developed system avoids this consumption.

Materials

The materials and components are produced in Istanbul, thus the transportation is not harmful for the environment. Also the recycled materials are used for the pavilions.



Thermal confort

The levelling of the roof and service system provides air conditioning in the service unit and semi open seating area. Also according to the sun positioning analysis, the shading panels designed to provide maximum heath com-
fort inside the pavilions.

Visual comfort

The system provides waste management and more hygienic conditions. The security of the pavilions are provided by rolling shutters for the service unit and fences for the semi open seating areas. Also, the uniformity of the pavilions provides visual comfort.

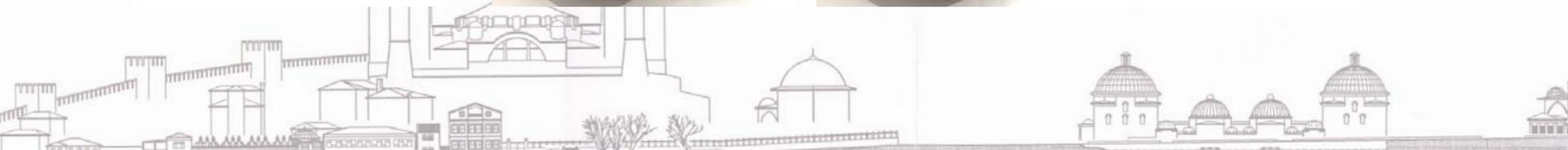
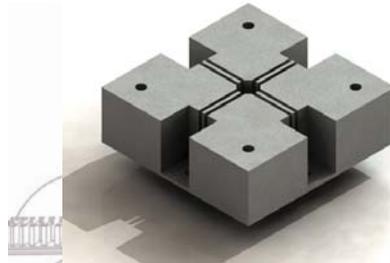
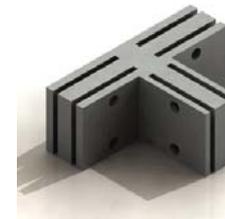
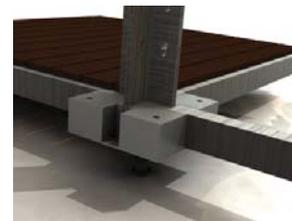
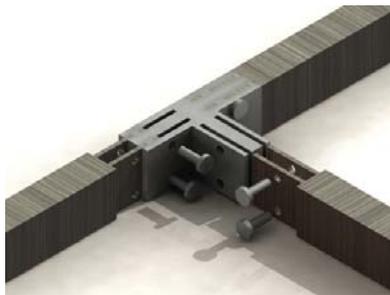
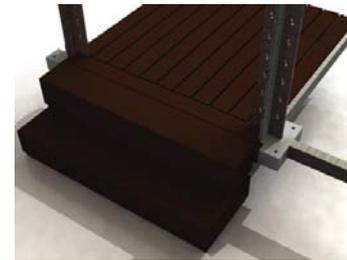




Constructability

Ease of handling

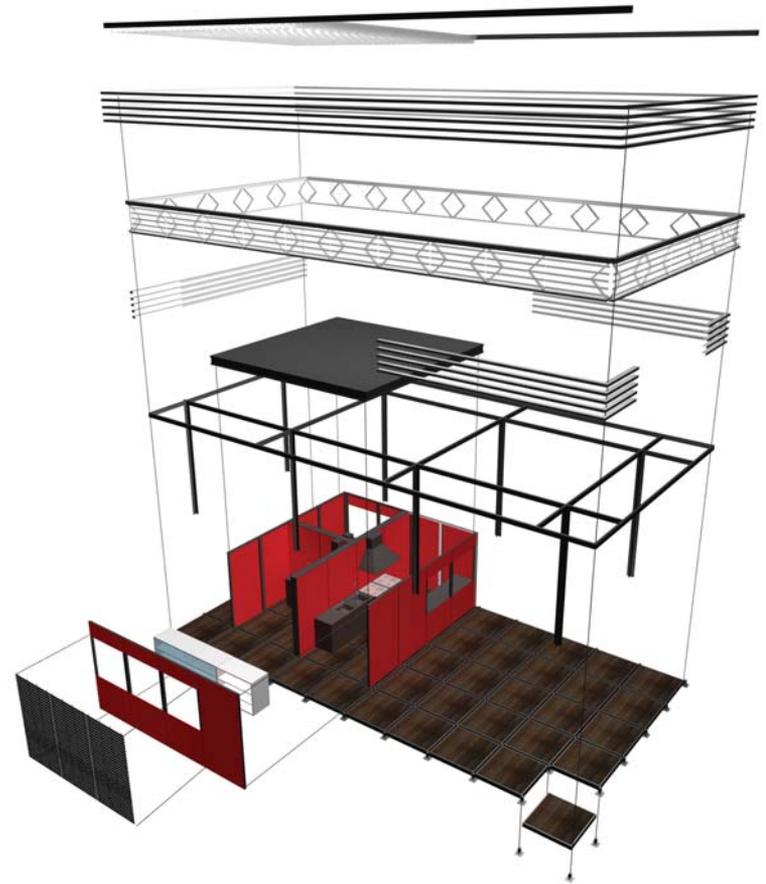
The components are able to be carried by one or two persons. The structural system elements can be connected by keyhole, pinhole and friction connections. Height of the deck can be adjusted by using a battery powered drill.



Group 3, the wall

Design for disassembly

The components of the system can be assembled and disassembled without damaging the modules.

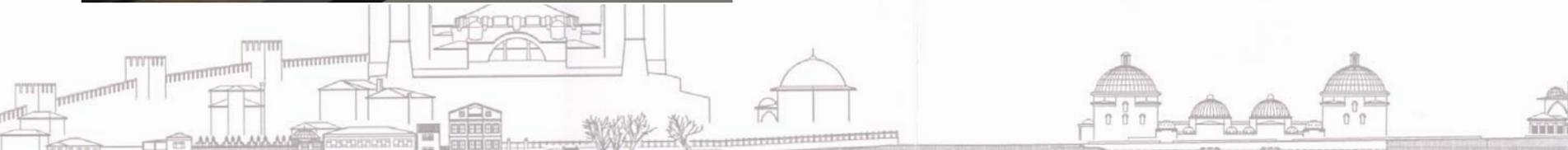




Cultural identity

Cultural behaviour

The dimensions and scale of the pavilions are not competing with its historical environment. The clear structure provides visual esthetic in such an important square and event.

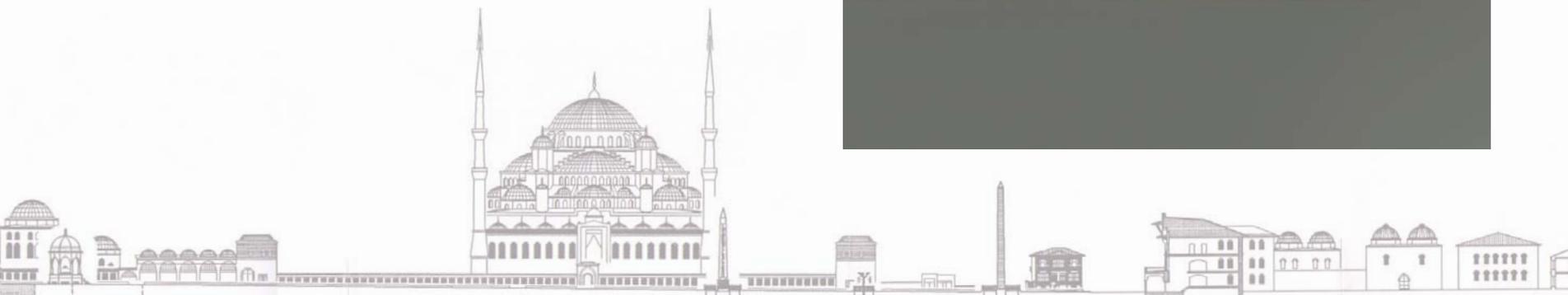


Group 3, the wall



Local estetics

The balance of the solid service units and transparent semi open spaces reminds the abstract geometry of the historical monuments of Istanbul.







The Blue Mosque is one of the two mosques in Turkey that has six minarets, the other is in Adana. When the number of minarets was revealed, the Sultan was criticized for presumption, since this was, at the time, the same number as at the mosque of the Ka'aba in Mecca. He overcame this problem by paying for a seventh minaret at the Mecca mosque.

Until recently the muezzin had to climb a narrow spiral staircase five times a day to announce the call to prayer. Today a public address system is used, and the call can be heard across the old part of the city, echoed by other mosques in the vicinity.

Chapter 4

/students_evaluation



This chapter is part of a course named “Collaborative Design”, which is one of the obligatory subjects for the master Civil Engineering and Management at the University of Twente. Using two different management approaches, systems engineering management (SE) and value management VM, the international design studio is being evaluated. First the principles of the two approaches are explained, followed by a similar description for the studio work according to Design for Disassembly (DfD) principles. Also a comparison is made between the three approaches, SE, VM and the practice of the DfD studio.

Systems Engineering Goals

Systems engineering (SE) is an interdisciplinary engineering management process that evolves and verifies an integrated, life-cycle balanced set of system solutions that satisfy customer needs (Defense acquisition university press, 2001). The desired end-result is a quality product that meets the user’s needs (Haskins, 2008). In this approach it is important not only to look at the elements and add them (as it is in the traditional approach which just looks at the sum of the parts), as well as to look at the relationships BETWEEN the elements that can generate extra value and are extremely important regarding the quality of the end-product. The most important thing in SE is that first the system is look at as a whole to form requirements and is then decomposed. After that at each level, all the parts are evaluated with respect to how they fit in the system as a whole.

According to “System Engineering Fundamentals” (Defense acquisition university press, 2001) *“the systems engineering process is a top-down comprehensive, iterative and recursive problem solving process, applied sequen-*

tially through all stages of development, that is used to:

- *Transform needs and requirements into a set of system product and process descriptions (adding value and more detail with each level of development),*
- *Generate information for decision makers, and*
- *Provide input for the next level of development.”*

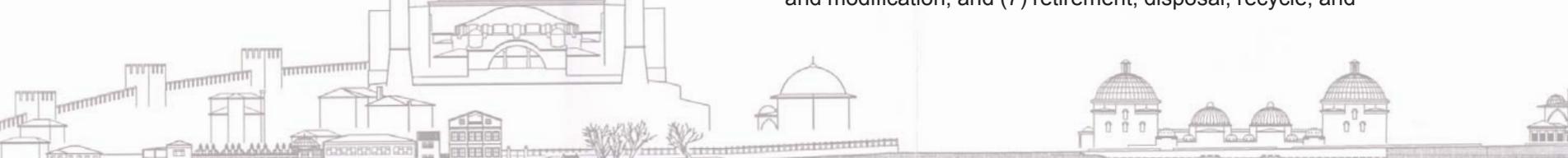
Structure

In the next figure the structure of the Systems Engineering process is presented. The process is applied sequentially, one level at a time, adding additional detail and definition with each level of development. As shown in the figure, the process includes: inputs and outputs; requirements analysis; functional analysis and allocation; requirements loop; synthesis; design loop; verification; and system analysis and control (Defense acquisition university press, 2001).

Argumentation

The systems engineering approach has become into existence as a result of the dissatisfying results from working according to the traditional functional approach. The communicational barriers between various disciplines led to errors in the design that are found during construction (Sarshar et al., 2004). These errors were time and money consuming. A different approach was needed to avoid these errors. The traditional manner of building could not manage the growing complexity of the projects and so a new approach was needed.

The system life cycle becomes more and more important to reduce overall costs. It is very important that engineers pay attention to the whole system life cycle. The system life cycle has seven general phases: (1) discovering system requirements, (2) creating and evaluating concepts, (3) engineering design and development, (4) system verification, (5) system production, (6) operation, maintenance, and modification, and (7) retirement, disposal, recycle, and



replacement. Systems Engineering, like Project Management, is mostly common sense. There are those who seek to make it complicated and esoteric, but it's mostly common sense and good engineering practices (Dean et al., 1997). Different industries have proved the systems engineering approach to be very effective. For the building industry this approach for designing is quite new, but has potential.

Functions

The "System Engineering Fundamentals" (Defense acquisition university press, 2001) state among others the following about how the functions and tasks are divided to use the systems engineering approach: "Integrated teams are composed of representatives from all appropriate primary functional disciplines working together with a team leader to:

- Design successful and balanced products,
- Develop the configuration for successful lifecycle control,
- Identify and resolve issues, and
- Make sound and timely decisions.

The teams follow the disciplined approach of the systems engineering process starting with requirements analysis through to the development of configuration baselines as explained earlier in this book. The system-level design team should be responsible for systems engineering management planning and execution. The system-level management team, the highest level program IPT, is responsible for acquisition planning, resource allocation, and management. Lower-level teams are responsible for planning and executing their own processes.

Integrating system development is a systems engineer-

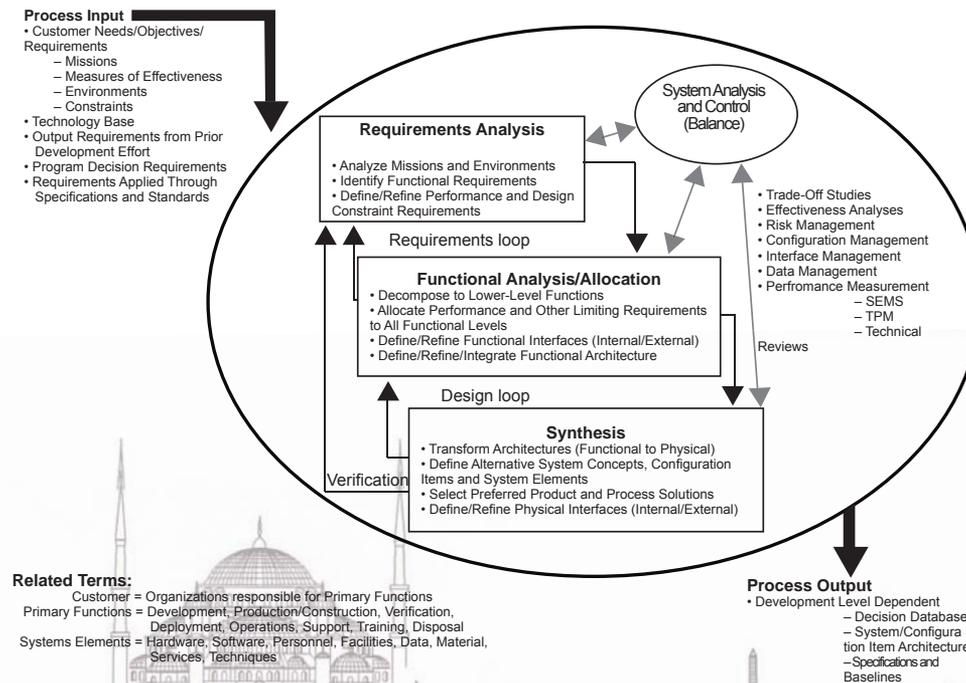


Figure 1 The Systems Engineering Process (Defense acquisition university press, 2001)



ing approach that integrates all essential primary function activities through the use of multi-disciplinary teams, to optimize the design, manufacturing and supportability processes. Team building goes through four phases: forming, storming, norming, and performing. Key leadership positions in a program network of teams are the program manager, facilitator, and team leaders. A team organization is difficult to build and maintain. It requires management attention and commitment over the duration of the teams involved.”

Phases

Development usually progresses through distinct levels or stages:

- Concept level, which produces a system concept description (usually described in a concept study);
- System level, which produces a system description in performance requirement terms; and
- Subsystem/Component level, which produces first a set of subsystem and component product performance descriptions, then a set of corresponding detailed descriptions of the products' characteristics, essential for their production.

The systems engineering process is applied to each level of system development, one level at a time, to produce these descriptions commonly called configuration baselines. This results in a series of configuration baselines, one at each development level. These baselines become more detailed with each level (Defense acquisition university press, 2001).

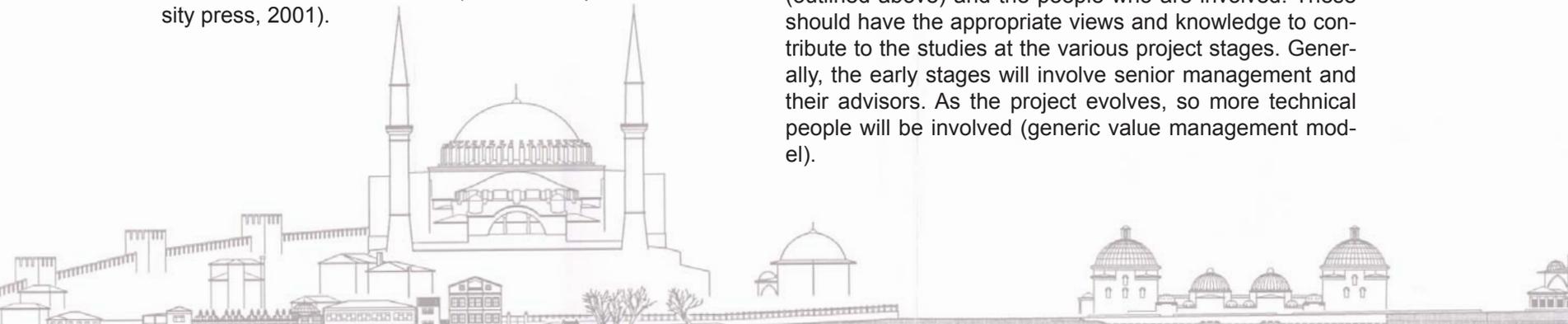
Value Engineering Goals

By describing value management (VM), the primary objective of value management is to develop a common understanding of the design problem, identify explicitly the design objectives, and synthesize a group consensus about the comparative merits of alternative courses of action. Value management makes no pretence about finding optimal answers; it is solely concerned with establishing a common decision framework around which participants can think and communicate (Green, 1994).

VM derives its power from being a team-based, process driven methodology using function analysis to examine and deliver a product, service or project at optimum whole life performance and cost without detriment to quality. Its goal is to reconcile differences in view between stakeholders, and, internal and external customers as to what constitutes value. It does this through a structured, systematic, analytical function-oriented and managed process involving a representative, multidisciplinary team brought together in a participatory workshop situation. (Male et al, 2007).

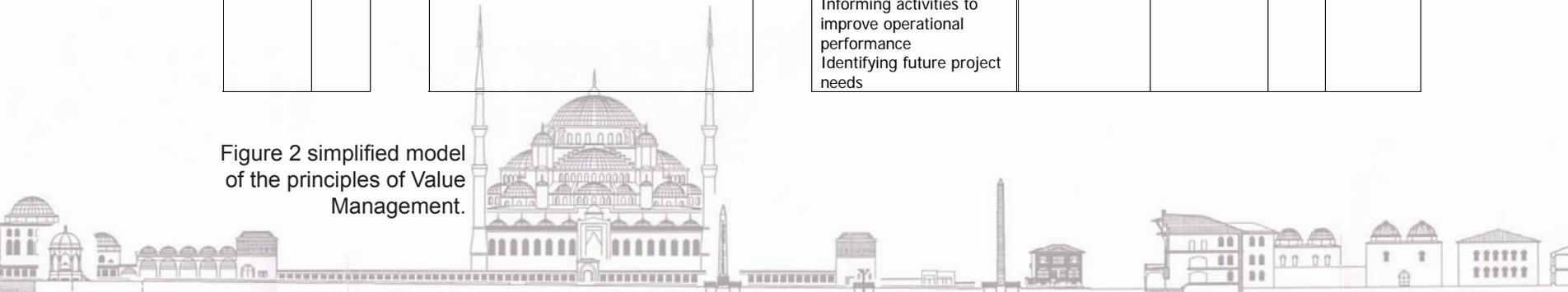
Structure

The model of figure 2 is deliberately simplified to show the principles of Value Management. In practice the studies at each stage should be tailored to address project specific issues. The quality of output is dependent on the process (outlined above) and the people who are involved. These should have the appropriate views and knowledge to contribute to the studies at the various project stages. Generally, the early stages will involve senior management and their advisors. As the project evolves, so more technical people will be involved (generic value management model).



Project Stage	Study Type	Issues addressed	DLE Study Type Possible outputs	Accelerating Change stage	OGC Gateway	RIBA stage	PFI stage
Inception	VM0	Business, user and other key stakeholder needs Benefits sought Triggers for considering a project Required strategic functional performance Business options under consideration	Need Verification Recommendations to Management Board	1 Verification of need	0 Strategic assessment	A	Strategic Outline Case/EoI
Develop Concept	VM1	Validation of business needs Confirmation of strategic functional performance Review of concept options and subsystems Development of functional performance model to 'system requirement' level Links between function and design objectives	Project Definition Information on which to develop Project Brief	2 Assessment of option	1 Business justification	B	ISOP
Test Feasibility	VM2	Validation of functional performance models Review and selection of system options Refinement of selected option(s) Review and selection of procurement strategy Develop proposals to improve	Brief Development Information on which to develop Design Brief	3 Develop Procurement Strategy	2 Procurement method and sources of supply	C	ITN
Design	VM3	Function cost analysis to component level Develop alternative design solutions Optimise cost, time and quality effectiveness of proposed designs	Value Engineering Information to develop detailed design and tender documentation	4 Implement procurement strategy	3 Confirm investment decision 3A Design complete	D	ITN/PB BAFO
Construct ion	VM4	Cost effectiveness Optimise components Buildability Supply chain issues	Design and Cost Review Refine detailed design and construction Improve supply chain efficiency	5 Project delivery	4 Readiness for service	E-H	Post-Contract Capex
Use	VM5	Project review Benefits realisation review	Project Review Lessons learned for improving management of future projects Informing activities to improve operational performance Identifying future project needs	6 Post Project Review	5 In-service benefits	L	Post-Contract Opex

Figure 2 simplified model of the principles of Value Management.



Argumentation

According to Thomson et al. (2003), government and industry initiatives are championing the cause of focusing on customer value. In order to do so, the whole life cycle of a building construction should be taken into account. The authors refer to Gale (1994) who noted the lack of direct investigation of the customer values. He argued that if these values fundamentally influenced how quality was perceived, they should be assessed and he coined the term 'customer value management'.

Functions

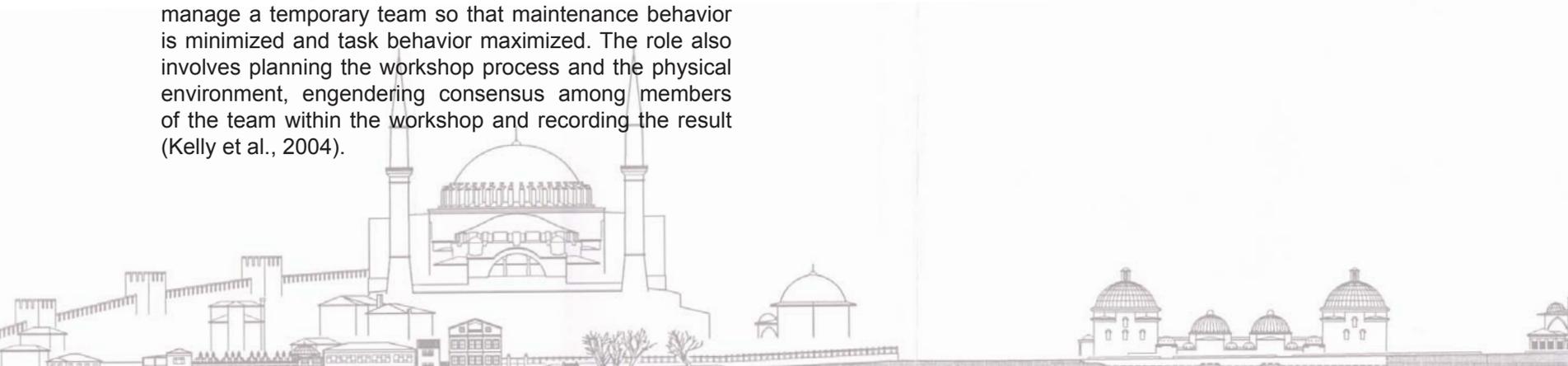
Kelly et al. (2004) state that in a value management workshop there are two fundamental points view concerning the make-up of the value management team. One mostly common in the US and the other in the UK. The US point of view is that the value management workshop team should be a totally independent review team overseeing the work of the design team, the team of record. This point of view gives a form of total independence making the process very objective. The disadvantage is that the team can only be reactive and backward looking. In the UK the design team will be the value management team and the advantages and disadvantages are the converse of the above.

A value management team is created by general team development standards (forming, storming, norming, etc.). A special role is granted to the facilitator who can efficiently manage a temporary team so that maintenance behavior is minimized and task behavior maximized. The role also involves planning the workshop process and the physical environment, engendering consensus among members of the team within the workshop and recording the result (Kelly et al., 2004).

Phases

Kelly et al. (2004) present a value management process, adapted from Male et al. (1998), where the VM workshop phase is part of eight different phases, the pre-study information, information, creativity/innovation, evaluation, option/ idea development, action planning, workshop report and implementation. The VM workshop phase involves the information till action planning phases.

The authors also present a revised value management process. Considering the structure and processes of VM, three generic phases can be identified; (1) the orientation and diagnostic phase involves the value manager(s) and value team preparing for the study, and meet with key players involved in the study, (2) the workshop phase involves a forum where alternative and/or complementary stakeholder and multi-disciplinary perspectives on the value problem are brought together to explore and reach a way forward, hopefully through agreement, and (3) the implementation phase, which in practice often acts as a key area where VM falls down (Kelly et al., 2004). Considering the eight phases the first generic phase involves the pre-study information and information phase. The implementation phase involves the action planning, workshop report and implementation phase.



Design for Disassembly studio

The introduction of this book states the goals, structure, argumentation, functions and phases at the beginning of the project. The next paragraph presents a short summary of this analysis, followed by how it was interpreted by the students during the workshop and the actual results. Also a comparison of the previous literature study and the practice is made.

Goals

The studio is a semester long international team project that focuses on the development of concept design for disassembly (DfD) systems, reuse of components and materials, flexibility, rule based design system, spatial transformations, and the use of CAD/CAM technologies in direct cooperation with manufacturing and construction industry in design and construction (IDS09, 2009).

The goals include;

- to develop design concept and system for realization of disassembled transformable pavilion prototype,
- to consider cultural aspects and site specifications in the development of design concept,
- to consider pavilions life-cycle management in the design process,
- to explore management and communication issues in team based design work,
- to stress integration and innovation in architectural design,
- to establish cooperation between the university and the local construction industry.

During the Studio

The studio started with three days of lectures by professors

and well known architects, emphasizing the importance of DfD systems and how to achieve this. A multi-criteria analysis was introduced to assess the designs on different criteria. Most students were not familiar working with such an analytical approach; those who did were able to explain how it worked. The MCA improved communication and setting goals.

Site specifications were also taken into consideration at the start of the studio, and students that were familiar with the Ramadan could explain the key issues of this festival to the other students.

The DfD systems approach considers life-cycle management, integration and innovation. The professors were very keen on emphasizing this particular part during the semester. Different scenarios were developed and the detailing of the pavilions were all according to the principles of DfD.

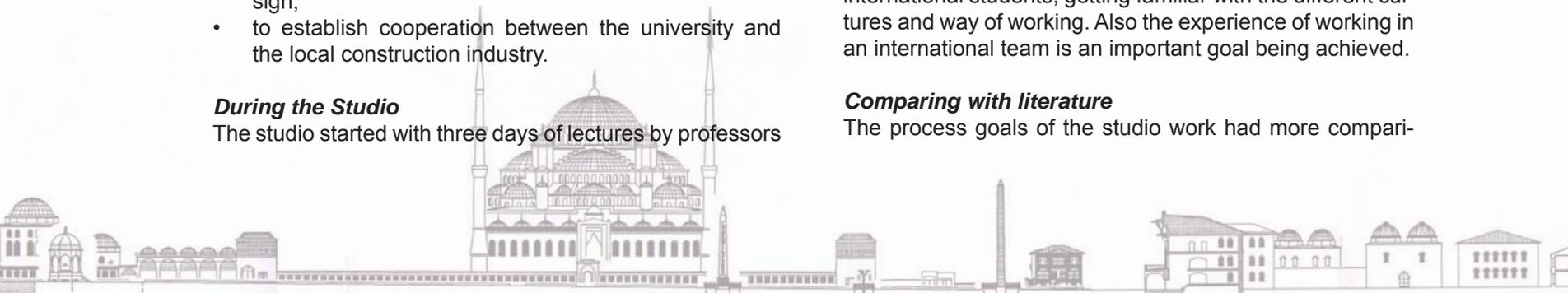
The management and communication faced its ups and downs during the semester. Typical ups were found during the workshop meetings in Istanbul, Sarajevo and Enschede where students and professors met face to face. In-between the workshops the internet connection was a main cause of failing to communicate with the teams individual and during main sessions. Next to that the hours students work on the project were different making it hard to plan online team meetings.

In the future this project should be realized in cooperation with the local construction industry; at the time of writing this is not yet established.

At the end it could be said that all goals are met. A goal which was not mentioned is that of the interaction between international students, getting familiar with the different cultures and way of working. Also the experience of working in an international team is an important goal being achieved.

Comparing with literature

The process goals of the studio work had more compari-



sion results in a total concept design considering all levels and sub criteria.

Comparing with literature

Without actually focusing on SE approach by the students, the structure of the studio was quite according to this structure. The input was delivered by the client and the professors. Analyzed by the students together with the professor. After that an iterative design process started resulting in output with specifications about the total design. Because the professors were part of the teams the output for information to make decisions was not comparable to the SE approach, because this was done during the process. In the end however the client will decide how to continue with this project and if it will be realized.

There are no recognizable structural parts according to VM theory. The key stakeholders, market holders, visitors, municipality etc. were not part of this particular studio project. It is unknown if the municipality took these stakeholders into consideration while stating the demands for their side of this project.

Argumentation

Design for disassembly (DfD) is becoming increasingly recognized as an effective tool by designers and manufacturers. However, the disassembly of buildings to recover materials and components for future reuse is not widely practiced in the modern design and construction industry. In architecture, DfD is the design of buildings to facilitate future change, and dismantlement for reuse. This design system includes developing design assemblies' components and construction techniques to accomplish this goal. It also seeks to ensure that all aspects of sustainable building are supported.

Although not typically considered as "product" buildings are

composed of materials, components, connections and are created through the collaboration of designer's engineers, manufacturers of the materials and components that are assembled to make a building. They are an assemblage of systems that create an integrated whole, which will be more efficient if it is designed for reuse, repair, maintenance, and adaptation of its components.

The international studio "Design for Disassembly and Re-use: Design & Build Multipurpose Transformable Pavilions" will cover a range of themes (DfD Design systems, rule based design, digital design and manufacturing, etc.) and a set of principles, or guidelines, for dismantlable pavilion design to facilitate greater rates of reuse of these pavilions in the future (IDS09, 2009).

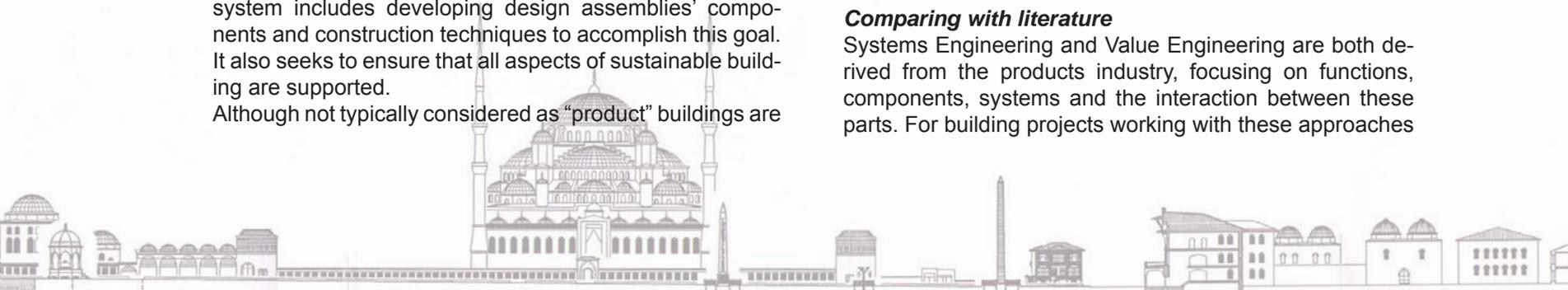
During the Studio

The possibilities for DfD are explored by students during this studio. The aforementioned arguments why and how this design system should be adapted became clear during the semester. Combining architectural and industrial design students resulted in teams who were able to use specific experiences (working method, way of thinking, design skills etc.). To consider a pavilion as a product the experiences of the industrial designers were important and to design the pavilion as a building (the bigger scale) the architecture students came into action.

The guidelines used in this project were good for the communication and also partly about designing for disassembly, simple because some of the sub criteria that had to be met were about DfD.

Comparing with literature

Systems Engineering and Value Engineering are both derived from the products industry, focusing on functions, components, systems and the interaction between these parts. For building projects working with these approaches



is less familiar. DfD can be considered as a method to apply SE or VM in practice for the building industry. Design for Disassembly has lots of potential to design systems and components with added value as these parts interact. Reconsidering the traditional approach VM can be applied during a DfD project to find alternatives with similar functionality and a better price/quality ratio.

Functions

The students of participating universities will work in teams on assigned design tasks. Geographically distributed team members will communicate via ICT. There will be three workshops each organized in participating university, where the students will meet face to face and work together on their design task. The students have three different backgrounds, architecture, industrial design and civil engineering. The industrial design and civil engineering students get the task of managing the process and try to use their team work experience to coordinate the work.

During the Studio

The work was divided into three groups, seven students each. Every group contains one or more students from the three different participating universities, making the groups very international. The professors were split up among these three groups giving every group a specific expert. It was supposed that all groups assigned one member to be the leader of the group for communication between the teams and the professors. The leader was also responsible for the presentations of the work done. Next to these roles two students and an assistant got the task to set up and maintain the communication channels for the time in-between the workshops.

Some students were more experienced in working in a team and with deadlines, other students worked better individually. Integrating these two groups of students into one working team was quite a task and succeeded partly

and with different success over the different teams. Also the communication between the different groups was difficult, mostly in-between the workshops. As already stated at 'goals' the communication had its ups and downs. For team leaders it was quite hard to get an overview of the work that was done or that had to be done. During the workshops this overview was created quite quickly when all team members were together.

Comparing with literature

A team with industrial designers and architects seems to be a good match to design for disassembly. That point of view taken into consideration the team forming is done in a similar way as SE management would recommend. Because the educational factor of the process not all specialists could participate in the team, because they would have come from other firms or schools, and they did not participate in this studio.

The VM approach considering functions is more focused on a bigger project, where several teams work on the same project with different functions. For this project it was not logical to create a team that would reflect in an objective way to the work done by other students, because it is an educational process. So again, the studio was not managed in a VM way.

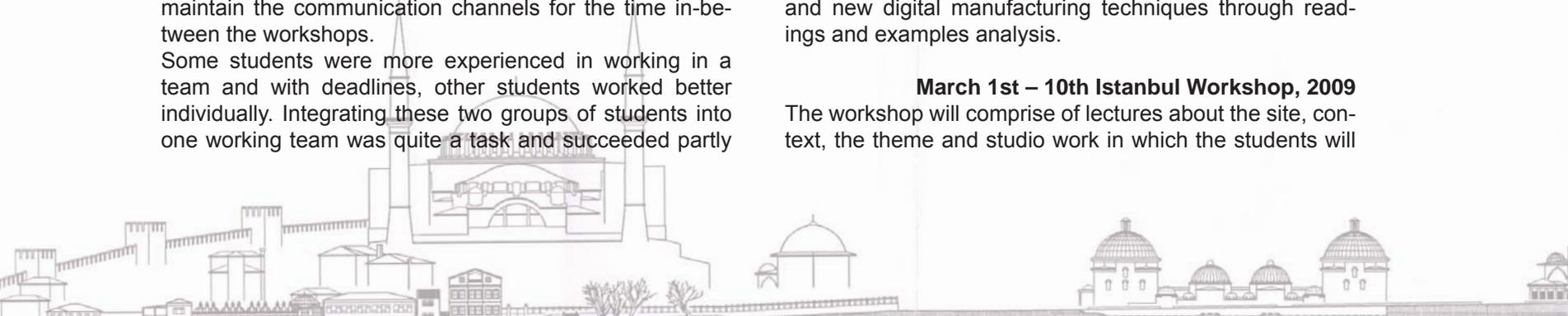
Phases

February 12th – March 1st 2009

Introduction to "Design for Disassembly" design process and new digital manufacturing techniques through readings and examples analysis.

March 1st – 10th Istanbul Workshop, 2009

The workshop will comprise of lectures about the site, context, the theme and studio work in which the students will





form teams and work on the first concept development of the pavilions. At the end of the workshop design proposals will be presented to the jury. The workshop will be organized by Yildiz Technical University and Istanbul Metropolitan Municipality.

March 11th - April 18th Pavilion designs development - Studio works

6 teams each composed of 6 students (2 from each school) will be formed. Group 1 and 2 will develop designs for summer pavilions. Group 3 and 4 will consider thermal conditions for the design of winter pavilions. Group 5 and 6 will work on central pavilion design. The teams will collaborate via Internet using ICT technologies.

April 19th- April 26th Sarajevo Workshop, Mid-term Review

Team members will meet in Sarajevo prior to the mid-term review and work on their designs together for the mid term review. The mid-term review will be hold at the end of the workshop. The workshop will be organized by University of Sarajevo Faculty of Architecture.

June 6th- June 10th Enschede Workshop, Final Presentation

Team members will meet in Enschede and work on their final presentations. The design works of the studio will be exhibited in CMS2009: CIB W115 International Conference on Construction Materials “Life Cycle Design of Buildings, Systems and Materials”. The workshop will be organized by University of Twente Faculty of Engineering Technology (IDS, 2009).

During the Studio

Most work was done during the workshops, outside of the workshops some students had to work on different projects

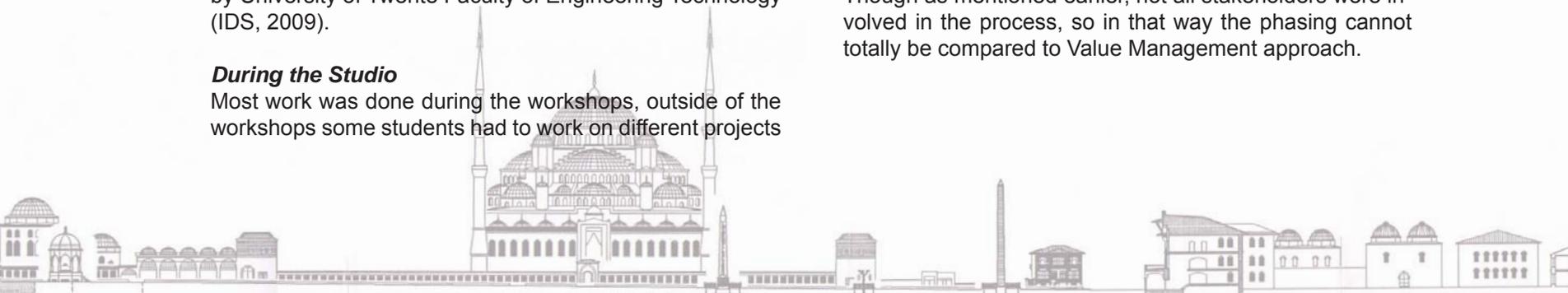
so their part of work came on a low profile. The book describes the phases from chapter 1 to 3, starting with an urban analysis, then conceptual design and concluding with the final design. The professors underlined the importance of transformability on three levels, urban, tissue and pavilion design. By doing this students were able to design according the principles of DfD.

Comparing with literature

The description of different phases according to the SE approach is quite the same as it worked in practice. Accept the level component of the description. The teams tried to finish parts of the design to be able continue and to have a basis, some teams were better in finishing and moving on than others. To give an image of the work done according to SE:

- Concept level, after the urban analysis concepts were generated for each part of the park.
- System level, the requirements of the system were analyzed by user scenarios and integrated into the design.
- Subsystem/Component level, the concept design was a basis to design the components and subsystems accordingly.

The phasing of VM can also be compared to the practice of the studio work. Though the implementation phase has not yet come to order. During the workshops information was gathered, there were creativity and innovation sessions and work was evaluated with the professors. Options were developed and actions were planned for the following work. Though as mentioned earlier, not all stakeholders were involved in the process, so in that way the phasing cannot totally be compared to Value Management approach.





Conclusion

It can be concluded that the studio work had quite some similarities with the system engineering approach. This approach has its roots in the manufacturing industry. DfD also tries to utilize the concept of this industry to design in a building environment.

The short evaluation showed that most goals and phases are obtained by the students and the work they show. It could be said that some teams have scored better on achieving these goals and filling in these phases which is part of the learning process at the universities.

Communication has not always been optimal. Mostly this was out of the range of the team members to solve, but it is essential for working in an international team to have the best communicable options available. For the next studio it is recommended to emphasize more on communication, for example at the last day of the first workshop. Agreeing on using a specific database to upload all files helps to show all team members the work done by a particular team member, the way this database is used can also be discussed on this last day. Also the software that will be used for the online meetings can be tested.

In the end it can be concluded that the studio was a success. The international aspect of the studio was a very nice experience and students learned how to work together with students from a different culture and country. The industrial designers and architecture students learned from each other key aspects of their domain.

June 2009
Mees Beeker

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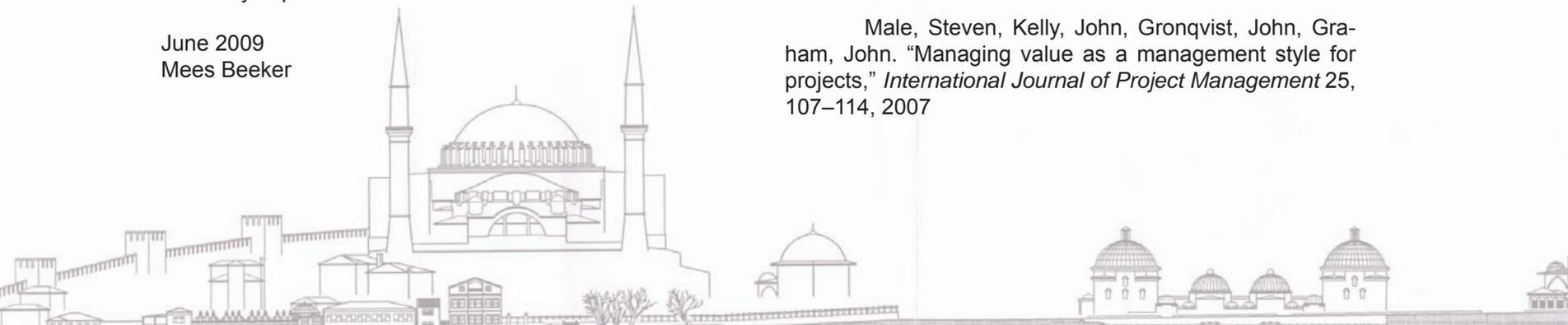
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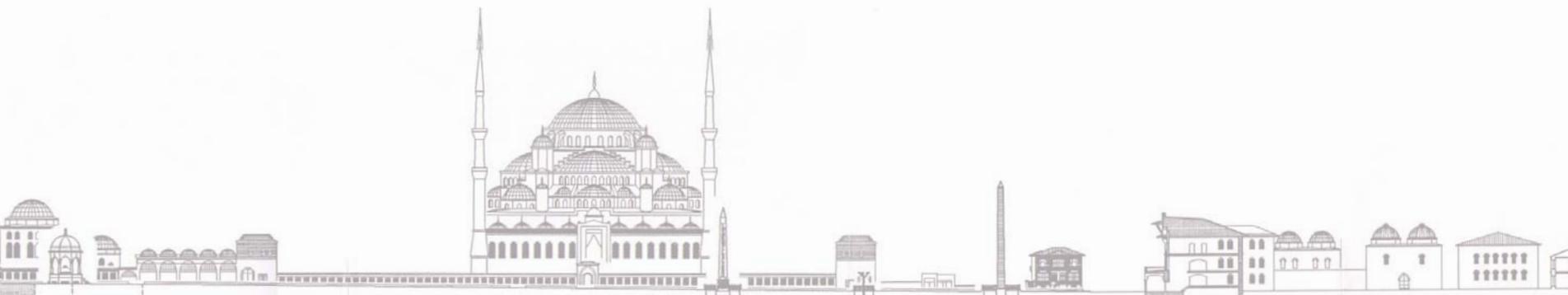
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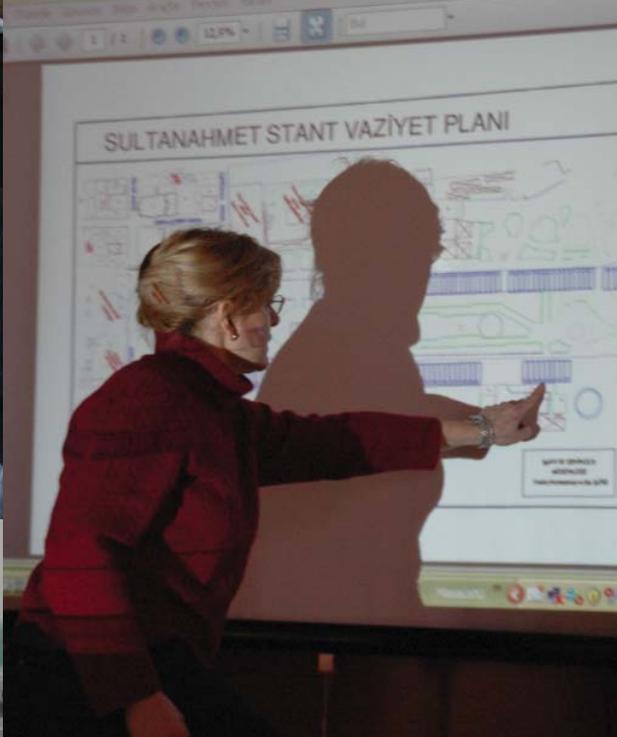


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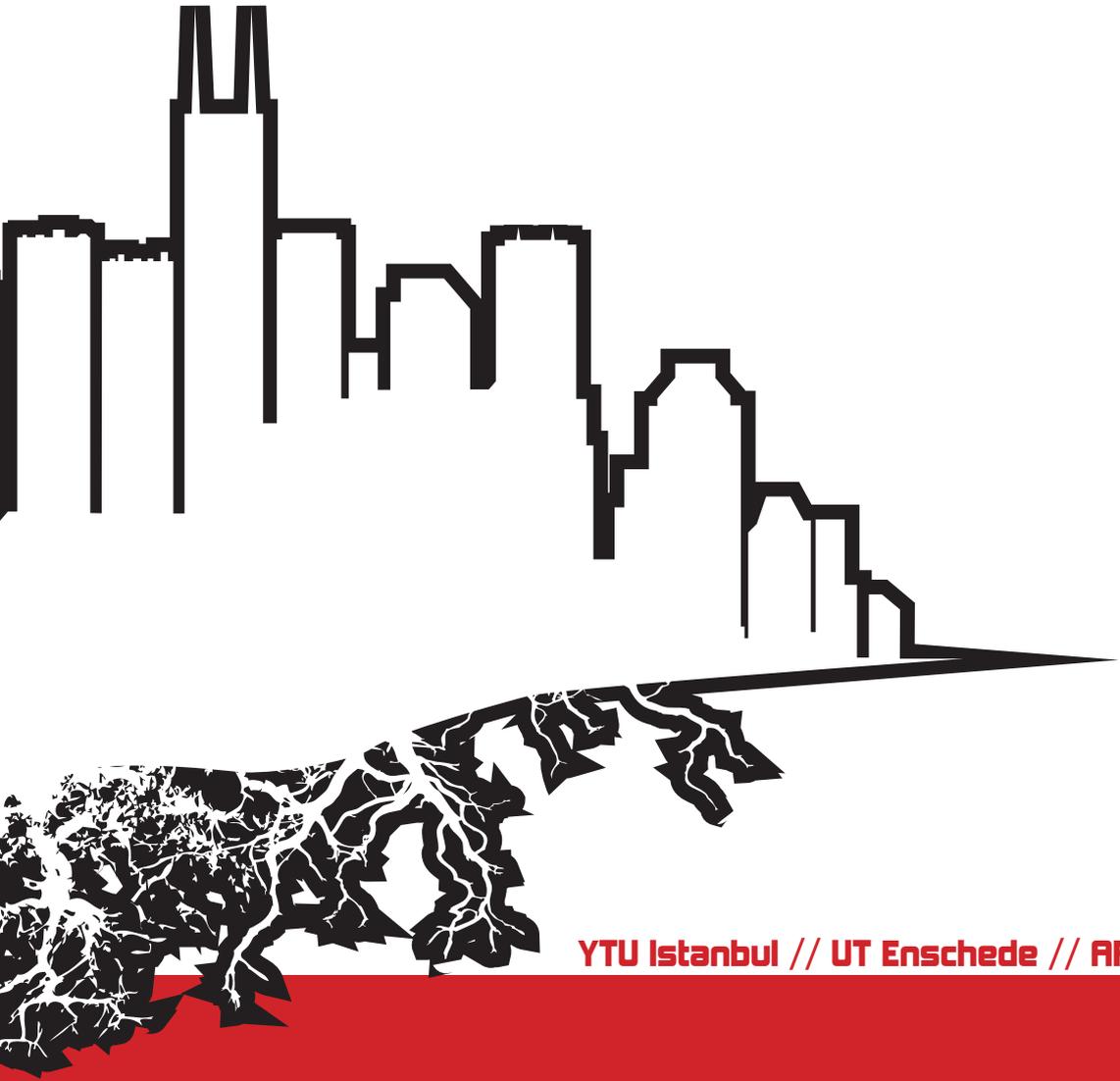
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