Analysis of the Structure and Design Relationship between Contemporary Extensions and Remodeled Masonry Buildings

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ABSTRACT

Old buildings are valuable in transferring the culture for further generations. They need to be sustained for future by renovating and converting. In the adapting process of these old buildings new extensions are required to create additional spaces because of the functional changes. In this process, qualities of the existing building should be preserved but it should not be forgotten that being respectful to the existing building does not mean to copy the same style.

Masonry structures bring some limitations while adding new extensions however these challenges make building unique in terms of identity. This research investigates the relationship between the existing building and its extension in terms of structural system and design approach. Extensions can be grouped in 5 categories: integrated, attached, inserted, wrapped and pierced. This categorization is done according to the location within the existing fabric.

This research focuses on the extensions to masonry buildings; however extensions to the other types of contemporary buildings are beyond the scope of this study. Besides, the research is limited to the public buildings such as cultural and commercial buildings from different countries. The data is collected through analysis of the buildings which take place in the literature and an empirical research. 20 case studies are selected randomly from the literature and categorized according to the location of the extension within the existing building. Secondly, effect of extension to the structure and the design approach has been examined. Lastly, an empirical

research has been done under the light of the analysis of Kadir Has University. This campus has been selected as the field study of the thesis. Finally, evaluations of the results have been discussed in the conclusion.

The study emphasizes the constraints that must be cared in the extension design and because of this it claims to be a reference for the designers working on existing fabric. Remodeling is a crucial issue since old buildings are aesthetic, cultural and economic resources. The main goal of the research is to raise the awareness of the issue and to create a base for the other researchers as a guideline to develop this study further.

Keywords: Remodeling, extension, masonry buildings, structural system, design approach

ÖZ

Eski binalar, kültürün gelecek nesillere aktarılması bakımından önemlidir. Bu binaların yenilenerek varlıklarının sürdürülebilmesi gerekir. Ancak binalarin uyum sürecinde fonksiyon değişiklerinden dolayı ek yapılar gerekmektedir. Bu süreçte mevcut yapının özelliklerinin korunması gerekirken, eskiye olan saygının mevcutu aynen kopyalamak olmadığı da unutulmamalıdır.

Yığma yapılar, yeni eklemeler bakımından yapıya bazı sınırlandırmalar getirir. Aynı zamanda bu ekler mevcut binayı kimlik bakımından özel kılar. Bu araştırma, yeni ve eskinin ilişkisini taşıyıcı sistem ve tasarım yaklaşımları bakımından sorgulamaktadır. Ek yapılar mevcut binadaki yeri bakımından iç içe geçen, bitiştirilen, içine yerleştirilen, sarmalanan ve delip geçen olarak 5 gruba ayrılmıştır.

Çalışmada yığma binalara yapılan eklere odaklanılmıştır; çağdaş binalara yapılan ekler çalışmanın dışındadır. Aynı zamanda, kültürel ve ticari bınalar gibi halka açık mekanlara eklenen yapılar olarak sınırlandırılmıştır. Veriler, kaynaklarda yer alan örneklerin analizi ve ampirik araştırma yoluyla toplanmıştır. 20 örnek seçilmiş, mevcut binadaki konumuna göre gruplanmış ve ekin mevcut yapıya taşıyıcı sistem ve tasarım yaklaşımları bakımından etkisi sorgulanmıştır. Son olarak ise analizler ışığında, ampirik bir araştırma yapılmıştır. Kadir Has Üniversitesi Cibali Kampüsü ampirik araştırma olarak incelenmiştir. Sonuç bölümünde ise bu analizlerin sonuçları ve bulgular tartışılmıştır.

Bu tez, ek yapı tasarımında dikkat edilmesi gereken hususları ortaya koymakta ve tasarımcılar ve araştırmacılar için bir kaynak oluşturmaktadır. Eski yığma binaların estetik, kültürel ve ekonomik bakımdan önemli kaynaklar oluşturmasından dolayı, yeniden modelleme önemli bir konudur. Araştırmanın esas amacı bu konu üzerinde farkındalık yaratmak ve gelecek araştırmalar için taban oluşturmaktır.

Anahtar Kelimeler: Yeniden modelleme, ek yapı, yığma yapı, taşıyıcı sistem, tasarım yaklaşımları

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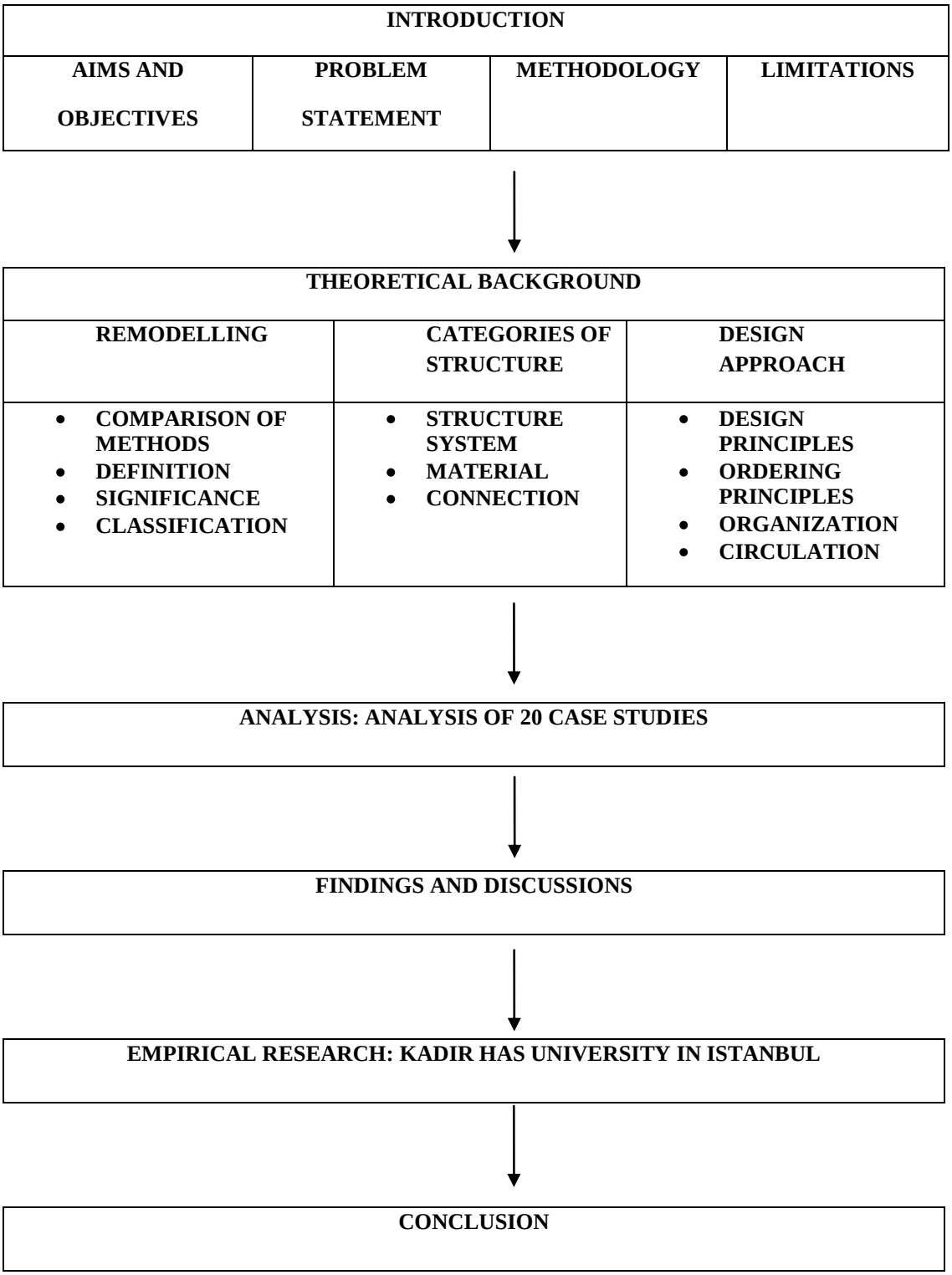
TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

STRUCTURE OF THE THESIS



Chapter 1

INTRODUCTION

1.1 Aims and Objectives of the Study

The design and construction of new buildings have started to decline at the end of the second millennium, especially in Central Europe. On the other hand; interventions to existing buildings are becoming more important (Cramer and Breitling, 2007). Awareness of ecological issues is growing and as Cramer and Breitling (2007) states: "The thoughtless demolition of old buildings is now perceived not only as an ecological waste but also the eradication of local identity, of cultural heritage and of socio-economic values."

This study focuses on contemporary additions in existing masonry structures. The purpose of this research is to examine the relationship between existing masonry buildings and contemporary additions in terms of structure system and design approach. Although researchers have devoted much attention to adapting buildings, they have little devoted attention to structure of extensions. Unlike previous studies that examine only refurbishment and restoration of old buildings, this study focuses on additional parts and searching their relationship in terms of structure system and design approach.

1.2 Problem Statement

Reused buildings are valuable in transferring the culture for further generations. They need to be sustained for future by renovating and converting. While adapting

the old buildings to new functions, new additions are required to create spaces. Different spaces can be created with the help of different structural systems. This process needs an understanding of the characteristics of the existing buildings in order to combine them with new structural systems and materials.

Combination of old and new is a problem when remodeling old buildings. This combination refers physical combination and combination in terms of design. Masonry buildings bring some limitations to extension design in terms of appropriateness of structural systems. The relation between structure system and design of extension is important for aesthetic concerns and sensitivity on conservation issues. The main goal of the study is to emphasize the constraints that must be cared in an extension design.

1.3 Methodology

This study is analysis and synthesis type of research with different type of extensions to existing masonry buildings. The data is collected through analysis of the examples in the literature and observation of an empirical study step by step:

- 20 examples of remodeled building are selected and categorized according to the connection between existing building and additional part as integrated, attached, inserted, wrapped and pierced.
- Secondly, structure system and materials are analyzed in each group and its relation has been searched. Lastly, effect of additional part has been examined in terms of design principles, ordering principles, circulation and organization.
- Then, an empirical research has been done under the light of the above analysis. Kadir Has University campus has been selected as the field study of this thesis. The case studies that have been analyzed in the previous chapter contain only one type of

extension. Almost every type of extension, which is identified, exists in the selected empirical study. The analysis method has been tested through empirical study and extensions in case studies have been compared with the Kadir Has University building.

- At the end, evaluation of the results had been made in the conclusion.

1.4 Limitations

Extensions can be classified according to the structure system of existing building as:

- Structures with traditional origin (masonry)
- Buildings with contemporary structural systems

It is divided into two because problem of adding an extension to each type creates different problems. This research focuses on the extensions to masonry buildings; however extensions to contemporary buildings are beyond the scope of this study. There are historic buildings as well as ordinary old buildings in the selected case studies.

The main goal of this study is to analyze extensions on masonry buildings after conversions. Thus, the research is limited to public buildings, mostly to the cultural and commercial, from different countries since there are other extensions to residential, transportation or gastronomic buildings.

Chapter 2

REMODELING

2.1 Remodeling in comparison to other similar concepts

The reuse of an existing building provides a link to our cultural heritage and historic memory; additionally it is important because it is environmental friendly. The amount of resources required for reuse is less than those necessary for redevelopment (Brooker and Stone, 2008).

Orbaşlı (2008) defines adaptive reuse as: "Most buildings will change their use through their life time; this will invariably necessitate changes to the internal layout and fabric of the old building. Making changes to a building to accommodate a new use is often a means of enabling the continued usefulness of a historic building. However, the appropriateness of the new use to the building fabric and its integrity does need to be considered."

Adaptation of a building is the process of transforming an existing building to accommodate new uses (Brooker and Stone, 2008). As Douglas (2006) determines: "It means any intervention go beyond maintenance to change its capacity, function or performance." It includes alteration, conversion, extension and refurbishment. There are various reasons of adapting buildings such as conservation and sustainability (Douglas, 2006).

Sustainability: Reuse of an old building is more ecological than erecting a new building. Razing and redevelopment activities spend more energy; and expose more waste than adapting the existing building (Douglas, 2006).

Conservation: The decisions to adapt an existing building rather than redevelopment can be influenced by the cultural and technical aspects. The historic and architectural significance of existing building can be satisfactory reasons why it should be sustained (Douglas, 2006).

Charter (1999), defines conservation as: "All the process of looking after a place so as to retain its cultural significance. It includes maintenance and may according to circumstances include preservation, restoration, renovation and adaptation and will commonly be combination of more than of those". There are a number of different methods used in the conservation of a structure and there are distinct differences between each approach:

Preservation: is to maintain a building in its existing form and condition and carrying out the repairs and maintenance work if it is necessary (Orbaşlı, 2008). It deals straightforwardly with cultural property. The main aim is to keep the existing building in its existing condition. Repairs must be undertaken as necessary in order to avoid from further decays (Craven, 2008).

Restoration: is the method of returning the existing building to its original condition with using material and techniques from the original period (Brooker and Stone, 2007). While returning the building back to its near original appearance, it is

important to provide adequate differentiation between old and new to avoid any misinterpretation in the future (Orbaşlı, 2008).

Renovation: is the process of renewing and updating the existing building (Brooker and Stone, 2007).

Adaptive reuse: "Most buildings will change their use through their life time; this will invariably necessitate changes to the internal layout and fabric of the old building. Making changes to a building to accommodate a new use is often a means of enabling the continued usefulness of a historic building. However, the appropriateness of the new use to the building fabric and its integrity does need to be considered" (Orbaşli, 2008).

Solutions that applied to the existing building should work with the existing building, instead of being against it. Sympathetic materials must be used where new additions are needed. Extension should be constructed either with the past techniques or in contrast to them. This choice is identified depending on the design. Modern technology should be used to preserve the existing building where traditional methods would be harmful (Latham, 2000).

As Orbaşlı (2008) states: "Conservation can involve anything from restoring gilded decorative moulding on the ceiling of a royal palace or remodeling a former factory into a new museum, to maintaining the character of a historic quarter while still allowing it to evolve as a place to live in."

As Brooker and Stone (2007) determine “Remodeling is the process of altering a building” however the most obvious change is the function, but other interventions can be made to the existing building such as its structure, circulation routes and its orientation. While some parts may be demolished, new extensions may be constructed (Brooker and Stone, 2007).

The old and new can be contrasting or harmonious but in each case the new addition have to be separated from the old ones with a different identity in order to see the difference between old and new. The relation between the historical buildings with the additions is so important that the new extensions have to be appropriate in terms of material selection, connection details and structure system. The new additions have to be separated from the old ones that can be removed any time without destroying the original building.

The forms are affected by the properties of materials from which they are made and which are influenced for structural element. The process of manufacturing materials into structural elements also play role in determining the forms of elements for which they are suitable. Masonry is composed from bringing together individual stones, bricks or blocks and sticking them together with the mortar to form columns, walls, arches or vaults. The range of different types of masonry is large due to the variety of types like brick, stone or concrete blocks (Macdonald, 1994).

The fact that masonry structures are composed of very small basic units makes their construction relatively straightforward. Subject to the structural constraints, complex geometries can be produced relatively easily, without the need for sophisticated techniques and very large structures can be built with the help of these simple means.

Other attributes of masonry type materials are that they are durable and can be left exposed in both the interiors and exteriors of buildings. They are also, in most location, available locally in some form and do not require to be transported over long distances. In other words it is an environment friendly material the use of which must be expected to increase in the future (Macdonald, 1994).

Many high-tech structures are being constructed with contemporary construction techniques and selection of materials, proposing sustainable design but in the long term, this is not sustainable. Old buildings are important resources at a time of increasing environmental consciousness and with necessary maintenance, can continue to be useful for a very long time (Orbaşlı, 2008). As Jodidio (2007) states: "Giving new life to old stones and wood is a worthy challenge rather than designing new buildings".

Despite these positive effects mentioned above, masonry structures have some negative effects to the design of the buildings. As structural actions it works as a whole and makes impossible to take some parts out in the remodeling process so different solution is required to be produced. Combination of old and new is a challenging process in masonry buildings, which is analyzed in different categories in the next part.

2.2 Definition of Remodeling

Remodeling is one of the methods of building conservation. Different methods used in the conservation of an existing building should be distinguished since there are different approaches to the problem (Brooker and Stone, 2004).

Douglas (2006) states that:”Remodeling is a North American term analogous to adaptation. It essentially means to make new or restore to former or other state or use.”

Working in the existing fabric has become an economic and ecological issue. It has stopped to be only a problem of preserving historical buildings. Resource and pollution issues are increasing because of decreasing population numbers in the industrialized nation; as a result, working in existing fabric, remodeling and restoring old buildings for future use, have become the order of the day. 40 percent of construction in Central Europe is conversion of old buildings which will go on to become more important, instead of destroying more green spaces and resources, accounting for an increasing percentage of the total building volume (Schittich, 2003).

Building in the existing fabric means reusing historically valuable structures, as well as ordinary buildings. The method for the task ranges from restoration to a creative conversion or from a simple refurbishment to a functional and aesthetic intervention for an ecological upgrade (Schittich, 2003).

As the simple reason, conversion is a cheaper and less complicated process than constructing a new building. Ordinary buildings needed to be preserved, which are plain, ordinary, low value including some run down buildings. The new interest in adaptive reuse makes unknown buildings transformed into major landmarks with some contemporary extensions (Powell, 1999). Saving old buildings is no longer enough since the aim is transformation rather than preservation, as Powell (1999)

indicates: “An architectural transformation approach to creating new form out of old fabric”.

The remodeling of an existing structure is not new since buildings have been adapted for new uses in the history. The Roman Arena in France is converted into residence in the middle ages and become a small town. People built houses in the performance space and lived in the massive arches of the structure. The Baths of Diocletian in Rome were converted into a church by Michelangelo and the Great Mosque in Cordova was remodeled by inserting a new church directly in the middle of its structure (Brooker and Stone, 2004).

Designers preferred to erect new buildings and focused all their energies on innovation especially during the classic modern era and gave less importance to old buildings. This idea has changed today as Schittich (2003) states: “Working with the given fabric, which imposes necessary constraints on the designer, is one of the most creative and fascinating tasks in architecture.”

Carlo Scarpa’s refurbishment of the medieval Castelvecchio in Verona (1956- 1964) was considered the benchmark for all creative conversions (Figure 1). The principle that Scarpa used in the remodeling was distinct separation through contrasting materials. His approach has not lost the validity even today and continued to be repeated in the historical buildings with only one difference that the limits of the interventions to the historical buildings is becoming blurred, where the designers interpret the existing fabrics in a more creative way and develop it further (Schittich, 2003).

Castelvecchio in Verona
by Carlo Scarpa
View from the top (URL1, 2011)

Castelvecchio in Verona
by Carlo Scarpa
View from the new bridge(URL1, 2011)

Figure 1. Remodeled castle which considered the benchmark of all conversions

Fiat factory in Turin, which was converted to Cultural and Business Center, is one of the successful approaches of the creative conversions (Figure 2). Renzo Piano's approach was to leave the old building untouched from the outside and to characterize the interior by a seamless merging between old and new, with the minimized details.

Cultural and Business Centre in Turin (Schittich, 2003)

Figure 2. Remodeled factory

On the other hand, Gunther Domenig has inserted a piercing bridge into the massive old building which is the Documentation Center in Nuremberg, achieving a practical use of the old Nazi Rally building (Figure 3). Although its negative historical

heritage, it is an important historic building that should be preserved (Schittich, 2003).

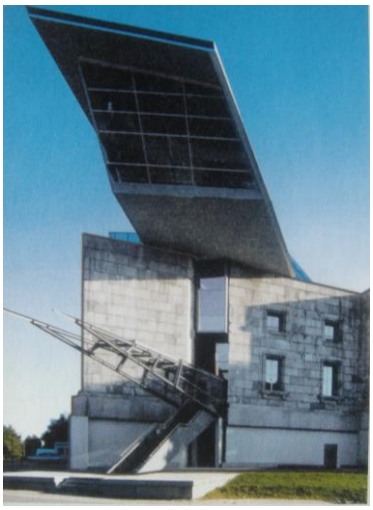
	
Documentation Center in Nuremberg Exterior view (Brooker and Stone, 2007)	Documentation Center in Nuremberg View from the bridge (Schittich, 2003)

Figure 3. Inserted piercing bridge into the massive old building

2.3 The significance of the remodeling

Re-addressing the meaning and the value of the old building is a difficult question when remodeling a building. The relationship between the existing and a new addition is variable according to three constraints: the cultural values, economics of the project and the approach of the designer. Out of the three, economic constraint is the most important one. New construction uses enormous amount of energy when compared with remodeling, which is saving energy (Brooker and Stone, 2004).

As Brooker and Stone (2004) indicates: “In Europe over the last few years, the architectural and the national press have devoted huge amounts of coverage to a series of massive remodeling projects”. The Tate Modern in London, a gallery placed conversion from a power station, The Baltic Art Factory in England, situated within a

flour mill (Figure 4) and the re-roofing of the great court in the British Museum was the three distinctive remodeling projects of the UK.

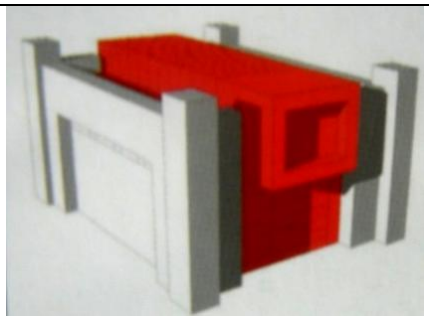
	
Baltic Art Factory in England Exterior view (Brooker and Stone, 2007)	Baltic Art Factory in England 3D Model (Brooker and Stone, 2007)

Figure 4. Extension situated within a four mill

The Grand Louvre pyramid (Figure 5) and courtyard and the iconic glass dome of the Norman Foster located on the German Parliament building are the significant examples of remodeled buildings (Brooker and Stone, 2004). Both become major landmarks of the city rather than ordinary historic monuments after conversion and additions.

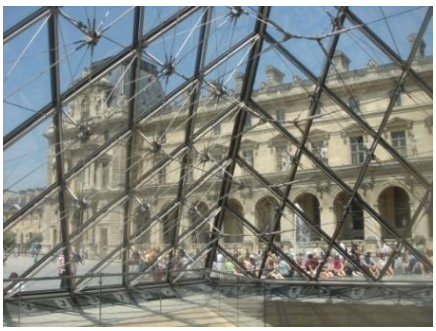
	
Louvre Museum in Paris View from the courtyard (Photo: Author)	Louvre Museum in Paris Interior view (Photo: Author)

Figure 5. Significant example of remodeled buildings

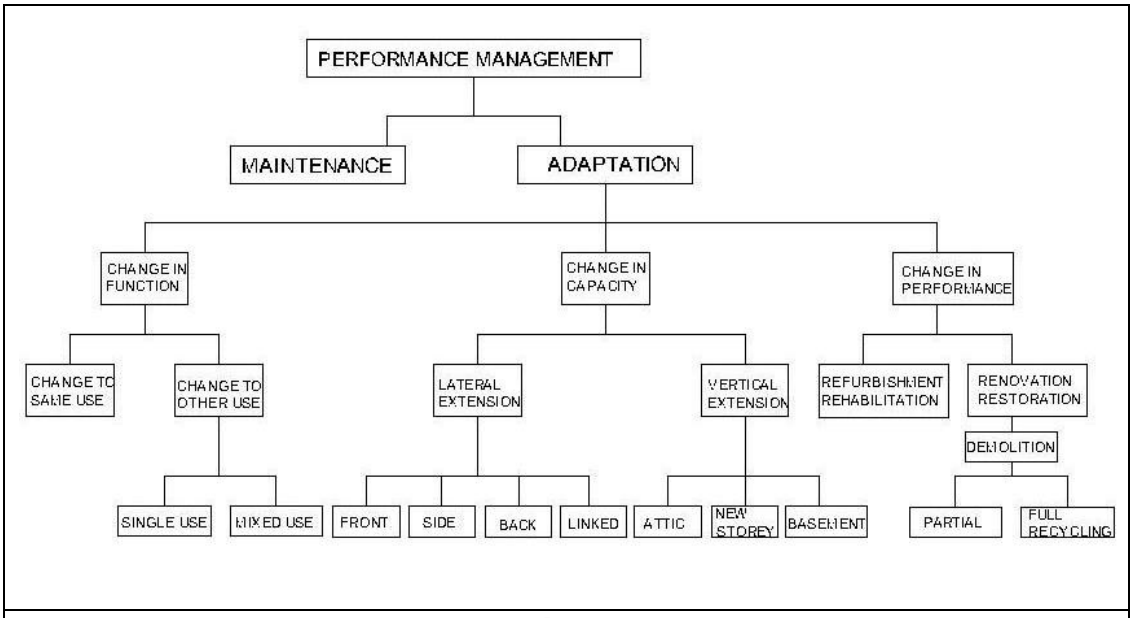
2.4 Classification of extensions in remodeled buildings according to the locations

As Douglas (2006) states: “An extension is to expand the capacity or volume of a building, whether vertically by increasing the height/depth; or laterally by expanding the plan area”. Extensions can be just as complicated as a new building. Beside the design limitations of working within an existing structure, there are also issues such as planning, legal and structural issues that should be taken into account. Circulation, access, structural integrity and choice of materials should be considered (Mornement, 2007).

In an extension design, ambition and an enthusiasm for experimentation can be motivational forces for designers; it improves usability and value of the existing building. It is hard to define universal characteristics of a good extension and with such a variety of types and scales. But essentially a successful extension should revitalize and enrich the existing building. It is not just the new spaces or adjacent rooms attached to the existing. It should be the part of the whole composition rather than a single project. Contemporary ideas and materials can be applied to an existing building as an opportunity in extension design. More recent buildings can also be improved with the addition of an extension as well as historic buildings. Extensions are classified as up and under, back and front, sideways, outdoors and innovative additions (Mornement, 2007).

Performance management is divided into two as maintenance and adaptation. An adaptation to a building can be analyzed in three parts: change in function, change in

capacity and change in performance (Figure 6) so according to the table, extensions are classified as lateral and vertical.



(Douglas, 2006)

Figure 6. Classification of performance management

According to the Günçe (2007), addition can be classified as horizontal, vertical, oblique and combined. In this study extensions are classified according to the location of the addition within the context of existing building as integrated, attached, inserted, wrapped and pierced. Ching's (2002) classification of space organization creates a base for this research however it is developed and applied for the relationship between existing building and additional space.

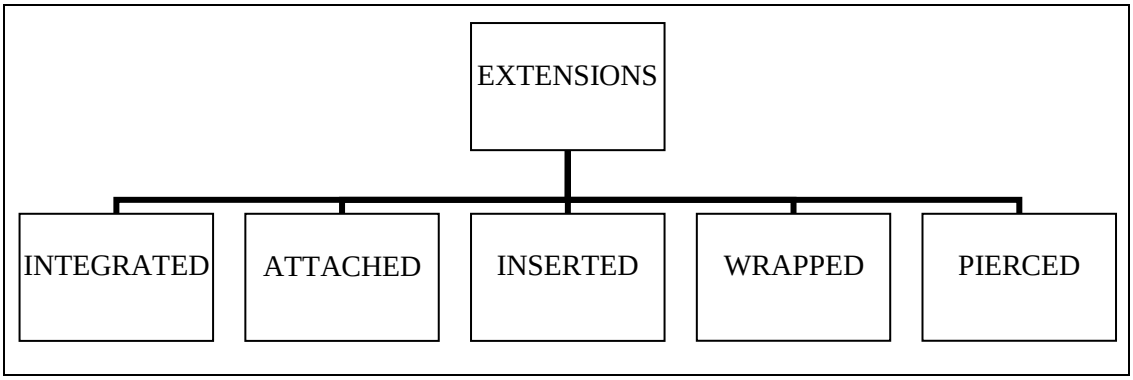
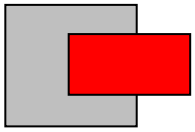
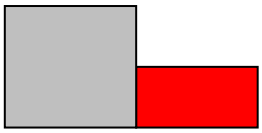
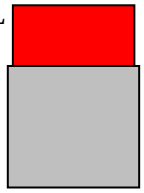
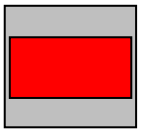
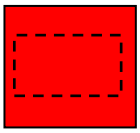
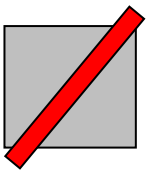


Figure 7. Classification of addition according to the location in the existing building

Table 1. Represents properties of extension types

CLASSIFICATION OF EXTENSIONS ACCORDING TO THE RELATIONSHIP BETWEEN OLD AND NEW		
TYPE	**RELATIONSHIP**	**PROPERTIES**
INTEGRATED		• Reflection to the outside • Can be seen from elevation • Inserted inside but combined • Annex punched out from openings or roof.
ATTACHED	**HORIZONTAL** 	• Added horizontally next to the existing building • No integration with the existing • Free standing structure • Complete addition can be seen from outside
	VERTICAL 	• Added vertically next to the existing building • Integration with the existing • Complete addition can be seen from outside
INSERTED		• Interior scale projects • No reflection to the elevation • Defines space within space
WRAPPED		• Existing building is surrounded like an envelope • Provides unity between different parts of the existing buildings • Old structure cannot be seen from outside
PIERCED		• Linear extension • Reflection to the outside • Inserted inside but combined • Annex punched out from openings or roof.
LEGEND	 EXISTING	 ADDITION

2.4.1 Integrated with existing building

In the process of remodeling the new function of the building may not fit with the existing space and new spaces is needed to be defined so new structures are added to the old buildings. In this category the additional part is integrated with the existing building. The reflection of the addition can be perceived from the outside of the

building as contrast with the third category. Some parts of the addition are punched out from the openings or roof so it can be perceived from outside of the building. It is again inserted inside but there is integration of old and new.

The distinction between new and old may be achieved using a different form, orientation or size. The size of the addition should be smaller than the existing, other wise the old building begins to lose its impact (Ching, 2002).

The other method of creating distinction is to use different material and structure system while repeating the language of the existing element but it should be taken into consideration that when combining the new and the old, existing building should not be crumbled. It is the most challenging type of the extension since structural integrity of the old building should not be exploited to support the contemporary insertion (Brooker and Stone, 2007). As shown in Figure 8, existing building has already been preserved and new additions have punched out from roof and openings.

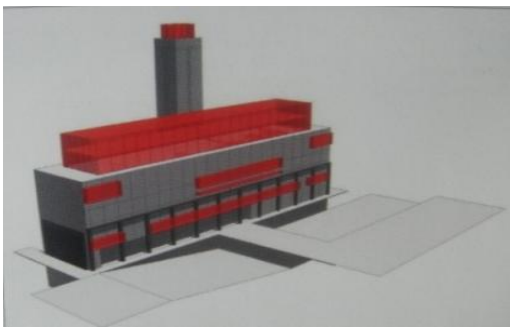
	
Tate Modern in London Exterior view (Brooker and Stone, 2007)	Tate Modern in London 3D Model (Brooker and Stone, 2007)

Figure 8. Example of integrated type of extension

2.4.2 Attached to the existing building

The second type is an addition which new structure is attached to the existing building horizontally or vertically without any combination or integration. It can be attached next to the building with a freestanding structure (Figure 9) or on top of the building with structural integrations. Complete addition can be perceived from the outside of the building.

It is mostly used relationship between new and old. There is exact definition of two spaces with different styles, linked functionally. The new addition may also differ in form from the existing building in order to strength its image as a freestanding volume. The contrast of existing and addition creates differences in terms of function (Ching, 2002). The new addition can be different also with the structural system or material while repeating the similar form and proportion of the exiting space.

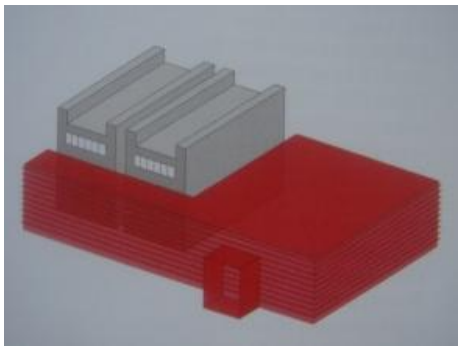
	
Public Library Extension, Germany Exterior view (Brooker and Stone, 2004)	Public Library Extension, Germany 3D Model (Brooker and Stone, 2004)

Figure 9. Example of attached type of extension

2.4.3 Inserted inside the existing building

Existing space cannot fit to the new function and new additional spaces needed to be defined. A single striking element is designed to be inserted into the existing space

(Brooker and Stone, 2007). Inserted type of extension is mostly seen in interior architecture scale projects in which new structures added inside the existing building, mostly defines space within a space. Very close relationships between the existing buildings are established in inserted interiors. The new addition may contain a number of different functional and servicing activities that can easily be separated from the main activity of the building including circulation, meeting rooms or larger activities such as lecture theatres and conference halls which private spaces is needed in the building (Brooker and Stone, 2007). Proposed addition can be a plane defines floors in the building (Figure 10) or can be a volumetric object that defines subspaces with the existing building which will be discussed in the following chapters as design approach. The extension cannot be perceived from outside since there is no reflection to the façade unlike the first type as shown in Figure 10. New floors were added inside the old building with contemporary structure system and material but it cannot be perceived from outside. In this type of relationship, addition should be smaller than the existing building (Ching, 2002). Ching (2002) states that: "To avoid this situation, the inserted space may share the form of the enveloping shape but be oriented in a different manner".

	
Borusan Cultural Center in Istanbul Exterior view (URL2, 2011)	Borusan Cultural Center in Istanbul Interior view (URL2, 2011)

Figure 10. Example of inserted type of extension

2.4.4 Wrapping the existing building

As Ching (2002) states: “In this type of relationship, the larger enveloping space serves as a three dimensional field for the existing space”. Instead of razing an old building and erecting a new one, old vacant buildings are reused. An addition is needed to wrap the existing building like an envelope to achieve unity between old and new building masses. As shown in Figure 11, old structure can not be perceived from the outside of the building so it creates a surprising effect for the people when they enter inside the building. In the third category the extension can not be perceived from the outside since there is no reflection, however in this category old building can not be perceived from outside as a contrast.

Wrapping additions covers the existing building as a shell that is hidden or camouflaged. A plane is designed to cover the surfaces of the original building which gives the appearance of a completely new building. The contemporary addition has qualities that are independent of the original building since its material, structural and physical characteristics are distinctive (Brooker and Stone, 2007).

Insurance building in Munich
(Schittich, 2003)

Figure 11. Example of wrapping type extension

2.5.5 Piercing the existing building

In some cases existing organizations of the buildings do not match with the requirements of proposed functions so circulation and organization need to be changed with the help of an addition. As mentioned in the inserted type, the new addition may contain a number of different functional and servicing activities that can easily be separated from the main activity of the building including circulation, meeting rooms or larger activities such as lecture theatres and conference halls which private spaces is needed in the building (Brooker and Stone, 2007). In the last type, a linear extension is pierced through the building providing a circulation route inside the building. It is commonly used in museum conversion. In Archbishopric Museum, bridge addition is placed in the museum which creates a circulation route for the visitors (Figure 12).

The existing building effects the new arrangement and the place of the inserted element but it does not change the structure or size of the original building. It just reacts to it (Brooker and Stone, 2007). It has similarities with the integrated category because again some parts of the addition punched out from the openings or roof so it can be perceive that there is new addition from the elevations.

	
Archbishopric Museum in Hamar Interior view (Brooker and Stone, 2007)	Archbishopric Museum in Hamar View From the courtyard (Brooker and Stone, 2007)

Figure 12. Example of pierced type of extension

Concept of remodeling has been introduced and compared with the other concept of conservation in this chapter. Additionally, extensions have been classified according to the location in the existing building.

In the following chapter, structure has been defined and categorized. Relationship between structure and material has also introduced.

Chapter 3

CATEGORIES OF STRUCTURES

3.1 Definition of the Concept of Structure

From the beginning of their existence, human beings had been interested in structure systems consciously or not. Like every living organism, people need to resist wind, earthquake and gravity forces. Thus, shelters were needed to protect human beings from natural factors like rain, snow, storm and sun as well as attacks of other human beings and animals. In this sense, the logic of the contemporary structure systems is not different from the structure of primitive shelters which were built instinctively in the ancient periods (Türkçü, 2009).

Simply, an architectural structure is the part of the building which withstands the loads that are imposed on it. A building can be defined as an envelope which encloses and divides space in order to create shelters for human beings. Walls, floors and the roof of the building are the surfaces of the envelope which are divided to resist different types of loadings. External surfaces are subjected to the climatic loads of snow, wind and rain; however floors are exposed to their own weight and the gravitational loads of the residents. Structure is provided to prevent the building from deformation and collapse of the building. It supplies the strength and rigidity to the building which is needed to prevent a building from collapsing (Macdonald, 1994).

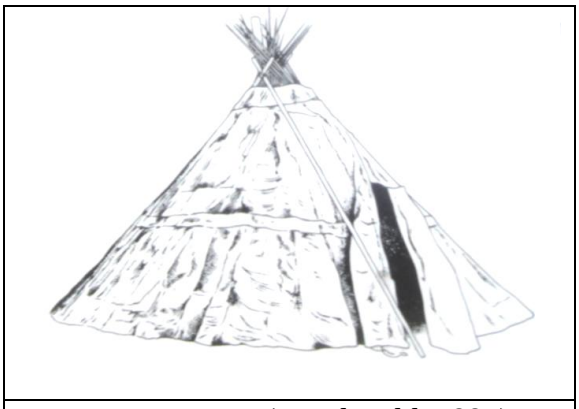
Structural and nonstructural parts of the building can be integrated in some cases so the location of the structure might not be visible. Igloos, which are the early

examples of dome structures, can be shown as an example of these type of structures. Ice blocks form a self supporting protecting dome acting as structure and enclosure elements as well.

Igloo (Macdonald, 1994)

Figure 13. Example of the integrated structures

On the other hand, in some cases structural and enclosing elements are separated. Primitive tents are the examples of separated structures in which protecting envelope is a skin supported with timber sticks. The envelope is nonstructural and the sticks are structural which they are separated completely (Macdonald, 1994).



Primitive tents (Macdonald, 1994)

Figure 14. Example of separated structures

There are various types of structures as mentioned which is classified and defined below.

3.2 Classification of the Structural Systems

Basically, there are two types of structure systems: traditional and contemporary structures, which produce different types of space. Masonry can be defined as structures with traditional origin which are thick heavy structures with a limited span that tend to create small spaces while contemporary structures usually allow larger spans and create free spaces (Brooker and Stone, 2004).

Masonry structures are built up layer by layer from the ground. The length of the element that spans across the wall limits the size of the space. The choice of the material is limited as well. For traditional structures stone and brick were the only available materials. Changes that are made to these types of structures have to respect the integrity of the structure (Brooker and Stone, 2004). Masonry structures can be categorized as arch, vault, dome and masonry wall.

Contemporary structures are structure systems which are developed with the invention of concrete and steel as new structural materials. The 21st century has brought Libeskind's fractals and Gehry's computer generated buildings which have quit the traditional structures. The contemporary structures create an uninterrupted free plan. The walls and the floors are separated from the structure so choice of their position is almost unlimited. The most appropriate materials can be used with various combinations of metal, timber, glass, stone, concrete and plastic (Brooker and Stone, 2004). Different type of structures can be developed with the use of innovation technologies which can be divided into four as: form active, vector active, section active and surface active as represented in Table 2.

Table 2. Classification of structure systems as traditional and contemporary

CLASSIFICATION OF STRUCTURAL SYSTEMS				
STRUCTURES WITH TRADITIONAL ORIGIN *	**CONTEMPORARY STRUCTURAL SYSTEMS ****			
MASONRY	**FORM ACTIVE**	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE ACTIVE**
MASONRY WALL	CABLE	TRUSS	FRAME	SHELL
ARCH	TENT	SPACE FRAME	SHEAR WALL	FOLDED PLATE
VAULT	PNEUMATIC	GEODESIC DOME	SLAB	
DOME	ARCH			
* Adapted from (FEILDEN, 2003)				
** Adapted from (ENGEL, 1997)				

3.2.1 Structures with Traditional Origin

Structures with traditional origin refer to the structures which are stone, brick, mud brick and timber, because these were the only available materials before the development of concrete, steel and the contemporary structure systems. They comprise masonry as a structure system. There are also contemporary applications of masonry structures, which can be radically different than the traditional masonry application.

An assemble age of masonry units in a specified pattern and joined together with mortar is called masonry structure (Ramm, 2003). Masonry structures consist of elements which are put on top of each other and integrated with an adhesive. Steel or various bindings can be used as addition to adhesive to support the elements. Masonry units can be stone, brick or mud brick. Walls, which work as a whole, are used both as structural elements and as borders of the spaces. It has high durability against compression but its low resistance in tension. It consists of vertical walls.

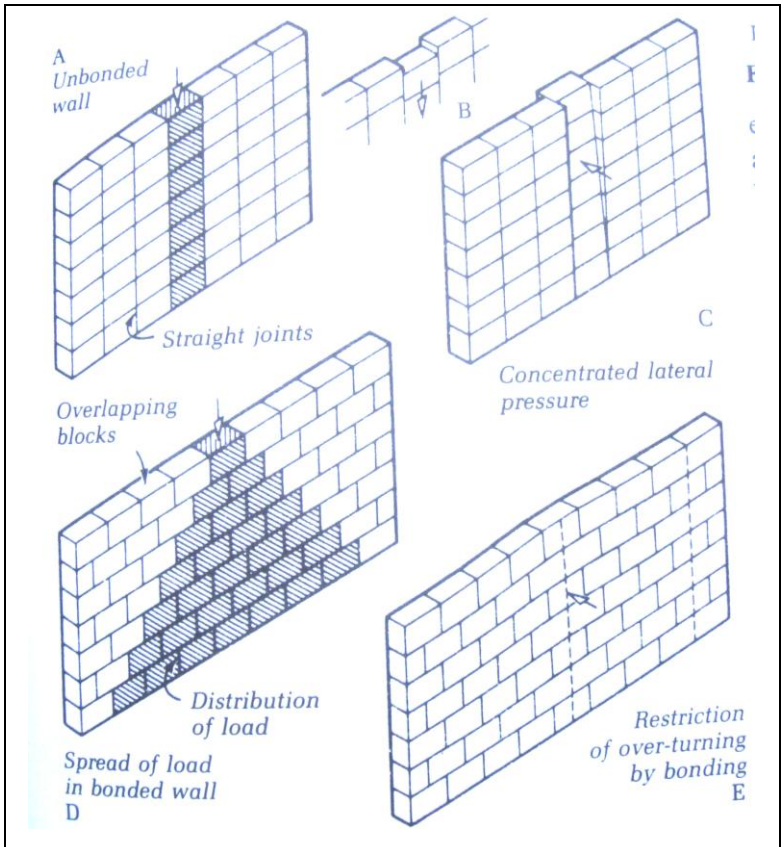
Masonry walls also have a limited capacity to support horizontal loads and bending moments (Ramm, 2003). In order to cover roof of the masonry buildings another material, such as timber, which is durable against tension force or a system such as dome, is needed. The developments of the masonry arch, vault and dome has started with the search for creating a cover in which works with compression force (Türkçü, 2009). Masonry is used for components subjected to compressive loading: walls, columns, arches, vaults and dome (Ramm, 2003). Basically, masonry structures can be divided into three as linear (arch), planar (masonry wall) and volumetric (vault and dome) (Türkçü, 2009).

3.2.1.1 Masonry wall

Masonry wall is constructed from single blocks of materials such as brick, concrete block or stone in horizontal direction. Masonry construction may be in the form of either a single thickness of wall known as solid wall or two thicknesses with a space between known as cavity wall. It is composed of rectangular units built up in horizontal layers called courses (Foster, 1994).

As Foster (1994) states: "The mortar is used as binding material which is a mixture of sand with cement or lime. Its function is to bind the walling units together, distribute pressures from unit to unit and to fill the joints between units". Masonry construction is one of the cheapest structures for buildings which are up to five storeys (height is limited in the earthquake zones). Thickness of the wall is determined by building regulations and calculations (Foster, 1994). It is minimum 40 cm for stone and minimum 20cm for brick for load bearing walls. It depends on the height and width of the wall in the mudbrick, generally height and width determines the thickness.

A load applied to a block at the top of the wall will be transferred to those immediately below it and thus to the foundation the pressure being concentrated on a narrow band (A). This concentration of pressure could lead to unequal settlement in the wall due to greater consolidation of the mortar (B). The wall should undergo lateral pressure at one point as indicated in (C) however the blocks are laid to overlap those in the courses below as shown in (D). Under the application of lateral pressure at one point the tendency of the wall to overturn at that point will be restricted by the masonry on each side to which it is connected by overlapping blocks (E) (Foster, 1994). A, B and C is dangerous solutions for bonding. D and E represent the acceptable solutions.

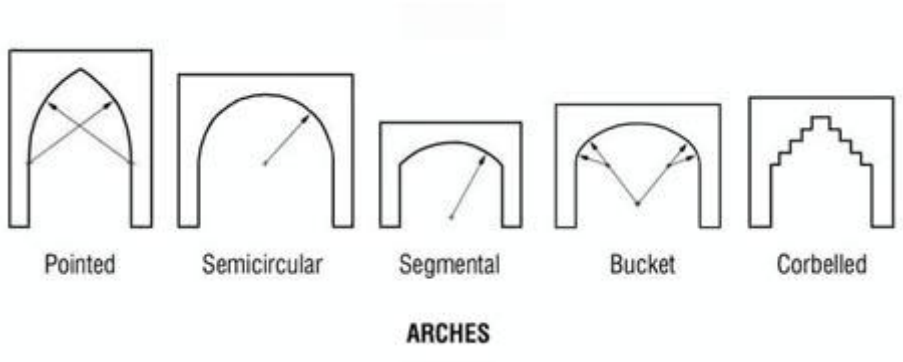


Bonding of masonry (Foster, 1994)

Figure 15. Load distribution of masonry walls

3.2.1.2 Arch

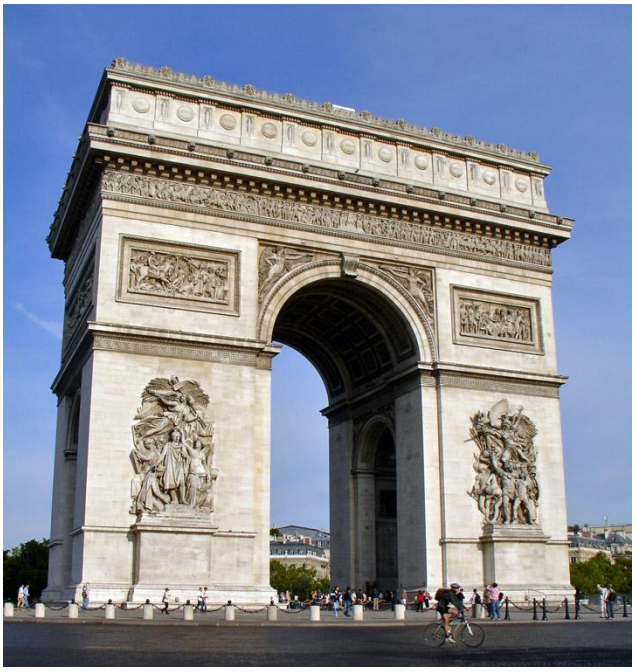
Ramon (2003) defines that: "Arch is a rigid span, curving upward between two points of support". It contains small compression units made up of stone or brick which is developed to span large distances. A stone arch can span 8-20m.



(URL3, 2011)

Figure 16. Types of arches

It consists of wedged shaped blocks which supported each other over the opening between the supports. The wedged shaped blocks are called voussoirs. The center voussoir is the key which is the last voussoir and locks the arch in position since arch is not self-supporting until the key stone has been put (Foster, 1994). According to the shape arches are classified as pointed, segmental, semi-circular, bucket and corbelled as shown in Figure 16.

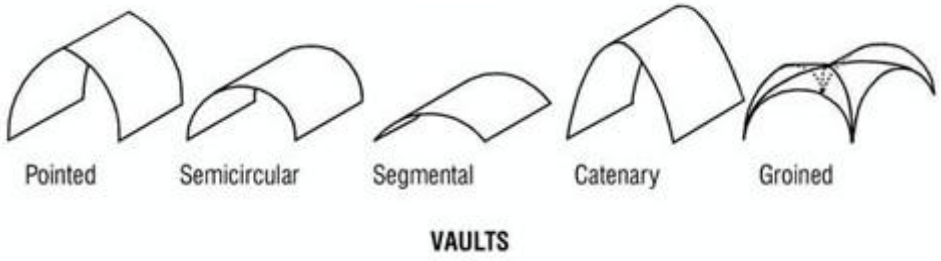


Arc de Triumph in Paris
(URL4, 2011)

Figure 17. Example of masonry arch

3.2.1.3 Vault

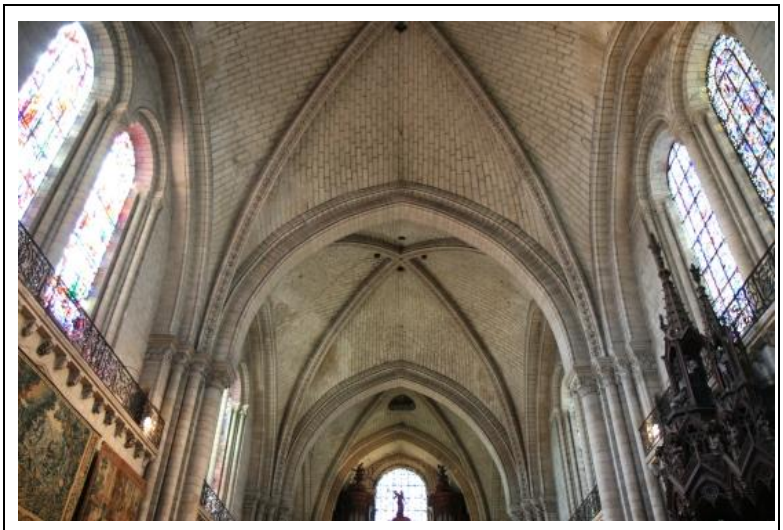
A vault is an arch-shaped structure. Masonry vaults consist of voussoirs like the stones of an arch which works with compression of the neighboring pieces. A temporary structure is needed to support the vault until the construction is completed since the vault is not self-supporting until the last stone is putted in place (Ramon, 2003). A stone vault can span up to 20m.



(URL3, 2011)

Figure 18. Types of vault

Since the vault structure works with compression, it has a tendency to buckle and its strength can be increased by using strong, heavy walls to support the arch or by using buttresses. Different types of vault can be designed which is classified as pointed, semicircular, segmental, catenaries and groined as shown in Figure 18.



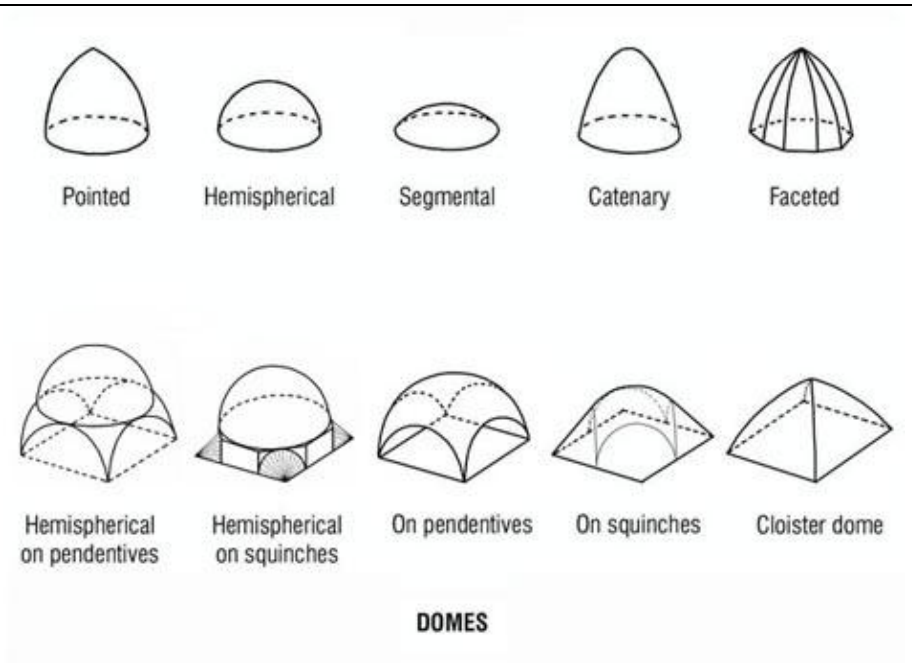
Romanesque Church, Interior view
(URL5, 2011)

Figure 19. Example of masonry vault

3.2.1.4 Dome

A spherical vault located on a circular base wall is called as dome (Ramon, 2003). It was mostly used in religious buildings in order to create a center of interest and to achieve a symmetrical organization.

They have same properties with the vaults however their forms are different. There are types of dome which are shown in Figure 20.



(URL3, 2011)

Figure 20. Types of dome

Pantheon, Rome
(URL6, 2011)

Figure 21. Example of masonry dome

3.2.2 Contemporary Structure Systems

After development of different materials, new structure systems have began to develop. Since the masonry structures limit the design in terms of form, different structure systems developed by the help of innovative technologies and they gave flexibility to design.

Contemporary structure systems refer to the structures which developed after developments of iron and reinforced concrete.

3.2.2.1 Form active structures

Structures acting mainly through material form and adjust to the forces is called form active structures. Its basic components are subjugated to one kind of stress which is either compression or tension.

Form active structures are systems which are usually flexible and non-rigid matter. Direction of forces is effected through particular form design and form stabilization. They are distinctive in redirecting external forces. For instance, arch works with compression suspension cable works with tension. Vertical hanger cables are the processors of form active structures that carry the load directly to the point of suspension. Prototypes of these structures are vertical column and vertical hanger cable which transmit loads either through compression or tension.

Form active structure systems develop at their ends horizontal forces which the response to these forces creates a major problem in design of these structures. The load bearing mechanism of form active structure systems depends on the form of the

material. Deflection from the form stakes the functioning of the system or requires additional mechanism that recompenses the deflection.

Form active structures especially arch and suspension cable are being stressed by simple stresses such as tension or compression so they are most economical system of spanning space with regard to weight/span ratio. They are suitable structure systems for achieving long spans and forming large spaces because of their identity with the natural flow of forces (Engel, 1997).

Cable:

Cables are structures that many cables come together with different geometries to form surfaces. Its form is a negative curvature (Figure 22). The use of this structure has started at the 19th century after industrial revolution with the design of suspension bridges and has developed with the innovative technologies. It is mostly used in bridge designs and wide span roofs. It usually spans 50-200m in buildings without any vertical support however suspension bridges span thousands of meters. The most important characteristic of cables is the type of the force. It works with the tension force only. The advantages of the structure are its lightness, strength in tension and durability against torsion (Türkçü, 2009).

The word cable refers to the linear elements as steel cables or rods that are the basic elements of the whole structure but mostly cable is used with other supporting elements like pillar, arch, ring, curtain wall or truss systems. Cable roof is supported with two pillars which transfer the load to the ground (Figure 22).

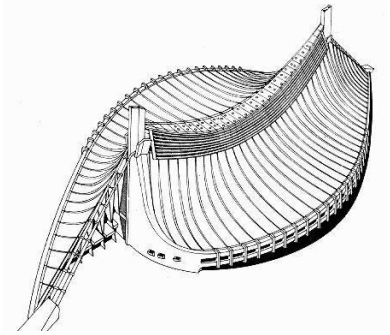
	
Tokyo Olympic Arena Exterior view (URL7, 2011)	Tokyo Olympic Arena 3D Model (URL7, 2011)

Figure 22. Example of cable structure

The improvement of the high-tensile steel cable has made it probable to transfer large axial forces in tension with lower cost. Cables are the most obvious examples of the economical way of covering large spans with an elegant appearance. The cable roof structure first fired the imagination of the designers with the North Caroline state Fair Arena in USA which was completed in 1953. The main structure of this building consists of a cable net supported between two intersecting concrete arches. Cables were pre-tensioned and rigidity of the roof was achieved through curvature (Figure 23).After the completion of the Arena different structures using steel cables have been developed and built in various forms (Buchholdt, 1999).

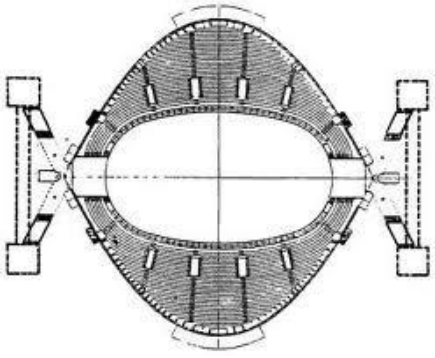
	
North Caroline state Fair Arena in USA Exterior view (URL7, 2011)	North Caroline state Fair Arena in USA Plan (URL7, 2011)

Figure 23. First cable roof structure

Cable roofs have been used to cover wide spans such as stadium, sport hall, swimming pools and concert halls since have been considered for buildings which require large column free areas. They have a wide field of application with various forms. Cable roof structures have architectural, structural and economical potential so the use often resulted in attractive buildings with structures that are rigid and efficient. The use of cables is steadily becoming a more attractive, economic and innovative with the use of steel (Buchholdt, 1999).

Tent:

Tent is a structure system working with the tension force and acting as both structure and cladding, supported with the pillars, cables, arches or rings. It is made up of any material which is flexible, pliable and is not rigid. Membranes have similar characteristics with the cables structurally but the only difference is their structural elements. Cables are linear, membranes are planar. The use of tents in architecture has started in the ancient periods. Tents constructed with the wooden sticks and animal skin is the earliest examples of membrane structures (Türkçü, 2009).Tents are membranes which are supported with an arch or a column.

	
Munich Olympic Stadium Exterior view (URL7, 2011)	Munich Olympic Stadium Inner view (URL7, 2011)

Figure 24. Example of tent structure

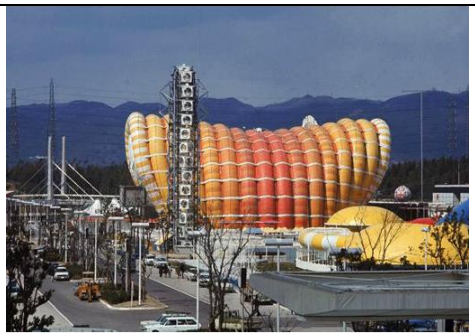
Repeated modules are used and combined to form large geometries. The most significant feature of tension structure is their range of spanning capability. Each unit can span between 30-80 m. It is the art of creating forms that are aesthetically and functionally satisfactory. It has a construction technique that supports are lifted high into the air and membranes are stretched easily (Huntington, 2004).

Pneumatic:

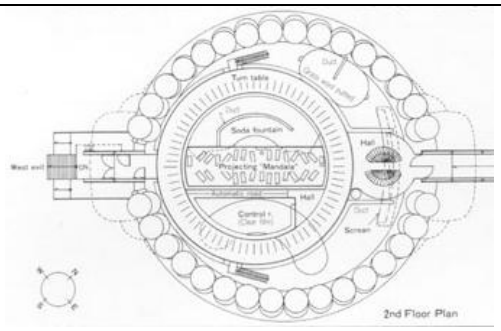
One type of pneumatic structure is formed with the air pumping into a volumetric membrane and acts as both structure and cladding. The use of this structure in architecture has started at the beginning of the 20th century. They are light, economic, easy and fast to construct (Türkçü, 2009). Pneumatic structures can span large distances without vertical elements (Eren, 2007). It was used for temporary buildings like sport halls that covers only in winter, festival areas and shelters in construction sites in the early examples but today it is used for permanent buildings as well. It can span 10-50 m. with new approaches. Despite the advantages of the structure there are disadvantages as well. It is not suitable for all sites and weather conditions and is not easy to make openings on the facades. It has similar characteristics with the tents structurally. It can be made up of any material which is flexible, pliable and is not rigid. The materials mostly used in the production of pneumatic structures are plastic or metal foils and textile (Türkçü, 2009).

There are two types of pneumatic structures which is single layer and double layer. In the first type which is single layer air is pumped into a structure with a compressor constantly in order to create a pressure difference between inside and outside. The pressure of the space is adjusted with this compressor. In the second type air pressure

is squeezed between two layers (Figure 25). This type has more advantages than the first one. It is not required to pump the air constantly into the space since air is between layers and there is no air loss (Eren, 2007).



Fuji Pavilion
Exterior view
(URL8, 2011)



Fuji Pavilion
Plan
(URL8, 2011)

Figure 25. Example of double layer pneumatic structure

Arch with contemporary materials:

Until the 19th century the arch and vault were the only alternative solution to span large distances but masonry structures give limitation to this distance (Ramon, 2003). In the 20th century, after developments of steel and concrete, arches have been used in more creative and economic solutions (Eren, 2007).

Gateway (URL9, 2011)

Figure 26. Example of arch structure

The development of a spanning structure through the use of only internal compression is the basic idea of an arch. The form of the arch is obtained by loading and support conditions. The weight of the arch in the stone arches was the principle load. Other forces were unimportant in magnitude when compared to the gravity force however in contemporary arches; the lightness of the structure has changed this situation. In addition to the basic arch compression, most arches today are made up of continuous ribs of steel, laminated wood, reinforced concrete or truss. There are three types of arch which are fixed arch, two-hinged arch and three hinged arch.

The fixed arch is mostly seen in reinforced concrete bridge and tunnel construction. It is designed as a series of arches built continuously with their supporting piers. This form is more often used for short to medium spans. The two hinged arch is mostly seen in long spans. The pinned base is developed for a large arch and is not subjected to forces as a result of thermal change to the degree that the fixed support is. The three hinged arch is mostly used to form medium span building roof structures because the pinned bases are more easily developed than the fixed ones. While masonry arch can span between 8-20m, spanning capacity of a reinforced concrete laminated wood or metal arch is between 25-70m.

The vault is obtained with the repetition of adjacent arches side by side. The only difference from arch is that a vault is a surface, rather than a planar rib. Complex three dimensional forms can be created with the intersection of vaults.

Leipzig Fair Center in Germany (URL11, 2011)

Figure 27. Example of contemporary vault structure

A dome is obtained with the rotation of arches around a crown. In contrast to the vault dome has a circular plan which vault relates to a rectangle or cross plan. Both vault and dome forms can be created as ribbed or as direct shell forms (Ambrose, 1993).

The Reichstag in Berlin
(Brooker and Stone, 2007)

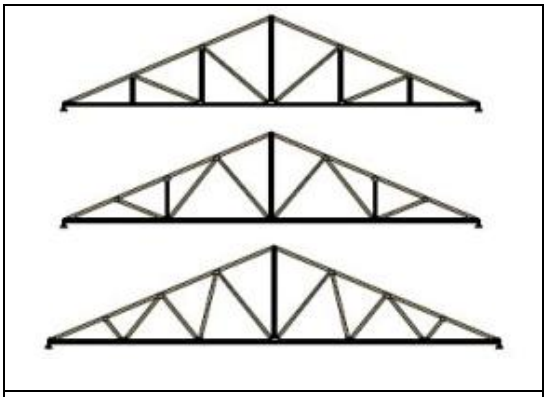
Figure 28. Example of contemporary dome structure

3.2.2.2 Vector active structures

Structures acting mainly through composition of compressive and tensile members are called vector active structures. Some members are in tension, while the others in compression. Vector active structures are structure systems of solid straight line

elements (bars, rods) in which the redirection of forces is effected through vector partition (Engel, 1997).

Structural components of vector active structures are short, solid, straight-line elements. Because of their small section in comparison to their length can transfer only forces in direction of their length, normal stress: compressive and tensile members. Compression and tension elements are arranged in a pattern and put together in a system with hinged points to form a stable composition. They form mechanism that can redirect forces and can transfer loads over long distances without intermediate supports. They are distinctive from other structures with its triangulated assemblage of straight line members (Engel, 1997).



Truss structure (URL11, 2011)

Figure 29. Example of vector active structures

The mechanism of vector active redirection of forces can be applied also to other structure systems such as arches frames or shells can also be designed as trussed systems. Vector active structures are suitable form for the dynamic cities of the future because of their unlimited possibility for three dimensional expansions with standardized elements (Engel, 1997).

Truss:

Trusses are a set of rigid bars connected by pin joints which is a broad category man-made structure. It gives flexibility to design structures in different forms and span large distances such as bridges, towers, building exoskeletons and roof supports. The spanning capacity of a truss is between 15-30 m.The effective and distinctive look of trusses is obtained by the simple construction of rod elements which exert only axial forces (Smith, 2002).

The triangular subdivision of the planar system produces stable geometric units. An almost infinite variety of truss configuration is possible. Other structural forms such as rigid frames, arches or three dimensional towers can also be produced by truss system (Ambrose, 1993).

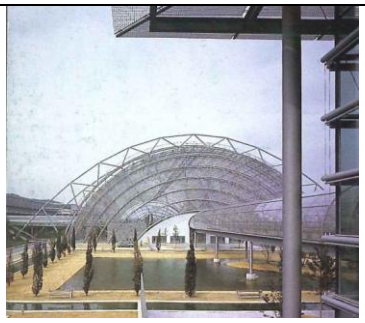
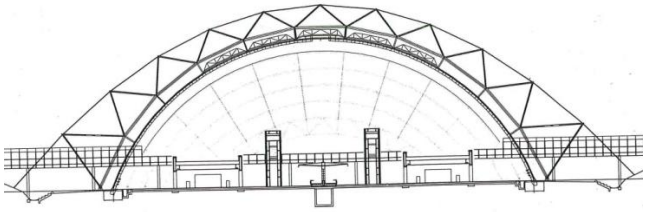
	
The Leipzig Fair Center Exterior view (URL10, 2011)	The Leipzig Fair Center Section (URL10, 2011)

Figure 30. Example of truss structure

Space frame:

Space frames mostly used for sport halls, exhibition spaces, industrial buildings, shopping malls and airports which large spans is needed to cover. It is one of the most frequent used structure system in architecture because it is more economic, light, easily prefabricated and covers large spans without any vertical support. Its

spanning capacity is between 25-100 m. It is a three dimensional structure system composed of straight rods that grouped together at specific points. Every connection point should be supported by minimum three rods and the structure is the repetition of basic element (Türkçü, 2009).

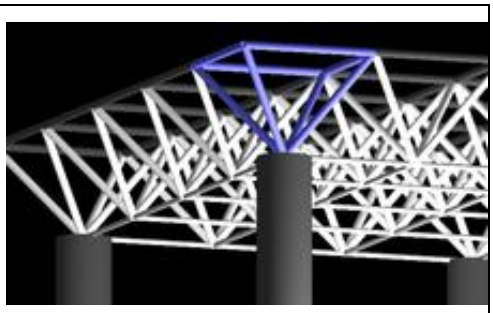
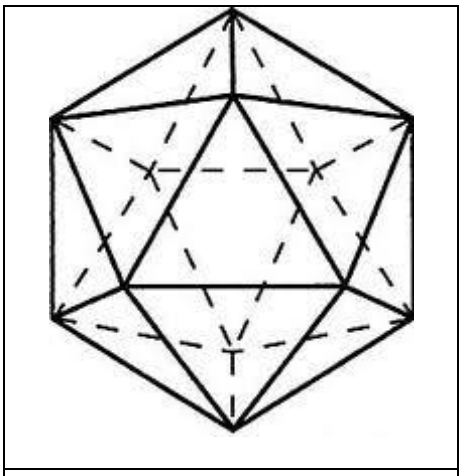
	
Indian Oil Company, Administration (URL12, 2011)	Basic unit of a space frame (URL13, 2011)

Figure 31. Example of space frame structure

Geodesic dome:

A complex version of a dome that is composed of small equal triangles is called geodesic dome. The vertices of the triangles all lay on the surface of a sphere (Davis, 2011). In mathematics the shortest bow that connects two points on the surface of a sphere is called geodesic bow. Buckminster Fuller has developed geodesic dome and apply it into architecture. His aim was to design an efficient vector system with minimum energy (Türkçü, 2009).



Icosahedron (URL14, 2011)

Figure 32. Geodesic domes are projection of icosahedron

The form of these domes is based on the projection of the icosahedrons (Figure 32) on the surface of the sphere and makes it possible to create spherical domes (Muttoni, 2006). They are light in weight and can easily span large distances up to 200 m. (Eren, 2007).

Science Museum in Paris
(Photo: Author)

Figure 33. Example of geodesic dome

3.2.2.3 Section active structures

Structures acting mainly through cross section and continuity of material are called section active structures. The logic of the system is confinement of forces. Its system works in bending stress condition: sectional forces. They are structure systems of

solid, rigid linear elements in which the redirection of forces is effected through sectional forces. The system members are primarily subjected to bending.

Linear elements, straight and fixed in their length, are geometric means of defining spaces and setting up three dimensional relationships. Straight linear elements can determine axes and dimensions; length, height and width. They can be used as compression members with compressive strength and with tensile strength as tension members.

Beams are basic elements of section active structure systems which are straight line, bending-resistant structural elements. Beam is the structure element most frequently used in building construction. They cannot only resist forces that act in the direction of their axis, but can receive also forces perpendicular to their axis and transport them laterally along their axis to the ends.

Section active structures mostly have rectangular form in plan and elevation. One of the advantages of section active systems is the simplicity of the rectangular geometry in coping with structural and aesthetic problems and cause for the universal application in building. On the other hand, the future development of these structures will meet the disadvantage of low weight/span ratio because of pre-stressing techniques and also by replacing the massive beam section with form active, vector active or surface active forms.

Frame:

Use of tree trunk as building elements and stone post and lintel systems in the history were the prototypes of this system. Later expansion of the vocabulary has been

developed with the use of materials such as concrete, metal and timber. The potentialities of the system keep this building technique a major part of structural variety. The two basic elements of the system are column and beam:

Column: essentially a linear compression element subject to crushing or buckling, depending on its relative slenderness.

Beam: essentially a linear element subject to transfer loads; must develop internal resistance to shear and bending and resist deflection (Ambrose, 1993).

Frames are structures which columns and beams are tied together to resist horizontal and vertical forces at the same time (Eren, 2007). Structural and covering parts are separated in frame systems. Walls and ceilings can be covered with other materials according to the design. Frames are more economic and light when compared with masonry structures.

It is divided into three according to the material as timber, steel and reinforced concrete frames (Türkçü, 2009). Reinforced concrete frames are built with the help of formworks so it takes longer to build these structures and this process may give harm to the existing building. However, steel structures are much lighter, flexible, and transparent. It is easy to construct and deconstruct in the site so it is mostly preferred in the additions to old buildings (Eren, 2007).

Spanning capacity of a glued timber frame slab is between 15-40 m, a steel frame slab is 15-60 m and a reinforced concrete slab is between 10-25 m.

		
Pompidou Center (URL15, 2011)	Drusch Villa (URL16, 2011)	Prostho Museum (URL17, 2011)

Figure 34. Example of steel, reinforced concrete and timber frame respectively

The relation of length to radius or thickness of the post and the relation of depth to span of the beam are the critical aspects of the system. The resistance to horizontal load can be provided in a number of ways: by fixing the base of the post, connecting post and using trussing and x-bracing (Ambrose, 1993).

Slab:

The structural slab is a section active planar element that integrates the most diverse bending mechanism. It is most effective within a certain limit of span (Engel, 1997).

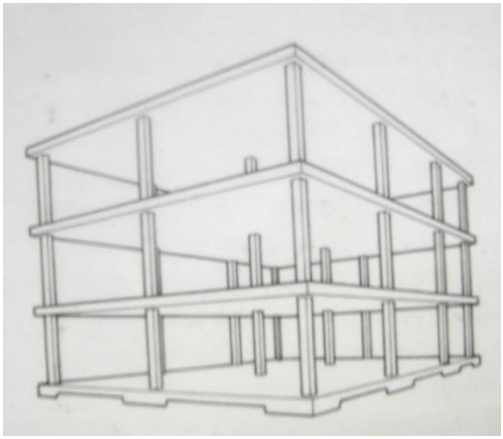

(Macdonald, 1994)

Figure 35. Example of slab

A slab can be accepted as a shallow laterally extended beam, spanning between other beams of normal depth or directly between walls. In order to span larger distances, it

can be stronger by simplifying assumptions with the secondary bands in one or two way (Mainstone, 1998). Slabs can be divided into three as simple, ribbed or waffle. Ribbed slab is strengthened in one way and waffle slab is strengthened in two ways.

The spanning capacity of a simple slab is up to7 m, a waffle slab is between 7-15 m and a ribbed slab is between 4-9 m.

	
University of Chicago, Library building View from the roof (URL18, 2011)	University of Chicago, Library building Interior view (URL18, 2011)

Figure 36. Example of waffle slab

3.2.2.4 Surface active structures

Structures acting mainly through extension and form of surface are called surface active structures. Its logic is dispersion of forces. Its system works in surface stress condition: membrane forces. Surface active structures are systems of flexible, but otherwise compression, tension, shear-resistant surfaces, in which the redirection of forces is effected by surface resistant and particular surface design. The system members are primarily subjected to membrane stresses.

Surfaces are the most effective and intelligible geometric means of defining space, from interior to exterior, from elevation to elevation, from space to space. Stiffening of surface is a condition for the functioning of the bearing mechanism but the

difficulty here is to design the stiffening elements in a way that avoids any sudden change of both rigidity and tendency of deflection. Surface structures define space while carrying loads. Because of the identity of structure surface active structures permit neither tolerance nor distinction between structure and building. The space and form of the building are subjected to the laws of mechanics, since structure form is not randomly (Engel, 1997).

Folded plate:

Structural surface elements (plates) come together with a certain angle and form the folded plate structure system. A structure should have minimum 2 different surface elements folded with an angle to be called as folded plate structure. Plates transfer load on the surface to the vertical structural elements. But when the span is large its surface bends downwards. Wide spans are covered by folded plates without any vertical element in the middle of the space. Its spanning capacity is between 15-50 m. It is mostly used for factory buildings or auditoriums that wide span is needed. Possible materials that can be used for folded plates are reinforced concrete, metal panels and plastic. (Türkçü, 2009).

	
Tempodrum Berlin Exterior view (URL19, 2011)	Tempodrum Berlin Interior view (URL19, 2011)

Figure 37. Example of folded plate

Shell:

Shells are volumetric structure systems which its two dimensions are much greater than its thickness, it carries load and covers the space at the same time and resist all the exterior forces. It has 3 main properties: curved, rigid and thin. Exterior cover is curved in one way or two ways. It is homogenous, rigid and thin when is compared with the span covered.

Eye Museum in Valencia
by Santiago Calatrava
(URL20, 2011)

Figure 38. Example of shell structure

Shell structures mostly are used to cover large spans. Its spanning capacity is between 40-250 m. (Engel, 1997). There are lots of examples in contemporary architecture because of its flexibility. Any curved forms can be designed with suitable material (Figure 39). Possible materials that can be used for shells are reinforced concrete, steel and plastic (Türkçü, 2009).

Grid shell
Interior view
(URL20, 2011)

Figure 39. Example of grid shell

3.3 Structural materials

Design of building structures, deals with the available structural materials and the products are formed from them (Ambrose, 1993). One of the most important variables in the process of design is the materials (Wienand, 2008).

The discussion in this part deals with mostly used structural materials and their typical uses in contemporary construction (Ambrose, 1993). There are many factors which affect the choice of materials since this method of choosing materials reflect the approach taken in the design process (Wienand, 2008).

The most critical properties of the structural materials which are form, weight, durability, cost, availability, appearance, workability and strength have been discussed and possible structural systems are determined (Ambrose, 1993).

3.3.1 Stone

Stone is one of the earliest structural materials usually available at any locality with various types, in association with mud or timber. It is much the most durable of the four and therefore tended to be preferred because of its availability. It can be cut to any shape when it is not possible simply to select usable blocks. Although it varies greatly in hardness and internal structure (Mainstone, 1998), natural stones are extremely durable (Everett, 1994). Stone is used in masonry structures.

Notre Dame Cathedral in Paris
(Photo: Author)

Figure 40. Example of stone building

3.3.2 Timber

From earliest times, timber has been used as a structural material. It affects both tensile and compressive strength in the structural role. It is suitable for elements which carry axial compression, axial tension and bending type internal forces (Macdonald, 1994). Timber elements are light in weight when compared with stone; additionally have high strength both in tension and compression (Everett, 1994).

Timber is mostly used in buildings of domestic scale as structural frameworks and floors and roofs in load bearing masonry structures. Various elements such as rafters,

floor beams, skeleton frames, trusses, built up beams of various kinds, arches, shells and folded forms is constructed with timber. Timber used in load bearing wall structures both as the horizontal elements in masonry buildings and as vertical timber elements which form wall panels (Macdonald, 1994).

Some of the longstanding limitation of timber has been overcome by technological innovations hence size and form limitations have been expanded through glue lamination and special techniques have made large structures possible through better joint (Ambrose, 1993). Local availability and cost are major factors in the selection of a timber as structural material. Because of its availability, low cost and simple working possibilities, it is generally used as structural material of choice unless its limitation (Ambrose, 1993).

Bodegas Protos Winery in Spain
by Richard Rogers
(URL17, 2011)

Figure 41. Example of timber

3.3.3 Reinforced Concrete

Concrete is a composite of stone fragments and cement binder which is made by mixing together dry cement and aggregate in suitable proportions and adding water.

The cement to hydrolyze by adding water and the whole mixture harden to form a substance with stone like qualities (Macdonald, 1994). Concrete takes the shape and the texture of its mould or formwork, on site and tensile strength is given to concrete by reinforcement (Everett, 1994).

Reinforced concrete possesses both tensile and compressive strength. As Macdonald (1994) states: “It is suitable for all types of structural element including those which carry bending type of internal forces, nevertheless it is also a reasonably strong material”. Concrete can be used as skeleton frame for which strong material required and also can be used to make long span structures and high, multi-storey structures (Macdonald, 1994).

Phaeno Science Center in Germany
by Zaha Hadid
(URL21, 2011)

Figure 42. Example of reinforced concrete

Reinforced concrete can be accepted as a development of the form of composite construction since it contains steel bars in concrete. It is very flexible and capable of carrying its own weight over any distance without having considerable deformation.

Substantial formwork is required to give shape to the concrete until the concrete has hardened enough to carry loads. The need to provide this formwork is, the main limitation on the forms that can be economically adopted (Ambrose, 1993).

The PFA Building in USA
by Tadoo Ando
(URL21, 2011)

Figure 43. Example of reinforced concrete

3.3.4 Steel

The use of iron as a structural material has started from the late nineteenth century when cheap methods for manufacturing it on a large scale were developed. Then steel has been developed and it has been started to use in a variety of forms in nearly every type of building. It is a material that has advantages as structural material. It has high strength, equal strength in tension and compression and is suitable for the every kind of structural elements (Macdonald, 1994). From huge columns to the smallest nails, steel is the most adaptable structural material. It is also strongest and the most resistant to aging (Ambrose, 1993). Its density is high but the ratio of strength to weight is also high so that steel components are not heavy in relation to their load carrying capacity (Macdonald, 1994).

Lyon Train Station
by Santiago Calatrava
(URL22, 2011)

Figure 44. Example of steel structure

Steel is a completely industrialized and fabricated material. Although the bulk material is expensive its forming process is making it competitive with materials of lower bulk cost since economy can also be achieved through mass production of standardized items. The vocabulary of steel for building structures has recently been expanded and there is now a wide range of use in different forms (Ambrose, 1993).

Law Faculty of Cambridge in England
Exterior view
(URL23, 2011)

Law Faculty of Cambridge
Facede Detail
(URL23, 2011)

Figure 45. Example of steel

3.4 Relationship between structure and material

Different types of structure systems and materials have been identified, their differences and similarities have been determined above to be able to analyze the structure system of the extensions and discuss the suitability of them in the analysis chapter. Properties of the materials have been summed up in Table 3 and possible structural systems have been determined with the related structural material in order to see the relationship between structure systems and materials.

Table 3. Relationship between structure and material

STRUCTURAL MATERIAL	PROPERTIES	POSSIBLE STRUCTURE
STONE	• Most durable • Availability problem • Heavy in weight • Strong in compression • Needs good craftsmanship • Shrinkage of the mortar is a problem • Thermal expansion cracking • Limited forms can be created • Long time for construction	• Masonry wall • Arch • Vault • Dome
TIMBER	• Light in weight compared with stones • Suitable for elements which carry axial compression and tension • High strength • Flexible • Simple working possibilities • Availability problem • Weak against fire	• Frame • Truss • Arch
REINFORCED CONCRETE	• Strong in bending • Possesses tensile as well as compressive strength • Shrinkage problem • Needs formwork • Long time for construction	• Frame • Arch • Dome • Shell • Folded plate
STEEL	• High strength • Strength in tension and compression • Light • Versatile • Longlife • Fast • Weak against fire	• Frame • Truss • Space frame • Geodesic dome • Cable • Tent

Chapter 4

DESIGN APPROACH

The study examines extensions by focusing on structural systems and their relation on design. Design approaches are collected under four headings as: design principles, ordering principles, organization and circulation. Factors have been defined and their possible effect of the extension to the existing building has been identified.

4.1 Design principles

Design principles can be classified as unity, harmony, contrast, dominance, repetition, balance, scale and proportion in this study.

4.1.1 Unity

Unity is related to composition in design which is produced by the relationship between the visual elements. Building materials such as brick, timber and concrete also provide the visual elements which form the composition. There are different aspects of unity that must be satisfied in order to produce a satisfactory composition (Smithies, 1981).

Different materials used in the remodeled buildings like stone, glass or steel create variety of colors, tones and texture and can be accepted as elements of composition. These are inherent aspects of most building materials. Old and new parts should be contrasting but at the same time they should have unity. Unity can be achieved with the following approaches:

- Continuity of layout
- Arrangement on series of axes
- Harmonious layout with the existing building
- Repetition of geometrical shapes
- Balance throughout composition
- Adding a little variety for proving a sense of personality
- Appearance of completeness (Şahin, 2010); (URL 40)

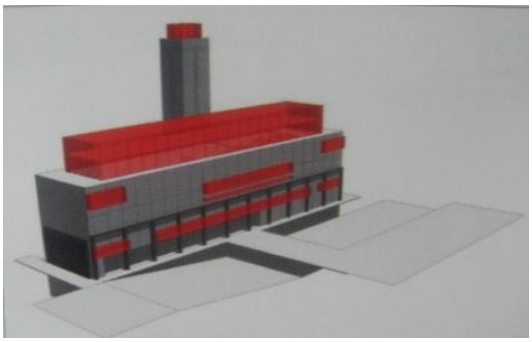
	
Tate Modern London Exterior view (Brooker and Stone, 2007)	Tate Modern London 3D Model (Brooker and Stone, 2007)

Figure 46. Unity between old and new by repetition of similar geometrical shapes

Similar geometric shapes are repeated with different sizes to achieve unity between old and new in the extensions.

4.1.2 Harmony

Harmony is one of the aspects of unity. It may be concerned as opposite of contrast. Harmony in color means, colors being related by being near to each other in the color wheel. On the other hand, harmony in texture means a matching in the textural quality (Smithies, 1981).

In remodeled buildings it refers the harmony of old and new. Although the old and new parts should be differentiated, they should be in harmony as well to achieve unity. Harmony can be achieved by following approaches:

- Similarities of elements in terms of form or shape
- Repetition of character with a little variety
- Repetition of character providing right mix (Şahin, 2010); (URL40)

House Extension in Remscheid
(Schittich, 2003)

Figure 47. Repetition of character with a little variety to achieve harmony

Same unit is repeated with use of different materials to achieve harmony between new and old.

4.1.3 Dominance

Dominance may be provided by the effect of one color, texture or element being visually stronger than the reminder. A dominant form or shape can help to provide a sense of unity. Dominance is one of the aspects of the unity. Unity can not exist if there is a competition of visually equal elements. A dominance of old or new is necessary to avoid an equal competition which would tent to destroy unity (Smithies, 1981).

Dominancy is used to break static organization of historic buildings and brings dynamism to the structure by applying following approaches:

- Creating center of interest
- A sudden change in direction, size and shape. (Şahin, 2010) ; (URL40)

Cultural and Business Centre in Turin
(Schittich, 2003)

Figure 48. Creating center of interest to achieve dominancy

4.1.4 Contrast

Contrast of color, tone or texture, of direction or proportion, between solid and void, give interest and vitality to a design. Harmony taken too far can lead to monotony, so contrast is used to break this monotony. But too many contrasting elements will weaken harmony and tend to produce more than one equal interest. This reduces any dominance and weakens unity. The use of too many different elements leads to visual chaos (Smithies, 1981). In order to achieve contrast, following approaches can be applied. Contrast:

- In terms of size
- In terms of shape
- In terms of direction
- In terms of alignment

- In terms of position (Şahin, 2010) ; (URL40)

Workshop building
in Rotterdam
(Schittich, 2003)

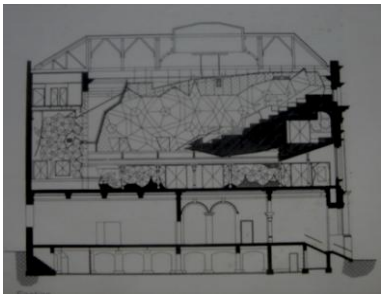
Figure 49. Contrast of shape and color

4.1.5 Repetition

Repetition of forms and shapes can be used to produce rhythm. On the other hand, any repetition taken too far without change will eventually tend to monotony and will destroy unity. Rhythm is a particularly useful way of providing harmony (Smithies, 1981). There are types of rhythm which will be discussed in the ordering principles part.

ARM Storey Hall
in Melbourne
Maggie (1997)

Interior view
Maggie (1997)



Section
Maggie (1997)

Figure 50. Repetition of forms to achieve unity

4.1.6 Balance

Balance is one of the aspects of unity. Nevertheless, a design can be lacking balance even though other aspects have been satisfied. It must be considered that when balancing the design, symmetry must be avoided not to create monotony (Smithies, 1981). While combining old and new whole composition must be balanced. There are two types of balance:

- Informal balance in composition of layout
- Formal balance in composition of layout (Şahin, 2010) ; (URL40)

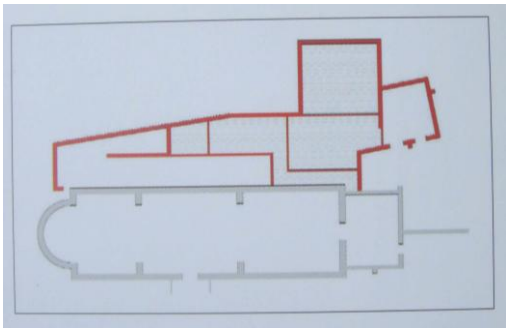
	
Canova Museum in Italy by Carlo Scarpa Interior view (Brooker and Stone, 2007)	Canova Museum in Italy Plan (Brooker and Stone, 2007)

Figure 51. Addition is creating informal balance

New addition is creating informal balance in composition of layout. Old and new part is not symmetrical but in balanced.

4.1.7 Proportion- Scale

In architecture, proportion is the geometric relationship of the volumes, also the ratio or comparison of different parts of the composition. Proportional relationship is not measured by eye, it can be compared and tend to judge the relationship of one part to another on a proportional basis. Proportional relationship of the historical buildings was more successful; however proportion is less emphasized on simpler forms of modern buildings (Smithies, 1981).

While remodeling old buildings existing proportional relationship should not be destroyed and it should be taken into consideration that additional part should not over dominate the existing building in terms of scale as shown in the figure.

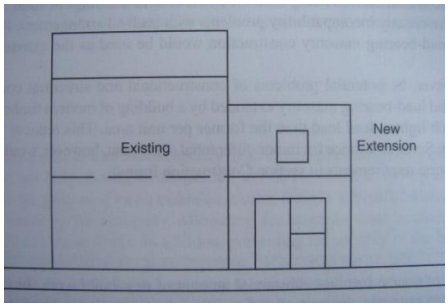
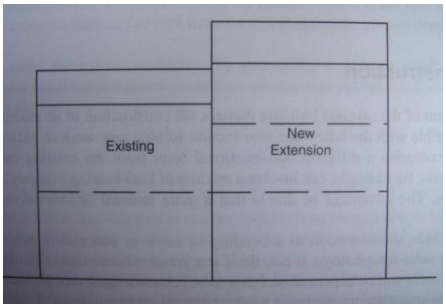
	
Extension in correct scale and proportions (Douglas, 2006)	Extension over dominating existing (Douglas, 2006)

Figure 52. Relationship between existing and extension in terms of scale and proportion

Various approaches to achieve proportion and scale in design are:

- Achieving human scale
- Height to width ratio
- Proportion between existing space and addition (Şahin, 2010); (URL40)

Antwerp Central Port Building in Belgium
By Zaha Hadid
(URL24, 2011)

Figure 53. Addition over dominating the existing building

4.2 Ordering Principles

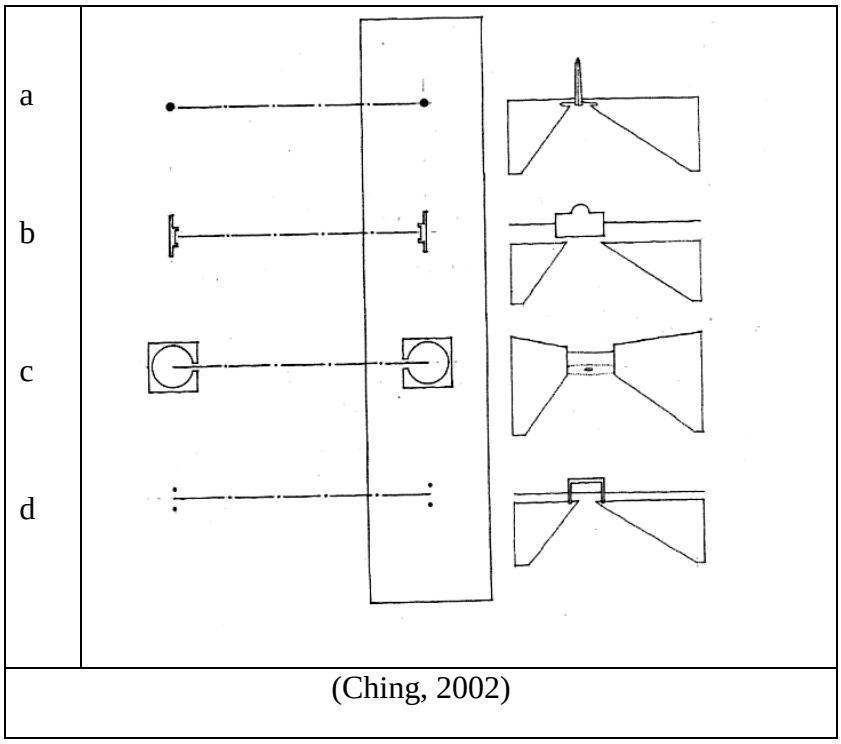
Ordering principles are axis, symmetry, hierarchy, datum, rhythm and transformation.

4.2.1 Axis

Axis is a line between two points which orders forms and spaces around it symmetrically or in balance. It is the basic tool in ordering forms and spaces in architecture. Although it is invisible, it is a strong and dominant line. It gives a symmetrical effect but still it is in balance. Characters of the elements around the axis, define visual strength of the organization (Ching, 2002).

Axis is a linear element and it obtains movement and view along the route. To be well defined, it should have a starting and ending point, additionally its edges can be defined with planes or spaces around it. According to the Ching (2002) there are four types of axis according to the starting and ending points as:

- Points in space established by vertical and linear elements or centralized building forms (Figure 54a)
- Vertical planes, such as symmetrical building facades or fronts, preceded by a forecourt or similar open space (Figure 54b)
- Well-defined spaces, generally centralized or regular in form (Figure 54c)
- Gateways that open outward toward a view or vista beyond (Figure 54d)



(Ching, 2002)

Figure 54. Types of axis

4.2.2 Symmetry

Symmetry is a concept of order which arises from a reflected disposition of elements on one side and on the other side of the axis, as in a mirror. It is a special case of the principle unity through orientation of elements. A symmetrical organization acts as a magnet in comparison with the asymmetrical although it provokes monotony (Meiss, 1990).

Basically there are two types of symmetry:

- Bilateral: It describes symmetry which equal elements are organized around an axis.
- Central: It is composed of elements which intersect on a central point, balanced with an axis

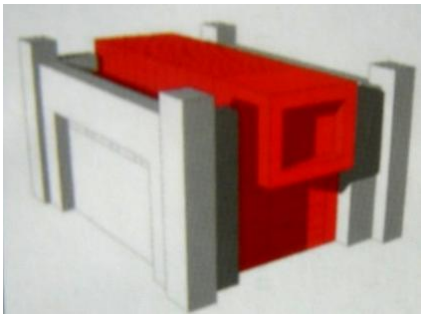
	
Baltic Art Factory Exterior view (Brooker and Stone, 2007)	Baltic Art Factory 3D Model (Brooker and Stone, 2007)

Figure 55. Example of bilateral symmetry

4.2.3 Hierarchy

Hierarchy is a more complex order in comparison to the symmetry since similarity between elements is not necessary (Meiss, 1990). Hierarchy principle expresses differences between forms or spaces. These differences show the levels of the importance between elements in an organization. A form or shape must be unique in order to be distinctive in an organization. Uniqueness can be achieved in three ways:

- By exceptional size
- By a unique shape
- By strategic location

In an architectural composition, a form or space can be different from other elements by an exceptional size and become dominant element of the organization. The other way to achieve hierarchy is to change the shape of one element in order to create contrast between elements. Thirdly, an important element in the design can be placed in a strategic location to create hierarchy between elements (Ching, 2002).

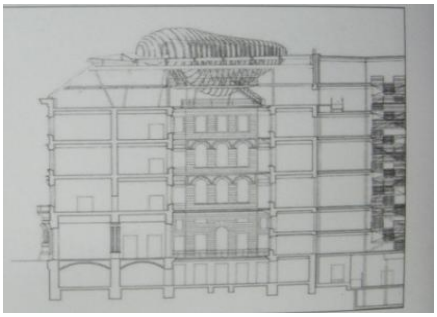
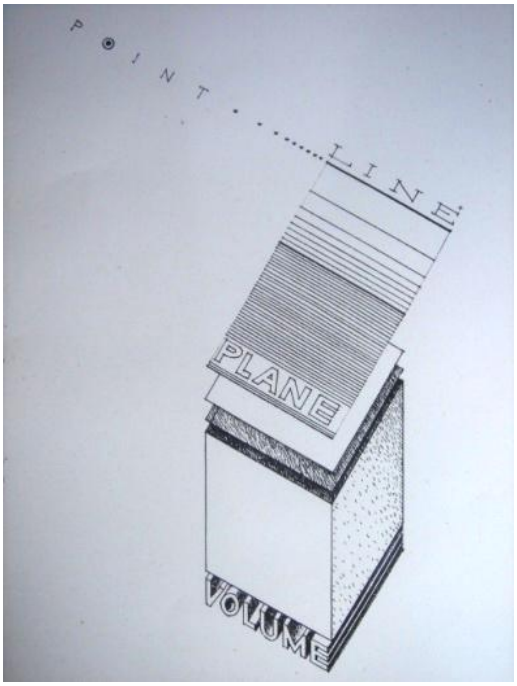
	
ING and NNH Bank, Exterior view (Powell, 1999)	ING and NNH Bank, Section (Powell, 1999)

Figure 56. Hierarchy by a unique shape

4.2.4. Datum

Datum expresses a line, plane or a volume that creates relationship between elements in a composition. It creates its own way to make connections between different elements. It has similarities between axis that discussed in previous part but a datum does not have to be a linear element, it can be planar or volumetric.



Point, Line, Plane and Volume (Ching, 2004)

Figure 57. Types of datum

According to Ching (2002), datum can organize randomly selected elements that do not have similarities in three ways:

- Line
- Plane
- Volume

A single line may divide a group of object into parts or a group of lines may from a grid to provide an organization (Ching, 2002).

A plane may collect elements under it or may form a background to frame the elements (Ching, 2002). Planes organize and separate spaces. A plane, whether it is horizontal or vertical, is a major element of design control, used both inside and outside a building and is probably the most obvious and easily recognizable detailed element in any building (Brooker and Stone, 2004).

An additional plane in a remodeled building can be additional mezzanine floor inserted inside of the existing building, a wrapping plane that collects different parts together or an attached plane on an existing building which defines closed spaces as roofs.

National Studio for
Contemporary Arts
(Brooker and Stone, 2004)

Figure 58. Example of wrapping plane

A volume may group different elements into its border, may order elements around its frame (Ching, 2002) or it can be inserted into the building to create unity and order between elements formally for a different function.

An object is loaded with meaning establishes a physical and cultural relationship with its environment. It can be a large sculpture or a number of elements clustered together and can effect the perception of the space or it can form a focal point or even a landmark (Brooker and Stone, 2004).

4.2.5 Rhythm

Repetition of forms, shapes or lines in a systematic and harmonic way is called rhythm. It is used in different disciplines like music as well as design. This idea is placed in architecture as repetition of forms and spaces with an order. Nearly all types of buildings have this principle with repetition of different building elements like, structural elements, openings or space modules. Elements that will be repeated do not have to be exactly same but these elements should be grouped according to:

- Size
- Shape
- Detail characteristic (Ching, 2002).

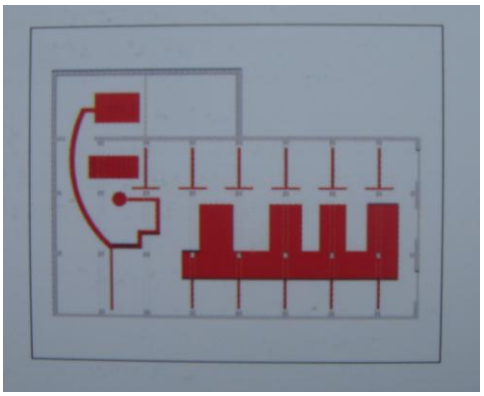
	
La Llauna School in Barcelona Interior view (Brooker and Stone, 2007)	La Llauna School in Barcelona Plan (Brooker and Stone, 2007)

Figure 59. Example of Rhythm

4.2.6 Transformation

Transformation principle is to take an architectural model as a prototype and organize a new design by having references with the prototype. These references can be its form, order of elements or material characteristics (Ching, 2002).

Reichstag Parliament House in Berlin
(Powell, 1999)

Figure 60. Transformation of dome into contemporary architecture

In this research the prototype is the existing old building and the addition will be the new design having references from the old one.

4.3 Organization

Since the aim of the study is to search the effect of the addition to the existing, organization is one of the possible effects. There are different categories of space organization: central, linear, radial, cluster and gridal.

4.3.1 Central organization

Central organizations are formed by a central and dominant space which secondary spaces are grouped around it. Dominant space of this kind of organizations is big enough to organize other spaces around it. The secondary spaces should be similar in terms of shape and size and organized symmetrically with different axis in order to form a shape (Ching, 2002). This kind of organization creates symmetry and was used especially in historic building organizations. An inner courtyard or a central space of a religious building can be a good example of central organization.

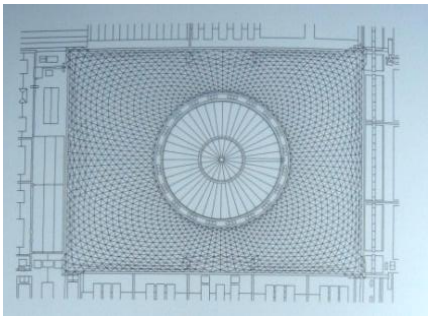
	
British Museum Interior view (Schittich, 2003)	British Museum Plan (Schittich, 2003)

Figure 61. Example of central organization

4.3.2 Linear organization

Linear organizations are formed by repeated spaces on a line which have similarities in terms of size, shape and function. Because of its length linear organizations define a movement and a growth so they always need an end point as dominant spaces or shapes (Ching, 2002).

	
Interior view	Section
Documentation Center (Brooker and Stone, 2008)	

Figure 62. Example of linear organization

4.3.3 Radial organization

Radial organizations consist of linear space organizations, starting from a central point. It combines center and the linear elements each other. The arms coming from the central point should be similar in terms of form and size. It has similarities with the central organizations. Central organizations create an introverted organization that focuses one point. On the other hand, radial organizations create extroverted organizations which are open to the outside (Ching, 2002).

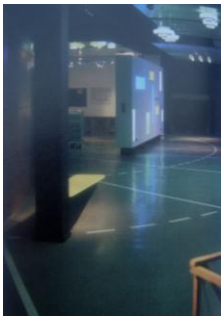
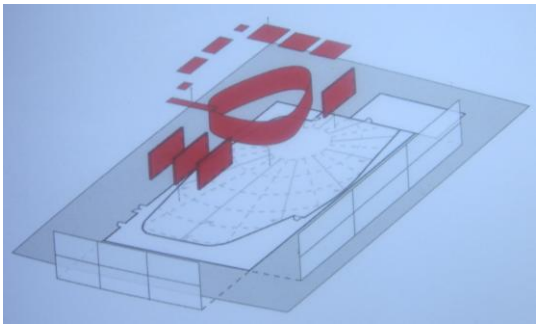
	
Zumtobel Staff Showroom Interior view (Brooker and Stone, 2004)	Zumtobel Staff Showroom 3D Model (Brooker and Stone, 2004)

Figure 63. Example of radial organization

4.3.4 Cluster organization

Clustered organizations are used to group spaces which have similar functions. It brings different elements together which is different in terms of size and shape. Its form is flexible so growth and transformation between elements are acceptable. Unity is achieved in the organization with help of symmetry or axis. In order to create a hierarchical order these spaces can be clustered around a dominant space (Ching, 2002).

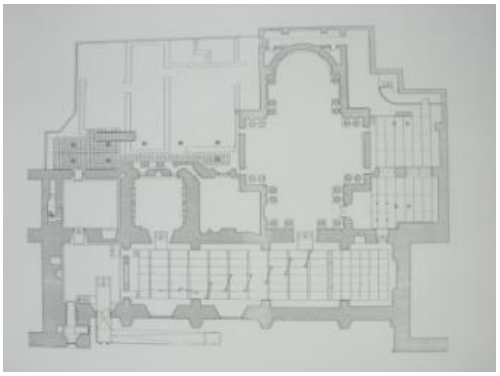
	
X'teresa Alternative Art Center Exterior view (Broto, 2004)	X'teresa Alternative Art Center Plan (Broto, 2004)

Figure 64. Example of cluster organization

4.3.5 Gridal organization

Gridal organizations are formed by spaces which are organized by a structural grid or a three dimensional frame. These grids create modular spaces which are repeated in an order in the third dimension. Although elements in this organization are different in terms of size, shape or function, it creates relationship between them (Ching, 2002).

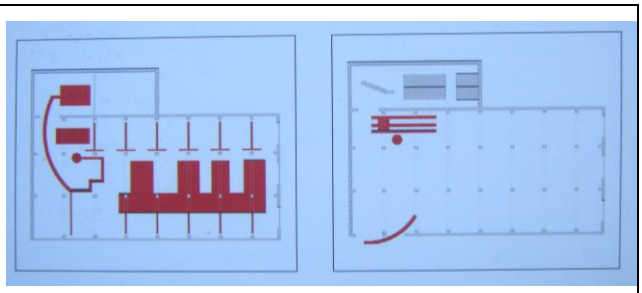
	
La Llauna School in Barcelona Interior view (Brooker and Stone, 2007)	La Llauna School in Barcelona Plan (Brooker and Stone, 2007)

Figure 65. Example of gridal organization

4.4 Circulation

Circulation is one of the other possible effects which might determine building design. Movement provides access to different parts of the building and also serves to link separate spaces together. Circulation in a building might occur in different ways. It can be a corridor that links a number of rooms or it can be by means of a dynamic series of stairs, ramps and bridges, or the building itself can be a massive circulation route.

Movement can be a boring activity in some buildings. Expression and drama can be brought to a space with some additional stairs, lifts, escalators, ramps and bridges. Stairs can be used as sculptural elements, since they make only vertical emphasis in a building and only refer to three dimensional qualities. It can be a focal point of the building with an expressive contrast to its surrounding (Brooker and Stone, 2004).

Kadir Has University
inner courtyard
Photo: Author

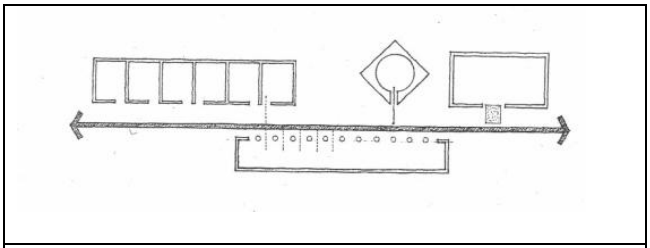
Figure 66. Circulation elements can be used as sculptural elements

Circulation which can be analyzed under three headings as:

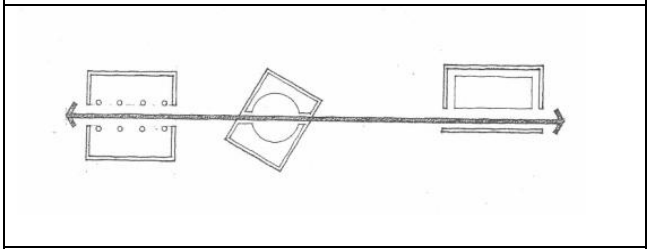
- Configuration of the path
- Path- space relationship
- Type of the circulation element (Ching, 2002)

Configuration of the path can be divided as: linear, radial, spiral, grid, network or composite (Ching, 2002).

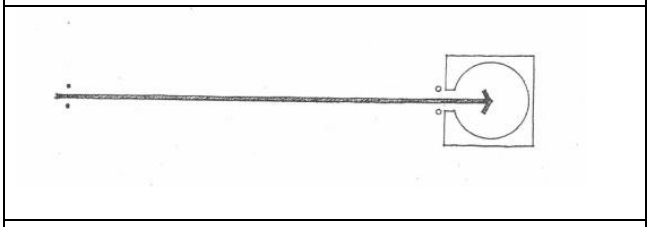
Path- space relationship shows the relationship between existing space and the additional circulation element. It can be divided as: pass by spaces, pass through spaces and terminate in a space (Ching, 2002).



Pass by spaces (Ching, 2002)



Pass through spaces (Ching, 2002)



Terminate in a space (Ching, 2002)

Figure 67. Path-space relationship

Type of circulation element indicated if it is a stair, escalator, ramp or bridge. Circulation elements are not just used to provide movement in the building. They can be used as design elements according to the function of the building. Existing floors of the old building have been removed and a circular ramp is inserted in the middle of the building providing circulation up to last floor of the building (Figure 68).

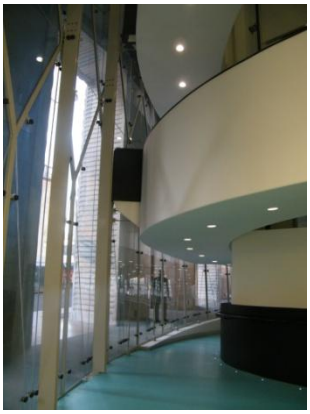
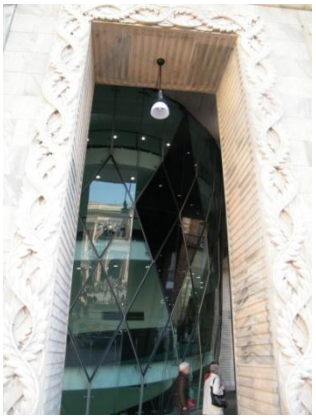
		
Museo del Novecento Exterior view (Photo: Cemal Osmanlılar)	Museo del Novecento Interior view (Photo: Cemal Osmanlılar)	Museo del Novecento Façade detail (Photo: Cemal Osmanlılar)

Figure 68. Ramp addition into an old building as a circulation element

Factors effecting design have been defined and their possible approach identified in this chapter. In the following chapter, selected case studies have been analyzed according to the identified criteria.

Chapter 5

CASE STUDIES

5.1 Selection of the case studies

20 case studies of remodeled buildings are selected according to the following properties:

- Selected buildings are public buildings which are converted into different functions like museums, cultural centers, libraries, etc.
- Existing structures are masonry and the proposed additions have contemporary structure.
- There are historic buildings as well as ordinary old buildings; however the historic buildings are the ones that designers are free about the limit of interventions.

5.2 Method of analysis

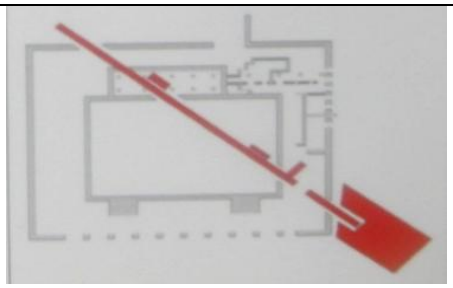
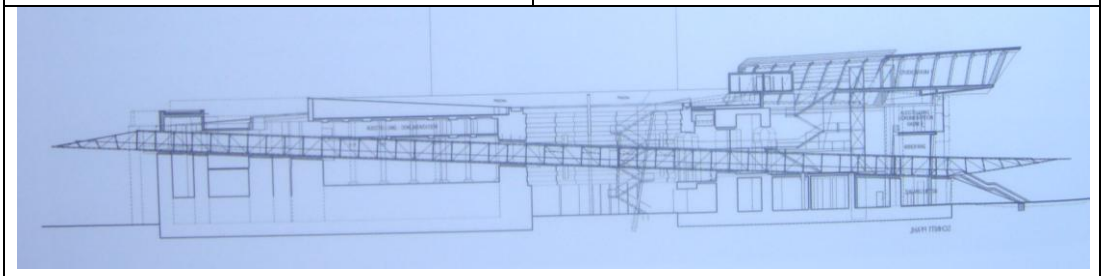
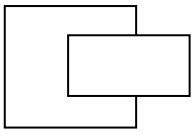
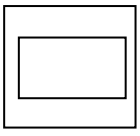
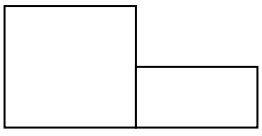
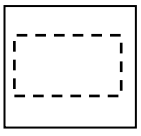
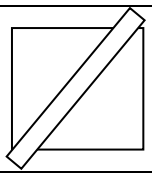
A series of tables were developed in order to analyze the case studies. In the first table general information has been given about the case studies as well as photos and drawings of the building. Required photos and drawings have been selected in order to perceive the buildings. On the table, type of the related extension is identified which have been grouped into five categories as integrated, inserted, attached, wrapped and pierced. These categories are introduced after the analysis of the case studies which were selected out of 100 examples.

The second table consists of two parts: in the first part, buildings have been analyzed in terms of design approaches. The criteria of the design approach are design principles, ordering principles, organization and circulation. Selected buildings have been analyzed according to these criteria in order to find the answers of "what the effect of the addition to the existing is; and what their relationship is". Factors that are satisfied have been marked on the matrix. Unity, harmony, contrast, dominance, balance, repetition, scale or proportions are the factors of design principles. Axis, rhythm, datum, hierarchy and transformation are the factors of order.

In the third table, buildings have been analyzed in terms of their structural approach. The criteria of the structural approach are structure system, material and the connection between old and new: which structure system is used for the addition, what is the structural material and how the proposed addition is connected with the existing building. At the end of this analysis a method has been developed to evaluate the case studies.

5.3 Analysis of the case studies

Table 4. General Information about Documentation center

<table>
<tr><td colspan="5">CASE STUDY 1</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: DOCUMENTATION CENTER FOR THE THIRD REICH</td></tr>
<tr><td colspan="5">LOCATION: NUREMBERG, GERMANY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE :1930S</td><td colspan="3">CONSTRUCTION DATE :2002</td></tr>
<tr><td colspan="2">OLD FUNCTION: MEETING PLACE</td><td colspan="3">NEW FUNCTION: DOCUMENTATION CENTER</td></tr>
<tr><td colspan="2">ARCHITECT : ALPERT SPEER</td><td colspan="3">ARCHITECT :GUNTHER DOMENIG</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Brooker and Stone, 2007)</td><td colspan="3">INTERIOR VIEW (Broto, 2004)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">SCHEMATIC PLAN (Brooker and Stone, 2007)</td><td colspan="3">SCHEMATIC SECTION (Brooker and Stone, 2007)</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">SECTION (Brooker and Stone, 2007)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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</table>

Table 5. Analysis of the Documentation Center

CASE STUDY 1: DOCUMENTATION CENTER FOR THE THIRD REICH			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	
		A sudden change in shape	X
	CONTRAST	In terms of size	
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	X

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			X
		Terminate in a space			X
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			X
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010); (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the circulation route. -It is a light material and it is easy to construct in the existing masonry buildings.	
MATERIAL	**STEEL**	**TIMBER**	**R.C.**	**STONE**
	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
CONNECTION	**SUSPENDED FROM EXISTING STRUCTURE**	**ATTACHED**	**FREESTANDING**	**COMPLEX**
	-Circulation bridge is piercing the existing building with a slope. -The addition is suspended over the stone columns at the points where the bridge is in the building.			

Table 6. General Information about Tate Modern

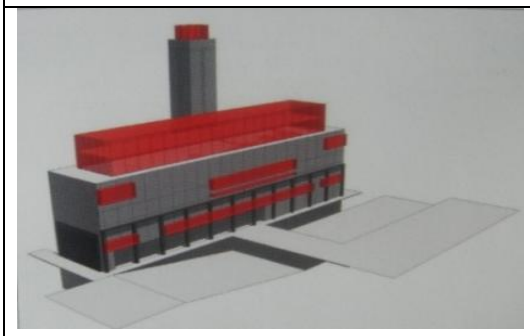
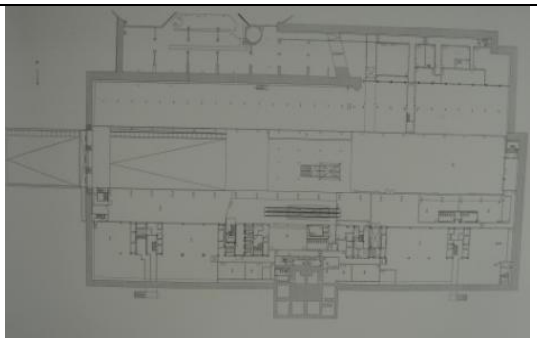
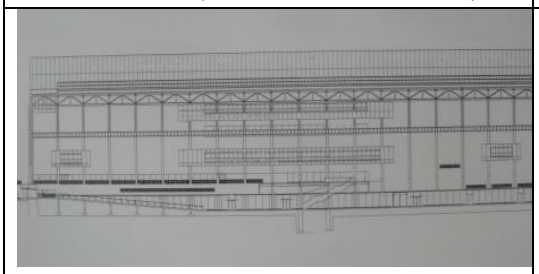
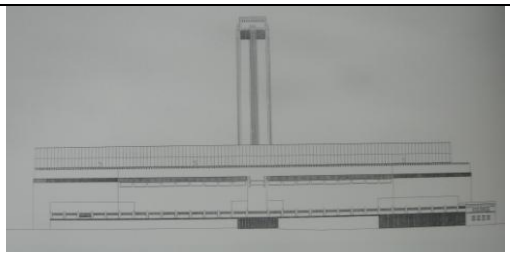
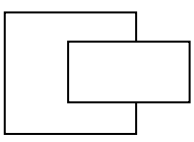
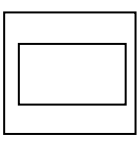
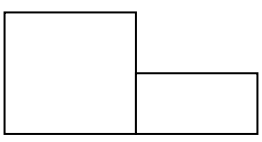
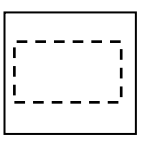
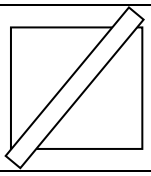
<table>
<tr><td colspan="5">CASE STUDY 2</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: TATE MODERN</td></tr>
<tr><td colspan="5">LOCATION: LONDON, UK</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1947-1963</td><td colspan="3">CONSTRUCTION DATE : 2000</td></tr>
<tr><td colspan="2">OLD FUNCTION: POWER STATION</td><td colspan="3">NEW FUNCTION: ART GALLERY</td></tr>
<tr><td colspan="2">ARCHITECT : GILES GILBERT SCOTT</td><td colspan="3">ARCHITECT: HERZOG &DE MEURON</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: TRUSS</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Schittich, 2003)</td><td colspan="3">INTERIOR VIEW (Broto, 2004)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">3D MODEL (Brooker and Stone, 2007)</td><td colspan="3">PLAN (Powell, 1999)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">SECTION (Powell, 1999)</td><td colspan="3">ELEVATION (Powell, 1999)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td></tr>
</table>

Table 7. Analysis of Tate Modern

CASE STUDY 2: TATE MODERN			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	X
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	X
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			X
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			X
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			X
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR	X	LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM		**Truss:** Truss is used as the structural system of the roof and it is supported with steel columns. It is a light material and it is easy to construct in the existing masonry buildings.		
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	Steel is used as structural material and it is covered with glass. A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			Additional volume is a freestanding element which is not touching to the existing walls. Truss roof is supported with steel columns located at the edge of the existing walls.	

Table 8. Analysis of Archbishopric Museum

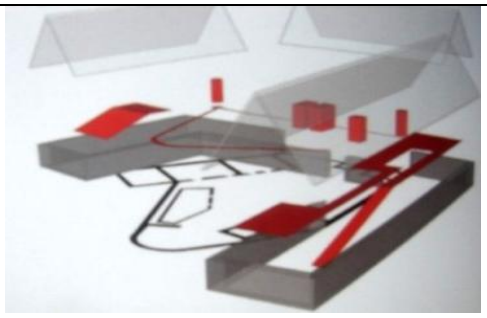
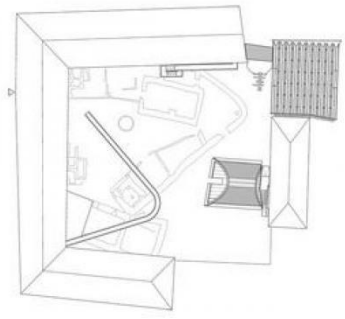
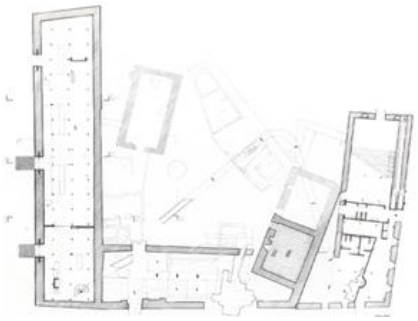
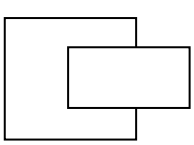
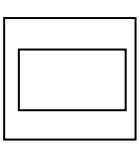
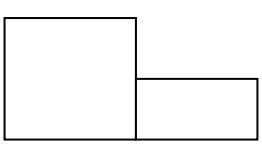
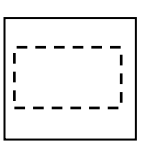
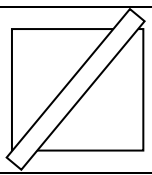
<table>
<tr><td colspan="5">CASE STUDY 3</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: ARCHBISHOPRIC MUSEUM</td></tr>
<tr><td colspan="5">LOCATION: HAMAR, NORWAY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : UNKNOWN</td><td colspan="3">CONSTRUCTION DATE : 1967-1979</td></tr>
<tr><td colspan="2">OLD FUNCTION: BARN</td><td colspan="3">NEW FUNCTION: MUSEUM</td></tr>
<tr><td colspan="2">ARCHITECT : UNKNOWN</td><td colspan="3">ARCHITECT: SVERRE FEHN</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: REINFORCED CONCRETE</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">VIEW FROM COURTYARD (URL25, 2011)</td><td colspan="3">INTERIOR VIEW (Brooker and Stone, 2007)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">3D MODEL (Brooker and Stone, 2007)</td><td colspan="3">EXTERIOR VIEW (URL1, 2011)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">SITE PLAN (URL25, 2011)</td><td colspan="3">PLAN (URL25, 2011)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td></td><td></td><td>X</td></tr>
</table>

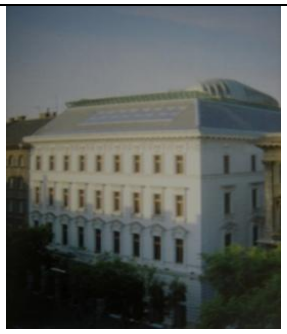
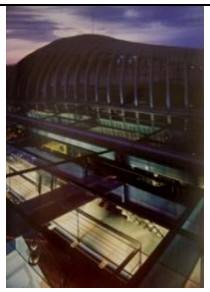
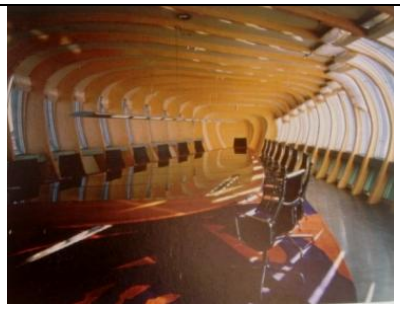
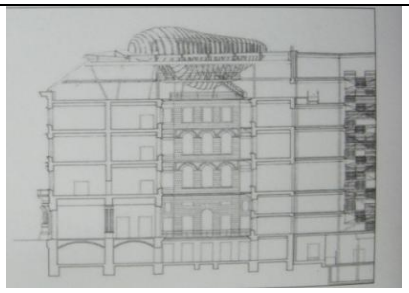
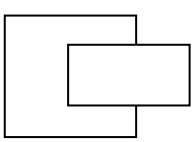
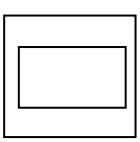
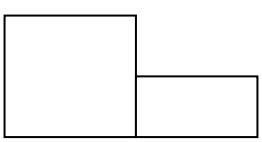
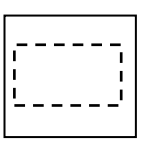
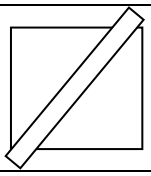
Table 9. Analysis of Archbishopric Museum

CASE STUDY 3: ARCHBISHOPRIC MUSEUM			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			X
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			X
		Terminate in a space			X
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			X
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Frames used as the structural system of the bridge which provides circulation in the museum. -Columns are sitting on the ground and supporting the bridge.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL			-R.C. is used as structural material since it is not a frequently used material in the addition. -Concrete has left exposed to give a dramatic effect in the old building.	
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional volume is a freestanding element which is not touching to the existing walls. -The bridge which is passing through the existing building is supported with reinforced concrete columns.	

Table 10. General information of Ing and Nnh Bank

<table>
<tr><td colspan="5">CASE STUDY 4</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: ING AND NNH BANK</td></tr>
<tr><td colspan="5">LOCATION: BUDAPEST, HUNGARY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1882</td><td colspan="3">CONSTRUCTION DATE : 1992-1997</td></tr>
<tr><td colspan="2">OLD FUNCTION: UNKNOWN</td><td colspan="3">NEW FUNCTION: OFFICE BUILDING</td></tr>
<tr><td colspan="2">ARCHITECT : UNKNOWN</td><td colspan="3">ARCHITECT: ERIC VAN EGERAAT</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: ARCH</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: TIMBER</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Powell, 1999)</td><td colspan="3">EXTERIOR VIEW (Powell, 1999)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">ROOF (Brooker and Stone, 2007)</td><td colspan="3">INTERIOR VIEW (Brooker and Stone, 2007)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">SECTION (Powell, 1999)</td><td colspan="3">PLAN (Powell, 1999)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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</table>

Table 11. Analysis of Ing and Nnh Bank

CASE STUDY 4: ING AND NNH BANK			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of	X
	SCALE	Achieving human scale	X
	PROPORTITION	Height to width ratio	
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	X
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
STRUCTURE SYSTEM	**FORM ACTIVE**	**VECTOR**	**SECTION**	**SURFACE**
	Arch: -Timber arches were repeated continuously and formed a spherical structure.			
MATERIAL	**STEEL**	**TIMBER**	**R.C.**	**STONE**
		-Timber is the structural material of the repeated arches. -Gaps between arches are covered with glass for transparency.		
CONNECTION	**SUSPENDED FROM EXISTING STRUCTURE**	**ATTACHED**	**FREESTANDING**	**COMPLEX**
		- Additional volume is at the top of the building. -It is attached to the walls of the existing buildings.		

Table 12. General information of the Reichstag

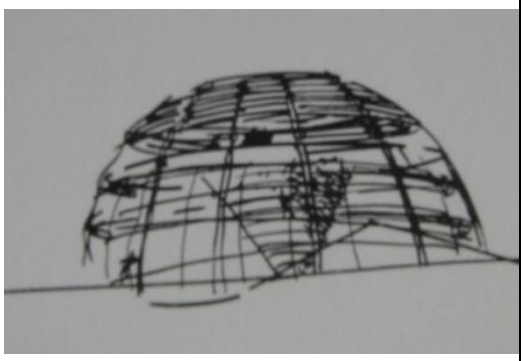
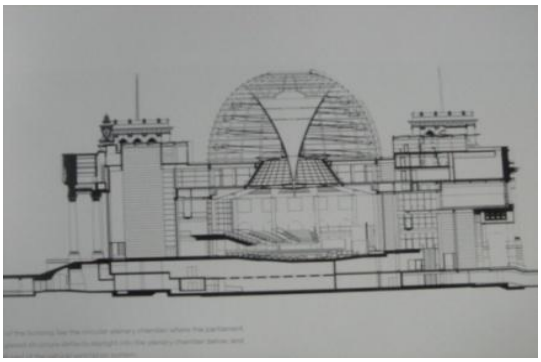
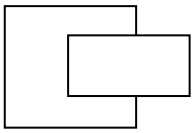
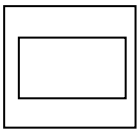
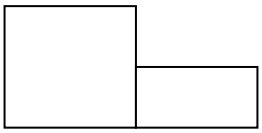
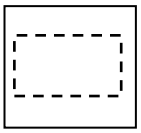
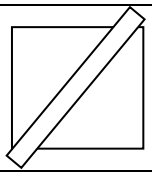
CASE STUDY 5				
NAME OF THE BUILDING: THE REICHSTAG				
LOCATION: BERLIN, GERMANY				
EXISTING		**ADDITION**		
CONSTRUCTION DATE : 1894		**CONSTRUCTION DATE :** 1992-1999		
OLD FUNCTION: PARLIAMENT HOUSE		**NEW FUNCTION:** PARLIAMENT HOUSE		
ARCHITECT : PAUL WALLOT		**ARCHITECT:** NORMAN FOSTER		
STRUCTURE SYSTEM: MASONRY		**STRUCTURE SYSTEM**: DOME		
MATERIAL: BRICK		**MATERIAL**: STEEL		
				
EXTERIOR VIEW (Powell, 1999)		CONSTRUCTION PROCESS (Powell, 1999)		
				
3D SKETCH (Powell, 1999)		SECTION (Powell, 1999)		
INTEGRATED	**INSERTED**	**ATTACHED**	**WRAPPED**	**PIERCED**
				
X				

Table 13. Analysis of the Reichstag

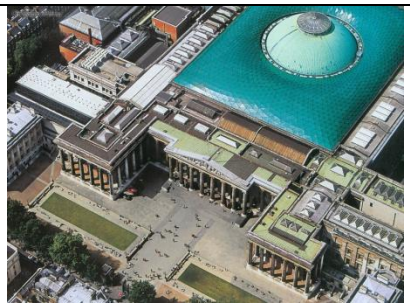
CASE STUDY 5: THE REICHSTAG			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	X
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			X
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			X
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			X
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	

Adapted from
(Şahin, 2010) ; (URL40)
(Ching, 2002)
(Brooker and Stone, 2004)

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM	**Dome:** -Steel elements are repeated in horizontal and vertical direction to form the dome. - The spiral ramp is attached to the dome which provides circulation to the upper parts.			
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION				-Additional volume is a freestanding element which is not touching to the existing walls; however it is suspended from some points.

Table 14. General information of the British Museum

<table>
<tr><td colspan="5">CASE STUDY 6</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: GREAT COURT , BRITISH MUSEUM</td></tr>
<tr><td colspan="5">LOCATION: LONDON, ENGLAND</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1820-1850</td><td colspan="3">CONSTRUCTION DATE : 1994-2000</td></tr>
<tr><td colspan="2">OLD FUNCTION: MUSEUM</td><td colspan="3">NEW FUNCTION: LIBRARY</td></tr>
<tr><td colspan="2">ARCHITECT : SIR ROBERT SMIRKE</td><td colspan="3">ARCHITECT: NORMAN FOSTER</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: GRID SHELL</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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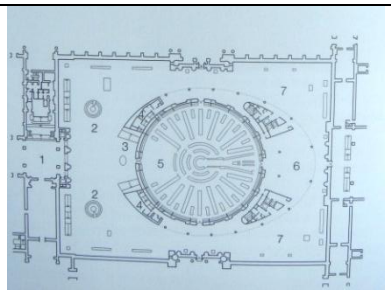
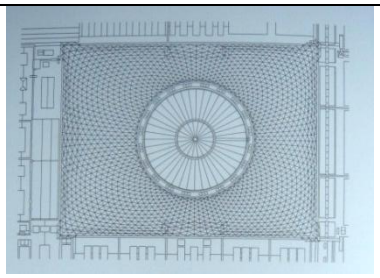
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">PLAN (Schittinch, 2003)</td><td colspan="3">ROOF PLAN (Schittinch, 2003)</td></tr>
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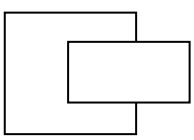
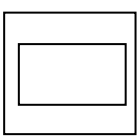
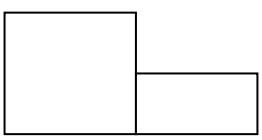
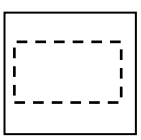
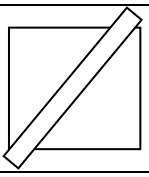
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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Table 15. Analysis of the Great Court, British Museum

CASE STUDY 6: BRITISH MUSEUM			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			X
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			X
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			X
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM				**Grid Shell:** -Steel elements are repeated in two ways to form the grid shell surface. -The structure allows spanning the distances without any column. -Transparency is achieved.
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION		-Additional roof is a lightweight grid shell so it is attached to the existing building. - It is located on the stone porticos.		

Table 16. General information of the X'teresa Alternative Art Center

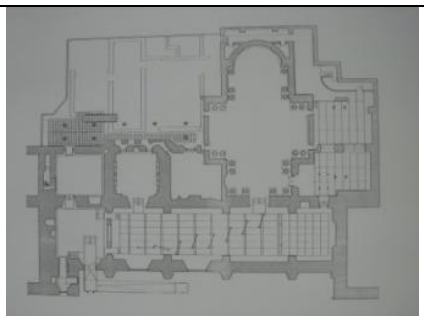
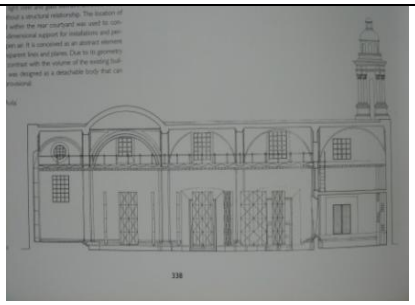
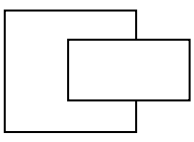
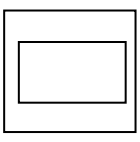
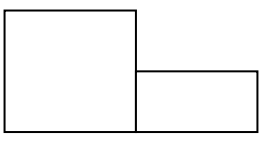
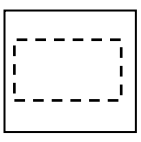
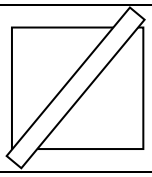
<table>
<tr><td colspan="5">CASE STUDY 7</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: X'TERESA ALTERNATIVE ART CENTER</td></tr>
<tr><td colspan="5">LOCATION: MEXICO CITY, MEXICO</td></tr>
<tr><td colspan="3">EXISTING</td><td colspan="2">ADDITION</td></tr>
<tr><td colspan="3">CONSTRUCTION DATE : UNKNOWN</td><td colspan="2">CONSTRUCTION DATE : -</td></tr>
<tr><td colspan="3">OLD FUNCTION: CHURCH</td><td colspan="2">NEW FUNCTION: ART CENTER</td></tr>
<tr><td colspan="3">ARCHITECT : UNKNOWN</td><td colspan="2">ARCHITECT: LUIS VICENTE FLORES</td></tr>
<tr><td colspan="3">STRUCTURE SYSTEM: MASONRY</td><td colspan="2">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="3">MATERIAL: BRICK</td><td colspan="2">MATERIAL: STEEL</td></tr>
<tr><td colspan="3">  </td><td colspan="2">  </td></tr>
<tr><td colspan="3">EXTERIOR VIEW (Broto, 2004)</td><td colspan="2">EXTERIOR VIEW (Broto, 2004)</td></tr>
<tr><td colspan="3">  </td><td colspan="2">  </td></tr>
<tr><td colspan="3">INTERIOR VIEW (Broto, 2004)</td><td colspan="2">PLAN (Broto, 2004)</td></tr>
<tr><td colspan="3">  </td><td colspan="2">  </td></tr>
<tr><td colspan="3">SECTION (Broto, 2004)</td><td colspan="2">ELEVATION (Broto, 2004)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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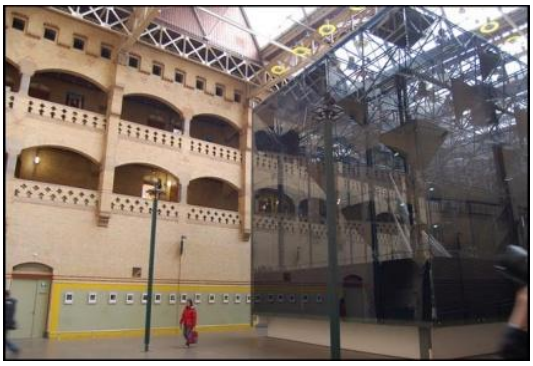
Table 17. Analysis of the X'teresa Alternative Art Center

CASE STUDY 7:			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	
		A sudden change in shape	X
	CONTRAST	In terms of size	
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			X
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	X
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the circulation route. -It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. - A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional volume is a freestanding element, supported with steel columns, located in the existing inner courtyard of the building.	

Table 18. General information of the Glass Music Hall

<table>
<tr><td colspan="5">CASE STUDY 8</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: GLASS MUSIC HALL</td></tr>
<tr><td colspan="5">LOCATION: AMSTERDAM, HOLLAND</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1899</td><td colspan="3">CONSTRUCTION DATE : -</td></tr>
<tr><td colspan="2">OLD FUNCTION: CHURCH</td><td colspan="3">NEW FUNCTION: CONCERT HALL</td></tr>
<tr><td colspan="2">ARCHITECT : H.P. BERLAGE</td><td colspan="3">ARCHITECT: PETER ZAANEN -MICK EEKHOUT</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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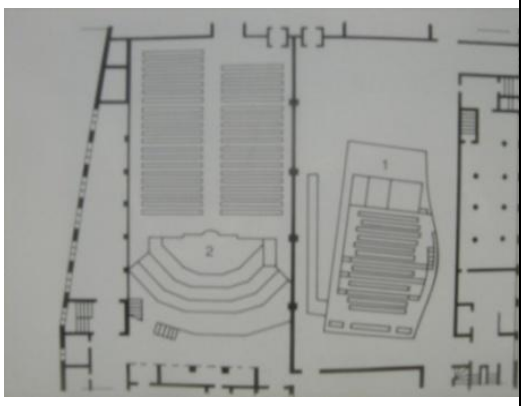
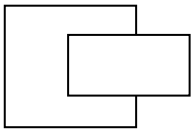
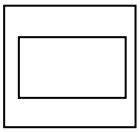
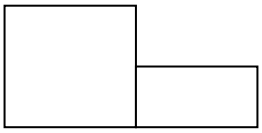
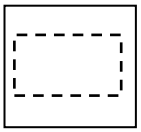
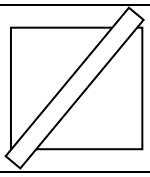
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">PLAN (Brookes and Grech, 1992)</td><td colspan="3">INTERIOR VIEW (Brookes and Grech, 1992)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td>X</td><td></td><td></td><td></td></tr>
</table>

Table 19. Analysis of the Glass Music Hall

CASE STUDY 8: GLASS MUSIC HALL			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	X
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	X
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM		**Space Frame:** -Space frame is used as the structural system of the additional concert hall. - It is a light material and it is easy to construct in the existing masonry buildings.		
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional volume is a freestanding element spanned with space frame. - It is supported with steel columns, located in the existing building.	

Table 20. General information of the Architectural Documentation Center

<table>
<tr><td colspan="5">CASE STUDY 9</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: ARCHITECTURAL DOCUMENTATION CENTER</td></tr>
<tr><td colspan="5">LOCATION: MADRID, SPAIN</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1945</td><td colspan="3">CONSTRUCTION DATE : 2004</td></tr>
<tr><td colspan="2">OLD FUNCTION: DOCUMENTATION CENTER</td><td colspan="3">NEW FUNCTION: CONGRESS HALL</td></tr>
<tr><td colspan="2">ARCHITECT : UNKNOWN</td><td colspan="3">ARCHITECT: APARICO, FERNANDEZ, ELORZA</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: SLAB</td></tr>
<tr><td colspan="2">MATERIAL: BRICK</td><td colspan="3">MATERIAL: REINFORCED CONCRETE</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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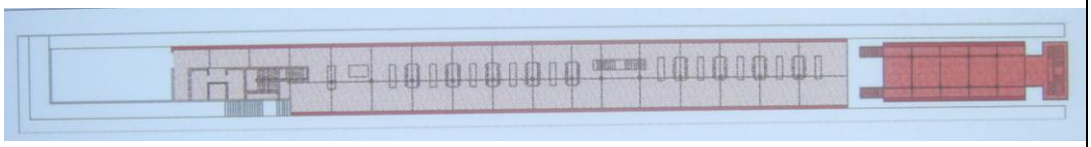
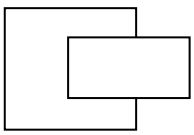
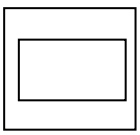
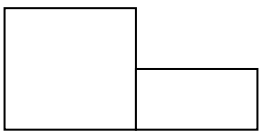
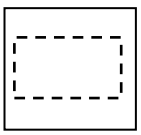
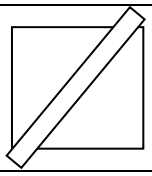
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">PLAN (Brooker and Stone, 2008)</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">SECTION (Brooker and Stone, 2008)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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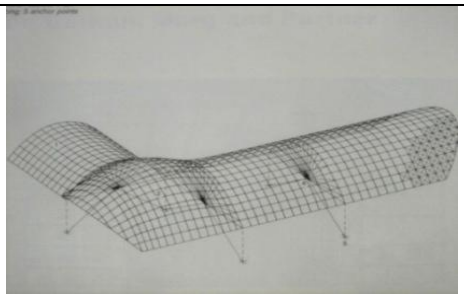
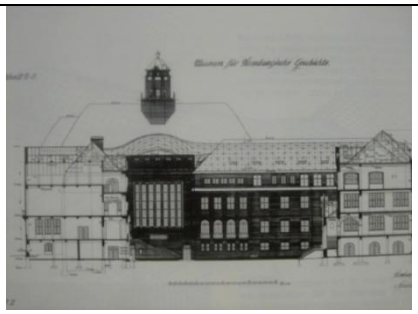
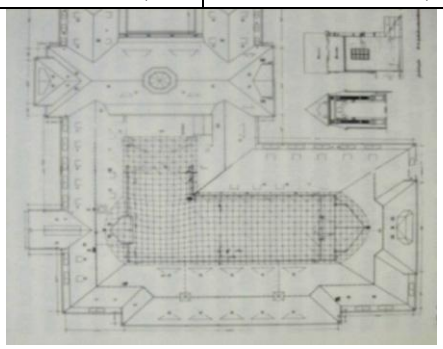
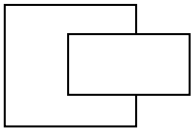
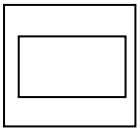
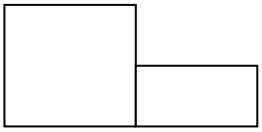
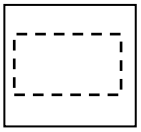
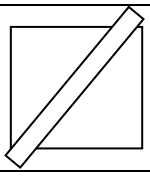
Table 21. Analysis of the Architectural Documentation Center

CASE STUDY 9: ARCHITECTURAL DOCUMENTATION CENTER			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	X
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	X
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			X
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			X
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			X
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR	X	LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** **-**Concrete frames used as the structural system of the additional conference hall. -Columns are sitting on the ground and supporting the plane.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL			-Reinforced concrete is used as structural material since it is not a frequently used material in the addition. -Concrete has left exposed to give a dramatic effect in the old building.	
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional volume is a freestanding element which is not touching to the existing walls. -The plane is supported with reinforced concrete columns in the existing building.	

Table 22. General information of the Museum of Local History

<table>
<tr><td colspan="5">CASE STUDY 10</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: MUSEUM OF LOCAL HISTORY</td></tr>
<tr><td colspan="5">LOCATION: HAMBURG</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1913</td><td colspan="3">CONSTRUCTION DATE : 1988</td></tr>
<tr><td colspan="2">OLD FUNCTION: MUSEUM</td><td colspan="3">NEW FUNCTION: MUSEUM</td></tr>
<tr><td colspan="2">ARCHITECT: FRITZ SCHUMACHER</td><td colspan="3">ARCHITECT: VON GERKHAN</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: GRID SHELL</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (URL29, 2011)</td><td colspan="3">INTERIOR VIEW (Brookes and Grech 1992)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">3D MODEL (Brookes and Grech, 1992)</td><td colspan="3">ELEVATION (Brookes and Grech, 1992)</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">PLAN (Brookes and Grech, 1992)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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</table>

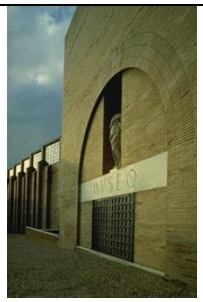
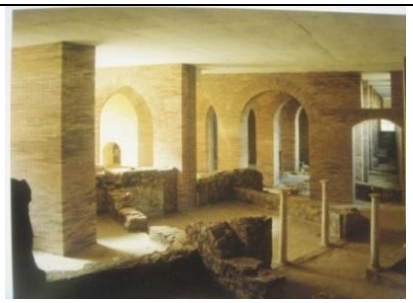
Table 23. Analysis of the Museum of Local History

CASE STUDY 10: MUSEUM OF LOCAL HISTORY			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM				**Grid Shell:** -Steel elements are repeated in two ways to form the grid shell surface. -The structure allows spanning the distances without any column. -Roof is supported at some points with tension cables.
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION		-Additional roof is a lightweight grid shell so it is attached to the existing building. - It is located on the stone porticos and supported with cables.		

Table 24. General information of the National Museum of Roman Art

<table>
<tr><td colspan="5">CASE STUDY 11</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: NATIONAL MUSEUM OF ROMAN ART</td></tr>
<tr><td colspan="5">LOCATION: MERIDA, SPAIN</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 25 BC</td><td colspan="3">CONSTRUCTION DATE : 1989</td></tr>
<tr><td colspan="2">OLD FUNCTION: CITY RUINS</td><td colspan="3">NEW FUNCTION: MUSEUM</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: RAFAEL MONEO</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: ARCH</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STONE</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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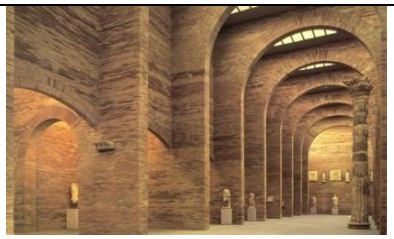
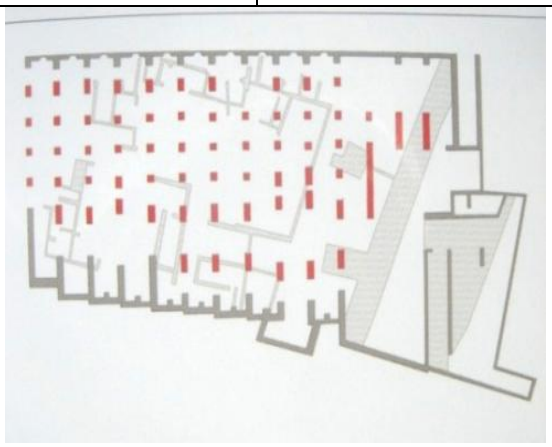
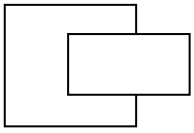
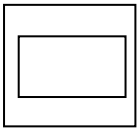
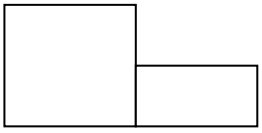
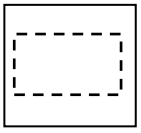
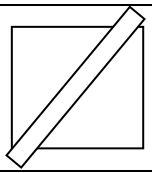
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">INTERIOR VIEW (URL30, 2011)</td><td colspan="3">INTERIOR VIEW (URL30, 2011)</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">PLAN (Brooker and Stone, 2008)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td></td><td>X</td><td></td></tr>
</table>

Table 25. Analysis of the National Museum of Roman Art

CASE STUDY 11: NATIONAL MUSEUM OF ROMAN ART			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	X
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	X
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	X
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			X
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			X
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			X
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL	X	GRIDAL	X
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM	**Arch:** -Arch is used as structure system in order to have a harmony between existing and addition.			
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL			-Reinforced concrete used as structural material and arches have covered with stone cladding material to have a historical effect.	
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building that wraps the existing ruins is a freestanding volume. -Supports are located on a sloped axe and they do not touch to the existing building.	

Table 26. General information of the Santa Catherina Market

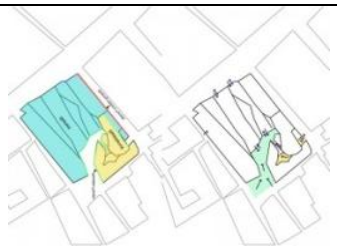
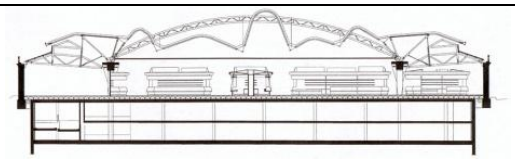
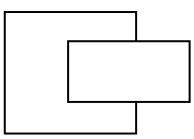
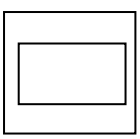
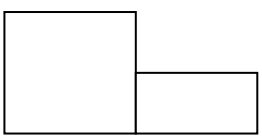
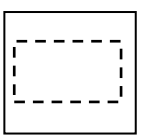
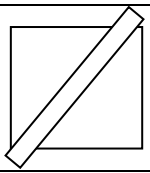
<table>
<tr><td colspan="5">CASE STUDY 12</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: SANTA CATHERINA MARKET</td></tr>
<tr><td colspan="5">LOCATION: BARCELONA, SPAIN</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1845</td><td colspan="3">CONSTRUCTION DATE : 2006</td></tr>
<tr><td colspan="2">OLD FUNCTION: MARKET</td><td colspan="3">NEW FUNCTION: MARKET</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: EMBT (ENRIC MIRALLES-BENEDETTA TAGLIABUE)</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: ARCH</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: TIMBER</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Brooker and Stone, 2008)</td><td colspan="3">INTERIOR VIEW (URL31, 2011)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">3D MODEL (URL31, 2011)</td><td colspan="3">FRONT ELEVATION (URL32, 2011)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">SITE PLAN (URL1, 2011)</td><td colspan="3">SECTION (URL1, 2011)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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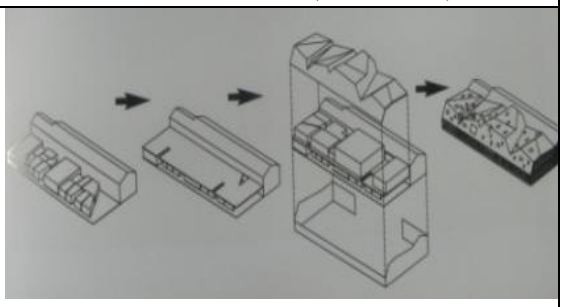
Table 27. Analysis of the Santa Catherina Market

CASE STUDY 12: SANTA CATHERINA MARKET			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	X
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL	X	GRIDAL	X
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM	**Arch:** -Arch is used as structure system in order to have a harmony between existing and addition. -Steel arches supported with trusses vertically at some points. Arches transfer the load through tree like columns.			
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building that wraps the existing building is a freestanding plane. -Supports are located on a different axe system and they do not touch to the existing building.	

Table 28. General information of the Culture and Education Center

<table>
<tr><td colspan="5">CASE STUDY 13</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: CULTURE AND EDUCATION CENTER</td></tr>
<tr><td colspan="5">LOCATION: DEN HELDER,NETHERLAND</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : -</td><td colspan="3">CONSTRUCTION DATE : -</td></tr>
<tr><td colspan="2">OLD FUNCTION: WAREHOUSE</td><td colspan="3">NEW FUNCTION: CULTURE AND EDUCATION CENTER</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: BJARNE MASTENBROEK</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Broto, 2004)</td><td colspan="3">EXTERIOR VIEW (Broto, 2004)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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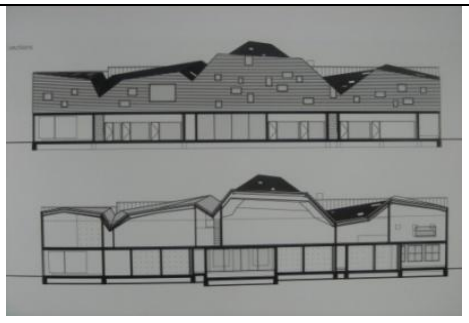
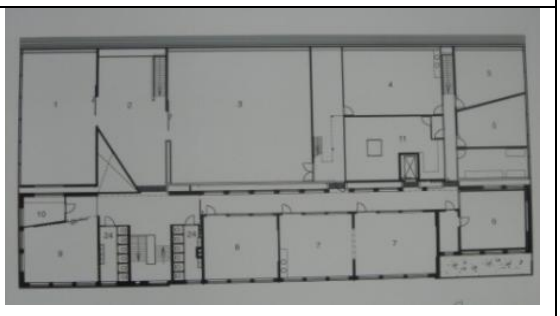
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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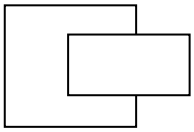
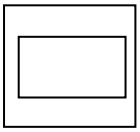
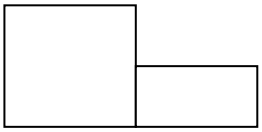
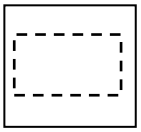
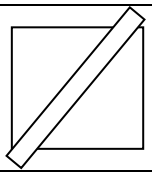
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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</table>

Table 29. Analysis of the Culture and Education Center

CASE STUDY 13: CULTURE AND EDUCATION CENTER			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	X
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used to cover a group of existing small buildings. -Addition is wrapping the existing as an envelope.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building that wraps the existing building is a freestanding plane. -Supports are located on a different axe system and they do not touch to the existing building.	

Table 30. General information of the Landesusstellung Kärnten

<table>
<tr><td colspan="5">CASE STUDY 14</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: LANDESUSSTELLUNG KARNTEN</td></tr>
<tr><td colspan="5">LOCATION: HUTTENBERG, AUSTURIA</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : -</td><td colspan="3">CONSTRUCTION DATE : -</td></tr>
<tr><td colspan="2">OLD FUNCTION: FACTORY</td><td colspan="3">NEW FUNCTION: CULTURE AND EXHIBITION CENTER</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: GUNTER DOMENIG</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
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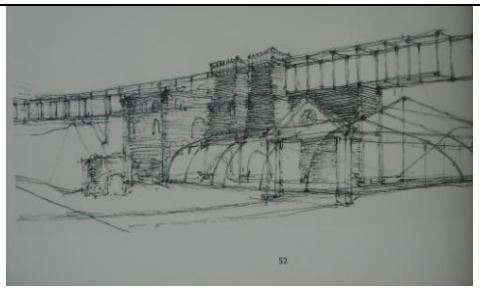
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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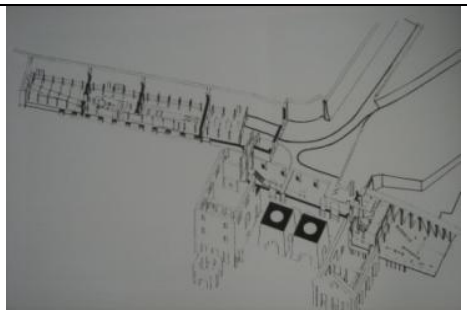
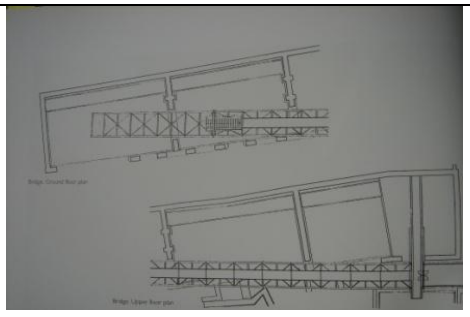
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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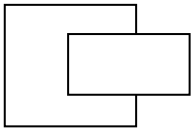
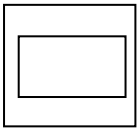
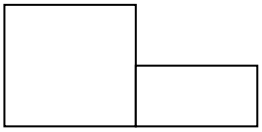
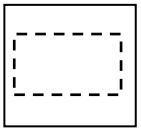
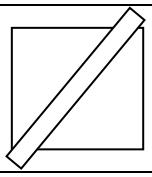
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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Table 31. Analysis of the Landesusstellung Kärnten

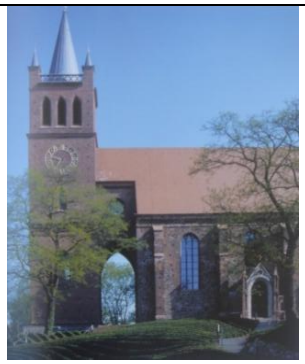
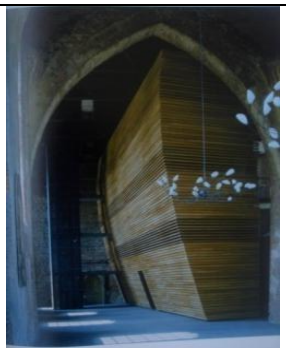
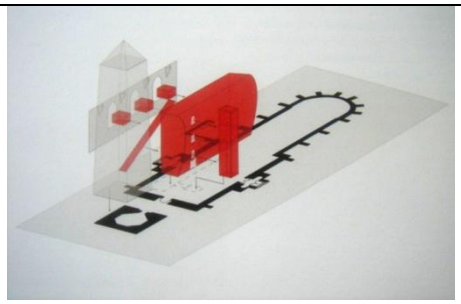
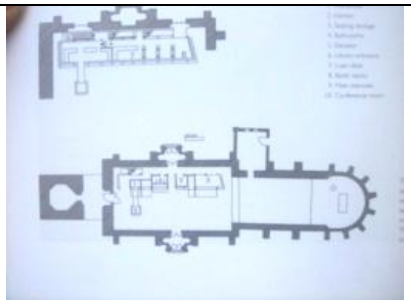
CASE STUDY 14: LANDESUSSTELLUNG KÄRNTEN			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			X
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			X
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	
		GRIDAL		GRIDAL	

Adapted from
(Sahin, 2010) ; (URL40)
(Ching, 2002)
(Brooker and Stone, 2004)

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the circulation route. -It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass to achieve transparency. - A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with columns and cantilevered at some point. -Addition is not touching to the existing walls.	

Table 32. General information of the St. Mary Library

<table>
<tr><td colspan="5">CASE STUDY 15</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: ST. MARY LIBRARY</td></tr>
<tr><td colspan="5">LOCATION: MUNCHEBERG, GERMANY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE: 13 TH</td><td colspan="3">CONSTRUCTION DATE : 1992</td></tr>
<tr><td colspan="2">OLD FUNCTION: CHURCH</td><td colspan="3">NEW FUNCTION: LIBRARY</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: KLAUS BLOCK ARCHITEKT</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Broto, 2004)</td><td colspan="3">INTERIOR VIEW (Broto, 2004)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
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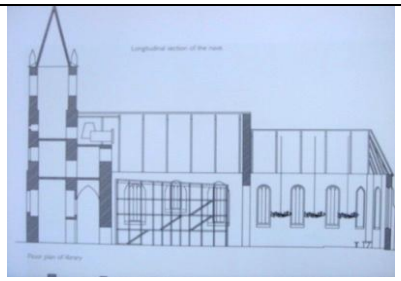
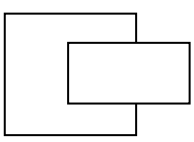
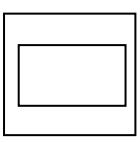
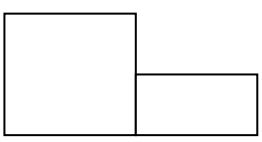
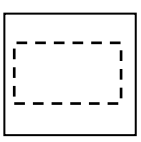
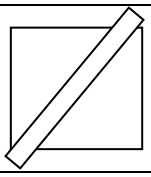
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">PLAN (Broto, 2004)</td><td colspan="3">SECTION (Broto, 2004)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
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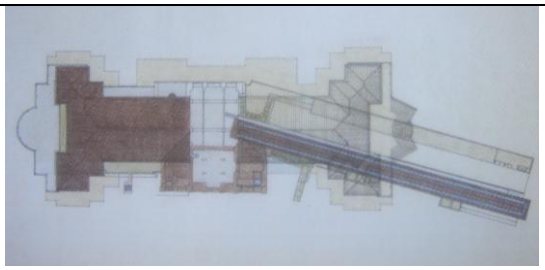
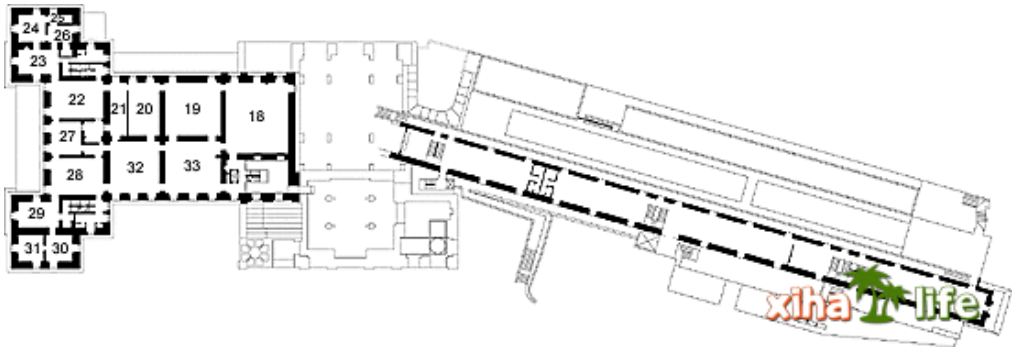
Table 33. Analysis of the St. Mary Library

CASE STUDY 15: ST. MARY LIBRARY			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR	X	LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** - Steel frames are used as the structural system of the addition. - It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with timber. - A harmony is created with the use of timber in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with columns. Addition is not touching to the existing walls.	

Table 34. General information of the Rivoli Museum of Contemporary Art

CASE STUDY 16	
NAME OF THE BUILDING: RIVOLI MUSEUM OF CONTEMPORARY ART	
LOCATION: RIVOLI, ITALY	
EXISTING	**ADDITION**
CONSTRUCTION DATE : 18TH	**CONSTRUCTION DATE :** 1985
OLD FUNCTION: CASTLE	**NEW FUNCTION:** MUSEUM
ARCHITECT: FILIPPO JUVARA	**ARCHITECT:** ANDREA BRUNO
STRUCTURE SYSTEM: MASONRY	**STRUCTURE SYSTEM**: FRAME
MATERIAL: STONE	**MATERIAL**: STEEL
	
EXTERIOR VIEW (Brooker and Stone, 2007)	SITE PLAN (Brooker and Stone, 2007)
	
PLAN (URL33, 2011)	

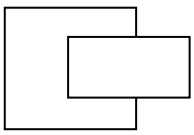
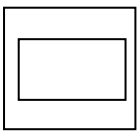
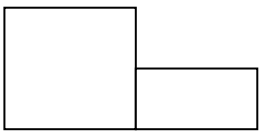
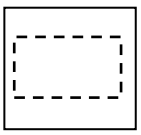
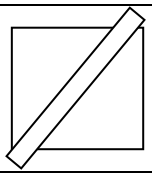
INTEGRATED	**INSERTED**	**ATTACHED**	**WRAPPED**	**PIERCED**
				
				X

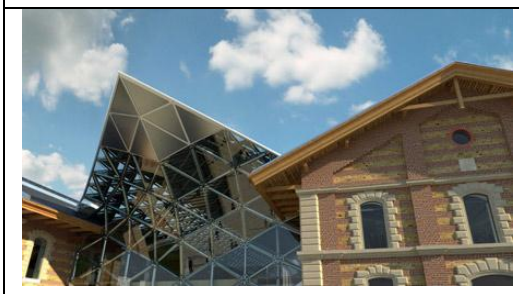
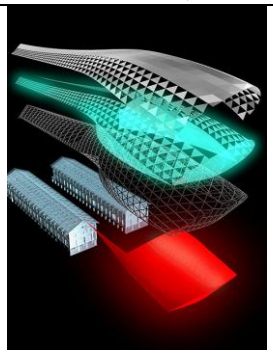
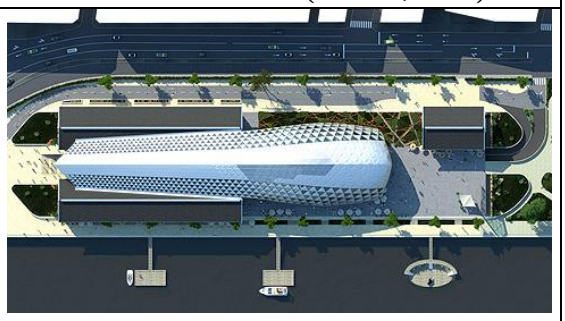
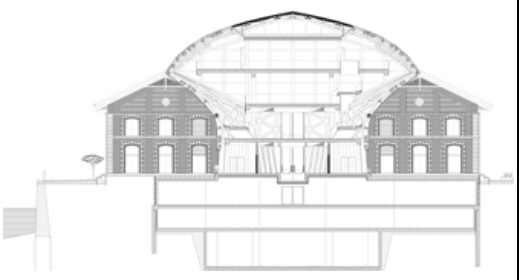
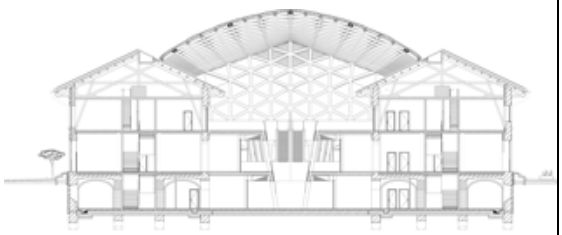
Table 35. Analysis of the Rivoli Museum of Contemporary Art

CASE STUDY 16: RIVOLI MUSEUM OF CONTEMPORARY ART			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	X
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	X
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of layout	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	X

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			X
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			X
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER	X	CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the addition. - It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION	-The Castle floors are accessed by a metallic staircase suspended by steel tie-beams designed by the architect.			

Table 36. General information of the CET Budapest

CASE STUDY 17	
NAME OF THE BUILDING: CENTRAL EUROPEAN TIME	
LOCATION: BUDAPEST	
EXISTING	**ADDITION**
CONSTRUCTION DATE : 19TH	**CONSTRUCTION DATE :** 2010
OLD FUNCTION: WAREHOUSE	**NEW FUNCTION:** MIXED USE DEVELOPMENT
ARCHITECT: UNKNOWN	**ARCHITECT:** MARTHIJIN POOL
STRUCTURE SYSTEM: MASONRY	**STRUCTURE SYSTEM**: GRID SHELL
MATERIAL: STONE	**MATERIAL**: STEEL
	
EXTERIOR DETAIL (URL34, 2011)	EXTERIOR VIEW (URL34, 2011)
	
3D MODEL (URL34, 2011)	SITE PLAN (URL34, 2011)
	
SECTION-ELEVATION (URL34, 2011)	SECTION (URL34, 2011)

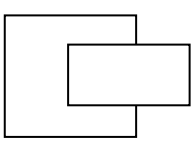
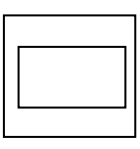
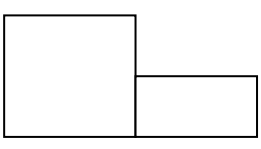
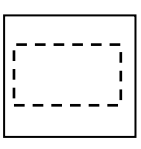
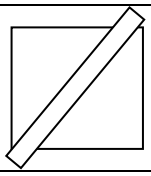
INTEGRATED	**INSERTED**	**ATTACHED**	**WRAPPED**	**PIERCED**
				
X				

Table 37. Analysis of the CET Budapest

CASE STUDY 17: CET Budapest			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			X
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			X
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			X
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			X
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL		CENTRAL	
		LINEAR	X	LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM				**Grid Shell:** -Steel elements are repeated in two ways to form the grid shell surface. -The structure allows spanning the distances without any column. -Transparency is achieved.
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION				-Additional volume is a freestanding element which is not touching to the existing walls; however it is suspended from some points.

Table 38. General information Hedmark Museum & Glass Cathedral

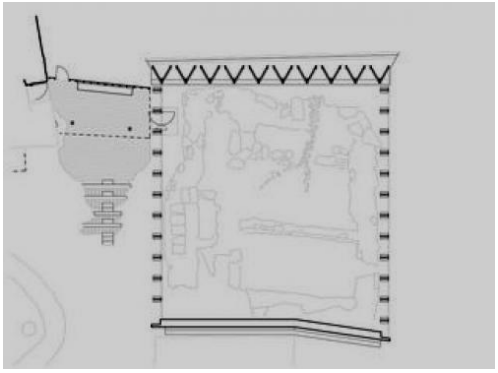
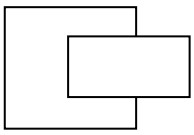
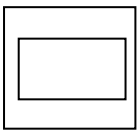
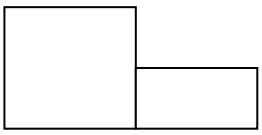
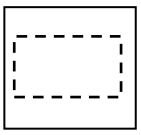
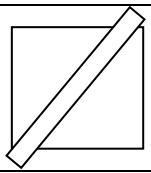
<table>
<tr><td colspan="5">CASE STUDY 18</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: HEDMARK MUSEUM & GLASS CATHEDRAL</td></tr>
<tr><td colspan="5">LOCATION: HAMAR, NORWAY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 13TH CENTURY</td><td colspan="3">CONSTRUCTION DATE : 1987</td></tr>
<tr><td colspan="2">OLD FUNCTION: CATHEDRAL</td><td colspan="3">NEW FUNCTION: MUSEUM-</td></tr>
<tr><td colspan="2">ARCHITECT: UNKNOWN</td><td colspan="3">ARCHITECT: KJELL LUND</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXISTING BUILDING (URL35, 2011)</td><td colspan="3">EXTERIOR VIEW (URL36, 2011)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">INTERIOR VIEW (URL1, 2011)</td><td colspan="3">PLAN (URL25, 2011)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td></td><td>X</td><td></td></tr>
</table>

Table 39. Analysis of the Hedmark Museum and Glass Cathedral

CASE STUDY 18: HEDMARK MUSEUM & GLASS CATHEDRAL			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	X
		A sudden change in size	X
		A sudden change in shape	X
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	X
		In terms of alignment	X
		In terms of position	X
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			X
		By a unique shape			X
		By strategic location			X
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM		**Truss:** -Steel truss is used as the structural system of the addition to span the large distance over the ruins. - It is a light material and it is easy to construct in the existing masonry buildings.		
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with trussed columns. - Addition is not touching to the existing walls.	

Table 40. General information of Museum of Contemporary Art

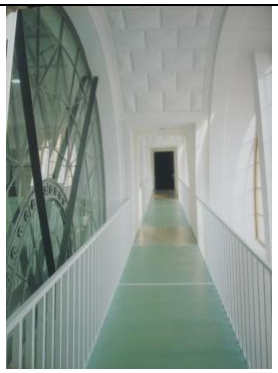
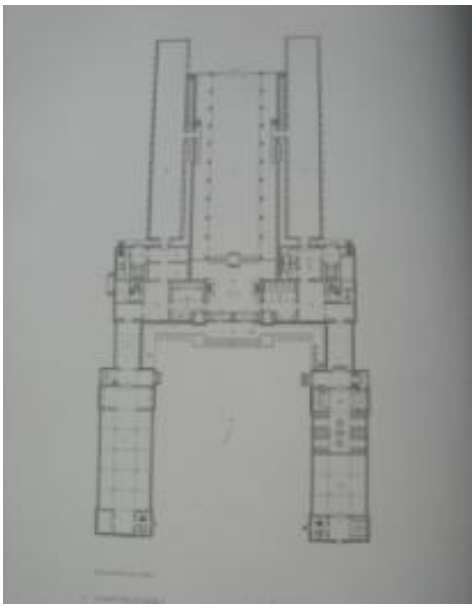
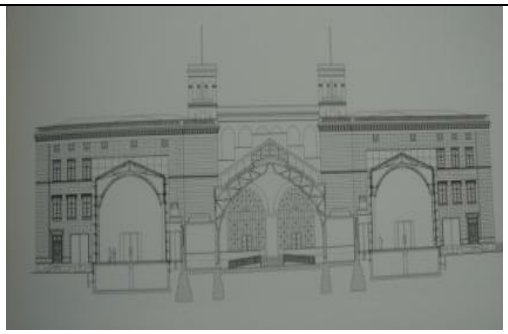
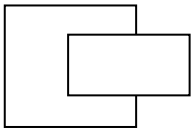
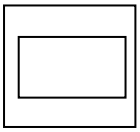
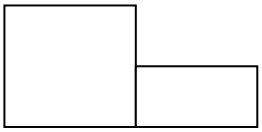
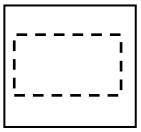
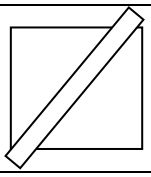
<table>
<tr><td colspan="5">CASE STUDY 19</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: MUSEUM OF CONTEMPORARY ART</td></tr>
<tr><td colspan="5">LOCATION: BERLIN, GERMANY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1845-47</td><td colspan="3">CONSTRUCTION DATE : 1989-1996</td></tr>
<tr><td colspan="2">OLD FUNCTION: UNKNOWN</td><td colspan="3">NEW FUNCTION: MUSEUM</td></tr>
<tr><td colspan="2">ARCHITECT: FERDINAND WILHELM</td><td colspan="3">ARCHITECT: JOSEF-PAUL KLEIHUES</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: TRUSSED ARCH</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Powell, 1999)</td><td colspan="3">INTERIOR VIEW (Powell, 1999)</td></tr>
<tr><td colspan="2">  </td><td colspan="3" rowspan="3">  </td></tr>
<tr><td colspan="2">INTERIOR VIEW (Powell, 1999)</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">SECTION (Powell, 1999)</td><td colspan="3">PLAN (Powell, 1999)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td>X</td><td></td><td></td></tr>
</table>

Table 41. Analysis of the Museum of Contemporary Art

CASE STUDY 19: MUSEUM OF CONTEMPORARY ART			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	X
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	X
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	X
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	X
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	X
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	X
		Formal balance in composition of layout	
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM		**Truss:** -Steel truss is used as the structural system of the addition. -It is a light material and it is easy to construct in the existing masonry buildings.		
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with trussed columns. -Addition is not touching to the existing walls.	

Table 42. General information of Billingsgate Market

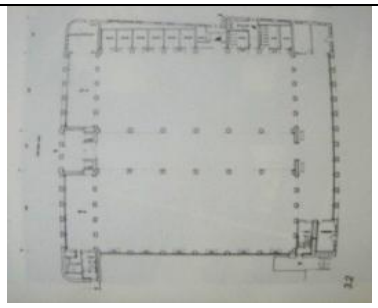
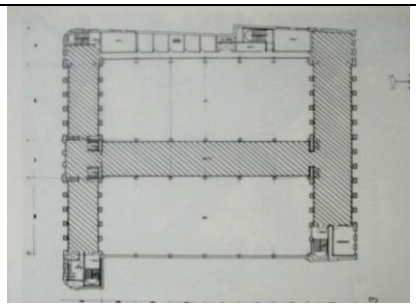
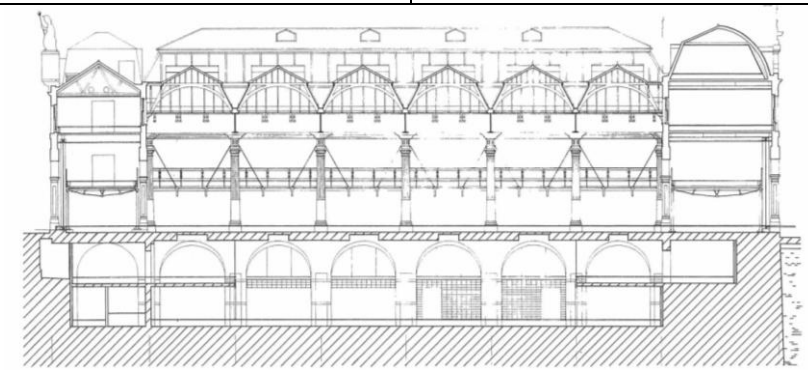
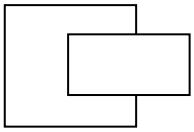
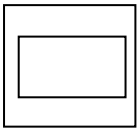
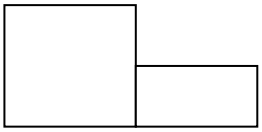
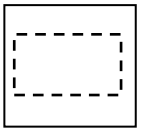
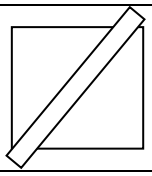
<table>
<tr><td colspan="5">CASE STUDY 20</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: BILLINGSGATE MARKET</td></tr>
<tr><td colspan="5">LOCATION: LONDON, UK</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1874-1877</td><td colspan="3">CONSTRUCTION DATE : 1985</td></tr>
<tr><td colspan="2">OLD FUNCTION: MARKET</td><td colspan="3">NEW FUNCTION: MUSEUM</td></tr>
<tr><td colspan="2">ARCHITECT: SIR HORACE JONES</td><td colspan="3">ARCHITECT: RICHARD ROGER</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: CABLE</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Brookes and Grech, 1992)</td><td colspan="3">INTERIOR VIEW (Brookes and Grech, 1992)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">GROUND F. PLAN (Brookes and Grech, 1992)</td><td colspan="3">FIRST F. PLAN (Brookes and Grech, 1992)</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">SECTION (Brookes and Grech, 1992)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td>X</td><td></td><td></td><td></td></tr>
</table>

Table 43. Analysis of the Billingsgate Market

CASE STUDY 20: BILLINGSGATE MARKET			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		**APPROACH**	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	X
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	X
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	
		Repetition of character providing right mix	X
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	X
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
STRUCTURE SYSTEM	**FORM ACTIVE**	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
	Cable: -Mezzanine floors are supported with steel cables. There is no connection from the floor.			
MATERIAL	**STEEL**	**TIMBER**	**R.C.**	**STONE**
	-Steel is used as structural material and it is covered with glass. -A contrast is created with the use of steel and glass in the brick masonry building.			
CONNECTION	**SUSPENDED FROM EXISTING STRUCTURE**	**ATTACHED**	**FREESTANDING**	**COMPLEX**
	-Additional mezzanine floor is suspended from the stone columns with the cables.			

5.4 Evaluation of the case studies

All case studies which are analyzed are represented in a single table in order to see the relation between structures used in the case studies and the types of extension which is identified as integrated, inserted, attached, wrapped and pierced. Each type is represented with a different color (Table 44).

As the second step, all the possible factors are represented in a common matrix to see the relationship between structure and the design approach for each case study (Table 45).

Lastly, every case study is colored with the colors of the types that are identified in Table 44 in order to see the relationship between structure and the design approach within the groups (Table 46) and the ones that have the same characteristics have been grouped together. In Table 47 examples which are in the same color (in the same group) have been put side by side to be able to read the relation better.

Table 44. Represents relationship between case studies and the type of the extension

CASE STUDY	RELATIONSHIP BETWEEN EXISTING AND ADDITION				
	INTEGRATED	INSERTED	ATTACHED	WRAPPED	PIERCED
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Table 45. Representation of factors affecting design and structural approach

FACTORS AFFECTING DESIGN APPROACH																FACTORS AFFECTING STRUCTURAL APPROACH															
	DESIGN PRINCIPLES							ORDERING PRINCIPLES								STRUCTURE SYSTEM										MATERIAL				CONNECTION			
CASE STUDY	UNITY	HARMONY	DOMINANCE	CONTRAST	REPETITION	BALANCE	PROPORTION	AXIS	SYMMETRY	HIERARCHY	RHTYHM	DATUM	TRANSFORMATION	ORGANIZATION	CIRCULATION	CABLE	TENT	ARCH	TRUSS	SPACE FRAME	GEODESIC DOME	FRAME	SLAB	FOLDED PLATE	SHELL	STEEL	TIMBER	R. CONCRETE	STONE	SUSPENDED	ATTACHED	FREESTANDING	COMPLEX
1	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
2	X	X	X	-	X	X	X	-	X	-	-	X	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
3	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
4	-	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-
5	-	-	X	X	-	X	X	-	X	X	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X
6	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
7	-	-	X	X	-	X	X	-	-	X	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
8	X	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-
9	X	X	-	-	-	X	X	X	X	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
10	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
11	X	X	-	X	X	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
12	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	
13	X	-	X	X	-	X	X	-	-	X	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
14	X	-	X	X	-	X	X	-	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
15	X	-	X	X	-	X	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
16	X	X	-	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
17	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	X
18	-	-	X	X	-	X	-	-	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-	-	X	-
19	X	X	X	-	X	X	X	-	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
20	X	X	-	-	X	X	X	-	X	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-

Table 46. Representation of factors affecting design and structural approach within the groups

FACTORS AFFECTING DESIGN APPROACH																FACTORS AFFECTING STRUCTURAL APPROACH															
	DESIGN PRINCIPLES							ORDERING PRINCIPLES								STRUCTURE SYSTEM										MATERIAL				CONNECTION			
CASE STUDY	UNITY	HARMONY	DOMINANCE	CONTRAST	REPETITION	BALANCE	PROPORTION	AXIS	SYMMETRY	HIERARCHY	RHTYHM	DATUM	TRANSFORMATION	ORGANIZATION	CIRCULATION	CABLE	TENT	ARCH	TRUSS	SPACE FRAME	GEODESIC DOME	FRAME	SLAB	FOLDED PLATE	SHELL	STEEL	TIMBER	R. CONCRETE	STONE	SUSPENDED	ATTACHED	FREESTANDING	COMPLEX
1	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
2	X	X	X	-	X	X	X	-	X	-	-	X	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
3	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
4	-	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-
5	-	-	X	X	-	X	X	-	X	X	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X
6	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
7	-	-	X	X	-	X	X	-	-	X	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
8	X	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-
9	X	X	-	-	-	X	X	X	X	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
10	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
11	X	X	-	X	X	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
12	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	
13	X	-	X	X	-	X	X	-	-	X	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
14	X	-	X	X	-	X	X	-	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
15	X	-	X	X	-	X	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
16	X	X	-	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
17	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	X
18	-	-	X	X	-	X	-	-	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-	-	X	-
19	X	X	X	-	X	X	X	-	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
20	X	X	-	-	X	X	X	-	X	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-
LEGEND				INTEGRATED						INSERTED						ATTACHED						WRAPPED				PIERCED							

Table 47. Representation of factors affecting design and structural approach within the groups side by side

FACTORS AFFECTING DESIGN APPROACH																FACTORS AFFECTING STRUCTURAL APPROACH															
	DESIGN PRINCIPLES							ORDERING PRINCIPLES								STRUCTURE SYSTEM										MATERIAL				CONNECTION			
CASE STUDY	UNITY	HARMONY	DOMINANCE	CONTRAST	REPETITION	BALANCE	PROPORTION	AXIS	SYMMETRY	HIERARCHY	RHTYHM	DATUM	TRANSFORMATION	ORGANIZATION	CIRCULATION	CABLE	TENT	ARCH	TRUSS	SPACE FRAME	GEODESIC DOME	FRAME	SLAB	FOLDED PLATE	SHELL	STEEL	TIMBER	R. CONCRETE	STONE	SUSPENDED	ATTACHED	FREESTANDING	COMPLEX
2	X	X	X	-	X	X	X	-	X	-	-	X	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
4	-	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-
5	-	-	X	X	-	X	X	-	X	X	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X
17	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	X
8	X	-	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-
9	X	X	-	-	-	X	X	X	X	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
15	X	-	X	X	-	X	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
20	X	X	-	-	X	X	X	-	X	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-
6	-	-	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
7	-	-	X	X	-	X	X	-	-	X	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
10	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	X	-	-
19	X	X	X	-	X	X	X	-	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-
11	X	X	-	X	X	X	X	-	X	X	-	X	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
12	X	-	X	X	-	X	X	-	X	X	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	
13	X	-	X	X	-	X	X	-	-	X	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
18	-	-	X	X	-	X	-	-	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-	-	X	-
1	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
3	X	-	X	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-
16	X	X	-	X	-	X	X	X	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-
14	X	X	X	X	-	X	X	-	-	X	-	X	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X	-
LEGEND				INTEGRATED						INSERTED						ATTACHED						WRAPPED						PIERCED					

5.5 Findings

Additions should reflect the date which they are built in terms of innovation, technology and material. When reflecting its own era, unity between the old and new must be achieved, either with harmony or contrast. Table 44 represents relationship between effects and case studies in terms of design approach. Relationship has been searched within the groups.

In general, case studies which are selected are prime examples which have satisfied most of the design criteria as shown in Table 45.

In general, steel is the most common used material in additions because it is light, easy to construct and has a good match in terms of contrast with the stone walls. However, there are approaches, where timber and reinforced concrete are used in order to create a harmony between new and old.

In **integrated** category; dominance, balance and proportion are the mostly used design principles. Old and new is contrasting, having no unity with each other. Additions affect the existing circulation of the building; but do not affect organization. Arch and truss are the mostly used structure systems with complex connections, where are sometimes suspended and sometimes freestanding.

In the next category, which the new addition is **inserted** into the existing building, unity, balance and proportion are the mostly used design principles. Symmetry and hierarchy are used as ordering elements. In this category there is almost no

intervention to circulation and organization. In general, frame is the mostly used structure system in combination with steel as material in the inserted type of addition; however there is an approach where additions are suspended with cables from existing structure. In this category there is no need to span large distances like in wrapping category.

For the **attached** category, dominance, balance and proportion are the mostly used design principles with unity and contrast. Symmetry, hierarchy and datum are used for ordering elements. In the few examples it affects the circulation and organization.

In the **wrapping** category, contrast and balance are used as design principles mostly. There is almost no effect to organization and circulation. Hierarchy and datum are used to order the elements. Arch, truss, frame and space frame are the mostly used structural systems where large distances are needed to span without touching to the existing masonry walls in wrapping category.

For the last category which is **pierced**, the organization and circulation of the existing building are affected by the new addition in all examples. Contrast, balance and proportion are used to achieve unity between the old and the new. Axis, hierarchy and datum are used as ordering principles. Steel frames are used mostly as suspended from the existing structure.

Chapter 6

EMPIRICAL STUDY

6.1 Selection of the empirical Study

Kadir Has University Cibali Campus Building was selected as the empirical study of this thesis. The case studies that have been analyzed in the previous chapter contain only one type of extension. Almost every type of extension, which was identified, exists in the selected empirical study. The analysis method has been tested through empirical study and extensions in case studies have been compared with the Kadir Has University building. Different types of additions in the complex have been observed and the issues identified in the previous chapters have been discussed.

6.2 History of the building

Cibali Tobacco Factory
(URL37, 2011)

Figure 69. Haliç Silluette in 19th century

Cibali was built in 19th century as a tobacco factory next to the Halic Sea by Ottomans. The construction of the building had started in 1876. The architect of the

building was Alexandre Vallaury. It served as a factory until 1995 and closed in 1997 for renovation. Many companies wanted to buy the building to convert it into different functions because of its strategic location however it had been given to Kadir Has for conversion of the building from factory to a university building, since educational functions was more suitable for conservation projects. The project was given to restorator Dr. Mehmet Alper and it took 3 years to complete the project. In 2000, conversion process had started and 2 years later, at 30 January 2002 building was opened as Kadir Has University (Alper, 2008).

	
Tobacco factory in 19th century (URL37, 2011)	Tobacco factory in 19th century (URL37, 2011)

Figure 70. Tobacco factory before conversion

The project won the Europe Nostra Prize in 2003 with the A and B blocks. As a restoration philosophy; structure of the building, load bearing parts and originality of the building had been preserved. The only interventions were about the division of the space with partitions in the A-B block and the new additions as D block (Alper, 2008).

The most crucial characteristics of the building are its different historic layers. The building was composed of four different layers. At the basement floor there is a Byzantine water tank from 13th century and an Ottoman Bath from the 16th century,

tobacco factory which belongs to the 19th century and lastly the new extensions which were added in 2002.

	
Tobacco factory in 19th century (URL37, 2011)	Kadir Has University in 21th century (URL37, 2011)

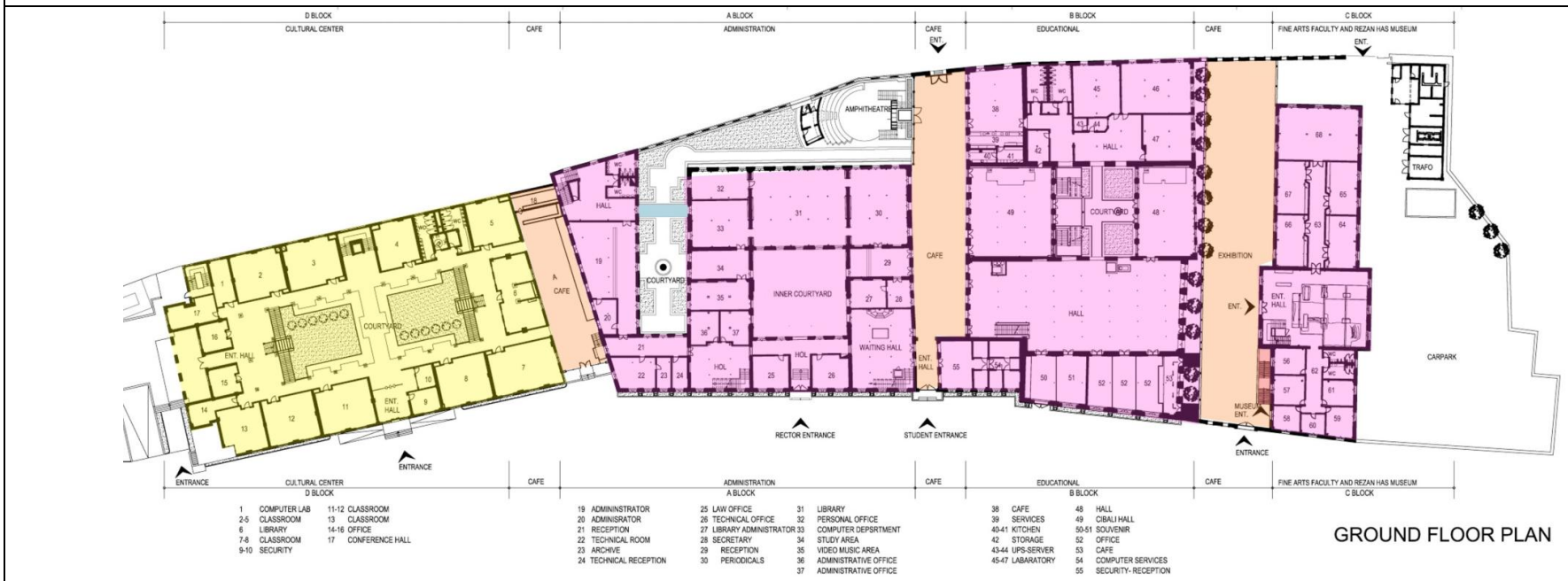
Figure 71. Views before and after conversion

6.3 Analysis of the empirical study

Kadir Has University building has been analyzed with the same method developed in the previous chapter. In table x, different types of extensions were represented with different color on the ground floor of Kadir Has University building. Every type of extension has been analyzed separately and their relation has been discussed by using mentioned criteria in the previous chapters.

Table 48. Different types of extension in the Kadir Has University building

KADIR HAS UNIVERSITY CIBALI CAMPUS BUILDING (Taken from personal achieve of Dr. Mehmet Alper)



GROUND FLOOR PLAN

LEGEND

INTEGRATED	INSERTED	ATTACHED IN BETWEEN	ATTACHED	WRAPPED	PIERCED

Table 49. General information of the Kadir Has University, A and B Block

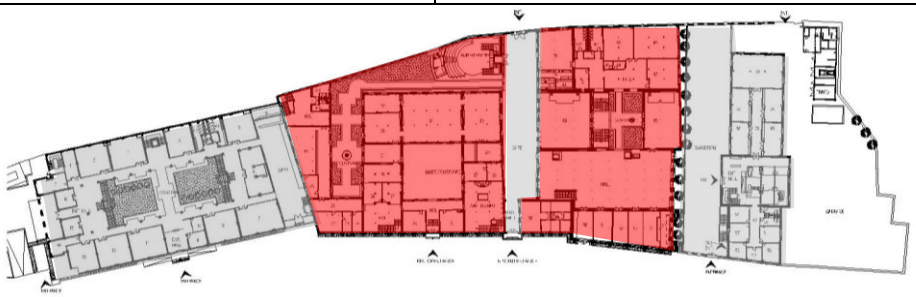
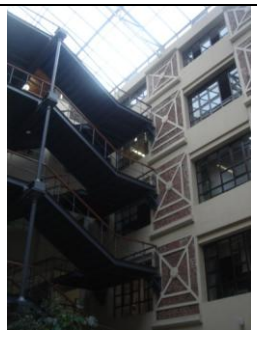
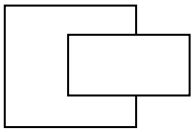
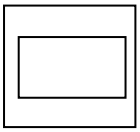
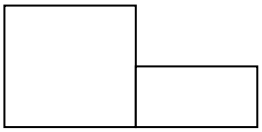
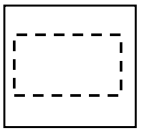
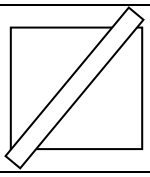
<table>
<tr><td colspan="5">EMPIRICAL STUDY: A AND B BLOCK</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: KADIR HAS UNIVERSITY CIBALI CAMPUS BUILDING</td></tr>
<tr><td colspan="5">LOCATION: ISTANBUL, TURKEY</td></tr>
<tr><td colspan="3">EXISTING</td><td colspan="2">ADDITION</td></tr>
<tr><td colspan="3">CONSTRUCTION DATE : 1876</td><td colspan="2">CONSTRUCTION DATE : 2002</td></tr>
<tr><td colspan="3">OLD FUNCTION: TOBACCO FACTORY</td><td colspan="2">NEW FUNCTION: UNIVERSITY</td></tr>
<tr><td colspan="3">ARCHITECT: ALEXANDRE VALLAURY</td><td colspan="2">ARCHITECT: MEHMET ALPER</td></tr>
<tr><td colspan="3">STRUCTURE SYSTEM: MASONRY</td><td colspan="2">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="3">MATERIAL: STONE</td><td colspan="2">MATERIAL: STEEL</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">GROUND FLOOR PLAN</td></tr>
<tr><td colspan="3">  </td><td colspan="2">  </td></tr>
<tr><td colspan="3">FRONT FAÇADE (Photo: Author)</td><td colspan="2">LINKAGE (Photo: Author)</td></tr>
<tr><td colspan="3">  </td><td colspan="2">  </td></tr>
<tr><td colspan="3">INSERTED FLOORS (Photo: Author)</td><td colspan="2">STAIRS IN COURTYARD (Photo: Author)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td colspan="2">ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td colspan="2">  </td><td>  </td><td>  </td></tr>
<tr><td></td><td>X</td><td colspan="2"></td><td></td><td></td></tr>
</table>

Table 50. Analysis of the Kadir Has University, A and B blocks

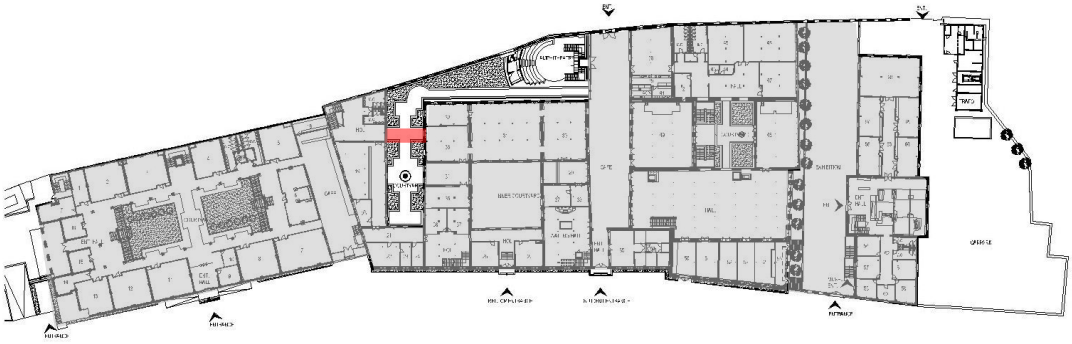
EMPIRICAL STUDY: A AND B BLOCKS			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	X
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the addition. -It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material. -A contrast is created with the use of steel in the masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional floors are freestanding elements supported with steel columns. -It is not touching to the existing walls.	

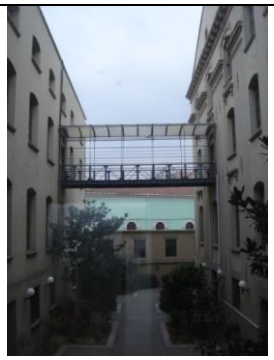
Table 51. General information of the Kadir Has University, The bridge

EMPIRICAL STUDY: THE BRIDGE	
NAME OF THE BUILDING: KADIR HAS UNIVERSITY CIBALI CAMPUS BUILDING	
LOCATION: ISTANBUL, TURKEY	
EXISTING	**ADDITION**
CONSTRUCTION DATE : 1876	**CONSTRUCTION DATE :** 2002
OLD FUNCTION: TOBACCO FACTORY	**NEW FUNCTION:** UNIVERSITY
ARCHITECT: ALEXANDRE VALLAURY	**ARCHITECT:** MEHMET ALPER
STRUCTURE SYSTEM: MASONRY	**STRUCTURE SYSTEM**: FRAME
MATERIAL: STONE	**MATERIAL**: STEEL



GROUND FLOOR PLAN

FRONT FAÇADE (Photo: Author)



LINKAGE BETWEEN A AND B BLOCKS (URL38, 2011)

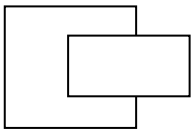
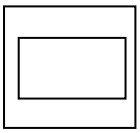
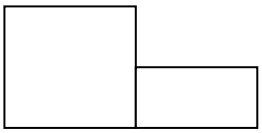
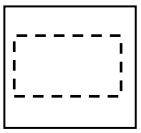
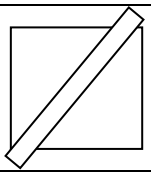
INTEGRATED	**INSERTED**	**ATTACHED**	**WRAPPED**	**PIERCED**
				
				X

Table 52. Analysis of the Kadir Has University, bridge extension

EMPIRICAL STUDY: BRIDGE			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	X
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	
		LINEAR		LINEAR	X
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Sahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the addition. -It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material. -A contrast is created with the use of steel and glass in the masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION		-Additional bridge is attached to the existing walls of the building.		

Table 53. General information of the Kadir Has University, C Block

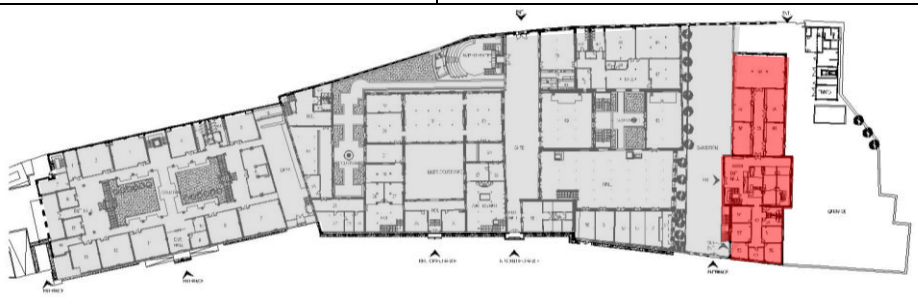
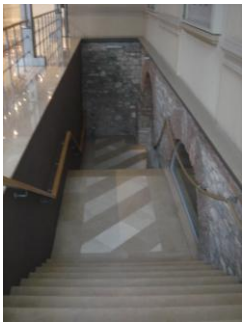
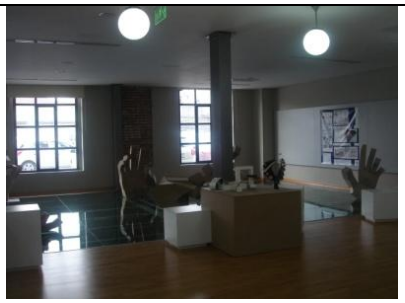
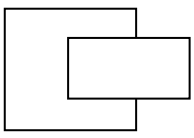
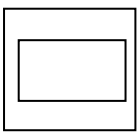
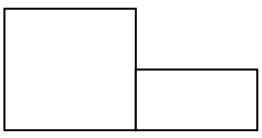
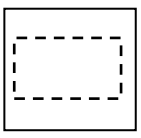
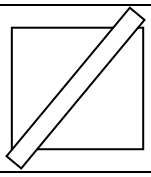
<table>
<tr><td colspan="5">EMPIRICAL STUDY: C BLOCK</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: FINE ARTS FACULTY AND REZAN HAS MUSUEM</td></tr>
<tr><td colspan="5">LOCATION: ISTANBUL, TURKEY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1876</td><td colspan="3">CONSTRUCTION DATE : 2002</td></tr>
<tr><td colspan="2">OLD FUNCTION: TOBACCO FACTORY</td><td colspan="3">NEW FUNCTION: UNIVERSITY</td></tr>
<tr><td colspan="2">ARCHITECT: ALEXANDRE VALLAURY</td><td colspan="3">ARCHITECT: MEHMET ALPER</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">GROUND FLOOR PLAN</td></tr>
<tr><td colspan="2">  </td><td colspan="3">   </td></tr>
<tr><td colspan="2">EXTERIOR VIEW (Photo: Author)</td><td colspan="3">MUSEUM ENTRANCE (Photo: Author)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">EXHIBITION OF FINE ARTS (Photo:</td><td colspan="3">MUSEUM (URL39, 2011)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td colspan="2">ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td colspan="2">  </td><td>  </td><td>  </td></tr>
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Table 54. Analysis of the Kadir Has University, C block

EMPIRICAL STUDY: C BLOCK			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical, linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			X
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the addition. - It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material. -A contrast is created with the use of steel in the masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional floors are freestanding elements supported with columns. Addition is not touching to the existing walls.	

Table 55. General information of the Kadir Has University, D Block

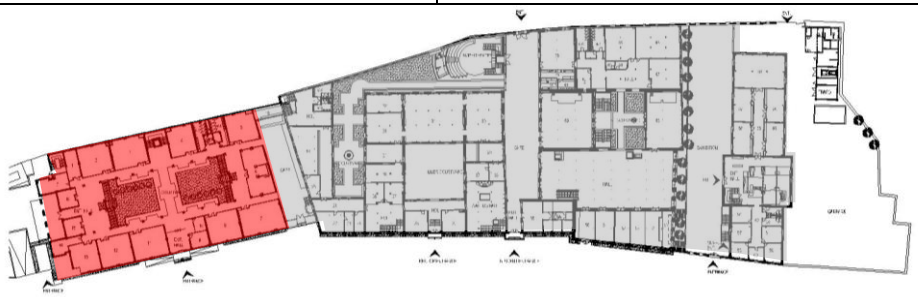
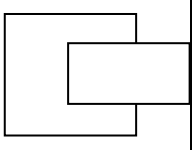
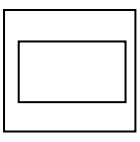
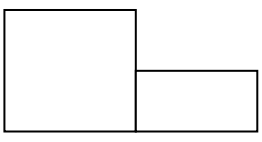
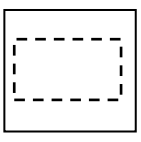
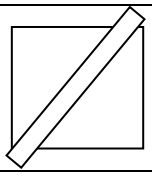
<table>
<tr><td colspan="5">EMPIRICAL STUDY: D BLOCK</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: CULTURAL CENTER</td></tr>
<tr><td colspan="5">LOCATION: ISTANBUL, TURKEY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1876</td><td colspan="3">CONSTRUCTION DATE : 2002</td></tr>
<tr><td colspan="2">OLD FUNCTION: TOBACCO FACTORY</td><td colspan="3">NEW FUNCTION: UNIVERSITY</td></tr>
<tr><td colspan="2">ARCHITECT: ALEXANDRE VALLAURY</td><td colspan="3">ARCHITECT: MEHMET ALPER</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: FRAME</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">GROUND FLOOR PLAN</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">VIEW FROM THE ROAD (Photo: Author)</td><td colspan="3">EXTERIOR VIEW (Photo: Author)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">ENTRANCES (Photo: Author)</td><td colspan="3">CIRCULATION ELEMENTS IN COURYARD</td></tr>
<tr><td>INTEGRATE</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td>X</td><td></td><td></td></tr>
</table>

Table 56. Analysis of the Kadir Has University, D block

EMPIRICAL STUDY: D BLOCK			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	X
		Arrangement on series of axes	
		Harmonious layout with existing old building	X
		Repetition of geometrical shapes	X
		Balance throughout composition	X
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	X
		Repetition of character with a little	X
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	
		In terms of shape	
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	X
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical, linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			X
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM			**Frame:** -Steel frames are used as the structural system of the addition. -It is a light material and it is easy to construct in the existing masonry buildings.	
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material. -A contrast is created with the use of steel and glass in the masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with columns. -Addition is not touching to the existing walls.	

Table 57. General information of the Kadir Has University, Transition spaces

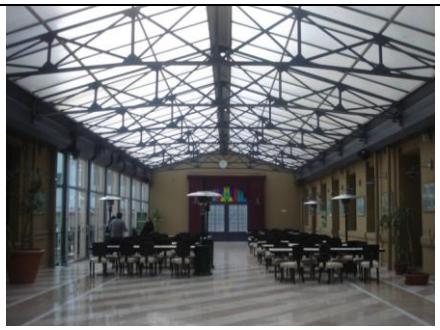
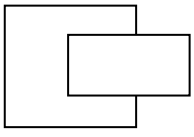
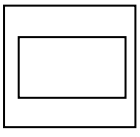
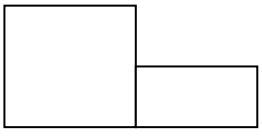
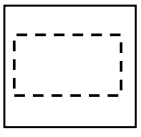
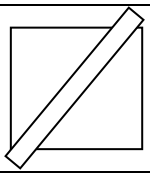
<table>
<tr><td colspan="5">EMPIRICAL STUDY</td></tr>
<tr><td colspan="5">NAME OF THE BUILDING: TRANSITION SPACES</td></tr>
<tr><td colspan="5">LOCATION: ISTANBUL, TURKEY</td></tr>
<tr><td colspan="2">EXISTING</td><td colspan="3">ADDITION</td></tr>
<tr><td colspan="2">CONSTRUCTION DATE : 1876</td><td colspan="3">CONSTRUCTION DATE : 2002</td></tr>
<tr><td colspan="2">OLD FUNCTION: TOBACCO FACTORY</td><td colspan="3">NEW FUNCTION: UNIVERSITY</td></tr>
<tr><td colspan="2">ARCHITECT: ALEXANDRE VALLAURY</td><td colspan="3">ARCHITECT: MEHMET ALPER</td></tr>
<tr><td colspan="2">STRUCTURE SYSTEM: MASONRY</td><td colspan="3">STRUCTURE SYSTEM: TRUSS</td></tr>
<tr><td colspan="2">MATERIAL: STONE</td><td colspan="3">MATERIAL: STEEL</td></tr>
<tr><td colspan="5">  </td></tr>
<tr><td colspan="5">GROUND FLOOR PLAN</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">CAFETERIA 2 INTERIOR (Photo: Author)</td><td colspan="3">CAFETERIA 1 INTERIOR (Photo: Author)</td></tr>
<tr><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td colspan="2">CAFETERIA 3 INTERIOR (Photo: Author)</td><td colspan="3">CAFETERIA 3 EXTERIOR (Photo: Author)</td></tr>
<tr><td>INTEGRATED</td><td>INSERTED</td><td>ATTACHED</td><td>WRAPPED</td><td>PIERCED</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td></td><td>X</td><td></td><td></td></tr>
</table>

Table 58. Analysis of the Kadir Has University, Transition spaces

EMPIRICAL STUDY: TRANSITION SPACES			
POSSIBLE EFFECT OF THE ADDITIONAL PART TO THE DESIGN APPROACH			
FACTORS		APPROACH	
DESIGN PRINCIPLES	**UNITY**	Continuity of layout	
		Arrangement on series of axes	
		Harmonious layout with existing old building	
		Repetition of geometrical shapes	
		Balance throughout composition	
		Adding a little variety for proving a sense of personality	
		Appearance of completeness	
	HARMONY	Similarities of elements in terms of shape	
		Repetition of character with a little	
		Repetition of character providing right mix	
	DOMINANCE	Creating center of interest	
		A sudden change in direction	
		A sudden change in size	
		A sudden change in shape	
	CONTRAST	In terms of size	X
		In terms of shape	X
		In terms of direction	
		In terms of alignment	
		In terms of position	
	REPETITION	Repetition of existing layout	
	BALANCE	Informal balance in composition of	
		Formal balance in composition of layout	X
	SCALE	Achieving human scale	X
	PROPORTITION	Appropriate height to width ratio	
		Proportion between existing space and addition	X
ORDERING PRINCIPLES	**AXIS**	Points in space established by vertical, linear elements or centralized building forms	
		Vertical planes, such as symmetrical building facades, preceded by a forecourt or similar open space	
		Well-defined spaces, centralized or regular in form	

		Gateways that open outward toward a view or vista beyond			
	SYMMETRY	Bilateral			X
		Radial			
	HIERARCHY	By exceptional size			
		By a unique shape			
		By strategic location			
	DATUM	Line			
		Plane			
		Volume			
	RHYTHM	Size			
		Shape			
		Detail characteristic			
	TRANSFORMATION	Using existing as prototype			
CIRCULATION	**CONFIGURATION OF THE PATH**	Linear			
		Radial			
		Spiral			
		Grid			
		Network			
		Composite			
	PATH-SPACE RELATIONSHIP	Pass by spaces			
		Pass through spaces			
		Terminate in a space			
	TYPE OF THE CIRCULATION ELEMENT	Stair- escalator			
		Ramp			
		Bridge			
ORGANIZATION	**TYPE OF ORGANIZATION**		OLD		NEW
		CENTRAL	X	CENTRAL	X
		LINEAR		LINEAR	
		RADIAL		RADIAL	
		CLUSTER		CLUSTER	
		GRIDAL		GRIDAL	
Adapted from (Şahin, 2010) ; (URL40) (Ching, 2002) (Brooker and Stone, 2004)					

STRUCTURAL APPROACH				
	FORM ACTIVE	**VECTOR ACTIVE**	**SECTION ACTIVE**	**SURFACE**
STRUCTURE SYSTEM		**Truss:** -Steel truss are used as the structural system of the addition. -It is used to span the distance without vertical support.		
	STEEL	**TIMBER**	**R.C.**	**STONE**
MATERIAL	-Steel is used as structural material. -A contrast is created with the use of steel and glass in the masonry building.			
	SUSPENDED FROM EXISTING STRUCTURE	**ATTACHED**	**FREESTANDING**	**COMPLEX**
CONNECTION			-Additional building is a freestanding element supported with columns. -Addition is not touching to the existing walls.	

6.3 Discussions about the Kadir Has University building

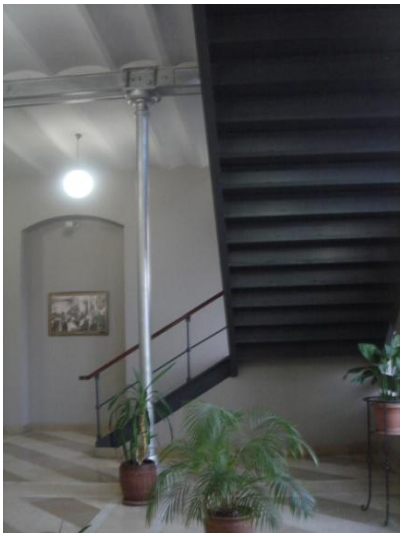
The building has a linear organization, creating a silhouette facing with the Haliç Sea. It is composed of four blocks. A and B blocks are the renovated factory parts of the complex. A block is functioned as administration, and B block is functioned as educational activities which are linked with a new addition, serving as cafe. These additions are attached type of extensions with some differences in comparison to the

attached examples that have been discussed in the analysis part (Table 48). In the case studies the analyzed, extensions were attachments either horizontal or vertical, but in this example, additions are linking two spaces each other. The extension which is used as cafeteria 1 is linking two existing blocks, A and B blocks, together serving as a transition space. The other extension which is used as cafeteria 3 is linking existing A block and the new extension, D block.

The trussed roof of the cafe addition is contrasting with the heavy load bearing masonry walls of the existing factory building but there is no unity between existing building and the extension. There are two more transition spaces, designed with the same linear organization parallel to each other acting as linkage of the different parts with different historic layers, shown in Table 48.

The bridge addition in the first floor is a pierced type of extension which links A and B blocks. In the other examples, which are analyzed in the previous chapter, piercing extension served as a circulation route inserted in the building; but in this example, it acts as a linkage of two spaces. It has a steel frame structure, covered with glass and attached to the existing building. Transparency is achieved with the use of steel and glass; and it creates a contrast with the solid masonry wall.

The existing old floors of the block was knocked down during restoration because they were unsuccessful additions built after construction of the factory and did not have the same language with the existing. The vertical walls have been preserved and new planes were inserted as new floors; and supported with the steel columns. New required spaces were created with the partition walls (Figure 72).



View from the administration block
(Photo: Author)

Figure 72. Additional floors supported with steel columns

C block is the museum and fine arts part of the complex. At the basement floor there is a Byzantine water tank from 13th century which is still under restoration and will be opened next year and besides an Ottoman Bath from the 16th century. This floor is the museum part of the block.

Rezan Has Museum under construction
(URL39, 2011)

Figure 73. Construction process of the museum block

Different exhibitions take place in the museum, but visitors can visit the bath as well as the museum. The Fine Arts Faculty of the university is built above this museum which is another conversion. The vertical walls have been preserved and new planes,

were inserted as new floors, and supported with steel columns. New required spaces were created with the partition walls like in the A and B block. Steel columns were placed at the museum floor which support the planes of the floors (Figure 74), covered with glass at some parts to have the visual contact between museum and fine arts exhibition hall.

Rezan Has Museum interior view
(URL39, 2011)

Figure 74. Steel columns are placed in the museum

D block is a contemporary addition, serving as Cultural Center of the complex (Table 47). It is attached to the A block with a transition space which is linking two blocks together. Although it is a new extension, there is unity between old and new in terms of color, proportion and space organization. It breaks the symmetry of the existing building, however it creates informal balance.

Kadir Has University
Cultural Center block
(Photo: Author)

Figure 75. Inner courtyard of new addition

New building has a centralized organization with an interior courtyard, with fascinating interior landscaping, like the existing building had (Figure 75). Same proportion of windows on the existing façade has been repeated on the façade of the new addition. It is constructed with steel frames as a contrast to the heavy masonry walls. Although they are contrasting, they have unity as well, because of the same color. There are transparent boxes constructed with steel and glass, functioned as offices around the interior courtyard. The courtyard is covered with a glass and steel structure to have the light inside.

Chapter 7

CONCLUSION

Reusing and remodeling an old building is a worthy challenge since having different layers on a single building makes buildings unique and charming in terms of identity. Combination of old and new is a problem when remodeling old buildings. This combination refers physical combination and combination in terms of design. In this study, remodeled buildings have been analyzed in two parts; in the first part of the thesis, selected case studies are analyzed as type of the structure system, material of the extension and the connection type of the new and old. In the second part, they are analyzed in terms of design approaches according to selected criteria, which were design principles, ordering principles, organization and circulation. Their relation and effect to each other have been searched in the analysis part.

Twenty different remodeled buildings were analyzed in the case study to find out which type of extension is used. The study emphasize that there are five different types of additions used in the remodeled buildings. Integrated, attached, inserted, wrapped and pierced additions are introduced as approaches of extensions through analysis of case studies.

For each type, case studies are analyzed in terms of structure and design approach. A common language is searched within the groups. Generally, it is achieved that additions should reflect the date which they are built in terms of innovation,

technology and material. When reflecting its own era, unity between the old and new must be achieved, either with harmony or contrast.

Kadir Has University campus is a large complex with different types of additions which are introduced in the thesis. Although old and new are differentiated from each other, unity, proportion and contrast are achieved when combining old and new. Existing proportion on the elevations is repeated on the new extension however contrast is achieved through use of different structure system and materials.

Centralized organization of the existing building was repeated in the new attached addition to have link between old and new. Existing building has been left untouched; however the new additions are reflecting the innovation and technology of their era. Types of extensions identified in the analysis chapter are seen in the empirical study with some differences. It is a large complex and different types of extensions exist in the building. Mostly, extensions are used to link different parts of the existing building in order to achieve appearance of completeness.

In general, there are no dominant elements between the additions. There is no effect to circulation and organization. The new additions respect the originality of the building, with the material and the structure system selection and the connection points.

The study emphasizes constraints that must be cared in extension design; and creates a reference for the designers who work on existing fabric. Remodeling is a crucial issue since old buildings are aesthetic, cultural and economic resources. The main goal of the research is to raise the awareness of the issue, and create a base for the

other researchers to develop this study further as a guide line. This study is focused on the contemporary additions to public masonry buildings, however future studies can be developed as extensions to contemporary buildings or residential buildings as well. Additionally one of the types introduced in the thesis can be selected and analyzed in depth.

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APPENDIX

Table 59. Kadir Has University Building, Site plan and silhouette

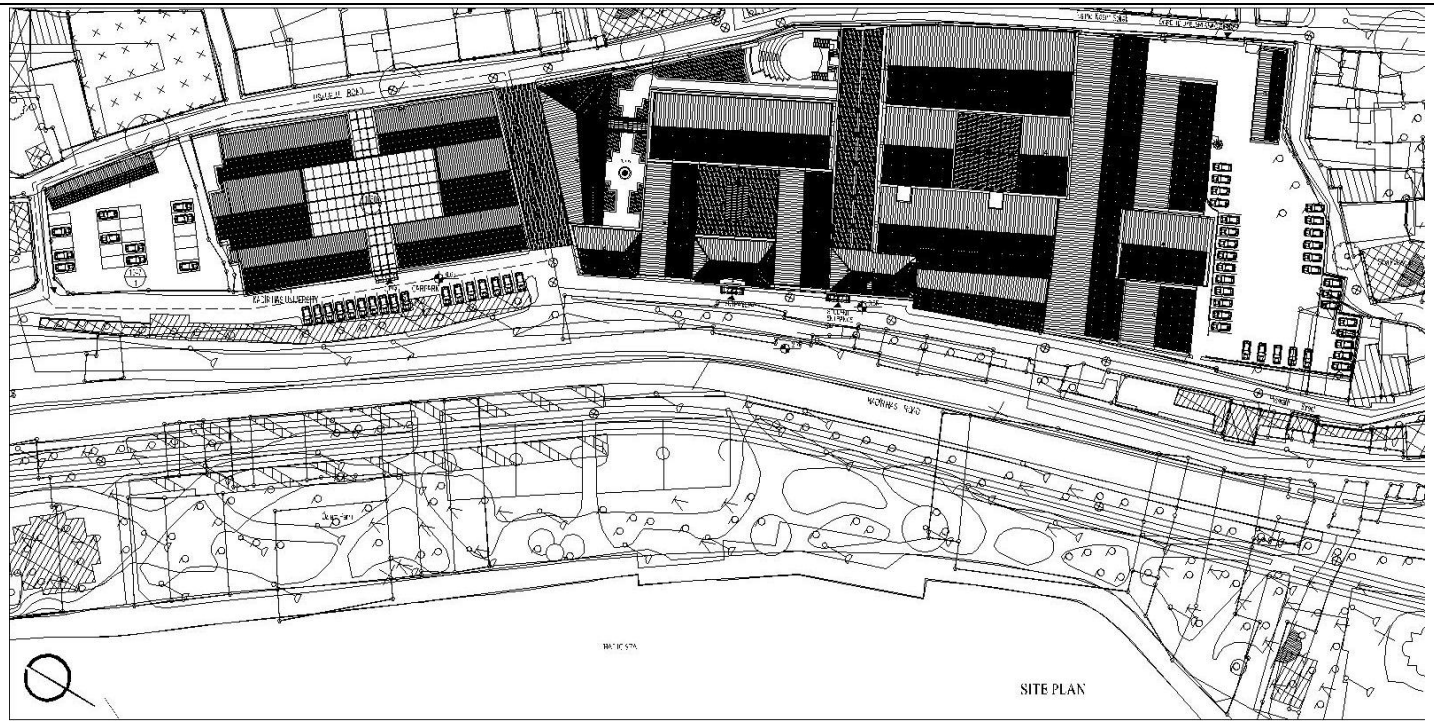
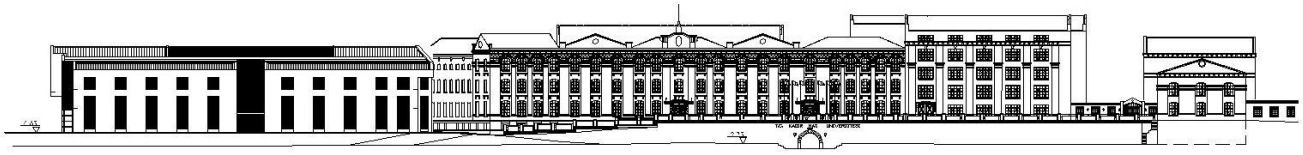
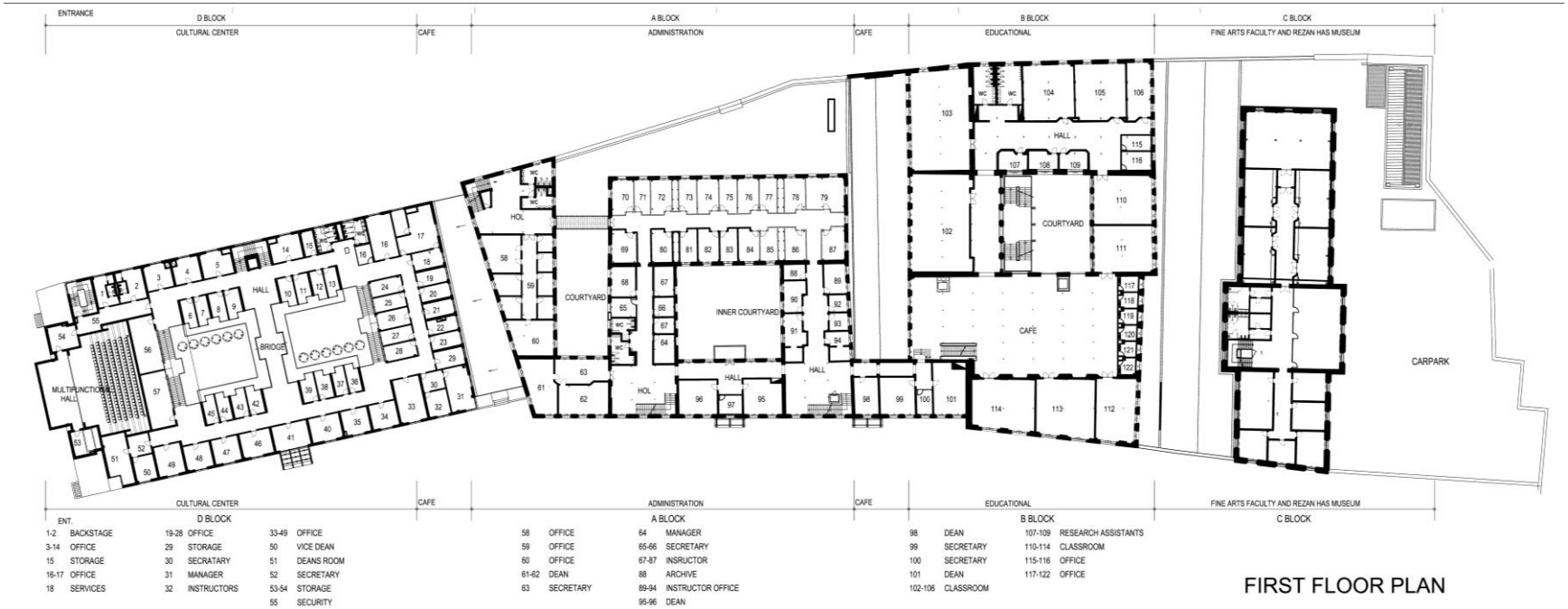
KADIR HAS UNIVERSITY CIBALI CAMPUS BUILDING

SITE PLAN (Taken from personal achieve of Dr. Mehmet Alper)

HALIC SILHOUETTE (Taken from personal achieve of Dr. Mehmet Alper)

Table 60. Kadir Has University Building, First floor plan

KADIR HAS UNIVERSITY CIBALI CAMPUS BUILDING

FIRST FLOOR PLAN (Taken from personal achieve of Dr. Mehmet Alper)