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COLLABORATIVE 3D DESIGN WITH BDMUD METHOD: THE EFFECTS OF BUILDING ON CITYSCAPE REFLECTIONS ON URBAN PLANNING

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Abstract

This study examines a building located on the Adana-Ankara road axis in Kayseri, and its relationship with its immediate surroundings in terms of urban design, during its design and construction process, as well as post-construction. The study consists of two main sections. The first looks at the use of the Building Design Management in Urban Design (BDMUD) method in relation to this building. BDMUD is a proposed new method for integrating urban design, urban planning and architectural design, by adding collaboration planning to Virtual Reality (VR) and Building Information Model (BIM).

The second section is a post-construction survey to evaluate the success of the BDMUD method in terms of the building's size, geometric shape (hereafter form), proportion, material, building layout and building use–land use conducted with a target group comprising city planners and architects based in Kayseri and architecture students (especially senior students) from the Erciyes University Department of Architecture. The survey group represents stakeholders with a role in the transformation of urban spaces who are able to give an opinion on urban design.

The outcomes of the survey are presented in percentage comparison. In the survey, 100% of the architects, 85.7% of the city planners and 94% of the architecture students recognized that the building was designed using the BDMUD method due to its differentiation from the other buildings on the road axis. In other words, according to 91.1% of the participants, the BDMUD method resulted in differentiation between this building and the others in terms of form, proportion, material and building layout. On the other hand, in terms of building use-land use at this site, 62.75% of the participants preferred mixed use with commercial use on the ground floor and residential use on the upper floors, while 37.25% of participants favored commercial

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use only. Further research is needed to create new building code guidelines based on the BDMUD method for important streets, boulevards and city entrances.

1. Introduction

“Lynch (1981) argued that two of the most critical problems designers and planners would encounter when using the conventional methods of recording settlement forms are the limited descriptive power of 2D modes and the lack of the time dimension” (Yin and Shiode, 2014: 152). Advanced technology and especially computer-aided 3D design (hereafter 3D design), allows us to illustrate, prior to application, both the settlement form and its evolution, according to various planning decisions.

Through such models, it is possible to simplify or abstract the complexity of the real world and quantify and iteratively change its characteristics based on *what if?* scenarios to analyze and identify preferred outcomes (Lewis et al, 2012: 87; Ervin, 1992).

It is by answering the *what if* questions, by identifying choices as a result of the architectural design and defining scenarios and analyses, that pre-application 3D design becomes so important. 3D design offers us an opportunity to evaluate changes in physical space in terms of land, architectural structures, transportation relations and landscapes, prior to application, and the success of 3D design and the collaborative design approach in answering the *what if* questions contributes to the overall success of urban design projects.

3D modeling began in the 1970s based on early computer-aided design (CAD) in several industries and both CAD and 3D design are now widely used in architecture and urban planning (Volk et al, 2014: 110). Over time 3D modeling has been enriched by additional design methods, the most significant of which are the Building Information Model (BIM) and Virtual Reality (VR). Briefly, BIM involves 3D architectural design technology and the management of project data (Miettinen and Paavola, 2014; Wong et al, 2010), while VR provides interactive and real time imaging in spatial and virtual settings which allows for the combination of virtual and current circumstances (Whyte 2003). VR was first used in 1989 by Jaron Lanier in order to distinguish between the immersive digital worlds that he was trying to create and traditional computer simulations (Paranandi and Sarawgi 2002; Pimentel and Texeira, 1995).

The use of 3D design to create models of the final version of a project in a virtual setting reduces construction costs, increases design quality, integrates project systems, improves interdisciplinary studies and reduces the propensity to change decisions that have already been adopted (Love et al, 2014). 3D models can be graphic or image models for the description of shapes, positions, orientations, and sizes of geographical entities, as well as the expression of aspects of their spatial-temporal distribution and dynamic changes (Xu et al, 2010: 211). A review of the 3D architectural design and planning literature shows that the issue of participation in 3D design is mostly handled by web-based collaboration (Hunter et al, 2015; Resch et al, 2014; Jones et al, 2010).

1.1 3D Visualization in Urban Design and Planning

An urban area is a highly humanized system (Yang et al, 2011: 5) and human beings are becoming primarily an urban species (Moere and Hill, 2012: 25). Yin (2010) states that urban planning is a series of future-oriented actions taken in accordance with what people desire. Urban planning is an instrument for speculating about, and intelligently guiding, urban development. In addition, Yin (2010: 419) emphasizes that 3D Geographic Information Systems (GIS) can be a useful tool for multiple professions concerned with planning, design, and construction of the built environment.

Urban development plans not only provide information as to the future of a city, but also include data that can help to better shape the built environment in that city. By specifying how urban architecture must be shaped, these plans limit urban architectural formation and lead to influences, either positive or negative, on architectural design. Urban design, on the other hand, plays a pivotal role in guiding architectural design and shaping urban structural framework. Urban design is the most significant instrument by which some harmony can be established between urban development plans and architectural designs.

"Urban design is in fact a mongrel discipline that draws its legitimizing theories from diverse intellectual roots: sociology, anthropology, psychology, political science, economics, ecological, physical and health sciences, urban geography, and the arts; as well as from the *professional* theories and practices of: architecture, landscape, planning, law, property, engineering, and management" (Carmona, 2014: 2). Urban design aims to synthesize these roots and shape the built environment. Zhang et al (2004: 82) defines urban design as a discipline that deals with the regulation of urban components, including form, surface and physical components. Hence, it would not be wrong to argue that urban design is directly focused on the built environment, urban architecture, and space creation. Furthermore, urban design is a process or attitude which explains rather than describes a place, by asking how this can be bettered or changed (Bell, 2005: 372).

Urban design sets particular criteria for improving or changing urban space. The criteria include concrete elements of distance, material, scale, view, vegetation, land area, water features, road alignment, building style, and numerous other items that make up the natural landscape and the built environment (Sternberg, 2000: 265). Urban design is what shows up on the ground in three dimensions and how it supports human flourishing (Ellis, 2014: 48). Urban design would therefore seem to be the profession that sets out to shape the spatial or physical environment (Sternberg, 2000: 266).

Urban planning is established on the same above-mentioned roots as urban design. What distinguishes urban planning from urban design is that the former is focused on future-oriented predictions, actions, and plans on the basis of the issues discussed above. Urban design, on the other hand, involves predictions and actions as to how a city will be shaped by those issues, its spatial formation, and how urban space will come to life in accordance with information specified in planning. Urban planning shapes the future of a city through two-dimensional drawings; however, it is the third dimension that is the indispensable component of urban design in terms of the structural and physical environment. "Design should be a major instrument for carrying out comprehensive plan objectives" (Bacon, 1960: 224). Jeon et al

(2009: 67) states; architectural images that form the surfaces of urban landscapes respond to the changes occurring in technical, social, and cultural contexts and attract the viewer's visual attention. Architectural form constitutes urban perceptibility and gives interface to public space because urban images are concentrated in the forefront of the space (Jeon et al, 2009: 67).

Al-Kodmany (2001) states that 3D designs could be divided into two main categories: conventional methods (including pencil, paper, and maps) and computerized design (CAD and GIS software and urban simulations). This study uses the *computerized design* approach. The advantage of models obtained through computerized designs over conventional methods is that they provide an opportunity to study the relationship between a building and urban space from different viewpoints and to identify urban perceptions of the building.

Compared with 2D drawings, 3D design simulates the real world directly and fits better with people's spatial awareness. 3D simulation needs to take into account spatial psychology and as a result has more problems to resolve (Yang et al, 2011). "3D visualization and modeling capabilities can make communication easier for planners and facilitate the study of complex urban environments in their full spatial extent, including shape, size, volume, and the spatial configuration in all x, y and z dimensions" (Yin, 2010: 419-420; Yao et al, 2006). "The deep understanding and skillful employment of three-dimensional design concepts is becoming increasingly a key element in the planning process" (Bacon, 1960: 224). In brief, visualization offers a method for seeing the unseen (Lewis et al, 2012: 86).

In light of the above, this study first examines the Building Design Management in Urban Design (BDMUD) process in relation to this building, and then, using a survey, evaluates the building and others in relation to the road axis that they are located on.

The BDMUD method was used to design a building on a plot that is located on the Adana-Ankara road axis, which constitutes a main entrance to the city of Kayseri. This side of the axis is planned in block layout and designated for commercial use on the ground floors and residential use on the upper floors. The study aims to answer two main questions:
1. Can urban space be differentiated with the BDMUD method in terms of form (size and geometrical shape), material and proportion?
2. Can the BDMUD method be successful in terms of building use and urban land use? Or, should urban functions be handled with an Implementary Development Plan (IDP)?

3D designs both give direction to city development and integrate demands of land owners and the public. 3D designs make it possible to synchronize architectural design and urban design, enabling planning bodies to assume a more rational role in guidance. This study will be helpful for planners and designers, and especially for building design at the main arterial road of Kayseri.

2. BDMUD Methodology in URBAN DESIGN

The methodology of this study includes the process of 3D design of the structures according to requirements determined by the IDP and incorporating suggestions and demands of several

stakeholders, including the users, designers, and municipality and project managers, using urban design methods. The various stakeholders' needs were integrated using VR and BIM design processes and, as a new method proposed for urban design, Building Design Management in Urban Design (BDMUD).

Apart from the accurate visualization of the effects of the architectural product on the city and urban landscape provided by VR, BDMUD is distinct from BIM in that it also brings together the stakeholders of building design and shapes this process using 3D designs. Four actors were involved in the management of the process: user, land owner, designer and the municipal planning department. In addition to visualizing the physical reality of the planning decisions prior to application via 3D design, the BDMUD method also allows public sector actors, design actors and private entrepreneurs to participate in the collaborative design approach.

Here is how stakeholders' demands play a role in VR and BIM processes and how the collaboration process develops:

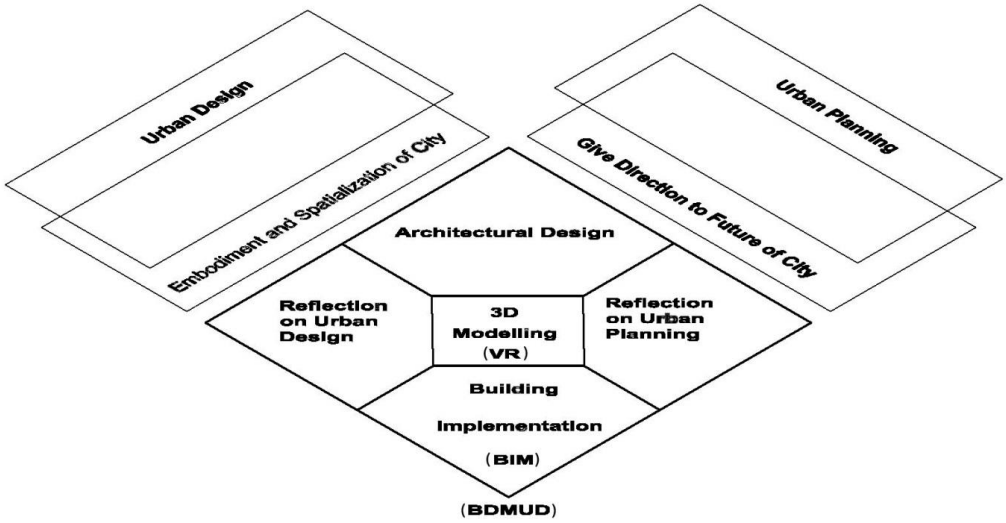
In this study, the owner of the plot asked the architect to design a building for commercial use and asked that the building be differentiated from other buildings on this road axis in terms of appearance, form, material and proportion. The land owner indicated that *the building itself should be distinguishable and attractive* and that *the building must sell itself*. Thus, the designer created a draft according to the building codes of the Implementary Development Plan. The first draft, created in block layout with mixed use according to development plan requirements, was visualized via CAD, but the resulting 3D appearance did not differentiate it from other buildings on the road axis in terms of the aspects indicated by the land owner.

A new design was developed, without violating the building ratio limits, after consulting with a city planner. This was done by simulating the actual physical conditions of the plot via CAD and VR and it was integrated with a new 3D architectural design. At this stage, the city planner and the architect realized that the process should be managed by all stakeholders. 3D drawings were created after adding new data into the design and submitted to the municipal planning department in order to manage the process and to integrate the BIM process with the methodology.

Following this, the design process continued with meetings that brought the architect, the city planner, the land owner and the officials of the municipality together, where 3D drawings created according to existing urban plans and alternative designs that differentiated the project in accordance with the land owner's demands were compared. Thus, an approach that integrated BIM and VR was developed. As the stakeholder that represents the public interest, the municipality was especially concerned about the alternatives in terms of:
1- Compliance with the floor area ratio decisions in the existing plans and avoiding added infrastructure costs
2- Avoiding negative impact on public space and public interests by eliminating extensions to the building
3- Preserving urban aesthetics

Figure 1. **Details the BDMUD methodology, demonstrating the impact that the integration of urban design and urban planning with VR and BIM methods has on architectural design**

Figure 1. **BDMUD Method**



Source: By author.

With the BDMUD method, the design process can be managed to include the demands of the stakeholders which can then be reflected in the design. The BDMUD methodology provides 3D computerized architectural and urban design for building construction data, reflected by IDP, and attempts to make the most appropriate decision in terms of land use, material, volume, and form.

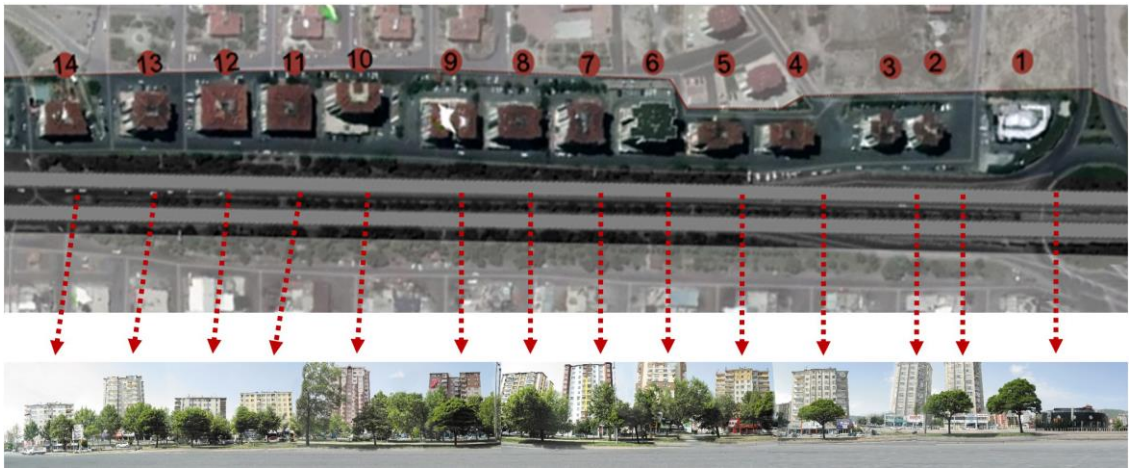
The BDMUD method involves adding a project management aspect to 3D design. The method allows for collaboration between the land owner, the user, the designer and the municipal project management department. In this approach, the municipality protects the public interest, the land owner and the user represent the functional and aesthetic expectations of private investors, and the designer responds to both public interest and the expectations of private entrepreneurs and users with design alternatives.

A survey about the form (size and geometrical shape), material, proportion and building layout of the buildings on the road axis was conducted with participants that know, use and are able to comment on the aesthetics and creation of urban space, in order to test whether the BDMUD method is successful in that the building was differentiated from others in that location. As Gaber and Gaber (2007) pointed out, planning and design cannot be defined merely by numbers, but also require observational data, which is why this survey was conducted. The survey was based on the participants' opinions as percentages. The target group consisted of architects and city planners who are working in Kayseri and architecture students from Erciyes University. There were 10 architects, 7 city planners and 34 architecture students among the 51 survey participants.

A questionnaire was presented to participants with photographs of individual buildings placed under the aerial photo of the axis, and each building was given a number from 1 to 14 (see Figure 2). The survey included the first 14 buildings because the rest of the buildings located on the same axis were similar to these. Each photo was also offered on a separate page for detailed inspection. The first building was the one designed with the BDMUD method. However, this information was not given to the participants so that their opinions were not influenced. The questions were: 1) Gender; 2) Age; 3) Education Level; 4) Profession; 5) How long have you lived in Kayseri?; 6) Which urban function is appropriate for this road axis?; 7) Which building layout is appropriate for this road axis?; 8) Which building on this axis is different in terms of form?; 9) Which building on this axis is different in terms of materials and proportion?; 10) Should this axis have block layout as proposed by the development plan or a free design with precedent layout?

The survey aimed to find out whether the building that was designed and built with the BDMUD method made a difference in urban space in terms of form, material, proportion and building layout, in the context of the target group's perspective on urban space, and whether this method is successful in terms of building layout.

Figure 2. **Buildings Included in the Survey**

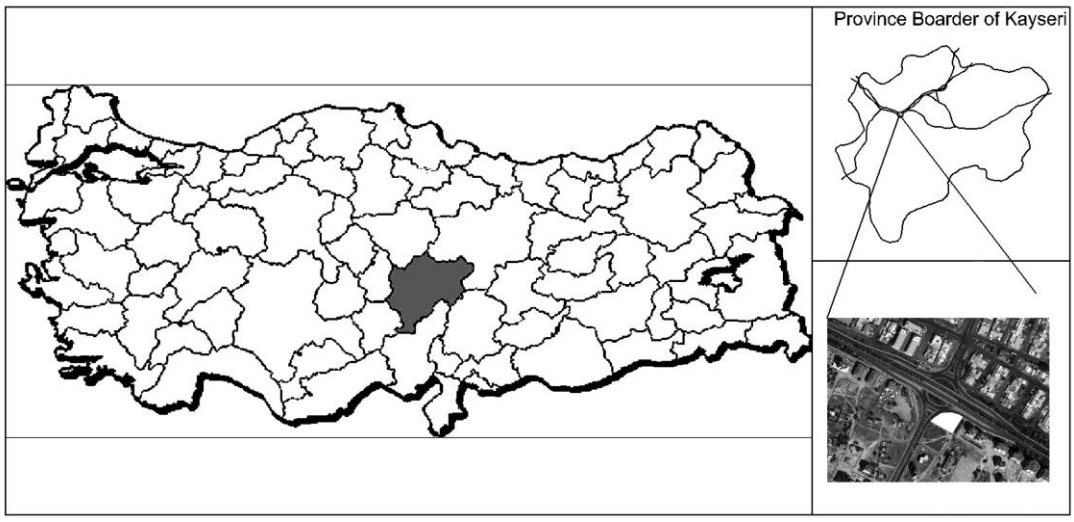


Source: Google Maps and Photos.

2.1 Sampled Area

The sampled plot was in the western part of Kayseri on the Ankara Road, the road linking the city center with other cities, namely Nigde, Adana, Nevsehir, and Ankara. The plot was significant in that it was located around the first multi-level junction at the western entrance to the city, where the roads into the city joined each other. In this context, the first thing to focus on in the design was to improve the spatial legibility with the purpose of creating urban perceptions. Figure 3 presents the location of the city of Kayseri in reference to Turkey and the location of the sampled area in reference to Kayseri. The location of the plot was colored white.

Figure 3. **The location of the Sampled Area**



Source: Google Maps.

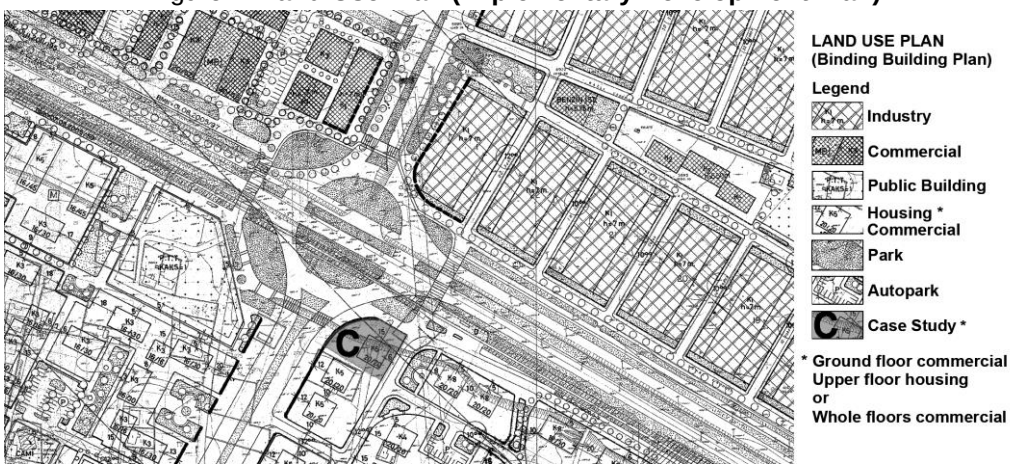
2.2 Land use plan and 3D Visualization

Issues taken into consideration by the designer in the building design and 3D design processes are:
a) Urban legibility, as the plot is located around the first multi-level junction at the western entrance to the city where the roads into the city join one another, especially so that the building constitutes a *landmark* in this part of the city.
b) Building form, as the area where the plot is located is a transition from the industrial zone to the residential zone, in order to distinguish the building from both the industrial and the residential buildings in the immediate surroundings.
c) Perceptibility of the building from vehicles, as the plot is located on a spot accessible by vehicles and at an intersection on the Adana-Ankara motorway.
d) Façade solution and design distinctiveness, as it is a commercial building (top floor can be transformable to housing).
e) Gauge (height) control, as the junction spot has an influence on urban silhouette.

The IDP recommended block building for the sampled plot. The drawing for the plan is presented below, and planning information is represented by the letter K. Those structures that are expressed by the letter K in IDP by the Kayseri Metropolitan Municipality have two main parts, namely the first floor which can be used for commercial purposes and upper floors which have to be used for housing. Commercial use has to be limited to the floor area of building (Notes on the IDP by Kayseri Metropolitan Municipality). Figure 4 presents recommended land use and building construction rules specified in the IDP for the sampled plot and its surrounding area. What is interesting in the figure is that double use (i.e. the first floor for commercial purposes and the upper stories for housing purposes) was recommended on the condition that block building must be applied around the sampled plot, whereas the other side of the road was

comprised of industrial zones. The location of the plot was characterized by a transition from industrial zones to residential zones.

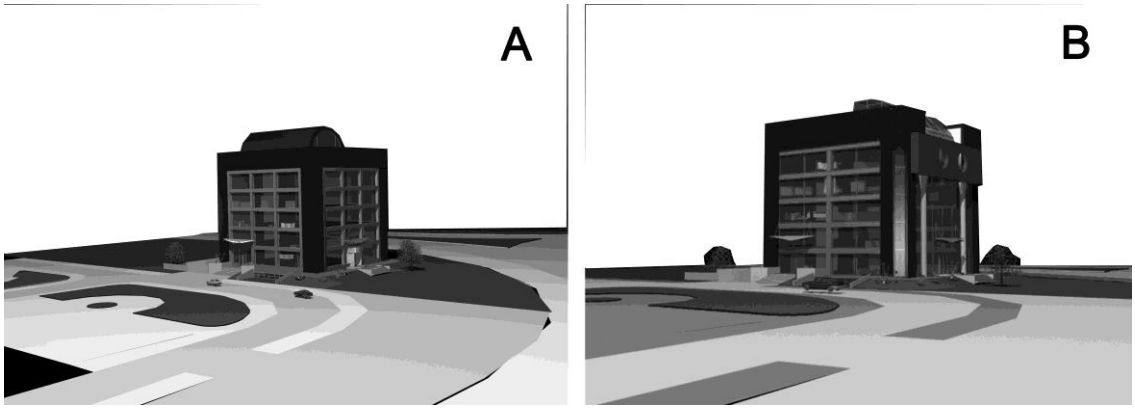
Figure 4. **Land Use Plan (Implementary Development Plan)**



Source: Archives of Melikgazi Municipality.

The land owner requested a mixed use for the building (i.e., the first floor for commercial purposes and the upper floors for housing), or commercial use for the whole building with last floor transformable into housing, according to the IDP. On the basis of the data specified in the IDP, two different architectural solutions were offered to the user for the former case. Figures 5A and 5B present the solutions regarding the first floor which can be used for commercial purposes and upper floors which have to be used for housing in a three-dimensional way.

Figure 5. **Reflections of the Planning Data on the Architectural Design**



Source: By author.

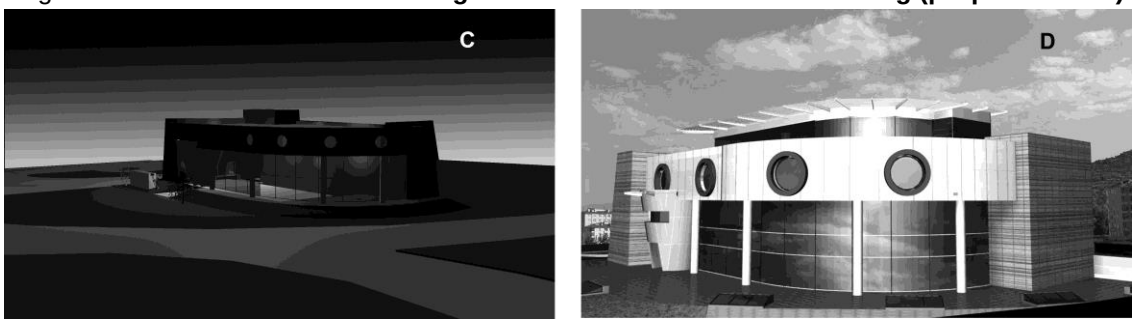
The planning decision for the plot stipulated a block building solution in the architectural design. In this context, the focus was on the commercial use for the whole building with the possibility to transform the top floor into housing. The location of the plot, the demands of the land owner, the effects on public space and the silhouette entailed an architectural solution which would make

the building different from the surrounding buildings in terms of the choice of materials and the nature of the façade, which would contribute to urban perception and make it a landmark, considering that the building was located on a node.

Such a solution brought about two significant considerations. First of all, based on the property of the land owner and in accordance with the floor area ratio (hereafter precedent) decision from the IDP as well as the setback distances, the building coverage was increased while the number of floors was decreased. In this way, it was possible to horizontally apply the vertical density; and gauge control was ensured, as the building would not rise vertically. Secondly, it was necessary to change the form of the mass, whose size was recommended as 20 x 20 meters in the IDP because of shaping according to the cross-road in front of the plot. First, the 3D design was composed on computer through an analysis of the architectural form planned for the plot and its locational considerations.

The design, which is presented in Figure 5, was submitted to both the municipality and the plot owner. The design also formed the basis for the request to change the mass, whose size was recommended as 20 x 20 meters in the IDP. A second alternative was also designed in 3D with lower gauge, with the top floor convertible into residential use, as well as providing the demanded differentiation by the land owner in terms of form, material and proportion. Figures 6C (night view) and 6D (daylight view) present the two design proposals submitted to the land owner and municipality.

Figure 6. **Reflections of Urban Design on the Architecture and Planning (proposed form)**



Source: By author.

Having ensured the satisfaction of the municipality and the user, the proposal was submitted to the municipality for amendment in the IDP. The proposal was approved, leading to the application phase. The layout plan emerging from the application is presented below. The white spot in the figure shows the plot of the sampled area. The spot for which block building was proposed in the IDP was hatched gray. The IDP recommended K legend for the spot. The other structures formed in accordance with the K legend proposal were hatched in gray. Figure 7 indicates that the building stands out among the surrounding structures with its form and position in the plot. The significant aspect of Figure 7 is the differentiation of the building from the other buildings on the road axis in terms of geometric shape. This differentiation is also found between the buildings at the intersection.

Figure 7. **The Difference in Form between the Building and Other Structures after Application**

Source: Google Maps.

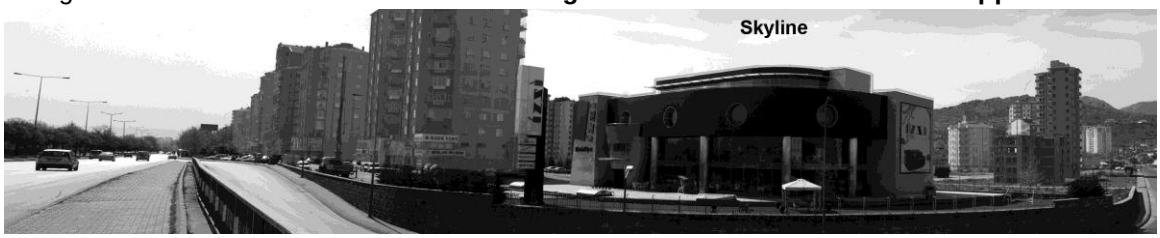
The choice of contrasting colors and materials played a crucial role throughout the application so that the entrance to the building could be perceived. Considering that the owner of the building owned a a furniture factory and needed a showroom, the decision was to design the building as a furniture showroom. Glass and steel were chosen as construction materials in order to enhance the outside perception, a quality always desired in showrooms. Figures 8E and 8F present the applied building in the form of night view and daylight view respectively. Shiny colors and authentic forms were chosen especially for the entrances to the building to reflect the distinctiveness of the western entrance to the city in the architecture (Figures 8E and 8F).

Figure 8. **Night and Daylight Views of the Building after the Application**

Source: Photos taken by Nihat KARAKAYA.

The effect on the silhouette was taken into consideration for the relationship between the building and urban space. Figure 9 presents the effect of the building on the silhouette after the application. In the silhouette, the BDMUD building stands out among the other buildings on the road axis. The other buildings on the road axis are seen on the left and right of the building. As can be concluded from the figure, the block layout buildings have a negative influence on the silhouette. Looking from the multi-level junction, the buildings behind the BDMUD building are not included in the silhouette. The underlying idea behind this was to enable the skyline to be perceived by passersby, suggesting that a building with two regular floors as well as a mezzanine and penthouse would actually be sufficient in terms of the scale. It is apparent that the other buildings on the road axis are denser and higher. The following figure presents the view of the building from the multi-level junction and its effect on the silhouette.

Figure 9. **The Effect of BDMUD the Building on Urban Silhouette after the Application**



Source: Photos taken by Nihat KARAKAYA.

Figure 9 indicates that the building had a design different to those of the other buildings on the road alignment according to form, gauge, material, and proportion and that it also enjoyed a human-scale design that enabled the skyline to be perceived. Its scale also ensured that the other parts of the city could be perceived. In this way, the building made a difference in the city in terms of urban design and represented a significant landmark in the built environment.

3. Results of the survey

The participants in the survey were chosen from professions that play a role in urban design and who are able to comment on urban space. In this context, architects, city planners and architecture students (especially senior students) were chosen. Freelance architects, city planners and Erciyes University Department of Architecture students were given questionnaires. As indicated by Gaber and Gaber (2007), planning and design do not only consist of numbers but are also based on observational data. Therefore, we used observational opinions of professionals who live in the city and who can offer an opinion on the built environment. The survey was conducted with 10 architects, 7 city planners and 34 architecture students. Their answers to the questionnaire are presented below.

3.1 Architects

There were 10 architects who participated in our study. They have been living in Kayseri for 20 years on average. In terms of the appropriate use for the axis, 60% of the architects were of the

view that it should be commercial and 40% indicated that the building should have mixed use with the ground floor as commerce and the upper floors as residential. For building layout, 40% of the architects indicated low-rise attached housing, 30% indicated high-rise detached buildings, and 10% indicated a precedent layout would be appropriate (see Table 1). All of the architects indicated that Building 1 (the BDMUD building) was different from the others in terms of form. Free design with precedent layout was found to be appropriate for this axis by 90% of the architects.

Table 1. **Opinions of the Architects**

Architects	Average Years Lived in Kayseri					20
	Which Land Use is Appropriate for this Road Axis		4 architects chose Residential + Commercial		6 architects chose Commercial	0 architects chose Residential
	Which Building Layout is Appropriate for this Road Axis	Precedent=1	Low-rise Attached=4	High-rise Attached=2	High-rise Detached=3	Low-rise Detached=0
	Which Building is Different in terms of Form			10 Architects found BDMUD building different from other buildings		
	Which Building is Different in terms of Materials and Proportion			10 Architects found BDMUD building different from other buildings		
	Which is Appropriate for this Road Axis				1 architect preferred block layout	9 architects preferred precedent
	Gender				Male=3	Female=7
	Average age					28,8

Source: By author.

3.2 City Planners

The survey included seven city planners. They had lived in Kayseri for an average of 20,2 years. In terms of urban function, 71% of the city planners preferred mixed use with ground floor for commercial and upper floors for residential use, while 29% favored commercial use. Low–rise attached was considered to be the appropriate building layout by 42,8%, high-rise detached layout by 28,6% and low-rise detached layout by 28,6%. The BDMUD building was identified as different in terms of form by 71%, while Building 11 was identified as different by 29%. In terms of materials and proportion, the BDMUD building was identified as different by 85,7%. Unlike architects, city planners found block layout to be more appropriate than the precedent layout, with 85,7% of the city planners favoring the former (see Table 2). This indicates that city planners are less open to precedent layout than architects. City planners are more concerned about establishing order as opposed to the possible architectural outcomes of the precedent layout. Therefore, they prefer the block layout which limits architectural design.

Table 2. **Opinions of City Planners**

City Planners	Average Years Lived in Kayseri					20,2
	Which Land Use is Appropriate for this Road Axis		5 city planners chose Residential + Commercial land use		2 city planners chose Commercial land use	0 city planners chose just Residential land use
	Which Building Layout is Appropriate for this Road Axis	Precedent =0	Low-rise attached =3	High-rise attached =0	High-rise detached=2	Low-rise detached=2
	Which Building is Different in terms of Form		6 city planners found BDMUD building different		1 city planner found Building 11 different from the other buildings	
	Which Building is Different in terms of Materials and Proportion		6 city planners found BDMUD building different		1 city planner found Building 14 different from the other buildings	
	Which is Appropriate for this Road Axis		6 city planners chose block layout		1 city planner chose Precedent	
	Gender				Male=4	Female=3
	Average age					29,4

Source: By author.

3.3 Architecture Students

The third group of participants included 34 students from Erciyes University's Department of Architecture. Their residence in Kayseri averaged 10,5 years. A mixed use, with ground floor for commercial and upper floors for residential use, was favored for the road axis by 67,6% of the students, while 32,4% preferred commercial use. In terms of building layout, 23,5% chose precedent layout, 8,8% chose low-rise attached, 26,5% chose high-rise detached and 41,2% chose low-rise detached layout. The BDMUD building was found to differ from the other buildings in terms of form, materials, and proportion by 94,1% of the architecture students. Free design with precedent layout was favored for the road axis by 70,5% of the students (see Table 3).

Table 3. **Opinions of Architecture Students**

Architecture Students	Average Years Lived in Kayseri					10,5
	Which Land Use is Appropriate for this Road Axis			23 students preferred Residential + Commercial	11 students preferred Commercial	0 students preferred Residential
	Which Building Layout is Appropriate for this Road Axis	Precedent=8	Low-rise Attached=3	High-rise Attached=0	High-rise Detached=9	Low-rise Detached=14
	Which Building is Different in terms of Form		32 students found BDMUD building different		2 students found Building 14 different	
	Which Building is Different in terms of Materials and Proportion			32 students chose BDMUD building	1 student chose Building 10	1 student chose Building 5
	Which is Appropriate for this Road Axis				10 students prefer Block	24 students prefer Precedent
	Gender				Male=10	Female=24
	Average age					23,9

Source: By author.

4. Discussion

Synchronizing urban planning and architectural design through a multidisciplinary approach, urban design plays a key role in urban visual perception and urban legibility in today's cities. Designs complying with urban design criteria not only enhance the aesthetic appeal of cities, but also prevent them from becoming increasingly similar to one another. In the present study, the distinctive form of the building increased urban legibility. In addition, an attempt was made to ensure that the building could be well perceived from the multi-level junction both during the day and at night. The scale of the building had a positive influence on the urban silhouette and presented a human-scale design in that the skyline could be perceived by passersby. The purpose of the design was to generate flexibility in use, allowing the building to be used for a number of purposes ranging from furniture showroom to car gallery, from exhibition of construction materials to food and beverage units, and from meeting rooms to exhibition halls.

The significant issue that emerged from the present study is the extent to which planning should affect the architecture. Building construction decisions, especially those recommended by IDPs, impose restrictions on the architecture, resulting in ordinary and similar applications. Nevertheless, every spot in a city should be separately assessed according to local dynamics and structural characteristics. Even so, designing every single spot in a separate way will disrupt urban integrity. Therefore, the balance between the two approaches is established

through urban design criteria for form, scale, volume, silhouette, choice of materials and colors, building-road alignment, and so forth.

The increased use of precedents in IDPs will lead to flexibility in planning and architecture. 3D designs and 3D computer models will ensure that the integrity is not disrupted. One of the most important conclusions that can be drawn from the present study is that 3D designs play a crucial role in synchronizing planning and architectural design.

A 3D design does not only keep a balance between planning and design, but also guides reflections in planning data and architectural design, thus resulting in changes in planning decisions.

One of the outcomes of this study indicates the difference between the perspectives of architecture and city planning professions on cities. While architecture favors a free design approach, city planners are concerned with command over the city. Urban design and the BDMUD method can lead to an important discussion between architects and city planners and achieve a common language between them. The BDMUD method offers a certain freedom in design, with an approach that allows various actors to contribute in the design process, as well as providing order and common language in the design of urban space. Further research is needed to create new building code guidelines based on the BDMUD method for important streets, boulevards and city entrances.

5. Conclusion

Since locations that need special building construction conditions, such as city entrances and gateways, play an important role in urban perception, designing such areas calls for delicate decisions in terms of plot size and other relevant criteria. It was necessary to represent the public interest for the plot in the sampled area, as it was a multi-level junction, had formal parameters, and could be perceived from a main arterial road. Thus, the function of the building, as well as its form, scale, and relationship with the surrounding area, was to be such that it would leave an impression on urban memory.

In accordance with the answers provided by the participants, the first question given in the introduction can be answered as follows:

1- Can urban space be differentiated with the BDMUD method in terms of form (size and geometrical shape), material and proportion?

The BDMUD building was identified as different from the other buildings by all the architects surveyed in terms of materials, proportion and form, by 71% of city planners in terms of form, by 85,7% of city planners in terms of materials and proportion, and by 94,1% of architecture students in terms of materials, proportion and form. This study shows that the BDMUD method makes a difference in design. Therefore, the BDMUD method can make a difference in terms of form, materials and proportion, when used in the creation of urban image and in areas where spatial differentiation is needed. Of the 51 participants, 48 or 94,1% distinguished the BDMUD building from the other buildings on the axis in terms of form, proportion, material and building

layout. The BDMUD method can be said to be good for differentiation in form, design, materials and proportion.

In answer to the second question:

2- Can the BDMUD method be successful in terms of building use and urban land use? Or, should urban functions be handled with IDP?

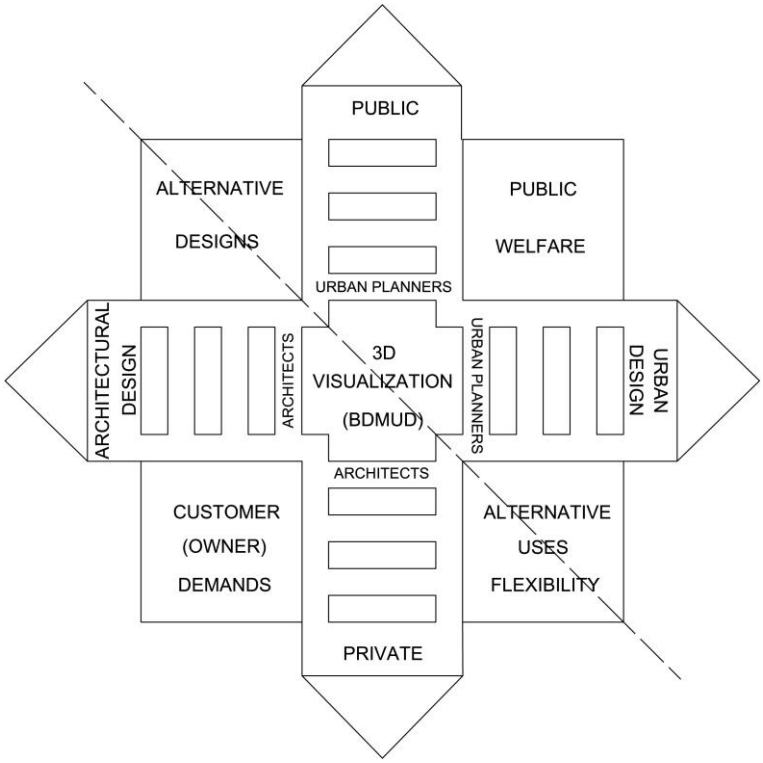
In terms of urban function, 40% of the architects, 71% of the city planners and 67,6% of the architecture students indicated that mixed use with commercial use on the ground floor and residential use on the upper floors was appropriate for this axis. Of the 51 participants, 32 (62,75%) chose the same land use as the IDP (commercial use on the ground floor and residential use on the upper floors). The building designed with the BDMUD method complied with the IDP and its top floor could be converted to residential use. Therefore, it was found to have plan compliance and design success by 62,75%. Since land use and building use need to be considered within the urban context, the BDMUD approach had less success in this aspect than it had in terms of form, material, proportion, and design differentiation. This reveals the importance of considering a holistic picture of the city, rather than a piecemeal approach. Therefore, urban functions should be determined through urban planning.

However, from the perspectives of different professional groups, designing with the precedent layout leads to different results in the formation of urban space. Architects especially demand more freedom in design, while city planners disagree due to concerns about urban order. There is a significant disagreement between professional groups on using precedent layout for design on this axis. Architects favor the precedent layout with 90% of the participants choosing it, while only 14,3% of the city planners thought it was appropriate. Precedent layout was deemed appropriate by 70,5% of the architecture students who participated in the survey.

In terms of building heights (gauge) for the road axis, low-rise development (low-rise attached and low-rise detached) was favored by 40% of the architects, 71,4% of the city planners and 50% of the architecture students. Therefore, it can be concluded that city planners prefer a lower profile on the road axis. In terms of gauge control on the road axis, 26 of the 51 participants chose low-rise attached and low-rise detached, which constitutes 50,98% of the participants, while 16 of them chose high-rise attached and high-rise detached, which constitutes 31,37%. Precedent layout where gauge is not limited was chosen by 9 participants, constituting 17,65%.

In design process management, a compromise was reached between the municipality, the designer (architecture), the consultant (urban planner), and the user (entrepreneur) through 3D design. In this way, public interests were taken into account in the plot located on a significant arterial road of the city, which was a humanized system. Figure 10 shows the conclusion of BDMUD.

Figure 10. **Conclusion of BDMUD**



Source: By author.

Furthermore, compromises in planning and design were managed in accordance with the opinions of all parties concerned. Accordingly, the block layout approach should be modified in a way that will allow plots to be granted with a building density in relation to their size. Determining the building density depending on the plot size will not only bring about richness and diversity in architectural design, but also lead to flexibility in planning. Urban design and 3D design stand out as two significant instruments for supervising flexibility and ensuring harmony between urban architecture and the built environment. 3D designs make it possible to synchronize architectural design and urban design, enabling planning bodies to assume a more rational role in guidance. In this way, urban design and 3D design can be used for designing architectural dimensions in embryo, and the architecture can have positive influences, especially in terms of the constructed environment in urban planning.

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