

# Criteria for designing pedestrian bridges to achieve the aesthetic value in Iraqi cities

Zeyad Ali Ismael<sup>1</sup>, Zainab Hamid Mohson<sup>2</sup>, Saba Salih shalal<sup>1</sup>

<sup>1</sup> College of Physical Planning, University of Kufa

<sup>2</sup> Department of Architectural Decorating, Middle Technical University

<sup>3</sup> Architectural Department, Al Safwa University Colleg

## ABSTRACT

The Aesthetic Value of pedestrian bridges is measured in the extent of the homogeneity and integration of the bridge with the surrounding Urban scene, which contains and Fulfills functional needs of users. Despite the tremendous technological progress, the design that comes to these bridges is limited to completing the functional aspect as means of crossing between two points. Therefore, this paper studied these bridges and how to achieve the aesthetic value through the theoretical study, in which the aesthetic aspect of these bridges is clarified down to the practical aspect by evaluating the bridges that have been implemented in Iraq and the extent of the success of showing the aesthetic value to the results and recommendations.

**Keywords:** Pedestrian Bridges, Pedestrians, Design, Bridge, Beauty, Aesthetic Value

### Corresponding Author:

Zeyad Ali Ismael  
College of Physical Planning  
University of Kufa  
Iraq  
E-mail: [Zeyada.Ismaeel@uokufa.edu.iq](mailto:Zeyada.Ismaeel@uokufa.edu.iq)

## 1. Introduction

Pedestrian bridges are usually built for the safety of pedestrians to cross crowded roads, crossing which is especially dangerous for children and the elderly. The pedestrian bridge must achieve the functional aspect in addition to the aesthetic aspect, and the aesthetic value must be an effective factor in the design process, and there are several foundations that must be achieved to take this into account.

### 1.1 pedestrian bridge design basics

#### 1.2 Visual level

The visual aspect takes into account the lines, shape, color and texture and their relationship with the elements of the visual formation of the surrounding space to achieve a state of homogeneity and balance as in Figure (1)[1].



Figure 1. Visual aspects of the pedestrian bridge in Baghdad, Palestine Street

### 1.3 Functional level

The function of the bridge is simply the continuity of the road over a gap, so its structure represents the means and the aim at the same time, and its truth does not lie in encircling the space but in the origin itself[2].

The function is achieved in pedestrian bridges by designing the width of the bridge in proportion to the number of people that will use it at peak time and taking into account the climatic and environmental aspects of the site[3].



Figure 2. Shows the visual aspects of the pedestrian bridge

### 1.4 Structural level

Bridges are a pure construction, meaning that they do not contain building elements such as walls, doors, windows ... etc. The architectural form of the bridge is a natural translation of the structural system or form, and to achieve the beauty of the form, a mask must not be placed to hide the structural system used[4].

Pedestrian bridges are constructed using various materials such as a concrete or iron structure that connects the two sides to allow traffic movement without interrupting the flow of other traffic[5].



Figure 3. Structure of a pedestrian bridge in Anbar, Iraq

### 1.5 Economic level

It works on shortening the distances between regions, saving money, time and effort, and creating urban attractions for the reconstruction of new lands, in addition to the economic and social recovery of the country and the employment of the largest amount of labor [6].

In the process of designing bridges, there are two directions: the first is that an effective structure will automatically be elegant, versus the second, which says that you must spend a lot of money to get a beautiful structure for the bridge[7].

## 2. Achieving the aesthetic value in pedestrian bridges

The aesthetic value of a bridge involves its perception in our senses and how it appears to us visually. In general, bridges appear more aesthetically pleasing if they are simple in form and Evaluated on the basis of:

### 2.1 Basic elements of the design include

The shape of the bridge, its proportions, its scale, the compatibility of the parts and elements with the environment, and the shape of the columns.

- Strength and durability.
- The relationship of the bridge elements to each other and to the perimeter
- The concept of harmony and a sense of visual balance[8].



Figure 4. The Abu Tayara pedestrians on the highway in Baghdad, compatibility with the environment, the shape of the columns, and the sense of visual balance

### 2.2 Secondary elements in the design include

- Use of color and texture.
- Expression of structural strength and ornamentation.
- Accuracy in designing elements and details.
- The light value is valuable in shading the features of the bridge in the landscape, and giving the bridge and its extensions visibility at night [9].

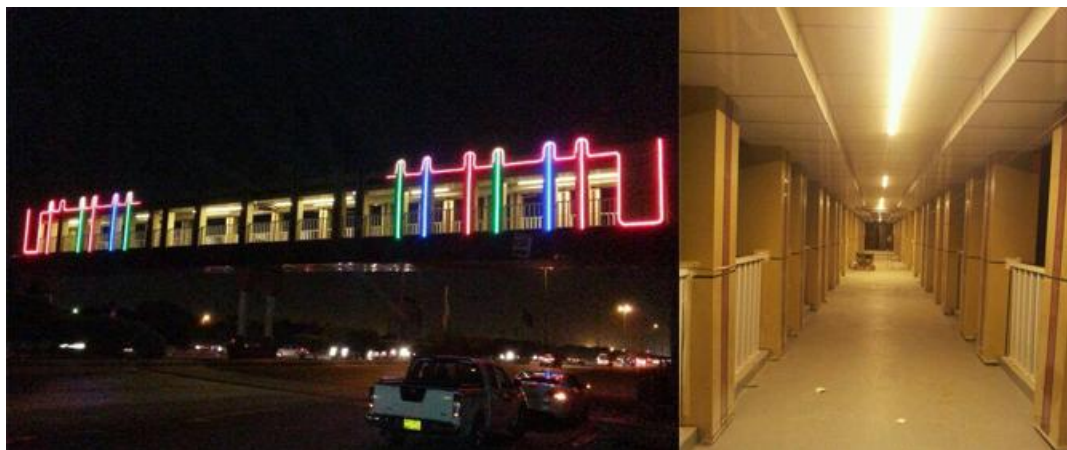


Figure 5. The Mithaq pedestrian bridge on Baghdad Street in Basra and the effect of external and internal luminous value

According to what was dealt with in the previous theoretical study, many pedestrian bridges projects that have been implemented in Iraq can be evaluated and the designer's success in activating the project's target aesthetic value through a proposed table (1) that will be applied to a group of bridges in Iraq.

Table 1. A proposal to evaluate the realization of the aesthetic value in the design foundations of pedestrian bridges

Origin name:				
Location :				
Description of the aesthetic value of the project:				
Design criterion	Achieve	Partially achieved	Not achieved	Notes
basics design:				
<b>1-The visual level:</b>				
Observe the elements and qualities of the visual formation of the mass.				
<b>2-The functional level:</b>				
Reflection of the function on the figure.				
Reflection of functionality on design aspects				
Taking into consideration the environmental and climatic aspects				
<b>3- The structural level:</b>				
Choosing a structural system that matches the functional and architectural requirements.				
Availability of safety and security factors for users				
<b>4- The economic level:</b>				
A balance is achieved between the design aspect, which targets certain values, including the aesthetic and the economic aspect.				
Elements that achieve the aesthetic value in the formation and its relationship to the environment:				
<b>1- main elements:</b>				
The shape of the bridge, its proportions, its scale, and the compatibility of parts and elements with the environment.				
Strength and durability.				
The relationship of the bridge elements to each other and to the outer perimeter. (Stairs, ramps and elevators)				
The concept of harmony and a sense of visual balance.				


<b>2- Secondary elements:</b>				
The use of color and texture in the design of bridge components and exterior finishes.				
Expression of structural strength and decoration.				
Accuracy in designing elements and details.				
The luminous value of the lighting units.				
Number of points achieved out of a total (15)				
The number of points achieved by				
The number of points not achieved.				

### 3. Application of the proposed evaluation schedule for case studies

The pedestrian bridges chosen for the case study are located in Iraq, where the first bridge is located in the Governorate of Baghdad. The goal for the construction of these bridges was to reduce traffic congestion that occurs on a daily basis and provide crossing for citizens. By applying the proposed schedule, the evaluation was as follows:

#### 3.1 First case study

Table 2. Applying the proposed table to the first case study

Name of origin: pedestrian bridge on the Euphrates highway in Baghdad				
Location: Baghdad, Iraq, the Euphrates Highway				
Description of the aesthetic value of the project: It connects the ends of the highway called the Euphrates Expressway to enable citizens to cross to and from the Ghazaliya and Al-Khadra districts and to avoid traffic accidents and the difficulty of movement. It is monitored and seen through the Al-Ghazaliya and Al-Khadra areas.				
Design criterion	Achieve	Partially achieved	Not achieved	Notes
basics design:				
1-The visual level:				The scales of the columns are appropriate to some extent in relation to the dimensions of the space, as well as the entrances and exits
Observe the elements and qualities of the visual formation of the mass				
2-The functional level:				The external shape of the block did not succeed in effectively reflecting the function because it became just a means of
Reflection of the function on the figure.				
Reflection of functionality on design aspects				

Taking into consideration the environmental and climatic aspects			●	communication between two sides only, and the space allocated for crossing with the number of users at the peak time.
3- The structural level:				It is not provided safety factors for users.
Choosing a structural system that matches the functional and architectural requirements.	●			
Availability of safety and security factors for users			●	
4- The economic level:				The design is very simple and achieved the functional goal of crossing only, but the aesthetic aspects were not taken care of.
A balance is achieved between the design aspect, which targets certain values, including the aesthetic and the economic aspect.			●	
Elements that achieve the aesthetic value in the formation and its relationship to the environment:				
<b>1- main elements:</b>				The heterogeneity of building materials and the lack of respect for the surrounding urban character from coordinating colors and materials, which results in a visual distortion in the formation as a whole.
The shape of the bridge, its proportions, its scale, and the compatibility of parts and elements with the environment.		●		
Strength and durability.		●		
The relationship of the bridge elements to each other and to the outer perimeter. (Stairs, ramps and elevators)		●		
The concept of harmony and a sense of visual balance.			●	
<b>2- Secondary elements:</b>				The railing for the stairs are a longitudinally cut iron network and the use of colors that are not related to the outer perimeter and do not add any aesthetic value to the origin. The columns are ready-made concrete blocks and were applied on the site without any details and decorative additions, and there are no lighting units at night.
The use of color and texture in the design of bridge components and exterior finishes.			●	
Expression of structural strength and decoration.				
Accuracy in designing elements and details.				
The luminous value of the lighting units.				
Number of points achieved out of a total (15)	1			
The number of points achieved by		6		
The number of points not achieved.			8	

From the previous table, we conclude that there is a small percentage of the mass formation in terms of proportions and scale (Figure 6), and there is no competition in terms of color and texture, and there is no correlation between the bridge and the general environment, which caused visual imbalance.

The origin respected the structural system that suits the functional requirements. The external shape of the block did not succeed in effectively reflecting the function. Rather, it became a means of transportation only, and the aesthetic aspect was not taken into account. Concrete techniques were used with iron quarries directly without any standards of aesthetic designs Figure (7).

It is also the lack of adequate lighting at night, which increases crime rates.



Figure 6. Huge concrete columns partially compatible with the length of the bridge, but devoid of details and decoration



Figure 7. Locally manufactured iron quarries and the lack of color coordination with the environment

We find that the percentage of the aesthetic value in the pedestrian bridge project on the Euphrates Highway was achieved by 7%, partially achieved by 40%, and the aesthetic value was not achieved by 53%.

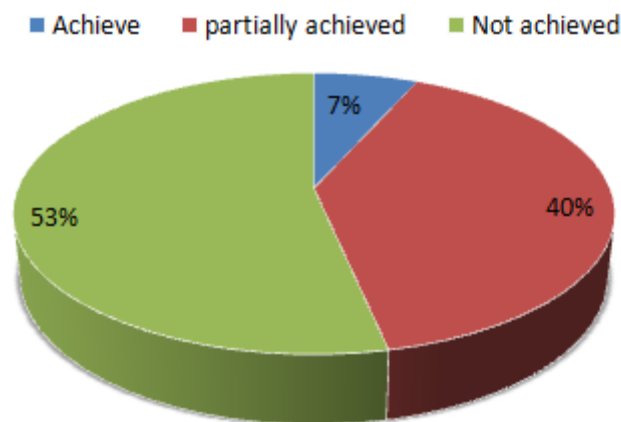



Chart 1. The percentage of achieving the aesthetic value in the first study case Euphrates fast pedestrian bridge

## 3.2 The second case study

Table 3. Applying the proposed table to the second case study

Design criterion		Achieve	Partially achieved	Not achieved	Notes
Origin name: Husaiba Bridge					
Location: Anbar, Iraq					
Description of the aesthetic value of the project: It was newly established in Husaiba district of Al-Khalidiyah district (23 km east of Ramadi) in Anbar Governorate, linking the road linking Fallujah and Ramadi. It can be monitored from the two areas.					
<b>basics design:</b>					
<b>1-The visual level:</b>					The designer, to some extent, succeeded in creating a design in which the required visual formation elements are available, such as proportions, scales, colors and homogeneity.
Observe the elements and qualities of the visual formation of the mass.	●				
<b>2-The functional level:</b>					The external shape of the block succeeded in reflecting the function to some extent by providing a suitable environment for crossing, but he did not find innovative design solutions and took into account the environmental and climatic aspects in terms of providing natural lighting and covering the bridge, but it does not absorb heat because it is iron.
Reflection of the function on the figure.		●			
Reflection of functionality on design aspects		●			
Taking into consideration the environmental and climatic aspects	●				
<b>3-The structural level:</b>					
Choosing a structural system that matches the functional and architectural requirements.					
Availability of safety and security factors for users					
<b>1.1. 4-The economic level:</b>					
A balance is achieved between the design aspect, which targets certain values, including the aesthetic and the economic aspect.					



Elements that achieve the aesthetic value in the formation and its relationship to the environment:				
<b>1.2. 1- main elements:</b>				The empty design in some parts and covered with transparent glass panels formed a strong relationship with the surrounding environment to enable vision through it, as well as stairs and ease of access and allows visual continuity and homogeneity of the entrances with their coverage with the general shape of the block and notices a strong sense of visual balance.
The shape of the bridge, its proportions, its scale, and the compatibility of parts and elements with the environment.	●			
Strength and durability.	●			
The relationship of the bridge elements to each other and to the outer perimeter. (Stairs, ramps and elevators)	●			
The concept of harmony and a sense of visual balance	●			
<b>1.3. 2- Secondary elements:</b>				The railing are simple inside the covered stair space and do not add any aesthetic value to the structure. The columns are prefabricated concrete blocks of small size compared to the overall design and were applied on the site without details and decorative additions. As for the lighting, there are indoor and outdoor spotlights installed on the structure that give an aesthetic shape when lit at night.
The use of color and texture in the design of bridge components and exterior finishes.	●			
Expression of structural strength and decoration.			●	
Accuracy in designing elements and details.			●	
The luminous value of the lighting units.	●			
Number of points achieved out of a total (15)	11			
The number of points achieved by		2		
The number of points not achieved.			2	

From the previous table, we conclude that there are clear paths to enter and exit the bridge. The design also has elements of visual formation in terms of color and texture, and taking into account the environmental and climatic aspects, but it did not use heat-absorbing materials for the bridge structure or cooling methods inside it, but it used heat-reflecting glass, and it is characterized by the presence of Streamlined entrances and exits of the bridge with the surrounding space, as well as the aesthetic lighting and attention to the lighting units gave it a beautiful view at night (Fig. (8))

Despite the designer's success in trying to produce a good architectural product, he neglected many considerations that highlight the aesthetic value of the design, such as the details and decorations that are added to the columns or the accuracy of the designs in the elements and details Figure (9).



Figure 9. Smooth concrete columns that are not compatible with the proportions of the bridge and are devoid of details and decoration (The Researchers)



Figure 8. Streamline between the entrances and exits of the bridge with the surrounding space, as well as the aesthetic lighting at night (researchers)

We find that the percentage of achieving the aesthetic value amounted to 74%, partially achieved by 13%, and the aesthetic value was not achieved by 13% at the pedestrian bridge in Husayba, as shown in the following chart:

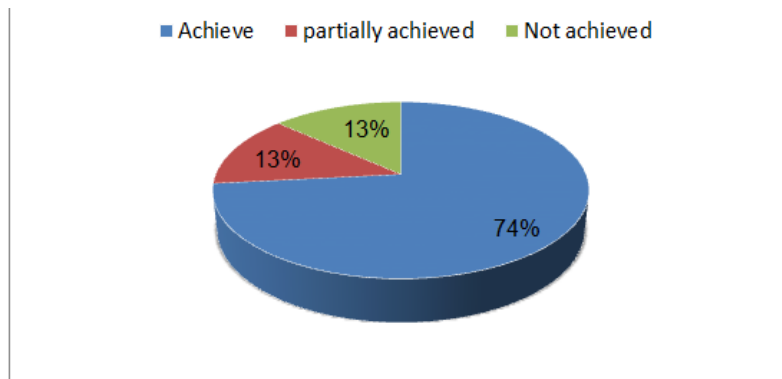


Chart 2. Percentage of achieving aesthetic value in the second study case, the pedestrian bridge in Husaybah (researchers)

### 3.3 Third Case Study

Table 4. Applying the proposed table to the third case study

Origin name: Al-Jumhuri Hospital pedestrian bridge				
Location: Basra, Iraq				
Description of the aesthetic value of the project: It was established in Basra in 2014, opposite the Al-Jumhuri Hospital. It is an electric bridge. It was built in areas of congestion and the presence of health institutions to facilitate traffic and reduce congestion				
Design criterion	Achieve	Partially achieved	Not achieved	Notes
basics design:				

1.4. 1-The visual level:				Semi-circular arched walls with huge dimensions compared to the bridge body itself and turning it into a metal cage with few openings and its metal entrances and exits are not compatible with the bridge body.
Observe the elements and qualities of the visual formation of the mass.		●		
1.5. 2-The functional level:				The external shape of the block did not succeed in reflecting the function to some extent by providing a suitable environment for the crossing, and it took into account the environmental and climatic aspects in terms of providing natural lighting and the presence of coverings for the bridge coated with heat-blocking materials such as cork, wool and thermal silicon to prevent heat from reaching the inside of the bridge.
Reflection of the function on the figure.		●		
Reflection of functionality on design aspects		●		
Taking into consideration the environmental and climatic aspects	●			
1.6. 3-The structural level:				Use the escalator system to facilitate traffic, especially the presence of a hospital in front of it and patients who facilitate their movement.
Choosing a structural system that matches the functional and architectural requirements.	●			
Availability of safety and security factors for users			●	
1.7. 4-The economic level:				
A balance is achieved between the design aspect, which targets certain values, including the aesthetic and the economic aspect.			●	
Elements that achieve the aesthetic value in the formation and its relationship to the environment:				
1.8. 1- main elements:				The solid design, with glass parts in some parts, closed the bridge from the surrounding environment and could not be seen, did not allow the visual sequence, and the entrances by covering them did not harmonize with the general shape of the block of the bridge, which generated an optical cutout.
The shape of the bridge, its proportions, its scale, and the compatibility of parts and elements with the environment.				
Strength and durability.				
The relationship of the bridge elements to each other and to the ocean.				
The concept of harmony and a sense of visual balance.				

1.9. 2- Secondary elements:				The use of the semi-circular shape caused the heterogeneity of building materials, the use of coupon units, and the lack of respect for the urban character of the area, the hospital in front of it, and the surroundings from coordinating the colors, so it caused a visual distortion in the formation as a whole.
The use of color and texture in the design of bridge components and exterior finishes.			●	
Expression of structural strength and decoration.	●			
Accuracy in designing elements and details.		●		
The luminous value of the lighting units.		●		
Number of points achieved out of a total (15)	4			
The number of points achieved by.		5		
The number of points not achieved.			6	

From the previous table, we can conclude that there is a slight agreement in the mass formation of the bridge in terms of proportions and scale (Figure 10), and the lack of proportionality in terms of color and texture, and the inhomogeneity of the formation itself with the general formation of the region, causing visual distortion.

The design respected the structural system that suits the functional requirements, and the external shape of the block did not work in a large proportion to reflect the function effectively, and the designer was interested in providing a comfortable internal environment for citizens in terms of thermal insulation and providing internal lighting Figure (11).

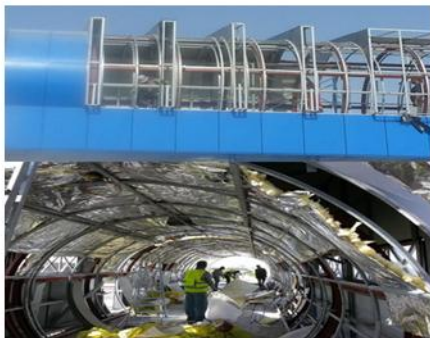


Figure 11. The huge iron structure diagonally with thermal encapsulation inside with heat insulating materials (researchers)



Figure 10. The mass formation of the bridge, the lack of color coordination, and the use of the alcobone as a sheathing for the bridge (researchers)



Figure 13. The bridge structure and its connection point with the escalator (researchers)

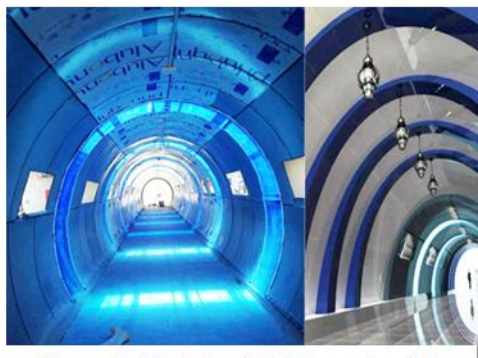


Figure 12. The internal lighting units of the bridge (researchers)

Internal lighting was used, the color of which does not fit the function of the bridge, as shown in Figure (12), and escalators were used to facilitate traffic, as shown in Figure (13).



Figure 13. The bridge structure and its connection point with the escalator (researchers)



Figure 12. The internal lighting units of the bridge (researchers)

We find that the aesthetic value was achieved by 27%, and it was partially achieved by 40%, and the aesthetic value was not achieved by 33% in the pedestrian bridge at Al-Jumhuri Hospital, and it was found according to the following chart:

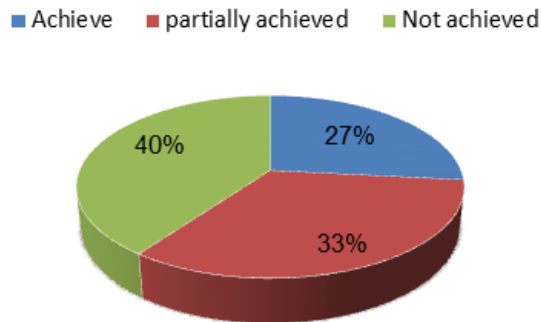


Chart 3. The percentage of achieving the aesthetic value in the third study case Al-Jumhuri Hospital pedestrian bridge (researchers)

The table shows the comparison between the three chosen projects, where the percentage of achieving the aesthetic value in all designs was 35%, partially achieved by 29%, and not achieved by 36%, as in chart (4).

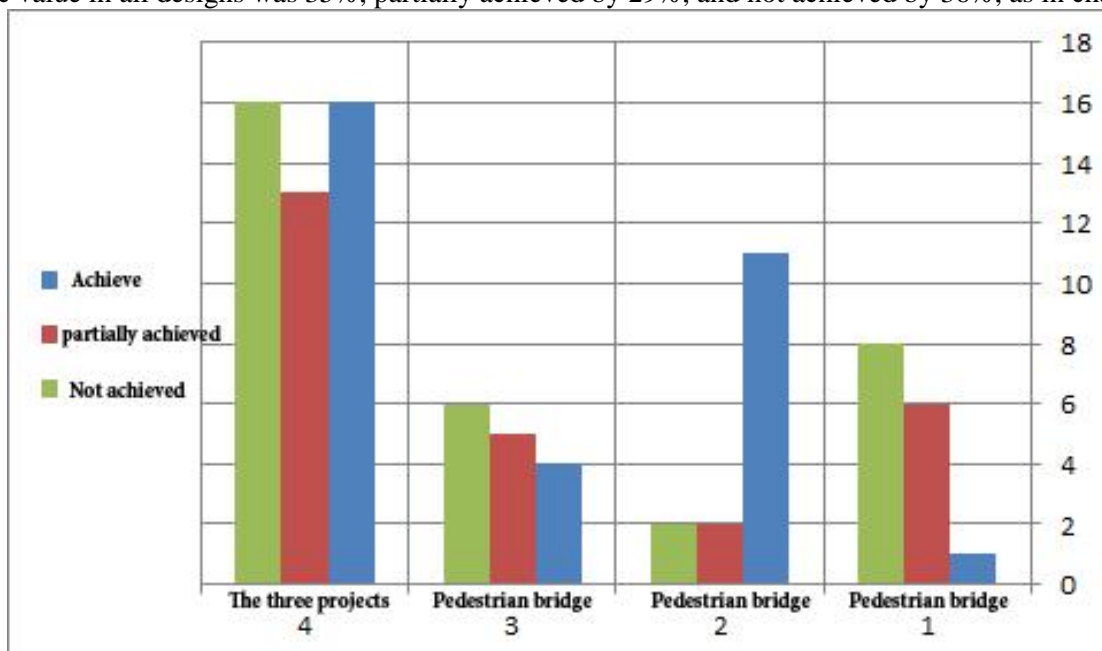


Chart 4. Comparisons in achieving the aesthetic value between the three projects (researchers)

#### 4. Conclusions and recommendations

1. The aesthetic value of pedestrian bridge installations goes beyond the shape and form and is reflected through many other structural, economic and functional considerations.
2. The percentage of achieving the aesthetic value for the pedestrian bridges implemented in Iraq, according to the study cases, does not exceed 35%, and this is due to the lack of coordination or participation between the concerned parties, which causes a state of distortion and visual deterioration.
3. There are influential elements in the process of designing pedestrian bridges, including major ones such as the bridge's shape, proportions and scale, the compatibility of parts and elements with the environment, the concept of harmony and a sense of visual balance, and secondary ones such as the shape and type of lighting inside and outside the facility.
4. Systematic plans must be developed to avoid implementing more unexamined bridges at the structural, functional and architectural level, and to attempt to repair the current situation of the actual existing bridges and solve the resulting problems if possible.
5. It is necessary to develop a successful design program for the facility before starting the design process and to conduct studies and analyzes by specialists in terms of the site and users to find the required capabilities and limitations.
6. It is necessary to find integration and flow between stairs and ramps in terms of entrances and origin.
7. Linking the block formation of the structure to the general formation of the urban surroundings in which it is located, including elements and spaces.
8. Attention to the quality and lightness of the materials used and the structural structure to express functionality and beauty at the same time, and attention to proportions, scales, color and texture within the bridge.
9. Avoid full coverage of bridges, because it separates the user's vision between the source and the ocean, as well as prevents ventilation and natural lighting. Light coverage is preferred, if any, that prevents heat and rain and allows air movement along the corridors.

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