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Scenarios for Increasing the Visual Quality of Erzurum City İpekyolu Bridge Intersection with Different Landscape Designs

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Abstract

Landscaping works are needed to eliminate the monotony of concretion caused by bridge intersections, which increases with traffic density in cities. In this study, where the Erzurum city İpekyolu Intersection is the main material, 3 different scenarios have been created to increase the visual quality of the intersection landscape. A total of 4 visual groups consisting of the current situation of the intersection and the scenarios created in the Lumion Program were evaluated. The survey prepared for the analysis was applied to 80 undergraduate and graduate students at Atatürk University Faculty of Architecture. In the analysis, design elements were considered as evaluation criteria. In Scenario 3, which received the highest score, color and color harmony were effective in the side wall visuality. As a result of the research, it was seen that the design scenarios had higher visual quality than the current situations without design.

Keywords: *Landscape design, İpekyolu bridge intersection, scenario, visual quality analysis, Erzurum.*

Farklı Peyzaj Tasarımları ile Erzurum Kenti İpekyolu Köprülü Kavşağının Görsel Kalitesinin Artırılması Senaryoları

Öz

Kentlerde trafik yoğunluğuyla artan köprülü kavşaklarla oluşan betonlaşmanın monotonluğu gidermek için peyzaj çalışmalarına ihtiyaç duyulmaktadır. Erzurum kenti İpekyolu Köprülü Kavşağı'nın ana materyali oluşturduğu bu çalışmada köprülü kavşağın yan duvar, üst geçit, kavşak peyzaj görselliğini artırmaya yönelik 3 farklı senaryo oluşturulmuştur. Köprülü kavşağın mevcut durumu ve Lumion Programı'nda oluşturulan senaryolardan oluşan toplam 4 görsel grup değerlendirilmiştir. Analiz için hazırlanan anket Atatürk Üniversitesi Mimarlık Fakültesi'nde lisans ve lisansüstü eğitim gören 80 öğrenciye uygulanmıştır. Analizde tasarım unsurları değerlendirme kriterleri olarak ele alınmıştır. En yüksek puanı alan Senaryo 3'de yan duvar görselliğinde renk ve renk harmonisi etkili olmuştur. Araştırmanın sonucunda tasarım senaryolarının, tasarım yapılmayan mevcut durumlardan daha yüksek görsel kaliteye sahip olduğu görülmüştür.

Anahtar kelimeler: *Peyzaj tasarımı, İpekyolu Köprülü Kavşağı, senaryo, görsel kalite analizi, Erzurum.*

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1. Introduction

Since highways are a structural factor in nature, they need to be harmonized with nature in terms of landscape. Another important reason for this necessity is to ensure the comfort and safety of vehicle drivers in the landscape (Altınçekiç & Altınçekiç, 1996). Landscape arrangements on highways have an effect that arouses curiosity and excitement in drivers (Seçkin, 1997).

The main function of roads and wide boulevards, which determine the direction of development that forms the skeleton of cities, is the comfortable, reliable, easy and comfortable use of pedestrians and vehicles. Especially in planned cities, roads serve as a link between various urban uses and connect urban areas to rural areas (Söğüt, 2005; Yazıcı, 2017).

A bridge intersection is defined as connecting two roads at different levels. The road network that can be used jointly in different directions is called a co-level intersection. According to the research, it has been concluded that 60% of the accidents occurring on the roads inside and outside the city are caused by concurrent intersections. Another negative reason for concurrent intersections is that they increase traffic density and slow down the progress in transportation networks (Yayla, 2011).

Intersections are built at the junction of multiple roads to ensure traffic sustainability. Traffic density can be reduced with interchanges at different levels. Even if the curves at the intersections limit the designs, interchanges provide an excellent result and traffic density control, safety and comfort are supplied by interchanges (Namlı, 2015).

Visual quality has an important effect on the planning and design processes of the elements that make up the landscape. For this reason, determining the possibilities of the landscape structure in determining the visual quality is an important factor in determining the potentials of the elements and components that make up the landscape of the area to be evaluated in terms of visual quality (Ak, 2010).

The use of photography is a very common and valid method for determining aesthetic preferences. This is because it is practical, economical and easily comparable with real natural conditions. According to the studies, it is concluded that there is a link between opinions about real landscapes and opinions about landscape photographs (Kalın, 2004; Kaptanoğlu, 2006; Çakıcı, 2007).

Many national and international studies have been conducted to evaluate the visual quality of urban road landscape and highway landscape. Among these, there are visual quality assessment studies carried out on bicycle paths by Benliay and Soydan (2015), highway by Dere (2017), urban road trees by Sezen et al. (2019), highway route by Yuca and Aşur (2022), bridge junction by Gürbüz and Sezen (2023), and green roads by Zhang et al. (2024).This study aims to create design scenarios to increase the landscape visuality of structures such as side walls, overpasses, bridges and refuges that make up intersections, which are important for solving road networks that have become complex with rapid urbanization and are constantly increasing. In the study carried out in the case of Erzurum City, design scenarios were prepared for the İpekyolu Intersection, which is located in the city and has a high traffic density. The current condition of the intersection and the different scenarios created were evaluated with visual quality analysis, and the most appropriate designs were determined.

2. Material and Method

The main material of this study is the Silk Road Intersection in Erzurum city. The auxiliary materials used in the study are various local and foreign books, theses, articles, etc. The additional materials used in the study are data obtained from multiple local and foreign books, theses, dissertations, articles, etc. and internet search results, photographs obtained by imaging and drone shooting from different angles to define the study area and apply visual quality analysis, Google Earth Pro used to prepare and edit the current site plan of the study area, AutoCAD 2013 used for digitizing the data obtained from Google Earth Pro and transferring the designs in the sketch to the computer, Photoshop CS6 program used to edit the visuals of the scenarios created in line with the data digitized in AutoCAD

program, 3Ds Max and SketchUp 2019 used to draw the data digitized in AutoCAD program in a scaled 3D way, Lumion 10.5.1 program, SPSS 20.0 program used for transferring the data of the surveys conducted for the scenarios produced about the study area to the computer and analyzing them.

A total of 32 visual groups were created, consisting of the current status of the intersection and 3 different design scenarios for each intersection. After the current situation photographs and designs were prepared, a visual quality analysis survey form was prepared. The photo and design groups created include 4 images each, including side wall, median, overpass and intersection photos and design scenarios. A total of 128 images were analyzed. Interchange photographs and design scenarios compliance (Güngör, 2005; Karaşah, 2006; Sarı & Karaşah, 2018); balance (Robinson, 2004; Sarı & Karaşah, 2018), emphasis (Uzun, 1999; Sarı & Karaşah, 2018); measure (Booth, 1990; Robinson, 2004; Sarı & Karaşah, 2018) and function, unity (Robinson, 2004; Smith, 2011; Sarı & Karaşah, 2018) and composition, color (Austin, 1982; Booth, 1990; Sarı & Karaşah, 2018), color harmony, naturalness (Bulut et al., 2010), liveliness (Bulut et al., 2010) were scored on a 5-point Likent scale (1 being the lowest to 5 being the highest score).

The reason for choosing İpekyolu Intersection as the subject of the study is to bring movement to its dense, monotonous surfaces and to create awareness. At the same time, it is aimed to contribute to increasing the amount of green space per capita. Within the scope of the intersection used in the study, various written sources and computer programs were used, and alternative scenarios were produced in accordance with the natural and cultural structure of the research area.

In order to evaluate the scenarios created to improve the visual quality of İpekyolu Intersection in Erzurum city with different landscape designs, Daniel (2001), Arriaza et al. (2004), Güngör & Arslan (2004), Önder & Polat (2004), Karahan & Yılmaz (2004), Müderrisoğlu & Eroğlu (2006), Bulut & Yılmaz (2008), Acar & Güneroğlu (2009), Sezen & Yılmaz (2010), Irmak & Yılmaz (2010), Elinç (2011), Turgut et al. (2012), Özhancı & Yılmaz (2013), Sezen (2015), Sezen et al. (2015), Özgeriş & Karahan (2015), Güneroğlu (2017), Sezen et al. (2019) used the Visual Quality Analysis Method in their research.

In the 2020-2021 academic year, the total number of undergraduate students enrolled in Atatürk University Faculty of Architecture and Design and graduate students studying in the departments of the faculty is 1390. In this case, the population size was determined as 1390. A simple random sampling method was used to determine the sample size for the survey study (Karasar, 1982; İslamoğlu, 2003; Özdamar, 2003; Büyüköztürk, 2008; Yazıcıoğlu, 2004). The following formula used by Özdamar (2003) was used to determine the sample size.

Formula 1:

$$n = \frac{N \cdot P \cdot Q \cdot Z_{\alpha}^{2}}{(N-1) \cdot d^{2}}$$

N: Number of population units, n: Sample size
P: Observation rate of X in the universe
Q: (1-P): Unobserved rate of X
Zα : 1.96 for α= 0.05
d: Sampling error
For α = 0.05 (d = 0.10) with sampling error (p = 0.3; q = 0.7), the sample size for Atatürk University Faculty of Architecture and Design with a population unit number of 1390;
N=1390*0.3*0.7*$(1.96)^2$:(1390-1)*(0.10) =80

The sample size was found to be 80, and the questionnaires of 80 people were evaluated. The SPSS 20.0 Package program was used for the statistical evaluation of the questionnaires. Visual quality analysis was performed using the T-test and ANOVA test. As a result of the analysis, 58,75% of the respondents were between the ages of 25-35, 41,25% between the ages of 18-25, 68,75% female,

31,25% male, 75% Landscape Architecture, 16,25% Architecture, 8,75% Urban and Regional Planning undergraduate and graduate students.

3. Findings and Discussion

İpekyolu intersection is located at the intersection of Fatih Sultan Mehmet Boulevard, Refik Saydam Street and Yenişehir Street. It was constructed by Highways in 2008. Figure 1a and b show the location of the İpekyolu Interchange Interchange. It is located on one of the busiest streets of the city and in a location where the central administration buildings are located. It is also located on the airport road route.

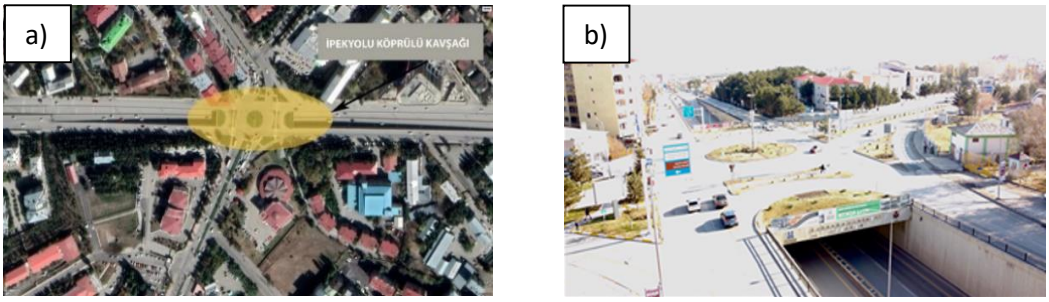

Figure 1. a. Location of the İpekyolu Bridge intersection, **b.** General view of the İpekyolu Bridge Intersection (Gürbüz, 2021)

Figure 2a, b, c, d, e and f show İpekyolu bridge intersection scenarios on vertical garden design and plantation.

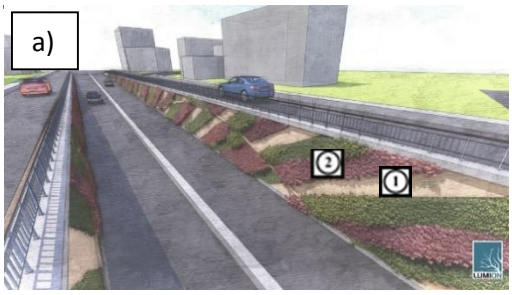

Figure 2.a. İpekyolu bridge Intersection scenario 1 vertical garden design

b. İpekyolu bridge Intersection scenario 1 vegetative design

c. İpekyolu bridge Intersection scenario 2 vertical garden design

d. İpekyolu bridge Intersection scenario 2 plantation

Figure e. İpekyolu bridge Intersection scenario 3 vertical garden design

f. İpekyolu bridge Intersection scenario 3 plantation

As can be seen in Figure 2a and 2b, *Begonia semperflorens* L. (1) and *Juniperus sabina* 'Tamariscifolia' (2) were combined with solid wood in the side wall design in scenario 1 of the İpekyolu interchange. Modular (potted) system from vertical garden systems was preferred in the design. The design principles of rhythm, movement and contrast were utilized. *Robinia pseudoacacia* 'Umbraculifera' (3) *Philadelphus coronarius* L. (4) were used in the intersection design.

In the side wall design of İpekyolu bridge intersection scenario 2, a combination of composite wood and *Begonia semperflorens* L. (1) and *Juniperus sabina* 'Tamariscifolia' (2) was designed. A modular (potted) vertical gardening system was preferred in the design. *Robinia pseudoacacia* 'Umbraculifera' (3) and *Berberis thunbergii* "Atropurpurea" (5) were used in the intersection design (Figure 2c and 2d).

Parthenocissus quinquefolia L. (6) species plants were preferred as living material in the side wall design in scenario 3 of the İpekyolu bridge intersection. A modular (potted) system from vertical garden wall systems was used. The design principles of pattern and rhythm were used. The inanimate materials used in the design are solid wood, and colored insulation felt. A 3-dimensional appearance was aimed to be achieved. In the intersection design, *Prunus cerasifera* 'Pissardii nigra' (7) was used in the central refuge, *Juniperus sabina* 'Tamariscifolia' (2) and *Pinus mugo* 'Mops' (8) were used at the intersection (Figure 2d and 2f). Figure 3a, b, c and d show the existing condition images of the İpekyolu bridge Intersection that were evaluated.

Figure 3.a. Side Wall Visuality -1 (Gürbüz, 2021)

b. Side Wall Visuality -2 (Gürbüz, 2021)

c. Overpass Visuality (Gürbüz, 2021)

d. Central Median Visuality (Gürbüz, 2021)

Table 1 shows the average scores of the side wall, overpass, center median and intersection visuals of the bridge intersection according to the evaluation criteria.

Table 1. Average scores of the bridge intersection according to the evaluation criteria

Bridge Intersection	Evaluation Criteria	The number of participants	Sig. (P)	Average Score	
Side Wall Visuality (SWV)	Technic	80	**0,001****	2,088	**1,911**
	Harmony	80		2,076	
	Balance	80		2,088	
	Emphasis	80		1,763	
	Size and Function	80		2,125	
	Unity and Composition	80		1,975	
	Color and Color Harmony	80		1,675	
	Naturalness	80		1,663	
	Vividness	80		1,750	
Overpass Visuality (0V)	Technic	80	**0,202**	2,225	**2,028**
	Harmony	80		2,250	
	Balance	80		2,038	
	Emphasis	80		1,938	
	Size and Function	80		2,075	
	Unity and Composition	80		1,925	
	Color and Color Harmony	80		1,888	
	Naturalness	80		1,913	
	Vividness	80		2,000	
Central Median Visuality (CMV)	Technic	80	**0,869**	2,050	**1,953**
	Harmony	80		2,038	
	Balance	80		1,988	
	Emphasis	80		1,888	
	Size and Function	80		2,038	
	Unity and Composition	80		1,863	
	Color and Color Harmony	80		1,950	
	Naturalness	80		1,900	
	Vividness	80		1,863	
Intersection Visuality (IV)	Technic	80	**0,033***	2,013	**1,846**
	Harmony	80		1,813	
	Balance	80		1,950	
	Emphasis	80		1,638	
	Size and Function	80		2,125	
	Unity and Composition	80		1,763	
	Color and Color Harmony	80		1,750	
	Naturalness	80		1,788	
	Vividness	80		1,775	
General Average		**80**		**1,935**	

*Significant (p<0.05) **Very Significant (p<0.01)

As can be seen in Table 1, the highest average score in the visual quality assessment of the bridge intersection was given to the OV (2,028). The most influential evaluation criterion in the average score given to the OV is harmony (2,250). IV received the lowest average score (1,846). Emphasis (1,638) are the evaluation criteria that are effective in such a low average score of IV. Among all evaluation criteria, harmony (2,250) received the highest score in OV and emphasis (1,638) received the lowest score in IV. The overall average score for the bridge intersection is 1,935. There are very significant ($p<0.01$) differences between the scores given by the respondents to the evaluation criteria to determine the SWV. The difference between the scores assigned to the evaluation criteria to determine the IV is significant ($p<0.05$). The difference between the scores given to the evaluation criteria to assess (OV) and (CMV) is insignificant ($p>0.05$). Figure 4a, b, c and d show the evaluated images of the İpekyolu Bridge Intersection Scenario 1 (S1).

Figure 4.a. Side wall visuality -1

b. Side wall visuality -2

c. Overpass visuality

d. Central median visuality

Table 2 shows the average scores of S1's side wall, overpass, center median and intersection visuality according to the evaluation criteria.

Table 2. Average scores of the S1 intersection according to the evaluation criteria

Bridge Intersection		Evaluation Criteria	The number of participants	Sig. (p)	Average Score	
S1	**Side Wall Visuality (SWV)**	Technic	80		3,775	
		Harmony	80		3,750	
		Balance	80	**0,906**	3,788	**3,760**
		Emphasis	80		3,750	
		Size and Function	80		3,663	
		Unity and Composition	80		3,750	
		Color and Color Harmony	80		3,838	
		Naturalness	80		3,650	
		Vividness	80		3,875	
	Overpass Visuality (0V)	Technic	80		3,888	
		Harmony	80		3,625	
		Balance	80	**0,713**	3,838	**3,750**
		Emphasis	80		3,613	
		Size and Function	80		3,775	
		Unity and Composition	80		3,763	
		Color and Color Harmony	80		3,750	
		Naturalness	80		3,775	
		Vividness	80		3,725	
	Central Median Visuality (CMV)	Technic	80		3,888	
		Harmony	80		3,725	
		Balance	80	**0,564**	3,900	**3,750**
		Emphasis	80		3,588	
		Size and Function	80		3,838	
		Unity and Composition	80		3,700	
		Color and Color Harmony	80		3,725	
		Naturalness	80		3,713	
		Vividness	80		3,675	
	Intersection Visuality (IV)	Technic	80		3,913	
		Harmony	80		3,775	
		Balance	80	**0,723**	3,813	**3,803**
		Emphasis	80		3,646	
		Size and Function	80		3,850	
		Unity and Composition	80		3,825	
		Color and Color Harmony	80		3,750	
		Naturalness	80		3,813	
		Vividness	80		3,838	
	General Average		**80**		**3,766**	

* Significant (p<0.05) **Very Significant (p<0.01)

As seen in Table 2, IV (3,803) received the highest average score in the visual quality assessment of S1. Technic (3,913) was the most influential evaluation criterion in the average score given to IV. OV and CMV received the lowest average score (3,750). The evaluation criteria that were effective in such a low average score for OV and CMV were emphasis (3,588) for CMV and emphasis (3,613) for OV. Among all evaluation criteria, technique in IV received the highest score (3,913), and emphasis in CMV

received the lowest score (3,588). The overall average score for S1 is 3,766. The difference between the scores given by the respondents to the evaluation criteria for determining SWV, OV, CMV and IV in the Interchange Scenario 1 (S1) is insignificant (p>0.05). Figure 5a, b, c and d show the evaluated images of the İpekyolu bridge intersection scenario 2 (S2).

Figure 5.a. Side wall visuality -1

b. Side wall visuality -2

c. Overpass visuality

d. Central median visuality

Table 3 shows the average scores of S2 according to the evaluation criteria of the side wall, bridge (overpass), center median and intersection visuality.

Table 3. Average scores of the S2 intersection according to the evaluation criteria

Bridge Intersection		Evaluation Criteria	The number of participants	Sig. (p)	Average Score	
S2	**Side Wall Visuality (SWV)**	Technic	80		3,763	
		Harmony	80		3,613	
		Balance	80	**0,978**	3,738	**3,734**
		Emphasis	80		3,713	
		Size and Function	80		3,800	
		Unity and Composition	80		3,700	
		Color and Color Harmony	80		3,775	
		Naturalness	80		3,763	
		Vividness	80		3,738	
	Overpass Visuality (0V)	Technic	80		3,788	
		Harmony	80		3,688	
		Balance	80	**0,948**	3,763	**3,730**
		Emphasis	80		3,663	
		Size and Function	80		3,825	
		Unity and Composition	80		3,663	
		Color and Color Harmony	80		3,738	

	Naturalness	80		3,675	
	Vividness	80		3,763	
Central Median Visuality (CMV)	Technic	80	**0,828**	3,750	**3,681**
	Harmony	80		3,763	
	Balance	80		3,763	
	Emphasis	80		3,663	
	Size and Function	80		3,775	
	Unity and Composition	80		3,600	
	Color and Color Harmony	80		3,625	
	Naturalness	80		3,625	
	Vividness	80		3,563	
Intersection Visuality (IV)	Technic	80	**0,993**	3,900	**3,836**
	Harmony	80		3,850	
	Balance	80		3,875	
	Emphasis	80		3,838	
	Size and Function	80		3,813	
	Unity and Composition	80		3,863	
	Color and Color Harmony	80		3,763	
	Naturalness	80		3,833	
	Vividness	80		3,788	
General Average		**80**		**3,745**	

* Significant (p<0.05) **Very Significant (p<0.01)

As seen in Table 3, IV (3,836) received the highest average score in the visual quality assessment of S2. The most influential evaluation criterion in the average score given to IV was technique (3,900). CMV received the lowest average score (3,681). The most effective evaluation criterion for CMV to have such a low average score was vividness (3,563). Among all evaluation criteria, technique (3,900) received the highest score in IV and vividness (3,563) received the lowest score in CMV. The overall average score for S2 was 3,745. As seen in Table 3, the difference between the scores given by the respondents in Scenario 2 (S2) and the evaluation criteria for determining the SWV, OV, CMV and IV is insignificant (p>0.05).

Figure 6a, b, c and d show the evaluated photographs of the İpekyolu Interchange Scenario 3 (S3).

Figure 6.a. Side wall visuality -1

b. Side wall visuality -2

c. Overpass visuality

d. Central median visuality

Table 4 shows the average scores of S3 according to the evaluation criteria of side wall, bridge (overpass), median and intersection visuality.

Table 4. Average scores of the S3 intersection according to the evaluation criteria

Bridge Intersection	Evaluation Criteria	The number of participants	Sig. (p)	Average Score	
Side Wall Visuality (SWV)	Technic	80	**0,770**	4,088	**4,104**
	Harmony	80		4,050	
	Balance	80		4,150	
	Emphasis	80		4,100	
	Size and Function	80		4,113	
	Unity and Composition	80		4,125	
	Color and Color Harmony	80		4,238	
	Naturalness	80		3,925	
	Vividness	80		4,150	
Overpass Visuality (0V)	Technic	80	**0,999**	3,950	**3,974**
	Harmony	80		3,963	
	Balance	80		3,988	
	Emphasis	80		3,938	
	Size and Function	80		3,988	
	Unity and Composition	80		3,988	
	Color and Color Harmony	80		4,025	
	Naturalness	80		4,000	
	Vividness	80		3,925	
Central Median Visuality (CMV)	Technic	80	**0,916**	3,988	**3,917**
	Harmony	80		3,925	
	Balance	80		3,938	
	Emphasis	80		3,813	
	Size and Function	80		3,975	
	Unity and Composition	80		3,975	
	Color and Color Harmony	80		3,938	
	Naturalness	80		3,900	
	Vividness	80		3,800	
Intersection Visuality (IV)	Technic	80	**0,902**	4,013	**4,020**
	Harmony	80		3,913	
	Balance	80		4,000	

	Emphasis	80	3,963
	Size and Function	80	4,088
	Unity and Composition	80	4,075
	Color and Color Harmony	80	4,125
	Naturalness	80	3,975
	Vividness	80	4,025
General Average		**80**	**4,004**

* Significant (p<0.05) **Very Significant (p<0.01)

As can be seen in Table 4, the highest average score in the visual quality assessment of S3 was given to SWV (4,104). Color and color harmony (4,238) was the most influential evaluation criterion in the average score given to the SWV. CMV received the lowest average score (3,917). The most influential evaluation criterion for ORG to have such a low average score was vividness (3,800). Among all evaluation criteria, color and color harmony (4,238) received the highest score in the SWV and vividness (3,800) received the lowest score in the CMV. The overall average score for S3 is 4,004. The difference between the scores given by the respondents in Scenario 3 (S3) and the evaluation criteria for determining the SWV, OV, CMV and IV is insignificant (p>0.05).

The ranking of the average scores given to the existing condition and design scenarios of the interchange is shown in Figure 7.

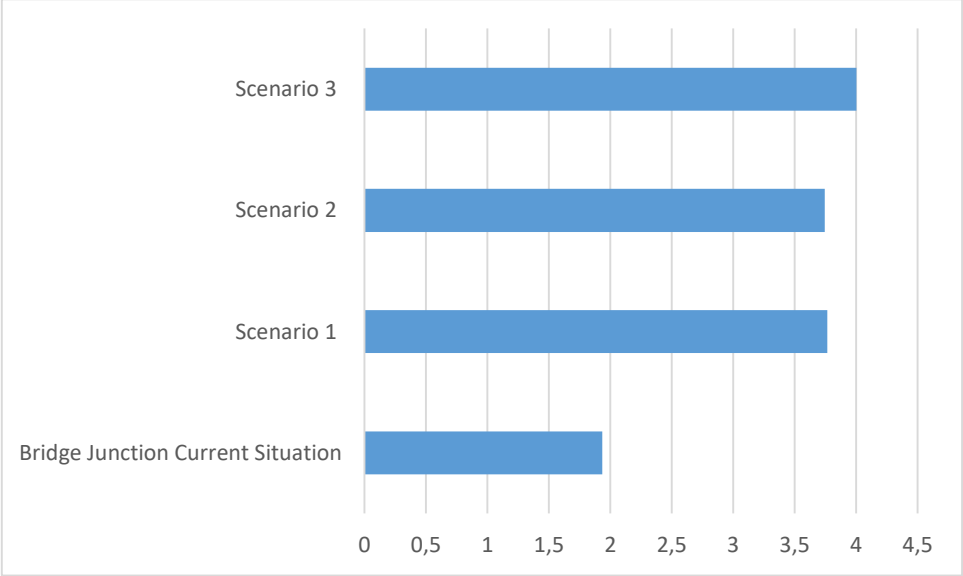

Figure 7. The existing condition of the interchange and average scores given to design scenarios

As can be seen in Figure 7, the scores given to the design scenarios are higher than the scores assigned to the existing condition of the un-designed interchange. Scenario 3 received the highest score among the design scenarios.

In cities with rapid urbanization, the connection with nature is broken due to activities such as rapid population growth and urban transformation. The rate of destruction of nature increases with the effect of variables such as climate change, rapidly developing technology and consumption habits in the area where urban people engaged in trade, industry and service management live. Therefore, landscape architecture studies with urban afforestation, lighting, planting, and water basins have gained importance. Green walls on the sides of highways in big cities are also included (Güleç, 2019).

Cities have to adapt to a constantly developing and changing world and people. For this reason, planning and design processes in cities never end. New designs and plans must be continuously

produced in order to meet the increasing and changing demands, population, requirements of the modern age, spatial growth and similar needs. Accordingly, planners and designers must constantly produce new things and renew and improve themselves. In order to create solutions to continually changing needs, many experts from different professional disciplines, designers and planners can work together. For example, landscape architecture, which is a professional discipline that takes into account ecological needs and is carried out as a whole with nature, has long taken its place as one of the important actors of urban studies, especially in developed countries. Urbanization, but also respect, longing and needs for nature, require collaborative work with landscape architects (Bulut & Atabeyoğlu, 2010).

When the scores given are examined, it is seen that the lowest average score is given to the IV in its current condition (1,846), and the evaluation criterion that is effective in the IV having such a low average score is color and color harmony (1,638). It is seen that the effect of color and color harmony is important in visual quality evaluations. As a matter of fact, Şekerci et al. (2016) also stated that color is one of the most important elements of design and that all forms and surfaces in the space are perceived with color differences. According to Akoğlu and Akten (2022), visual perception color is an important factor for its realization. The respondents gave the highest average visual quality score (4,004) to the 3rd scenario (S3) designed for the Silk Road Interchange (Figure 8).

Figure 8. Highest scoring ınterchange among the designed scenario

Parthenocissus quinquefolia L. plant was preferred as living material in the side wall design of İpekyolu interchange scenario 3. As a matter of fact, according to Aslan and Akan (2019), the leaves of *Parthenocissus quinquefolia* L. first turn yellow, orange, then copper and red, and during shedding, they turn into red and red, offering a feast of visual colors in parks and gardens. According to Sağlık et al. (2020), it is a suitable plant for covering walls, trees or structures.

The design principles are based on the principles of pattern and rhythm. The inanimate materials used in the design are solid wood, and colored insulation felt. A 3-dimensional appearance was aimed to be achieved. In the intersection design, *Prunus cerasifera* "Pissardii nigra" plants were used in rows in the central refuge. According to Aslan and Akan (2019), the flowers of *Prunus cerasifera* "Pissardii nigra" bloom in pink, white and red colors in late winter and early spring. This species, which is widely grown for fruit and ornamental purposes, is used in landscaping for its flowers and sometimes for its bark and leaves.

Juniperus sabina 'Tamariscifolia' and *Pinus mugo* ''Mops'' were used at the intersection. According to Özcan (2022), *Juniperus sabina* 'Tamariscifolia' is a suitable plant for highways, squares, parking lots, refuges and avenues. According to Yücel (2012), *Juniperus sabina* 'Tamariscifolia,' an evergreen shrub, is resistant to cold climates; *Pinus mugo* 'Mops' is an evergreen, young shoots yellow, bark grayish-black, needle leaves dark green, used singly or in groups, used on roadsides, has high aesthetic and decorative value, has different forms.

A potted system was used among vertical garden wall systems. The inanimate materials used in the design are solid wood, and colored insulation felt. Color and color harmony (4,238) is the most effective evaluation criterion in the average score given to the SWV. As a matter of fact, Gürbüz and Sezen (2023) concluded that color and color harmony increase the visual quality in the design scenarios they created for Erzurum City Mecidiye Bridge Interchange.

In the visual quality assessment of the İpekyolu Interchange, the highest average score was given to the OV (2,028). The most influential evaluation criterion in the average score given to the OV is harmony (2,250). As a matter of fact, according to Gülgün & Türkyılmaz (2001), harmony between human and environment is an important factor in design. IV (1,846) received the lowest average score. The evaluation criteria that are effective in IV having such a low average score are color and color harmony (1,638). As a matter of fact, Şekerci et al. (2016) also stated that color is one of the most important elements of design and that all forms and surfaces in the space are perceived with color differences.

4. Conclusions and Suggestions

As a result of the research, when the landscape design scenarios created for the intersections and intersections of Erzurum city were evaluated with the visual quality analysis method, it was seen that the design scenarios were given much higher scores than their current state without design. These data show that the side walls, overpasses, central refuges and intersections of the bridge intersections in Erzurum City are in need of landscape design. The landscape quality of urban road routes, road connections, and intersections is very effective in enhancing the high visual quality of a city's landscape. For this reason, the local administrations of Erzurum city should not ignore the landscape visuals as well as the design and implementation of intersections. Landscaping work to be carried out in the sections forming the interchanges will not only increase the visual quality value of the city but also improve the ecology of the city and increase the amount of green space per capita. With this study, urban aesthetics and visual quality evaluations are taken into consideration in the concept of sustainable landscaping for the future and a database that can serve as a resource for local governments is provided.

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All authors contributed equally to the article. The first author contributed 50% and the second author contributed 50%. The authors declare no conflict of interest.

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