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Assessing Environmental Aesthetics of Roadside Vegetation and Scenic Beauty of Highway Landscape: Preferences and Perception of Motorists

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ABSTRACT: This paper discusses the importance of environmental aesthetics and scenic beauty of current roadside vegetation in the highways, and the necessity for the contribution of users (motorists) preferences in the integration of scenic beauty of roadside vegetation into its management plans. The results of a questionnaire survey of motorist's opinion on the landscape aesthetics and quality of some highways in Tehran city are presented with their analyses. Findings of the research indicate the roadside vegetation as the most important elements of highway scenic beauty for the majority of users. High-rise building, historic or cultural landmarks, farmlands, street lighting and advertisement boards found with lower level of importance to the passengers. A strong positive tendency of respondents found towards variety of vegetation types instead of a uniform composition. The most preferred combination of plant types of road were preferred were: trees in the background, grass and flowering herbs in the foreground and shrubs in the middle. In our case study, dissatisfaction with vegetation type and combination was reported lower among those who travelled once or twice a month or longer, compare to those who travelled the site more frequently in a daily or weekly basis. This indicates that for less frequent users the roadside vegetation was reported almost satisfactory, as their personal cognition of a route is less affected by their prior knowledge. However, the preferences of motorists who used the highway more frequently, showed a great tendency with planting design patterns of trees in background and shrubs in the foreground.

Key words: Highway, Scenic beauty, Questionnaire survey, Roadside vegetation, Environmental Aesthetics

INTRODUCTION

Rapid urban population growth and development of cities is largely associated with mass transportation by different patterns of movement, which in turn it leads to the construction of new roads and also motorways expansions. Roads and highways occupy a great deal of land, alter surrounding landscape immensely, and diminish natural systems and disrupt life cycles sharply. Hence, their impacts in the urban and suburban areas are increasingly alarming and their roles, becomemore important in sustainable urban development (Masnavi, 2012, Aminzadeh and Khansefid, 2010; Alberty 2008). They have also great impacts on landscape ecology and environmental aesthetic and scenic beauty of altered areas (Alberty, 2008; Ingegnoli,2002). Landscape is seen as both qualitative and quantitative entity which entails many dimensions. It should be defined by considering it as an entity which carries different layers of activity, function, resources and potentials across many disciplines. Many studies on sustainable development are tied with relations of landscape and environmental systems. Some Scholars for instance argued over the landscape as a complex system, and stressed landscape complexity as essential features for environmental sustainability (Norberg and Graeme, 2008; Masnavi and Soltanifard, 2007; Cadenasso *et al.*, 2006; Green *et al.*, 2006; Loehle, 2004;. Witting, 2003; Mikulecky, 1995). Landscape has also been subject of beauty and aesthetic values in the works of Ruskin(1988), Porteous(1996) and Berleant (1997) concerning conservation of natural beauties and promotion of aesthetical values, and appreciation of perceptual values (cited in Makhzoumi and Pungettie,1999).

Considering environmental and ecological aspect as well as aesthetics features, this study therefore is to examine the perception of passengers or travelers in terms of scenic beauty and environmental

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compatibility of highways. The rate of citizens' commuting in the urban and suburban areas has been growing up as they are provided by various incentives. Although the tendency to use public transport or non-motorized transportation facilities such as Biking and cycling are slightly increasing, most of the people drive their cars for their daily trips to work, shop and other activities. Increased demand to use hierarchical network of transportation is making the potential effects of highways condition on users a major concern. In this regard, roadside vegetation has been considered as one of the influential elements of the roadside condition based on its environmental aesthetics, cultural, economic and social contribution to public life (Wolf, 2006). Roadside environment considered as public open space improving or even creating a sense of place and identity in local communities. The major element affecting this capacity is aesthetics and scenic beauty; because motorists' perception on a road is shaped during a relatively rapid progression along a corridor (Stamps, 2001). As the landscape is defined as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (CE, 2000), the impact of road environment on the landscape aesthetics perceived by the passenger is a function of physical and psychological distance between the observer and the landscape which is accentuated when moving in a closed vehicle (Froment and Domon, 2006). Moving in a closed vehicle also reinforces the dominance of the sense of sight and restricts the cone of vision of the driver at high speed (Tunnard and Pushkarev, 1963). Moreover, there are different initiatives related to aesthetic aspects of roadside environment. Clay and Smidt (2004) refer to them as physiographic features, cultural additions, transportation concerns and transitional relationships which all affect the viewer's experience. This study investigated a 9Km highway in peri-urban southern Tehran (in Iran) and its surrounding neighborhoods. As the research corridor is extended across different landscapes (urban residential areas and countryside agriculture land) many of these initiatives can be considered such as along the corridor, differences in motivations for travel, travel speed, frequency of use and even variety in composition and intensity of roadside elements, environmental changes, land uses and structures.

It has seen as a challenge for the management authorities in Department of Roads and Transport, especially in Highways, to establish safe and cost-effective transportation projects that fit their surroundings visually, culturally and ecologically. Different approaches such as intensive or ecological management can be taken into account in this regard; which can have significant effect on aesthetics of the roadside environment and users' perception and preferences.The pros. and cons. of different approaches are documented in many studies (for example: Spooner and Smallbone, 2009, Karim and Malik, 2008; Porteous, 1996). However, the important point is the contribution of the approaches towards aesthetic, cultural and environmental qualities of the corridor and their success to fulfill the objective of research should be investigated simultaneously. Furthermore, in peri-urban areas management of highway landscapes would also reinforce the connection with nature and cohesion in the Tehran city suburban landscape. Urban growth in Tehran, like many other cities around the world, is coincided with establishment of linear elements, rows of buildings, trees, and urban infrastructures alongside highways and roads. These are often closing the visual access of the car passengers and motorists, leaving them with outdoor views they may not like. This process affects the motorists' perception and eventually their aesthetic preferences of roads and highways environment. In addition, prior knowledge of the route modifies the conditions for perception. Over time, the user builds personal cognitive structures of a route, from both past experiences and immediate sensations, which are characterized by a series of determinant elements (Froment and Domon, 2006).

In this study, we undertook a questionnaire survey to explore the user's preferences about roadside vegetation, its aesthetic values and contribution in the scenic beauty of the highway. The major question was how to make the drive a more safe and pleasant experience for the motorists avoiding any increase in complexity that disturbs driver's attention. And does the frequency of use affect these preferences? There has been a great emphasis on the importance of visual elements of the landscape and its relation to the people's preferences or the visual perceptions of users in shaping behavior or interaction with their environment (Porteous, 1999; Jakle, 1987; Punter, 1982). Some of scholars postulated the idea that experiencing natural landscape or providing the urban areas with greater greenery can lead to create a quality environment for the citizens (Ulrich and Addoms, 1981; Ulrich 1974). Therefore, the key elements in creating mental picture of the roadsides for motorists needs to be identified and for the consideration in the in highways planning and design process. The importance of planting planning and design has been reviewed. This was in terms of, aesthetics, combination and composition of the plant types. The roadside environmental perception from motorists' point of view and the way its aesthetics affect the preferences and perception of scenic beauty in a highway roadside is

stressed in the numerous governmental reports and also the works of many scholars (WSDOT, 2011; RTANSW, 2010; EPD 2006; DDT 2005; UDGHK 2005; DOTD 2000; FHA, 1997). Some research reports saw trees as an important aspect of community identity. They might carry a great deal of emotional relations and value to the community members and hence encourage them to consider protection and improvement and even the design of the greenery in the neighborhood (DOTD, 2000).

Many researches have shown that people prefer naturalistic scenes. Those occupied with vegetation rather than man-made structures (Kaplan & Kaplan, 1989; Nasar, 1998; Higuchi, 1998; Kearney, 2006). Inside the city, urban scenes are preferred to be coupled with great presence of nature or in general vegetation (Talbot, 1988; Sullivan *et al.*, 2004). This preference for nature also is promoted to highways, and they are not seen just as conduits that provide a means for traveling between two destinations, but it is believed that they also establish a framework for a unique experience (Clay and Daniel, 2000). This framework is mostly affected by the physical conditions and most importantly by roadside vegetation which gives a soft and natural character to a highway. Findings from researches have demonstrated the positive effects of naturalistic roadways (DOTD 2000, Parsons *et al.*, 1998; Kent, 1993), greater appreciation of freeway roadsides are expressed in terms of having trees (Wolf, 2003); and roadside vegetation on streetscape improvement (Fukahori *et al.*, 2003). Some scholars maintain that People prefer less developed and more intact scenic routes (Cackowski & Nasar, 2003). Some other has reported that vegetation comes at first priority in the list of aesthetic qualities that great streets and highways should include (Todorova *et al*., 2004). In addition, vegetation is claimed to improve mood, reduce stress, and facilitate recovery from directed attention fatigue which is a common phenomenon among drivers. Scenes with vegetation produce greater positive feelings than urban scenes (Tyson, 1998; Herzog and Strevey, 2008). In the natural landscape of the roadside environment all forms of vegetation contribute to landscape aesthetics and visual improvement, trees can build a smooth skyline and provide delineation of space in the wall plane, shrubs can reinforce the vertical relationship of structures and the ground plane, and grass and ground cover help to provide a more desirable ground plane (Smardon, 1988). Froment and Domon found that in the highways, movement at high speed will restrict the cone of vision of the driver. In this context only large and simple forms are truly perceptible (Froment and Domon 2006). On a highway corridor, it is necessary for the driver to compose an image as quickly as possible, due to the complexity of the driving. These limitations put a particular importance on the design of the roadside environment, regarding individual elements and structures and visual access to focal points inside or outside the corridor. This restriction is often for the car driver and is not fully applicable to the passengers. Their perception is different from drivers, as they don't need to focus on the road, and scenic beauty in the corridor can play a vital role in the making of their perception and preferences and improve their journey to a more pleasant one. Moving inside a linear corridor gives a potential to the visual sequence and the spatial organization of the elements to affect the way motorists percept the road environment (Clay & Smidt, 2004). This spatial organization can be accentuated through going uphill or downhill and having turns on the road and the conformity of changes in the landscape with these variations in the direction of sight. Accordingly, vegetation as a key element in scenic beauty should be distributed in a way that create successive sequences of landscapes with enough variety to be more attractive and less complex at the same time.

MATERIALS & METHODS

The major difficulty dealing with scenic beauty is the elusiveness and complexity of the concept. The perception of beauty has been considered as a result of the reactions of persons experiencing the landscape (Daniel, 2001). Despite this difficulty, there are reports in the literature about the assessment of scenic beauty of urban forests, parks and roadside vegetation (Clay and Smidt, 2004; Franco 2003; Parsons 2002; Clay and Daniel 2000; Jones *et al.*, 1976). The methods generally used for assessing scenic beauty are cartographic representations, simulated assessments and questionnaire surveys (Akbar *et al.*, 2003) which each of them belong to one of the two main approaches: expert/ design and public perception-based (Daniel, 2001; Scott and Benson, 2002). Cartographic representation as an expert approach leans toward the philosophy of aesthetics in that landscape quality can be determined by competent inspection of the relevant features of the landscape (Lothian 1999). In cartographic representation some of the landscape features are selected and recorded on maps to illustrate the scenic beauty of a specific area. Same as other expert approaches, this method is criticized for having inadequate level of precision, reliability and validity. Many scholars maintain that among the challenges of this method is the controversy in the issue of selection of variables that are going to represent scenic quality, in addition of the difficulties of two-dimensional representation of views seen in elevation (Appleton, 1994; Bell, 2001; Dramstad *et al.*, 2006) which are very much facilitated by GIS and RS techniques and methods.

In our simulated assessment, the giving some photographs, slides or short clips of a landscape, to a survey sample group of observers (who are travelling by cars in the area) and asked them to evaluate those views and landscape, and express their opinions. Their responses then were categorized, like what is done in Q-Sort method. This method is used by many researchers e.g. Pitt *et al.,* 1979; Swaffield *et al.,* 1996; Clay and Smidt, 2004; Arriaza et al. , 2004; Green, 2005. In this method, possible bias is expected in professional incompetence in taking photographs, in their selection procedure and in their presentation.The sample size and its characteristics is also a challenge, because the social and professional backgrounds of observers may influence their judgments. This study hired the third method to collect data; while surveys are widely used to portray the attitudes and preferences of the sample society (for example: Gidolf-Gunnarsson and Ohrstrom, 2007; Asakawa et el., 2004; Höppner *et al.,* 2007; Pearson *et al.,* 2010) and according to some researches they can be efficient as they have the advantage of providing descriptive assertions, reaching a reasonably representative group of people in a short period of time, providing the means to generate data that can be quantified and analyzed. it is hoped that this can provide chance to assess different issues by collecting the views of people with different social, economic and geographical backgrounds (Gillham, 2008; Akbar, 2003).The principal basis on which the framework of the questionnaire survey was designed was including: a) the importance of scenic beauty of highway environment, b) the key elements inside or outside the highway corridors providing scenic beauty and c) the public perception of the highway roadside vegetation and their preferred condition versus the existing condition. Respondents were asked a series of questions to describe their perception and preferences about the quality of the existing roadside vegetation in terms of variety of vegetation, colorfulness, vegetation type and combination of plant types and planting design.

The survey was carried out from May to June 2008. The selected highway for investigation is a 9Km in long corridor located in southern Tehran (Fig.1). The highway connected a large urban square within a residential district to the town cemetery in the countryside; and in its path crosses three different urban districts. Survey Sample size was determined based on the formula and table provided by Israel (2003); and also Cochrane (1963). As the size of the population studied was more than 100,000 people, sample size was calculated 204 for precision level ±7% where confidence level was 95%. To ensure random sampling, it was undertaken on different days of a week, at different times in a day, at different places along roadway and residential areas nearby. In total, 210 persons were interviewed but out of them, 198 answered and/or completed the questionnaire. 32 percent of the respondents were women. Dominant age group of the sample was 35 to 45 years old. They mostly lived nearby the site and in some parts of the north and west district.

RESULTS & DISCUSSION

Results of this survey are divided into three categories to cover the objectives of this paper. First we frame respondent's opinion about the current environmental condition and the scenic beauty of roadside vegetation and then describe their preferences in this regard. Based on the frequency of travel in this highway for each respondent, aesthetic preferences will be reframed to show the effect of familiarity and prior knowledge on them. In the meantime, to analyze the survey results, frequencies were converted to percentages. This technique provides some degree of simplification and has been used in previous studies involving surveys of public opinion (Vesely, 2007; Forment and Domon, 2006; Tyrväinen *et al.,* 2003).

Respondents were given an open ended question to mention the most important element of the scenic quality of the roadside environment (Table 1). Roadside vegetation, wall paintings of the residential buildings near the verge, (Fig. 1, *Photo A*) and the visual access to agricultural lands in the countryside (Fig. 1-*Photo B*) were the most important elements of the scenic beauty of the current condition of the site.

This shows the importance of the roadside vegetation and its contribution in building of the personal cognitive structure of the road. The diversity of the elements highlights the fact that perception is a complex process and very different from one individual to another even though the individual is sat in a closed moving vehicle.

Current vegetation of the site is mostly composed of trees and their species composition is *Ulmus dens, Pinus elderica, Aillantus spp., Robinia spp., Morus spp.* and *Fraxinus spp.* Shrubs and flowering herbs are rare and limited to areas near office and organization buildings. Vegetation is distributed on road verge and refuges in middle of the roadway. Drivers and passengers were asked about the variety of vegetation (which can differ from mostly varied to all one type or single seed mixture), its colorfulness (which can differ from drab to very bright and colorful and combination of plant) and their types- which can differ from just mown grass to a combination of trees, shrubs, grass and flowering herbs.

Photo A:The image of a highway with buildings on the sides

Photo B:The image of a highway without buildings on the sides

Fig. 1. Photos A and B: As the highway crosses a densely populated urban district and then goes to the countryside, these are typical scenes of the verge mentioned by respondents: Photo A: Wall paintings; Photo B: Agricultural lands in countryside (Fathi, 2009)

Table 1. Frequency distribution of the responses to the most important element of scenic beauty of road

Element	Frequency (%)
Ads	8
Agricultural lands	17
High-rise buildings	2
Historic or cultural buildings	12
Landmarks	5
Lightings	5
Vegetation	31
Wall paintings	19
etc.	1
Total	100

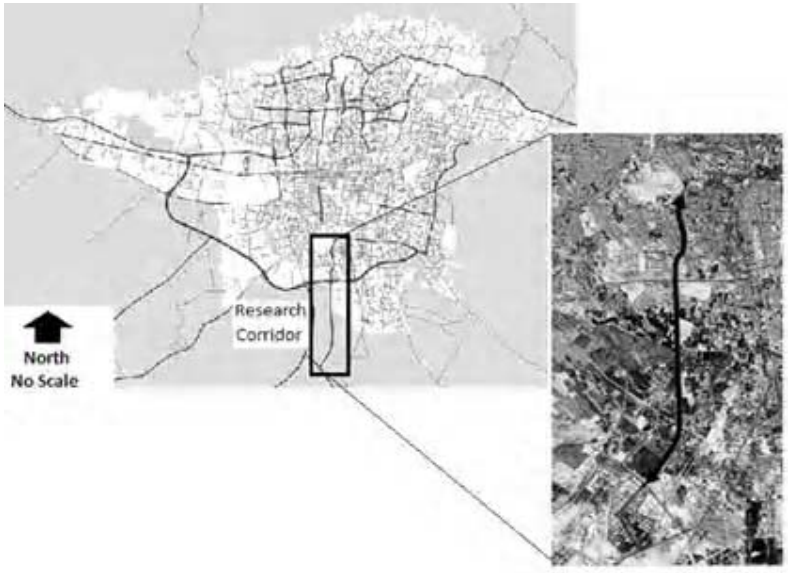

Fig. 2. Map of Tehran City showing the general location of study corridor in the urban and Peri-Urban context

Table 2 summarizes the respondent's answers to the question(fig.2). "how do you find the existing condition of the roadside vegetation?" Responses show a degree of dissatisfaction among the users in general, 67% of the respondents were not satisfied with vegetation type; 74% with its colorfulness and 65% with its combination. Although they express their dissatisfaction, they experienced different conditions during their travel in this highway. In some parts there is no verge and the roadside is occupied by the buildings; and the motorist's vision is limited by three or four story buildings in one side and vegetation in other side (Fig. 3-Photo C). In some parts there is managed vegetation alongside the roadway in which typical neighborhood parks can be found (Fig. 3-Photo D). Meanwhile in some other parts there is no management, and vegetation is in its natural condition (Fig. 3-Photo E) which is a linear plantation of trees used as a borderline for agricultural lands of the countryside.

In other words, despite the diversity of landscapes experienced in a successive sequence, the whole picture of the perceived landscape is not satisfying for the user who is in motion, especially in terms of colorfulness; however it is not very unsatisfactory and there seems to be a potential for improvement of existing conditions.

Users were also asked about what they prefer to experience in terms of roadside vegetation type (Table 3). The majority of the respondents (68%) preferred to see a variety of plant type including tree, shrub, flowering herbs and mown grass instead of singular type dominated the others. This diversity in type should also be presented in a distinguished combination in their preferences framework.

According to the Table 4, this combination includes a succession of mown grass and flowering herbs near the roadway, trees further away in the background and ornamental shrubs in between. Thirty three percent of respondents selected it as the most preferable choice. They also liked to experience clumps and communities of different compositions of species of trees, shrubs, flowering herbs and grass alongside the roadway in continuous intervals (28% of the respondents). Respondents liked to find this vegetation type and combination bright and in different colors. Table 5 indicates that in their belief, vegetation should not be gray and drab, but also not all or mostly green in a sequential linear plantation (almost 21%). They preferred to see different colors in different and attractive sceneries (almost 75%).

Table 2. Respondents level of satisfaction with the existing condition of the roadside vegetation

Degree of satisfaction	Vegetation elements		
	Type	Colorfulness	Combination
Very satisfactory	4	7	3
Satisfactory	27	29	20
No comment	2	2	12
Unsatisfactory	41	38	30
Very unsatisfactory	26	24	35
Total	100%	100%	100%

Photo C **Photo D** **Photo E**

Fig. 3. Photos C, D, and E; The existing condition of the road verge and roadside vegetation: Photo C: No verge; Photo D: Managed vegetation; Photo E: unmanaged vegetation (Fathi, 2009)

Table 3. Frequency distribution of the responses to the preferred condition of the roadside vegetation type

Type	Frequency (%)
Very varied	11
Varied	57
No preference	7
Mostly one type	16
All one type	9
Total	100%

Table 4. Frequency distribution of the responses to the preferred condition of the roadside vegetation combination

	Combination	Frequency (%)
(A)	Grass and flowering herbs near the road and trees further away and shrubs in between	33
(B)	Specimen trees surrounded by shrubs, flowering herbs and grass	19
(C)	Successive divers communities of trees, shrubs, flowering herbs and grass	28
(D)	Trees in background and shrubs near the road	12
(E)	Whole grass with occasional clamps of trees and flowering herbs	8
Total		100%

Table 5. Frequency distribution of the responses to the preferred condition of the roadside vegetation colorfulness

Colorfulness	Frequency (%)
All green	5
Mostly green	16
Neutral	4
Bright and colorful	55
Very bright and colorful	20
Total	100%

Motorists were asked to categorize their frequency of trip with regard to our research corridor in the four main categories: (1) daily trips which is considered as very frequent, (2) weekly trips which is considered as frequent, (3) monthly which is considered as regular and (4) yearly trips which is considered as occasional. Out of 198 respondents 41% travelled the site almost every day, 28% travelled almost every week, 19% had more than one trip in a month, and 12% had once, twice or more in a year. Table 6 is a concise description of respondent's perception of the current condition of the site based on their frequency of use. They express lower level of dissatisfaction when they travel less en-route (Fig. 4). Less than or almost 50% of those who travel occasionally, monthly or even weekly are not satisfied with road side vegetation attributes, while almost 70% of those traveling very frequent find those attributes very unsatisfactory.

The most unsatisfactory attribute of vegetation for the users in motion found to be its combination, which increases by the frequency of use. Table 7 is showing the effect of prior knowledge of the site, by experiencing it more and more over the time, on the preferences of the motorists traveling the route with different frequencies, based on Tables 3, 4 and 5. Users who travelled very often en-route were mostly willing to replanting the site with very varied (39%) and varied (35%) type of vegetation. They also preferred the combination of grass and flowering herbs near the road and trees and shrubs further away much more than other combinations. On the other hand there are people who travelled occasionally en-route and prefer the mostly one type of vegetation and the combination choice of trees in background and shrubs in foreground.

Despite having a limited cone of vision for the drivers and passengers in the vehicle during the car motion, the results of the questionnaire survey revealed that travelers can provide a list of important elements of scenic beauty that they can recognize nearby a highway corridor or even in distant location with view from route. Drivers take rapid glances, as they cannot zoom in, to the elements outside of the highway corridor which attract only momentary

Table 6. Most frequent responses to the existing condition of the roadside vegetation type, combination and colorfulness based on frequency of use

Frequency of use	Vegetation elements		
	type	combination	colorfulness
Daily (very frequent)	Very Unsatisfactory 51%	Very Unsatisfactory 62%	Very Unsatisfactory52%
Weekly (frequent)	Unsatisfactory 44%	Unsatisfactory 52%	Unsatisfactory 40%
Monthly (regularly)	Unsatisfactory / SatisfactoryBoth 38%	Unsatisfactory 47%	Very Unsatisfactory39
Yearly (occasional)	Unsatisfactory 39% Satisfactory 31%	Unsatisfactory 38% Satisfactory 35%	Very Unsatisfactory 47%

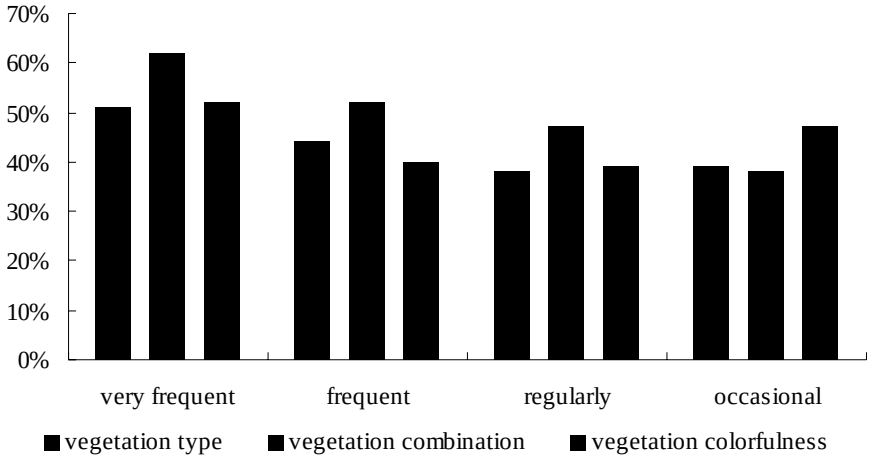

Fig. 4. The level of respondent's dissatisfaction (sum up of unsatisfactory and very unsatisfactory responses) with existing conditions expressed by the respondents based on their frequency of use

Table 7. The effect of frequency of use on the responses to the preferred condition of the roadside vegetation type, combination and colorfulness

Frequency of use	Most preferred type	Most preferred combination*	Most preferred colorfulness
Daily (very frequent)	Very varied 39%	A 61%	Very colorful 48%
Weekly (frequent)	Varied 45%	B 43%	Colorful 52%
Monthly (regularly)	Varied 41%	A 35% D 31%	Colorful 39%
Yearly (occasional)	Mostly one type 55%	D 53%	Mostly green 45%

* Refer to table 5 to find the description for capital letters A-E

attention, while other passengers on the vehicles can pay much more attention to the elements inside or outside the corridor. Therefor here we have a list of those elements as ads, agricultural lands, high-rise buildings, historic or cultural buildings, landmarks, street lightings, vegetation, wall paintings and some others; this might lead us to significance of the landscape design and spatial distribution of major features inside or outside the road corridor and their potentials to affect the personal cognitive map and mental picture of the motorists (Lynch, 1960).

Overall, the most important element in their opinion was roadside vegetation regardless of their satisfaction with its quality or quantity. This puts more emphasize on the role of the highway's roadside

vegetation, especially in an urban context. This should not be neglected by urban management authorities. Although maintenance cost and property values of land parcels near the highways in the area of study is relatively high. The evidence from this study support the idea that that people has certain tendencies regarding roadside vegetation and authorities should involve naturalness, vividness, variety and unity suggested by Akbar *et al.,* 2003; Clay and Smidt, 2004 in their evaluation plans. The ability of having visual access to the distant landscape in the suburban areas and agricultural fields is appreciated by the majority of respondents, showing the key role of the roads in opening up the landscape. As previous literature are emphasizing, roads are catalysts to ribbon development (Forman, 2008) whereas the elements that accompany roads will consequently limit the visibility panoramic view of the distant scenery. In our case study, after experiencing three major landscape sequences throughout the highway corridor(from densely urban mixed use context to low density residential areas and agricultural lands), people expressed their interest towards the scenic beauty of the areas within which the road verges are not occupied, and hence visibility is not interfered.

CONCLUSION

This research was conducted to assess the importance of environmental aesthetics and scenic beauty of current roadside vegetation in the highways, and the necessity for the contribution of users' preferences in the integration of scenic beauty of roadside vegetation into its management plans. The results of a questionnaire survey of motorist's opinion on the landscape aesthetics and quality of some highways in Tehran city are presented and analyzed thoroughly. Evidence from this research suggested that motorists in the highways tend to experience different type of plants with diversity in their composition and ornamental characteristics. This comply the fact that spatial distribution and the changes in the landscape of the roadside environment should provide successive scenic visual sequences. In each of these sequences there can be a different planting design scenario in terms of composition and combination of the plant materials. To increase the colorfulness and attractiveness of the scenery in highway corridors, the user's preferred the order of grass and flowering herbs near the road and trees and shrubs further away. The point here is the change in structure and composition of the plant communities over the time which highlights the need for proper roadside greenery management and maintenance, as one of the municipality's regular tasks. One of the study's propositions was that "the frequency of use affects the perception of motorist of the roadside vegetation, and also their aesthetic preferences". These propositions, are supported through findings of the paper as supported this the most preferred type of roadside vegetation(in the opinion of regular users) was the diversity of plants(*very varied*); while less frequent users preferred *varied* and almost one type of vegetation. The most preferred combination of vegetation for those who travel very frequent was "grass and flowering herbs near the road and trees and shrubs in the background." While those who travelled regularly or occasionally through the site, preferred "whole grass with occasional clamps of flowering herbs". The most frequent users preferred *very colorful landscape*, while less frequent users preferred *colorful or almost green landscape*. The evidences from this study demonstrate that prior knowledge of the route not only modifies the conditions for perception, but also affects preferences of motorists. Users build their personal cognitive structures of a route from past experiences. When they get used to the condition of the highway corridors, roadside vegetation will dramatically affect their immediate feelings and sensations through the changes in color, texture, size and shape of plants, during different seasons and also their continuity or discontinuity to provide wider views.

In our case study those who travelled the site once or twice a month or once or twice a year were people living in central part of the city aiming to reach Tehran international airport (IKA) or central cemetery by using research corridor. They expressed some sort of satisfaction with vegetation types and combination which means they liked existing globular shape *Ulmus dens* trees in road verge, and also refuge island of the roadway. As their personal cognitive structure of a route is less affected by their prior knowledge, the motorists found roadside vegetation almost satisfactory (table 6) in visual sequences and variations in the views they experience en-route. Despite those who are more familiar with the roadside vegetation, the preferences of this group is not far from existing condition of the roadside vegetation as they prefer mostly one type of vegetation with trees in background and shrubs in foreground. These respondents enjoy their travel across agricultural landscape of the countryside and their wider view to natural and semi-natural sceneries which provided them with some sort of relief from tense and stressful urban environment. Thereby the level of satisfaction in this group is lower than the other groups-they report these sceneries as important elements contributing in scenic beauty of the highway landscape. Those who travelled the site in the daily or weekly basis were people usually living nearby and used the highway to reach their work or

other daily activities. They were not satisfied with existing roadside vegetation condition. As diagram 1 show, the level of satisfaction with any of the roadside vegetation attributes decreases when the frequency of use increases. These users are more detail-oriented and believe that roadside vegetation is the most important element contributing to scenic beauty of the highway landscape. In contrast to the other, this group found vegetation drab and monotonous, so they prefer to re-vegetate it with *very varied* type of plants. In conclusion, scenic beauty of highway landscape should be considered as a major part of the planning and design process of highways management, and generally in the network of transportation; as it is of significant importance in the eyes of the people driving through these corridors. Management plans should take planting materials combination and composition into the account, based on the spatial distribution of the changes in the direction of the road and major elements of the landscape in the background. A successful transportation projects should fit its surroundings area visually, culturally and ecologically. These will be realized through establishment of proper roadside vegetation that brings natural setting to man-made infrastructure, vividness to public open spaces, variety to landscapes perceived by public, and unity to attractive visual sequences.

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