# Investigating the Social, Economic and Environmental Impacts of Constructing Urban Interchanges (Comparison of the Main Interchanges in the City of Qazvin)

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**Abstract**

Traffic problems are the most prominent urban dilemmas, especially during recent years, since the capacity of old traffic arteries don't meet the increasing volume of population and vehicles, therefore, adopting some measures in order to enhance the capacity of existing roads has been placed on the agenda of urban managers. Changing the existing intersections to over changes is one of these methods. It seems that these structures which facilitate traffic dimension in some cases and after a period of time since exploitation make considerable impacts on other dimensions especially in terms of economic and social perspectives on neighborhoods. This research is the result of investigating the impacts caused by construction of four unleveled crosses of *Shahid Motahari*, *Kowsar* (*Shahid Rajaei*), *Sardaran*, and *Seyed Hasan Nasrallah* (Nasr) on their surrounding neighborhoods in Qazvin city and during a 6-year period since 2011 to 2016. Extracting and investigating the existing documentary data from prior-to-construction to the end of research period besides obtaining the comments of citizens and managers and then, statistically analyzing the results of SPSS and how the impacts affect neighborhoods and desirability rate of crossroads in terms of being overpass or underpass were of the main goals of this research. Also, developing the SWOT charts and applying the AHP method and recommending the practical solutions on the basis of extracted results in order to enhance desirability and to reduce negative effects of these crosses were of other measures performed in this study.

***Keywords:*** Urban Interchange, Economic, Social, Environmental Effects, Qazvin

## 1. Introduction

Solving the issues of traffic density in the cities is always one of the foremost concerns of urban planners, managers especially with the advance of the sciences and development of engineering sciences for the construction of highways, bridges, tunnels etc., using the mentioned ways have reached a considerable importance in the cities. It seems that constructions of such traffic facilitators have caused issues in the local area and between the social interactions of the residents following an economic recess era instead of bringing prosperity, the outcome of this issue, would be worn-out areas in both contexts of physical and activity in the localities in the plan. Two of the most dominant types of constructions that are used to solve the traffic issue in Tehran are unleveled junctions, including overpasses and underpasses. Nowadays most of the managers consider the physical condition of the plan and the finished price of the junction for deciding between these two. According to some authors, overpasses are the symbol of the modernization and advanced functionality of the urban transit network system and numerous unleveled decisions are made based on the very same notion that result in grade-separations that are constructed in incorrect places in the cities, as they mark secondary issues rather than just to fail on enhancing the function of transit system

## 2. Research Background

Olmsted, famous American urban designer, and architect who is the considered as the originator of landscape architecture or landscape gardening have first put forward the idea of separating the pathways in 1858 while designing New York's central park as he separated the motorway from the pedestrian pathways (Mehdizadeh, 2000: 14). Between 1913-1933 the French architect Eugene Henard put forward the notion of creation "interchange junctions" and different types of overpasses and underpasses which become publicly prevalent afterward (Pakzad, 2003: 218). His first solution was to construct Interchange that are the primary type of the Interchange we see nowadays, as these are developed and altered forms of overpasses and underpasses that are considered in any type of maps for constructing cities

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(Ostrovsky, 1992: 57). Lecour Bossier introduced it as one of his innovations, but the authenticity and the value of this plan are for Annard at first, as he proposed the plan of an overpass junction in the overpass, interchange plan by 1906 (Pakzad 2013, 221). By the year 1928, that was concurrent with the increasing rates in the production of automobiles during the 30s, two American architects, Henry Wright and Clarence Stein employed Interchange in order to develop coherence in the movement of pedestrians in the design of Radburn city (Pakzad, 2013: 267). Later on, Le Corbusier described how the issues are raised by the advances during the industrial revolution where the traverse speed of human beings have increased from 4 kilometers per hour for human or a horse to 50-100 kilometers per hour for the transport vehicle that travels on flat roads as it have altered human balance (Le Corbusier, 1965: 19, 83). In his glittering city theory, Le Corbusier proposed his idea of heightening the constructions and to free the ground level for the green spaces in 1935 (Kashani Koo, 2010: 7). In this idea, some of the proposed topics regarding the transit relocation of the vehicles in autobahns and parkways with parallel borders and smooth turn in the path together with interchange intersections (Pakzad, 2013: 388).

Table 1
A list of relevant studies in Iran.

| Descriptions | Researcher(s) | Date | Title |
|---|---|---|---|
| In this thesis, a collection of physical, social, environmental and economic evaluations are defined for interchange junctions. Results of this research show that the *Defa-e Moghadda*s overcharge has enhanced with a rate of 4.1% and *Bahonar* has the rate of 9.8%. | Hamed Naghibzadeh | 2013 | Evaluating the influences and impact of constructed Interchange in Shiraz city. |
| The researcher has analyzed this bridge with aim to evaluate and measure the social impacts of construction of *Sardaran* overcharge, and also to define the key benefits as the winners or the losers in the plan of the bridge. This study is categorized as the post-construction research and it was done by the distribution of questionnaires. | Maryam Lamei | 2013 | Evaluating the social impacts related to the construction of *Sardaran* interchange in Qazvin city. |
| Research indicates that a number of 6 out of 7 interchange junctions in Kermanshah region has influential role in solving the traffic issues, and those which are related to the reduction of environmental/ ecological contamination, increase in the speed and decrease in the time of the transport in addition to the fuel consumption of the automobiles while the technical rules and regulations were considered as they have a proper function. Construction of two Interchange in Kermanshah is proposed. | Kalantary, Fatemeh; i; Binesh, Negin; Karami, Houshang. | 2014 | Role of Interchange in reducing the urban traffic and enhancing ecological issues in Kermanshah province. |
| This research describes how the decrease in the pedestrian access, increase in the function of the Dodge park as one of the important green spaces of the city, loss of the neighborhood culture and change of the neighborhood values is some of the cons of constructing such implementations that keep our cities from human-oriented architecture and transition into sustainability | Afagh, Heidarian; Golshan, Rezaie; Mohammad Mehdi, Mallak. | 2014 | Evaluating the social impacts of constructing Interchange: *Ziol dini* interchange in *Sanandaj* city. |
| The researcher has examined the interchange junctions in Qazvin city with a research based on a descriptive-analytic and survey method along with the use of questionnaire and processing of the answers; he has finally proposed a number of recommendations for constructing interchange junctions. | Reza Keshavarz | 2015 | Survey and analysis of locating interchange junctions in the urban planning (Case study: Qazvin city) |

Source: Authors

## 3. Theoretical Framework

### 3.1. Definitions

A network of streets makes possible the internal urban connections. The desirable function of a connection network depends on the coordination of its forming axis. The constant flow of the traffic in the streets networks needs observation toward the argumentative hierarchy and those which rely on the scientific and technical basis in the structure of the network in order to supply the communicative demands, safety and economic advantage along with its communicative function. Therefore, the technical characteristics of an axis will shape in the network of streets and proportional to its function (Ahadi 2013: 23).

An intersection is an at-grade junction where two or more roads cross each other. Each of the leading roads to the intersections is called an intersection branch. Intersections include an important part of the roads. Efficiency, safety, speed, exploitation cost and capacity of a road depends on its design to a great extent. The most ordinary type of the intersection is when two of them pass through each other and form an at-grade junction, such junction is called a crossroad. A junction can be at-grade or grade separation (Ministry of housing and urbanization, 1996: 1). Some of the most important point to consider for the junctions in a multi-aspect view include safety, capacity, plan of the junctions, the passage of pedestrian, distance of sight in the

junctions, lights and the distance between the junctions (Shahi, 2015: 24-57).

### 3.2. Usage of Interchanges

In the cases in where the need of the local traffic to pass from a transit pathway (without the need to be joining it) becomes comparatively high, or in the cases where the pattern of local street patterns are considered to be preserved in order to enhance the pedestrian and cyclist access through the transit routes, Interchange are used. In urban areas, Interchange are used only in some of the location where ramps of the interchange stay in short distances from each other as a natural flow in the local traffic system is considered as desirable.

Table 2
Effective recommended parameters on converting Interchange to at-grade junctions in Iran.

| **Effective recommended parameters** | **Primary parameters** | **Secondary parameters** |
|---|---|---|
| | ● Access control<br>● Reducing the traffic points (nodes)<br>● Checkpoint<br>● Increasing safety<br>● Conditions of the region topography<br>● Benefit of the users<br>● Level of traffic masses | ● Providing services for the bicycle pathway<br>● Increase in the access<br>● Distance between consecutive nodes<br>● Cost<br>● Border, and access to the demanding land<br>● Preservation of natural environment<br>● Analyzing of the network and appointing efficient intersection in order to change |

Source: (Saffarzadeh, 2010).

The most important regulation on using Interchange is in the categorization of junctions which can either be the first (principal), or second grade (minor) local arterial roads. In addition, since an extra sum of resources are used in the construction of such roads and there should be considerations toward it, therefore researching the feasibility has an importance in this regard. In these studies, a wide variety of options should be considered and to subject them to the comparison (Keshavarz, 2015: 32).

### 3.3. Analyzing the Influence of Constructing Interchange Junctions.

Underpasses and overpasses become very dangerous when they become situated away from the occupied, residential spaces or when then end in surprising points. Such spaces are considered as ambiguous spaces and they are included in the list of spaces which lack visual sight (due to various reasons, including the physical structure) as they provide a field for the commitment of crimes since they don't make a visual connection with the outside [periphery] environment (Pudratchi, 1993: 10).

Table 3
Pros and cons of interchange junctions:

| **Pros** | **Cons** |
|---|---|
| ● Their capacity can be according to the capacity of surrounding roads.<br>● Safety, convenience and welfare of the driver is increased.<br>● Stops and a considerable amount of changes in the speed are eliminated<br>● Design will become more flexible as it can eliminate the crossroads with the dangerous characteristics.<br>● Possibility of constructing the intersection in different phases<br>● Use of interchange intersections are mandatory in the highways. | ● High construction expenses<br>● Need for a wider area (A bigger land will be occupied)<br>● It may be confusing for strangers to drive and learn, but it can be solved using traffic signs.<br>● It is likely that due to the urgency of creating curves in the flatlands to have a negative influence on a number of crossroads.<br>● Multiple-path crossroads may face some problems, which can be solved by disconnecting or changing the pathway of less important streets. |

According to Keshavarz (2015: 26-37).

In the end, the impacts of Interchange are summarized in six dimensions in the table 4

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Table 4
Impacts of interchange junctions

| Dimensions | Descriptions |
|---|---|
| Economic | Need to solve the issues related to the interferences of urban infrastructure and the imposed hidden expenses on the project and local neighborhoods.<br>The relationship between the benefits of constructing interchange intersections (decrease in delays and the cost of users for a yearly basis) on the funding and development of it.<br>Possibility of using the plan with a lower cost, either during the construction or during the retention and operation time.<br>Efficient use of land property as a valuable capital.<br>Impact on the users in the area of the plan before and after the construction of bridges, in the terms of jobs and housing price rates. |
| Ecological | Impact of the construction of intersection including hygiene, less weather pollution and noise pollution.<br>Analyzing the excavation volume and the extent of encroachment on the natural environment and the type of interaction with the surface and subsurface waters.<br>Development and preservation of green spaces |
| Social | Supporting the social activities and development of public spaces.<br>Social security including these dimensions: Surveillance and lighting of surprising points.<br>Sense of belonging and public participation for the preservation and continuity of the local connections especially for the pedestrians. |
| Physical | Researching the infiltrability, flexibility and separablity of the overpass from the underpass and an easier development in the future.<br>Eventual physical erosion as an outcome of the construction of the plan on the neighborhoods and the body of intersection.<br>Considering passive defense in construction of overpasses and underpasses<br>Correspondence between the condition of neighborhood localities and the physic of the plan on the body and the function of neighborhoods together with elevating the levels of walking-based spaces. |
| Visual perception | Subjective presence and beauty of plans, wall paintings, elements and overnight lighting of barriers of sight, keeping a proper visual corridor and to be coordinate with the nature. |
| Traffic | Safety and the relocation of pedestrians, motorists and cyclists in the underpasses and the overpasses<br>Enhance in the pedestrian and bicycle transit in the localities and public transit during and after the implementation of plan.<br>Development of cohesion and decreasing the delays and avoiding the creation of traffic nodes.<br>Preserving the pattern of local streets. |

Source: Authors

## 4. Research Method

In this research, documentary, field research and survey method with the use of interviews and questionnaire were used. The questionnaires are composed according to the analytical model of the research with 6 main factors and the results were categorized with the use of SPSS software and the hypotheses were analyzed by T-test and Friedman Test. In order to specify the statistical population and due to the transitional nature of the case study of the research and lack of information about the exact rates or numbers, the statistical population is calculated by the Cochran formula without being provided with the levels of the main sample as a number of 2000 questionnaires were distributed. Finally, an effort was made to identify the weak and strong points and opportunities on the surface of the city revolving the case study and related recommendations.

## 5. Case Study

### 5.1. Qazvin Transportation Network

Qazvin city has been developed in the contemporary era on the northern side of Tehran-Zanjan highway; city network have been developed on the north side of Imam Khomeini Street and it is expanded to the area of *Shahid Beheshti* in a radial-annular shape. In the following stage, the area of the *Shahid Beheshti* is offered as a northern ring for the city that is started in the *Valiasr* square and continues to the *Shahid Navvab-e Safavi* Boulevard (Qazvin master plan, 2016). The bridges that were analyzed in this research are located in the first artery roads area for the possibility of connecting with interchange intersections.

### 5.2. Introducing the Case Study Areas

*Shahid Rajai* overcharge intersection (*Kowsar*)
This overpass is located in the northwest of Qazvin city. This junction connects *Kosar* complex in its northern areas to the *Q'ias* Abad (or *Razmandegan* Boulevard) in its southern parts while makes possible a number of ...access roads in its main course - east-west to the western areas in *Bahonar* Boulevard. Sports gym of *Basij* is located in the northeast and there exists an abandoned land in the northwest. A number of residential land uses are located in the southeast while the same use is found in the southeast with a much lesser density, while the Bazar River is passing in a north-south direction under passing the western area of the plan.

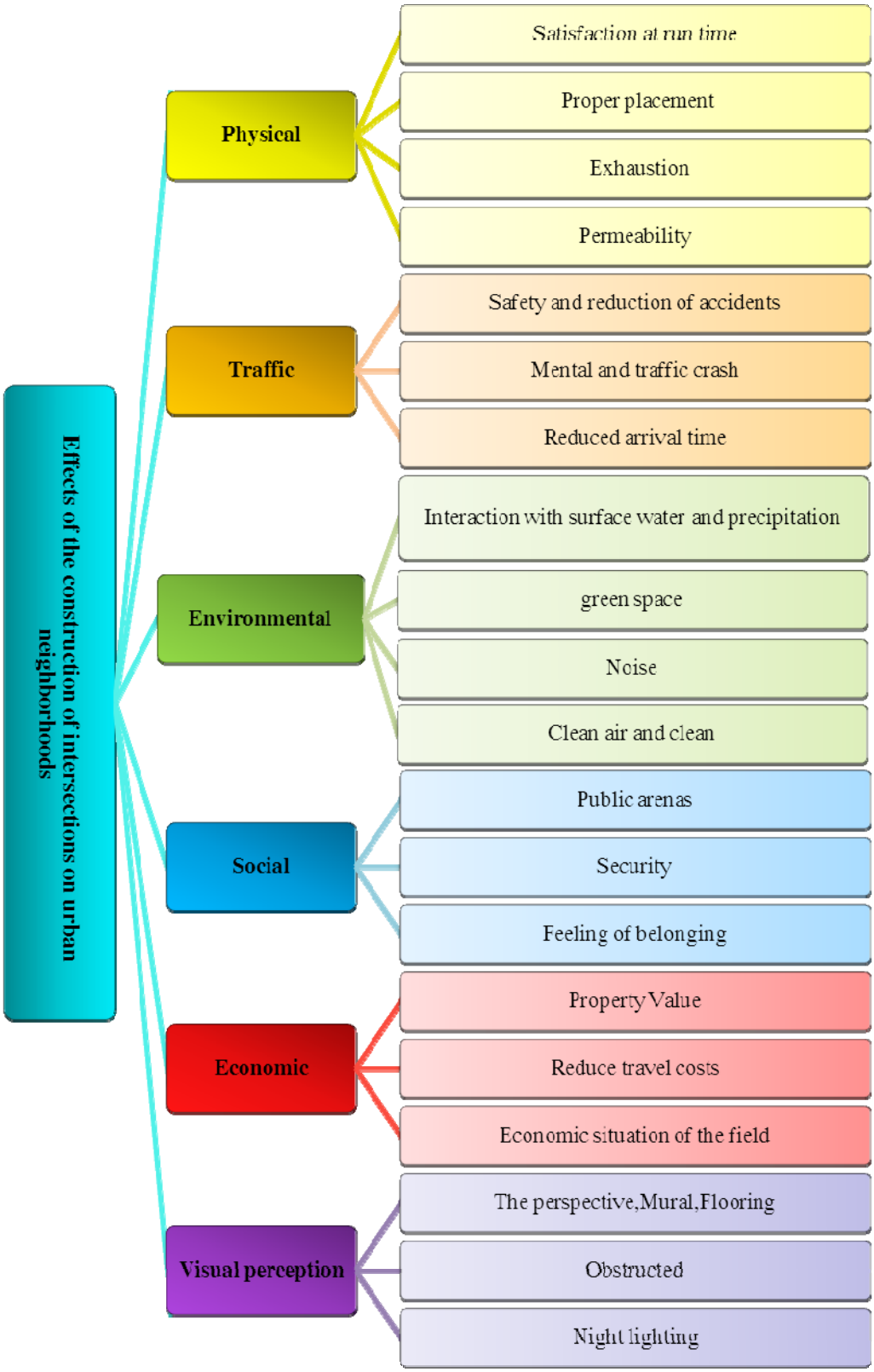


Fig. 1. Analytical model

Fig. 2. Aerial photo of *Shahid Rajai* overpass in three-time intervals: prior-to-construction, during the construction and after the construction

*Nasr* overcharge intersection:

Nasr intersection is designed to solve traffic issues, especially in the east-west axis, but on the other hand, according to the ever increasing process of growth in the northern areas and increase in the rate of constructions in *Sortok* and *Velayat* regions, a square was considered for constructing on the top of the underpass in order to keep a healthy transit of traffic to the northern areas which itself is the subject of discussion as a local traffic node. Construction of residential buildings was taking place in the northwest, also the construction of a big religious building is in the process on the northwest together with the development of residential units. A number of vacant lands next to the residential zone and the sports gym is visible in the northwest.

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Fig. 3. Aerial photo of *Nasr* overpass in three construction phases: Before the construction, during the construction, after the construction

*Sardaran* grade separation

*Sardaran* grade separation was constructed with an east-west orientation along the Nasr junction. It was anticipated that by constructing a set of junctions in the west to east direction in the entering route from Tehran-Qazvin autobahn to the city starting from *Velayat* intersection some of the issues in the mentioned route would be solved by increasing the speed limit and allowing access to the north and south of it. The overpass is situated in a location with significant distance to the area of residential units. Administrative centers, including state government building and the power electricity office for the north, are located in the northeast and southwest, some green spaces and a limited number of commercial uses of land are evident in the northeast, Traditional Garden [*Bagh-e Sonati*] and the Women's park is located.

Fig. 4. Aerial photos of *Sardaran* overpass bridge before the construction, during the construction, after the construction.

*Motahhari* overcharge junction:

The construction of this intersection is implemented in a west-east under passage as no external access to the northern or southern roads is defined for it. Different types of residential, commercial or cultural land use exist along the road near the junction. Functional of this intersection can be included in the list of most challenging options compared with the previous three intersections. Area of the junction on the north and southwest has a less density in residential and commercial land use and the major existing use in these areas includes educational purposes. On the southern area, a considerable vacant space exists and the northeastern part includes residential and commercial land uses in general.

Fig. 5. Aerial photo of *Shahid Motahhari* underpass junction in three construction phases: Before the construction, during the construction, after the construction.

In table 5 to 8, by referring to the documentary data, including maps and subcontractors and those related to the project employer's expenses, researchers have inspected the four mentioned junctions in the terms of their final construction costs with an economic view, extent of excavations through the viewpoint of encroaching nature, area of the constructed green space according to the environmental approach and development of pedestrian access in order to elevate social interactions and to keep the communication and cohesion in the localities of the plan.

Table 5
Grading the projects in the terms of the primary approximation in the contract and the final construction price.

| Project name | Value of the primary approximation in the contract, for each square meters (in Rials.) | Final construction cost in the absolute reports for each square meters (in Rials.) | Variation (percentage) | Junction score |
|---|---|---|---|---|
| *Shahid Motahhari* intersection | 3.488.940 | 7.872.583 | 56% | 1 |
| *Nasr* intersection | 3.987.692 | 5.029.604 | 21% | 2 |
| *Shahid Rajaie* intersection | 7.065.614 | 7.468.024 | 5% | 3 |
| *Sardaran* overpass | 5.202.230 | 5.398.096 | 4% | 4 |

Table 6
Grading the projects in the terms of the primary approximation in the contract and the final price.

| Project name | Value of the primary approximation in the contract, for each square meters (in Rials.) | Average of the final construction cost in the absolute reports for each square meters (in Rials.) | Variation (percentage) |
|---|---|---|---|
| *Shahid Motahari* and *Nasr* intersections | 3.738.316 | 6.451.093 | 42% |
| *Shahid Rajaie* and *Sardaran* overpass | 6.133.922 | 6.433.060 | 5% |

Table 7
Grading the projects in the terms of expense of eliminating urban infrastructure interferences for each square meters.

| Project name | Proportions in estimation of expenses for eliminating the infrastructure interferences (in Rials.) | Junction score |
|---|---|---|
| *Shahid Motahhari* intersection | 640.722 | 1 |
| *Nasr* intersection | 413.169 | 2 |
| *Sardaran* overpass | 120.656 | 3 |
| *Shahid Rajaie* intersection | 31.713 | 4 |

Table 8
Grading the projects in the terms of available useful area and the developed areas over, or underneath the deck.

| Project name | Percentage of useful area underneath the decks. | Junction score |
|---|---|---|
| *Sardaran* overpass | 42% | 1 |
| *Shahid Rajaie* intersection | 35.3% | 2 |
| *Shahid Motahhari* intersection | 13.8% | 3 |
| *Nasr* intersection | 5.4% | 4 |

Table 9
Grading the projects by their excavation masses for each square meters

| Project name | Correspondence of excavation volume (cubic meters) | Score of the junction |
|---|---|---|
| *Nasr* intersection | 46/14 | 1 |
| *Shahid Motahhari* intersection | 8/12 | 2 |
| *Shahid Rajaie* intersection | 7/2 | 3 |
| *Sardaran* overpass | 67/1 | 4 |

Table 10
Grading the projects in the terms of area of green spaces for each $m^2$

| Project name | Correspondence of the area of green spaces (square meters) | Junction score |
|---|---|---|
| *Shahid Rajaie* intersection | 76/0 | 1 |
| Nasr intersection | 48/0 | 2 |
| *Sardaran* overpass | 43/0 | 3 |
| *Shahid Motahhari* intersection | 4/0 | 4 |

Table 11
Grading the projects in the terms of one meter for an individual.

| **Project name** | Percentage of pedestrian space area (square meters) | Junction score |
|---|---|---|
| *Shahid Rajaie* intersection | 48/0 | 1 |
| *Sardaran* overpass | 2/0 | 2 |
| *Shahid Motahhari* intersection | 09/0 | 3 |
| Nasr intersection | 03/0 | 4 |

## 5 .3. Analysis and Discussion

### 5 .3.1. Documentary and Field Evaluations

According to the following tables along with other data like the probable dissatisfaction of the residents during the implementation of the plan or after the constructions of it which are existing in the form of past records of compliant in the project records or those complaints which are received in the interviews with the citizens by the authorities during the constructions that reflects the various dissatisfaction of them on the subjects like the reduction in the land value and recess in their business in some cases. Finally, the four mentioned intersections are arranged in an overall concluding set of comparison tables detached by the average of the documentary data results related to the underpasses in comparison with the overpasses.

Table. 12
Comparison of underpass and overpass based on documentary and field research indexes in the economic dimension.

| dimension | Factors | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| Economic | ● Sustainability, success and preserving the existing conditions in the economy of the local neighborhoods. | **Final construction cost** | P | |
| | | Expenses for eliminating the interferences | P | |
| | ● Efficient exploitation of the land as the local and national expensive and valuable asset. | Lower retention costs | P | |
| | | Area of the recycled land with the capability of using it as a parking space. | P | |
| | ● The possibility of a correct estimation of the plan's budget (According to the condition of the budget and the income in order to avoid the incomplete construction of the pan or unfinished implementation of it in comparison to the primary plan) | Lack of increase in the value of the surrounding lands or to keep their values. | P | |
| | | Lack of influence on the local businesses. | P | |
| | ● Reduction in the expenses of the local users. | Proportions of the expenses with the primary estimations. | P | |
| | | The possibility of offering services by the bus companies | P | |

Table. 13
Comparison of underpass and overpass based on documentary and field research indexes in the environmental dimension.

| Dimension | Factor | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| Environmental | ● Sustainability of the environment and less destruction or intervention in the periphery area<br>● Correspondence and coordination with the natural conditions<br>● Elevating the quality of ecological condition in the neighborhoods | Area of the green space | P | |
| | | Interaction with surface and undersurface waters especially during the rainfalls | P | |
| | | Encroachment in the natural environment according to the mass of excavations. | P | |
| | | Contamination, levels of hygiene | P | |

Table 14
Comparison of underpass and overpass based on documentary and field research indexes in the social dimension.

| Dimension | Factor | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| **Social** | ● Elevating the confrontation level and meetings by developing a public space<br>● Security<br>● Sense of belonging | Existence of a place for meetings | P | |
| | | Occurrence of robberies | P | |
| | | Surveillance cameras. | P | |
| | | Possible visibility during the time of danger. | P | |
| | | Naming the surrounding businesses according to the intersection | P | |

Table 15
Comparison of underpass and overpass based on documentary and field research indexes in the physical dimension.

| Dimension | Factor | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| Physical | ● Infiltrability and a lack of rupture in the neighborhood<br>● Elevating the pedestrian-oriented pathways<br>● Flexibility during the construction and detachability.<br>● The enhancing structure of public spaces<br>● Erosion (Exhaustion)<br>● Flexibility of the plan during the construction<br>● Safety of the plan during of an army intervention. | The possibility of traversing in a route vertical to the plan. | P | |
| | | Existence of erosion on the bridge | P | |
| | | Existence of erosions in the sidewalls of the neighborhood | P | |
| | | The retention condition of the installations (Lighting systems, sewerage pipes, etc.) | P | |
| | | Extent of the constructed pathway for the pedestrians and cyclists. | P | |
| | | Existence of the pedestrian bridges | P | |
| | | Existence of local complaints during the construction phase. | P | |
| | | Regulation of passive defense | | P |

Table 16
Comparison of underpass and overpass based on documentary and field research indexes in the visual perception dimension.

| dimension | Factor | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| Visual perception | Landscape vision readability | Limitless sight over surrounding housing units | | P |
| | | Proper visual corridor and the lack of blockade in the view | | P |
| | | Landscaping | P | |
| | | Flooring | P | |
| | | Wall painting | P | |
| | | Memorial elements and signs | | P |
| | | Overnight lighting | P | |

Table 17
Comparison of underpass and overpass based on documentary and field research indexes in the traffic dimension.

| dimension | Factor | Index | Advantage | |
|---|---|---|---|---|
| | | | Overpass | Underpass |
| Traffic | ● Safety | Proper geometrical patterns | P | |
| | ● Cohesion and preservation of local traffic pattern | Better field of view (regulation) | P | |
| | | Reduction in the rate of car crashes | P | |
| | | Supplying the lighting | P | |
| | ● Public transit | Direct connection of local arterial roads on an axis vertical to the plan | P | |
| | ● Smoothness of traffic | Developing traffic light in the main axis | P | |
| | | Possibility of local bus transit service | P | |
| | | Eliminating traffic nodes | × | × |

Existence of a square in the Nasr underpass and traffic light in *Shahid Motahhari* underpass junction reduces their standing in the set of intersections but due to the construction of the square in as a node in *Sardaran* overpass intersection, none of the analyzed cases does not has an absolute advantage.

Based on a general look at the results, these tables reflect an overall advantage in relation to Interchange and it seems that one of the reason of the satisfaction of urban planners for employing an underpass plan is its comparatively lower primary cost without considering the economic, social and environmental circumstances in the future and unexpected imposed expenses for the retention and removing the interferences related to the installations and properties which will be created during and after the constructions of the plan, a point that will influence the primary savings as the following tables indicate that reverse results are extracted. On the other hand, the effort of the consultants and contractors would be increased according to a lower responsibility of the designers in the required calculations for the underpass plan and the more profit from these types of plan for the contractors can be considered aligned with the persuading the urban managers to use the underpass plan. On the rest of the article, the proposed topics which were extracted from documentary data together with the indexes which lack documentation were put into a set of questions and were distributed among the citizens as the resulted conclusions would be analyzed based on standard statistical methods.

### 5 .3. 1. Evaluating the Data from Survey

According to the performed test, the influence of each factors after the construction of Interchange are defined on the residential neighborhoods in the Table. 14. As it is evident, most of the factors has an influence, in which the economic factor has the most influence. The economic factor with the score of 4.85 is the most important factor and the visual perception factor has the lowest importance degree with the score of 2.12.

Table 18
Standing based on the Friedman test.

| Factor | Average standing | Factor | Average standing |
|---|---|---|---|
| Physical | 4.1 | Environmental | 3.61 |
| Visual perception | 2.12 | Social | 4.18 |
| Traffic | 4.24 | Economic | 4.85 |

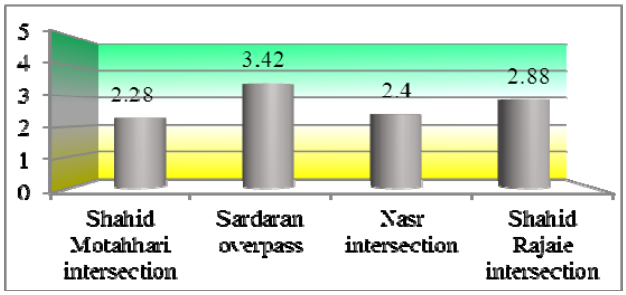

Fig. 6. Satisfaction of the residents from the resulted situation during the construction of the plan.

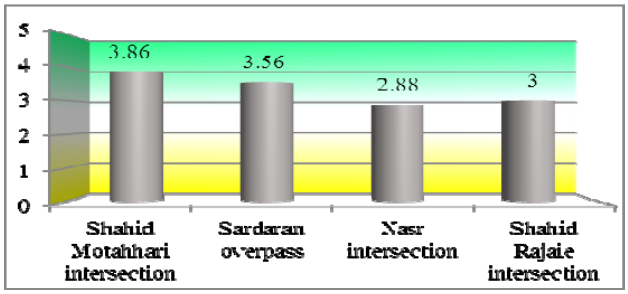

Fig. 7. Residents' evaluation from the sense of satisfaction with the location of the existing interchange intersections.

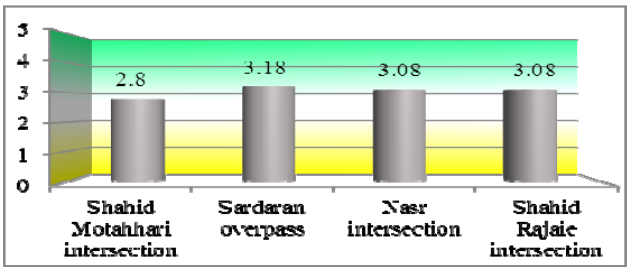


Fig. 8. Individual's evaluation of the extent of satisfaction with the location of existing Interchange.

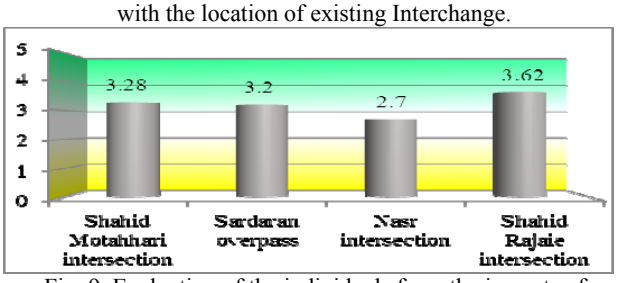


Fig. 9. Evaluation of the individuals from the impacts of the existence of intersections on the attenuation of issues in the flow of traffic during the everyday life urban transits.

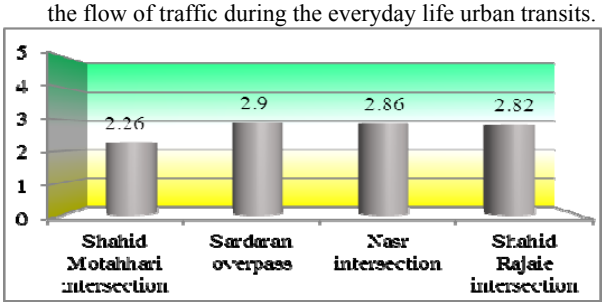


Fig. 10. Evaluation of individuals from the interchange intersections on the economic condition of the functioning field of the intersection.

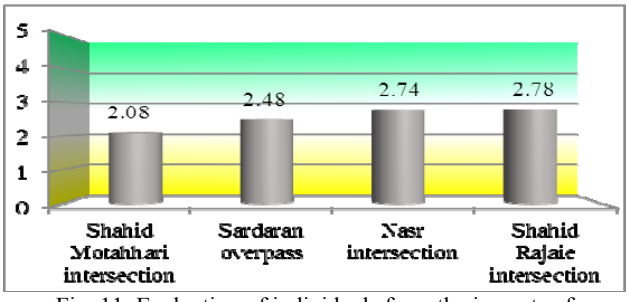


Fig. 11. Evaluation of individuals from the impacts of interchange intersections on the value of commercial and residential properties.

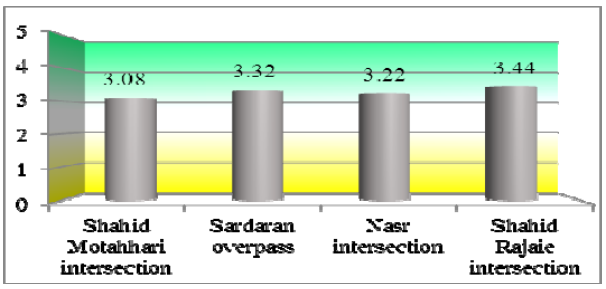


Fig. 12. Evaluation of individuals on the influence of intersections on the hygiene of the locality and the reduction of air pollutants.

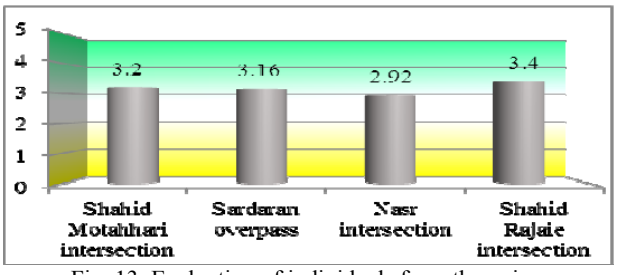


Fig. 13. Evaluation of individuals from the noise pollution around the intersection area

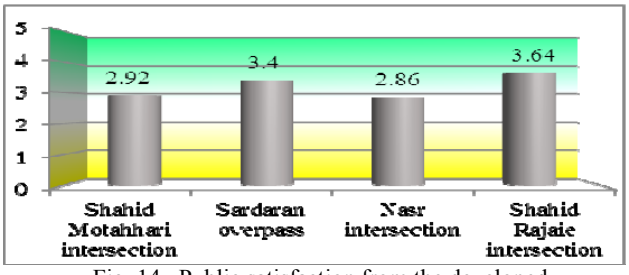


Fig. 14. Public satisfaction from the developed green spaces around the intersection.

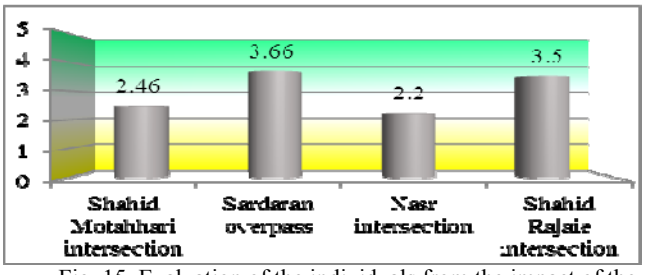


Fig. 15. Evaluation of the individuals from the impact of the construction of intersections as a contributing factor to the development of public spaces and places to have meetings.

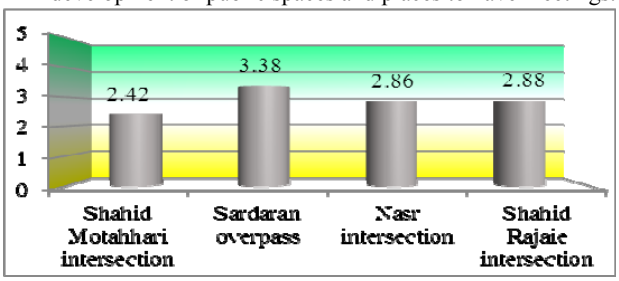


Fig. 16. Evaluation of the individuals from the landscape design, including symbols, proper flooring, and presence of textures on the walls around the intersection.

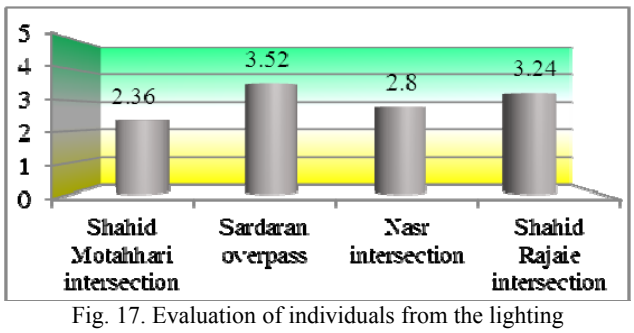


Fig. 17. Evaluation of individuals from the lighting in the area of intersections overnight.

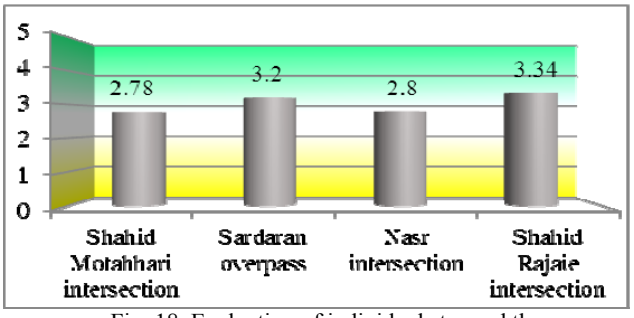


Fig. 18. Evaluation of individuals toward the condition of the sense of security especially for the overnight pedestrian transit.

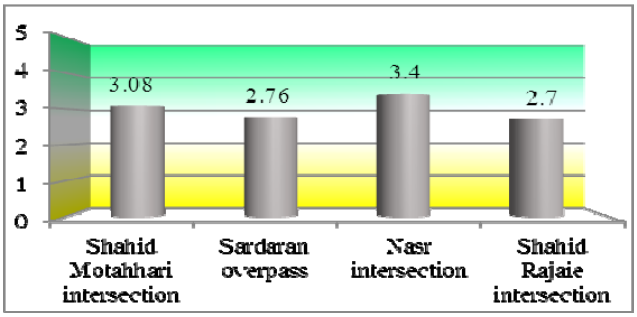


Fig. 19. Evaluation of individuals from the impacts of the construction of intersections on the blockade of view.

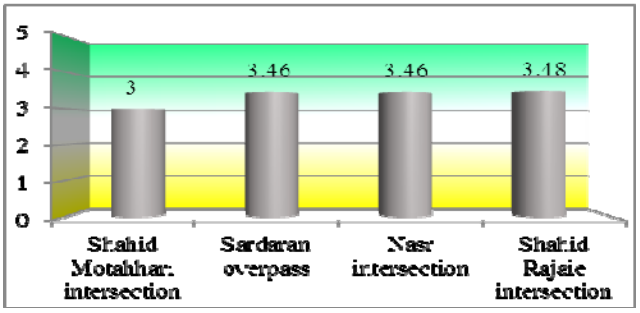


Fig. 20. Evaluation of the individuals about the impact of constructed alterations on the sense of belonging to the local neighborhood.

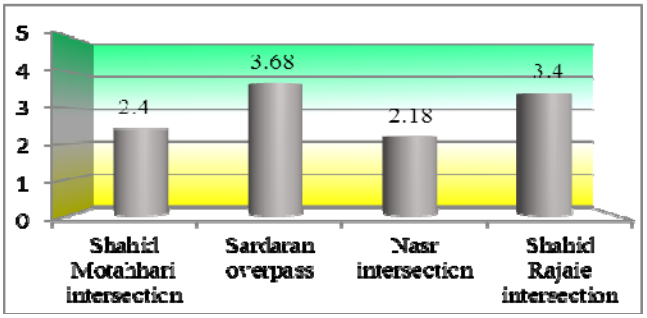


Fig. 21. Evaluation of individuals with the influence of the constructions of intersections on the daily cross-eighborhood transits on different sides of the intersection with a focus on the pedestrian and bicycle transit.

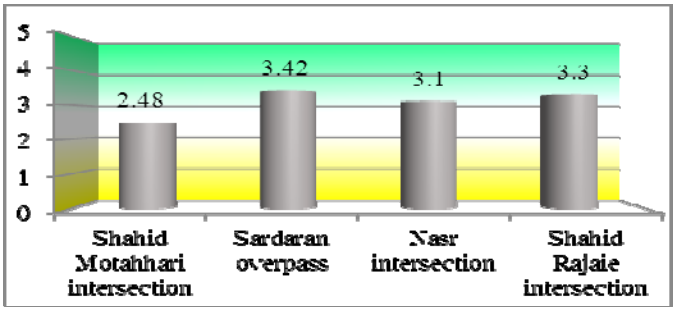


Fig. 22. Evaluation of the individuals about the influence of constructed intersection on the physical exhaustion of the neighborhoods.

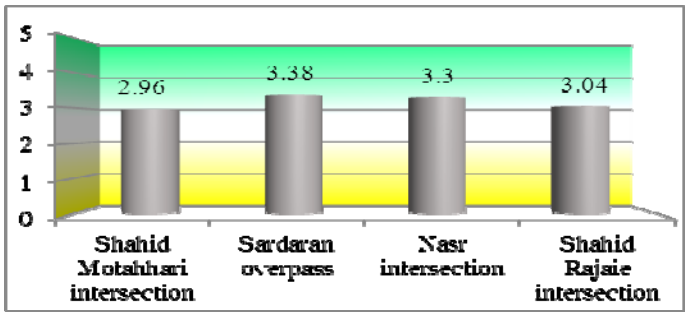


Fig. 23. Evaluation of the individuals toward the reduction of the cost of internal urban transits by relying on the public transit.

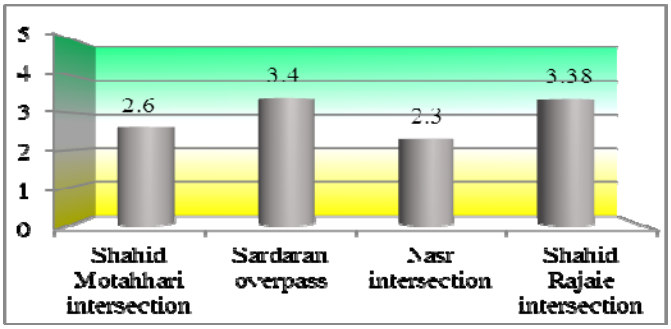


Fig. 24. Evaluation of the individuals from the impacts of interchange junctions on decreasing the road incidents.

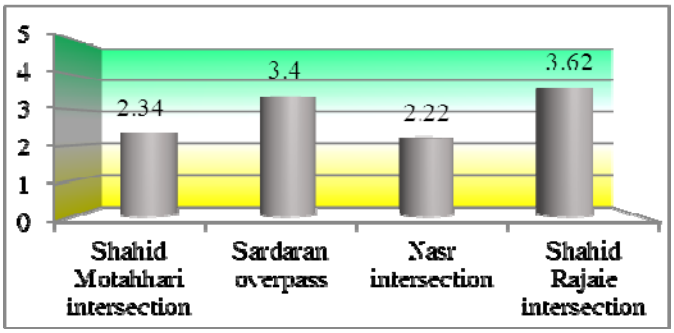


Fig. 25. Evaluation of individuals with the condition of the junction during the rainfalls.

Table 19
An overall comparison of the success rate for the overpasses and underpasses together.

| Indexes | Question | Underpass | Overpass | Average of the weight of underpass and overpass depending on each index |
|---|---|---|---|---|
| Final weight of the physical condition | | 2.59 | 3.29 | 2.94 |
| Physical | How is your satisfaction of the developed condition in the place of the plan during the implementation of the project? | 2.34 | 3.15 | |
| | Your evaluation of the satisfaction from locating the existing interchange intersections? | 2.94 | 3.13 | |
| | Your evaluation of the impacts of constructing intersections on the daily transits between the existing localities on the two sides of the intersection with a focus on bicycles and pedestrians? | 2.29 | 3.54 | |
| | Your evaluation of the impact of constructing interchanges on the physical exhaustion of the localities? | 2.79 | 3.36 | |
| Final weight of the traffic condition | | 2.93 | 3.36 | 3.14 |
| Traffic | Your evaluation of constructing interchange intersection in reducing the time to reach the destination? | 3.37 | 3.28 | |
| | Your evaluation of the impacts of intersection in the flow of the traffic for the daily urban transits? | 2.99 | 3.41 | |
| | Your evaluation from the impact of interchange intersections on reducing the traffic incidents? | 2.45 | 3.39 | |
| Final weight of the economic condition | | 2.7 | 2.9 | 2.8 |
| Economic | Your evaluation of the influence of the interchange intersections on the economic condition of the plan area? | 2.56 | 2.86 | |
| | Your evaluation of the impact of intersections on reducing the costs of internal urban transits? | 3.13 | 3.21 | |
| | Your evaluation of the impact from the construction of interchange intersections on the value of the commercial and residential properties? | 2.41 | 2.63 | |
| Final weight of the environmental condition | | 2.8 | 3.42 | 3.11 |
| Environmental | Your evaluation of the functionality of intersections on the hygiene of the neighborhood and reduction in the air pollutants? | 3.15 | 3.38 | |
| | Your evaluation of noise pollution in the junction area? | 3.06 | 3.28 | |
| | Your satisfaction from the recently constructed green areas? | 2.89 | 3.52 | |
| | What is your evaluation of the intersection during the rainfalls? | 2.28 | 3.51 | |
| Final weight of social condition | | 2.78 | 3.44 | 3.1 |
| Social | Your evaluation on the impacts of the intersection constructions on the development of public spaces and places to meet each other? | 2.33 | 3.58 | |
| | Your evaluation of the condition and the sense of security of intersection especially during an overnight transit? | 2.79 | 3.27 | |
| | Your evaluation of the constructions on the sense of the belonging to the local neighborhood? | 3.23 | 3.47 | |
| Final weight of the perceptive visual condition. | | 2.82 | 3.08 | 2.95 |
| Visual perception | Your evaluation from the existing landscape design including wall paintings, proper flooring and the role of walls around the intersection? | 2.64 | 3.13 | |
| | What is your evaluation of the lighting situation in the intersection area overnights? | 2.58 | 3.38 | |
| | You evaluation of the conditions in the influence of constructing intersections on the blockade of the view? | 3.24 | 2.73 | |
| Final weight of the underpasses and overpasses | | 2.77 | 3.24 | 3.01 |

According to the results, the final weight of the underpasses is 2.77 which indicates the satisfaction level in an undesirable level, while the final weight of the overpasses is equal to 3.24 which indicates a favorable level of satisfaction.

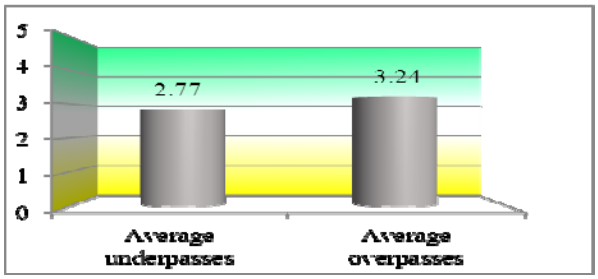


Fig. 26. Comparison of the desirability of underpass and overpass

**5.3.2. SWOT Analysis of the data from the Field Research and the Survey (Comparison of the Underpass and Overpass)**

In this section, a number of six indexes are presented by using all of the documentary and field data in the area of the plan and according to the ideas of the residents and experts in order to study the weak points, strong points, and the opportunity or threat points of each of this urban impositions.

Table. 20
IFE Matrix (External factors including the weak points and strong points of the underpass)

| Dimensions | Strong points | Dimensions | Weak points |
|---|---|---|---|
| Environmental | • S1: Developing green spaces on the corners of Nasr underpass and refuges in the middle of *Motahhari* area visible to motorists.<br>• Comparable low and desirable noise pollution<br>• S3 Impact in the air pollution | Environmental | • W1: Floods in the time of rainfalls in the area of the underpasses and sidewalks<br>• W2: Disrupting the natural hydraulic slant of the surface waters channel and under passing channels.<br>• W3: Extended destruction and encroachment on the land due to a high level of excavations<br>• W4: Low level of hygiene and accumulation of contaminations. |
| Social | • S4. Development of a sense of belonging in the residents | Social | • W5: Lack of security of spaces specially overnights due to the invisibility or the reduction or lack of social supervision.<br>• W6: Disruption in the communication and decrease of social interactions and weakness on enhancing the public relations and meetings. |
| Economic | • S5: Lower transit expenses for the citizens<br>• S6: Low amount of primary construction cost<br>• S7: Providing jobs during the construction and need for an increased workforce during the function stage for the purposes of repair and retention.<br>• S8: Benefit of motorists in the reduction in the consumption of the fuel. | Economic | • W7: Economic recess of the commercial units and reduction in the value of surrounding residential and commercial areas and units.<br>• W8: high expense of repair and maintenance in comparison to the overpass.<br>• W9: Increase in the hidden expenses due to the need to eliminate the interferences and to impose them on the urban management.<br>• W10: High costs of control in order to supply the safety and also the control of traffic by using cameras.<br>• W11: Increase in the costs of providing light, especially overnights. |
| Physical | The absence of blockade in the view. | Physical | • W12: Physical exhaustion of the neighborhoods with a major reason of humidity<br>• W13: Physical exhaustion in the intersection due to the incorrect maintenance and other causes which are mainly due to the humidity.<br>• W14: Developing an extended open space channel and other obstacles toward infiltrability<br>• W15: Development of fragments in the texture<br>• W16: Weakness in the geometrical plan because of the position of the arc in the thalweg<br>• W17: Improper quality of the pedestrian sidewalks in *Motahhari* area |

| | | | |
|---|---|---|---|
| | | | and the lack of it in some local pathways including the southwestern side and the improper 35 centimeter around the Nasr underpass.<br>● W18: Developing a dedicated space for the motorists and less constructed pathways for different types of transit.<br>● W19: Low flexibility during the construction, interventions and other issues in the traffic flow due to the extended area of the workspace and decrease in the detachment between executive groups in comparison with the overpass<br>● W20: Increase in the construction of the project in comparison to the overpass due to the demand to coordinate with a wide range of different organizations.<br>● W21: Weakness in development of accessible public spaces<br>● W22: A vulnerable place toward natural disasters<br>● Developing an invisible space in the neighborhoods<br>● W24: Incorrect lighting and darkness overnights. |
| Traffic | ● S10: Reduction in the traffic delays and increase of its flow<br>● S11: Decrease in the time to reach the destination on the main road. | Traffic | ● W25: Increase of the incidents due to several reasons including the increase in the field of view and the improper geometrical shape in Nasr interchange.<br>● W26: Creating obstacles in the cyclist and pedestrians pathways<br>● W27: Change in the local accesses and pathways and creating obstacles<br>● W28: Deviation in the straight pathway for the cyclists<br>● W29: Cutting the cohesion and developing nodes by constructing a square in the Nasr intersection and installing a traffic light in a 4 meter distance in *motahhari* intersection.<br>● W30: Lack of facilities for loading and unloading passengers in the main pathway of the underpass for the public vehicles.<br>● W31: High Degree of traffic disturbances during the construction |
| Subjective-perceptive | ● S12: Developing some memorial elements and sidewalls with illustrations in Nasr intersection.<br>● S13: Suitable lighting in Nasr intersection<br>● S14: Lack of developing visual distortion | Subjective-perceptive | ● W32: Most of the aesthetic aspects are situated in the view of the motorists and not the local residents or the pedestrians.<br>● W33: Inexistence of a view from inside of the texture to the underpass area.<br>● W34: Lack of attraction and proper flooring and using suitable material in the sidewalks. |

Table 21
IFE Matrix (Internal factors, including the strong and weak points of the overpass)

| **Dimensions** | **Strong points** | **Dimensions** | **Weak points** |
|---|---|---|---|
| Environmental | ● S15. Reduction in air pollution<br>● S16. Proper and visible public green spaces<br>● S17. Desirable noise pollution<br>● S18. Accordance with the surrounding natural environments like rivers and interaction with surface flows of water | Environmental | ● W35: Lack of direct sunlight for the constructed green space under the deck |
| Social | ● S19: Elevating the social interactions in the area under the deck<br>● S20: Sufficient sense of security<br>● S22: Enhancing the sense of belonging among the residents. | Social | ● W36. Lack of proper urban furniture in the place of the population. |
| Economic | ● S23: Efficient use of the land<br>● S24 : Reduction of transport costs<br>● S25: Increased unwanted economic impacts on the economic activities in the area and the real estate price.<br>● S26: Benefit of the drivers in the increase of fuel consumption.<br>● S27: Lower costs of repair and retaining and occupations during the construction | Economic | ● W37: More primary average construction cost<br>●<br>● |

| | | | |
|---|---|---|---|
| physical | ● S28: Higher infiltrability<br>● S29: Development of pedestrian and bicycle pathways<br>● S30: Enhancing the transit of citizens and the continuity in the flow of daily life in an axis vertical to the areas in the plan<br>● S31: Lack of physical exhaustion in the surroundings<br>● S32: Desirable flexibility during the construction<br>● S33: Providing a proper levels of light over nights.<br>● S34: Developing public spaces<br>● S35: An observable space | physical | ●<br>● W38: Disconnection of connection in the area of (کوله‌ها)<br>● W39: Eyesight over the housing units on the sides of the plan specially in the *Shahid Rajaie* intersection<br>● W40: Creating obstacles in the pedestrian pathways in *Sardaran* and Rajaie.<br>● |
| Traffic | ● S36: Reduction in the travel time to destination<br>● S37: Reduction in the load of traffic and the flowing current in the main road<br>● S38: Reduction in the rate of incidents<br>● S39: Coordination with the local network and the transit of pedestrians and bicycles. | Traffic | ● W41: Developing traffic node in *Sardaran* square |
| Subjective-perceptive | ● S40: Installing elements and wall paintings with a good lighting that can | Aesthetic | ● W42: Lack of definition for the aesthetic indexes on the deck of *Kowsar* Intersection.<br>● W43: Creation of visual distortion<br>● W35: Improper Visual corridor specially i the کوله ها area.<br>● W45: Lack of attraction in the pedestrian pathway on the deck of *Sardaran*. |

Table. 22
EFE Matrix (External factors including opportunity areas and the underpass threat)

| **Dimensions** | **threats** | **Dimensions** | **opportunities** |
|---|---|---|---|
| Environmental | ● T1: A vulnerable space toward floods and the infiltration of water from the underpass water channel which are now totally dry.<br>● T2: A vulnerable place against earthquakes and bonfires.<br>● T3: Increase of the pollutions in the case of increased traffic<br>● T4: Increase of the dissatisfaction and demotivation of the residents in the terms of repairs considering the constant infiltration of humidity. | Environmental | ● O1: The possibility of using vertical green spaces and green walls.<br>● O2: The possibility of using recycled water in the underground containers in order to enhance the green spaces.<br>● O3: The possibility of managing surface waters. |
| Social | ● T5: Increase in the crime rates and social vulnerability specially overnights because of the lack of maintenance of the lighting systems and also the lack of emergency electricity generator,<br>● T6: Diffusion in the identity of the neighborhoods and the duality of the texture.<br>● T7: Change in the former uses of the land in the neighborhoods<br>● T8: Social exhaustion | Social | ● O4: The possibility of developing typical symbols which become influential to introduce and represent the neighborhood.<br>● O5: The possibility of improving the surveillance with new technologies, namely the CCTV surveillance cameras.<br>● O6: Possibility of improving the interactions by reviving spaces like the Grocery Bazar in the northwest *Motahhari* intersection.<br>● O7: Appropriate design especially in the place of entrance doors in order to enhance the sense of identity and belonging to the residential units in the sides. |

| | | | |
|---|---|---|---|
| | ● T9: Authorities disregarding the case of security | | |
| Economic | ● T10: Tendency of the planners and consultants to the underpass model due to the ease in the calculations and less responsibilities during and after the construction<br>● T11: Tendency of the employers due to a lower primary expenses in comparison to the overpasses.<br>● T12: More decrease in the real estate value in the area of the plan and development of recess with the possibility of major fluctuation and high risk in the local economy.<br>● T13: Being imposed of unexpected expenses regarding the lawsuits and interferences, etc.<br>● T14: High cost for the widening of the 4m and 6meter sidewalks. | Economic | ● O8: providing jobs and income for the repair and retention teams for the lighting in the nights and the water systems.<br>● O9: Developing income by introducing economic functions especially through the use of commercial advertising billboards. |
| Physical | ● Explaining the periphery area with a comparison with the motorists or the difficulty or impossibility of the design for the pedestrian access.<br>● T16: Increase in the local issues in the case of lengthy time for the everlasting adjustments in the Nasr projects<br>● T17: Increase in the erosion and decrease in the environmental quality.<br>● T18: Difficulty of instant services during the occurrence of incidents due to the lack of sight and a more difficult access. | Physical | ● O10: Use as a shelter for the urban passive defense.<br>● O11: Repair and solving the issues related to the infiltration of humidity in order to stop more erosion.<br>● O12: Allocating proper budget for the retention. |
| Traffic | ● T19: Increase in the rate of road incidents during the rainfalls and the darkness overnight in the case of increase in the volume of cars from the overflow to the local transit networks and development of nodes. | Traffic | ● O14: Possibility of providing transit facilities for the pedestrian and cyclists through the bridge over the underpass axis in order to connect the two local neighborhoods in the plan and to keep a walking-oriented cohesion.<br>● O15: Designing stairs in order to connect the underpass with the surface in order to use public transit services<br>● O16: The possibility of adjusting and adopting geometrical textures and increasing the width of the sidewalks. |
| Subjective perceptive | ● T20: Tarnish sidewalls<br>● T21: Lack of proper hygiene due to the hidden place of the contaminations from the eyesight.<br>● T22: Increase in the dissatisfaction due to the decrease in the visual quality and the subjective image among the residents because of the erosions. | Subjective perceptive | ● O17: Existence of the potential in order to develop attractive wall paintings and textile design on the sides.<br>● O18: The possibility of using different patterns like fountains with the existing savings of water<br>● O19: The possibility of creating a network of memorial elements<br>● Improving the readability by creating symbols. |

Table. 23
EFE Matrix (External factors including opportunity and threat points of the interchange)

| Dimensions | threats | Dimensions | opportunities |
|---|---|---|---|
| Environmental | ● T23: increase of the noise pollution<br>● T24: Erosion of green spaces in the condition of noise-pollution and incorrect retention.<br>● The residential units around the plan will be exposed to the | Environmental | ● O20: Development of vertical green spaces and eye catching landscapes.<br>● O21: Possibility of developing limited green spaces on the deck of Interchange by the use of green boxes.<br>● O22" Providing facilities under the bridge in order to preserve the social relations and interactions. |
| social | sight of other constructions in the case of irregular constructions in the empty areas of the plan. | social | ● O23: Equipping and furniture suitable for the public arenas under the space of the deck and to turn it into a lively social place<br>● O24: Especially in two sides of the river in *Shahid Rajaie* intersection. |
| Economic | ● T28: Decrease in the value of the land in the different stories of adjacent units.<br>● T27 Defenseless spaces as the target of army assaults. | Economic | ● O25: Possibility of defining the space with an economic function and to attract participation under the decks.<br>● O26: The possibility of deciding suitable land uses and to change it to a lively place in the social terms of it and the possibility of making turning points in the empty spaces especially around the sides of river around *Shahid Rajaie* and under the deck of *Sardaran*. |
| Physical | | Physical | ● O27: Developing a space in order to construct taxi stations.<br>● O28: The possibility of providing service facilities including health services. |
| Traffic | ● T28: Increase in the issues related to the traffic node in *Sardaran* square with the masses of automobiles | Traffic | ● O29: The possibility of providing suitable parking spaces under the deck. |
| Subjective-perceptive | ● T29 Exhaustion of elements due to a lack of maintenance. | Subjective perception | ● O30 capability of turning into a beautiful urban imposition and a memorial symbol. |

### 5.3.3. Giving Weight to the Indexes and Prioritize them with AHP Method.

On the next stage, by appointing score of the items according to the results and also using the idea of statistical population on putting value and importance to a part of dimensions according to the research approach aligned with the selection in the type of intersection symmetric to the ideal of the planners, internal and external factors are weighted. In order to weight each of the sub-indexes, the weight of each index in a hierarchical AHP analysis in order to provide the weight of weak points, points of strength, opportunity and threat points in respect to each other (Table. 24). On the second stage, corresponding weight for the each of the physical, environmental, economic, social and subjective-perceptive and traffic are calculated together with each other (Table. 25); afterwards, weight for each subcategory for each index in respect with other sub-indexes is resulted following the same index and finally by multiplying the weight of strength points in each of the indexes and then by multiplying it on the weight of each of the sub-indexes for each. The very same method is used for the weak points, points of opportunity and threat points.

Table 24
SWOT- giving weight with AHP method

| SWOT AHP | Strengths | Weaknesses | Opportunities | Threats | Geometric Average | Coefficient of significance for the indexes |
|---|---|---|---|---|---|---|
| Strong points | 1 | 2 | 3 | 3 | 2.05 | 0.45 |
| Weak points | 0.5 | 1 | 2 | 2 | 1.18 | 0.26 |
| Opportunity points | 0.33 | 0.5 | 1 | 1 | 0.63 | 0.14 |
| Threat points | 0.33 | 0.5 | 1 | 1 | 0.63 | 0.14 |
| Total | | | | | 4.49 | 1 |

Table 25
Scoring the indexes with an AHP method.

| AHP Indexes | Environmental | Economic | Physical | Traffic | Social | Subjective perception | Geometric average | Coefficient of significance for the indexes |
|---|---|---|---|---|---|---|---|---|
| Environmental | 1 | 2 | 2 | 0.5 | 1 | 2 | 1.8 | 0.2 |
| Economic | 0.5 | 1 | 1 | 0.33 | 0.25 | 3 | 1.3 | 0.14 |
| Physical | 0.5 | 1 | 1 | 1 | 0.5 | 2 | 1.2 | 0.13 |
| Traffic | 2 | 3 | 4 | 1 | 0.5 | 4 | 2.04 | 0.23 |
| Social | 1 | 1 | 2 | 2 | 1 | 2 | 1.91 | 0.21 |
| Subjective perception | 0.5 | 0.33 | 0.5 | 0.25 | 0.5 | 1 | 0.52 | 0.059 |
| Total | | | | | | | 8.77 | 1 |

According to the resulting data from the SWOT charts and weighing of them, Figure 27 and 28 are produced. In Figure 27, the horizontal axis indicates the final weight of the pros of overpasses and vertical axis indicates the final weight of the opportunities. According to the illustrated diagram it is evident that overpasses has more strong points in comparison with the probable opportunities in the underpasses with has the second standing with a slight difference to the overpass. In other words we can add to the positive aspect of the underpasses by proper construction planning and providing funds.

In the Figure 28, the horizontal axis is the final weight of the weaknesses on the overpasses and underpasses and the vertical axis indicates the final weight of the threats. According to the illustrated diagram, it is evident that the overpasses possess fewer weaknesses and are susceptible to less threats and damages in the future in comparison with the underpasses. The considerable point about the underpasses is the significant distances in the axis of threats, in other words in the case of disregarding the mentioned points in the section related to the threats can mark serious negative effects in the area of the plan.

According to the both Figure 27 and 28, and with a general overlook we can propose the idea that overpasses has an evident more success than to underpasses, except for a few cases with a slight distance.

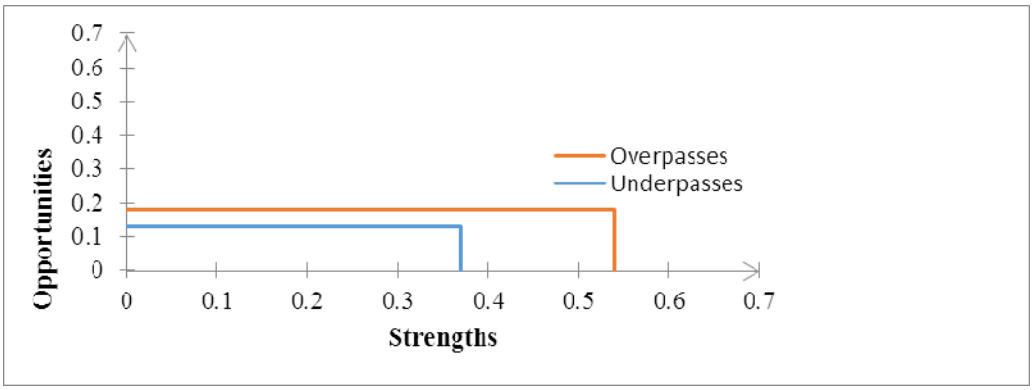


Fig. 27. Location of the final matrix for the positive factors (Strengths and opportunities) of the studied overpasses and underpasses in the research area.

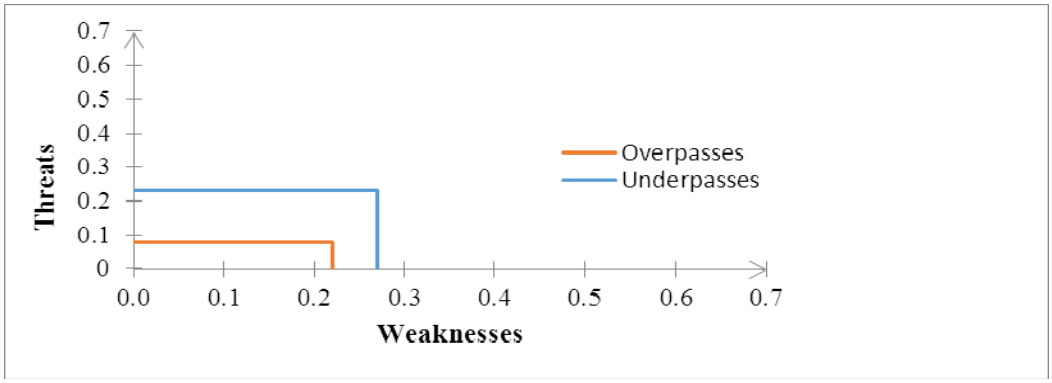


Fig. 28. Location of the final matrix for the negative factors (Weaknesses and threats of the studied overpasses and underpasses in the research area.

## 6. Conclusion

According to the documentary data, advantage of the overpass plan was proven in the most of the analyses and some of the reasons including the tendency of consultants according to the simplicity in the technical calculation of the structure in comparison with overpasses together with more benefits for the executors and the most important motivation for the managers is the more accurate primary estimation prior-to-construction of a plan, especially in the proposed intersections in which the construction of both underpass and overpass is possible according to the condition of the construction site. But as it was noted, researching the mentioned intersections indicates an enormous differences between the primary estimation of the expenses and the final costs. Also the possibility of pedestrian access from between the interchange columns for the residents of the both sides of the plan's axis and also a significant amount of developed green spaces under the decks of the interchange than can be utilized for different necessary land uses on the surface of neighborhoods like parking spaces, toilettes, etc. along with the high land values around the crowded areas which demands for such projects such spaces can bring income for the urban management, it can be considered as the advantage of the overpass plan. Difficulty in providing an accurate estimation for the expenses of underpass plan is based on unknown undersurface factors like: transitional installations, soil type, et., which can cause to spend the whole budget before the completion of the construction, along with the development of a roofless channel as an underpass which obstructs a high percentage of the transit of residents on two side of the plan's pathway and serious issues occur during the rainfalls, together with the developed recess in the body of the commerce according to the lack of convenience in access and security issues due to the surprising points and reduction in the field of view in the underpass are considered as the major known negative factors based on the documentary research and existing regulations. Results of the field research on the social, economic impacts of the overpasses and underpasses also indicate negative feedbacks from the statistical population toward these dimensions. In the following diagram and table, these impacts are shown in each of the overpass and underpasses in the city of Qazvin from the viewpoint of the statistical population.

Table 26
Impacts of constructing interchange junctions regarding the sextet indexes in the target localities.

| Sextet indexes | Underpass | | Overpass | |
|---|---|---|---|---|
| | Final score | Level of desirability | Final score | Level of desirability |
| Physical condition | 2.59 | Low to medium | 3.29 | Medium to high |
| Traffic condition | 2.93 | Low to medium | 3.36 | Medium to high |
| Economic condition | 2.7 | Low to medium | 2.9 | Low to medium |
| Environmental condition | 2.8 | Low to medium | 3.42 | Medium to high |
| Social condition | 2.78 | Low to medium | 3.44 | Medium to high |
| Subjective perception condition | 2.82 | Low to medium | 3.08 | Medium to high |

Table 27
Standing based on the Friedman test.

| **Factor** | **Average standing** |
|---|---|
| Environmental | 3.61 |
| Social | 4.18 |
| Economic | 4.85 |
| Physical | 4.1 |
| Visual perception | 2.12 |
| Traffic | 4.24 |

According to the Friedman test influence of the main factors on the neighborhoods is evident in this research. The most impact is in the economic dimension and the next standing on the extent of influence is dedicated the traffic and social aspects, although the traffic dimension have gain the next station with the small difference of 0.06 in comparison with the social dimension as we can categorize the impact of two mentioned dimensions in a single category with a slight condonation. Data from the results indicates that the six regarded indexes as the independent variables of the research have a greater than 0.7 value of *Cronbach* Alpha which is an approved level of significance and according to the data analysis on all of the six layers of these junction, they had direct influence on the surface of mentioned neighborhoods, also the underpasses possessed a less amount of desirability which is in accordance with the results of documentary data research.

In other words, according to the results of this research on the both documentary and survey aspects of it, it is eminent that urban managers avoid implementing these types of plans but when the importance of such projects in the point, a number of other aspects than the mass of traffic, etc., which are planned in order to ease and enhance the flow of motor vehicle traffic should be considered including: ecological issues, adjacency of different land uses and the condition of peripheral localities with these intersections and social impacts on the relation between the local residents and citizens together with the economic impacts

on the tradespeople of the neighborhood based on the adjacency theory on deciding the type of underpass or overpass for the localities with a dual choice.

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