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AN EMPIRICAL ASSESSMENT OF THE WALKING ENVIRONMENT IN A MEGACITY: CASE STUDY OF VALIASR STREET, TEHRAN

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Abstract
High air pollution, car dependency, and increasing statistics of obesity and cardiovascular diseases are growing issues in the mega city of Tehran, the capital city of Iran. Therefore, investigating the quality of walkability as an effective solution for these issues in Valiasr Street, the longest street of Middle East and one of the key vena of Tehran, becomes significant. Research shows that despite the attempts of executed projects, the majority of implemented actions in this street were not in accordance with services of its pedestrian facilities. Even in some cases, they may threaten the walking environment. This paper discusses not only the physical features of Valiasr Street but it also considers the consequences of policies and municipal decisions in light of walkability criteria. Using walkability indexes from various scholars, this study seeks to investigate the level of walkability in Valiasr Street through field observation and mapping by trained observers/ auditors.

***Keywords*:** *Sustainable urban environment; walkability index; urban life quality*

INTRODUCTION
Intensification of car dependency, high level of pollution, and reduction of physical activities that may result in obesity (Kopelman, 2000) and related diseases has raised tremendous public attention in the last few decades. Therefore, walkability as a necessary supplement to transit access and an effective solution for decreasing pollution emissions, improving public health, and achieving a sustainable environment, has been suggested in several researches (Carnoske et al, 2010; Evans-Cowley, 2006; Ewing et al, 2003; Frank and Kavage, 2009). Walkability is a healthy sport and a recreation activity to experience the local environment as well as a natural mode of transportation that has a strong relationship with the quality of the environment (Southworth, 2005).

The mega city of Tehran, similar to most global cities, is suffering from high-level air pollution, traffic congestion, and a growing level of obesity associated with an increasing number of cardiovascular and respiratory and other chronic diseases, which threatens public health (Hamshahrionline, 2013; WHO, 2011). Other than health issues, inadequate walkable space may also have negative consequences on economic and social mobility (Krambeck and Shah, 2006). Numerous research have been done on walkability audits (Kelly, 2011; Pikora, 2003), while the majority of them were just restricted to the physical environment (Burton and Mitchell, 2006; Cerin et al, 2011) without considering the consequences of adoption of new policies and implementation of projects on pedestrian, and just a few studies considered the impacts of policies to some extent. This research aims to measure walkability features and obstacles by assessing the physical features as well as considering the consequences of implementation of policies and new projects. Valiasr Street as one of the main access routes, commercial and entertainment poles of Tehran metropolitan, has been chosen as the case

study. The paper first presents a literature review on walkability. The second section describes the research framework, which contains thecase study and walkability assessment, followed by the research method. The third section is dedicated to results and discussion, and finally the last section is allocated to the conclusion.

Literature review

To overcome serious challenges of contemporary cities with urban mobility, pollution and health of city dwellers, walking as one of the most important non-motorized transport modes, received an increasing interest from both the scientific community and local authorities in the past few decades (Zayed, 2016). Considering many associated benefits from reducing traffic and air pollution to economic, health, and environmental improvement, walking is the most natural and necessary form of human disposition in the environment (Pakzad, 2005; Park, 2008).

In the last half century, walking-related topics has become a critical research area especially for two active groups of researchers: (1) transportation planners and (2) urban designers (Southworth, 2005). Enormous work has been done on the design of transportation space over the last 60 years; however, pedestrian transportation and walking-related issues were mostly neglected until the post-modernism era (Lo, 2009; Mofidi and Kashani Jou, 2010). In the early 1960s, Jane Jacobs' seminal work drew the attention of urban design researchers' and theorists to the importance of walkable environment and its impact on walking behaviour through looking at non-functional aspects of walking, such as a sense of security and visual interest (Park, 2008) . Moreover, Ewing and Handy (2009) argue that five perceptual qualities, (1) imageability, (2) enclosure, (3) human scale, (4) transparency and (5) complexity, may affect people's perceptions of the paths and walking patterns along the space. Since mid-1990, scholars have recognized many indicators to measure the walking environment such as the Pedestrian Level-of-Service (LOS) (Gallin, 2001) and the Walking Suitability Assessment (Emery and Crump, 2003).

Walkability-related terms are terms that have been used in different disciplines such as health and urban design. Therefore, the terms walking, walkability, walker, and pedestrian, require a clear clarification. Walking refers to a form of physical activity, while walkability is a term describing the physical environment where walking takes place. According to Southworth (2008), walkability is "the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network". Moreover, in this study, we differentiate between walkers and pedestrians. According to the suggested definition in the Oxford Dictionary (2016), a pedestrian is "a person walking rather than travelling in a vehicle"; however, the walker is "a person who walks, usually for pleasure or exercise". Considering the comprehension of the term, in this study, pedestrian refers to all different purposes of walking such as transportation, recreation and exercise.

Growing interest in the relationship between the quality of the built environment and walkability has led to a series of research to develop environmental audit methods and walkability indexes (Krambeck and Shah, 2006; Pikora et al, 2003). Although various indicators have been addressed by researchers, the impact of policies, implemented projects, and decision making in the small scale of street, have been neglected in the majority of research. The legislation of pedestrian master plan in most pioneer cities of developed countries turns pedestrian and walkable environments into an important indicator of urban development (Mofidi and Kashani Jou, 2010); however, this approach is still confronted with difficulties in developing countries like Iran. A review of Tehran's comprehensive plan from 1969 (first comprehensive plan) (Habibi and Hourcade, 2005) to its newest version in 2007

reveals that pedestrians are neglected in the city's vision. Amongst the various scales with which walkability can be evaluated, this study focused on the street scale (micro scale).

According to Le Corbusier, the street is "a machine for traffic, an apparatus for its circulation, a new organ, a construction in itself and of the utmost importance, a sort of extended workshop" (Corbusier, 1929). The street, as an ancient component of the built environment, not only provides accessibility and connection to different destinations in cities, but as a public realm, it also contains a range of activities and plays a significant role in the life of cities. The phrase that has been offered by Jane Jacobs effectively describes the importance of the street: "Think of a city and what comes to mind? Its streets. If a city's streets look interesting, the city looks interesting; if they look dull, the city looks dull" (Jacobs, 1961). Considering the significant place of a street in both social and economic life of cities, evaluating the street's walkability becomes really important. As walking means the presence of people, walkable streets can greatly contribute to the wealth, health, and sustainability of the city through raising the economic value of offices, retail businesses, and houses, improving both social interaction and social security while enhancing the sense of place (Zayed, 2016). This study aims to address the influence of urban design policies and decisions as well as walkability audits in the micro scale of Valiasr Street as a public realm and one of the most important streets of Tehran.

Research framework

Case study

The study area is Valiasr Street, which is known as the longest street in Tehran and the Middle East with a length of 18.6 km (HamshahriOnline, 2011). Valiasr with planted plain trees and open irrigation ditches on both its sides has been built in 1921 at the first period of the Pahlavi dynasty with the effort of Reza Shah Pahlavi. It connects the railway station, Rah Ahan Square, which is the most important conduction hub with other cities in the south of Tehran (on the edges of Dashte-Kavir desert) to the northern highland of Tehran to portray the state's authority. Initially, Pahlavi Road (the former name of Valiasr) was a private road that only courtiers and ministers were allowed to use, but, in 1941, it became open to the public (Molahoseini, 2011; Motazed, 2003, 2005). Since fifty years ago, due to its potential, Valiasr has become the promenade of Tehran citizens and attracts the general population as well as visitors. The environmental beautification of the street with tree-lined pedestrian pathways and the sound of running water in combination with the appearance of luxury shops and cafés, transformed the street into a commercial hub. In addition to the presence of several historical buildings, parks, and architectural and cultural attractions, the plain trees of the street, which are considered sacred in the ancient culture of Iran, have a special place in the collective memory of several generations. This street is also one of the most important north- south artery of Tehran that passes through four regions (region 1, 3, 6 and 11). It started from Rah Ahan Square in the south, connecting Monirieh, Valiasr, and Vanak Squares along its path, and then continuing to Tajrish Square in the north of Tehran (Figure 1).

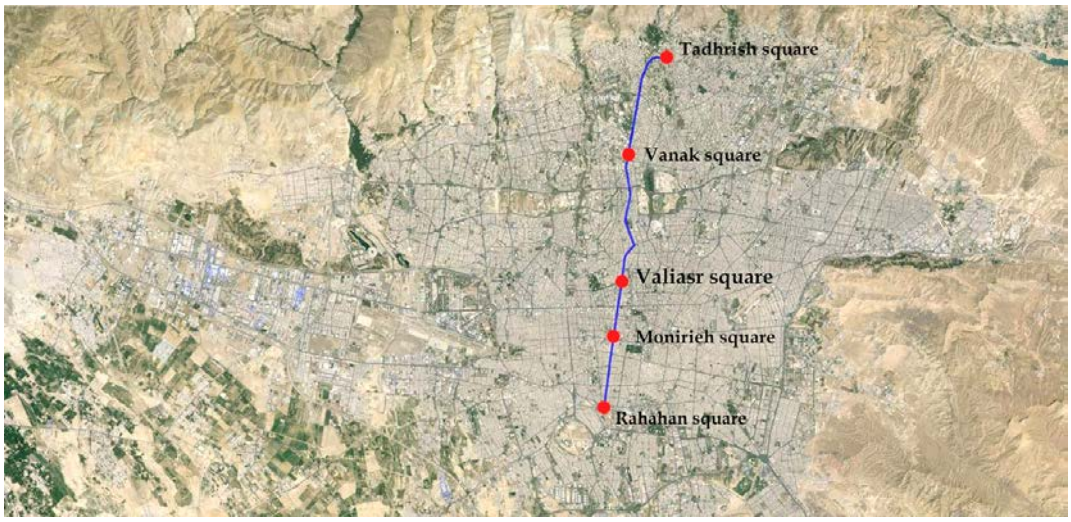

Figure 1. The blue line shows the path of Valiasr Street, which started from Rah Ahan square in the south to Tadjrish square in the north. (Source: The map is extracted from http://au.nearmap.com and modified by authors).

Valiasr Street seems to be suitable for this study because (a) it has great accessibility and connections to other parts of the city; (b) it is a part of the identity of Tehran and has a special place in the collective memory and sense of place of its dwellers and visitors; (c) it can be counted as one of the cultural, historical, and business hubs of the city; and, (d) its spatial features such as the rows of robust plain trees have a potential to attract pedestrians to walk along the street (Figure 2). Moreover, Valiasr Street contains both formal and informal activities such as trading, and the presence of street peddler and itinerant musicians during the day and night, which intensifies its attractiveness for pedestrians. Therefore, reducing car dependency and improving walkability on such an important street by considering its impact on reducing pollution emission and improving the economic and social health becomes an important issue that needs to be studied.

Figure 2. A view of Valiasr Street. (Photo by Kamyar Adl - Flickr user).

Another reason to study Valiasr is the attempt that has been carried out in recent years by municipal authorities to improve the condition of the street (Habibi and Hourcade, 2005; Zibasazi, 2016). However, most of these actions were just based on facilitating vehicles flows without even addressing pedestrians. Therefore, the study of Valiasr provides a unique opportunity to investigate the consequences of implementation of such projects on attracting or repelling walkability as well as to examine the potentials and obstacles of the street itself. Considering the length of the street, it has been divided into three sections to allow us to investigate walkability audits and the impact of executive projects more accurately. The first section contains two parts starting from Tajrish Square to Parkway intersection and Parkway intersection to Vanak Square; the second section is from Valiasr to Vanak Square; and the third section, which is divided into two parts, starts from Valiasr square to Monirieh and Monirieh to Rah Ahan Square (Figure 3).

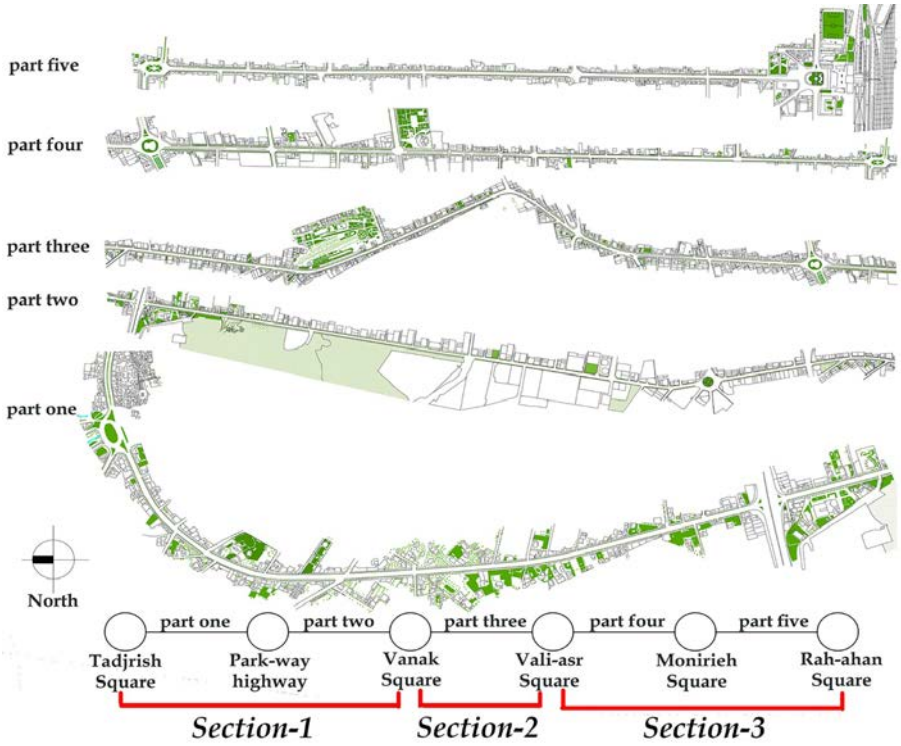

Figure 3. Three sections of Valiasr Street (Source: Authors).

Walkability assessment

Measuring walkability can be assessed through objective (physical environment) (Burton, 2006) or subjective (personal perception) (Ewing and Handy, 2009) evaluation methods. Several tools entitled walking audit instruments have emerged during the past few years for walkability assessments, which are using widely across the world by researchers and local governments. The focus of the majority of studies is on physical aspects such as landscaping (Zayed, 2016) and urban planning measures. Some researchers consider subjective aspects of place such as the spirit of place as influential factors on walkability (Ferwati, 2007). Considering the diversity of introduced walkability audits in different research, accessibility, convenience, attractiveness, road safety, and personal safety were the basic suggested factors of walkability in most of these research (Galanis and Eliou, 2011; Tal and Handy, 2011). Moreover, with the rising interest in walkability, a number of local agencies in United States, including those in Portland, Oregon, developed criterias for evaluating walkability

within the context of wider multimodal transportation planning, which has been furthered by the City of Kansas to develop the Kansas City Walkability Plan (Lo, 2009). Eight parameters were introduced by Portland's pedestrian planning index: (1) presence of sidewalk, (2) accessibility, (3) safety, (4) connectivity, (5) destination, (6) sense of place, (7) topography, and (8) policy factors. According to the national nature of proposed walkability indexes, the World Bank developed a more international index entitled Global Walkability Index (GWI), which includes universally applicable variables such as crossing safety, perceived security, and accessibility (Krambeck and Shah 2006). According to the global walkability index that has been produced by Krambeck (2006), the effective variables on walkability are classified into three categories: safety and security, convenience and attractiveness, and policy support. In another study, Pikora et al (2003) divide the effective variables into four groups: functional, safety, aesthetic, and destination. The review of different walkability indexes reveals that the index of Krambeck (2006) and Pikora (2003) can be considered as the most comprehensive index as they consider objective and subjective factors with great details. However, it should be considered that, due to the aims of GWI to focus on aspects that can be improved upon in the short and medium terms, the GWI index did not consider some variables such as land use, sense of place, and aesthetics comprehensively (Lo, 2009).

As this study aims to consider the influence of policies and decisions on walkability in addition to physical and social features in the micro scale of a street, the walkability index has been modified by adding some of the variables that have been recognized by Pikora and the city of Portland to the walkability index of Krambeck to meet the goals of this paper and be more applicable to the national scale of the selected case study (Table 1).

Table 1. Walkability index for Valiasr Street. The table is based on Krambeck & Pikora research (Krambeck & Shah, 2006; Pikora et al, 2003) that has been modified by authors.

Components	Indicators	Items
Safety & Security	1. Personal	• Lighting
		• Surveillance
	2. Road and Traffic	• Crossing safety
		• Route buffer
		• Motorist behavior
		• Pedestrian and vehicles conflict
		• Volume
		• Speed
		• Number of lanes
		• Control devices
Functional	3. Sidewalk	• Surface type, quality of pavement, width, continuity,
	4. Accessibility and convenience	• Permeability
		• Accessibility by car, taxi, bus, etc
		• Crossing availability
Attractiveness & Facilities	5. Streetscape	• Natural features: trees
		• Architecture
	6. Destinations	• Parks & gardens
		• Public places: cinema, theatre, cultural centres, Museum, café, restaurants
		• Mixed use: shops (Passages, individual shops, peddlers), business
	7. Maintenance	• Building facades, pavements,
	8. Amenities	• Fixed furniture: benches, kid's play equipment, sport equipment
		• Movable furniture: shades, restaurant furniture
		• Public toilets

		• Facilities for blind and disabled pedestrians
	9. Parking	• Parking along the street
		• Multi level parking
	10. Public transportation	• Bus
		• Taxi
		• Metro
Pollution & Cleanliness	11. Visual pollution	• Facades: advertising, cleanliness
		• Litters and surface water disposal
	12. Noise pollution	• Level of traffic
		• Vehicles conditions
	13. Air pollution	• Air quality
Policies & guidelines	14. Planning for pedestrians	• Presence and quality of programs
	15. Executive projects	• Consideration of pedestrians in designing the project
	16. Municipal decisions and guidelines	• Presence of design guidelines

Research method

The method of this study is informed by the study of Mofidi and Kashanijou (2010), which has specifically been done on the public walkable environment of Tehran; however, they just focused on obstacles and opportunities for developing pedestrian streets in the city of Tehran. Therefore, to measure the walkability of Valiasr, this study performs in the following three phases:

1. The desired street has been divided into three sections to allow us to examine walkability with more details in micro scale.
2. Based on reviewed literature, the walkability audit has been chosen as a suitable method for facilitating the goals of this research. The environmental quality of Valiasr's walkability has been assessed based on identified indicators. In addition to the mentioned indicators, policies and guidelines have been investigated in Valiasr Street as the fifth influential factors in the walking quality of the street.
3. The investigation of walkability along Valiasr Street is based on (1) data collection conducted by the authors as a trained auditor through field assessment of three sections of street using observation methods, including detailed field notes, photography, and self-analysis, and (2) the designs, policies, and implementation issues through assessing the walkability audits.

Results and discussion

Safety and security components

Personal and road safety and security are features that reflect the need to provide a liveable, fearless, and safe community and transportation. As walking is influenced by access to the pleasant, safe and secure environment, various elements of personal and road safety and security such as lighting, crossing safety, and the adaptation of environmental design principles for crime prevention need to be considered.

Personal safety and security

For a relaxing and enjoyable walk, pedestrians need to feel that their safety is a priority in the design of the environment. The high volume of commute in Valiasr Street for entertainment, transport, and business purposes, provides a safe and secure environment for pedestrians during the day. As the evening fell, this situation was likely to change. However, sufficient lighting has been provided in most parts of the street, the closure of shops, and lack of nightlife businesses in some sections of Valiasr intensified the possibility of criminal behaviors. Consequently, increasing the feeling of fear and insecurity may result in a reduction of the number of commuters especially females in these areas.

Due to the high level of mixed use in the north and central parts of the street, the distance between Valiasr Square and Tadjrish Square can be considered as the safest environment for pedestrians. By reducing the level of mixed use, lack of nightlife businesses and eyes on the street, from Valiasr square to the south part of the street, the level of safety and walkability reduces in the night time. However, the presence of a railway station in Rah Ahan Square brings mixed use and nightlife business to this area, which provides security through natural surveillance of streets by people and adequate lighting through the night time (Burden et al, 1999; Worpole, 1992).

Road and traffic

Road and traffic safety has a serious impact on people's willingness to walk along the street. Crossing safety, route buffer, traffic volume, and conflict between pedestrians and vehicles are some of the factors that have been studied in Valiasr, in order to investigate the quality of walkability on the street.

Valiasr Street, as one of the main routes of metropolitan Tehran, is suffering from the high volume of traffic, especially during rush hours. The aggregation of various entertainment and recreational centers, such as parks, restaurants, and shops, and its high level of connectivity with other important streets of Tehran, brings heavy traffic to the street even on weekends. Despite high traffic volume, the speed of vehicles is another significant factor in pedestrian exposure to crash risk (Oxley, 2010). To reduce the volume of traffic and improve safety in line with Tehran's master plan, several strategies were employed by the Municipality of Tehran: (1) in 1981 traffic plan restriction was applied to Valiasr, (2) in 1990 the first part of the street from Rah Ahan to Valiasr Square (from south to north) became one way, (3) the second part of street from Valiasr Square to Parkway intersection became one way in 2010 (Tehran Municipality, 2016), (4) improving public transport by adding BRT (bus rapid transit) and metro to the system, and (5) reducing the number of roadside parking spaces. Considering the positive effect of implemented actions, in some cases, they have had negative consequences as well due to neglecting pedestrians' needs (Figure 4). It is well established that pedestrians' possibility of death highly increases at collision speeds beyond 30km/h (Burtt, 2014). Considering the speed limit of Valiasr Street (60 km) in most parts, it can be seen that not much work has been done to moderate vehicle speeds especially in areas with high pedestrian activity to reduce the risk of collision.

Figure 4. The high volume of traffic in one way part of Valiasr Street (Photo by Kamyar Adl - Flickr user).

Crossing safety and minimum conflict between vehicle and pedestrian play a significant role in creating a walkable and accessible environment. The pedestrian crossing, which is marked with warning colors and sometimes uneven surfaces, signalised intersections, and adapting tactile ground surface indicators such as raised dots to indicate nearby hazards, are some of the examples that have been measured along Valiasr Street. In addition, in high activity areas such as Tadjrish Square and Valiasr intersection, a pedestrian overpass and underpass have been installed to provide a safe crossing environment. In order to improve crossing safety on the one-way part of the street, the vehicles lanes have been separated from the BRT lane with fencing. However, the installation of these fences may increase crossing safety for pedestrians, the lack of consideration of adequate crossways or placing them far from one another may increase the risk of accident and death of pedestrians who attempt to cross the street by passing through the fences (Figure 5). Reducing accessibility to street facilities especially for seniors and people with disabilities is another consequence of this action.

Figure 5. Reducing a crossing safety due to lack of enough pass ways for crossing the street through fences (Photo by Roya Salimzadeh).

It should be mentioned that the behavior of pedestrians and motorists is also a significant cause of conflict, resulting in injuries and fatalities (Spainhour et al, 2006). Failure to acknowledge the priority rights, the high speed of drivers in high pedestrian activity areas, refusing to use the pedestrian underpass and overpass, and their unexpected behavior in crossing the street intensifies the potential of crashes and creates an unsafe environment both for pedestrians and motorists.

The separation of sidewalks from the flow of vehicles is another important factor for improving a walkability via increasing the environmental safety. The sidewalks of Valiasr Street have been completely separated from the vehicles' flow with a row of robust trees and wide waterway, which provides a great buffer. Table 2 shows a summary of effective road and traffic items present in the three part of Valiasr Street.

Table 2. Investigating the impact of Road and traffic items on three part of Valiasr Street (Source: Authors).

Indicators	Items	Sub-items	P.1	P.2	P.3
Road & traffic	Traffic	Volume	High/medium during the day Light at night	High during the day High in day and night during weekend	High during the day High in day and night during weekend
		Speed	Max 60 km	Max 60 km	Max 60 km
		Control device		Yes	
	Rout buffer	Separation by trees		Yes	
		Separation by bollards	In order to prevent entrance of motorist to sidewalk, bollards have been installed in some part of sidewalks or avenues entrance		
		Separation by waterway		Yes	
	Road	Number of lanes	2-lane in each side	One-way road with 2-lane+ special lane for BRT	2-lane in each side
		Motorist behavior	Lack of respect to priority rights	Conflict between motorists and BRT between Parkway and Vanak Square due to the elimination of a separate lane for BRT	Conflict between motorists and BRT between Vanak and Tadjrish Squares due to the elimination of a separate lane for BRT
		Pedestrian and vehicles conflict	Around Monirieh Square and Rah Ahan Square	Valiasr and Vanak Square, Parkway intersection	Around Tadjrish Square
		Crossing safely	Adequate crossing safety in most parts, lack of crossing area between Monirieh and Rah Ahan Square	Lack of crossing safety along the street and in intersections	Lack of crossing safety especially near the squares and intersections

Functional components

The functional components include two indicators: sidewalk, and accessibility and convenience.

Sidewalk

The condition of sidewalks including width, continuity, and quality of its surface can affect walkability on Valiasr Street, especially for entertainment purposes. Consequently, the economy of the longest multifunctional street of Tehran is highly affected by its level of walkability. To attract more pedestrians and extend their presence time on the street, most parts of street sidewalks have been refurbished over the past few years. The measures taken include changing pavements, installing stoppers in slippery areas and tactile ground surface indicators for pedestrian with vision impairment, and injecting colours to the street by using colorful flooring tiles and blocks (Figure 6).

Figure 6. A project of refurbishing sidewalks in Valiasr Street through changing the flooring, green environment, benches and other pedestrian facilities (Photo by Roya Salimzadeh).

Figure 7 shows different types of sidewalk flooring along Valiasr Street. The dominant color palette of Valiasr floorings includes red, green, and yellow.

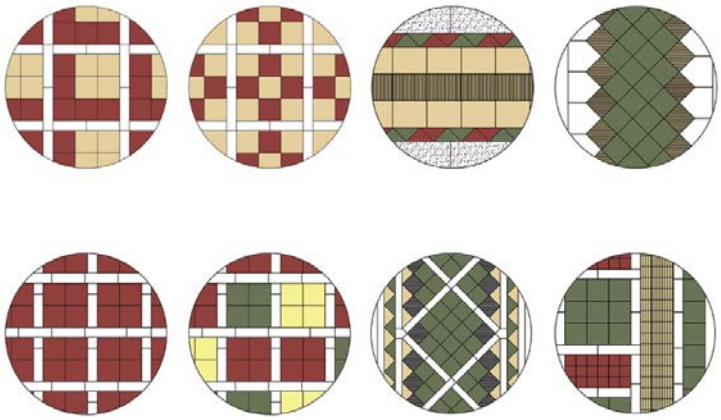

Figure 7. Types of sidewalk flooring in Valiasr Street which have been observed by the auditor (Source: Authors).

Despite the implemented projects on Valiasr's sidewalks, due to the lack of maintenance, improper implementation, and in some cases the use of downscale materials, the condition of sidewalks in some areas are still uneven and broken. Moreover, due to the lack of consideration of vulnerable groups such as seniors, people with disabilities, and people with prams during the design process, sidewalks are still inadequate to support facilities and accessibility for these groups (Figures 8a and 8b).

Figure 8. (a) Difficulty for using the street for people with disabilities due to uneven surfaces and absence of kerb ramp. Tadjrish square (Photo by Kamyar Adl- Flickr user); (b) gradual destruction of pavements due to improper implementation and lack of maintenance caused difficulty for pedestrians (Photo by Roya Salimzadeh).

Accessibility and convenience

According to the length of Valiasr Street, it has a great connection with other important streets of Tehran from north to south, which provides great accessibility and permeability for its commuters. For those who prefer to travel by public transport, the presence of different types of public transportation such as bus, taxi, metro, and especially BRT makes Valiasr an accessible destination. In contrast, difficulty in street crossing especially on the one-way part of the street, which is separated with a fence reduced crossing availability and people's willingness to walk along the street. From a motorist's point of view, despite the high accessibility of the street, reduction of roadside parking and turning most parts of the street to a one-way road reduced its convenience. Therefore, some drivers prefer to use other streets than Valiasr, especially during rush hours and weekend afternoons.

Attractiveness and facilities

The presence of natural features, public places, and valuable architectural and historical places provides a high quality streetscape that converted Valiasr Street to a great destination for recreation and transport walking purposes.

Valiasr is mostly known for the rows of its robust plain trees, which are parts of the street's character and distinguishes it from other places in Tehran. These plain trees not only create a beautiful streetscape but they also improve the quality of air and reduce the level of noise in one of the busiest street of the capital city. Moreover, the plain trees of Valiasr have a special place in the collective memory as they are known as a great source of attraction for walking along the street. Unfortunately, in the past few years, due to a high level of air and water pollution and attacks by harmful insects, a number of trees have been cut to prevent a possible danger for commuters. If this trend continues, we will be faced with the elimination of peoples' memory and sense of belonging to Valiasr Street, which could reduce the quality of walkability and willingness for walking (Figures 9a and 9b). Therefore, Tehran's municipality tries to plant new trees along the street to keep the spirit of street alive (Figure 9c).

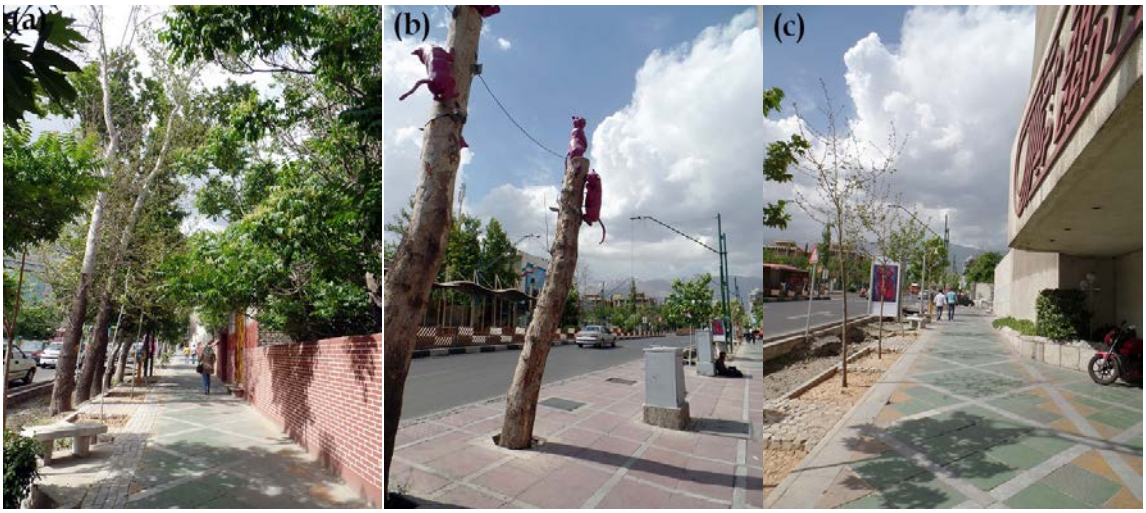

Figure 9. (a) Rows of robust plane trees along Valiasr Street. (b) A view of trees that have been cut; (c) View of new trees that have been planted instead of old ones (Photos by authors).

As stated above, attractive destinations play a crucial role in encouraging people to walk especially for entertainment purposes. Aggregation of various attractive places and mixed land uses along the street turns Valiasr into a recreational, liveable, and attractive destination particularly for pedestrians.

Figure 10 shows the first section of the street. The Saleh shrine and historical bazaar of Tadjrish host large crowds of pilgrims, window shoppers, and other users. As an entrance to recreational places such as Darband, which is a popular hiking trail into the Mount Tochal, Tadjrish Square becomes a stamping ground for youth, climber groups, and local and international tourists. The strategic location of Tadjrish absorbs shopping malls, cinemas, museums, and libraries to this area. Mellat Park is another attractive destination that is situated on the west side of Valiasr Street, between Parkway intersection and Vanak Square (Figure11). It is one of the largest recreational areas in Tehran, which contains the Mellat cinema complex with four theater halls and an exhibitions space. In addition, the adjacency of important hospitals, specialist clinics, and doctors' offices to Valiasr Street, is be considered for other purposes or attractions for referrers to the street.

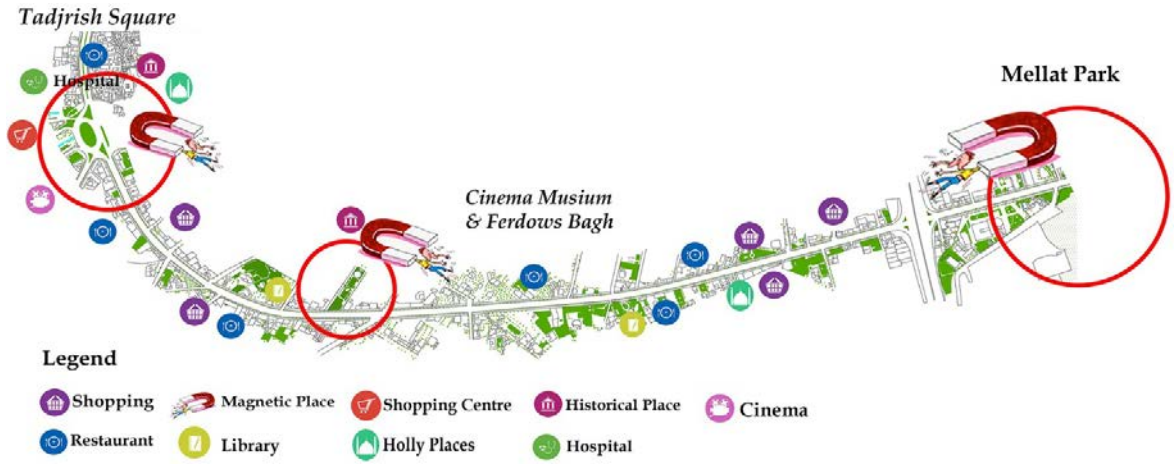

Figure 10. The first part of Valiasr Street from Tadjrish Square to Mellat Park (section-1) (Source: Authors).

Figure 11. Attractions along the first section of Valiasr Street. (a) Cinema museum in Ferdows Park (Photo by Ali Zonoozi- Flickr user); (b) Historical Bazaar of Tajrish near the Saleh shrine (Photo by Kamyar Adl, Flickr user); (c) Mellat Park (Photo by Ninara, Flickr user).

The second section of the street from Vanak to Valiasr Square is also an attractive place for pedestrians (Figure 12). The aggregation of various shopping centers and restaurants turns it to a great stamping ground. The public Saei Park (exploited in 1952) is another popular recreational center of Tehran located on the downhill of the east side of Valiasr Street, which contains a collection of animals, vegetations, waterfalls, and a ponds.

Figure 12. Section- two of Valiasr Street from Vanak Square to Valiasr square (Source: Authors).

Figure 13 shows the first part of the third section of the street from Valiasr Square to Monirieh Square. A variety of land usees around Valiasr Square including restaurants, shops, cafés, and cinemas makes it a powerful magnet to absorb people from different age groups and social classes. The performing arts complex of City Theater, which always hosts international and national theater festivals, is located in Daneshjo Park on the east side of Valiasr Street, which turns this area into a stamping ground for the artist and art lovers. According to the popularity of this section of the street, a special refurbishment project had been implemented in this area in the past few years to provide beautiful sidewalk with sitting spaces among the plain trees and beside a waterway.

From Valiasr Square towards Monirieh Square, the density of vegetation and diversity of mixed-use areas gradually decreases. As the dominant land use of Monirieh Square is

dedicated to sports shops, it does not have sufficient attractions to absorb pedestrians, which results in the reduction of the variety and number of referrers to this part of the street.

Figure 13. Part one of the Third section of street from Valiasr to Monirieh Square (Source: Authors).

In contrast to the north and central parts of the street, due to the lack of mixed use and public spaces in the area between Monirieh to Rah Ahan Squares, the level of walking for recreational purposes becomes much less than other sections of the street(Figure 14). However, situating the railway station in Rah Ahan Square as a destination for travellers from around the country absorbs specific land uses to this area to support the travellers and commuters. Therefore, the dominant land use in this area is dedicated to hotels/ motels, restaurants, and shopping centers to provide the needs of its specific users (Figure 15).

Figure 14. Second part of the third section of the street. Rah Ahan Square (Source: Authors).

Figure 15. (a) City Theatre. Photo by Ali Noorani; (b) Railway station in Rah Ahan square (Photo by Timon 91- Flickr user).

Besides formal attractions, the presence of informal attractions makes walking in Valiasr Street more enjoyable. Vendors, which are scattered along the street, play an important role in street liveability and encourage people to walk longer distances. Some of the street vendors are permanent such as Vanak Square florist, vendors around Valiasr Square and the chandleries of Tadjrish Square. Recently, Valiasr Street experienced a presence of a new group of itinerant musicians who bring life and energy to the street and have been welcomed by people. Moreover, the presence of mixed land use and vendors not only brings nightlife to the street, but it also create a safe, exciting, and enjoyable environment for pedestrians.

In addition, installation of artworks and statues along Valiasr injects a special spirit into the street and attracts people to spend more time and take pictures with the them (Figures 16a and 16b).

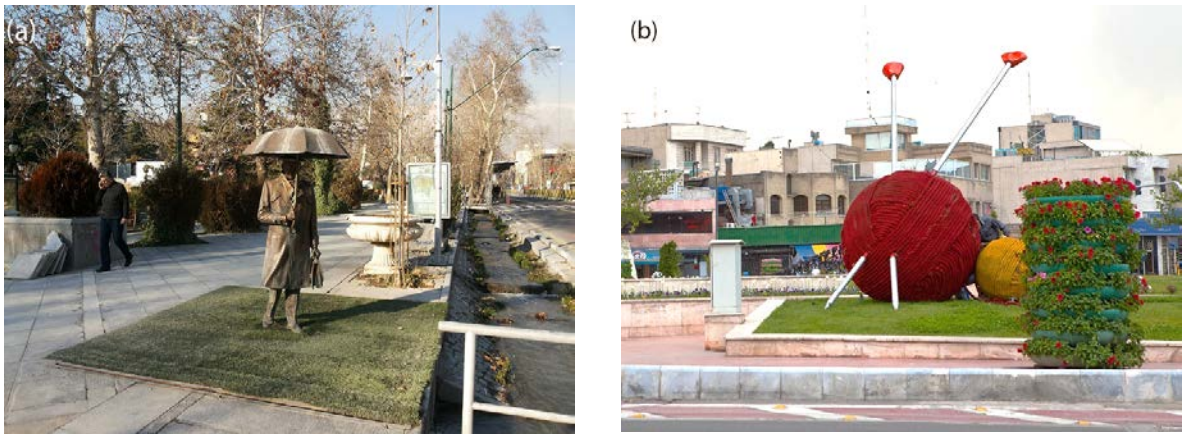

Figure 16. sample of artworks in Valiasr Street. (a) near Mellat Park (Photo by Roya Salimzadeh); (b) Vanak Square (Photo by Ninara- Flickr user).

Maintenance

At first sight, streetscape can affect our judgment and interpretation of space, which may encourage or prevent us from spending our time walking in that area. Despite beautiful rows of plain trees and several attractions along the street, in a highly polluted and busy street like Valiasr, maintenance plays an important role in the quality of streetscape. Although most parts of Valiasr's sidewalks have been refurbished in recent years, insufficient maintenance caused a gradual destruction of flooring and urban furniture that not only affects our judgment of the environment but it also increases a risk of injury for pedestrians. The consequences may result

in reducing the level of walkability and presence of people, especially elderlies and disabled pedestrians along the street. Besides flooring and urban furniture, maintenance of building facades, due to their effect on streetscape, can result in a more pleasant environment for walking that needs to be considered in some parts of the Street (Figure 17).

Figure 17. A view of facades along Valiasr Street (Photo by Roya Salimzadeh).

Amenities

Providing sufficient amenities can influence the decision of people in choosing a place for walking. Due to the changing character of Valiasr Street in its different sections, the number of pedestrians and their reasons for walking along the street differ. Therefore, each section of the street needs different types and levels of facilities to meet the demands of its users (Figure 18a). The area between Valiasr and Monirieh Square is the most facilitated section of street in terms of urban furniture, such as sitting areas, bins, and public toilets. Although other parts of the street such as Tadjrish and Vanak Squares also provide facilities for pedestrians, due to the high volume of users, their current amenities cannot meet the needs of the space's users (Figure 18b). Despite efforts for considering disabled friendly design in recent sidewalk refurbishment, such as implementing sidewalk line for blind, the poor performance and the failure in implementing an integrated project along the street resulted in an unfriendly environment for the disabled. Therefore, broken sidewalks and uneven surfaces along the street should be known as effective reasons of excluding disabled people from city life.

Figure 18. (a) sitting areas in front of City Theater (Photo by Ensi & Matthias- Flickr user); (b) lack of enough of sitting areas in Tadjrish Square (Photo by Kamyar Adl- Flickr user); (c) Resting area under the overpass motorway (Photo by authors).

Parking and public transportation

There is a possibility to use roadside parking and multilevel parking along Valiasr Street. However, due to the aim of Tehran municipality for reducing traffic volume, the number of roadside parking spaces have been reduced significantly and multileveled parking has been increased in recent years. In terms of public transport, it can be argued that Valiasr Street features a wide variety of public transportation including taxi, bus, and metro. Recently, by dedicating a special lane to Bus Rapid Transport (BRT) and opening subway stations, access to street became much easier and faster.

Pollution and cleanliness

Today, there is a growing concern about environmental pollution especially in mega cities, which threatens human health and quality of life. The mega city of Tehran, with a population surpassing 14 million, has been listed as one of the most polluted cities on earth, deals with growing environmental problems such as air, noise, and visual pollution (Motamed et al, 2015). Containing entertainment, commercial, and cultural uses, several environmental and architectural elements, and a high level of accessibility, Valiasr Street hosts a huge volume of 24-hour commute, which intensifies the level of pollution on this street. Therefore, the willingness for walking along the street for both recreational and transportation purposes becomes seriously hindered and reduced. Due to the high level of pollution, the cleanliness of facades and sidewalks is another issue that the street is struggling with.

Air pollution

Heavy traffic congestions are becoming the dominant characteristic of Valiasr Street as the longest and one of the main route of Tehran metropolitan. Air pollution, according to the Economist (2003), is the most dangerous type of environmental pollutions threatens residents' health and quality of life (Economist, 2003). Several strategies have been employed by the municipality to decrease the number of commuters especially the number of private vehicles in the street. Traffic restriction plans, changing the busiest part of the street to a one-way street, reduction of roadside parking, and improving the public transport are some of the proceedings that have been done in the research area. In the last 16 years, Tehran has experienced only 219 clean air days which equates to 3 percentage clean days in 16 years (Eghtesadnews, 2014). This high level of pollution resulted in a decline in the amount of walking travel especially with leisure purposes along Valiasr Street. Due to topographical conditions and urban form, the central and southern districts of Tehran are the most polluted parts of the city, but the level of pollution is reduced towards northern areas located at the height of Alborz mountain. The air quality control company that is a subsidiary of the Tehran Municipality releases an air quality report annually and estimates CO, NOX, SOX, volatile organic compounds (VOCs), and PM for the base year based on air quality index (AQI) (AQCC, 2015). The score for air pollution that has been calculated by Iranian national standards for 2015 is normalized and presented in Figure 19.

Noise pollution

Due to the high volume of vehicles and road traffic in Valiasr Street, especially during the day, noise pollution is inevitable. Although, noise pollution is an important issue in Valiasr Street similar to other parts of the city, having rows of robust plain trees and waterways along the street as a buffer zone, which separate sidewalk from traffic, plays an important role in reducing the level of noise and creating a more pleasant environment for a walk. However, it should be considered that due to the cut down of several trees along Valiasr in recent years, this buffer is going to be disappear. The studies by Mirsanjari and Zorufchin (2012) and Gholami et al (2012) estimate the level of noise pollution in the central area of Tehran, which

includes Valiasr Street. The score of noise pollution that has been suggested through the study is normalized and presented in Figure 19.

Visual pollution

Visual pollution is a type of pollution that is not often considered among the others. Nevertheless, it is not a new issue but it is greatly expanding, especially in mega cities like Tehran, for reasons such as ravages in building facades, a mass of advertisng, and lack of maintenance and cleanliness (Motamed et al, 2015). Moreover, the high level of air pollution, which covers everything with a layer of dust should be considered as a factor that intensified visual pollution in the street. With no exception to other parts of the city, Valiasr Street is also struggling with visual pollution. Dirty and old facades, the mass of advertising and shop signs, and a scattered tract along the street are some of the elements of visual pollution in this street which can affect the quality of space and consequently the level of walkability in the street. The score of the visual pollution bar that is presented in Figure 19 is based on the assessment of auditors. Considering the literature review, a modified walkability index and the field study in Valiasr Street, 14 factors have been recognized as influential factors on the walkability of the street. Each bar of the following graph (Figure 19) shows the scores (20 to 100) that auditors considered for each of 14 factors that have been investigated in Valiasr. The measurements of some of the factors have been extracted from literature, however, the measurement of remained factors i.e. lighting, park and garden, crossing safety, crossing availability, public toilet, public places, urban furniture, disable facilities and multi-level parking along Valiasr Street, were defined through field assessment using observation methods, including detailed field notes, photography, and self-analysis.

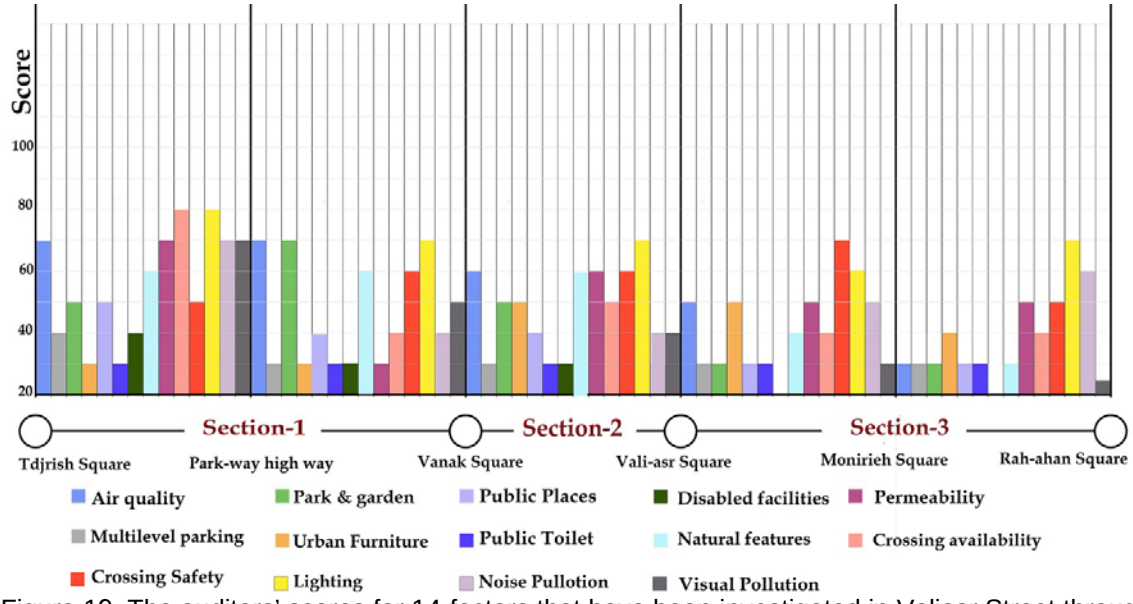

Figure 19. The auditors' scores for 14-factors that have been investigated in Valiasr Street through literature review, field assessment and observation (Source: Authors).

Policies and guidelines

Although according to Pikora et al (2003) , urban planning and transportation policies can provide additional insight into factors that could affect patterns of physical activity and walkability, the inappropriate and incorrect policies may have a negative and even destructive impact.

According to the cultural and economic importance and high volume of commuters, Valiasr Street always attracted the attention of authorities. In order to reduce the street issues such

as traffic and improving its condition, various projects have been designed and implemented along the street. Converting the busiest part of Valiasr Street to a one-way street, dedicating its west lane to BRT, and improving the public transport system are some of the actions that have been done in recent years. Considering the positive impacts of the stated actions, the implementation of these projects also had negative consequences such as crossing difficulty due to fencing along the street and limited crossways. Moreover, reducing the accessibility to destinations along the street, specifically on the west side, lack of crossing safety and decrease of roadside parking without being replaced with sufficient alternatives, not only reduced the walkability and presence of pedestrians along the street, but also resulted in severe financial losses for businesses along Valiasr. Therefore, the closure of several shops, restaurants, and cafes especially on the west side of the street threatened the economic and social life of the street.

The plain trees of Valiasr are not only a part of the street and Tehran identity, but they also have a special place in the collective mind of people. Accepting the premise that there must be a strong reason for doing this, the nighly cutting down of Valiasr trees not only caused a reduction of walkability along the street but it also weakened the sense of place and belonging to the place through the gradual elimination of elements of collective memories in this street. Lack of collaboration between the municipalities of region 1, 3, 6, and 11 that Valiasr Street passes through, is another issue that resulted in the implementation of projects and decisions without considering their influence on the street as a whole and, in some cases, without any coordination with other sectors of the street. Similar to Majid and Kashani Jou's study, which found an insufficient awareness of local authorities, poor quality of footpaths, and lack of a pedestrian master plan as the obstacle to pedestrian development in cities, this study finds a huge gap between implementing projects and policies and the requirement of walkability improvement in the city of Tehran. Moreover, due to the specific focus of this study on the issue of walkability in Valiasr Street, the findings also show the influence of key factors of walkability in each section of the street. The key findings of walkability measurement in Valiasr Street and the proposed recommendations are presented in Table 3. According to the findings, both physical and social aspects play a significant role in the level of walkability on Valiasr Street; however, the high level of air pollution over the last few years and the implementation of inaccurate policies in Valiasr Street can be considered as the most influential factors.

Table 3. Key issues and proposed recommendation for improvement of walkability on Valiasr Street based on the study findings (Source: Authors).

Components	Indicators	Key issues	Recommendations
Safety & Security	Road & Traffic	Lack of crossing safety and conflict with vehicles	Improving the crossing safety along the street through designing special paths for crossing or using overpass and underpass crossing in areas with high conflict with vehicles
		High speed of vehicles & traffic	The revision of the vehicles speeds along the street Installing speed bombs near the crossing areas
Functional	Sidewalk	Lack of maintenance, downscale material, and improper implementation	Establishing a committee for quality control of materials, monitoring the implementation process Designing a regular maintenance program for the street
Attractiveness and Facilities	Parking	Lack of alternative parking space	Designing more alternative parking such as multi-storey parking along the street

	Accessibility and convenience	Lack of accessibility to both sides of street	Improving the accessibility to both sides of street through designing more crossing path and convenient parking space along the street
	Amenities	Neglecting the disabled, elderlies and children in design of the street	Establishing research teams contains urban designers and policy makers to define the designing policies and possible solution for disabled through conducting more research and use of successful example projects around the world
		Lack of public toilets, sitting areas, and bins	Development of public amenities especially in the most crowded points of the street, e.g. near metro stations
	Maintenance	Lack of maintenance of flooring, urban furniture, and facades	Designing a regular maintenance program for the street and establishing a committee for monitoring progress
Pollution & Cleanliness	Air Pollution	High level of air pollution	Improving the maintenance of current plain trees and try to avoid cutting down any more trees Replacing the cut-down trees and vegetation with new trees.
Policies & guidelines	Policies	Planning for pedestrians	Increasing the number of pedestrian-oriented projects to be implemented at different scales Creation of consensus among experts and influencing organisations via proposed technical committee
		Executive projects	Designing a committee to examine the place of pedestrian and the impact of proposed projects and policies on the walkability of the street previous to their approval
		Municipal decisions and guidelines	Defining a way to establish more collaboration between municipalities of different regions to be able to consider the influence of any decision on walkability in the whole length of the street

CONCLUSION

A high quality walkable street as a public realm must be supported by facilities and policies based on pedestrians' needs. The research findings indicate that, although Valiasr as a walkable street is supported by its great accessibility to public transport and the existence of mixed use and diverse attractions, insufficient amenities, low crossing safety, high level of pollution, and lack of maintenance are issues that threaten street walkability. Moreover, imprudent design and policy making, the implementation of projects without considering pedestrians, and on a larger scale, the lack of vision or holistical approach for pedestrians caused severe financial losses and economic problems for local business in addition to the reduction of walkability in Valiasr. The lack of collaboration and absence of any upstream integrated plan for the distribution of duties among the municipalities of four regions that Valiasr Street passes through is another issue, which leads to inappropriate decision making with regards to the walkability of the street . The result of this study, in addition to the normalized scores for fourteen factors that is presented in this paper (Figure19), can help the municipalities of four regions to observe the status of walkability factors not only in their own region but also in other parts of the street as a whole. It also provides an opportunity for more collaboration between municipalities in decision making and in the implementation of projects for improving walkability in the street. Therefore, it can be concluded that both physical and social factors play a significant role in the walkability of Valiasr Street.

The lessons from this research can be applied to other districts of Tehran to evaluate the level of walkability and recognize the current obstacles and opportunities in each district

to be able to improve the city livability and sustainability by reducing the risk of diseases and pollution. It also raises the importance of the consideration of pedestrians in policy making and design through improving decision makers' and urban designers' awareness of different aspects of walkability. There is an opportunity for future research to investigate walkability index from pedestrians' perspective and investigate the level of people's awareness about the importance of walkability in their built environment.

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