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Research Paper

Presenting a Strategic Model of Traffic Reduction using the Analysis of the Implementation Models of Successful Countries (Case Study: Central Roads of Yazd City)

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Abstract

Transportation and moving is one of the main aspects of urban life, and organizing transportation is one of the primary needs of any healthy and good city. The existence of traffic problems in the central border of the cities is an issue that unfortunately is not given due attention by the city management, while the traffic problem causes irreparable damage to the economy of the city and the country. Therefore, the purpose of this research is to achieve a strategic model of traffic reduction in the central roads of Yazd city by using the analysis of implementation models of successful countries. The current research is applied in terms of purpose and descriptive-analytical in terms of nature and method. In order to analyse the data and to adopt the strategic model necessary to reduce the traffic of the central roads of Yazd city, the SWOT model has been used. The results of this research show that the total weighted score of internal factors is 1/93, which is less than the average of 2/5. As a result, it can be said that the weak points in the area of traffic reduction in the central roads of Yazd city are superior to its strong points. Also, the total weighted score of external factors is 1/6, which is less than the average of 2/5. It can be said that the threats in the field of reducing the traffic of the central roads of Yazd city are superior to its opportunities. And according to the internal and external factors of the central roads of Yazd city as well as the implementation models of successful countries, defensive strategies should be prioritized to reduce the traffic of the central roads of Yazd city.

Keywords: Central Roads, Successful Countries, Traffic, Yazd City

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1. Introduction

Along with its merits and advantages, transportation brings with it disadvantages and limitations for its users. One of the undesirable aspects of this phenomenon is the traffic and the damages caused by it (Aslani et al., 2017: 734). Today, due to the development of urbanization and more use of technology and machine life in recent decades, most societies are facing a problem as traffic (Khashaypoor et al., 2022: 782). The development of cities introduced a new scale of access and transportation systems in urban planning, which was different from traditional definitions. Before the industrial revolution, the size, proportions and distances of the city were based on the human scale and the movement pattern was also based on the movement of the pedestrian. In fact, humans determined the size and distances, but with the beginning of the industrial revolution, which brought the rapid growth and expansion of cities, on the other hand, with the invention of the automobile and its use, speed and convenience in transportation became possible; It caused the pedestrian to gradually lose his position in the space of the roads, and on the other hand, the division of uses and their separation based on housing, work, shopping, etc. in our modern urban development, increased the distances (AASHTO, 2010). Today, transportation, commuting and communication activities have changed a lot and these changes have been regardless of the environmental conditions and the favorable human environment. In such a way that it has created many problems for people, especially in terms of transportation and disorder in the urban road network (Litman, 2011: 2). However, almost all cities are under the pressure of heavy traffic, which has led to many urban problems (Roman, 2014: 295).

The main problem facing urban management in the field of intra-city transportation is traffic, environmental pollution caused by the excessive use of private cars and its adverse effects on urban life and the mental health of people in the community (Bibri and Krogstie, 2017: 450). The integration of transportation modes, which coordinates the coordination of all modes of transportation such as pedestrians, bicycles, motor vehicles, buses, and railways, is an important issue for the safety and sustainability of urban transportation systems (Chen et al., 2017: 238). Also, the coexistence of bicycles and public transportation is an essential element for sustainable urban transportation. In developing and advanced countries, the strategic planning of urban transportation is the first goal to improve pedestrian and bicycle transportation and reduce car consumption. However, in countries with high dependence on cars, cars are not only the focus of transportation systems, but also generally drive the planning decision-making process (Cheng and Chen, 2015: 387). In other words, the transportation planning of motor vehicle regulations is a wrong policy. This wrong policy and planning causes low access to bicycles and pedestrians and less ownership of bicycles and pedestrians (Conrow et al., 2018: 164). This is despite the fact that public transportation policies can not only lead to the reduction of car congestion and the resulting air pollution, but can also bring important health benefits, including increased physical activity (Rojas-Rueda et al., 2016: 2).

Currently, cities such as Oslo in Norway, Paris in France, Stockholm in Sweden, Istanbul in Turkey, Amsterdam in the Netherlands, Helsinki in Finland, etc. intervention methods such as the health protection method (creating pedestrian and bicycle access networks, calming the passage and review in the central sector (restrictions on private vehicle traffic, strengthening the public transportation network, etc.); decorative protection method (priority of pedestrian movement in the central part, allocation of some main routes for pedestrian crossing, directing crossing routes to peripheral accesses, etc.); The method of urban reconstruction (slowing down the movement of

pedestrians, creating uneven intersections for pedestrians with historical and cultural axes, equipping the pedestrian network with two elements of water and plants, etc.); Local-thematic method (calming the traffic noise in the areas and complexes of the central sector, creating special lanes and special areas for rapid transit, transferring fast transit traffic outside the area and complexes of the central sector, etc.) and The comprehensive method of urban restoration (separation of vehicular movement from pedestrians, limiting the volume and number and speed of vehicles allowed to pass in central and historical areas, defining the hierarchy of pedestrian access networks, slow and fast, etc.) in the central part of the city have implemented and managed to control the volume of traffic to positive results of achieve (Habibi, 2013: 40). Transportation is deined as the movement of products from one location to another location. It also refers to shipping the products from the beginning of a supply chain to the end customers and or consumers. Since few products are produced and consumed in the same location, transportation proves to play an important role in the supply chain. Moreover, transportation costs are regarded as an important part of the total supply chain cost (Hassanzadeh et al., 2018: 60)

In Iran, with the gradual dominance of motorized vehicles over urban spaces and passages, urban planning and design has been moving away from the scale and human need for bicycles and pedestrians, and as a result, the values and social and cultural attractions of urban spaces have decreased. In this process, the concept and function of compatible and desirable urban elements such as neighborhood, street, square, pass, ditch, etc. have changed qualitatively and substantively and lost their rich human content (Farrokhi, 2009: 2).

The central core of the city of Yazd, with a historical texture that includes localities with special characteristics in terms of texture and religious, historical and cultural centers, the historical background of this part and the presence of these centers in it, has caused more socio-cultural solidarity among the citizens. The functions of this area (the central area of Yazd city) have caused the formation of a deep relationship between the function and the urban form, and in recent years, along with these initial nuclei, new nuclei have been formed and caused the formation of two different cultures as well as different social relations in the city. Is. In general, it can be said that with the change and relocation of the different urban contexts of Yazd, a different urban culture prevails, which is caused by the effects of urban plans and planning, which has caused the morphology of the city to become multiplicity in the social, economic and cultural sectors (Hajforoush, 2016: 56-57). But in year 2024, the most important problem in the field of traffic in Yazd city; Increase the average speed on the main roads. Therefore, special attention should be paid to how to reduce the traffic on the roads of Yazd city, especially the central roads. Also, today, the central part of Yazd city is facing many problems in terms of management, economic, social, physical, facilities, urban equipment and other urban services and facilities. The use of personal cars and motorcycles has provided such that more than 70% of households in Yazd city have cars and more than 50% of households have motorcycles (first rank in the country), which causes problems in the central part of Yazd city, including the safety and security of roads, increasing congestion Traffic, increase in driving accidents, failure in the transportation network, lack of marginal parking, lack of cohesion in pedestrian traffic, etc. One of the important factors in road accidents is the existence of critical segments in arterial transport roads, which investments should be done in order to increase safety and improve these points (Hadadi and Shirmohammadi, 2018: 2). With these interpretations and problems, it can be said that in addition to the need to reduce traffic in contemporary urban spaces and in line with the goals of sustainable

urban development in the era of globalization, the final orientations on patterns coordinating the function of urban uses with urban transportation, the need to organize traffic reduction, especially for The central roads of Yazd city very important and necessary seem to be.

In this regard and according to the above contents, the main goal of the research is to achieve a strategic model of traffic reduction in the central roads of Yazd city by using the analysis of the implementation models of successful countries. Therefore, the main question of the research is what are the strategies to reduce traffic in the central roads of Yazd city?

In comparison with previous researches, it can be said that in previous studies in the field of traffic reduction, the effective criteria of traffic reduction were evaluated according to the investigated environment identified in an urban space. However, there is no research that considers traffic reduction with the implementation models of successful countries in the field of traffic reduction. Also, it is the first time in this field that a case example is evaluated according to the implementation models of successful countries in the field of traffic reduction. Most of the previous studies have evaluated the evaluation of traffic reduction in a certain area or only the role of a criterion and its impact on urban roads, but this research evaluates the strategic model of traffic reduction exclusively with a case study of the central roads of Yazd city in an integrated and comprehensive manner. It should be noted that the previous researches were only limited to the investigation of traffic, but this research, after examining and measuring the patterns of traffic reduction based on the operational models of successful countries in the field of traffic reduction according to the criteria and standards (so far, scientific research and investigation based on the operational models of successful in the field of reducing traffic and standards regarding reducing traffic in the central roads of Yazd city), presenting and prioritizing strategies in Yazd city and then proposing a strategic model have been discussed.

2. Materials and Methods

The current research is applied in terms of purpose and descriptive-analytical in terms of nature and method. The collection of information in this research is by library, document and survey method. The necessary information for the present research was obtained according to the purpose of the research and through documents, magazines, books related to the subject, internet sources, statistics and reports of the traffic police and municipality, the results of the general population and housing census and the detailed plan of the city of Yazd. Due to the specialization of the subject, the statistical population of the research is municipal experts, traffic police, as well as university professors in the field related to the subject. For the selection of experts, a judgmental (intentional) purposeful sampling method has been used, in this way, an expert was accepted as the most expert and trusted expert, and 30 experts were selected as selected experts. The amount of Cronbach's alpha coefficient to determine the stability level of the questionnaire tool is equal to it was calculated as 0/897, which indicates high and acceptable stability of the questionnaire. In this research, it has been tried to use SPSS and Excel software to perform calculation operations, draw graphs and analyze data. In order to analyze the data and to adopt the strategic model necessary to reduce traffic in the central roads of Yazd city, the SWOT model has been used.

2.1. SWOT Analysis

The term SWOT stands for strengths (S), weaknesses (W), opportunities (O), and threats (T), and the process of identification, evaluation, and assessment of the potentially effective internal and external variables is conceptually referred to as SWOT analysis SWOT analysis is a systematic analysis method

for the identification of internal and external factors and strategy development in order to create the best adjustment and harmony among them. The following steps should be taken to prepare the matrix of strengths, weaknesses, opportunities, and threats:

1) Identification of internal factors, including the key strengths and weaknesses as well as establishment of the internal factor evaluation matrix (IFE)

2) Identification of internal factors, including the key opportunities and threats and production of external factor evaluation matrix (EFE)

3) Drawing the internal-external matrix

4) Development of proposed strategies using the matrix of weaknesses, strengths, threats, and opportunities (SWOT)

Using SWOT analysis, it is possible to obtain four types of strategies through the internal and external factors: aggressive strategies (SO), competitive strategies (ST), conservative strategies (WO), and defensive strategies (WT) (Hatefi, 2018: 101-102).

Criteria (C_i)	Weight (w_j)	Unit	Alternatives (A_i)		performance value
			A_1	...	A_m
C_1	w_1	Q	$(a_{11}^E, b_{11}^E, c_{11}^E)$	...	$(a_{1m}^E, b_{1m}^E, c_{1m}^E)$
C_2	w_2	N	$(a_{21}^E, b_{21}^E, c_{21}^E)$	...	$(a_{2m}^E, b_{2m}^E, c_{2m}^E)$
⋮	⋮	⋮	⋮	...	⋮
C_n	w_n	Q	$(a_{n1}^E, b_{n1}^E, c_{n1}^E)$	...	$(a_{nm}^E, b_{nm}^E, c_{nm}^E)$
Weight score	1		$\tilde{R}_1^E$	...	$\tilde{R}_m^E$
BNP			R_1^E	...	R_m^E

Source: Kuo et al., 2009

Environment	Coordinate value	Alternatives A_1	...	Alternatives A_m	Benchmark
Internal	Weighted score (R_i^I)	$\tilde{R}_1^I$	...	$\tilde{R}_m^I$	$\tilde{A}^I$
	Coordinate value (IC)	$\tilde{R}_1^I - \tilde{A}^I$	...	$\tilde{R}_m^I - \tilde{A}^I$	
External	Weighted score (R_i^E)	$\tilde{R}_1^E$	...	$\tilde{R}_m^E$	$\tilde{A}^E$
	Coordinate value (EC)	$\tilde{R}_1^E - \tilde{A}^E$	...	$\tilde{R}_m^E - \tilde{A}^E$	

Source: Kuo et al., 2009

3. Case Study

Yazd city is the center of the central part of Yazd city. This city, as the center of the district, has a very convenient location in terms of access, and due to the large population and the concentration of services in it, as an important urban center, it can play the role and function of a district well, which has different urban roads in the form of a hierarchy of road networks (Figures 1). The concentration of industrial workshops, the establishment of educational and university units at different levels and the facilities of health care services that have trans-regional and national functions have caused a strong concentration of the population in the central area of Yazd city and have given a multi-functional role to Yazd city (Saraei and Hajforoush, 2021: 93). The city of Yazd, with a population of 729,673 people, one of the big middle cities is (Iran Statistics Center, 2021). Also, the research work process is specified (Figure 2).

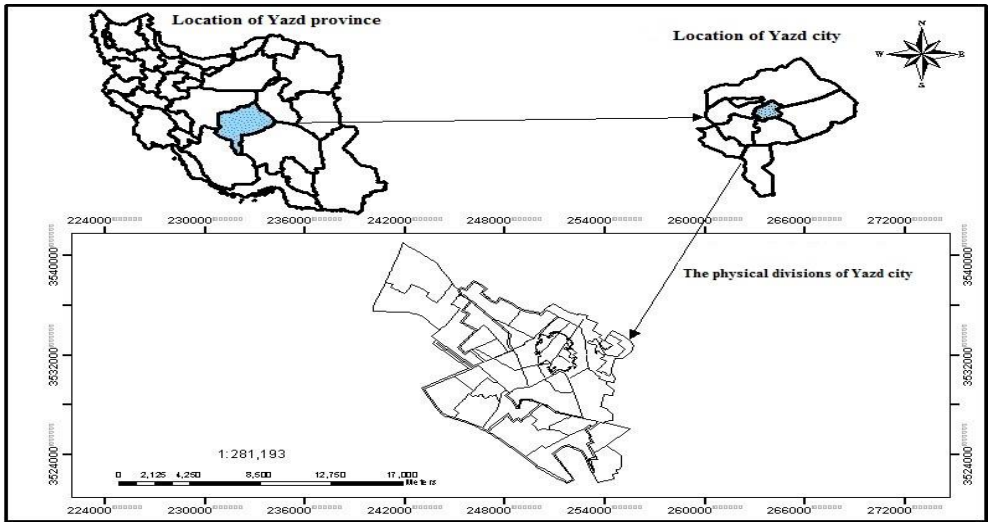

Figure 1. Location and physical divisions of the Study Area
Source: Authors, 2024

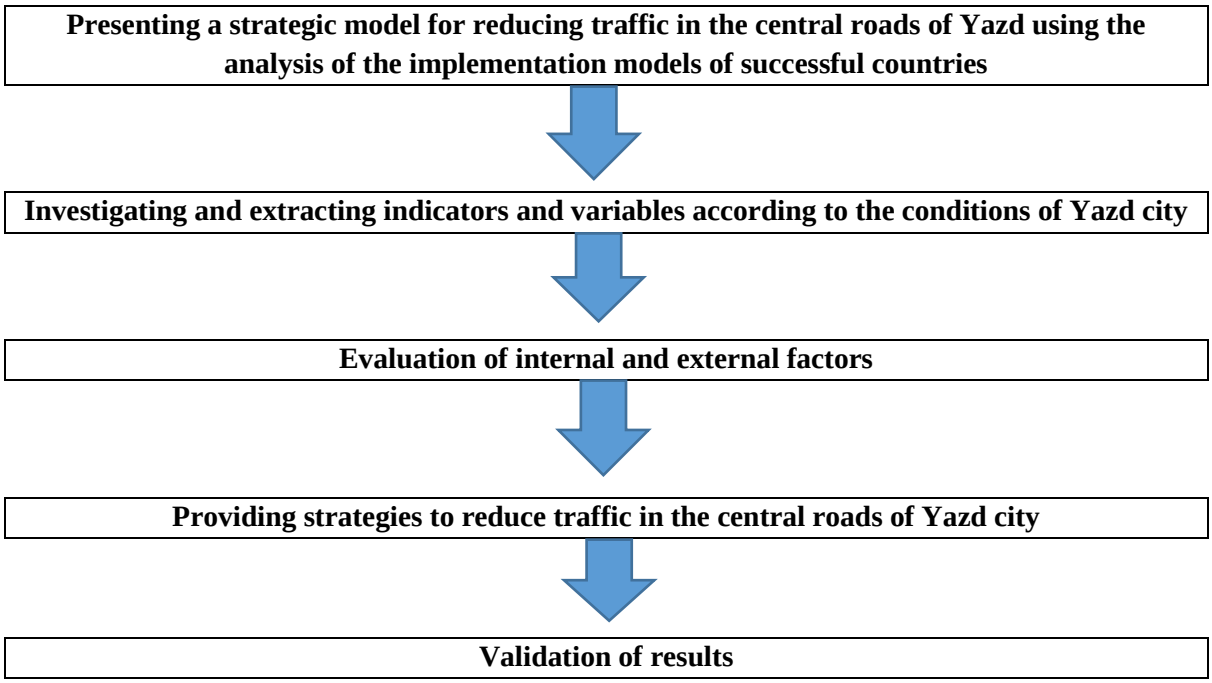

Figure 2. Research process, Source: Authors, 2024

4. Results

In this section, according to the research approach, the analytical findings based on the SWOT statistical test have been used to answer the research questions and finally generalize to a larger society (statistical society). For this purpose, in this chapter, firstly, to identify and evaluate the environmental factors (including the factors of the internal environment i.e. strengths and weaknesses) and (the factors of the external environment i.e. opportunities and threats) according to the variables in the internal and external environments to reduce the traffic of the central roads of Yazd city. Been paid. Then, according to the internal and external factors of Yazd city and the implementation models of successful countries in the field of traffic reduction, all the strategic factors of traffic reduction in the central roads of Yazd city have been identified.

4.1. Descriptive Findings

Table 1 shows the descriptive findings of this research:

Table 1. Descriptive research findings

Gender	Gender	frequency	percentage
	Man	27	90
	woman	3	10
	Total	**30**	**100**
Education level	Literacy level	frequency	percentage
	bachelor	8	26/6
	Master's	5	16/7
	PhD	17	56/7
	Total	**30**	**100**
Age structure	Age structure	frequency	percentage
	40-25	14	46/7
	55-40	10	33/3
	+ 55	6	20
	Total	**30**	**100**

Source: Authors, 2024

4.2. Internal and External Factors

To carry out research and analysis of the findings, the most important strengths, weaknesses, opportunities and threats of reducing traffic in the central roads of Yazd city by using statistical analysis of the current traffic

situation and also by using intuitive judgments, discussions and dialogues of the statistical community of the research such as municipal experts. Traffic police as well as university professors in the field related to the subject were identified according to the theoretical literature and extracting some of them from the background section related to the present subject. And following the example of most successful European and American and even Asian cities because it has taken place in Oslo, Paris, Amsterdam, Stockholm, Malaga, Helsinki, Istanbul, Kansas, etc. In Table 2, the constructive matrix considered for statistical analysis is introduced:

Table 2. Matrix of strengths, weaknesses, opportunities and threats to reduce traffic in the central roads of Yazd city

Strengths - S	Weaknesses- W
1. The possibility of choosing multiple riding routes from the origin to the destination due to the checkered transportation network structure 2. Separate commuting routes in most two-way streets 3. Separation of riding and walking routes 4. Appropriate width of most sidewalks 5. Sufficient number of public transport fleet 6. Using taxis (line taxi), especially in the central areas of the city 7. Appropriate coverage of most streets 8. Simplicity and short routes 9. Slope of movement paths	1. Lack of use of intelligent intra-city transportation systems (such as video surveillance, mechanized speed control, violations, etc.) 2. Absence of traffic restrictions such as traffic plan limits or restrictions on the entry of heavy vehicles 3. Unbalanced distribution of urban services and uses that attract the population (medical centers, offices, etc.) 4. Many branches and entrances in the central streets of the city 5. The width of the roadway is not suitable for its function 6. The lack of widening of some central roads due to their location in the historical context 7. The low level of permeability of historical tissues 8. Lack of multi-storey parking 9. Increase in public transportation fare (taxi, bus, etc.) 10. Lack of attractiveness and cleanliness of public transportation 11. Not allocating a special path for cyclists and pedestrians 12. Inattention of pedestrians to use the flyover 13. Lack of mechanization of high-traffic bridges 14. Increasing parking on the edge of the city's central streets 15. Defects in traffic light operation 16. Lack of pedestrian traffic lights at intersections, intersections, squares, and the middle of busy roads. 17. Aimless patrolling of citizens
Opportunities - O	Threats- T
1. Taking advantage of the implementation models of successful countries in the field of reducing traffic 2. The support of political institutions and the increase of government budget for the construction and rapid development of public transport hardware	1. Weakness of driving culture and prevalence of single passenger cars 2. Lack of cultural integration to develop cultural programs for traffic 3. Excessive production of cars 4. Not decommissioning used cars 5. Technical defects of cars

3. The existence of high technical and operational potential in the development of smart systems and new technologies in the field of reducing traffic	6. Cheap fuel prices
4. The great power of the media in changing the perspective of traffic	7. Absence of single and integrated urban management and lack of coordination of some custodian organizations
5. Existence of technical infrastructure to use the ITS system	8. Ignoring the master plan and its approvals in the executive program of the municipality
6. Advancement of technologies used in traffic control and management	9. Ignoring traffic rules and regulations
7. Welcoming schools and educational centers to provide necessary traffic training to different people	10. Non-observance of citizenship rights and violation of each other's rights
8. Evaluation of the existing situation and the use of experts to correct and eliminate the defects of the central roads	11. Lack of executive guarantee of traffic law and regulations
9. Existence of upstream documents in the field of urban transportation (comprehensive transportation plan)	12. The city's population growth does not fit with the growth of the road network, followed by an increase in traffic and traffic accidents
10. Great motivation and willingness of citizens to participate	13. The increase in the city's population during Nowruz trips and the unresponsiveness of the city's central roads
11. Existence of historical and ancient centers in some routes leading to the city center in order to turn them into pedestrians	14. The high rate of pendulum migration to the city of Yazd (difference between day and night population)
12. Allocating suitable spaces for non-motorized vehicles such as pedestrians and cyclists by creating sidewalks and traffic control and management	15. People's willingness to use private transportation over public transportation
13. Low average age of citizens for the development of non-motorized transportation	16. Greater growth of private transportation facilities than public transportation
14. Correct location of necessary parking lots in central roads	17. Not paying attention to the simultaneous planning of transportation and land use in the past years
	18. Lack of a comprehensive vision and proper study for the future development of city streets and passages

Source: Authors, 2024; Adapted from Maljaars, 2020; Nævestad, 2022; Puyt et al., 2023; Shamlitsky et al., 2023; Sharifian et al., 2023

In this research, the IFE and EFE matrix has been used to evaluate the internal and external strategic factors. The Internal Factors Evaluation (IFE) matrix is a tool for examining internal factors. In fact, it evaluates the strengths and weaknesses of the organization's units, and the evaluation matrix of external factors (EFE) is a tool for analyzing how the managers of the organization respond and face the opportunities and threats outside the organization. After identifying the internal and external factors, the strengths, weaknesses, opportunities and threats in the field of reducing traffic are identified and in the matrices of internal and external factors, each of these factors is scored according to the importance of each of these factors in reducing traffic of the central roads of Yazd city have been taken into account. In the next stage, each factor is assigned a weighting factor between zero (unimportant) and one (very important), where normalization is used for weighting. The coefficient given to each factor indicates its relative importance in success; Regardless of whether the factor in question is considered as an internal strength and weakness of the organization or opportunities and threats outside the organization, the factor that has the greatest effect in reducing traffic in the central roads of Yazd city was given the highest coefficient and vice versa. Then, the status of each factor is determined with a score between 1 and 4 (1 = poor, 2 = average, 3 = above average, and 4 = very good), which is called

"score of the current status". If the management of the organization seeks to reduce weaknesses or threats, it will receive a high score regarding the weakness or threat, and on the contrary, if the strengths and opportunities are not managed well, it will receive a low score. Therefore, the weighted or weighted score of each action has been calculated, for this purpose, each row of internal and external factors of the organization has been multiplied by the normalized weight and inserted in a new column. At this stage, the sum of the weighted points is calculated. If the final score of IEF in the field of reducing traffic is less than 2/5, this means that the area of reducing traffic in the central roads of Yazd city is weak in terms of internal factors. Also, if the final EFE score of the area of reducing traffic is less than 2/5, this confirms that the area of reducing traffic in the central city of Yazd does not work well in terms of using opportunities and dealing with threats (Tables 3 and 4).

Table 3. Matrix of Internal Factors (IFE)

Internal strategic factors	normalized weight	existing weight score	weighted score
Strengths - S			
The possibility of choosing multiple riding routes from the origin to the destination due to the checkered transportation network structure	08/0	3	24/0
Separate commuting routes in most two-way streets	04/0	2	08/0
Separation of riding and walking routes	03/0	3	09/0
Appropriate width of most sidewalks	02/0	3	06/0
Sufficient number of public transport fleet	03/0	2	06/0
Using taxis (line taxi), especially in the central areas of the city	06/0	3	18/0
Appropriate coverage of most streets	01/0	3	03/0
Simplicity and short routes	04/0	3	12/0
Slope of movement paths	04/0	4	16/0
Weaknesses- W			
Lack of use of intelligent intra-city transportation systems (such as video surveillance, mechanized speed control, violations, etc.)	08/0	2	16/0
Absence of traffic restrictions such as traffic plan limits or restrictions on the entry of heavy vehicles	07/0	1	07/0
Unbalanced distribution of urban services and uses that attract the population (medical centers, offices, etc.)	06/0	1	06/0
Many branches and entrances in the central streets of the city	05/0	1	05/0
The width of the roadway is not suitable for its function	01/0	2	02/0
The lack of widening of some central roads due to their location in the historical context	02/0	2	04/0
The low level of permeability of historical tissues	02/0	2	04/0
Lack of multi-storey parking	03/0	1	03/0
Increase in public transportation fare (taxi, bus, etc.)	03/0	1	03/0
Lack of attractiveness and cleanliness of public transportation	03/0	2	06/0
Not allocating a special path for cyclists and pedestrians	03/0	1	03/0
Inattention of pedestrians to use the flyover	03/0	2	06/0
Lack of mechanization of high-traffic bridges	03/0	1	03/0
Increasing parking on the edge of the city's central streets	05/0	2	10/0
Defects in traffic light operation	02/0	2	04/0
Lack of pedestrian traffic lights at intersections, intersections, squares, and the middle of busy roads	04/0	1	04/0

Internal strategic factors	normalized weight	existing weight score	weighted score
Aimless patrolling of citizens	05/0	1	05/0
Total	1	-	93/1

Source: Authors, 2024

Table 4. Matrix of External Factors (EFE)

External strategic factors	normalized weight	existing weight score	weighted score
Opportunities - O Taking advantage of the implementation models of successful countries in the field of reducing traffic	04/0	1	04/0
The support of political institutions and the increase of government budget for the construction and rapid development of public transport hardware	04/0	2	08/0
The existence of high technical and operational potential in the development of smart systems and new technologies in the field of reducing traffic	03/0	2	06/0
The great power of the media in changing the perspective of traffic	03/0	2	06/0
Existence of technical infrastructure to use the ITS system	03/0	1	03/0
Advancement of technologies used in traffic control and management	03/0	1	03/0
Welcoming schools and educational centers to provide necessary traffic training to different people	03/0	2	06/0
Evaluation of the existing situation and the use of experts to correct and eliminate the defects of the central roads	04/0	1	04/0
Existence of upstream documents in the field of urban transportation (comprehensive transportation plan)	03/0	2	06/0
Great motivation and willingness of citizens to participate	03/0	2	06/0
Existence of historical and ancient centers in some routes leading to the city center in order to turn them into pedestrians	03/0	4	12/0
Allocating suitable spaces for non-motorized vehicles such as pedestrians and cyclists by creating sidewalks and traffic control and management	03/0	1	03/0
Low average age of citizens for the development of non-motorized transportation	02/0	3	06/0
Correct location of necessary parking lots in central roads	03/0	2	06/0
Threats- T Weakness of driving culture and prevalence of single passenger cars	04/0	1	04/0
Lack of cultural integration to develop cultural programs for traffic	03/0	1	03/0
Excessive production of cars	03/0	1	03/0
Not decommissioning used cars	04/0	1	04/0
Technical defects of cars	03/0	1	03/0
Cheap fuel prices	03/0	1	03/0
Absence of single and integrated urban management and lack of coordination of some custodian organizations	03/0	2	06/0
Ignoring the master plan and its approvals in the executive program of the municipality	03/0	2	06/0
Ignoring traffic rules and regulations	03/0	2	06/0

External strategic factors	normalized weight	existing weight score	weighted score
Non-observance of citizenship rights and violation of each other's rights	03/0	2	06/0
Lack of executive guarantee of traffic law and regulations	03/0	1	03/0
The city's population growth does not fit with the growth of the road network, followed by an increase in traffic and traffic accidents	04/0	2	08/0
The increase in the city's population during Nowruz trips and the unresponsiveness of the city's central roads	03/0	1	03/0
The high rate of pendulum migration to the city of Yazd (difference between day and night population)	03/0	2	06/0
People's willingness to use private transportation over public transportation	03/0	1	03/0
Greater growth of private transportation facilities than public transportation	03/0	2	06/0
Not paying attention to the simultaneous planning of transportation and land use in the past years	02/0	1	02/0
Lack of a comprehensive vision and proper study for the future development of city streets and passages	03/0	2	06/0
Total	1	-	6/1

Source: Authors, 2024

As can be seen in Table 3, the factors of multiple riding routes from the origin to the destination have the most important strength due to the checkered transportation network structure with a weight of 0/08, and the factor of suitable coverage of most streets with a weight of 0/01 has the least strength. Also, the factors of using intelligent urban transportation systems (such as video surveillance, mechanized speed control, violations, etc.) with a weight of 0/08 have the most important weakness and the factor of the width of the thoroughfare and its performance with a weight of 0/01 have the least weakness (total The weight score in this table is 1/93, which is less than the average of 2/5. As a result, it can be said that the weaknesses of the area of traffic reduction in the central roads of Yazd city are superior to its strengths, and in terms of internal factors, it has weaknesses. Also, the factors of using the executive models of successful countries in the field of reducing traffic, supporting political institutions and increasing the government budget for the construction and rapid development of public transport hardware and the use of experts to correct and fix the defects of central roads with a weight of 0/04 are the most important opportunities and The factor of low average age of citizens is the least opportunity for the development of non-motorized transportation with a weight of 0/02. But the factors of driving culture and traffic of single-passenger cars, the state of decommissioning of worn-out cars and the growth of the city's population with the growth of the road network with a weight of 0/04 are the most important threats and inhibiting factors and the simultaneous planning factor of transportation and land use in the past years with a weight 0/02 is considered to be the least threat and deterrent factor in the field of traffic reduction in the central roads of Yazd city (according to the total weighted score of 1/6, which is less than 2/5, it can be said that the threats in the area of traffic reduction in the central roads of Yazd city outweigh its opportunities and from the point of view of external factors, it has a threat, so it is confirmed that the area of reducing traffic in the central city of Yazd does not work well in terms of using opportunities and dealing with threats) (Table 4). Based on the SWOT model, scores

between 1 and 4 have been given to each of the internal and external factors (the second column of tables 3 and 4) and in the third column, the product of the weight in the score of each factor was calculated. As seen in the above tables, the total weighted score of internal factors is 1/93. While the weighted score of external factors is 1/6, it shows the relative superiority of internal factors in comparison with external factors. The matrix of implementation strategies and priorities in the field of traffic reduction in the central roads of Yazd city is shown in Figure 3. The sum of the final scores of the evaluation of internal factors is shown on the X-axis and the sum of the final scores of the evaluation of external factors is shown on the Y-axis. The point of intersection of the points of external and internal factors in the field of reducing traffic in the central roads of Yazd city on the axis of X and Y determines the position of this sector in the matrix of strategies and executive priorities. The position of the traffic reduction area of the central roads of Yazd city in the matrix of strategies and implementation priorities determines the appropriate strategies to improve the traffic reduction situation of the central roads of this city. These strategies are strategies based on the defensive environment in the management planning of the area of traffic reduction in the central roads of Yazd city. Therefore, during planning, putting the basis of defensive strategies is a priority.

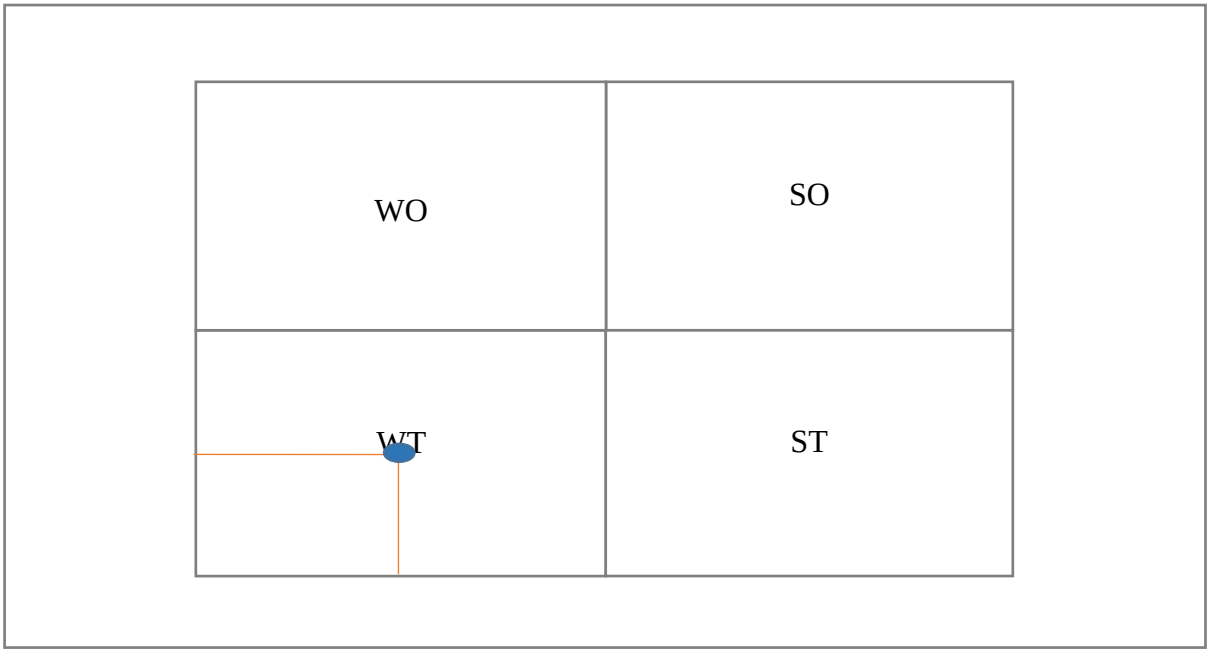

Figure 3. Matrix of implementation strategies and priorities in the field of reducing traffic in the central roads of Yazd city; Source: Authors, 2024

4.3. Traffic Reduction Strategies in the Central Roads of Yazd City

According to SWAT analysis, internal and external factors were investigated. In order to better deal with the strengths, weaknesses, opportunities and threats of traffic in the central roads of Yazd city, appropriate strategies should be prepared. After comparing the information related to internal and external factors and according to the implementation models of successful countries, in the next stage, the types of possible strategies in SO, ST, WO and WT categories have been obtained in the form of Table 5.

Table 5. Strategies or strategies defined separately

	Strength S1…… S9	Weakness W1…… W17
opportunity O1….O14	SO SO1: early and even odd scheme SO2: One-way design SO3: Converting some streets leading to the central area of the city to pedestrians and reducing the volume of traffic in this way SO4: Construction of fast track or BRT SO5: Plan for organizing medical centers and clinics	WO WO1: Construction of multiple parking lots, especially multi-storey ones WO2: Creating a separate bicycle path and organizing sidewalks WO3: Creation and mechanization of pedestrian bridges WO4: Traffic light timing correction WO5: Installation of pedestrian lights
Threat T1…..T18	ST ST1: Encourage carpooling ST2: Construction of intermediate refuge, safety islands, as well as markings, signs and direction signs ST3: Revealing the bases of the electric lampposts as well as the lighting of the central streets of the city at night ST4: controlling the technical defects of cars and restricting the use of non-standard cars in terms of environment and... ST5: Education and cultural creation in the media regarding traffic, as well as placement of the traffic discussion as a subject in schools and universities	WT WT1: Reduce the number of junctions and entrances on some streets to enter the city center WT2: providing facilities for the use of public transportation (such as free tickets, monthly payment, etc.) by organizations to employees to encourage the use of public transportation and monitoring for taxi fares WT3: More serious monitoring of drivers' traffic behavior, such as motorcyclists' violations, speed limit, moving between lanes, special movements and sudden lane changes, etc., especially taxi and Snap drivers, through the regular presence of police forces and mechanized cameras WT4: demand-based bus network redesign WT5: Creating a memorandum of understanding with education to use schoolyards as parking lots during holidays, especially on busy days of the year

Source: Authors, 2024

Assuming no interdependence between the main factors of SWOT, the matrix of paired comparisons of the main factors is formed by experts using a scale of 1 to 9. Pairwise comparison matrix using the software, Expert Choice is analyzed and the weight vector is obtained. It is worth noting that the compatibility ratio is CR, which is used to measure the validity of comparisons, and if it is greater than 0/1; Comparisons should be made again (Table 6).

Table 6. Pairwise comparison matrix of groups SWOT

SWOT groups	Strength points	weak points	Opportunity points	Threat points	degree of importance
Strength points	1	1/2	1/3	1/3	0/103
weak points	2	1	1/2	1/3	0/157
Opportunity points	3	2	1	1/3	0/251
Threat points	3	3	3	1	0/488
compatibility ratio			-		**CR=0/05**

Source: Authors, 2024

5. Conclusion

In scientific research, drawing conclusions from the results and findings of the research from the analysis of the data collected from the society or a statistical sample is considered one of the most important stages of conducting the research and distinguishes the research from other similar researches. In this section, in order to achieve the goal and more accurate results, 30 municipal experts, traffic police and university professors in the field related to the subject were questioned and each of them gave answers according to their different conditions. In the questions of various variables, the strengths, weaknesses, opportunities and threats of reducing traffic in the central roads of Yazd city by using the statistical investigation of the current traffic situation and comparing their related information, as well as identifying and prioritizing strategies to reduce traffic in the central roads of Yazd city according to the models The implementation of successful countries has been used and in general, the questions are appropriate to provide a strategic model for reducing traffic in the central roads of Yazd city.

According to Table 5, the strategies for reducing traffic in the central roads of Yazd are: SO1: early and even odd scheme SO2: One-way design SO3: Converting some streets leading to the central area of the city to pedestrians and reducing the volume of traffic in this way SO4: Construction of fast track or BRT SO5: Plan for organizing medical centers and clinics WO1: Construction of multiple parking lots, especially multi-storey ones WO2: Creating a separate bicycle path and organizing sidewalks WO3: Creation and mechanization of pedestrian bridges WO4: Traffic light timing correction WO5: Installation of pedestrian lights

ST1: Encourage carpooling ST2: Construction of intermediate refuge, safety islands, as well as markings, signs and direction signs ST3: Revealing the bases of the electric lampposts as well as the lighting of the central streets of the city at night ST4: controlling the technical defects of cars and restricting the use of non-standard cars in terms of environment and... ST5: Education and cultural creation in the media regarding traffic, as well as placement of the traffic discussion as a subject in schools and universities WT1: Reduce the number of junctions and entrances on some streets to enter the city center WT2: providing facilities for the use of public transportation (such as free tickets, monthly payment, etc.) by organizations to employees to encourage the use of public transportation and monitoring for taxi fares WT3: More serious monitoring of drivers' traffic behavior, such as motorcyclists' violations, speed limit, moving between lanes, special movements and sudden lane changes, etc., especially taxi and Snap drivers, through the regular presence of police forces and mechanized cameras WT4: demand-based bus network redesign WT5: Creating a memorandum of understanding with education to use schoolyards as parking lots during holidays, especially on busy days of the year. In total, defensive strategies (WT) should be prioritized to reduce traffic in the central roads of Yazd city.

5.1. Discussion

The results of this research with the results of the introduction and the research literature that came to the conclusion that in order to improve the transportation of urban roads in order to reduce traffic, a health protection method should be used (creating access networks for riders and pedestrians, calming traffic in the central part (restrictions on vehicle traffic) private vehicle), strengthening the public transportation network, etc.); decorative protection method (pedestrian priority in the central part, allocation of some main paths for pedestrian crossing, directing crossing paths to peripheral accesses, etc.); The method of urban reconstruction (slowing down the movement of pedestrians, creating uneven intersections for pedestrians with historical and cultural axes,

equipping the pedestrian network with two elements of water and plants, etc.); Local-thematic method (calming the traffic noise in the areas and complexes of the central sector, creating special lanes and special areas for rapid transit, transferring fast transit traffic outside the area and complexes of the central sector, etc.) and The comprehensive method of urban restoration (separation of vehicular movement from pedestrians, limiting the volume and number and speed of vehicles allowed to pass in central and historical areas, defining the hierarchy of pedestrian access networks, slow and fast, etc.) is on the agenda. It has a direct relationship because based on the results of the current research, the proposed strategies for reducing traffic in the central roads of Yazd city are in line with the results of the research literature and are consistent.

The limitations of this research were that considering that little research has been done in the field of the subject of the research, in the field of collecting information and providing a strategic model of traffic reduction in the central roads of Yazd city by using the analysis of the implementation models of successful countries in the field of traffic reduction It has faced many problems and there was no written and reliable information in the field of determining these patterns. Also, due to the specialization of the subject, our statistical community included a group of experts and they were not present in every place and time, and in certain places and times. There were special people present, which was also time-consuming and tiring for the questioning group.

5.2. Recommendations

1. Construction of multiple parking lots, especially multi-storey ones, and prohibiting marginal parking on one side of the street and charging fees for parking on the other side of the street in the central thoroughfares of Yazd city.
2. Using smart traffic lights (priority with public vehicles first, buses, then taxis, and then traffic congestion at intersections, which encourages the use of public transportation and optimal use and saving time).
3. The creation of a separate bicycle path on Farrokhi St. starts from Azadi Square and continues to the historical context (anti-clockwise from the city center).
4. Encouraging carpooling or carpooling through the special service of offices for employees (separately for men and women), service for students, etc., as well as changing the working hours of offices according to the coordination of organizations.
5. One-way network planning of Farrokhi, Imam Khomeini, Fahadan, Seyed Golsarkh, Imamzadeh, Motahari, Shahid Rajaei and Qiyam streets (anti-hourly in the city center).
6. Demand-based bus route network redesign using AVL and AFC.
7. Methods Construction of rapid transit line or BRT.
8. Organizational plan of medical centers and clinics in Taleghani Street.
9. Pedestrian Street of Yazd Qiyam Street.

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