

Prioritization the types of urban transportation, using a TOPSIS method, a case study in Tehran, Iran.

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Abstract:

Millions of passenger and cargo movement per day, indicating transport is important, so that we have become one of the most important necessities of life. Without it, human life is stagnating. However, its disadvantages such as noise and air pollution, the cost of repair and the occupied space should not be ignored. The system can be managed efficiently promoted it. In this paper we review the many articles on a variety of factors, ideal for an optimal transport were identified. Then the weighted criteria, we designed a questionnaire for it, and we have verified Experts. Cronbach's such that 0/79, respectively. 150 questionnaires among urban elites, stakeholders and the general public were distributed, and based on their input, we measure the weight. The types of urban transportation in Tehran was identified. And we recognize the importance of each criterion for each vehicle obtained TOPSIS method. The metro highest weight and lowest weight was accounted for motorcycles. And finally, for improving metro transportation infrastructure development and private sector participation was offered

Key word: transportation, criteria, metro, topsis, urban.

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1. Introduction

Nowadays, due to the growing trend of communication between the different economic sectors and increase in interaction with the outside of the world, the world systems of transportation with the feature of the optimization, expenses, speed and safety for services is undeniable. In this context, that must be able to manage the transportation of all its potential, the highest efficiency achieved with minimal cost.[1] Transportation within the city's urban system is one of the key elements that provide context and mobility of people and citizens to access and use the various parts of the city. The rapid increase in the transportation of motor vehicles especially in Tehran metropolis with population growth and uncontrolled expansion and lack of scientific planning and comprehensive transportation system difficulties cause severe public health problems such as environmental pollution, high traffic density and tedious, very time consuming citizens, excessive consumption of energy insecurity routes and accidents. Moreover, it is difficult to live in this environment and the welfare is a range of degradation. [2] Today, the calm and passion in your car as part of urban culture in most countries has become undeniable. And urbanization has caused transport needs of everyday people to become one of the most important and most challenging issues. [3].The contribution of the transport sector in the GDP of countries confirms the government focus more on the issue. Economic development is impossible without the development of transport infrastructure. Social and economic phenomena are strongly tied to the issue of transportation and weaknesses in these areas can have negative effects on these phenomena. Employment to millions of transportation (car manufacturing to management and operation) itself a big challenge in front of decision makers, planners and government have. [4]. While inventing the wheel might not be the greatest service to humanity, but also the invention will become the biggest threat to human societies. It is too late now to go back and life would be impossible without transportation, so what? With considering these advantages, but there are a lot of problems in Tehran's transport system which have to planner for research in the field of urban management, which should be prioritized by vehicles. [5] Tehran because of high traffic congestion and the time to reach the destination by car in most cases is far less than public transport. The pace of development of streets and highways, is far more than the development of public transportation (construction of 250 KM of road and freeway for seven years in Tehran). [6] A reliable car is a good investment. Manufacture and supply of



automotive indiscriminate far higher than the actual demand (demand is an important part of the attractiveness of investment in this sector). Instead of focusing on the public transport sector continues to expand its rail bus system is emphasized in the passages (passages that are used jointly with private cars). The cost of using their own vehicles to increase fuel rate remains low for most users is justified. [7] So our goal in this article is to answer such questions as to why such a situation arises and what should do to fix it based on some criteria? In the last two decades of the 20th century, there was growing concern about pollution in major cities, and in particular about the large contribution made by road transportation sources to this problem (Mcnicol et al., 2001). [8] Government legislation on ICE emissions and fuel quality substantially improved the air quality in cities through reduction in regulated pollutants. Current researches about alternative-criteria of vehicles and Research related to various aspects of transportation, such as pollution, traffic, types of vehicles, substrates for transport, the transportation costs and related travel are well grounded. The scope of research includes the direction of development (Morita, 2003; Harding, 999), [9] comparison of alternative-fuel vehicles (Maggetto and Van Mierlo, 2001; Johnsson and Ahman, 2002), [10] impact evaluation (Kazimi, 1997; Matheny et al., 2002; Brodrick et al., 2002), [11] batteries (Moseley, 1999), [12] policy (Nesbitt and Sperling, 1998), [13] costs (DeLucchi et al., 2002; Delucchi and Lipman, 2001), [14] market (Sperling et al., 1995), [15] Diane M. Phillips (A social network analysis of business logistics and transportation 2002), [16] Toan Tran and Brian H. Kleiner (Managing for Excellence in Public Transportation, 2005) etc. [17] In addition, some research is related to the evaluation of alternative vehicles and its attribution. (Poh and Ang 1999). [18] Applied forward and backward analytic hierarchy process (AHP) to analyze the transportation fuels and policy for Singapore. Winebrake and Creswick (2003). [19] Also applied AHP to evaluate the future of hydrogen fueling systems for transportation. Both of these teams utilize scenario analysis to build their evaluation model. A similar approach is applied in this current research. In this paper, alternative fuels and vehicles are considered for their potential to displace oil as the main and only source of transport fuel and provide further convenient for personal and public usage. The evaluation of alternative-criteria priority of vehicles should be considered from various aspects; for example, energy, efficiency, emissions, technologies, costs, facilities and so on. The multi-attribute evaluation process is thus used in this paper. The AHP is used to



determine the weights of evaluation criteria. The AHP, introduced by Saaty (1980), [20] is known as a pairwise comparison method and a popular method in evaluation problems. There is a lot of research on the application of decision analysis techniques to transportation, energy and environmental planning, such as the researches of Tzeng et al. (1992, 1994), [21] VICOR is compared and used to rank the alternative criteria priority of vehicles. The multi attribute evaluation of alternative criteria priority was performed by the experts from different decision making groups, such as bus users, the social community, and the operators. The selection of the best vehicle mode has to be done according to several competing (conflicting) criteria. This decision-making problem has no solution satisfying all criteria simultaneously. The compromise solution of the problem of conflicting criteria should be determined, and the criteria could help the decision makers to reach their final decision. The compromise ranking method is applied to determine the best compromise alternative-criteria priority of vehicles. In addition AHP model system, determine the cost of trips by different modes of transportation were in Tehran in 2012. And then calculate the average value of time for business trips in 2012, the cost of travel time is also calculated. According to the results of the surveys and the cost of travel time, according to different criteria, we chose the best type of transportation. For testing and verifying the usability of this methodology, we illustrate the evaluation of alternative criteria of vehicle of Ukraine urban areas as an empirical example. The results can prove the effectiveness of this method and illustrate the directions for future development and the weakness of the best alternative, which make it easy to implement in the future.

2. Establishing the evaluation criteria

The evaluation of alternative fuel modes can be performed according to different aspects. Four aspects of evaluation criteria are considered in this paper such as social, economic, technological, and transportation. In order to evaluate the alternatives, 11 evaluation criteria are established, as follows: (1) **Energy supply**: This criterion is based on the yearly amount of energy that can be supplied, on the reliability of energy supply, the reliability of energy storage, and on the cost of energy supply. (2) **Energy efficiency**: This criterion represents the efficiency of fuel energy. (3) **Air pollution**: This criterion refers to the extent a fuel mode contributes to air pollution, since vehicles with diverse modes of fuel impact on air differently. (4) **Noise pollution**: This criterion refers



to the noise produced during the operation of the vehicle. (5) **Costs of implementation**: This criterion refers to the costs of production and implementation of alternative vehicles. (6) **Costs of maintenance**: The maintenance costs for alternative vehicles are the criterion. (7) **Vehicle capability**: This criterion represents the cruising distance, slope climbing, and average speed. (8) **Road facility**: This criterion refers to the road features needed for the operation of alternative vehicles (like pavement, and slope). (9) **Speed of traffic flow**: This criterion refers to the comparison of the average speed of alternative vehicles for certain traffic. If the speed of traffic flow is higher than the vehicle speed, the vehicle would not be suitable to operate on certain routes. (10) **Sense of comfort**: This criterion refers to the particular issue regarding sense of comfort, and to the fact that users tend to pay attention to the accessories of the vehicle (air-conditioning, automatic door, etc.). (11) **Urban landscape**: Urban Landscape is a series of natural and artificial factors that affect natural features, cultural, socioeconomic, or formed in a city shelter. Urban landscape of quality and desirability of cities, real and concrete and tangible result of observation and understanding of the various manifestations including buildings, spaces, activities, sounds, smells, and when faced with the phenomenon of citizen (at various scales, ranging from distant view of the city or town or even when placed on the establishment of structures).

3. Method

For this paper, the most important factor for a favorable transportation, basis of many papers be detected. Then we designed a questionnaire and we confirm it by expert of this field. As the cronbach's became 0/79. And for weighting them, the questionnaire among 150 city managers, urban management students, professionals and transport drivers were distributed. After we obtain the ideal mode, then by TOPSIS method the criteria's were classified. TOPSIS as a multi-criteria decision-making as a powerful technique for prioritizing options, option selects the shortest distance from the ideal solution and the farthest distance from most Non-efficient be answered. This prioritization is done through a special algorithm and near the largest coefficient (CL_i^*) is calculated, it will be a top priority.

$$CL_i^* = \frac{d_i^-}{d_i^- + d_i^+}$$

In this method, the quantitative and qualitative criteria can be simultaneously involved in the assessment, and a considerable number of criteria considered. Furthermore, system performance is acceptable and desirable and can be the perfect way to quickly and easily applied. Quantitative output of this method is the final weight options [22]. According to the literature, 11 the criteria for selecting the best means of transport have been identified. Means of transport are divided into nine categories. Given the importance of each criterion out of opinions of respondents to the questionnaire were specified in Table 1 were completed. And In table 2 Results of TOPSIS and weigh each option and priority for the application using them is shown.

Table1: weight of each criteria.

Criteria	Energy supply	energy efficiency	Air pollution	noise pollution	employment cost	maintenance cost	vehicle capability	road facility	speed of traffic flow	sense of comfort	city picturesque
Weight of each criterion	۲,۵	۲,۶۶	۴,۶۷	۲,۲۵	۲	۲	۲,۲۵	۴,۲۲	۲,۸۵	۴,۵۲	۲
Line bus	1.67	3.24	3.24	3.2	4	4.32	4.36	4.32	5	3	1.53
Taxi	2.56	2.35	4.32	3	2.89	2	2.53	2.36	3.67	4	2.36
Metro	2.65	3.27	2.42	1.32	2.36	1	3.42	2.45	3.26	3.53	2.36
Motorcycle	3	2.27	4.32	4.32	3.24	4	2.53	3.27	4.68	3	3
Bicycle	3	4.32	5	4.65	3.12	2.23	3	4.23	3	2.36	3.24
Mini bus	3.26	3.45	4.65	3.21	3.26	2.35	2.98	2.34	4.27	3.24	2.25
Personal car	2.36	4.01	4.65	3.25	3.42	2.45	1.95	2.34	3.27	3.24	2.25
BRT	3.25	3.36	2.43	2.21	1.33	1	3	3.24	4.36	4.35	3.43
Van	3.65	3.89	5	2.27	2	3.25	2.32	4.22	4.67	5	3.53

4. Result

Based on the results of questionnaires about the importance of different options for a suitable vehicle, respectively, in Table 1, for most people, experts and

stakeholders, traffic speed factor considered most important factor. And gave it the highest weight among other criteria. Criteria in Table 2 as well as Table 1, were experts. Based on the ideal of a vehicle (air pollution, noise pollution, comfortable, capable vehicle, energy supply, energy storage, cost of deployment, etc.) the best vehicle is picked up. That the vehicles listed as BRT, bus lines, bicycles, minibuses, taxis, vans and motorcycles, Metro as the best means of transport, given the circumstances and resources transportation in Tehran was chosen. For ranking the most important factor to consider appropriate measures of a vehicle, the data obtained from the questionnaire, we used the method TOPSIS. This TOPSIS combines the data from Table 1 and Table 2, the most important and least important criteria, scholars and stakeholders from the viewpoint ranked vehicle types. Thus the highest weight allocated to the subway. The lowest weight was given to the minibus.

Table2: Results of TOPSIS and weigh each option and priority for the application

Alternatives	Weight of each alternative	Priorities
Line bus	0.430751	6
Taxi	0.584598	2
Metro	0.623197	1
Motorcycle	0.407115	9
Bicycle	0.430321	7
Mini bus	0.415834	8
Personal car	0.551404	4
BRT	0.552906	3
Van	0.463297	5



5. Conclusion

Now shipping, the largest pro- humanity and the biggest current problems as being human. So that everyday millions of people are displaced, many social exchanges provide and handling billions of financial transactions deals. Along with many other benefits that can be many problems such as air pollution, noise pollution, accidents, cost of deployment and maintenance costs noted. Nowadays, many vehicles are used in cities. Tehran is also important that such a situation. But the priority to allocate resources and capital are the most important concerns for investors. Prioritizing the various items based on various articles, the most important factors were identified for a vehicle. Then we designed a questionnaire and distributed it among the elite and urban stakeholders have. Among the criteria that they quickly became the most important selection criteria. Then, based on these criteria, the best vehicle, the subway was selected. Then, taking into account the income Tehran, two factors were considered time and cost of travel. The appropriateness of the important features, such as passenger coefficient, velocity, displacement, less pollution, better urban landscape, comfort and higher energy supply, as compared to other vehicles such BRT, line Bus, taxi and van were given more weight . Therefore Meanwhile, Tehran topographic structure of the lipids, that the dip in many different areas and biking there is the possibility of high air pollution. Minibus and motorcycles, as well as the low importance found, should be removed or replaced by a system of transportation that appropriate alternatives such as electric motors vans with better fuel use. Thus, according to the results of the research, as well as concessions, willingness to invest in the transport sector, Rules and regulations to facilitate the transport sector in the city, Subway passengers safe Services, increasing employment rates, balance of home and work, reduce emissions, reduce energy consumption and efficient use of land and transportation, reducing traffic costs associated with traffic a large part of the funds and resources should be used to extend the subway. Also the urban planner have to overcome the weaknesses of this system to transport such as: Long-term return on investment in the transport sector, Metro travel demand is low due to the large crowd's users, Low levels of consumer culture and participation Metro, Disorders in land use around stations, The high cost of construction and maintenance of facilities and adjacent land, Lack of car parking near the station, Long walking path in the metro area, the possibility of disease transmission in crowded metro areas, the low quality of the trains, In order to further the welfare of passengers and citizens.



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