

## Energy and Environmental Issues in Transport Sector

Alipour, S.<sup>1</sup>, Karbassi, A. R.<sup>2\*</sup>, Abbaspour, M.<sup>3</sup>, Saffarzadeh, M.<sup>4</sup>, and Moharamnejad, N.<sup>1</sup>

<sup>1</sup>Faculty of Environment & Energy, Science & Research Branch, Islamic Azad University, Tehran, Iran

<sup>2</sup>Graduate Faculty of Environment, University of Tehran, P.O.Box 14155-6135, Tehran, Iran

<sup>3</sup>Faculty of Environment and Energy, Science and Research Campus of IAU, P. O. Box 14515-775, Tehran, Iran and School of Mechanical Engineering, Sharif University of Technology, P. O. Box 11155-8639, Tehran, Iran

<sup>4</sup>Civil & Environmental Engineering, Tarbiat Modares University, P. O. Box 14155-143, Tehran, Iran

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**ABSTRACT:** Nowadays, transportation sector consumes about 27 percent of the whole energy in Iran. Therefore, after domestic and business sectors which consume about 40 percent of the whole energy, transportation is placed in the second rank. However, the financial value of transportation is of the highest importance. Moreover, having 55percent of gasoline product consumption transportation has been also ranked as the largest consumer of gasoline products. Gasoline consumption in transport showed an increase until 1979. During 1980-1981, it decreased slightly and from 1982 have had a permanent upward trend. Oil products consumption in transport sector in 1950 has been less than average 15 million barrels (equivalent to crude oil) per year. In 1990, the above amount was approximately 140 million barrels per year, while in 2000; this amount was 20.7 times more than 1960s. Gasoline consumption in transport sector is about 98percent of the whole gasoline consumption in Iran. Since gasoline burning vehicles are consuming nearly all gasoline supply in the country; thereafter vehicle number is a determining factor in estimation of gasoline consumption. Investigations showed that the number of gasoline burning vehicles has increased constantly from 1960. The activities of domestic automotive factories have increased since 1970. Excessive demand for personal cars in 1990 and 2000s have caused enormous amount of cost for government to import gasoline and gas oil yearly. Thereupon, the energy management seems to be an inevitable necessity for transport sector. During the past ten years, by increasing car ownership and the moderate prosperity, the ratio of trips from 1.5 million has been reached to almost 15 million travels during the day. This huge number causes many other problems such as consuming about 12 million liters gasoline by vehicles in Tehran. More than 2 million vehicles are traveling in Tehran during a day. Tehran bus system can transfer about 1 billion passengers and the subway system transfers about 200 million passengers annually.

**Key words:** Transport, Energy, Demand, Supply, Pollution, Environment

### INTRODUCTION

In the recent years, transport sector has been widely studied in Tehran and other parts of world. Ghiasinejad and Abduli (2007) studied the transport of municipal waste from technical and financial views. Shafie-pour *et al.* (2007) analyzed the emission of greenhouse gases from various sectors in Iran. They assessed the total health damage from air pollution in 2001 at about US \$ 7 billion; equivalent to 8.4% of nominal Gross Domestic Production (GDP) in Iran. Shifting the global attention from the fossil fuels towards the renewable clean sources of energy would play a key role in preparing

the required infrastructure for achieving the global energy and environmental security (Mossalanejad, 2009). Shafie-Pour Motlagh and Farsiabi (2007) estimated the trend of total energy subsidies from 2003 (about 16.68 % of GDP) and they predicted that energy subsidies will reach to 20% of GDP by 2019 in Iran. Karbassi *et al.* (2008) analyzed the potential of energy savings in commercial building at Tehran. Due to low costs of various energy carriers, a very limited energy saving potential can be achieved in Iran (Karbassi *et al.*, 2008). Karbassi *et al.* (2007) concluded that Iran's energy consumption pattern is unsustain-

\*Corresponding author E-mail: arkarbassi738@yahoo.com

able and consumption oriented. According to Tehrani *et al.* (2009) e-shopping is an effective method in reduction of air pollution. Hence, considerable decrease of energy consumption (71 %) and air pollution (39 %) resulted from substitution of delivery vans with personal cars for delivery services of supermarket goods in Tehran. Low prices of oil and gas in some countries has lead to inefficient use of energy and such trend of consumption may lead to deterioration of the environment (Campbell and Laherrere, 1998). Today, the U.S. transportation sector accounts for one-third of all U.S. end-use sector CO<sub>2</sub> emissions, and if projections hold, this share will rise to 36% by 2020. U.S. transportation is also a major emitter on a global scale (Bernow and Dougherty 2000; ACEEE, 2005).

## RESULTS & DISCUSSION

Statistics show that in critical air pollution days in Tehran, the number of respiratory patients is increasing "up to 60percent". "Tehran Air pollution leads to decrease 5 years of lifelong of Tehran habitants. International statistics of air pollution damages present that air pollution diseases have the fourth place in death ratio According to the UN report, every year 3 million people die because of the air pollution. Researches conducted by the Air Quality Control Company and the Ministry of Health and Medical Education of the Islamic Republic of Iran also suggest that the ratio of air pollutions in Tehran is 2.8 times higher than the world standard. Based on this report, annually 4000 people die of air pollution in Tehran; in addition to the mentioned number, the same number of Lung cancer patients has been exposed to nitrogen oxides. Every day, 1200 tons emissions are spreading in the air of Tehran.

Urban Management Authorities have divided Tehran into 22 districts. The total area of these districts is about 750 Km<sup>2</sup>. There could be counted two types of Roads Network in Tehran. First, the Functional (Major) Roads network which has a fundamental role in Tehran transport operated within Tehran urban model. This network includes main highway roads, arterials and collector streets and local accesses which have more than 2700 km length. The second type is Minor Roads Network with no fundamental role in Tehran transportation and consisted of alleys, blind alleys and minor roads. It should be mentioned that just the roads with more than 8 m width could be laid in up to 3100 km length in the legal borders of 22 districts. In the total 2371 km length of Tehran Major Roads networks, there are 374 km highway, 180 km ramp and loop, 299 km first grade (major) arterial, 459 km second grade (minor) arterial and 1,419 km collector and local access. According to the Major Roads network, the major lengths are in districts 2, 4 and 6 but due to the very vast area of districts 2, 4 and 5, the ratio of the roads area to the whole area is a better indicator for comparison. Based on the Major Roads, the highest rates are in district 6 with 15.6percent and the next is district 8 with 14.1percent. Among the whole 22 districts, the longest average major roads are reported 28.6 m and 27.6 m in district 18 and 5, respectively. The next longest major roads are the districts 2 and 4 with 24.8 m. The lowest average major roads are 14.9 m in district 17, meanwhile; the average of major roads width is less than 17.7 m in district 10. Share of different transport mode and their type in the traffic of Tehran are shown in Table 1 and 2. It should be mentioned that, the share of private vehicles traveling in urban trips has been estimated about 40percent.

**Table 1. Share of different transport mode in Tehran (%)**

Quantitative target	Performance in 2008	Estimation in 2009	objective of Comprehensive Plan in 2025	Transportation Development Rule of 2011	Approved 5-year plan	
					2008	2009
Share of urban Trains in inter-city trips	6	7	30	30	6	7.3
Share of Buses and Mini-buses in the urban trips	19.6	19	25	25	21	21.5
Share of Cabs, Vans and Automobile Agencies within the urban trips	23.5	24	20	20	22	22
Share of all kinds of services in urban trips	10	10	0	--	10	9
Total share of Public and Semi-public transportation	59.1	60	75	75	59	59.8

**Table 2. Share of different types of Vehicles functioning in Tehran**

Vehicle Type	Share in Traffic Volume (percent)
Private cars	64
pick up trucks	14
motorcycle	4
Cabs and Private Passenger Cars	3
others	15

Source: Tehran Comprehensive Traffic and Transportation Studies Company

**Fuel Consumption Rate and Types**

At present, there are so many problems in transportation amongst them energy and fuel consumption indicators are of vital importance. About 98.5percent of gasoline and 48.5percent of gas oil consumed in Tehran in 2007 are issued to transport section. Gasoline consumption by transport sector in 2007 has exceeded 4.3 million m<sup>3</sup> that shows a 4% increase when compared with 1999. That shows average annual growth of 4.4 percent in gasoline consumption in this sector during 1999-2007. In 2007, the transportation sector has emitted 27.2percent of SO<sub>2</sub>, 97.2percent of HC, 98percent of CO, 52.1percent of NO<sub>x</sub> and 91.1percent of SPM. In general, transport sector has a share of more than 90 percent of total air pollution emissions. Meanwhile, the emissions mentioned in this section have been on average 4.2percent increase per year during 1999-2007. The highest annual increase in emissions was related to the gases carbon monoxide and suspended particles, by 4.4percent and 3.6percent, respectively. Total motor gasoline consumption in 2007 was 64.5 million L/day that in comparison with the last year have increased by 12.5percent. From this amount, about 5216 million L (22.2percent of the total amount of the country) was in Tehran Province and related to the consumption of motor gasoline per person which is equivalent to 379 L. In this regard, the Province has been in the 6<sup>th</sup> place among other consumption parts in the whole country (motor gasoline consumption in the City of Tehran has been 3451321000 L). Motor gasoline consumption has been 3811317000 L in Tehran City in 2006, and it was 5908314000 L in Tehran Province.

**Gas Oil Consumption**

This trend has been continued in 2007. During the last year, consumption of Gas Oil reached to 89.7 million L/day that shown a growth by 4.1 percent compared to a year earlier. Thereupon, natural gas has been replaced by gas oil in the cold season due to the natural gas shortage in other sectors. Gas oil is applicable

more diverse rather than other products. Among the Provinces of the country, the highest consumption Gas oil was reported in Tehran Province with share of 11.5percent (Gas oil consumption value in Tehran Province has been 3784 million L and in Tehran City was 1866526000 L/yr). The consumption of Gas oil in Tehran has been 2287097000 L in 2006.) In these years, 54percent of Gas oil has been consumed in transportation sector. Therefore, total gas oil consumption of transportation sector in 2006 was 1007924040 L in Tehran which has been 2043360000 L in Tehran Province and 1235032380 L in Tehran City.

Motor gasoline consumption in 2008 reached 67 million L/day that in comparison with last year has a growth of 3.7percent. Due to gas rationing and supplying it with fuel smart card, then, the upward trend of consumption in 2008 was related to factors such as increasing the number of automobiles, increased traffic and the normalization consuming process after this quota. Average daily consumption of each vehicle in Tehran, counting each 3.5 motorcycle a car in the recent year was about 5.8 L. Also at the same time, per capita consumption of motor gasoline reached to 342 L/yr. Motor gasoline consumption in Tehran Province has been 2008.5545 million L (22.6 percent of the total) in this year. Motor gasoline consumption per capita was 403 liters per person that in this regard it was the 4<sup>th</sup> place among the other provinces. Motor gasoline Consumption in Tehran has also been 3645540000 L in the same year. Gas oil consumption was 29.5 million L/day in 2008 that has 3.1percent growth in comparison with the previous year. The main reason for increasing the consumption of this product has been delivering more Gas Oil to power plants and increasing of construction projects. Among the whole Provinces, Tehran Province has owned the highest consumption with the share of 10.6percent. Oil Gas Consumption in Tehran Province has been 3593 million L (10.6percent of the whole country) and at the city of Tehran has been 1724918000 L. Also in this year, 54percent of the total amount of Oil Gas has been consumed in transportation sector. Thus, the consumption Oil Gas in transportation sector in Tehran Province has been 1940220000 L in Tehran Province and 931455720 L in Tehran City.

**Evaluation of Iran Travel Demand Management**

The most important plans and policies regarding travel demand management (Table 3) can be summarized as follows:

1. Restriction of traffic in central area of Tehran
2. Turn traffic restriction in the range of emergency vehicle air pollution in Tehran
3. Limited expansion of electronic government services and remote services, such as the IVR service organiza-

tions and various agencies, online registration of entrance examination of universities and other different test

4. Limited expansion of e-shopping, such as electronic train ticket reservation.

5. Legislation the limited rules about travel demand management

6. Light goods displacement service

7. Decentralization of major service centers and the creation of representative offices and various local police agencies

8. Banking system and creation of electronic systems, including ATM, POS and Phone bank and limited pay bills electronically

9. Create and develop specific lines for public transport (subway and BRT)

Considering the impact range of different management strategies on travel demand (Table 4) within the urban travel, strategies of comprehensive plan are dividing into five main groups as follow:

1. Strategies with impact range of travel elimination

2. Strategies with impact range of spread spectrum traffic at peak traffic hours

3. Strategies with impact range of changing the used Transportation mode

4. Strategies with impact range of shortening the distance between the source and destination

5. Strategies with impact range of travel route selection

**Table 3. Hierarchy of developed visions, outlines, strategies and travel demand management plans in traffic and transportation comprehensive plan**

vision	Outlines	str at egies	plans
In 2025 in Tehran where many trips will be made within urban management and new technologies to eliminate or change management model. In the similar year, Tehran electronic - Internet will strength. The city will be without administrative bureaucracy and the variety of travel patterns based on sustainable transport development	Decrease citizens' life stresses and improve their quality of life	Reducing the number of urban trips	develop electronic banking system and strengthening e-commerce and e-learning
	Improve environment indexes and decrease different emissions	Increase the range of peak hour traffic volume traveling less	Establish a planning and demand management and information technology in transportation center
	Minimize extra traffic demands and balance between demand and supply	Reduce private vehicle use and change the used transport method	Changing pattern of symptoms to receive a personal vehicle
	Decrease nonrenewable and limited energy and fuel resources	Decreased the length of urban trips and reduce travel time within the city	Time management of different activities
	Make optimal use of financial resources in transportation infrastructure projects and development of supply	Shifting the optimum travel routes	Increase effectiveness of public transit systems
		Reduce air pollution caused by urban transport	Management of public transport subsidies
		Optimizing urban trips pattern	Transfer some activities and jobs to other cities
		Decrease energy usage	Decentralize different activities and services and make multi-city
		Increase urban trips comfort	Establish and develop complex stationeries
		Decrease the worries about urban trips	Upgrade and modernize urban transportation systems

**Table 4. Effect of the proposed management strategies on travel demand with reduced travel range impact**

rows	axis	Suggestive solutions for decrease daily trips	Influence range		Number of daily motorized trips in 2025
			Percentage of decreased daily trips	Number of decreased daily trips	
<b>short-term and middle-term strategies</b>					
1	1	distance work based on working at home	45%	81000	17919000
2		Intensive working week	55%	99000	17901000
3		Intensive educational week at schools and distance learning	1.84%	331200	17668800
4	2	Develop giving information and distance services, improving its financial circulation and services	1.8%	324000	17676000
5		Establish and develop e-banking services	3.3%	594000	17406000
6	4	Developing distance shopping services	0.6%	108000	17892000
7		Reviewing side intakes from the owners of personal vehicles based on multivariate functions	75%	135000	17865000
8		Activities of studies and programming center in travel demand management and information technology in transportation and especial committees of travel demand management*	1.4%	252000	17748000
9	3	Decentralization based on decreasing 10% of the government employees along with their families	3.21%	577800	17422200
<b>Combined strategies</b>					
10		using strategies 4-5-6-7	7%	1260000	16740000
11		using strategies 4-5-6-7-9	10.21%	1837800	1612200
12		using strategies 4-5-6-7-8	8.4%	1512000	16488000
13		using strategies 4-5-6-7-8-9	11.61%	2089800	15910200
14		using all the strategies	13.9%	2502000	15498000

\* If the policies and travel demand management strategies number was executed, then, the number of daily trips in Tehran will reach to 18000000, if the estimation of growth rate of per capita travel in 2025 will be 1.45. In comprehensive plan of 2025, approximately 9 million people have been estimated to make 18 million roadway trips in a day. Table 5 illustrates the status of allocated trips in the case that no solution executed in the field of travel demand management practices and if the travel demand management strategies aimed at reducing travel. Due to the scenarios mentioned earlier, re-

duction of travel are shown in Table 6 and note that based on these Tables, a decrease by 13.9 percent was occurred. But, if the criterion is the (highest level of) maximum of Tehran population, then distribution and sharing journeys in the absence of implementing travel demand management strategies are as described in Table 7. In case of using strategies in likely state allocation of trips, the results are as shown in Table 8. It can be seen that, if the population reach to 10.5 million residents, it is necessary to use management strategies of travel reduction so the maximum daily trips will not exceed 18 million trips in Tehran.

**Table 5. Transportation indexes in Tehran in 2025 without applying Travel Demand Management Strategies with maximum of 9.1 million travels**

system	vehicle	Daily trips in 2025		Transferring factor in trip	Total daily trips	Number of required vehicles
		portion	number			
Private	Motorcycle	3	54000	1	54000	30000
	Automobile and trucks	22	3960000	1	3960000	2000000
Public	Urban train	30	5400000	1.5	8100000	440
	Bus	22	3960000	1.6	6363000	11000
	Mini-bus	3	540000	1.8	972000	4500
Semi-public	Vans	5	900000	1.7	1530000	11000
	Any kind of taxies	15	2700000	1.5	4050000	100000
total		100	18000000	—	25488000	2426940

**Table 6. Transportation indexes in Tehran in 2025 by applying travel demand management strategies (TDM) with impact domain of travel elimination (Likely option)**

system	vehicle	Daily trips in 2025		Transferring factor in trip	Total daily trips	Number of required vehicles
		portion	number			
Private	Motorcycle	3	464940	1	464940	250000
	Automobile and trucks	22	3409560	1	3409560	1700000
Public	Urban train	30	4649400	1.5	6974100	400
	Bus	22	3409560	1.6	5455296	9000
	Mini-bus	3	464940	1.8	836892	4000
Semi-public	Vans	5	774900	1.7	1317330	900
	Any kind of taxies	15	2324700	1.5	3487050	80000
total		100	15498000	—	21945168	2052400

**Table 7. Transportation indexes in Tehran in 2025 without applying trip demand management strategies with maximum 10.5 million travels**

system	vehicle	Daily trips in 2025		Transferring factor in trip	Total daily trips	Number of required vehicles
		portion	number			
Private	Motorcycle	3	627000	1	627000	30000
	Automobile and trucks	22	4598000	1	3960000	2000000
Public	Urban train	30	6270000	1.5	8100000	440
	Bus	22	4598000	1.6	6363000	11000
	Mini-bus	3	627000	1.8	972000	4500
Semi-public	Vans	5	1045000	1.7	1530000	11000
	Any kind of taxies	15	3135000	1.5	4050000	100000
total		100	20900000	—	25488000	2426940

**Table 8. management strategies with impact range of travel elimination (possible options) with maximum population of 10.5 million**

system	vehicle	Daily trips in 2025		Transferring factor in trip	Total daily trips	Number of required vehicles
		portion	number			
Private	Motorcycle	3	539847	1	539847	30000
	Automobile and trucks	22	3958878	1	3958878	2000000
Public	Urban train	30	5398470	1.5	8097705	440
	Bus	22	3958878	1.6	6334205	11000
	Mini-bus	3	539847	1.8	971725	4500
Semi-public	Vans	5	899745	1.7	1529567	11000
	Any kind of taxies	15	2699235	1.5	4048853	100000
total		100	17994900	_____	25480780	2426920

**CONCLUSION**

In the perspective of comprehensive plan of the year 2025, Tehran will have 9.1 to 10.5 million residents and 18 million daily trips. From this amount, almost 85 percent belongs to residents and 15 percent to the floating population. On the other hand, according to the approved policies based on share of 75 percent of public and semi-public transport in year 2025 and applying transferring factor to daily trips there will be more than 25 million daily travel demand in Tehran that there will be a 20 percent share of the taxi trips and 22 percent of displacements. Therefore, more than 5.5 million daily trips will be made by taxies. More than 1.5 million trips of this number occur by the 11,000 van and more than 4 million by 100,000 taxi ride system. Of these numbers, nearly 40,000 taxies will work in linear paths with specified source and destination.

Other taxi fleet including phone taxies and terminals and standard or based station taxi fleets is consisting of 60,000 vehicles. It is obvious that by improving rental taxi agencies and giving them to private taxi companies could decrease their activity and instead will increase taxi calls and special kinds of taxies. On the other hand, with the development of network coverage vans by private companies and also develops green taxies, the proportion of private companies in taxi fleet management will be more than 50 percent in the year 2025. In order to provide environmental standards, the type of taxi fuel should be mainly natural gas and low consumption vehicles with Euro 4 standard are used. Moreover, the maximum life of a taxi or a van in Tehran should not exceed 5 years. In order to supply 75 percent share of public transport, the most important factor is restricting share of private vehicles such as private cars, private pick up trucks and motorcycle less than 25 per-

cent that due to the rise of private car ownership rate, this seems unlikely. Therefore, it is necessary to take proper measures to restrict personal ridings and motorcycle to be limited. Of course, in Taxi course, one of the proposals can be offered constructing special taxi routes and developing traffic area zone that will increase the taxi speeds comparing to private cars, will increase the taxies effectiveness from the private cars. Transportation network modeling results and determining the share of urban rail of travel demand in the year 2025 were considered to view the results of using urban rail network in 2025 and the result of implementing the above options with the allocation traffic in the network of 2025. In Table 9. the results of loading travel demand in 2025 on urban rail lines network have been presented.

According to the results, about 8.1 million displacements will be done by urban rail lines in 2025, which will be about 30 percent of the total trips in Tehran. Comparison of indexes derived from network considered in Tehran in 2025 with the index network Transportation number of some of the European cities in 2006 (in Table 10) shows that although in terms of scale throughout the network area index, urban Tehran will be close to these cities, but in terms of the proportion of network length scale to its area, Tehran index will be near to these towns, But in terms of network length scale to population, even with the above construction of urban rail lines in 2025 is much lower than these cities.

**Executive plan of constructing new lines**

Total length of proposed network lines in Tehran and Suburbs in 2025 is over 490 km. From this amount,

Table 9. Results of Loading City Urban Railway Network in Tehran in 2025

Line number	Origin	destination	Length(km)	Number of stations	Time Headway(min)	Volume of transferred passengers(daily)	Number of trains
1	Tajrish	Haram-e-motahar	29.3	27	2	1100000	60
2	Sadeghieh	Shargh Terminal	26.4	22	3	770000	31
3	Ozgol	Saveh road	32.8	33	3	775000	41
4	Gharat Kosar	Jarat abad	35.7	33	2	1430000	62
5	Shahran	Shahr-e-Rey	33.1	25	4	856000	27
6	Saadat Abad	Ghaste firooze	26.7	25	4	630000	25
7	Resalat Sq.	Basij Sq.	34.3	27	4	490000	23
8	Poonak Sq.	Basij Sq.	32.2	23	5	505000	26
9	Karaj	Pak Dasht	51	15	6	577000	25
Express 1	damvand	Shahryar	46	17	6	210000	20
Express 2	Dehkadeh Olampic	Varamin	43.7	15	6	200000	18
Express 3	Ozgol	Saveh freeway	38.4	14	6	311000	21
Express 4	Basij Sq.	Tehran pars intersection	10.9	10	7	150000	10
Complementary 1	Sanaat Sq.	Park way bridge	6.7	5	7	83000	7
Complementary 2	Shahran	Daroo pakhsh	13.5	10	7	25000	11
	Total		460.7	301	—	8112000	407



**Table 10. Comparing Indexes of urban rail network in Tehran and European cities**

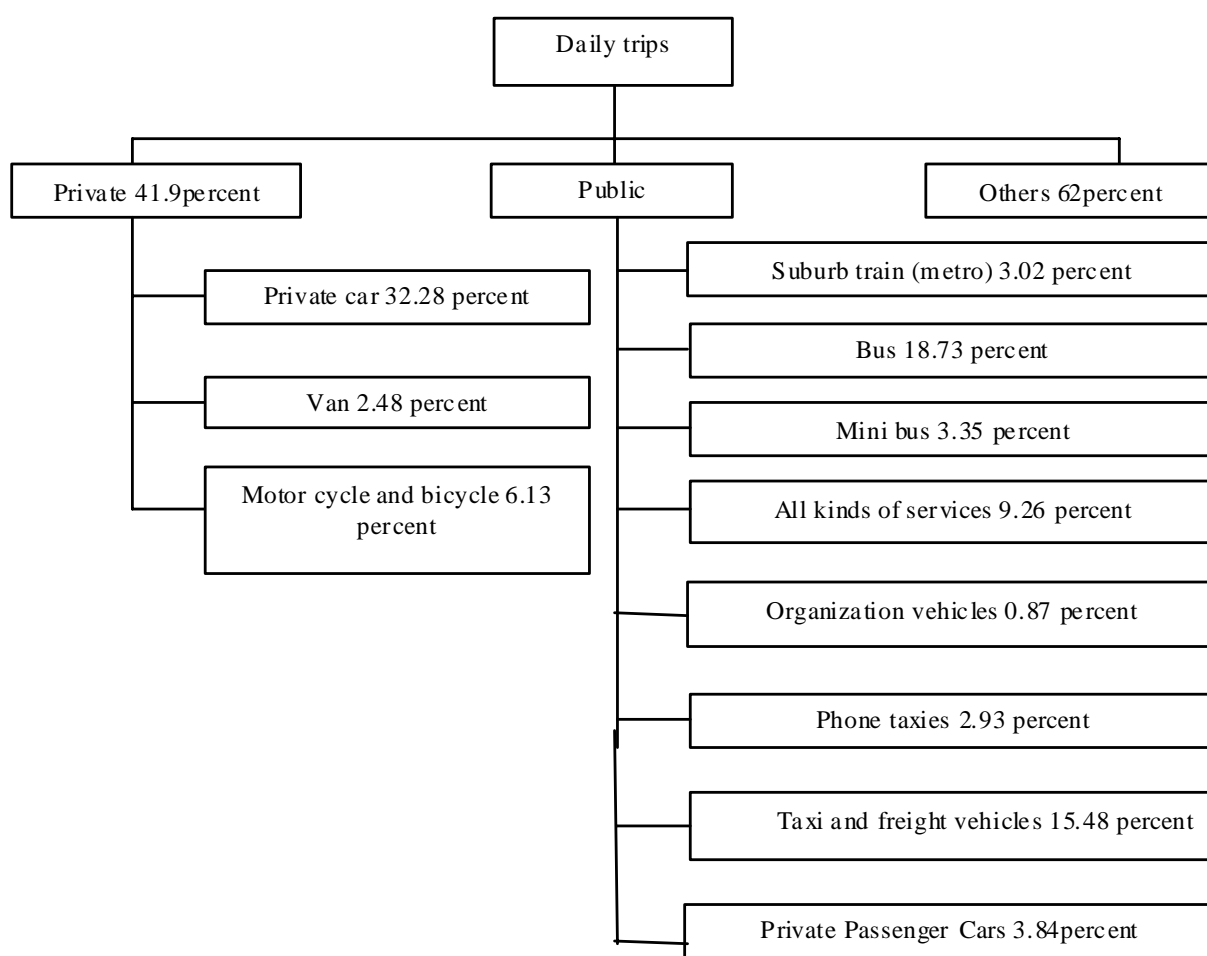
City	population	Area	Network length(km)	Network length per 1 million people	Network length in every km <sup>2</sup> area
Tehran	8.97	730	460	51.3	0.63
Paris	6.2	763	524	84.51	0.7
Berlin	3.4	891	702	206.47	0.79
London	7.3	1572	1171	160.41	0.75

461 km are located in District 22 so that from this total amount, by far about 90 km have been made. Therefore, an appropriate executive program will be considered for constructing and establishing 400 km lines that 370 km belongs to urban rail and the other 30 km belongs to 3 complementary rail lines.

According to surveys and perceptions made in 2005 (base year), the distribution of daily trips of all vehicle types was determined (Fig. 1).

As it is obvious from Table 11, in current situation about one third of daily trips in Tehran were done by Private Passenger Cars that this number of vehicles require a place to stop the local park. As it is obvious from Table 12, Tehran roads network will cover about 18 million trips per day in 2025.

Fig. 2 shows the prospects of traffic and transport in 2025. One of the restriction tools in transportation of such vehicles in the roads network in city streets is



**Fig. 1. Distribution of vehicle trips per day in the baseline year**

**Table 11. Tehran daily trips status and different types of vehicles**

Vehicle	Residents trips		Nonresident trips		Total daily trips	percentage
	number	percent	number	percent		
Motorcycle	862462	7.1	31395	1.3	893857	6.1
Private car	3953436	32.5	901526	37.1	4854962	33.3
Automobile	221135	1.8	141180	5.8	362315	2.5
Pick up trucks	961051	7.9	3903390	16.1	1351390	9.3
Any kind of service	127526	1	---	---	127526	1
Organizational vehicles	427883	3.5	---	---	427882	2.9
Phone taxis	2032538	16.7	22500	9.3	2257538	15.5
taxi	560110	4.6	---	---	560110	3.8
Private Passenger Cars	266044	1.9	263301	10.8	489345	3.4
Minibus	---	---	---	---	---	---
van	2474633	20.4	257000	10.6	2731633	18.7
bus	275090	2.3	165265	6.8	440355	3
Subway system(metro)	38123	0.3	52935	2.2	91058	0.6
other	1216003	100	2427941	100	14587972	1003
	1					
Total						

**Table 12. Functional distribution of daily trips estimated in Tehran in 2025**

System	Type	Daily trips in 2025		Transferring factor in trip	Total daily transfers	Function of vehicle daily transfer	Required active vehicle in a day	Total number of vehicles
		Percent	number					
Private	Motorcycle	3	540000	1	540000	2	270000	300000
	Pick up trucks	22	3960000	1	3960000	2.2	1800000	2000000
Public	Urban train	30	5400000	1.5	8100000	20000	405	440
	Bus	22	3960000	1.6	6336000	700	9051	11000
	Minibus	3	540000	1.8	972000	250	3888	4500
Semi-public	Van	5	900000	1.7	1530000	160	9563	11000
	Any kind of taxi	15	2700000	1.5	4050000	50	81000	100000
	total	100	18000000		25488000		2173907	2426940

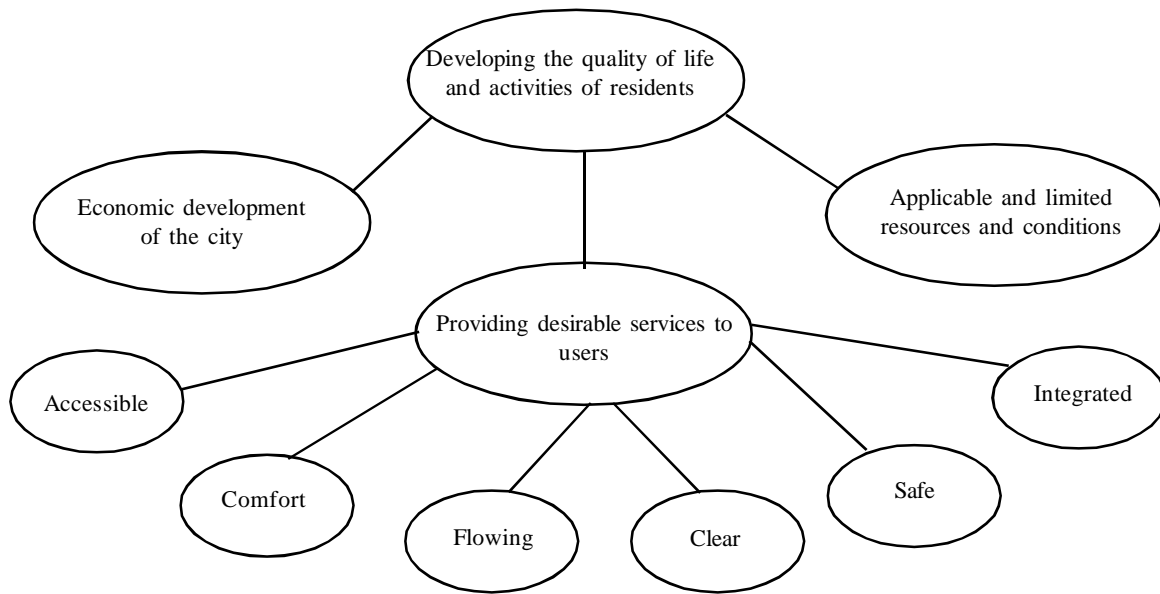


Fig. 2. Prospect of Tehran Traffic and Transport in 2025

Table 13. Indices of public transport in Tehran

Row	Index topic	Index unit	European index digit	Nubmer of studied cities	Tehran (present situation)	Tehran in plan perspective 2025
1	Area	Km <sup>2</sup>	358	43	730	730
2	Population density	Person per Km <sup>2</sup>	4283	42	10680	12329
3	Vehicles ownership	Number of vehicles per 1000 resident	448	40	200	320
4	Rail network density	Meter network in km <sup>2</sup> area	1072	34	123	685
5	Bus network density	Meter network in km <sup>2</sup> area	3261	34	4383	5202
6	Rail network coverage	Km network in million people residents	268	34	11.3	55.5
7	Bus network coverage	Km network in million people residents	1159	36	400	422
8	Public transit means speed	Km/h	25.5	29	15.8	20.3
9	Average public transit share	Percent	44	17	26	55
10	All public transit headways	min	7	25	7	5
11	Public fleet per a person	Person per a vehicle	842	43	974	650
12	Bus fleet fuel consumption	Km in a liters	2.28	10	1.7	2
13	Average age of bus fleet	Year	8.2	14	6.1	5
14	Proportion of a bus passenger fair to GDP in year	percent	2	37	0.34	1

parking issue that in this study examined in detail and its most important achievements are as follows:

- Banning On-street park in about 300 km length of urban streets
- Time limits on parking along 860 km of urban streets
- Constructing 413 thousand off-street Park spaces for responding a part of the park supply declined for the acts of the means of Prohibiting and restricting duration Park with regard to policy 22percent share of passenger within the urban trips.
- Determining the best and most suitable place for construction off-street parking
- Proposal of constructing 91,000 mechanical parking space and 322,000 mechanized parking.

The purpose of being integrated public transport system is that all users can travel from their origin within a short distance acceptable to reach one of public or semi-public transport (metro, bus, minibus, vans and taxi line). If you need replacing, this work was done easily and quickly, and finally after a walking distance from one of the public transport means with acceptable distances to reach their destination.

#### **Comparison of indexes to achieve System Vision for Public Transportation in Tehran**

For having a correct understanding of how comprehensive plan of bus and minibus improved ratio indexes, values of the current situation and 2025 plan calculated in Table 13. Also for better comparison, the average indices for advance European cities mentioned in the Table 13 were added.

As it can be seen through many indices, Tehran stands at a lower place when compared with European cities average. Most of the European cities have a modern public transit system. For example Rail network density in these cities is 1072 m/km<sup>2</sup> while in Tehran is 123 m/km<sup>2</sup> or the bus network coverage in these cities is 1159 km in 1 million residents while this number is 400 km in Tehran. This difference is also obvious in public transit portion, while public transit portion in these cities is 44percent; this number is 26percent in Tehran and will be 55percent in 2025. Thus, European residents in spit of taking advantage of private cars, tend to use public transit means. Tehran will be close to many of these average European indexes in 2025 even in some parts like rail transit network will be more than these cities.

#### **REFERENCES**

ACEEE (2005). Vehicle Fuel Economy Standards: Big Energy Savings at a Modest Const. American Council for and Energy Efficient Economy (<http://www.aceee.org/>).

Bernow, S. and Dougherty, W. (2000). The impacts of the Kyoto Protocol on full cost transportation in the U.S., social costs and sustainable mobility. ZEW (pp. 56–69). Heidelberg: Physica-Verlag.

Campbell, C. and Laherrere, J. (1998). The end of cheap oil. Scientific American, 78–83.

Ghiasinejad, H. and Abduli, S. (2007). Technical and Economical Selection of Optimum Transfer-Transport Method in Solid Waste Management in Metropolitan Cities. Int. J. Environ. Res., **1(2)**, 179-187.

Karbassi, A. R., Abduli, M. A. and Mahin Abdollahzadeh, E. (2007). Sustainability of energy production and use in Iran. Energy Policy, **35**, 5171–5180

Karbassi, A. R., Abduli, M.A. and Neshastehriz, S. (2008). Energy Saving in Tehran International Flower Exhibition's Building. Int. J. Environ. Res., **2(1)**, 75-86.

Mossalanejad, A. (2009). International Security Through Environmental Challenges. Int. J. Environ. Res., **3(3)**, 429-434.

Shafie-Pour, M., Ardestani, M. and Sarraf, M. (2007). Fuels Price Structuring; A Tool for Integration of Environmental Concerns into Energy Sector. Int. J. Environ. Res., **1(4)**, 358-367.

Shafie-Pour Motlagh, M. and Farsiabi, M. M. (2007). An Environmental & Economic Analysis for Reducing Energy Subsidies. Int. J. Environ. Res., **1(2)**, 150-162.

Tehrani, S. M., Karbassi, A. R., Ghoddosi, J., Monavvari, S. M. and Mirbagheri, S. A. (2009). Prediction of energy consumption and urban air pollution reduction in e-shopping adoption. Journal of Food, Agriculture & Environment, **7 (3&4)**, 898-903.