



## Research Article

# INVESTIGATION OF THE MOTORCYCLE USAGE IN ISTANBUL

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## ABSTRACT

In recent years, especially due to increased traffic congestion the motorcycle usage in Istanbul has become increasingly widespread. According to 2015 data, the number of automobiles in Istanbul has reached up to 2.5 million, while the number of motorcycles has reached up to 260 thousand. This transportation mode, which was predominantly used by the couriers previously, has become a preferred mode of transportation by the reason of its speed and operating cost at urban trips.

The aim of this study is to determine the advantages and disadvantages of the motorcycle usage and understand the travel habits with respect to their socioeconomic status of motorcyclists in Istanbul. The analysis is realized with the help of a face-to-face questionnaire study conducted with 201 motorcyclists. On the questionnaire, it is determined that the most important reason to choose motorcycle is the traffic congestion and the most important obstacle to the spread of the motorcycle usage is the behavior of other vehicle drivers. The motorcycle owners evenly prefer motorcycles on compulsory trips (home to work, home to school etc.) and on other trips. It has been seen that motorcycle usage rate does not change with respect to the length of the trip and accordingly for the trips shorter than 1 km, walking is preferred as well as motorcycle.

This study is one of the rare studies that inspect this transportation mode in İstanbul, which is more environment friendly than private car.

**Keywords:** Motorcycle ownership, motorcycle usage, urban public transport.

## 1. INTRODUCTION

The motorcycle, which is commonly spread in many cities around the world, is among the main transportation modes. Taking a small space in traffic flow and parking lots, being able to move fast in traffic with the help of the preceding feature, and being more environment friendly and economical than private car are the factors that enable the gradual increase of the use of motorcycle. Motorcycle riding is correspondingly considered as an entertaining activity [1].

Despite the mentioned advantages of motorcycle usage, it is certain that there are some problems in terms of safety. These problems can be stated as the driving difficulty due to the requirement of balance, the high injury risk due to the deficiency of protection systems, and the improper behavior of other vehicle drivers towards motorcycles. Additionally, the sudden maneuvers done by motorcyclists to increase their travel speed, disturb traffic flow by increasing the accident risk [2].

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The change of travel habits of Istanbul habitants in recent years due to the heavy traffic congestion affected the number of motorcycles in the city. According to annual statistics, the number of motorcycles in Istanbul has increased by 34% since 2010 and reached up to 266,587 in 2016. Meanwhile the number of automobiles has increased by 28% from 2010 to 2016 and reached up to 2,540,156 [3]. The reason, why the increase of the motorcycle population is more than the increase of automobile population is due to the gradual increase of traffic congestion in Istanbul and cheaper price of compared with private car.

In this study, a face-to-face questionnaire study was conducted with 201 motorcyclists to understand their travel habits with respect to their socioeconomic status and to determine the advantages and disadvantages of the motorcycle.

## **2. LITERATURE REVIEW**

The studies related to motorcycles are mainly focused on safety. Typical motorcycle accidents are generally single-vehicle accidents followed by side-on collisions at intersection. It is determined that the single-vehicle accidents are caused mainly by the loss control of the motorcycle by the driver; however, the accidents the intersections are realized generally because of the violation of right-of-way by other vehicles drivers [4].

The interaction between motorcyclist and other vehicles drivers plays a significant role in the accidents. Since the number of motorcycles is less than the number of other vehicles, the drivers have stated that drivers of other vehicles neglect the motorcycles and behave irresponsibly. The engine volumes, maneuvering capabilities and equipment of the motorcycles affect the driving behavior; additionally, motorcyclists behave more courageously when they are in a group. The necessary characteristics, that a motorcyclist must have, are good driving ability, and most importantly, experience. On the other hand, the accident reports show that even very experienced motorcyclists have accidents due to their own mistakes. Consequently, when all of the criteria are evaluated, it was determined that the most significant threat for motorcyclists is the behavior of vehicles drivers, and road conditions. [5].

A study conducted in Taiwan shows that the inadequate public transportation system encourages people to buy a motorcycle due to its low initial and operating costs. As the accessibility of motorcycle is higher than other motor vehicles, motorcyclists use their vehicles more frequently. It is correspondingly determined that high use of motorcycles at low-income levels is associated with the fact that motorcycle is economical [6].

The increase of motorcycle demand originating by the economic developments is frequently encountered. In the 1970s, with two sudden increases in fuel prices in UK, the drivers found driving costs of automobiles high and they started to prefer motorcycles and there occurred a sudden rise in motorcycle sales. The same case occurred after the tax increase in 1995. The investigation of motorcycle sales between 1965-2000 showed that if only the income increases rapidly, the demand of automobiles would increase again; however, it is anticipated that demand for motorcycles and other modes of transportation increased due to concerns such as fuel costs, environment and automobile taxes [7]. The quality and sufficiency of the public transport service change the role of motorcycle in daily travels [8].

The private car users, which are not satisfied with the driving conditions of their cars due to the long waiting time in traffic jams, prefer motorcycles in order not to lose the comfort of a private car [9]. To be able to move quickly without being stuck in the traffic and low operating cost are similarly increase the attractiveness of motorcycles in the eyes of private car drivers. A study conducted in Paris showed that, the travel time of motorcycles was 49% shorter than the travel times of private cars [10]. Another study realized in Barcelona indicated that mobility and offering the comfort of a private car at affordable prices ensure the increase in motorcycle sales even after the economic crisis [11].

The use of motorcycle can be encouraged to reduce traffic congestion and parking problems in several crowded cities [9]. If some of the private car users leave their cars and use motorcycle, this encouragement will be successful. However, this encouragement can similarly affect some public transportation users, causing them to switch from public transportation to motorcycle. This switch is the most critical risk of this encouragement. Although the low emission rate is an advantage of motorcycle, the high noise rate must be taken into account by evaluating this transportation mode in term of environmental effects [11].

### 3. FIELD STUDY

A survey was conducted on motorcycle users near the motorcycle inspection station located in the Istanbul Maslak district with a face-to-face questionnaire between September and October 2016 in order to examine the current situation of motorcycle usage. The survey was realized with 201 participants from different professions, and those who worked as motorcycle couriers who used motorcycles compulsory and continuously as a part of their job, were excluded from the study. The descriptive statistics of motorcyclists are given in Table 1.

The survey questions were designed to get information about socioeconomic properties of motorcyclists, their travel habits, motorcycle properties, usage, and threats against motorcycle.

**Table 1.** Descriptive Statistics of Motorcyclists

		Number	%
Gender	Male	196	98
	Female	5	2
Marital Status	Married	112	56
	Single	89	44
Age	18-30	70	35
	31-40	65	32
	41-50	45	22
	50+	21	11
Educational Status	Elementary	53	26
	High School	81	40
	Bachelor	54	27
	Master	13	7
Household Income (TL/Month)	1300-1500	9	5
	1501-3000	77	38
	3001-4500	36	18
	4501-6000	44	22
	6000+	35	17
Motorcycle Experiences (Year)	0-5	57	28
	6-10	61	30
	11-15	22	11
	16-20	29	15
	21-25	16	8
	25+	16	8

It is determined that women are not so familiar with motorcycle, only 2% of the users are woman. On the other hand, there is not a dominant group in term of age, marital status and education on motorcycle usage. The prices of the motorcycles purchased were converted to current prices with the help of Turkey Statistics Institution's domestic producer price index. [12].The average monthly fuel cost, the average monthly travel length, and the situation of sharing the motorcycle with another person has been asked, and the responses are shown in detail

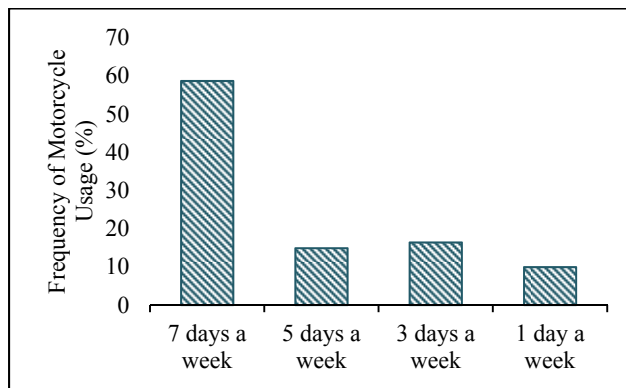
in Table 2. Survey results show that users tend to prefer used motorcycles. It is correspondingly found that most of the participants did not share their motorcycles.

**Table 2.** Descriptive Statistics for Motorcycles and Usage

		Number	%
Motorcycle type	New	64	32
	Second-hand	137	68
Motorcycle sharing	Yes	31	15
	No	170	85
Average Monthly Fuel Cost (TL)	0-50	44	22
	51-100	63	31
	101-150	26	13
	151-200	29	14
	201-250	11	6
Average Monthly Travel Length (km)	250+	28	14
	0-200	35	17
	201-400	40	20
	401-600	47	23
	601-800	27	14
Motorcycle Price (TL)	801-1000	26	13
	1000+	26	13
	1.000-5.000	75	37
	5.001-10.000	56	28
	10.001-15.000	32	16
	15.001-20.000	15	8
	20.000+	23	11

80% of participants had an average monthly fuel cost less than 200 TL, 74% of the average monthly travel was less than 800 km. As 68% of purchased motorcycles are second hand, %65 of motorcycles are cheaper than 10,000 TL.

To determine the frequency of motorcycle usage, the questionnaire participants were asked "How often do you use the motorcycle?" and the results are shown in the histogram in Figure 1. Regarding the frequency of motorcycles used by the participants, it is seen that more than half of the participants prefer to use their motorcycles every day, and other usage frequencies, such as 5 days, 3 days, and 1 day per week are close to each other's.



**Figure 1.** Frequency of Motorcycle Usage (%)

In order to determine the relationship between motorcycle usage rate and the compulsory trips such as home-work and home-school trips, home and work/school addresses are marked on google maps and average lengths of routes between these points are calculated. Motorcycle usage rates according to the length between home and work/school are shown in the histogram in Figure 2. It is seen that motorcycle usage rate which is about 80%, does not depend on the length traveled for compulsory trips. In other words, the increase of the length of travel is not changing the motorcycle usage rate. It has similarly been observed that, for the trips shorter than 1 km, walking were preferred dominantly.

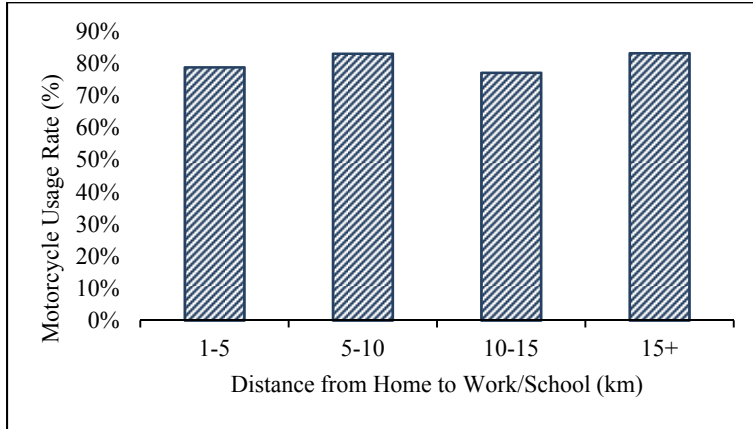


Figure 2. Motorcycle Usage Rate by Home and Work/School Length

Motorcycle usage rates in motorcycle owners' compulsory trips non-compulsory trips (health, shopping, entertainment, visits based trips) shown in Figure 3. It is seen that 70% of motorcyclists use their motorcycles for 75 to 100% of their home and work/school trips. However, this number drops to 49% for non-compulsory trips. Thus, the rate of motorcycle usage for compulsory trips is higher than for non-compulsory trips.

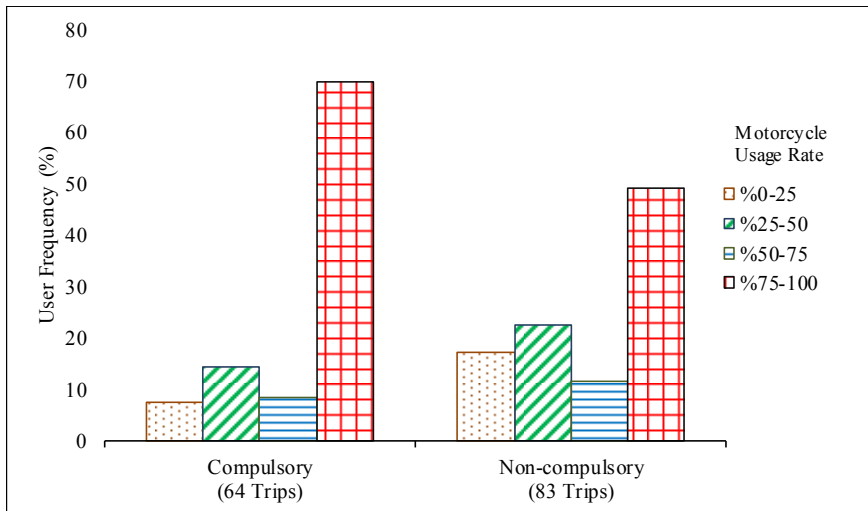
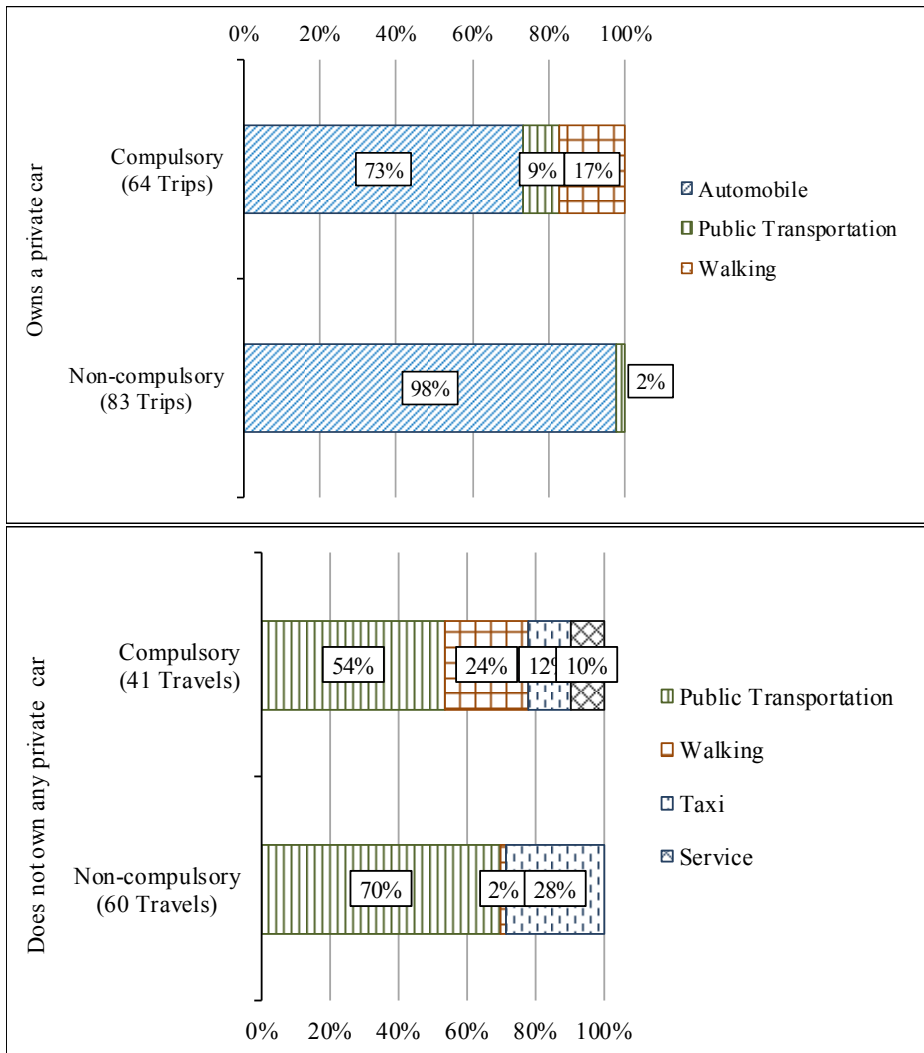


Figure 3. Distribution of Motorcycle Usage Percentage by Travel Type

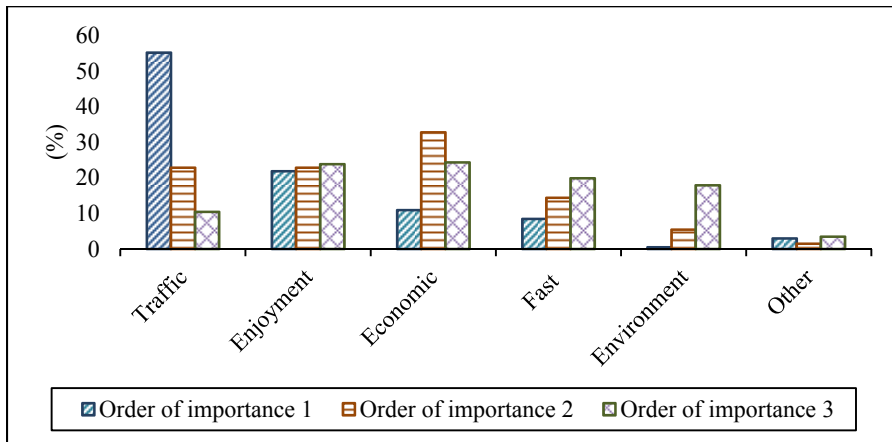
As it is determined that motorcyclists are not using their motorcycles for all of their trips, their other transportation modes are investigated. As the presence of a private car affects the mode choice, the participants are grouped such as “private car owners” and non-private car owners”. Additionally as it is known that, the purpose of the trip has an impact on the mode choice, the transportation mode choice of motorcyclists beside motorcycle are determined for compulsory and non-compulsory trips separately. The result of this analysis can be seen in Figure 4. 46% of the of the participants correspondingly have a private car beside the motorcycle. When we look at the user profile of private car owners, it is seen that 76% of them are married, the average age is 38 and the average monthly household income is 5870 TL. For those who do not own a private car, it is determined that the average age is 33 and the average household income per month is 3950 TL.



**Figure 4.** Distribution of Other Transportation Preferred Outside of Motorcycles

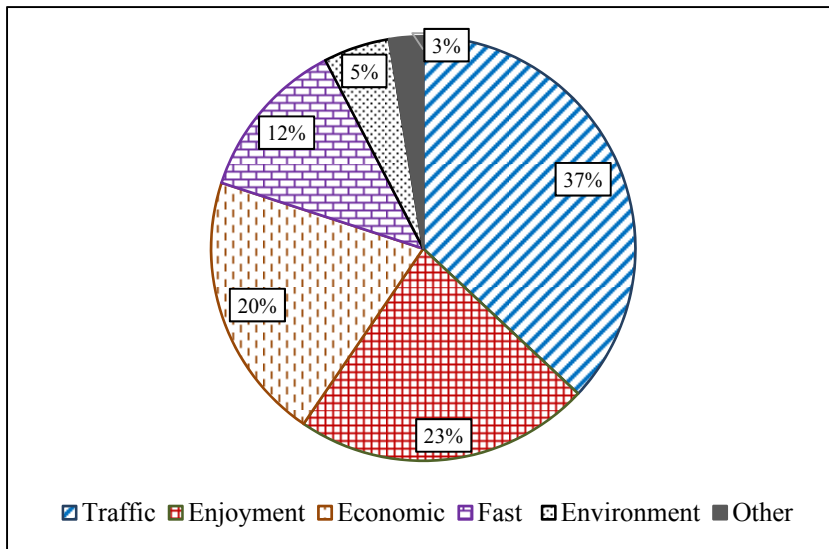
The motorcyclists, who own a private car, dominantly use their private cars when they are not using their motorcycles for non-compulsory trips. Similarly, for the compulsory trips, their favorite transportation mode beside motorcycle is the private car; however, its usage is not as dominant as compulsory trips, 26% of them prefer walking or public transportation. It shows that for those who own a private car, using motorcycle instead of private car, reduces environmental effects and traffic jam. On the other hand, the motorcyclists, who do not have a private car, use the public transportation as second transportation mode, and its usage is higher for non-compulsory trips. Walking and taxi are the third favorable transportation mode for compulsory and non-compulsory trips respectively. As the motorcyclists, who do not have a private car, use the public transportation when they do not use their motorcycles, the usage of motorcycle by them effects environmental negatively.

In this survey, one of the question is about to understand the reasons of using motorcycle. The participants told three reasons by paying attention to importance order. The distribution of the reasons is given in Figure 5. The meaning of “fast” in Figure 5 is not to travel from one place to another quickly especially in heavy traffic; however, it presents the desire to ride the motorcycle with high speed.



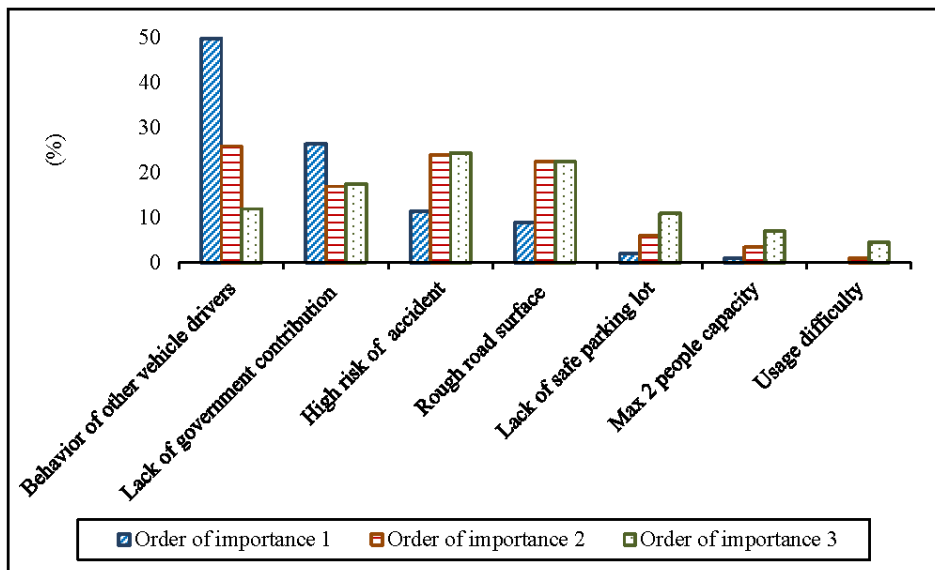
**Figure 5.** Order of Importance of the Reasons to Use Motorcycle

As the survey participants gave different ranks to different reasons for motorcycle usage, a weighted scoring approach is applied to determine the importance order of these reasons in general. This approach consists of giving 3 points for first, 2 points for second, and 1 point for third reason determined by participants separately and calculating the average score for each reason. According to the results, the dominant reason to use motorcycles is determined as the traffic congestion. The enjoyment of using motorcycles and being economical are second and third reasons. The reasons for the favored preferences are shown in Figure 6. The “other” option in Figure 6 represents the ease of parking, the suitability for people with disabilities.



**Figure 6.** The Distribution of the Reasons for Motorcycle Use

In this study, the reasons against motorcycle usage are investigated as well. The participants are indicated three reasons, why they do not want to drive a motorcycle, with respect to the importance order. The results of their answers can be seen in Figure 7.

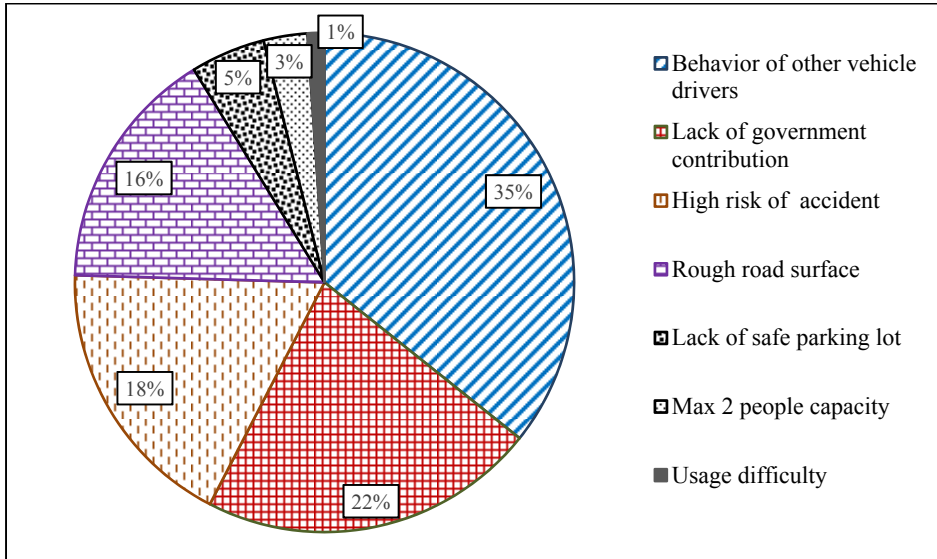


**Figure 7.** Order of Importance of the Reasons for Slowing Motorcycle Usage

Similar weighted scoring approach is applied to determine the order of the reasons that slow spread of motorcycle usage. It is found that the behavior of other vehicle drivers appeared to be



the most dominant reason against motorcycle usage. Second reason is the low level of government contribution (taxes, high level of traffic insurance etc.) and the third reason is the high risk of accident as given in Figure 8.



**Figure 8.** The Distribution of the Reasons against Motorcycle Use

#### 4. CONCLUSION

The motorcycle usage in İstanbul is investigated in this study by using a face-to-face survey with 201 motorcyclists. It is seen that 73% of motorcycle owners have a private car similarly. The average length traveled by motorcycle in İstanbul is determined as 593 km and the average monthly fuel cost is 162 TL.

Motorcycle owners are not using their motorcycles for all trips. Only 63% of their trips are done with motorcycle. This ratio is almost same for compulsory and non-compulsory trips. When they are not using their motorcycles, the private car owners prefer to use their cars and others prefer public transportation; however, for compulsory trips, walking is the mostly used way of transportation when the trip length is less than 1 km.

The most important reason for the preference of motorcycle is the traffic congestion in İstanbul, and then the use of motorcycles is determined as enjoyable and economical by participants.

The most effective reason for slowing the spread of motorcycle usage was the behavior of other vehicle drivers. The government incentive for motorcycle purchase and afterwards affects the decision of buying a motorcycle secondly. The height of risk of accidents has been identified as the third obstacle to motorcycle use. Even though, the behavior of other vehicle drivers disturbs motorcyclists, other vehicle drivers complain about the behaviors of motorcyclists. In this context, more education and enforcement is needed to solve the behavior problem between these two groups.

As about half of motorcycle owners (46%) own a private car, it is obvious that a reduction of the motorcycle price will increase its population and the private car usage will decrease. On the other hand, due to the fact that the motorcyclists, who do not own a private car, choose 73%

motorcycles for home-work/school trips, the reduction of motorcycle prices will cause to an increase of the motorcycle population and this increase will lead to a reduction of public transportation usage. As a result, it has been concluded that the reduction of motorcycle prices will have some positive and negative effects.

Further studies can be focused on the research of the reasons why the public transportation users tend to use motorcycle and development of strategies to decrease this transfer from public transportation to motorcycle. Better understanding of motorcyclists' behaviors can help to develop strategies to switch them from motorcycle to bike, which is the most sustainable transportation mode.

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