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Alternative Transport in México City

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Abstract

This paper analyzes a transportation system integrated by different kinds of vehicles called by the government "Alternative Transport", the study case operated in the southeast of Mexico City's, at the center of Tláhuac district. At the request of *Alternative Transport* driver's associations, the authorities have proposed a fixed rate of 6 pesos per person, regardless of time or distance. As clients pay the same fee traveling from a few hundred meters to more than 1.5 km, *Alternative Transport* owners do not consider it fair to charge the current fixed transport fee, as it does not leave room for profit. Therefore, trough a field research it was measure and analyze the demand and unmet demand of the service, the level of the service, the duration and length, in order to be able to propose rates that are profitable for the owners of the fleet and help unify the transport. The fare proposal is made based on the results of the demand analysis and takes into account a base salary for the driver, as well as the duration of the trip.

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Keywords: rate , field reseach , paratransit , demand , unmet demand , level of service , survey , rickshaw , pedicab , golf cart , Mexico city.

1. Introduction

In Mexico exists an individual public transport services operating in 29 of 32 states of the country where the "taxis" correspond to a rickshaw type transport, especially adapted for this purpose. In Mexico City and the metropolitan area of Mexico State this kind of transport constitute an average of 1.8 per cent of 19.38 millions of people mayor of six years old making one travel trough the weekday according to the mobility survey made by Instituto Nacional de Estadística y Geografía [INEGI](2017) –National Institute of Statistics and Geography, the majority of use in Alternative Transport are in Mexico State with 2.6% , Mexico City with only the 1.1%.

The name rickshaw is derived from *Jinrikisha*, which is a combination of three Japanese words: jin (= man), riki (= power) and sha (= vehicle) Kalabamu (1987). The rickshaw was originally a man-powered bicycle or tricycle connected in the back with a chairlike body where transported passengers can take place. At present, the term is used for contemporary variants, as improvised bicycles or motorcycles made by replacing the rear wheel with some structure to transport passengers or cargo (open or covered wooden or metal seats, an improvised cart, etc.). As they

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are man-powered, rickshaw type taxis tend to move more slowly than other types of public transport Kalabamu, (1987), but their small size makes them way more flexible for congested areas.

This peculiar kind of transportation is often described as informal, generally is used in developing countries and by people in the lower income categories as a door-to-door transport service Guillen et al. (2013). Some authors use the term *paratransit* for modes owned and operated by private companies and individuals Joewono et al.(2007). Examples are of this mode of transport are the *Philippines* Guillen et al. (2013), *India* Harding et al. (2016); Sarma Sadhu et al. (2014), *Colombia* Márquez et al. (2018), *Togo* Guézéré, (2015); Díaz Olvera et al. (2016), *Sri-Lanka* Kumurage et al. (2010), *Benin, Cameroon, Algeria, Morocco, Iran* Godard (2006) or *Mexico* Berrones-Sanz, (2018), generally in cities and areas with a high population density and lack of public transport options.

1.1. Driver's Associations

In Mexico City and its metropolitan area, in the early 90s, transporters formed associations of people who made their living offering transport services of the type described, still using a bicycle as a driving force, instead of a motorcycle. These groups allied themselves in a kind of union to dialogue with the government about their rights. Currently, most of these groups of drivers are closed, and do not allow more people to join them. In some cases groups come together in order to have better representation having only one manager, in some cases one manager can represent three different groups.

The owners of these *Alternative Transports* can do business in two ways: in group, by signing up to a so-called "*sitio de taxi*" taxi station or taxi ranks, or individually. The owners of the vehicles on the taxi station are affiliated within a guild of *pedicab* drivers, for which they need to pay a daily fee to the station administration to maintain their enrollment in the guild. By belonging to a guild and organizing transportation services in a group, the taxi driver can organize and plan his working hours more conveniently, his customer demand is less variable and he has support in cases of emergency.

The different guilds are organized geographically, usually by neighborhood, and divide their operational territory correspondingly. The guild holds regular meetings to discuss relevant issues among its members. Theoretically, the memberships are not transferable but inheritable. Out side the Anahuac Valley (Mexico City and State) it's unclear how the groups that exist were constituted and operates.

1.2. Types Of Drivers

There are four types of drivers: the first one is owner of both the complete vehicle and the guild's membership; the second one owns the motorcycle and the guild's membership but not the appended cart; the third one does not possess any part of the vehicle with which he provides his service, but owns his membership to the guild; finally, the fourth type of driver doesn't own neither vehicle nor membership. It is a very common practice to lend a vehicle to a family member or friend to relieve the driver's workload or because the third person has temporary financial problems and wants to make a living with the *Alternative Transport*. Some associations or guilds support this practice, but the responsible regulatory institutions do not. The last two ways of operating are prohibited by the authorities.

Not associated *Alternative Transports* do not belong to any guild and do not necessarily comply with regulations, so they do not have permission to operate. Also not associated alternative transport do not operates in a taxi ranks, normally to take some clients they make line near the taxi rank of a guild or circulated through the streets, this act has been noticed by the members of the guild and now they have implemented to also make line were the no associated taxis wait. This situation has complicated the order in the taxi ranks and the transit fluidity around the taxi ranks.

1.3. Vehicles

As indicated above, there are different vehicles used by the guilds; all of them are considered by the authorities within the same category of alternative transport and must be registered. Some of the vehicles have the label of

ecological taxi or *ecotaxis*, the term has its origin in the nineties, when the type of gasoline was changed to unleaded, and it has been used since for any kind of taxi (painted green at the time), regardless of the used fuel. Due to the current redefinition of the meaning of ecology, at present, this label can only be used for bicycle taxis and golf carts.

The *bicitaxi* or *pedicab* (Fig. 1) was the first alternative rickshaw type transport to be used in Mexico, This vehicle was more common around the begging of the alternative transport, but the use of this man power vehicle went to decline when the drivers staring to age.

Fig. 1. Prototype of a *bicitaxis* used in Mexico City.

In its current form, it consists of a common bicycle, which has a metal trolley attached to the bicycle rod, usually with a roof. Because of the great effort involved in transporting passengers with only leg power, this vehicle is not very much used anymore in Mexico City. It continues to be used by very few rivers affiliated with the guilds in the area of the study and in downtown Mexico City, which is the only place where this type of alternative transport is regulated (Fig. 2).

Fig. 2. Modern *bicitaxis* used in downtown Mexico City.

*Mototaxi*s or motocabs are motorcycles, adapted to attach a transport cart in the back by means of a screw or rarely by a tow. Although the cart shown in Figure 1 is also the most used in motorcycle taxis, many owners adapt a cart themselves. An example, typically designed in a small metalworking workshop, is presented in Figure 3.

Fig. 3. A typical Mexican *motocab* or *mototaxi*.

One of the newest types, having a good acceptation among Mexico City's population, is the use of an electrically driven and adapted golf cart (Figure 4). Although its cost triples with respect to motorcycle taxis, this is the second most used type of alternative transport in the south east of Mexico City and the third more common in the country, mainly because users find it safer and more comfortable than motorcycle taxis.

Fig. 4. A common golf cart used as *ecotaxi*.

The most common vehicle out side the Anahuac Valley is the rickshaw, in Mexico is called *"catarina"* or *Trimoto*. It also exist in the area of study, but they are only a few, even with the small number they are more common that the original *bicitaxi*. Went they arrived to Mexico in order to have registration papers the rickshaw were discuss with the authorities by the guilds, so all existing rickshaw in Mexico City were from that occasion and on they are within a guild. The new models of the electric rickshaws have arrived to Mexico, but the number is rater low, one (Study Area).

Fig. 5. A Normal Rickshaw operating in the Tlahuac Area.

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1.4. Service Policy

Customers of the geographical area and influence zone where these alternative transports are commonly used like the one explain in this paper, additionally, the services offered by this system can be customized according to the needs, therefore the user are accustom to it. Their services offer more than just transportation; individual requests can include:

- Pick up a child from school and take him home.
- They do not considered a child under 3 years to pay.
- Wait for the client while doing some activity (shopping, picking up children from school, going to the cashier, etc.).
- Go and collect an order and bring it home.
- The help for make easy the boarding and unbording of passengers with difficult of movement.
- Generally, *Alternative Transport* does not refuse to transport bulky materials, which is very convenient to business.
- The client can agree on periodic and future trips with the driver of the unit.
- In general, the cabdriver does not refuse clients with big baggage or animals (pets, poultry or small farm animals).

2. Description of the problem

In Tlahuac, there are currently 37 guilds registered. The results of our field study indicate that the number of vehicles per guild is 100 on average; of these, approximately 81% corresponds to motorcycle taxis, 17% to golf carts, 1% to rickshaws and only less than 1% to *bicitaxis*. However, for every *mototaxi* registered in a guild, there are another 3 or 4 irregular ones. For golf carts, this amount drops to one irregular golf cart for each golf cart registered in guilds. This generates an unfair competition from informal, which, despite the risk of a fine and the towing of the transport service unit, continues to operate irregularly.

The presence of not registered Alternative Transport and the lack of official rules caused the guilds to request regulations for the operation of the Alternative Transport. However, within these negotiations, the competent authority requests certain adaptations to the vehicle, in order to assure the client a safe trip. Examples are ceilings and outside and inside lighting for the vehicle, or inside rim protection for the *mototaxi* carts to prevent passenger's injuries. These adaptations have to be paid by the cart owners and reduce total profits.

The required investment of a golf cart *ecotaxi* is around 60 000 Mexican pesos and the unit has an average lifetime of 8 years. Total operation costs include a yearly battery change, electrical power to charge the vehicle,

maintenance, tires, vehicle insurance, the driver's license and the guild fee. Table 1 shows average values for these costs, obtained in a field study in the Tlahuac region in the Mexico City metropolitan area.

For *MotoTaxis*, the investment is around 15,000 to 20,000 Mexican pesos for the motorcycle and 3,500 to 5,000 Mexican pesos for the appendix cart, the live of a *mototaxi* in average is around 3 and 3.5 years. The life time were recently shorted because of the increase towed units, the fine was riced to 17,000 Mexican pesos plus the cost of towing and the space used in the pound, the majority of drivers chose to abandon their work units. Although, there are some appendix cart with a little more than 10 years still in operational status, normally the motorcycles are the ones to who dictates the life cycle being the mayor investment and the ones who take the mayor beats, in normal conditions a motorcycle last five years in working conditions.

Table 1. Vehicles Cost

Concept	Unit cost ($)MXN	Period/ frequency	Annual cost ($)MXN
Investment cost			
Golf cart	60000	8 years	7500
Operational costs			
Battery	11000	Yearly 1	11000
Maintenance	1500	Twice a year	3000
Tires	700	Yearly 6	4200
Electrical power	550	Bimonthly	3300
Insurance (Both)	500	Monthly	6000
Driver's license (Both)	796	3 Years	265
Guild fee (Both)	5	Daily	1300
Total:			**36565**
Investment cost			
Mototaxi	25000	3.5 years	7143
Operational costs			
Tires	450	Yearly 4	1800
Maintenance	400	Bimonthly	2400
Screw	90	Bimonthly	540
Fuel (3 liters average)	58.2	Daily	15132
Total:			**34580**

2.1. The rate

Currently, the rate of the trip is established at six pesos per person. When large distances are requested, long travel times are observed or bulky luggage is loaded, this fee is put to the customer's consideration, to see if he decides to pay somewhat more. This means that part of the service is paid for by informal tips, which usually vary between 50 and 350 pesos per day.

Although the 6 pesos fee is determined by agreement of the driver's guilds, the most important factor to establish it is the current fee for bus trips. For the moment, the *Alternative Transport* fee is lower to that of the buses that circulate in the area, to be able to compete with the bus service: when the fare for the bus has gone up, it has also been raised for alternative transportation, recently in Mexico City the fare has gone to 7 pesos. However, the bus has a considerably higher capacity than a golf cart, and also follows a fixed route, while the *Alternative Transport* corresponds to an individual and door-to-door service. There is little unification between the *Alternative Transport*

fees fixed by each guild for longer trips, so a negotiation with the client is required on each trip to agree on a fair price according to the specific requests of each user.

As seen in table 1, the total cost of operation adds up almost 3000 Mexican pesos per month. Considering the current cost of 6 pesos per person and per trip, at least 500 passengers per month are required for a golf cart driver to take out operating expenses. Knowing that, on average, *Alternative Transport* drivers work 27 days a month and 9 hours a day, a minimum of 2.1 passengers per hour would be required to exit expenses. With an average distance per trip of 800 to 1000 m, you get a maximum amount of 6 trips per hour. Considering that some trips can reach up to 2 or 2.5 km and that there is not always demand for the service, the average number of hourly trips was found to be 3.7. This information is consistent with that reported by Berrones-Sanz (2018).

As the current fee system does not seem fair and encourages abuse by clients, guild associated *Alternative Transport* drivers tried to implement a variable fee based on distance, with a minimum amount per trip (in this case, six pesos). The variable rate was based on the perimeter distance from the place where the taxi site is located and the number of street crossings that are passed during the trip. However, when the trip does not start from the taxi base, the proposed way of charging was not clear and this new fare system did not work well. Due to the lack of consistency in the computation of the rate, the drivers did not understand the system enough, did not know how to apply it coherently and could not explain the customers how they were being charged. As a consequence, most of the *Alternative Transport* drivers did not apply the new fare method.

Another reason that hindered the determination of the fee based on the distance is that the *mototaxis* and golf carts are very basic vehicles and most of them do not have an odometer installed, nor the possibility of installing it, so the measurement of the total distance of the trip was usually set arbitrarily and at the discretion of the driver.

Finally, irregular *Alternative Transport*, that are not being associated with a union, generally charge a lower fee (five pesos, being 17% lower than the official fee of six pesos), which implies an infidel competition with respect to regularized *Alternative Transport*.

2.2. The demand

The decrease in the profits that *bicitaxi* drivers have had in recent years has made them aware that they need to have a better forecast and, more importantly, an understanding of the real demand of their service. In cases of emergency the drivers and owners of the fleet are not well prepare to endure the situation, for example, in the earthquake of the 19th of September in 2017 due to the damage in the region the demand of this type of transport almost disappeared for a little more than a month, this forced some drivers to sell their work unit partially or totally, some others change temporarily of profession, in most of the cases to construction workers or informal trade.

3. Objective

The impetus of this paper is make a proposal of a rate through the analysis of the operation, function and perception of this transport mode which operates in the Southeast of Mexico city on Tláhuac Center, in order to have a better decision making in the operations of drivers and owners, hence increasing the ability of foreseen and endure eventualities or emergencies, therefore improving the transport and in general the mobility justice.

4. Methodology

As part 3 (Objective) establishes, it has to be observed and measure the operation, function and perception in this mode of transport, therefore the research is divided in two: Procedure (operation, function) and General Appealing (perception).

4.1. Procedure

First to know how this type transport it’s been operated, the authors ask the drivers in guild 7 of the Center Tláhuac taxi station, located in the "Los Reyes" neighborhood for how their work, consequently knowing the

schedule and general operation. Thus to have accountable numbers of people using this type of transport a field gauging was in order, it was made for a single golf cart, *ecotaxi* and three *mototaxis*.

The reason for the gauging is to get to know the demand to this transport mode, demand in general it could be a difficult idea to fully understand, in transport as almost everyone had used public transport the idea should be familiar. A concrete idea is given by Thomson(1974), which said that the demand in any transport it is not how many people has it, it is the amount of transport which in certain conditions would choose it, and normally the estimates leave some important factors out. This involve:

- The demand is not an unique number nor independent of the scope of time, seasons and space
- The transports do not obey the demand-offer law, because it exist a captive market (offer < demand) and also because some time the transports has to work in not even a tenth of the capacitive (offer > demand).
- Changes in transport can take a while to appear in the demand of itself
- The distance in transport it is a critical factor, because if the cost for the passenger are more related to the distance or the time increases the demand for long trips will decrease.

A demand study in transport is able to measure demand in different times and places. The measure characteristics depends in the type of investigation, for example gauging of the people boarding and unbording a bus during the day gives and idea in magnitude, which is the volume of people per a certain amount of time, also gives several other parameters like (trips-passenger/day) or (passenger/km), finally if the study last enough repetition will appear which is the occurrence of people during the study

The study considers all the observed demand for the vehicle, including both the interested users who become customers and the users who require the service but the driver was no able to provide the service. Because each trip with a client corresponds to a customer request, it is easy to count the demand for this type of transportation. On the other hand, unmet demand for the service was accounted for by the observed gestures to stop the vehicle but the driver was no able to provide the service. The number of people wishing to get on the *bicitaxi* on each occasion, when the demand was not met, was not clear; however, the measurement did consider how many people effectively got on the taxi when the trip was concreted.

In a third stage an observant is on board of the vehicles, the observant carry with the previous gauging, but it was take on account the sex and age of the users, the age was take in three different sections: juvenile, mature and elderly, juvenile were the people to board the vehicle with lees than 18 years, the elderly were the people with 65 years or more, and the mature were the middle rage, between 18 to 65 years. The observant also take geographical data of were the trip begging and ends, also took data about the duration in time and distance of the travel. During this stage the unmet demand wasn't gauged.

Subsequently, the obtained information was analyzed to detect the percentage of unfulfilled demand, resulting in a surprisingly high percentage. To find the reason why users decided not to use the service, the opinion and accumulated knowledge of guild 7 of the Center Tláhuac taxi station, located in the "Los Reyes" neighborhood, was considered, through interviews with its members.

4.2. General Appealing

The last stage of the study is a survey, the survey was asked to the general population within the research area. The survey has the purpose to know with a mayor detail about the users, confirm the data obtain in the first stage and finally to be able to get a rate in the level service of the transport.

Due to the fact that the deviation of the population variables that measure the level of service is unknown, it is necessary to use characteristic operating curves, considering an alpha value of 5%, beta of 0.2 and a sensitivity of 0.4, obtaining as a result a sample size n = 75.

According to Márquez et al. (2018), public transport users can be divided into two categories: choice and captive users. Choice users are users that use a certain transport because they want to. Generally, they are car owners that prefer to use public transport to avoid traffic jams and parking problems. On the other hand, captive or

disadvantaged users are (generally lower-income) people that depend on public transport to travel to their homes, schools or workplace, because they do not own a car.

Both types of users have different transport options and will base their selection, at least partially, on the quality of the offered service. To achieve an increase in the number of clients, this is an important issue to take into account.

As Molinero and Arellano (1998) said this category of service level is a general measure of all the characteristics on a services of transport which affects at the user, for example: operational speed, reliability and the security of the system. At the same time, look at aspects related to the quality of the service, in more of the cases this aspects are qualitative, such as: suitable cover of the net, cleanliness and aesthetics of the units.

In Alceda (1997) lights up the fact that this characteristics and aspects it exist based of and economical exploitation in order to have better economical performance. In addition it give three fundamental demands: Security, efficiency and economic performance.

For this paper the service level will it be conceder in three categories: reliability, security and quality. Reliability is if the service was able to transport the people in the manner the user intend within some parameters (speed, failed risk –total or partial-, availability of vehicles). Security is a wider aspect, in which includes sinestriability and crime vulnerability. Sinestriability is the level of safeness evolved in the trip, includes the working vehicle, his occupants and the assets moved within, it necessary to made the guideline, the behavior of the drives enters in this category as it could harm all establish above. Crime Vulnerability as his it name implied is how much the occupants (Drivers and clients) are exposed to crime.

Quality is by far the most qualitative of the three categories, because is measure in the perspective of each user. But it focuses in the cleanliness, general aspect of the units and manners of the drivers for mention some.

The level of service was dived in the fundamentals categories and ask to rank in a numeric order form one to five, one been poor and five been excellent.

Finally, in order to obtain a fair rate for the service, we analyzed the investment and operating costs, the working conditions, the average number of passengers and trips per hour, as well as the duration of the trips.

5. Results

The research yielded results on the occupancy level of the *motocabs* and *Ecotaxis (golf carts)*, their levels of demand and unmet demand, the change in demand with respect to the day of the week, the influence of the occurrence of specific holidays, duration in time and length of trips, sex and age of users/clients, and the perception of the general public in matters of the described in 4.2.

5.1. Procedure

Initially, the demand was analyzed for all weekdays in one week, from 4:30 to 24:00, dividing the analysis period into sections of one hour (except for the last section, which corresponded to one and a half hour). In a second stage, and based on the results of this preliminary analysis, a more detailed gauging was carried out, obtaining data from 980 trips during the months of March, April, May, July and August of 2018.

5.1.1. Occupancy level

According to its design, the analyzed vehicles – which corresponds to a golf cart and the three *Moto-cabs* –, has a maximum capacity of five people plus the driver, in the case of the *Moto-taxi* has one more place as it's able to fit a second person in the motorcycle. For the golf cart two passengers can sit in front, next to the driver, while another three can sit in the back seat, for the Moto-cab the places available for the clients are the one in the appendix cart, which are five, three facing the front (Motorcycle), two facing back. The result of the gauging by the gauge and the on board data show that (69%) corresponded to trips with only 1 passenger; another (25%) corresponded to trips with 2 passengers, (5%) of the trips transported 3 passengers or more, figure 6. summarizes the above results.

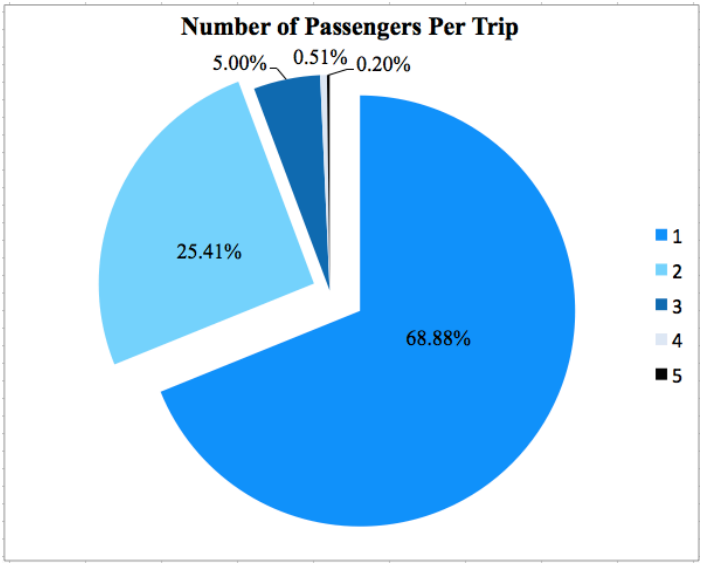

Fig. 6. Number of travelers per trip

From the analyzed data, the average number of people per trip or average occupancy per unit (AOU) was found to be 1.41. Determining the occupation index (OI) as the ratio of the actual observed occupancy and the maximum capacity of the vehicle (Alceda, 1997) were one is the maximum, the occupancy rate of the studied vehicles were 1.41 with a standard derivation of 0.104, therefore the OI is 0.282,which could mean 28.2% ± 2% of efficiency.

5.1.2. Demand and unmet demand

The *bicitaxi* demand simply corresponds to the number of people who use the service. On the other hand, and as explained above, the unfulfilled demand is measured by the occasions in which the driver observed people waiting and with the intention of using the transport. Considering that, on each occasion, the same average of 1.38 passengers would have been boarding, the unfulfilled demand can be estimated by multiplying the occupation index and the number of times that people were observed looking for a transport but where the trip did not take place (equation 1).

$$UD_t = UT_t \times \frac{D_t}{T_t} \tag{1}$$

Where t corresponds to the t^{th} unit of time, UD_t corresponds to the unmet demand, UT_t is the number of occasions where the driver were not able to heed a user, D_t is the number of passengers per trip and T_t is the number of trips within t^{th}.

The equation 1, obeys the difference between individual public transports and collective public transport, also because is obtain trough feed of the gauging has the ability to be specific enough to disintegrated the data by day or even hour. Instead the method used by Posada J. and Gonzales C. (2010) consider the unmet demand to be the necessity of transportation minus the capacity of the existing transport system, the result is just a constant and do not

consider the points given in 4.1, so it is more suitable the equation 1. Afain A. etal (2015) proposes a derivation of the equation presented by Posadas and Gonzales, aiming for a better organization of taxis in taxi rank, the unmet demand is equal to demand (the people who wants to taxi) less the demand of the service (the number of boarding people) and the demand always exist as a non-negative. The equation proposed by Afrain A. etal differs from the equation of Posada and Gonzales in the aspect that the result is not a constant hence is able to change trough time, but again fail to cover all the aspects seen in 4.1, because the equation is unable to see a offer bigger than the demand and do not conceder distance as a factor.

The proportion of the unmet demand with respect to the total demand ranged from 16.88% to 44.52%, which is a fairly high proportion. We observed that most users prefer a golf cart (like the one used for this study and in Figure 4), because it is considered safer and more comfortable than a motorcycle cab and faster than a bicicab. The motorcycle cabs have a reputation of being reckless and noisy (with a big audio system or/and noisy exhaust engines), but this conception exists for all types of motorcycles in the region.

As the second part of the gauge, were there was a meter on board the unit collecting data, part of this data was the time between the arrivals of users and the time spend of the unit in the rank.

We also noted that the majority of golf cart bicitaxi drivers are older, while those driving motorcycle units are generally younger; however, no specific cause was found to explain this phenomenon.

5.1.3. Weekly demand

There is no noticeable difference between the demand on a weekday, compared to the demand on Saturday or Sunday, although a small decrease in unmet demand is perceived in the weekend, see figure 7. The analysis of the information indicates that the demand for *Alternative Transport* varies according to the time of the day and the season of the year. For example, there is a high demand for service on regular school days, but when children are on summer vacation the demand decreases considerably. Owners state there has been a decline in demand after the earthquake of September 19, 2017. This is explained by the fact that some work centers and schools were closed for much of the rest of the year. Furthermore the weather also affects the demand of the *Alternative Transport*, in case of there was rain the number of people wanting to take a unit of this transport mode increases and because a lot of the drivers of *mototaxis* conceder a non worth risk to work under such condition, they retried to take a brake and the load of work rest in the *Ecotaxis* and the rest of the working *mototaxis*, so the demand increases and the offer decreases.

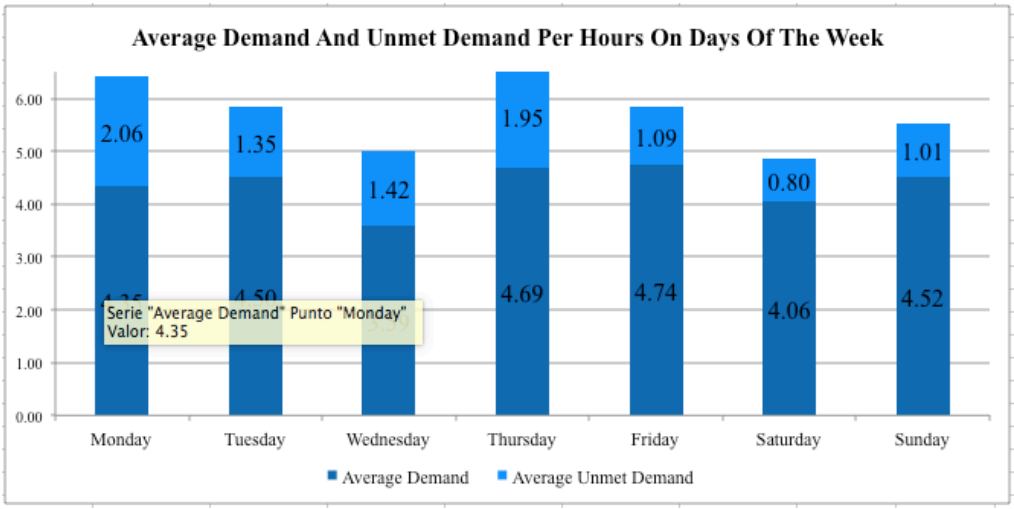

Fig. 7. Average Demand And Unmet Demand Per Hours On Days Of The Week

What does seem to have an important influence on *Alternative Transport* demand, is the occurrence of a public holidays. For example the behavior of the demand in the week of May 8 to 12, 2018; this week includes May 10, the day when Mother's Day is celebrated in Mexico, the demand increased by approximately 65%, while unsatisfied demand increased by even 100% with respect to the other days of that week, see figure 8. This is easily explained by the large portion of the population that goes out to eat to celebrate or to buy a gift, and the lower offer of public transport in those days. These results show the preference for golf cart taxis, in this case because on Mothers' Day the users typically travel with seniors, who feel more comfortable in a golf cart than in a *bicitaxi* or *mototaxi*.

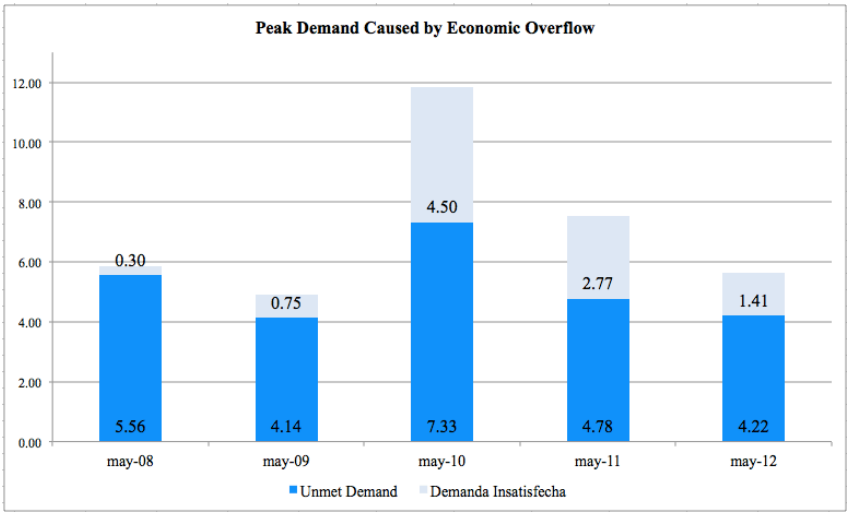

Fig. 8. Peak Demand Caused by Economic Overflow

5.1.4. Clients

Quickly was obvious that the majority of the users were female, with a total superiority of 43.14%, see figure 9. Analyzing in a normal distribution stands out that the majority of men that uses the transport are men under eighteen years and almost in every occasion the juvenile men were in company with an adult. With the characteristics of normal distribution seems that the users are the both ends of the spectrums in both of the sexes.

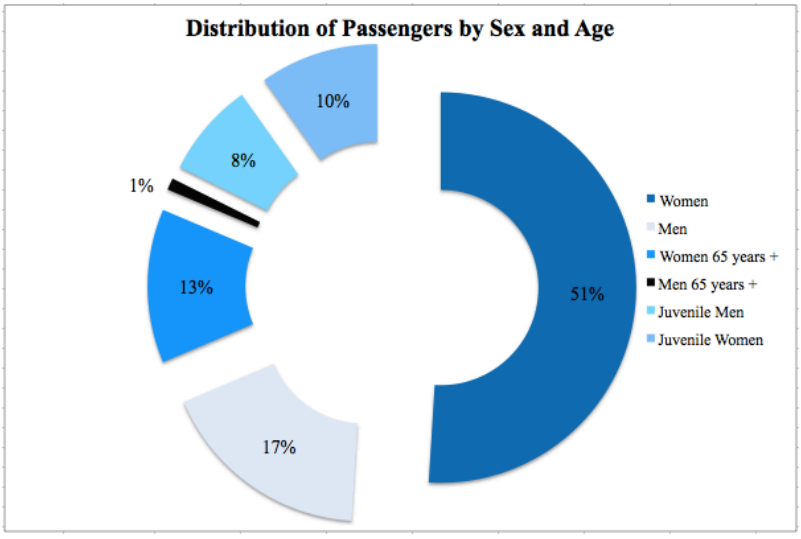

Fig. 9. Distribution of passengers by Sex and Age

5.1.5. Duration and Length of Trips

The duration and Length of trips settles the parameters in which this transport mode is operating and give a sense of normality for the trips, saying which are sorter or longer that the average and by how much. The average of distance in a trip is 0.98 Km with a standard deviation of 0.39 Km, but the was special cases with trips up to 3 Km or even 5 Km, the average duration of the trips are 4:56 minutes with an standard deviation of 29 seconds. This type of measurement gives also speeds of the transport; the *Ecotax*i with a velocity of 12 Km/hr and *mototaxi* were 13.9 Km/hr. A grand portion of people said qualitative the Moto-taxis are faster, the true is faster but only by almost 2 Km/hr, this conceder only went the trip hasn't had any kind of special request, with there is a special request, like the ones talked in 1.4, the velocity drops to 11.7 Km/hr for *Ecotaxis* and 12 Km/hr for *mototaxis*, if take into account the difference vanishes only to a difference of 0.32 Km/hr.

Also the way the gauge was made it gives us geographical information about the demands, these type of data can be used to make the study for gravity centers and in some cases corridors of high demand, which will not be discuss in this paper.

5.2. General Appealing

The survey it gives a fully characterization of the user and gives the level of service. The only way to know how the people are affected (for good or bad) it trough a survey. As it was explain in 4.2 this tell us how much the price can go up, which is fairly important. The distribution in sex and age is presented in figure 10.

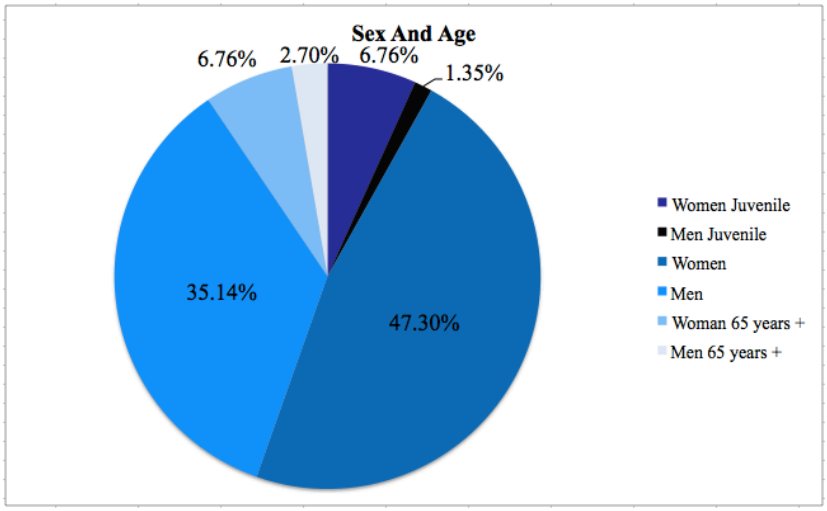

Fig. 10. Distribution of people asked the survey by Sex and Age

Others precise result were that 75.68% of polled people do not have access to a private vehicle, and 77% used the Alternative Transport, the reasons given for not using the transport mode were basically: Doesn't consider the transport safe, The range of the trip doesn't suits them, The cover of the other transport suits them better, Isn't a part of my routine and I don't know in that frequency of appearance. Parallel to the sex and age distribution the level of service was obtained by the same survey, the results are resumed in the figure 11, each sector was ask separately as every section.

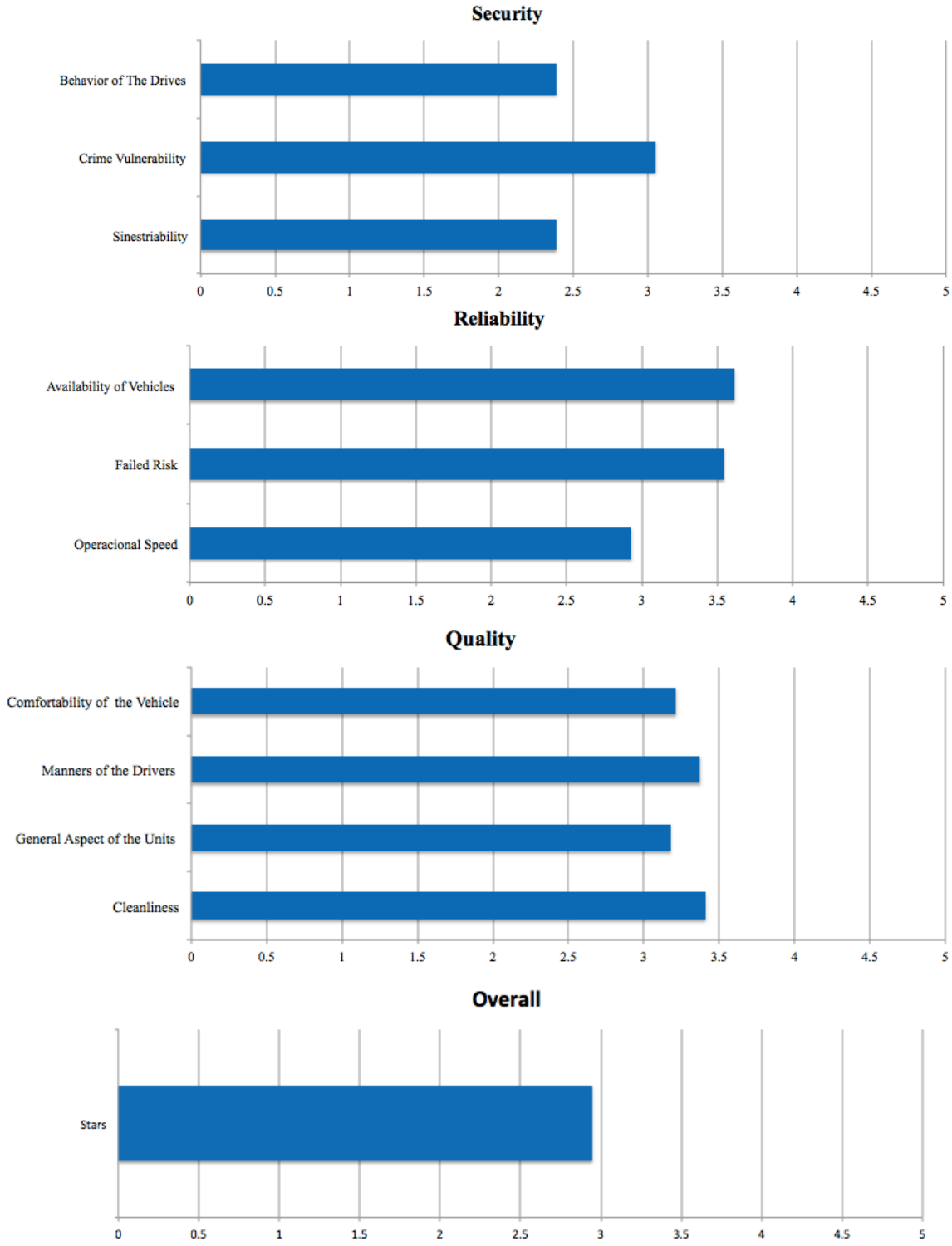

Fig. 11. Level of Service

6. The New Transport Fee Proposal

The first approach was to determine the fee considering the vehicles as a cargo vehicle, where the load corresponds to the traveling passengers. In this method, the transportation cost is based on the number of people per trip, distinguishing between fixed costs and variable costs.

The fixed cost is the one that the owner of the vehicle has to pay, even if the vehicle is not moving, for example: driver's salary, guild's contribution, insurance, driver's license, maintenance, etc. (see table 1). The variable cost are caused by having the vehicle circulating, for example, the cost of fuel, the road toll and other similar expenses. In the case of golf carts used in a taxi service, the variable cost corresponds only to the used electricity. However, since it is a very small expense in the golf cart (around 9%, not counting the driver's salary) and it is not clear how the consumption of electric power relates to the number of people in the vehicle, this is not an appropriate way to set the rate. Not only proposing a rate by the method would be inconvenient, every vehicle is costume in a different configuration, taking into account the average of consumption would make unprofitable a big part of the fleet or even a whole kind of vehicle as the new proposed rate in theory would rule all *Alternative Transport*.

The base rate was proposed as a fee that would be sufficient to cover the fixed expenses, for the average occupancy of the vehicle. Considering the costs presented in table 1, a 9-hour working day, 22 working days per month, the observed average of 3.7 trips per hour and the occupation rate of 1.38, fixed costs are found to ascend around 3 pesos per trip (a little more than half of the current travel rate - 6 pesos). The current rate would provide a basic salary of 3000 pesos per month (less than 1.5 times the official minimum salary). As stated in section 2.1, drivers receive tips in some of the trips. However, they are voluntary and depend on the user's goodwill. Currently, the average daily tips is around 200 Mexican pesos (4400 pesos per month); if 80% of this amount is included in the base salary, the rate must be adjusted to 10 pesos per trip. This would be a fairer fee, which allows the driver a more dignified life, but this is a second approach and in the same path is already in.

6.1. Rate based on the traveled distance

An important factor in the demand for public transport is the distance of the required trip; as the distance determined the time needed for the trip and the used quantity of fuel or electricity, it is one of the most important factors to take into account when establishing the transport rate.

The best rate for the proposed case is based on zoning, more precisely the concentric zoning (Bianchi, 2012), as used for example in Stuttgart or Milan, or even in Mexico City for the service of regular taxis at the Benito Juarez International Airport. A fee based on concentric zoning has the advantages of including the trip distance in the calculation, in addition to being easy to understand for users and drivers, for example by using a map. A major drawback for the concentric zoning method in the Tlahuac *Alternative Transport* case is that not all trips have the same starting point implying a recording of the route to clarify the charger; also most golf carts and *bicitaxis* do not have an odometer installed. Also when the distance of the trip increases, obviously the number of possible trips decreases

6.2. Rate based on the traveled time

The other existing method to create a rate is trough the time spend in the trip, because of the relation existing between time and distance trough speed, exist the possibility to propose a simpler variant based on the duration of the trip.

This makes it easier to understand the proposal for the users and a cheap alternative for the drivers, because he can easily activate the chronometer available on his mobile phone to obtain the trip duration and the clients also can do it to confirm the charges.

6.3. Final Rate Proposal

As seen in the previous paragraphs, in our case it is not practical to use a variable fee based on distance. Based on the observed in practice, the golf carts can make a maximum of 6 trips per hour and *mototaxis* 8 trips per hour, including when correspond the return to the taxi rank and if the time spend waiting for a user, also the obtained average duration of 5 minutes per trip. Previously said in 4.1, the distance is an important factor to construct the demand of any kind of transport, because is related to variable costs of the operation, more distance more fuel. Taking in the account the point given in 6 about the fix cost and 6.2 about the benefits of time based rate, it is conceder instead of distance would be taken by the duration in time, time it's very important for the making of the new fee because it says which kind of trip enter in the normality and what kind of trip should cost more.

According to the survey is possible to rise the fee, the increase has to be reasonable because the level of service in average it is a little above the half. Normally the longest trips are the ones that are going to be up because in the same time of a long trip with one people you can make at least the same amount of money, we are aware if the cost for longer trip rises the demand would be lower, but in the end the problem it is that the longer trips are the one not really profitable, so if the number of longer trips decreases the profitable per trip increases and be able to cover a bigger amount of demand and this would enhance the level of service. Also as the average of trips per hour increases directly would the profits. Moreover the average of passenger per trip is rather lower, applying measures that help increasing the number of passenger per trip would be a concrete contribution to the efficiency and profit of this transport mode. For example: if a Alternative Transport has a trip of 2.2 km and lasting a little more than 8 minutes with only 1 people, the current charge of the trip will it be 18 pesos, but if the same Alternative Transport has a trip of 2 people with a duration of almost 4 minutes and 0.9 km gaining 12 pesos and returning to the taxi ranks it's demand another trip with one people lasting 0.8 km and 3.5 minutes adding another 6 pesos. The second and the fist situation make the same amount of money in fairly the same amount of time but the gain in the level of services is added in the second situation.

The final rate would be alike some parking lots, the fist 7 pesos per person would cover 5:15 minutes of travel, once you cross that line .50 pesos per person would be added for every minute, all the way trough 7:15 minutes (for this trip would be 8 pesos per person), then if the trip continues 1 peso would be added for every minute and half, at the end of the 10:15 of this stage the charge would be 10 pesos per person, in case that the trip continue for every minute or fraction added, the rated rises 1 peso, for example a trip of 15 minute would be 15 pesos and a trip of 15:30 would be 16 pesos. If the trip starts with tree or more persons starts at 6 pesos per person and cover 5:30 of travel, once you cross that line .50 pesos per person would be added for every minute, all the way trough 7:30 minutes (for this trip would be 7 pesos per person), then if the trip continues 1 peso would be added for every minute and half, at the end of the 10:30 of this stage the charge would be 9 pesos per person, in case that the trip continue for every minute or fraction added.

7. Conclusion

The suggested procedure for the making of the new rate in this paper serves to improve the conditions of profitability afflicting drivers and owners of the fleet, joint to the simple form it works would help unifying the rate trough all the transport mode in the area, likewise would make easier to explain and corroborate the charges based on the new rate. Notwithstanding a new rate help dealing with the homogenization of the Alternative Transport does not act in the problem of the unfaithful competition from the non-associated drives.

As a general thought resuming the sixth section (The New Rate Proposal) the cost of the transport is not really in the distances, it is in the time trough the relation of speed. Making the new rate related to the duration of the trip would decrease the demand for longer trips that helps increasing the profitability and the level of service being able to attend more users. The misguidance of the managers applying the increased and a fix rate in the attempt of maintaining the Alternative Transport afloat feed by the thought, more is more, missed the toll it would have in their level of service, the hole weren't able to foreseen the kind of reverberation it would have take all kind of tips with the fix rate imposed by the authorities.

It is also possible that the low average occupancy can be explained by the low vehicle capacity and its "on request". This is in contrast to the average occupancy in for example a bus, which is generally greater than 1. On the other hand, the bus can travel empty, which makes the number of bus trips an inefficient measure to analyze the relationship between service availability and demand, that is why the gauge principal variable were trips and then number of people aboding in the trips in this research.

The sensitivity of the work condition to emergencies and eventualities is caused by the small or none existing savings by the drivers and owners of the fleet, due to the small profit that came of this profession and the condition of been related to a work unit with a heavy use increasing the risk of sudden break. Having a bigger income could compensate and give a more suitable share of money to save. Since this paper characterize the demand of the *Alternative Transport* the drivers and owners of the fleet can get to know in a more profound and quantitative form their demand they would bee able to organized in a more convenient way, having information on which days of the week and at what times more transportation of this type is demanded, it will be easier for a taxi drivers' union to plan the number of drivers required, the duration of the shifts, and even what would be a fair transport fee to make a living. Finally as they now have a notion of what their users think about the service they can make focus changes to quickly raise the level of service, but as said in 4.1 the changes in transport can take some time to make effect or show results.

Concluding the founding about that the majority of drivers of *Ecotaxis* or Golf cart were older than the rest, talked in 1.2 (Type of Drivers), it is possible that older drivers prefer to drive golf carts because they know that these have larger demands, or, on the contrary, that demand is higher because users prefer more experienced drivers, this was inconclusive.

7.1. Benefits for the community

This transport gives a better control over the times to their costumers, help the elderly to be more independents and have a more normal type of life and make more efficient the transport network in the zone.

The Alternative Transport is base to be a local kind of transport, the managers of guilds and the drivers are aware of this, so they tried to give back to the community in which they work, they tend to buy locally helping the local shops, they give free annual dinners to thank the people and they get involve in governmental and non governmental programs to enhance the community.

Rapidly was obvious that the target market will be the women, and it have sense because as said Hjprthol (2013), the women have poorer mobility, and more in the line of investigation of Hjprthol the ederly women also re more dependent on being in good health and in getting help from others for their personal mobility.

As a closure, this type of proposal in mobility are look down to the authorities, so part of this paper aims to draw attention in order to regularize the *Alternative Transport*, the complete legalization and legislation of it has been way to overdue and this have ravages within the structure of the transport mode, this kind of transport are some times put in the topic of problems, but we think that the people has come up to fix the problems in transport of its own community and in the way earning in a decent way of life.

The mayor problems the *Alternative Transport* has it's no able to scold the non-associated drivers and other not applying an inexistent laws, because that is part of a justice system and traffic regulations. The field of research we find here it's very big and unexplored, we invited people to try in.

Finally trying to give voice to the people in this work field (*Alternative Transport*) "We want order, We don't want to be told our jobs are inhumane because we are helping people and also helping our community's grow, We want to be heard and reasoned with".

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