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Dimensioning of a Bike Sharing System (BSS): A study case in Nezahualcoyotl, Mexico

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Abstract

The reported success in the implementation of sustainable transportation systems has generated great expectations at international level on the subject of urban planning. Particularly, Bike Sharing Systems (BSS) have been adapted successfully in places where it has identified a large proportion of short trips and characteristic geospatial conditions. This work is part of a project in Nezahualcoyotl in Mexico, where socioeconomic conditions in the area, the adherence of its society to this transportation mode as well as the urban trace and physical conditions favor the adoption of a BSS. This paper presents the methodology used to carry out the design and dimensioning of such system. The process involves: an optimal stations location modeling and a discrete simulation process for determining the ideal number of bicycles and the number of parking lots per station. This work focuses on the knowledge of the potential user preferences regarding their travel patterns and the computation of its utilization probability either replacing a motorized mode trip or as a link in a journey that involves transfers with more transportation modes.

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Keywords: Sustainable transportation; active mobility, Bike Sharing Systems

1. Introduction

Sustainable transportation systems have generated broad expectations and have recently attracted the focus in the scope of urban planning. Particularly, Bike Sharing Systems (BSS) have successfully adapted to places which combines short trips and specific geospatial conditions. In the last five years, more than five hundred cities all over

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the world have implemented these urban mobility systems, facing the noxious effects of the motorized transportation systems and promoting the return of street occupation by the people. This number is incremented at rate of one or two every week, making it the transportation system with the highest expansion rate in the history (Larsen, 2013). The present work is placed at Nezahualcoyotl in Mexico, where the socioeconomic conditions, the urban trace, the topography along with the people adherence to bicycles favor the adoption of a BSS.

The outline of this paper is the following: in section 2 the precedents and generalities of the BSS operation in worldwide implementations are presented as well as the role of the BSSs in Mexico. In section 3 the area of study is presented. Within this section, a mobility analysis, a purpose travel related analysis and a temporal analysis are made. In section 4 the results from the potential users' preferences analysis are presented. Those results are later used in section 5 in the dimensioning process in which a quantitative methodology is used. Finally, in section 6 the main conclusions and recommendations of this work are discussed.

2. BBSs precedents

BBSs contribute to sustainability since minor energetic resources are consumed in its operations. The door-to-door travel capability represents its main appeal and moreover in those places where access is not possible to motorized transportation modes. These systems are also known as *Public-Use Bicycles*, *Bicycle Transit*, *Bike sharing* or *Smart Bikes* (DeMaio, 2009). Users arrive to the bike-stations, take a bicycle for a short amount of time and finally turn it to the same or a different bike-station (NYCDCP, 2009), this is, the bike is used without the commitment and the responsibility of own it (DeMaio, 2003; DeMaio, 2008; Shaheen et al., 2010; 2012). These systems are generally promoted by the public administration and operated by advertisement companies, transportation operators and even by public organisms. Several business models exist in which different participation levels are distributed among different participants.

The first generation of the BSS started in the 1970's with the ambitious but ineffective White Plan in Amsterdam (Furness, 2010). Later, the second generation took place in Copenhagen in the 1990's where controls were established oriented to assure the bicycles conservation. The third generation started as a "bike loan library", where short-term "bicycle loans" took place based on data linked to the registered users. Nowadays, the fourth generation is characterized by the use of smartcards and payment integration with other transportation modes, the use of semi-automatic and solar technology in bike stations, and service reservations via mobile applications (DeMaio, 2008).

The existence of BSSs in different countries in the world is somehow related to the authorities' vision and policies adopted for the transportation systems integration (Larsen, 2013). In the literature there are identified and explained the requirements for the adoption of a BSS: factors such as city size, topography, weather, urban trace and demography (IDAE, 2007; 2010) are broadly discussed. Barrier factors are also identified: socio-demographic factors, directly observable factors, structural factors, and subjective factors (Rietveld and Daniel, 2004; Sener et al., 2009; Pucher and Buehler, 2007; Wardman et al., 2007; PRESTO, 2010a; Akar and Clifton, 2009; PROBICI, 2010).

Something common in these reviews is the fact that BSS strongly depends on the users' perception: the barrier factors previously mentioned are, at the end, user dependent. BSSs do not present inelastic demand behavior as other transportation modes, since BBSs are easily substituted.

In short, such guidelines about the adoption of BSSs are just oriented to list the benefits and the measures of promotion in order to assure the people acceptability in a short term, and moreover, to reach those society sectors whose travel patterns are compatible with the BSSs, and therefore potential changes in transportation mode election can be achieved.

The dimensioning approach presented in IDAE (2007) is the approach selected in this work due to the supporting background to perform the computations of an optimization model. The determination of the number of bicycles and parking spaces comes from a dynamic simulation procedure during a typical labor day, in which it is assured that a targeted level of service will be reached.

In Mexico, other cities have experienced excellent results with their BSS programs: Distrito Federal (*Ecobici*), Guadalajara (*Bikla*), Puebla (*Smartbike Puebla*) and Queretaro (*Queretaro se mueve en bici*). From the number of public bicycles in their systems, Mexico, occupies the eleventh place all over the world (Larsen, 2013).

It is noteworthy that in Mexico, it exist a remarkable motivation coming from cyclist groups of young people all over the country to promote bicycle use, at first, with recreational purposes framed into physical activation programs supported by local authorities. For instance, Mexico City, Aguascalientes, Guadalajara, Monterrey, Queretaro, Leon, Ensenada, Oaxaca, Puebla, Veracruz, Toluca and other important cities in the country organize cyclist journeys one day a week. More recently, in municipalities near Mexico City such as Nezahualcoyotl this kind of journey are also taking place. This change of culture towards a trend of active mobility is reflected over the time in systems such as the one in Mexico City, which with just 3 years of implemented, the shared bicycle demand had grown over 300 % in the population between 26 and 40 years old (Aldaz, 2012).

Conceptually, the BSSs are oriented to serve short trips inside a certain influence area, during short-term bike loans (limited to 30 minutes) to assure their continuous rotation and utilization. The target population are not regular cyclists (captive users) since they will continue to use their bicycle with or without BSS, but instead, those people that may change their transportation mode or to solve the “last mile problem” of completing their trip, depending on the whole conditions. Therefore, previous to the implementation of a BSS, it should be performed a design process to meet the mobility needs of the target population, and to be dimensioned according to their routes and most frequent destinations to provide optimal use and safety. In practice, the current paradigm is that current and potential user has to adapt their mobility needs to the available bikes and infrastructure as they are arranged and located.

3. Nezahualcoyotl mobility diagnosis

The study area is a relatively new created locality. Its origins date from the decade of the 1960’s in which people came from different states from the Southeast part of the country, and settled in some deserted fields in order to be close enough to Mexico City in the search of job opportunities. The people living on those irregular settlements, due to the lack of public services (water, electricity, markets, schools and transportation routes), and given their low job profile (bricklayers and laborers), adopted the bicycle as the primary way for transporting themselves. This is why in the study area people have a strong adherence to the bicycle as a personal transportation mode.

The Valley of Mexico Metropolitan Zone (Mexico City plus 60 municipalities of Mexico State and Hidalgo State) add up to more than 20 million people and only Nezahualcoyotl contributes with around 1’110,565 people (INEGI 2012). Figure 1(a) shows the municipalities that constitute the Mexico Valley Metropolitan Zone and the influence of Nezahualcoyotl on it. This city has an almost flat topography. It is an area of high population density. Business activities take place along the main streets in whose intersections exists susceptibility of traffic issues.

Another favorable point in terms of the bicycle mode is the existence of streets in the city wider than the conventional dimensions. Currently this additional space is used to park cars, for street business or to hold stations of other transportation modes such taxis, motorbike-taxis and pedicabs. Such space may be available for use of bikeway lanes or bike stations. Weather conditions in the area are a favorable factor since most of the year is ideal for physical activity outdoors. Another characteristic feature is its urban layout: the grid design allows good connection between streets and facilitates the traffic distribution to parallel paths. No inaccessible points are identified. The main traffic issue is the congestion of motorized traffic at intersections of main streets. In figure 1(b) it is illustrated the regular trace and flat topography of Nezahualcoyotl.

3.1. Nezahualcoyotl travel patterns analysis

The next step consisted in analyzing data from the survey Origin-Destination conducted at the Mexico Valley Metropolitan Zone in the year 2007 (INEGI, 2007). Such data came from the application of a home-based questionnaire intended to meet regular mobility patterns in labor days of its residents above 6 years old (the sample size was 360 homes per district: 83 districts for Mexico City and 72 districts for Mexico State, and a total sample of 55,800 homes). From the 22 million daily trips of the Mexico Valley Metropolitan Zone 49.5% are produced in Mexico State, and from this quantity 10.43% has Nezahualcoyotl as the trip origin. From those origin-based travels, 32% has Mexico City as the destination, and 68% has as destination some other place in Mexico State (INEGI, 2007).

Fig. 1. (a) Municipalities that conform the Valley of Mexico Metropolitan Zone; (b) Regular network trace and topography in Nezahualcoyotl. *Source (b): DS's World Lands (ds-lands.com)*

About one of six trips generated in Mexico City has as destination any surrounding municipality of Mexico State, and Nezahualcoyotl is one of the most popular municipalities due to its attractor centers. In fact, it is one of the localities that most stands in trip generation and attraction, since it generates 1'134,071 daily trips, and attracts 1'095,468. From these trips, 359,306 have Mexico City as destination. Conversely, 773,749 trips generated at Mexico City have Nezahualcoyotl as destination. Details about purpose trips generated and attracted to Nezahualcoyotl are shown in table 1.

From previous traffic engineering counting studies conducted by the UAEMex, there were computed Levels of Service (LOS) for the street network. Such LOSs provide specific information about street congestion which are correlated to the activity of mode interchanges (getting on/off from vehicles on different modes/routes in mixed traffic lanes). In figure 2(a) the generators and attractors centers are represented by means of a GIS; in figure 2(b) shows levels of service at main grid of streets, also in a GIS.

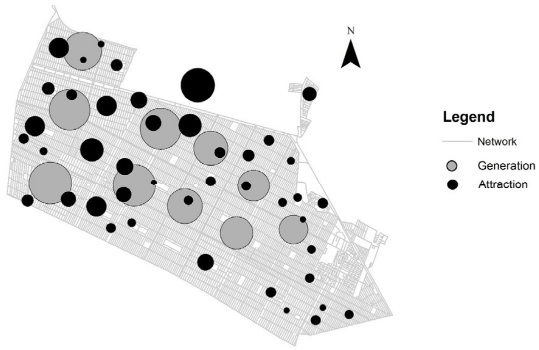
Clearly this city represents the point of more interaction in the Eastern region of this metropolitan area. There exist specific points of travel generation and attraction located at Nezahualcoyotl. The BSS points toward a market segment that might or might not possesses a private vehicle and also have the need of making a complete travel or as a part of a complete journey involving two or more transportation modes (Bachand-Marleau et al., 2010).

Table 1. Trips by purpose having Nezahualcoyotl as generator and attractor center.

Purpose (as generation center)	Trips	%
Work	309,487	27.2
Home	520,861	46.1
School /Study	98,359	8.7
Shopping	45,837	4.0
Pick someone	44,982	3.9
Leisure, social activity	41,652	3.7
Work related	13,296	1.2
Dinner	3,445	0.3
Personal administrative processing	18,828	1.6
Other	37,324	3.3

Purpose (as attractor center)	Trips	%
Home	523,243	48.0
School	155,108	14.0
Office / related to work	104,111	9.5
Market /Shopping	116,443	11.0
Industry	15,042	1.3
Another home	48,908	4.3
Hospital /clinic	45,789	4.2
Restaurant /bar / cafeteria	5,460	0.5
Workshop / laboratory	1,590	0.1
Gym / sport center	5,386	0.4
Park / leisure center	2,973	0.2
Other	71,415	6.5

Source: Own elaboration based on Origin Destination Survey, INEGI (2007).



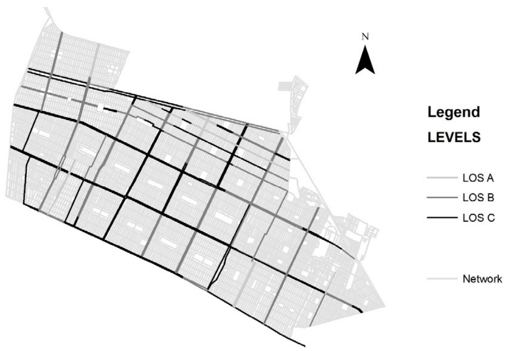


Fig. 2.(a) Generators and attractors centers by activity levels; (b) Levels of Service (LOS) at main streets at Nezahualcoyotl.

3.2. Temporal analysis

A time distribution of the population mobility was performed according to three main purposes: work, school and going somewhere else. With such hourly distribution it was possible to obtain the periods of time in which maximum and minimum demand exist. The period between 5:00 am and 10:00 am represents the period with the highest number of trips generated in the city. In this period of time people are generally directed toward school, work or back home (from finishing work shift, or from leaving children at school). Those people who travel to Mexico City usually do it by using public transportation (vans, minibuses, buses, etc.) whose routes are overlapped with the limits of the municipality and their destinations are points of connections and transfers to other transportation modes in the limits of Mexico City as the Metro (subway) or the Metrobus (Bus Rapid Transit). This public transportation operation scheme promotes excessive use of these pathways as a route of exit or entrance to the city.

Based on these people mobility considerations, candidate locations for station facilities are determined. The size of the vehicle fleet is such that it must exist at all hours. This is determined as a result of the analysis of the people flows between stations. Thus, a ratio of indexed locations with a possible number of bicycles for use is determined.

4. Preferences modeling of potential users

It was determined a utility model given some information from users Declared Preferences (DP) surveys. This utility model allows inferring the probability of mobility patterns by bike in the network for different users' profiles, and more important, it allows the determination of an initial bicycle Origin-Destination matrix. There were applied 900 exercises during six days in different hours at mode interchange places proportionally to their activity level.

The utility function for each transportation form estimated for the specific case are the following, for the case of a) travel by foot, b) travel by bike, c) travel by car, and, d) travel by public transportation, and where the variables are described as follows: V_{ttime} represents the travel time for determining; V_{Age} >40 is a variable that takes the value of 1 if the person has an age greater than 40 years old and 0 otherwise; the variable V_{Gender} takes the value of 1 for a woman and 0 when it is a man; the variable V_{Income} *<5 mw* takes the value of 1 in the person income does not exceed 5 minimum wage and 0 otherwise. The variable $V_{Car\ travel\ cost}$ represents the cost of traveling in motorized private vehicle. Analogously, the variable $V_{TP\ travel\ cost}$ represents the cost of traveling by public transportation. The variables $V_{tacc\ orig}$, $V_{tacc\ dest}$ and $V_{waitingt}$ represent respectively the time of access at the origin, the destination and the waiting time in the system. Here are presented the functions that were obtained.

$$U(foot) = 0.00 + \left(-0.25 + 0.03 * V_{Age>40} + 0.02 * V_{Gender}\right) * V_{ttime} \tag{1}$$

$$U(Bike) = -9.17 + \left(-0.25 + 0.03 * V_{Age>40} + 0.02 * V_{Gender} + 0.02 * V_{Income<5\ mw}\right) * V_{ttime} \tag{2}$$

$$U(PT) = 2.04 + \left(-0.34 + 0.03 * V_{Age>40} + 0.02 * V_{Gender} + 0.02 * V_{Income<5\ mw}\right) * V_{ttime} - 2.21 * V_{TP\ travel\ cost} - 0.12 * V_{tacc\ orig} - 0.09 * V_{tacc\ dest} - 0.83 * V_{waitingt} \quad (3)$$

$$U(Car) = -1.03 + \left(-0.53 + 0.03 * V_{Age>40} + 0.02 * V_{Gender} + 0.02 * V_{Income<5\ mw}\right) * V_{ttime} - 2.21 * V_{Car\ travel\ cost} \quad (4)$$

The variables that define both the utility of public transportation as well as the private motorized transportation are mainly the travel costs and their corresponding travel times (whose value depends on gender, age and the income level of each person). These variables are associated with greater weight than the variables that define the usefulness of both the walking mode and the bicycle mode, so these two modes are less attractive to the motorized users.

In the case of public transportation, besides the travel time, it is also important the waiting time, the access time to origin station and the access time to the destination station at the final of the trip. Finally, after modeling the PR data we end up with the following conclusions:

1. The probability of choosing the bicycle mode is higher in men than for women, independently of age and income level.
2. For people under 40 years old the probability of choosing the bicycle mode is higher than for those over 40 years.
3. For users with monthly income less than 5 minimum wages, the probability of choice is higher than for people with higher incomes than 5 minimum wages.
4. The willingness to pay is higher in men than in women, given that with lower income than 5 minimum wages, the willingness to pay is something higher than 50% for private motorized transportation than for public transportation.
5. The variation in the travel time affects severely the walking mode (elasticity of demand), because when it increases by 1%, its choice probability decreases by 6.44%. The variation in travel time affects the demand for all modes. The variable that most affect public transportation is the waiting time, when increasing by 1%, the probability of choosing it decreases 7.62%.

In this way the variable with more weight is the travel time. This analysis facilitates the demand management and the possible actuation policies, since it is known the variation of the choice probability when it is changed the value of the variables that define the utility of such modes.

5. BSS dimensioning methodology

A Geographic Information System (GIS) was constructed adding socioeconomic information. Mobility information was added: generation zones represented by residential areas linked to attraction zones represented by schools, workplaces and transfer stations to other transportation modes. From this step it was obtained an origin-destination matrix with specific attention to short trips. It is worth to mention that volume/capacity relationships become critical for some specific locations at certain hours due to the convergence of dynamic traffic flows. The next stage consisted in the use of an optimal bike-station location model and a discrete optimization model to determine the ideal number of bicycles and the number of parking spaces per bike station. Information of users' preferences allowed the analysis of travel patterns and particular mobility needs as the substitution of a motorized trip to reach their destinations, or as a link for complete trips in the integration with other transportation modes.

From a two-level optimization model, Origin-Destinations matrices are recalculated under the assumption that people might be willing to change to another transportation mode if total network costs reduces as the result of individual costs reductions. When no improvement can be reached we ended up with the final stations location. The network assignment and cost calculation were made using a well-known transportation planning software. Then, a discrete simulation step is made to determine the number of bicycles and parking space needs for each station at every hour. Here, the theoretical elements of the transportation systems planning and the four-stage model (generation, attraction, assignment and modal split) are used (Ortuzar and Willumsen, 2011).

In practice, the determination of points on board and descent from the transportation modes has traditionally been an aspect that in practice is determined by trial and error or for any legal justification and/or practical experience of the decision makers and rarely performed using a mathematical model that determines the optimal selection based on predefined criteria, where it is involved the people travel time and the maximization of a global utility function. The methodology presented was previously conceived by the Research Consortium PROBICI, and implemented into a Geographic Information System (GIS) to facilitate manipulation of socioeconomic information, and with the use of transportation models implemented in a standard modeling tool such as TransCAD, and exploiting this particular tool to perform assignment processes on the network. By applying this methodology the convenience of systematic handling of socioeconomic and geographic data in a GIS is demonstrated as well as the methodological basis for the design and dimensioning of sustainable urban mobility systems like a BSS (PROBICI, 2010).

There are approaches such as the one presented by Romero et al. (2012) that seek to optimize station locations using a combination of different optimization criteria (efficiency, sustainability, economy and social equity) based on a methodology that simultaneously models the private and public transportation systems considering their interactions through modeling assignment of each mode to the network. Another interesting approximation is the approach of Martinez et al. (2012) who used a heuristic for solving a mixed integer linear programming (MILP) that simultaneously optimizes the location of the stations, the size of the vehicle fleet, and regulates relocation activities required on a regular day of operation.

The logic of the dimensioning process involved in this work is the following: starting from users modeling preferences at high activity points, and given the probability of using the BSS system, we estimate the expected number of bicycles per station at hourly basis. The idea is to obtain an approximation of the travels, given the origins and destinations visualized. This number is the input for a one-day replication process of the system, and therefore, the determination of the number of bicycles needed to assure the utilization system at certain user level of service. This logic is shown in figure 3.

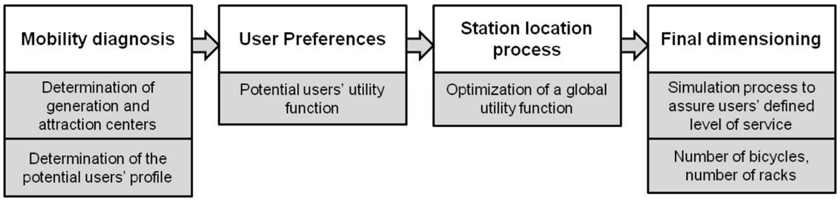


Fig. 3. BSS dimensioning methodology

5.1. Optimization model for stations location

In this section it is explained the methodology used for the optimal location for such points for the BSS as well as the most interesting results of its application. The optimization model adopted in this work consists in using a function of the total system, which consists of the users' costs from private traffic, the costs from public transportation users (bus/minibuses), the operating costs from the whole transportation system, the costs from bicycle users' mode and the operating costs from the bicycle loan system. This total cost function is minimized subject to a number of constraints: operational and physical of the three modes. The user costs come from the conversion through the different time values, which are calculated for the study area in particular, from the travel time of each mode. The operating are the ones that can support both public transportation and the bicycle mode to provide some level of demand. The lower level is represented by the user behavior with the combined modal model-assignment model, and the assignment model for the bicycle.

The first step to perform is to integrate in the model the three most significant modes that for medium-sized cities are typically car, buses and cycling. Although the network of the three modes is practically coincident (except in those cases where any of the traffic modes is restricted or has exclusive access), there is a considerable difference between the costs perceived by users for the same arc road network or connecting a source-destination pair.

The assignment process will determine the equilibrium between supply and demand of the three considered modes. This process is solved by a bi-level optimization model, since the structure of the problem perfectly meets the requirements of a two-level model with two interacting agents (Codina et al., 2003): the planner (leader) and ratings of automobile, bus/minibus and bike modes (followers) and consist of:

- A function of total system costs, which consists of the cost of private traffic users, the cost of public transportation users (bus/minibuses), the operating costs of the public transportation system itself, the operating costs of bicycle users and the operating costs of the BSS.
- The total cost function is minimized subject to a number of constraints:
  - The operational and physical restrictions of the three systems of transport: car, public transport and bicycle.
  - The model user behavior in the three modes described above.
- The user costs come from the conversion of their estimated travel time determined for Nezahualcoyotl from the stated preferences surveys (Dell'Olio et al., 2006).
- Operating costs are those that must support both public transportation modes as the bicycle mode to provide some supply level. Therefore, the operating costs include the operator of public transport in the study area (Ibeas et al., 2006).

Basically, at the high level of the problem it is placed the planner or the decision maker that specifies the characteristics of the 3 concurrent transportation modes. From them, the users (inferior level) select the mode and the route and it is reported the level of service reached in the equilibrium that allows complete evaluation of the cost function. This is an interactive procedure and the Hook-Jeeves algorithm is used. After the optimization model application it comes to the following candidate sites for the implementation of the bike stations, leading to the 10 locations: López Mateos–Pantitlán, Cd. Jardín, Palacio Municipal, Cama de Piedra, López Mateos–Bordo, Texcoco–López, San Ángel, Cuauhtémoc, Siete Leguas, and Agua Azul Station.

5.2. Simulation approach for bike fleet size calculation

It is necessary to highlight that the number of bikes is directly related to the number of parking spaces. Studies in Europe have determined that the relationship must be between 1.5 and 2, this is, that the number of parking spaces must be between 50 and 100% greater than the number of bicycles, in order to accept the variability that might occur depending upon the demand intensity in a given place. In order to compute the number of bicycles a dynamic demand simulation process was performed individually over all the stations. In this analysis the minimum unit time was 60 minutes. In figures 4 (a) and (b) it is represented the income flow and outcome flow simulation for two of the ten locations.

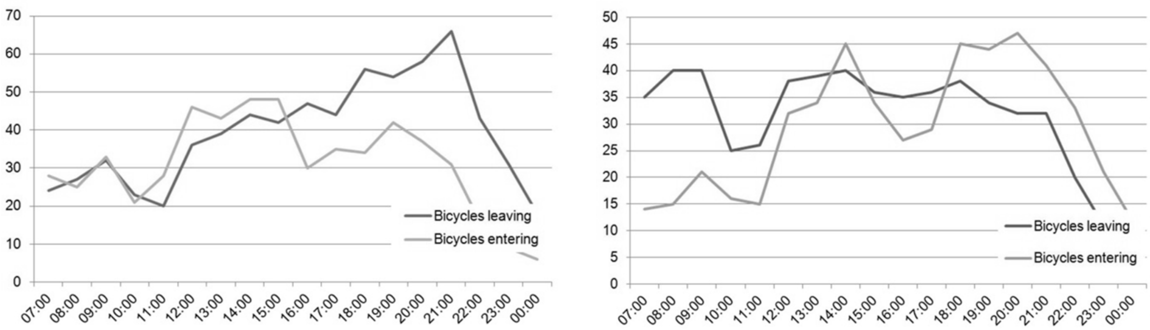


Fig. 4. Income and outcome bicycle flows at two different stations (a) *Cd Jardín Station (left)* a typical attractor node, and (b) *Cuauhtémoc Station (right)* a typical generator node.

In order to determine the number of bicycles at each bike station at the beginning of the system daily operations and therefore, the number of bicycles in the whole system, it is made an hourly addition that allows determining the number of bicycles occupied simultaneously. It is highlighted this point since it does not mean that all bicycles are located exactly where they can be used by the users. This hourly sum is presented in table 2. In terms of the demand estimations, the period from 14 to 15 hrs, at least 509 bicycles should be available.

Table 2. Hourly number of bicycles in the system.

Time (hr)	7:00	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Number of bicycles	372	382	383	277	272	431	498	509	433	397	390	418	442	458	414	285

5.3. Bike infrastructure considerations

Finally, the final bikeway network is determined allowing total connectivity among bike-stations and following guidelines already assessed in the literature, such as: no sharing with mass public transportation systems, avoiding the use of main streets or with high volumes, avoiding crossing main streets, guaranteeing a minimum wide lane, having full access to trip generators and trip attractors, and assuring network connectivity (CROW, 2007; PRESTO, 2010b; NACTO, 2011). In table 3 details of the number of bikes and parking spaces calculated are presented.

Table 3. Bicycles and parking spaces defined for each bike-station.

Station location	Bicycles calculated	Activity level	Parking spaces
López Mateos – Pantitlán	140	100%	280
Cd. Jardín	60	40%	84
Palacio Municipal	70	80%	126
Cama de Piedra	50	40%	70
López Mateos – Bordo	70	80%	126
Texcoco – López	90	80%	162
San Ángel	60	40%	84
Cuauhtémoc	50	40%	70
Siete Leguas	60	40%	84
Agua Azul	55	40%	77

6. Conclusions

The number of public bicycle systems in the world has experienced a truly exceptional rate of growth. The convergence of chaotic scenarios in economic and energy aspects seems to encourage active mobility schemes, while discouraging motorized transportation modes and revealing that it is not possible to ensure the sustainability of such systems. The reported number of established systems continues to increase, leaving no doubt about its position in the world as a public transportation mode.

In this paper it was highlighted the most significant elements that around BSS. Typically those elements converge to an ideal status which is used in the design and dimensioning of other transportation systems under the particularities of Nezahualcoyotl, where it exists a great attachment to the bicycle. Barrier factors are identified and measured in order to justify the design of social programs oriented to promote strategies for its implementation as a part of an integrated transportation system.

Considering the concept of integration of the bike sharing system into a highest concept of urban mobility, the analysis of mobility patterns was conducted. The estimated volumes for each main street, their traffic distribution by purpose and their corresponding time distribution are necessary in the process of location of ideal places for establishing or bike stations and the infrastructure that would part of the proposed bike network, in order to connect with other modes using existing streets. The characterization of the mobility determines the relevance of the proposed system for the study area and assures that the design is made to favor its short -term acceptability.

In this work we started from many elements from the Research Consortium PROBICI. The idea of dimensioning has been conceived mainly for systems already existing. Basically, the contribution of this methodology to the state-of-the-art consist in the inclusion of an all-day simulation process that reflects at some precision level the daily operations and therefore determining the system dimensioning at micro level, expressed by number of bicycles and parking spaces.

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