Methodology to determine a cycle network in a city

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Abstract

Mobility is fundamental to modern societies, but the growing dependence on fossil fuels resulting from the use of private vehicles has adverse impacts upon the environment and city quality of life. These growing concerns about environmental issues led to the implementation of soft transportation alternatives to the current use of the automobile. The sustainable mobility is an concern for the European Commission as well as the government of Portugal and they already established some guidelines to promote clean transportation as alternative to urban mobility.
The cycle mobility is a promising alternative to the current mobility system. Bicycle is environmentally friendly in terms of pollutant emissions and noise pollution. In the point of view of the user this alternative is cheaper and physically and psychologically healthy.

Actually, bicycle is a faster way of transportation in urban areas to travels between 300 meters (3 minutes) and 4.5 kilometers (22 minutes), see FIGURE 1.

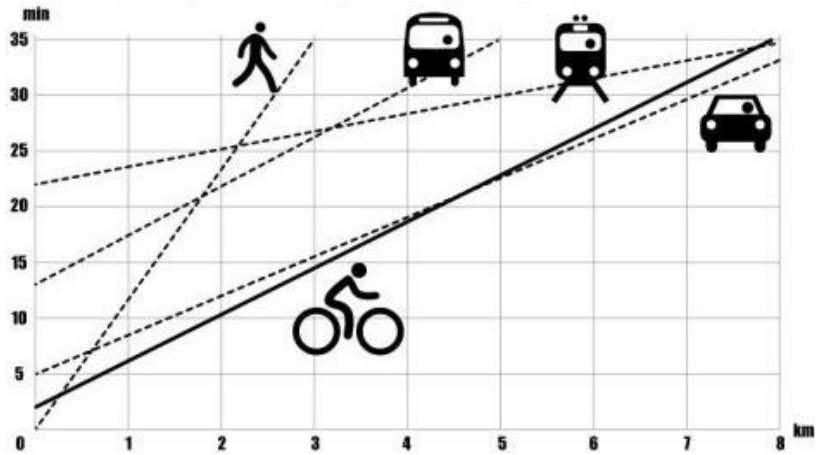

FIGURE 1 – Time of travel in urban areas in different modes of transportation (Source: [1]).

However, there is still a long way to turn this mode into a usual choice, namely in countries where changing from a leisure-based use to a commuter use of this transportation option is still in the beginning, which is the case of Portugal.
One of the problems that involves cycle mobility and preoccupies the European Commission and the Portuguese government is the lack of adequate infrastructure in the cities. It is also the biggest problem usually identified by cyclists. The security and the feel of security itself are very important to cyclists.

One first important step to promote cycle mobility is to turn the streets of a city into cycling friendly paths. This is achieved through setting up a consolidated, connected and supported network that allows attracting cycle users.
Yet the global investment to turn cities into cycling friendly paths can be very high and the local governments investment capacity is generally very limited for those purposes. Therefore, it is important to establish a prioritized investment program and adequate the intervention to the local conditions.

This paper presents a modeling based methodology to establish an hierarchy and scheduling of a set of possible interventions in the cycling network.

It is risky to predict the number of bicycle trips in a street network with no actual bicycle use. Even using stated choices survey, because people's behavior varies greatly and many times respondents answer these surveys in a strategic way towards what is more socially acceptable. This evaluation can produce unreliable results.
In this way, the methodology determines an indicator of the potential demand for each arc of a street network. It is calculated by arc weighted accessibility to the main trip generators/attractors in the city based on trip time and travel

purpose considering the distance from each arc to the main trip attractors/generators in the study area. It considers five different purposes: work, school, recreation, shop and home.
It is important to refer that the purpose of travel influences the probability that makes the bicycle mode and increases in travel time have a different effect in the different travel purposes. For instance, the probability of using a bicycle for recreational travel is bigger than for shopping purposes, because it can be hard travelling with shop bags, additional two minutes in the work travel time can reduce significantly the rate of bicycle users, whereas in recreational travel can be irrelevant.

This methodology characterize each arc of the network by its potential for bicycle trips, in other words, it determines the importance of each arc in network but doesn't determine the number of trips. The difference of potential arc-to-arc defines a hierarchy of importance that identifies arcs and zones with higher capacity to integrate the bicycle as a mode choice alternative for different types of trip purposes.

It is important to refer that the high potential of an arc does not always mean his pertinence to build a cycle path or cycle lane or other similar solution. After calculating the potential of demand, we have to analyze the characteristics of each arc and determine the best cycle typology to adopt.

Crossing information about hierarchy of potential and characteristics and conditions of road network it is possible to establish the best solution for a cycle network which will meet the population needs and promote cycle mobility.
This method is demonstrated using as case-study a Portuguese middle size city, Tomar.
Results point to the usefulness of the model as very helpful guidance mechanism to establish the investment program sought.

Keywords: Bicycle, cycle cities, network planning, investment hierarchy.