Chapter 11
A Comparison of Transport Modes in Terms of Energy Consumption

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ABSTRACT
Energy consumption of transport modes are partly dependent on the chosen travel mode. For specific OD pairs a comparison of travel modes in terms of energy consumption gives an idea of the possibilities to change the energy budget of a city. In this study a comparison of transport modes in terms of energy consumption is given for two chosen routes in the case study of Ankara, Turkey. The results show that there are differences with respect to chosen travel mode in terms of energy use and travel cost reflected to traveler for a certain OD couple.

INTRODUCTION
During the evolution of settlements, “an optimum” in space organisations with “a minimum” energy for mobility (adopted to the human dimension) had emerged until periods of rapid industrialisation. During the 20th century, cities have followed a disordered and limitless growth, which can be called as “sprawl”, “metropolisation”, “urban diffusion”, etc. This process has created a mobility and energy consumption problem because it has resulted in a settlement model wholly dependent on private car. With the introduction of motorised modes, urban development began to change. Energy, which had been restricted to the use of body energy of a person, has found new possibilities to create new orders and therewith to use the resources differently. The new technologies have created a new form of mobility,

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which is dependent on external energy. The use of external energy for mobility has changed the natural structure of the settlements and has created dispersed structures (Yildiz, 2003, p. 32).

Energy use in transport is determined by the demand for movement of people and goods. It is influenced by the spatial environment in which people live and by the activities that create movement. Any trip done by an individual by means of a transport mode generates an energy consumption. The level of this consumption and the type of energy required depend on the length of the journey and on the mode of transport (the characteristics of the travel modes) used. The structure of cities and their geographical constraints will influence the length of trips, thus energy consumption for passenger transport (Yildiz, 2003, p.32).

The (body) energy requirement of pedestrian, which can be measured in pulse frequency, is 50-60% higher than the car driver who sits still in his car (for unit distance). In inclined roads, this consumption raises to an additional 20%- 75%. Car drivers allocate their (body) energy savings to longer distances of travel. In addition, the cars they drive consume extreme amounts of external energy, which can be obtained from natural resources. Public transport modes can be considered to be more efficient compared to car due to their high occupancy levels but they are also dependent on external energy. They follow the same trend with car in supply of mobility needs. They also offer travelers the chance to save the body energy for unit distance and let them travel longer distances (Yildiz, 2003, p.33).

The main transportation modes in urban public transport are buses, trams, trolleybuses, trains and metro, and in some cities also ferries (Teodorović & Janić, 2017). Cities can have one or many of these systems according to their specific needs and opportunities. In some cities para-transit is also an important component of the transportation system.

Mode choice is a fundamental problem in transportation planning process and is dependent on many factors. There can be several travel alternatives to travel between a certain O (Origin) and a D (Destination). Public transport users try to make the best decision among these alternatives and sometimes they cannot choose the most rational one. This study presents a set of the possible alternatives for a certain OD couple with a comparison in terms of energy use.

Energy use is a basic indicator of the sustainability in transport systems. Public transport modes should follow a greener tendency to be more sustainable. There are a number of beneficial forms of green transportation that support and improve urban systems. The green transportation options make people’s lives easier, reduce congestion, and reduce dependence on cars and foreign oil. Green transportation is also safer and less costly which helps save the earth.

It is always much more comfortable and convenient to drive one’s own private vehicle to go to office, home or market every day. Citizen sensitivity lies on using green transportation that is easily accessible to everyone. Green transport’s sorting begins with pedestrians and bicycles and scooters come after them. Public transportation opportunities are followed by private cars.

Transportation is being faster and cheaper in today’s world. The differences among costs of transport get more negligible for transport users. However the important differences in energy use still exist and they can be overestimated sometimes. The cities all around the world are getting more crowded and that results many problems in urban life. As the cities are being more crowded, the need of energy increases. The dependency to external energy forces countries pay enormous amounts of money to import energy. The need of people for energy forced the big countries to get some precautions to control the region which has the energy (petroleum, natural gas, etc.). The need for energy has initiated many wars during the last century. So, it is a main duty of the city authorities to find more economic and energy saving solutions for public transportation.
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