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Estimation of Value of Time for a Congested Network – A case study of the National Highway, Karachi

Syed Fazal Abbas Baqueri[a,*], Wim Ectors[a], Mir Shabbar Ali[b], Luk Knapen[a], Davy Janssens[a], Ansar-Ul-Haque Yasar[a]

[a]*Transportation Research Institute (IMOB), Hasselt University, Belgium*
[b]*Department of Urban and Infrastructure Engineering, NED University, Pakistan*

Abstract

Traffic congestion in mega cities is a common phenomenon for developing countries. Numerous studies on congestion cost estimation, that aim to quantify their monetary losses, have been conducted. Value of Time (VOT) assessment through utility maximizing theory and choice models are abundantly applied in transport literature. However, estimating VOT on congested network is not widely applied yet. To recognize the difference under normal and congested network, the current study focuses on VOT estimation for work trips in an extremely congested network.The focus of this research is to conduct a VOT estimation of the National Highway, Karachi. It connects Karachi city with Port Qasim Industrial area and the rest of the country. A large amount of freight transport to and from the port is also observed on this road. The National highway, being the only link to commute to this industrial area, is therefore under excessive traffic congestion.A stated preference (SP) survey was conducted at various industries located in this stretch. The respondents were asked about current travel practices and their (stated) preferences based on hypothetical -though realistic- travel attributes. A choice set of four alternative modes based on the currently used mode was presented to each individual. A Multinomial Logistics Regression (MNL) Model was developed for data analysis.As perceived, the results revealed a strong impact of travel time and travel cost on the (dis)utility of travel. These results can be utilized by policy makers to reduce congestion, monetary and time losses through efficient transport planning.

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Keywords: Value of Time (VOT); Traffic congestion; Stated Preference (SP) survey

* Corresponding author. Tel.: +32-486-20 77 05
E-mail address: syed.fazalabbasbaqueri@uhasselt.be

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1. Introduction and Research Background

The focus of this research is to conduct a Value Of Time (VOT) estimation for a congested network in a developing country. The National Highway which connects Karachi city with the Port Qasim industrial area, has been selected for this study. This study emphasis on the work trips, as a major share of travelers uses this highway to reach their work place. Traffic congestion and delays on this stretch were quantified to be around 30,000 US$ per day[1].

The concept of VOT was introduced by Becker when he proposed the conversion of time into money by assigning more time to work[2]. Since then, a lot of research has been carried out that ascertains the impact of commuting purpose in estimating value of travel time. Many researchers including Belenky[3], Xumei[4], Kamga[5], Jiang[6] and Lei[7] worked on differentiating value of travel time between trip purposes. As per intuition, the highest value of travel time is associated with work/ business trips.

For this research, VOT estimations are made for 'passenger transport' only. Freight transport also passes through the stretch, but its VOT assessment is not part of this paper. The VOT is assessed for private car users and other transport mode users separately. Although it has been previously emphasized by researchers to analyze VOT for *each* mode separately[8], there are various reasons for this stand-out approach, the main one being that there is only a small percentage of public transport users. In addition, the bus is the only available mode of "public transport" in this area. Clustering "bus" with "bike" is needed for sound analysis. Moreover, "Company Van" was eliminated from the analysis as its travel cost estimation is an arguable matter in itself due to travel reimbursements. Travel reimbursements vary for each company (such as 25%, 50%, 100% etc.). This particular way of grouping revealed the difference between the VOT of car users and users of other modes.

This paper comprises of four sections. The next section explains the study area followed by data collection and methodology. The results and discussion is described in section 4. The last section of this paper is conclusion.

2. Study Area

The National Highway is a 20km stretch which connects Port Qasim Industrial Area to main arterial 'Shahrah-e-Faisal'. It comprises of nine intersections from the 'Star Gate' intersection to the 'Pakistan Steel' intersection. Each section is a two-way two-lane road with a median strip. The average volume per hour is higher than the road capacity[1] as this network is available for passenger and cargo transport and therefore is under excessive load. More than 100 medium and high scale industries are located in the Port Qasim area. A highly heterogeneous vehicular mix uses this stretch, including private vehicles, para-transit and public transport modes. Moreover, only motorized transport can be used to reach the work areas as it is far away from the residential areas. In the case of freight transport, heavy trailers traverse all day. There is also an oil depot situated in this area, which sets movement of tank trucks in the same stream which adds to stated quandary of traffic congestion. The Figure 1 below shows the Google imagery of the study area.

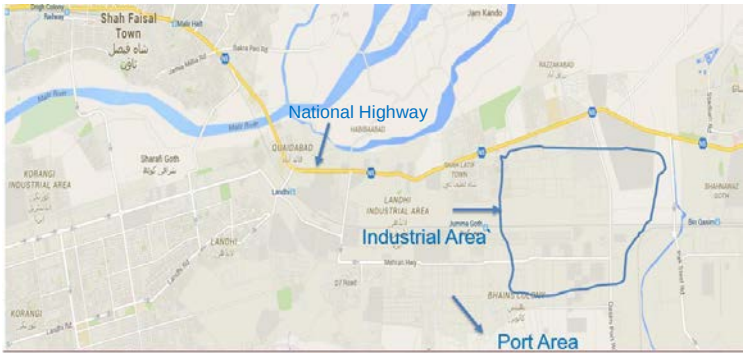

Figure 1. Google Image of National Highway Stretch.