

Comprehensive Analysis of Public Perceptions for Developing a Congestion Charging Framework for Private Vehicles within the Colombo Municipal Council Limits

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Abstract

Global traffic congestion is a pressing issue, incurring trillions of dollars in economic losses each year due to lost productivity and increased fuel consumption. Rapid urbanization, inadequate infrastructure, poor urban planning, and an increase in private vehicles are the main factors that contribute to global traffic congestion. To address this, various strategies have been adopted by transport planners, such as expanding road networks, improving infrastructure, and bolstering public transportation systems. Congestion charging out of many has emerged as an effective tool for mitigating traffic congestion in urban areas. Being the commercial capital of Sri Lanka, Colombo City is not an exception to this global issue. The city has adopted many traffic management strategies, but none have yielded significant reductions in congestion. Even though prior studies have considered congestion charging as an alternative to Colombo's traffic problem, none have conducted a thorough investigation. Therefore, the main objective of this study is to identify the macro-factors and their impacts on setting up a congestion charging system for private vehicles within Colombo Municipal Council (CMC) limits. In addition, the study also aims to identify the most preferred charging mechanism, payment mechanism, time-based charge, and the appropriate discounts for residents of CMC limits. According to the O-D matrix developed for peak periods, considering the traffic analysis zones (TAZs) within the Western Province, the concentration of traffic within CMC limits was one of the main reasons for selecting CMC as the study area. Further, the availability of the geographic and administrative boundaries of CMC was the other reason to select it as the study area. To gauge public opinions on congestion charging, the study employed a survey of 317 respondents from the Colombo district using convenience and snowball sampling methods. The respondents' perceptions of eleven key macro-level factors: vehicle category, charge, public transport quality and capacity, travel time improvements, travel activity disturbances, privacy of trips, equity, environmental protection, faith and leadership in government, transportation technologies, and enforcement policy were collected. The responses were rated using a Likert scale. Furthermore, respondents' demographic information, their preferences for charging mechanisms, payment methods, discounts for residents, and their preferred charges were gathered. An ordinal regression model was developed to analyze the data. The model exhibited a significant fit, and the factors: vehicle category, charge, public transport quality, travel activity disturbances, and equity were highly significant. Further, the charge displayed a strong positive correlation with the perception of congestion charging. The results revealed that "charge based on time travel within the cordon" as the most preferred, while electronic post payment was the most popular payment mechanism. Moreover, the preferred charge for a 30-minute travel time inside the charging zone was identified as Rs. 110, and the preferable discount for residents within the charging zone stood at 70%. According to the results of the study, when a congestion charging scheme is developed for private vehicles within CMC limits, vehicle category, charge, public transport quality and capacity, travel activity disturbances, and equity should be considered as

primary factors, along with time-based travel charges and electronic post-payment. Private vehicle users are willing to pay around Rs. 110 for a 30-minute journey inside the CMC limits, and equity concerns among CMC residents can be addressed by offering a 70% discount. However, the sample size of the study and the consideration of only private vehicle users in the Colombo District were identified as limitations. Future research should be conducted to investigate the influence of demographic factors on congestion charges, its impact on other vehicle types (public transport, emergency, goods, taxis, green vehicles), and its effects on occasional users and visitors to enhance the congestion charging mechanism.

Keywords: *Congestion charging, Traffic congestion, Public perception, Colombo Municipal Council*

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