Development of Intercity Travel Demand Models for a Highly Industrialised Regional Corridor

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Abstract

Transport connectivity is one of the critical factors for developing any city, state, or Country. Proper Transport connectivity at the local or regional level always ensures sufficient mobility of passengers and freight movement. Efficient mobility of passengers and freight has a tremendous societal, economic, and environmental effect; hence, transport connectivity leads to the regionâ€™s sustainable development if implemented better. This study considers 6 Rail corridors that connect the three cities Surat, Ahmedabad, and Vadodara, of the Gujarat state. The corridors have been named as the pair of cities such as Surat- Ahmedabad (ST-ADI), Surat-Vadodara (ST-BRC), etc. All three cities have well-established industries such as textiles, diamond bourse, chemical, machinery, metal products, pharmaceuticals, engineering, plastics, electrical appliances, electronics, biotechnology, petrochemicals, and construction. The current study aims to model the rail passenger travel demand and its forecasting up to 2030. Historical railway passenger travel demand (from 2009 to 2019) for the above corridors has been collected from the railway board, New Delhi. Surat-Ahmedabad & Ahmedabad-Surat is the consistently highest demanded rail corridor with an annual passenger of 0.6896 million and 0.7755 million in 2019. In contrast, the Vadodara-Ahmedabad & Ahmedabad-Vadodara rail corridor has the highest CAGR of 13.81% and 15%, respectively. Two approaches can be used (i) aggregate approach (ii) disaggregate approach to model the travel demand. The disaggregate approach is typically used for urban passenger travel demand, such as four-stage modelling, where we need more specific data. The aggregate approach is helpful in the case of regional (intercity) passenger travel demand modelling, such as the direct demand model, which requires lesser data comparably. This study takes the reference of the kraft-shaft model, which is an elasticity based direct demand model. Different explanatory variables such as socio-economic variables (total population of the city & annual income per capita) and level of service parameters of transit (travel time, travel cost, and annual frequency) have been used to develop the direct demand models. Considered variables show higher collinearity among them (>0.75). Ridge Regression approach was considered to establish the demand models. This regression approach works based on the collinearity characteristics of the variables. The collected time series data shows more significant seasonality and dependency with the past time span. To predict the future demand based on the actual behaviour of the time series data, the ‘Autoregressive Integrated Moving Average (ARIMA)’ approach was considered in this study. The correlation between the total travel cost and annual income per capita is very high, reflecting the positive elasticity concerning travel cost to travel demand. However, the general practice always indicates the negative correlation of cost with demand. A long span of time (here ten years) experienced more remarkable economic growth in the study area. A higher correlation between cost and per capita income shows the increased ability of people on travel expenditure. The increased ability is one of the reasons for positive elasticity for total travel cost. The forecast has shown that the passenger demand will grow around 1.6 times on ST-ADI & ADI-ST rail corridor whereas BRC-

ADI & ADI-BRC rail corridor will face around three times rise in passenger demand by the year 2030.

Keywords: *direct demand models, level of service, ridge regression, time series model, elasticity.*

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