Estimation of Life Cycle CO_2 Emission and Analysis of Variables Associated with Medium-Capacity Passenger Transport Systems

[Abstract]

CO_2 emissions from the transport sector in Japan account for approximately 20% of total emissions. Shift to public transport is one of the methods for reducing CO2 emission. Furthermore, medium-capacity passenger transport systems, such as LRT and BRT, have been introduced. However, CO2 emissions from each transport mode vary due to the differences in the region, energy resources, and vehicle properties.

The life cycle of transport systems is divided into four phases: 1) manufacturing of vehicles, 2) manufacturing of infrastructures, 3) operation of vehicles, and 4) operation of infrastructures. We estimated the medium-capacity passenger transport systems' life cycle (LC)-CO_2 emissions based on these four stages. Moreover, we analyzed the influence of different factors, such as CO_2 coefficient of electricity, average temperature, route gradient, power regeneration function, and so forth, on LC-CO_2 emissions of medium-capacity passenger transport systems.

As a result, the study shows that CO_2 emissions increase during operating phases of vehicles and infrastructure is proportional to the demand volume increase. The difference in regional traits is expected to reduce CO_2 emissions from medium-capacity passenger transport systems. Also, the extent of impact from such elements differs among various transport systems. Some factors were found to have non-negligible impact of up to 20~30% on the CO_2 emissions of the medium-capacity passenger transport systems. In addition to , it shows that constant-speed operation is more effective in reducing CO_2 on steep gradient sections . Through these results, importance of impact analysis of regional and vehicle characteristics which affect these phases is suggested. We also examined the construction of a simplified CO_2 emissions estimation methodology as a tool designed for operators and municipalities.