The city-forming role of rail transport in Europe

Public transportation, particularly rail transport, is crucial in reducing carbon dioxide emissions globally, directly impacting climate change. The spatial planning around tram, metro, and railway stations affects the housing location, value, and urban development. Our study focuses on two main areas: the analysis of land use changes around stations from 1975 to 2025/2030 and the characterization of spatial planning in 2023/2025.

Transit-Oriented Development (TOD) emerged in the 1980s as a response to issues related to road congestion and the expansion of car-oriented suburban areas. TOD promotes the development of buildings around public transport stations to reduce car travel and increase walking and cycling trips.

Our research analyses the spatial planning around rail transport stations in Europe. We examine two main issues:

- Changes in land use from 1975 to 2025.
- The characteristics of spatial planning in 2023/2025.

The study includes analysing population and land use data based on a 100-meter grid. We utilize data from OpenStreetMap, the Global Human Settlement Layer, and other available databases. The analysis will cover both accessibility indicators for public transport and various statistical methods, such as the Lorenz curve and the Gini coefficient, to understand population distribution and access to public transport.

Previous studies, such as those conducted by Newman and Kenworthy, indicate a correlation between population density, lower gasoline consumption per capita, and reduced greenhouse gas emissions. However, research by Duranton and Turner suggests that public transport only sometimes reduces traffic congestion, as individuals who give up their cars are often replaced by new users.

We also analyze the findings of Verbavatz and Barthelemy, which show that the primary factors controlling car traffic are the number of residents and access to rapid public transport.

Accessibility to public transport is defined as residents' ease of using the public transport system. Most studies focus on the number of lines, stops, and network length. In our study, we also consider the percentage of the population living within walking distance of rail transport stations.

Walking access to public transport stations is a crucial factor influencing the number of passengers. In Europe, over 50% of trips to and from railway stations are made on foot, varying by region. Good walking accessibility encourages people to use public transport, prompting operators to adjust their fleets to meet demand.

Our study examines the spatial planning around public transport stations, considering the number of potential transport users and access to jobs and services. We use population data in hexagons and a 100-meter grid to compare spatial planning in different European cities.

Rail transport has a lasting impact on urban development. Investments in rail transport systems bring economic, environmental, and health benefits. The location of rail transport stations and planned multi-family housing align well with the TOD concept.

Rail transport plays a crucial role in urban spatial planning and reducing carbon dioxide emissions. Our study analyzes changes in land use around rail transport stations in Europe, considering regional differences and the impact on urban mobility. The results will be helpful for policymakers and researchers, aiding in understanding spatial planning specifics and promoting sustainable urban development.