Farewell, Range Anxiety: Planning Layout of Public Charging Facilities for Urban Electric Vehicles

Jiang, Ziyue (School: The Experimental High School Attached to Beijing Normal University)

Electric vehicles (EVs) are growing exponentially in global sales and have become one major mode of urban mobility, but still face range anxiety due to insufficient charging infrastructure. Using original data of EV driving trajectories in Chaoyang District, Beijing, this project investigates the impact rule of population density, road density and passenger density in charging station layout and capacity. Based on the relationship between number of charging stations and service coverage, 947 charge stations, with a service radius of 1 km, could service 82% of the Chaoyang District's area and was the maximum amount required for EVs. By introduction of EV driver's preference and investment cost, it was found that investment cost linearly increases with the number of public charging stations, while service coverage increases fast then slowly. SBM efficiency model were employed to establish the connection between investment cost and the stations' service coverage, finding that under the conditions of a traffic density of 560*340 m2, 476 charging stations service 71.7% of the Chaoyang District's area, achieve the maximum return on investment and represent the best layout planning scheme. This planning scheme proposes a higher number of charging stations than the actual 424, which means that the current layout of charging stations should be expanded. This study provides a strategy for urban planning of charging infrastructure and will help address the increasing range anxiety caused by the rapid growth of EV owners.

Awards Won: