

What's the Relationship Between Aircraft Taxi Speed and its Pollutant Emissions?

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Abstract— Aircraft taxi speed has an important effect on airport operational efficiency, fuel consumption, and pollutant emissions. In order to achieve the shortest taxi time, aircraft prefer taxiing at the fastest speed, but this does not mean that the pollutant emissions are also optimal in most cases. In the context of vigorously advocating “green civil aviation,” the relationship between taxi speed and pollutant emissions (i.e., emission quantity and emission cost) needs further study to achieve the aim of lower pollutant emissions. Therefore, based on the aircraft taxi speed model and aerodynamics model, this paper establishes a multi-objective optimization model of taxi speed with consideration of pollutant emissions. Then, the light (CRJ-900), medium (A320), and heavy (A333) aircraft were selected to reveal the relationships between taxi speed, pollutant emission quantity/cost on a given route at Shanghai Hongqiao Airport. The study results show that: (1) For pollutant emission quantity, the faster average taxi speed, the less pollutant emissions of A333; while for A320 and CRJ-900, the pollutant emissions decrease first and then increase with the increase of the average taxi speed; (2) For pollutant emission cost, the faster average taxi speed, the higher pollutant emission cost of all three aircraft, which increases slowly first then rapidly; (3) The optimal taxi speed profile can be generated according to the specific demand of the airport stakeholders to seek a balance between economic benefits and environmental benefits. It also has a certain significance for the study on taxiing scheduling and planning.