Airport Capacity Management under IATA Guidelines: Modeling Approach and Real-world Application

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Due to the rapid growth of air traffic, demand often exceeds available capacity in the busiest airports worldwide. This may lead to significant airport congestion, creating serious problems of delays and, consequently, high costs for airports, airlines and passengers. To cope with this problem, airports may expand their capacity by building new airport facilities and/or developing new air traffic management technologies. However, these types of interventions are generally investment-intensive, very time-consuming, or sometimes even infeasible in the densest urban areas. Alternatively, airports may implement demand management mechanisms. These mechanisms aim to constrain flight demand at periods when airport capacity is expected to be exceeded by distributing flights more evenly over the day. The IATA slot allocation process is the key demand management mechanism practiced by the busiest airports outside the United States (more than 300 airports worldwide). Under this process, the airports provide a value of "declared capacity", which specifies the number of "slots" available for landings and takeoffs per hour and/or intervals of 15 minutes. For each season, the airlines submit their slot requests to a slot coordinator that must allocate the available slots in the most neutral, transparent and non-discriminatory way. The underlying slot allocation process, established in IATA's World Slot Guidelines, is very complex, with multiple criteria, rules and priorities. Recently, some optimization models have appeared in the literature aiming to support slot coordinators to better accommodate airlines' preferences at congested airports. However, these models are not yet compliant with the IATA guidelines as well as with some important airport's operational and regulatory constraints. This research develops a new modeling approach to support slot coordinators in the decisions they make during the slot allocation process, while complying with the IATA guidelines and other constraints. Results from the application of this approach are shown for a case study involving the Madeira airport (FNC).

Keywords: Airport Management; Demand Management; Slot Allocation; Optimization