Bringing Short-Haul Air Down to Earth
Exploring the Trade-Space of Mode Substitution for Regional Air Passenger Transport Markets

PROBLEM

Intercity passenger transportation is a time and energy intensive activity. Despite a growing social consciousness toward “green” alternatives, travelers continue to choose routes and modes based primarily on the travel time and cost. While long distance trips of greater than 500 miles are dominated by air travel, short- and medium-haul trips compete with surface modes when comparing total travel time and cost. However, due to hub-and-spoke air transport networks, short-haul air travel (closer than 200 miles) is bundled with long-haul itineraries. At congested hubs airlines, passengers can experience lengthy transfer times, and these can provide an opportunity for competitive mode substitution in a cost-effective and energy-efficient platform.

IMPACT

The framework presented along with the exploration methodologies allows for understanding the complex relationships between input parameters and the effects on mode substitution for a variety of short-haul travel markets. This methodology also allows for what-if scenarios to be explored using multiple adjustment factors to test, for example, the impacts of fuel prices, reductions in transfer times, or increases in vehicle fuel efficiency.

APPROACH

Seventeen short-haul markets hubbing with Chicago O’Hare International Airport were selected to explore multi-dimensional trade-offs (referred to as the trade-space) between currently scheduled air service and posited motor coach substitution. Multiple large transportation databases were combined to provide a detailed understanding of the trade-offs between surface and air modes – computing performance measures for travel time, energy consumption and operator costs.

Input assumptions are linked together in a spreadsheet model to flexibly explore the trade-offs of modifying operating assumptions across the measurement domain through the use of user-adjustable input variables. To identify wide ranges of the trade-space, Monte Carlo simulation techniques were used to sample market parameters based on empirical data to estimate resource impacts over a range of conditions. By adjusting the distribution and indices of various travel parameters, the simulation results were used to identify mode dominant regions of the trade-space for individual short-haul destinations. Parameters such as airport layover times, flight block times, airport ingress and egress and average highway speeds were simulated according to measured data.

FINDINGS

The results explore the trade-off in travel time, service frequency, energy and operator costs of surface trip alternatives. The figure (shown here) depicts the Monte Carlo simulation results for the travel time trade-space for three short-haul markets (Milwaukee, WI, Indianapolis, IN and Springfield, IL). The data scatter was plotted on a surface-air travel time diagram to determine the range of outcomes experienced by a consumer. The color scheme in the background of the figure illustrates the trade-space regions where modal dominance may exist – the lower right region intensity (blue color) indicates air travel dominance where the brown intensity in the upper left indicates surface dominant destinations.

These markets were selected to illustrate the trade-space regions where modal dominance may exist. The O’Hare-Milwaukee market (light blue scatter at the left side of the figure) indicates that the ground service tends to dominate over air service in total travel time, not all travelers experience this advantage. The opposite is true for Indianapolis, shown in dark blue. This research also illustrates that travel time is not purely a function of travel distance. Comparing Indianapolis with Springfield (shown in lavender), which are roughly equidistant and equally accessible from O’Hare, Springfield has many instances where surface transportation is more competitive than air even at that distance (indicated by the height of the data cluster). This research also allows similar comparisons to be made in other measure dimensions – energy and cost.

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