Airport Analyses Informing New Mobility Shifts: Opportunities to Adapt Energy-Efficient Mobility Services and Infrastructure

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Alejandro Henao, Josh Sperling, Venu Garikapati, Yi Hou, and Stanley Young
National Renewable Energy Laboratory

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Airport analyses informing new mobility shifts: Opportunities to adapt energy-efficient mobility services and infrastructure

Alejandro Henao, Josh Sperling, Venu Garikapati, Yi Hou, Stan Young
National Renewable Energy Laboratory
[*]15013 Denver West Parkway, Golden, CO 80401 [E: Alejandro.Henao@nrel.gov]

Abstract

An airport is one of the most important assets for a region's economic development and connectivity with the rest of the nation and world. Key aspects for investigation of energy efficient mobility at airports is ground transportation including factors ranging from the infrastructure, mobility services, and associated revenues. Data are critical to understand the maturity of new mobility services that can inform both cities and airports on how to respond, approach, manage, and adapt to the challenges, opportunities, and uncertainties associated with shifts in new mobility that influence human behavior, energy-efficiency, and sustainability strategies. One key question identified in this article is how quickly we are adapting to new mobility options—such as app-based ride-hailing and "pooling" services—that may provide an opportunity to influence energy efficiency of ground transportation to and from airports. By starting with airports in the regions of four smart city finalists in the U.S. DOT Smart City Challenge, this paper focuses on key observability aspects of new modes and the rate of shifts in mobility patterns across San Francisco, Portland, Denver, and Kansas City. With the emerging megatrend of rising urbanization and rising air travel demand (with a predicted doubling in demand, within a 20-year period, by 2035), airports are expected to increasingly be on the front lines of adaptation to new transportation technology and services in terms of infrastructure investments, policies, and revenues. As airports have demonstrated the most potential and capability of any public institution to implement fees for new ride-hailing services, they are also a prime resource for collecting important data to help understand smart mobility transitions. Results focused on the shifts in revenues for ground transportation at airports offer one vantage point into the pace of transitions and adaptations in the new emerging mobility landscape, and present an opportunity to analyze how future adaptations could support more energy-efficient scenarios.

KEYWORDS: Smart Cities, Airports, Energy Efficient Mobility, Ride-hailing, Public Data

Introduction

Urbanization (more than 70% of world population in cities by 2050), rising air travel demand, and the transformations in urban mobility systems, technologies, and services across cities of the United States and globally are accelerating, yet at different rates. This paper brings initial analyses on the extent of ride-hailing or transportation network company (TNC) services adoption in city airports. The emerging impacts of ride-hailing have become an increased area of city attention and research. This study focuses on airports as one initial opportunity for increased observability of city–by–city ride-hailing trends in terms of travel, parking, car rental, and economic impacts of the first publicly available TNC-fee based revenue records.

Recent studies have indicated that both air travel and ride-hailing such as Uber and Lyft are on the rise across cities in the United States and globally. By 2035, global air travel demand is expected to double (within just a 20-year period), and tens of billions in new airport infrastructure investments and modernization upgrades are expected. Comparative assessment of the benefits and losses resulting from TNC adoption at airports is analyzed across four of the U.S. DOT Smart City finalists (which represent some of the largest airports in the United States), including discussion on TNC-related airport infrastructure modernization. Preliminary results indicate a significant drop in parking revenues and smaller increases in airport TNC revenues per enplaned and deplaned passenger. With the data collected, new research questions can be explored, focusing on airports as useful intermodal transportation hubs for TNC research on travel, energy, and land use changes. Shifts in revenues offer one opportunity to explore the pace of transitions in the new emerging mobility landscape.

Alignment of Study with Connectivity, Automation, and the Future of Transportation

Mobility as a service (MaaS) currently provided by app-enabled and by automated vehicles (AVs) in the future are being touted as the connectivity and automation technologies that are transforming and will "disrupt" the way in which we travel and have future transportation choices. Among these technologies, app-based ride-hailing and "pooling" services have already become a reality and are gaining rapid popularity—especially at airports—as they provide a timely, affordable, reliable, convenient, and comfortable way to travel. While TNCs provide a for-hire transportation mode similar to taxis , they also offer a real-time on-demand mobility technology and payment method (through mobile phones, and the internet) to provide users with a choice that is priced lower than traditional taxi services. For example, an airport taxi trip that could have normally cost $80–$100 to make a few years ago now only costs around a third of that price, $30, with a TNC. This is not to mention the improved flexibility that a TNC trip offers (e.g., round the clock availability, trip observability through map-based monitoring, further reduction in trip cost when the ride is shared with another person, seamless payment and tipping, and automated electronic receipt). While the mobility market share of TNCs is increasing by the day, gaps remain in ability to analyze the amount of disruption that TNCs have caused in urban transportation and economic markets.

Methods

Case studies of four U.S. cities are developed through data collection with respective airport authorities to explore the extent to which emerging urban mobility services are shaping current revenues. This paper focuses on preliminary analyses with these data. We start by first analyzing baseline annual air travel, then examine the revenues from TNC fees, parking, and car rental. These analyses are from multiple data sets and are used to understand the various trends and mobility transformations among the airports.

Preliminary Results

For U.S. cities with large regional airports—such as Denver, San Francisco, Portland, and Kansas City—the number of recorded airport passengers has been rising steadily, from approximately 115M in 2011 to approximately 146M in 2017 (Figure 1). This represents an annualized growth rate of 3.8% for these airports, with a doubling time of approximately 18 years (even faster than global air travel demand projections). Today, air travel represents over 9% of total U.S. transportation energy use (EIA 2016), with a 567% increase (from 309 to 1,752 petajoules) in jet fuel and aviation-related gasoline consumption from 1960 to 2015 (BTS 2016).

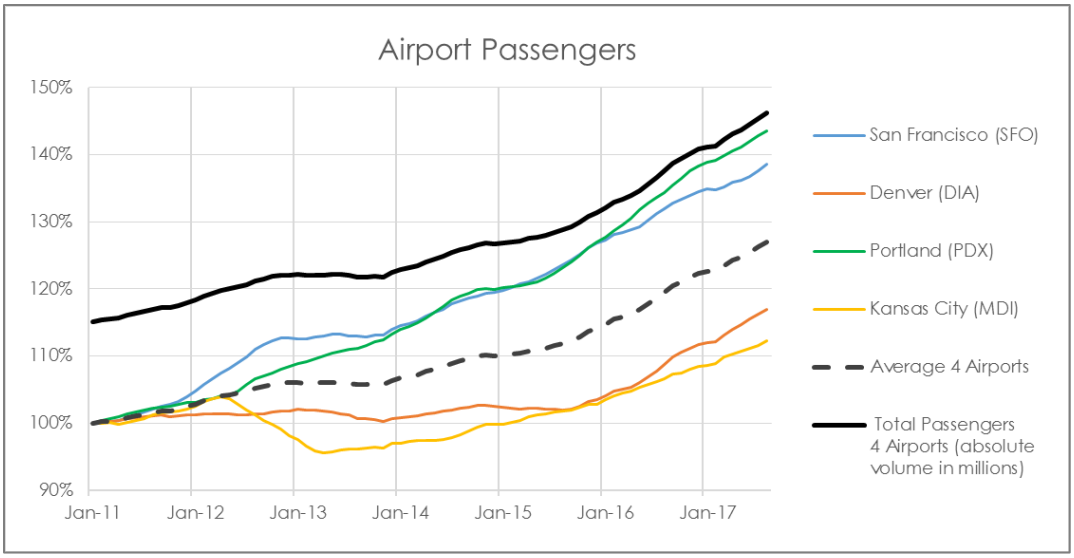

Figure 1. Airport passengers[1]

[1]Notes: Total airport passengers (enplaned + deplaned). All airports indexed to January 2011 as baseline (100%). Twelve-month running average, each month. Airports have mass transit service, except for Kansas City.

For the first time in many years (if not decades), the passenger transportation and aviation systems are on the frontline of significant innovation in moving more people faster, cheaper, and better (e.g., with more convenience, increased choices for use of time, less stress in finding parking at airports, etc.). These transitions are observed and tracked through shifts in revenue streams collected at airports with implications for the future of ride-hailing, parking, and car rental services in cities, as well as the physical infrastructure that supports each sector. While studies and initial evidence on the uptake and impacts of ride-hailing remain nascent, the revenue data associated with major transportation hubs, such as airports, collected for this article begin to quantify critical shifts underway in the adoption of new mobility services and adapting to new mobility choices, such ride-hailing to and from airports, as opposed to using personal vehicles.

What travel shifts are occurring with the introduction of ride-hailing at city airports?

By analyzing revenue streams associated with ground access fees for several airports, the research team was able to assess trends with respect to parking, car rental, and ride-hailing companies (also referred to as transportation network companies or TNCs). Preliminary findings for the four airports show repeatable and significant trends across these cities, reflecting the quick public adoption of the new mobility services. These ride-hailing impacts have implications for transportation, energy use, revenues, and future infrastructure.

- **TNC** use continues to grow, and now accounts for up to 18% of all passenger ground transportation to/from some airports (Figure 2; note that these are conservative estimates for ground transportation percentages as connecting passengers are included in the total traveler count).

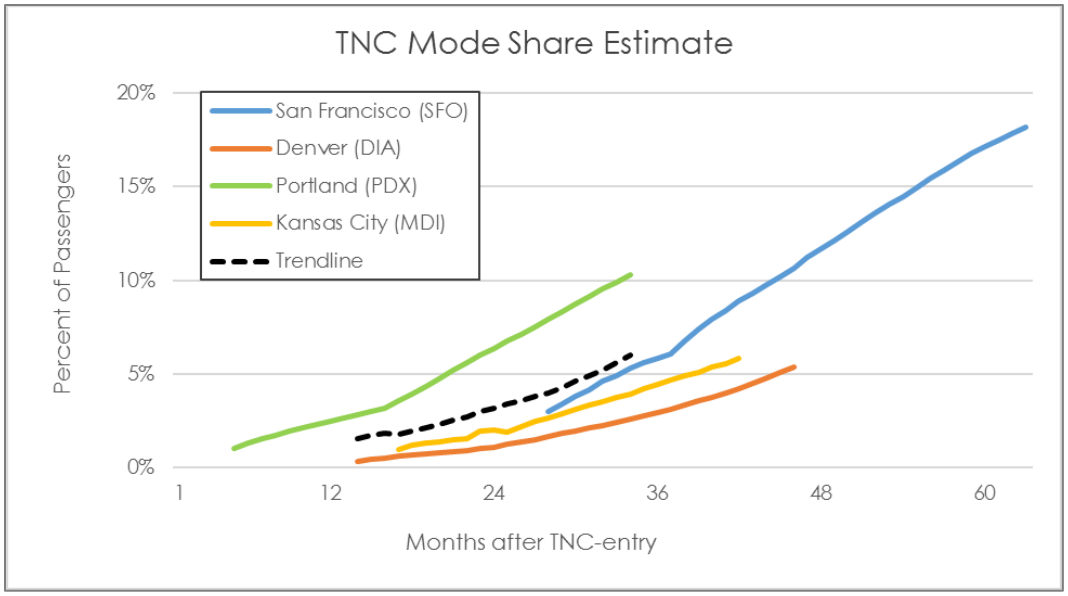

Figure 2. Ride-hailing to/from airport[2]

[2]Notes: Mode shared estimate of total airport passengers (enplaned + deplaned). Percentage of connecting passengers is unknown and neglected here (thus providing a conservatively low percentage estimate). TNC fee (date implemented) – San Francisco (SFO): $3.85 (July 2012), Denver (DEN): $2.15 (Oct 2013), Portland (PDX): $2 (Dec 2014), Kansas City (MDI): $3 pick-up only (May 2014). Vehicle Occupancy: 1.3 passengers per pick-up/drop-off.

- **Airport parking** no longer reflects growth in airport passengers (Figure 3). Rather, parking revenues per passenger peaked approximately 12 to 24 months after introduction of TNCs, and steadily declined thereafter. Initial findings from the four airports show an annualized declining rate range of 3% to 7%; continuing this trend would mean that parking demand at airports could be cut in half in about 14 years. This rate of decline is on par with the increase in ride-hailing use and growth in the number of airline passengers. On the one hand, this can be viewed as a declining revenue base, yet on the other, it may allow airports to continue to grow without investing in additional parking infrastructure or to consider repurposing of existing land for other uses.

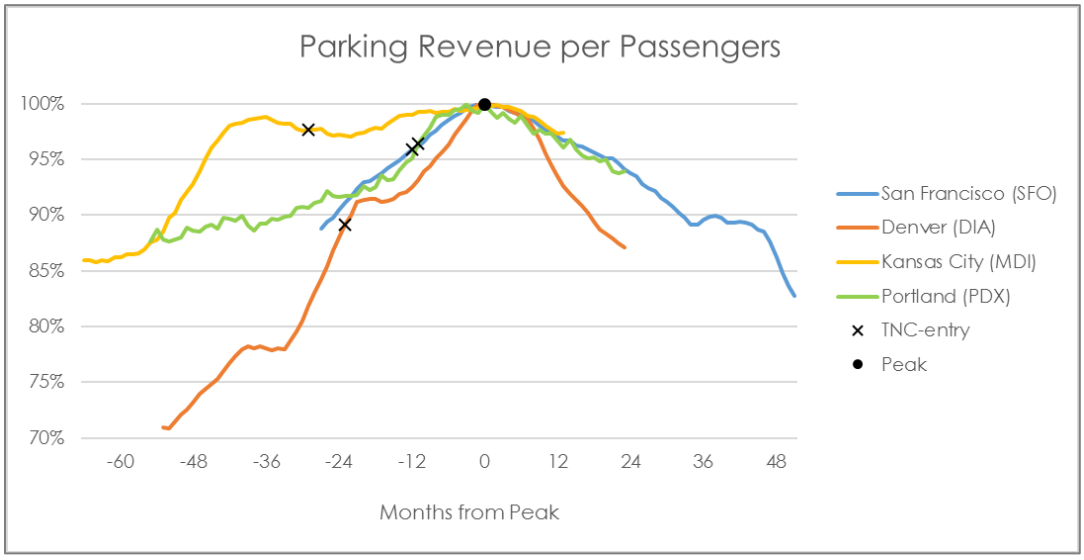

Figure 3. Parking revenue[3]

[3]Notes: Data indexed to peak (100%). Twelve-month running average, each month.

What secondary industries are profiting from increasing air travel?

According to the International Air Transport Association, almost 7.8 billion air passengers will travel in 2036, up from 4 billion air travelers today. With respect to near-term profit gains, a 2015 report on the state of the airline industry worldwide by PricewaterhouseCoopers noted the aviation industry reached above $29.3 billion net profit (in 2015), up from $16.4 billion in 2014, with North American carriers responsible for over half these profits. According to the Federal Aviation Administration in 2016, $3.5 billion were collected in parking and ground transportation fees representing 41% of the $8.5 billion in U.S. airport revenue not related to airlines. As secondary industries associated with these shifts, a close look at transportation fees for travel to and from airports, including parking, car rentals, taxis, shuttles, and other ground transportation, provides a barometer of impacts anticipated with these new aviation profit levels. While parking and car rental revenues appear to be in decline on a per-passenger level, airports implementing a TNC fee for ride-hailing pick-ups and drop-offs are seeing an uptick, with Denver and San Francisco seeing upwards of $600,000 to $2 million in new service fee revenue per month. Figure 4 shows the net change in revenues from parking and car rental and from new TNC fees in the initial data sets for the four cities discussed here. Note that although the per-passenger data reveal a significant shift, total revenue from parking and car rental has remained stable, with the increase in total air passenger traffic offsetting the decline in per-passenger revenue—in other words, total parking and car rental revenues at airports have peaked and stopped increasing proportional to growth in air traffic.

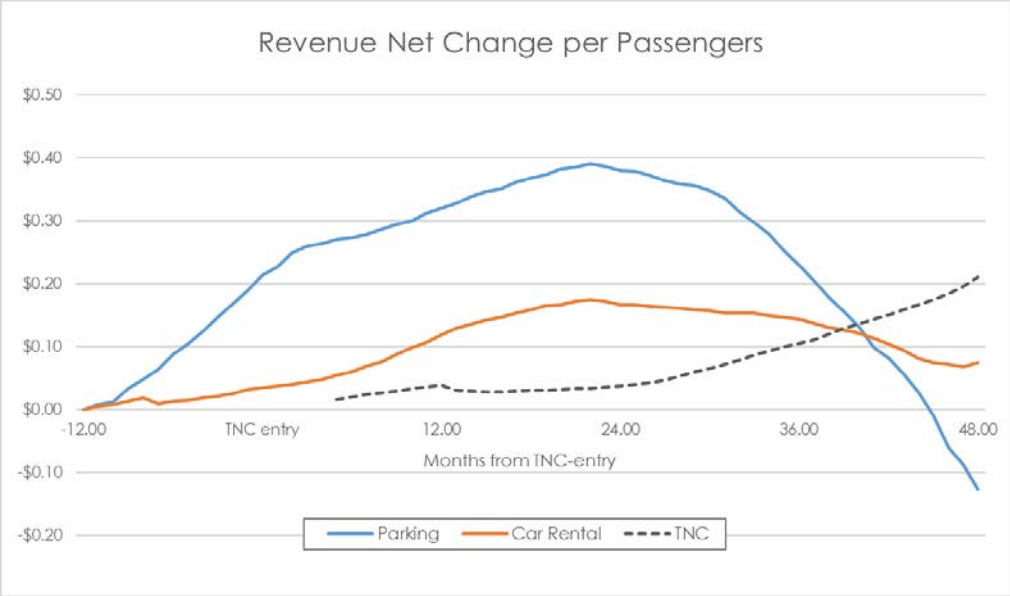

Figure 4. Net revenue change[5]

[5]Notes: Data indexed to 12 months before TNC entry ($0). Twelve-month running average, each month.

Discussion - *What are the implications for the future of mobility?*

The trends observed from new airport data are enabling a first look into the rapid adoption of mobility services over driving for accessing airports. Airport ground access revenue streams offer a useful and cost-effective data collection method for monitoring mode shifts in urban areas, as well as insights into future demand for parking infrastructure. Total parking revenue has peaked, and growth in parking demand is not tracking with growth in air travel, with ride-hailing being a large contributor to the shift. As a result, curb demand (rather than parking demand) is a factor in accommodating increased air travel. Demand management (in terms of pricing and access to encourage greater ride-sharing) and encouraging alternative fuel vehicles in mobility service fleets are at the forefront with respect to sustainability. While transit has not been addressed (three of the four airports studied have dedicated guideway transit to the airport), it will remain a critical component with respect to continued access to airport services and will be included in future data collection and analysis.

Conclusion

This paper focuses on ground transportation revenue analyses from four of the U.S. DOT Smart City Challenge finalists, including trends with respect to TNC, parking, and car rental revenues. Future work will include expanding beyond Denver, San Francisco, Portland and Kansas City to also develop analyses and comparisons with Pittsburgh, Columbus, and Austin, once data are available and once TNC service fees are introduced. Collection of public transit data (which must be obtained from a different entity than the airport) will be another valuable addition to the analysis. Finally, airport TNC travel demand and energy impacts through 2020 for select airports (using available and collected data) will be modeled to determine the least-cost future combination of automated, connected, electrified, and shared (ACES) mobility technologies and services to meet growing ground transportation demand under a variety of scenarios.

Foundational research, analyses, and benchmarking across these cities can inform future smart mobility efforts and networks. One shortcoming to informing city networks is the insufficient data available on the impacts of TNCs across intermodal transportation hubs beyond airports and across city-regions; this data is critically important to Smart City performance measurement, modeling the effectiveness of techno-economic interventions (e.g., shifts from ride-hailing to ride-sharing), and data-driven smart city planning.

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