Congestion Pricing Newark Airport Access for AirTrain Upgrades and Terminal Expansion

Michael Johnduff

January 29, 2019

Overview

On January 22, 2019 the Governor of New Jersey proposed funding an upgrade to the AirTrain to Newark Liberty International Airport.[1] The Governor considered the aging infrastructure an important link to a regionally significant airport. Costs of the upgrade are estimated at $2.1 billion.[2]

This represents a significant investment in our region's infrastructure. However, the community members, stakeholders, and experts who have formed the region's Fourth Regional plan have identified a long range option which the Governor should consider: constructing a shorter AirTrain link to a new airport terminal, which would free up space for a new runway to double the capacity of the airport, while pricing car trips to the airport under a congestion pricing scheme.[3] This solution would, according to the Fourth Regional Plan, allow the region's airports to handle a the doubling in passenger traffic projected by the FAA by 2045 and reduce delays by 33 percent.[4]

The Governor identified that it would cost $400 million to keep the AirTrain running for another 10 years, presumably even if the terminal would be moved.[5] However, with congestion pricing this problem can become an opportunity. Models indicate that if ground transportation trips to Newark were priced in terms of the 1.5 miles of road space they use through the terminal access loop, there would be significant revenue which could go to the demolition and shortening of the existing link and the construction of a new station:

- If the 33.5 million private and commercial vehicle trips to Newark in 2017 were priced at their actual value in terms of the road space they use at the airport—namely, at just $3.05 a trip—this would generate approximately $105 million annually (including costs).
- Together with other modes, this brings the revenue generated by all trips to Newark, including the Port Authority Bus Terminal (PABT) buses and the AirTrain, to $131 million annually (excluding parking revenue).
- The charge alone generates 100% of the proposed cost of maintaining the entire length of the AirTrain structure itself in four years, and, over 10 years, 50% of the cost of upgrading the existing system, which would make it difficult, if not impossible, to reconfigure the airport.
- Between 1.8 to 9.5 million annual trips may be diverted to airport shuttles and other modes, adding up to an $52 million in additional revenue.

Upgrading the AirTrain without a plan for airport expansion would potentially shut the door to these revenues. It would severely complicate future airport reconfiguration not only physically but financially.

---

[1] "Governor Murphy Calls on Port Authority to Build New AirTrain System at Newark Airport." Accessed January 22 at https://www.nj.gov/governor/news/news/562019/approved/20190122a.shtml

[2] Brett Johnson and Larry Higgs. "Murphy calls for a brand new $2B AirTrain at Newark airport" Accessed January 23 at https://www.nj.com/politics/2019/01/murphy-calls-for-a-brand-new-2b-airtrain-at-newark-airport.html

[3] Regional Plan Association (2017). The Fourth Regional Plan, pp. 13.

[4] See https://www.faa.gov/data_research/aviation/taf/ RPA predicts a 60% increase in airline travel by this date.

[5] See reference in note 1.

Congestion Pricing in the Context of Newark

How It Would Work

This short paper walks through the above figures and explains how congestion pricing at the airport would become a reality. It does so first by outlining the existing airport access traffic and the calculations involved in pricing the road space used by that traffic. It then considers impacts of the congestion charge, including revenues and displacements.

Overall, the system would be simple in design: because access to Newark is, unlike highly trafficked urban areas, controlled through only one link in the road network, pricing can be less complex affair compared to congestion pricing in areas with multiple access points, through the development of a single cordon system. Trips into the airport would be tolled electronically in the manner of NJ Turnpike trips.

Background on Existing Airport Transportation Ridership

The most reliable numbers for airport approach traffic are from the airport itself (Table 1, below).[6] They give us an estimate of 33.8 million annual ground transportation trips to Newark International (Table 2, below), all of which do not charge anything at all for their use of space.[7]

Table 1. Newark Airport Transportation Statistics

	Origin-Destination Survey (Extrapolated)[a]	Terminal Area Forecast[b]	Port Authority Transportation Statistics
Origin/Enplanements	20,900,920	21,215,859	-
Destination/De-planeing	21,107,120	-	-
Commuter	-	3,656,968	6,766,830
Total	42,008,040		36,626,669

[a]Bureau of Transportation Statistics Origin and Destination Survey DB1BMarket Q1-Q4

[b]https://www.transtats.bts.gov/DL_SelectFields.asp

[c]FAA Terminal Area Forecast https://www.faa.gov/data_research/aviation/taf/. The survey represents 10% of flights, and numbers here extrapolate from that sample.
Port Authority December 2017 Traffic Report https://www.panynj.gov/airports/traffic-statistics.html

[6] Data on the vehicles approaching the airport are more ideal figures for estimating approach traffic rather than passenger numbers. However, New Jersey Department of Transportation Average Annual Daily Traffic data from ramps to the airport is incomplete, showing an average of 9.7 million annual vehicle trips to the airport (exit ramps show 11.6 million). AADT data from entry and exits was collected only once, in 2013-14, at different days of the week, and often only for one count. Other counts exist only on the highways nearby the airport. The figures of 9.7 million were taken when airport passenger traffic was at roughly 35.0 million annual passengers (currently, it is 37.9 million originating and terminating airline passengers). These data, in other words, cover only 46.9% of all passengers (see Table 2). 2014 Uber data from the New York region were also consulted. but this was incomplete as well.

[7] See National Academies of Sciences, Engineering, and Medicine. 2010. Airport Curbside and Terminal Area Roadway Operations. Washington, DC: The National Academies Press. https://doi.org/10.17226/14451. Best practices indicate that it is possible to model airport traffic from passenger data, eliminating connecting and commuter flights. The Port Authority provides this data, and it matches other estimates, gathered from the US Department of Transportation Bureau of Transportation Statistics' Airport Passenger Origin-Destination Survey or the Federal Aviation Administration's Terminal Area Forecast. Allowing for the fact that the Origin-Destination Survey does not include regional connecting commuter flights, and because the Terminal Area Forecast only counts enplanements, and not de-planeing, their totals do come to approximate the 36,626,669 passengers reported by the Port Authority, as seen in Table 1, below. Calculations of airport employee traffic were omitted, under the assumption that these numbers would not be charged.

Table 2. Current Ridership

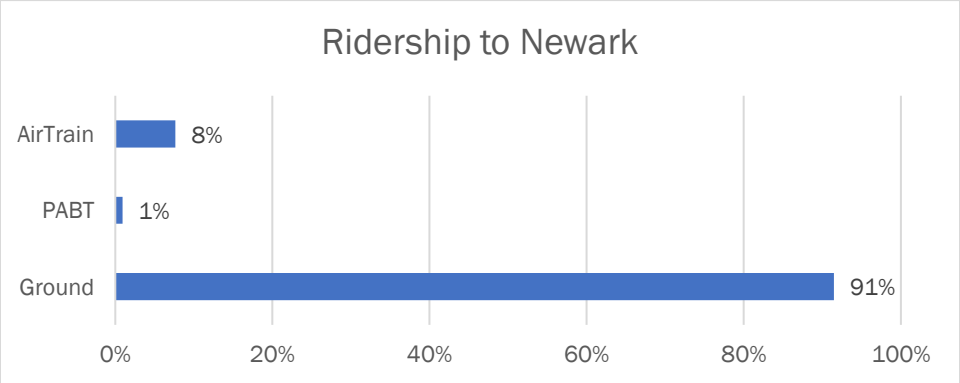
	Trips (Annual)	Current Pricing
Ground Transportation	33,829,530	Variable
- Parked Cars	3,409,479 [a]	$4/hr[b]
- Booked Ground Transportation	166,552[a]	Variable
- Airport Coach	276,041[a]	Variable
- Taxis	1,093,476[a]	Variable
- Other	28,553,172	$0
PABT	330,809[a]	$35.00[c]
AirTrain	2,797,139[a]	$5.50[c]
Total Trips	36,626,669	

[a] Port Authority of New York and New Jersey (2018). Airport Traffic Report. 2017, Tables 2.2.1-2.2.2

[b] Newark Airport (2019). "Newark Liberty International Airport Rates and Information." Accessed Jan 25, 2019 at https://www.newarkairport.com/to-from-airport/parking

[c] Newark Airport (2019). "Public Transportation." Accessed Jan 25, 2019. at https://www.newarkairport.com/to-from-airport/public-transportation

Figure 1. Ridership by Mode



Congestion Pricing Models

There are many models for congestion pricing, but the following model for a marginal external congestion cost has been agreed upon as a reasonable foundation by authorities[8] worldwide:

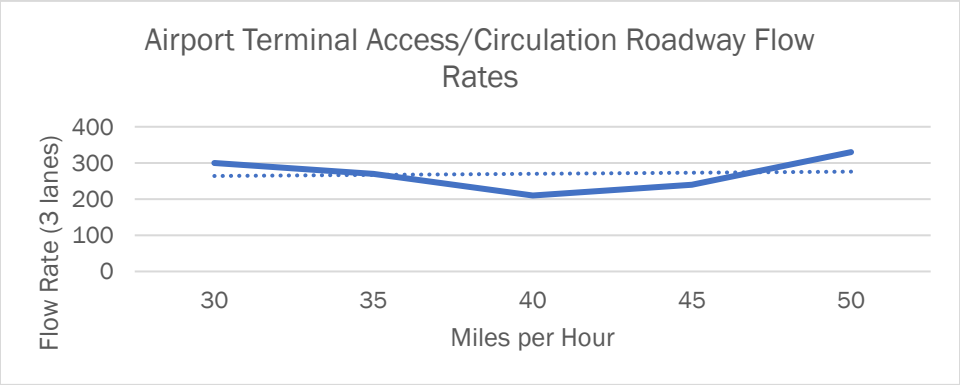
$$MECT = -q * b/v^2 * \Delta v/\Delta q$$

Where q is the volume of traffic, b is the value of time spent in congestion, v is the speed of the link, and, and Δv/Δq is the relationship of changes in speed to changes in flow (determined in terms of flow), all in terms of vehicle hours.

[8] See the European Commission's Advisors to the High Level Group on Infrastructure Charging (1999), Calculating Transport Congestion and Scarcity Costs.

The Urban Mobility Scorecard by Texas A&M Transportation Institute values the NY-NJ-CT urban area's time per vehicle hour at $17.67 (in 2014).[9] To determine the change in flow rate across the loop (and thus the impact of decongestion upon flow), this assumes level of service C flow rates for mixed large along three lanes of airport terminal access and circulation roadways (without traffic merging) as determined by the Transportation Research Board. From this, the change in flow with can be estimated at 54 cars/mph increase across Newark's three lanes.[10]

Figure 2. Change in Flow Rate



Using the above assumptions in the model described above suggests that the MECT, at $3.05. This fits assumptions for a highly-trafficked loop for cars under a cordon charge.[11] As has been discussed at length on the literature on the subject, the model can be made more precise in terms in terms of vehicle type, road link, time of day, real-time traffic conditions, trip purpose, and local conditions.[12]

Impacts

Revenues

A congestion charge equal to the congestion cost would generate approximately $105 million a year on vehicles which use the roads to the terminals, or over $1.04 billion over 10 years, which entirely covers the proposed maintenance cost of the AirTrain structure (Table 3, below). Adjusting for the expected 30% growth in the airport's enplaning over the subsequent 10 years forecasted by the FAA, by 2027 the charges will bring in $136.9 million, and would have generated $1.33 billion.[13] A charge would also bring current revenue from all tickets to the airport (including PABT and Air Train) to $131.1 million, excluding parking revenues (Table 4 below). These numbers factor in capital and operational costs as estimated by the Federal Highway Administration's TRUCE 3.0 Model, calling for one gantry mechanism, lane indicators, and collection booths (staffed) along 3 lanes entering the 1.5 mile loop and all connected roadways, in the manner of the NJ Turnpike.[14]

---

[9] Texas A&M Transportation Institute. 2015 Urban Mobility Scorecard Congestion Data. Accessed January 29, 2019 at https://mobility.tamu.edu/ums/

[10] National Academies of Sciences, Engineering, and Medicine. 2010. Airport Curbside and Terminal Area Roadway Operations. Washington, DC: The National Academies Press. https://doi.org/10.17226/14451. Table 4-1.

[11] Per-mile charges for large metro areas are usually much lower. See European Commission's Advisors to the High Level Group on Infrastructure Charging (1999), "Calculating Transport Congestion and Scarcity Costs." Annex 2.2.

[12] André de Palma, Robin Lindsey (2011). "Traffic congestion pricing methodologies and technologies." Transportation Research Part C: Emerging Technologies, Volume 19, Issue 6, 2011, Pages 1377-1399, ISSN 0968-090X, https://doi.org/10.1016/j.trc.2011.02.010.

[13] FAA Terminal Area Forecast. Accessed January 29, 2019 at https://www.faa.gov/data_research/aviation/taf/.

[14] Federal Highway Administration (2018). "Truce 3.0 – Metropolitan Areas" Accessed January 25, 2019 at https://ops.fhwa.dot.gov/congestionpricing/value_pricing/tools/

Table 3. Revenues from Congestion Pricing

	Trips	Proposed Pricing	Annual Revenue
Ground Transportation Revenue	33,498,721		$104,941,967.99
- Parked Cars	3,409,479	$3.05 + $4/hr	$10,410,421.13
- Booked Ground Transportation	166,552	$3.05 + variable	$796,723.24
- Airport Coach	276,041	$3.05 + variable	$1,320,476.59
- Taxis	1,093,476	$3.05+ variable	$5,230,775.60
- Other	28,553,172	$3.05	$87,183,571.42
Annual Costs			$(835,766.00)
- Capital and Operations			$(835,766.00)
Total			**$104,106,201.99**

Table 4. Revised Fares and Revenues

	Trips	Proposed Pricing	Annual Revenue
Ground Transportation	33,498,721	$3.05	$104,106,201.99
PABT	330,809	$35.00	$11,578,330.00
AirTrain	2,797,139	$5.50	$15,384,264.11
Total	**36,626,669**		**$131,068,796.10**

Other Impacts

Diversion to Other Modes

Besides construction costs, which vary, there is the issue of displacement into the rest of the system. Even though ground travel to the airport must a) already navigate many tolls in the New Jersey Turnpike system and b) may not be likely to be deterred by them given the regional importance of the airport, diversion to other roadways occurs with congestion pricing systems just as certainly as there is decongestion of the roadways through the system. Federal Highway Administration congestion pricing TRUCE models estimate between a 6.6% and 32% diversion in traffic to non-priced areas from congestion pricing freeways, the latter percentage more likely to take place in cordon-priced areas.[15]

Applying this same dynamic to the case of the airport access road means that between 1.8 and 9.5 million annual trips will be diverted, if not to arterials, then potentially to other modes (Table 5, below).

[15] Federal Highway Administration (2018). "Truce 3.0 – Metropolitan Areas" Accessed January 25, 2019 at https://ops.fhwa.dot.gov/congestionpricing/value_pricing/tools/

Table 5. Potential Diversion

	Total Diverted	Potential AirTrain
6.6% Diversion	1,778,798	$9,783,393.93
32% Diversion	9,486,927	$52,178,100.98

Newark Airport, of course, is not accessible by ground transportation on any other routes than the roads which are being priced, and would either have to be diverted to transit: if all the passengers took AirTrain, for instance, this would represent $9.7 to $52.1 million in revenue, though actual travel patterns would likely be spread across a range of available modes.

Conclusion

The Governor's remarks clearly recognize the real challenges to the AirTrain and to Newark Liberty International. Furthermore, it reveals a desire to keep Newark competitive with other airports around the world, which have stepped up their efforts to upgrade passenger connections between airport terminals and public transit (LaGuardia and Los Angeles International are only the most prominent examples). However, while these designs create efficient access to rental car lots, taxis, ridesourcing or ridesharing, they have also been pursued in concert with a strategy for terminal expansion which addresses growing regional need for air travel. While the AirTrain has always been a leader in providing transportation options, any upgrade to terminal access should factor in the pressing need for terminal expansion.

Furthermore, now is the time to use congestion pricing as a financing mechanism for this effort, given its immanent adoption in New York City. A well-conceived redesign starts with the aid of this financing tool, which provides funds for maintenance, upgrades, and the transition process as a new terminal is built. More refined models may involve even more aggressive pricing of trips to the airport to cover capital and operational costs. A long-range AirTrain upgrade option which focuses on doubling airport capacity is not only the most fiscally responsible but the most equitable outcome of investing in Newark, one which anticipates the most future needs of the region, which severely needs more capacity for air travel.