Flying Beyond | DCA Air Service Analysis

April 2023

Capital Access Alliance

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1 Objective and Key Considerations

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Washington, D.C., is one of the largest metros in the United States and the nation's capital, making it an important node in the U.S. air-travel network.

Washington, D.C., is one of the largest metropolitan areas in the United States and the nation's capital—making it an important node in the U.S. air-travel network. D.C. is served by three major commercial airports in the region, Reagan National (DCA), Dulles International (IAD), and Baltimore Washington International (BWI). DCA has been subject to a federal perimeter rule since 1966 that restricts the flights the airport can serve.

The air-travel ecosystem has evolved considerably in the past six decades. This report aims to understand the original rationale and intent of the perimeter rule and the broader air-travel ecosystem it was set in. To comprehend the perimeter rule, we assessed the reports the United States Government Accountability Office prepared on relevant topics over the past decades and conducted broader primary and secondary research of existing literature.

The report also aims to objectively evaluate the current effectiveness of the perimeter rule to meet its original intent and measure the broader impact on the communities served by Washington, D.C., airports[1]. We accomplished this by assessing different factors:

- **Air-travel supply-demand characteristics**—analyzed the scheduled passenger flow collected from the Official Airline Guide (OAG) Traffic Analyser, scheduled operations data collected from OAG Schedule Analyser, and actual flown schedules/passenger traffic data using OAG DoT Analyser (T-100 & DB1B)
- **Impact on airport congestion, reliability, and capacity utilization**—assessed the operational performance of flight legs using data collected from the OAG's operational performance module
- **Carbon emissions impact**—leveraged equipment-specific fuel consumption details and the CO_2 emissions methodology provided by the International Civil Aviation Organization (ICAO)
- **Effect on consumer ticket fares**—reviewed pricing information for tickets booked in 2022 (January to August) provided by the Airlines Reporting Corporation (ARC)
- **Consumer air-travel preferences and current issues**—conducted a comprehensive consumer survey of 2,500+ recent air passengers from top U.S. metros in terms of population
- **Broader economic impact**—leveraged inputs provided by IMPLAN, a leading economic research provider

[1] Throughout this report, Washington, D.C., airports refers to Baltimore-Washington International Airport (BWI), Dulles International Airport (IAD), and Reagan National Airport (DCA). The communities included as part of the Washington, D.C., metro for purposes of this report are the following: Washington, D.C., Loudoun (VA), Arlington (VA), Fairfax (VA), Prince William (VA), Baltimore (MD), Baltimore City (MD), Anne Arundel (MD), Montgomery (MD), Howard (MD), Prince George (MD), Jefferson (WV), Clarke (VA), Fauquier (VA), Spotsylvania (VA), Stafford (VA), Warren (VA), Alexandria (VA), Fairfax City (VA), Falls Church (VA), Fredericksburg (VA), Manassas (VA), Manassas Park (VA), Calvert (MD), Charles (MD), Washington (MD) and Frederick (MD)

Further details about our scope and methodology are available in the appendix. Most of the analyses used data through or from 2019 when air traffic was at its pre-COVID peak. To ensure that the assertions and arguments provided in the report are still relevant in an evolving post-COVID world, this report also analyzed the existing literature on developments of trends related to air-service reliability and air traffic since 2020.

The report culminates with recommendations to help mitigate the issues identified in the assessment above.

2 Executive Summary

2 |Executive Summary

The Reagan National (DCA) perimeter rule is no longer necessary to support its original objectives. It is, in fact, harmful to the communities and consumers served by the Washington, D.C., airports. Adding more in- and beyond-perimeter slot pairs is necessary and feasible to improve market conditions.

Since the late 1960s, Reagan National Airport (DCA) has been subject to federal perimeter and slot capacity control rules. The perimeter rule currently limits DCA only to allow flights to land or take-off within a 1,250-mile radius. Over the past 20 years, the U.S. Department of Transportation (DoT) has granted a limited number of “exceptions” allowing select carriers from DCA to serve cities beyond the 1,250-mile limit. Consequently, as of November 2022, seven airlines have been authorized to operate 20 daily roundtrips to ten beyond-perimeter destinations, less than 6% of daily scheduled flights from DCA.

In addition to the perimeter rule, the slot capacity control rule requires airlines to obtain slots for every take-off and landing. FAA regulations have established a maximum of 67 hourly slots to be allocated for carriers, commuters, general aviation, and unscheduled flights.

Reader's Note*: Throughout this study, you will see references to "slots" and "slot pairs". A "slot" is an authorization to either take-off or land at a particular airport on a particular day during a specified time period. A “slot pair authorization” allows carriers to conduct take-off and landing or roundtrips from the airport.*

When established in 1966, the stated objectives for the perimeter and capacity control rules were to:

protect in-perimeter communities' access to Washington, D.C.	protect DCA's air-service reliability	protect growth at Dulles International Airport (IAD)

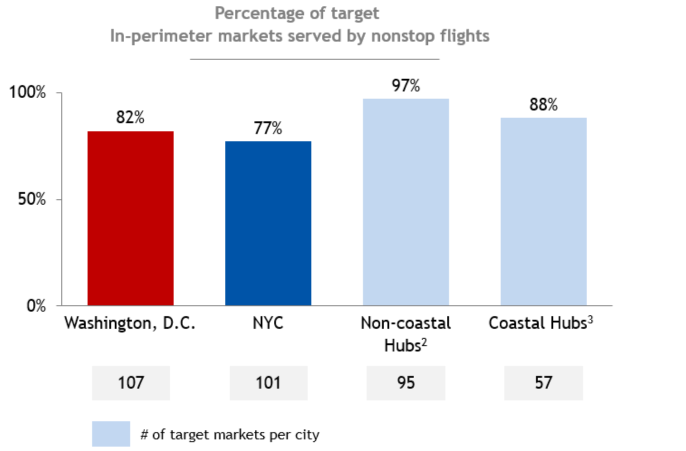
While the perimeter rule may have been essential to promoting the above outcomes in 1966, the past 60 years have seen significant shifts across the consumer, economic, technological, and industry landscape with substantial implications for the air-travel ecosystem in Washington, D.C., and the perimeter rule at DCA. Specifically:

- **Air traffic from the U.S. has increased 10-fold** since the 1960s, driven by airline industry deregulation, growing population, and income levels.
- Demand at IAD has increased dramatically since the **counties housing and surrounding the airport have more than tripled in population** since the 1970s.
- More broadly, global mobility and international travel demand have **increased in all-around partnerships and network strategies that support worldwide connectivity** through strategic (typically coastal) hubs.
- Advances in aircraft technology have resulted in **the continual evolution of faster, more efficient, and quieter aircraft.**
- Airlines have shifted towards up-gauging (i.e., higher seat counts) to capture demand more effectively, improving passenger throughput and increasing capacity while still delivering quality air service. From 1966 to 2019, the **average gauge for U.S. airlines rose 3x from 35 seats per flight to 105 seats per flight.**
- On the ground, infrastructure investments, operational improvements, and technological enhancements in the travel industry have allowed for **more efficient airport capacity utilization.**
- **Beyond-perimeter cities have seen tremendous economic growth**. They are now home to 28% of the Fortune 500 companies—doubling the 14% from 1966 when the perimeter rule was first instituted. **In the same period, Washington, D.C., also saw a ~10x increase in Fortune 500 companies**, adding 18 more for a total of 20.

As a result of these changes, the perimeter rule is no longer effective nor required to meet its stated objectives. Objective analysis can be used to demonstrate the ineffectiveness of the current rule at delivering each of these objectives, with examples being:

Protecting in-perimeter communities:

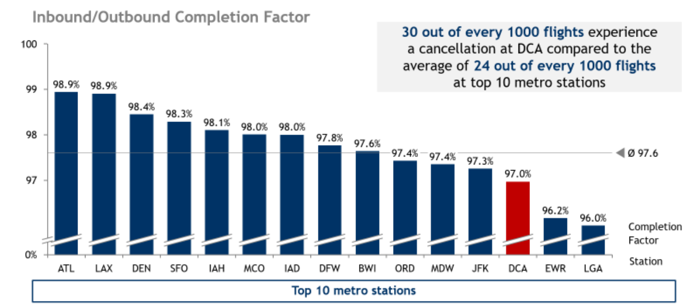
Cities not impacted by the perimeter rule provide, in most instances, better levels of direct access to in-perimeter communities when compared to cities affected by the perimeter rule.



Note: For additional details on methodology, refer to connectivity rate analysis in Section 9
Source: OAG 2019, scheduled flights and booked passengers

Protecting DCA's air service reliability:

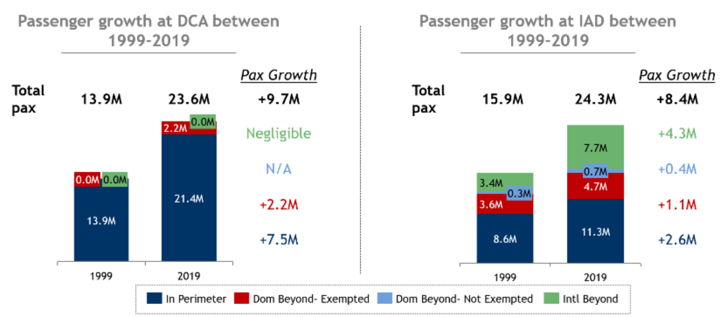
The perimeter rule at DCA has incentivized carriers to fly more regional aircraft, which, on average, experience a higher rate of disruption than narrow-body aircraft.



Note: For additional details on methodology, refer to completion factor analysis in Section 9
Source: OAG ops data for 2017-2019 and 2022

Protecting growth at IAD:

Over the past several years, IAD has seen significant passenger growth, even when exceptions to the perimeter rule were granted at DCA.



Note: For additional details on methodology, refer to passenger growth analysis in Section 9
Source: T-100, data at segment level

Further, the perimeter rule results in Washington, D.C., severely underserving beyond-perimeter destinations, as evidenced by limited non-stop capacity and very high load factors for these markets compared to similar metros. Nearly four of every ten beyond-perimeter passengers must connect when traveling from Washington, D.C.—almost 2x the rate for other top metros. Washington, D.C., requires ~110 additional daily roundtrips to its top 25 markets to reach parity in beyond-perimeter supply-demand vs. the top 30 to 100 U.S. markets. The lower access to beyond-perimeter markets results in unintended harm to the communities and consumers served by Washington, D.C.'s airport system, such as:

More expensive fares/reduced competition for consumers: Low supply costs beyond-perimeter passengers over $500M annually in above-average flight prices.

Productivity loss: Low supply-demand ratio also forces passengers to connect more frequently, costing them ~$200M in lost productivity.

Larger carbon footprint: The perimeter rule also results in DCA emitting the highest CO_2 footprint per passenger[1] among airports of the top U.S. metros.

Stifled economic growth: Low access to the beyond-perimeter market costs Washington, D.C., and its residents ~$1.8B in forgone economic impact and ~5.5K forgone jobs

~20 to 25 additional in- and beyond-perimeter slot pairs at DCA

We recommend granting ~20 to 25 additional in- and beyond-perimeter slot pairs at DCA. A slot pair authorization allows carriers to conduct take-off and landing or roundtrips from the airport. Additional in- and beyond-perimeter slot pairs at DCA are a necessary and feasible solution to mitigate the mentioned issues and help address the challenges created by the perimeter rule:

- **Improving access by allowing up to ~0.8M to 1.0M more passengers per year** to be connected by non-stop flights to beyond-perimeter markets.
- **Reducing flight ticket prices up to ~3-12%** through increased supply and competition.
- **Improving passenger productivity** by reducing passenger time spent on flights.
- **Creating up to ~1.0K to 1.3K new jobs** in the Washington, D.C., metro.

Generating up to ~$320M to $400M to the Washington, D.C., metro as an overall economic benefit, excluding federal and state tax revenues**.**

Adding up to ~$50M to $70M in federal and state tax revenues for the metro area.

Also, adding beyond-perimeter slot pairs at DCA will maintain the protections the perimeter rule intended to support, including air-service reliability, growth at IAD, and noise pollution for communities near DCA. This addition will provide higher reliability per passenger due to a shift towards more reliable narrow-body operations. DCA can cater to these additional flights even at its most constrained times without falling behind major U.S. airports in customer delays. If authorized, the added flights can also result in more efficient usage of airport capacity during non-peak hours. Moreover, focusing on slot-pair additions instead of in-perimeter conversions can mitigate any risk of underserving local communities.

It is important to note that most of the analyzed data in this report are from 2019, at a pre-COVID peak in air travel. However, the evolution of travel trends in the post-COVID world supports and further bolsters our findings as of March 2023.

- Operational reliability issues due to a high share of regional aircraft are likely to further deteriorate with factors such as regional pilot shortages
- Recent carrier investments at IAD will further strengthen its growth prospects, limiting the necessity of the perimeter rule to support IAD
- Increasing air-traffic volumes are fast approaching the pre-COVID supply-demand trends, necessitating additional slot pairs

3 Understanding the Perimeter Rule and its Objectives

3 | Understanding the Perimeter Rule and its Objectives

Washington, D.C., is one of the two U.S. cities with an airport subject to the perimeter rule, with New York (LGA) being the other. This section aims to understand D.C.'s airport system, its history, and the dynamics between its airports. We will then outline the details of the perimeter rule at DCA, its intent, and its evolution over time.

3.1 D.C. Metro Airport System

The Washington, D.C., region is served by three large airports—Reagan National (DCA), Dulles International (IAD), and Baltimore Washington International (BWI). In 2019, these saw 75M annual passengers[3] served by 51 carriers operating ~2,000 daily frequencies to 207 unique destinations—141 domestic and 66 international.

Reagan National (DCA)

Reagan National (DCA) was opened in 1941 in Arlington, VA. Operated by Metropolitan Washington Airports Authority (MWAA) since 1987, DCA has two passenger terminals with 58 gates . The three runways at DCA see ~800 day-to-day operations[4] to 93 domestic and six international destinations, serving ~65k daily passengers. American Airlines is the largest carrier by seat share with ~50%, followed by Southwest Airlines and Delta Air Lines with ~16% and ~14% respectively. DCA is located ~5 miles south of downtown Washington, D.C., and is accessible via public transportation, including bus, train, and even foot (Mt. Vernon trail). TSA operates 24/7 at DCA. In 2021, DCA completed Project Journey, an extensive $1B infrastructure project that added a 14-gate concourse and two new security checkpoints.

Washington Dulles International (IAD)

Washington Dulles International (IAD) was opened in 1962 in Loudoun County (VA), ~28 miles from downtown Washington, D.C. It has four runways, three terminals (one primary and two parallel midfield terminals), and 113 gates currently operated by MWAA. In 2019, it flew ~650 daily operations to 99 domestic and 64 international destinations, serving ~65K daily passengers. United Airlines is the largest carrier by seat share with ~65%, followed by Delta Airlines and American Airlines with ~5% and ~3% respectively. The airport was accessible only via private transport or public bus service till 2022, with the Washington Metro Silver Line set to be opened in 2022. TSA operates daily from 3:45 a.m. to 10:30 p.m.

MWAA operates IAD and DCA under a Use and Lease Agreement. In 2015, MWAA added a provision in the agreement to allow revenue sharing between the two airports. Under this provision, MWAA aimed to transfer up to $310M in revenue from DCA to IAD over ten years to help offset costs at Dulles. According to recent reports, the provision will lapse in 2024 and not be renewed.

Baltimore Washington International (BWI)

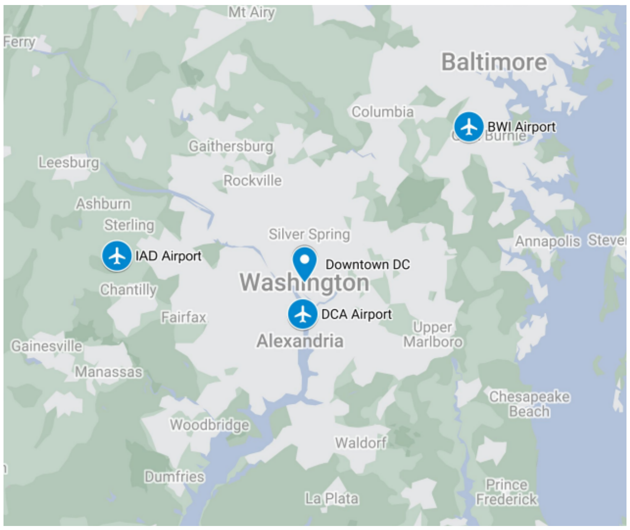
Baltimore Washington International Airport (BWI) was opened in 1950 in Anne Arundel County (MD), ~33 miles from downtown D.C. It has three runways, one terminal, and 75 gates and is currently operated by Maryland Aviation Administration (MAA). In 2019, it flew ~630 daily operations to 87

[3] Based on actual 2019 flown passenger traffic data using OAG DoT T-100

[4] Daily operations refer to average scheduled take-offs and landings in a day; calculated for 2019.

domestic and 15 international destinations, serving ~75K passengers daily. Southwest Airlines is the largest carrier by seat share with ~66%, followed by Spirit Airlines and Delta Air Lines with ~11% and ~8% respectively. The airport is accessible via public transportation—buses connecting with Washington Metro and Amtrak. TSA operates daily from 4 a.m. to 9:45 p.m.

Exhibit #1 – Map of the Washington, D.C., metro system with the three airports



Source: Google Maps

A survey[5] of 2,500+ recent passengers from Washington, D.C., and other top metros[6] revealed that customers prefer each airport for different reasons. Location, price, and convenient flight times were the top factors driving preference for DCA; price, non-stop flight options, and destination options were the top factors for IAD; price was the most critical factor for BWI, with nearly three of every five passengers choosing BWI for low fares.

As the airports are within 60–70 mins of driving time, the survey analysis expected to discover some consumer trade-offs between them. The GAO report[7] findings show that consumers have an outsized preference for DCA. The consumer survey results also show that less than 50% of passengers who traveled out of any of the three Washington, D.C., airports considered another airport for their travel[8]. Within the passengers that considered another airport for travel, passengers were 2x more likely to choose DCA and IAD as alternatives to each other compared to BWI[9].

3.2 Perimeter rule at Reagan National

In 1966, DCA was subject to a federal perimeter rule through an agreement between the airlines and the federal government.

As found in the GAO report, the rules have had several revisions over the past six decades:

- In 1966, the perimeter rule was initially set to limit DCA to serve non-stop flights to markets under 650 miles away. The limit was designed to optimally utilize DCA's capacity for airline and general aviation passengers, position DCA as a short-haul commuter and local service airport, and reduce congestion of landside resources
- In 1981, FAA expanded the perimeter rule stage-length limit to 1,000 miles. Objectives the FAA considered included providing the Washington, D.C., area with safe and efficient airport facilities, limiting congestion at DCA, and promoting better utilization of Dulles International Airport

[5] For additional details on methodology, refer to consumer survey methodology in Section 9
[6] Top ten metros by population
[7] GAO-21-176, Information on Effects of Federal Statute Limiting Long-Distance Flights, November 2020
[8] Consumer survey. Question: "On your [first/second] most recent trip, did you consider multiple airports?"
[9] Consumer survey. Question: "What other airport were you considering flying out of?"

- In 1986, the rule was revised to increase the stage-length limit to 1,250 miles

Federal law has, however, directed DoT to consider granting beyond-perimeter exemptions, i.e., authorization of non-stop service in cases in which:

- Flights are beneficial for connecting communities beyond the 1,250-mile perimeter
- Flights increase airline competition in multiple markets
- Flights don't reduce travel options within the perimeter
- Flights don't increase travel delays at DCA

As a result, a total of 40 beyond-perimeter flights daily (or 20 daily roundtrips) have been authorized based on the federal statutes being enacted on three occasions:

- 12 beyond-perimeter flights or six roundtrips in 2000
- 12 additional beyond-perimeter flights or six roundtrips in 2003
- 16 additional beyond-perimeter flights or eight roundtrips in 2012
  - Of these eight roundtrips, four were new beyond-perimeter authorizations, and the remaining were the conversion of existing in-perimeter slot pairs

Reagan Airport is also subject to capacity controls under the High-Density Rule (HDR), which requires airlines to obtain authorization for every landing or takeoff, defined as a slot. Currently, operations at DCA are limited to a maximum of 67 hourly slots, including:

- 48 hourly carrier and commuter slots for scheduled flights
- 12 hourly slots for general aviation and unscheduled flights
- Five hourly slot exemptions for the flights authorized through the various statutes, including 20 daily beyond-perimeter roundtrips
- Two hourly slots "slides," allowing airlines to allocate certain hours to be reassigned and used in different slot periods

To evaluate the effectiveness of the perimeter rule, its objective can be broadly classified under the following:

Protecting in-perimeter communities' access: As per findings of the GAO report, stakeholders assert that the perimeter rule ensured that airlines continue to provide service to smaller in-perimeter communities from the nation's capital. Flights to these communities generally tend to be less valuable than larger beyond-perimeter communities in revenue. Lower traffic volumes primarily drive this from these communities resulting in lower revenue per flight compared to a flight from a larger beyond-perimeter market.

Protecting DCA's air-service reliability: In 1969, DCA and four other stations (ORD, JFK, LGA, EWR) were identified as high-density traffic airports due to increasing congestion and travel delays in those times. Proponents of the perimeter rule assert that the rule was needed to improve congestion and benefit consumers as beyond-perimeter flights tend to utilize higher airport capacity, both landside and airside, compared to in-perimeter flights.

Protecting IAD's growth: Part of the perimeter rule's objectives in 1966 was strategically positioning DCA as a short-haul airport and promoting IAD's growth with longer flights. Given the consumer preference for DCA due to its proximity to the city and lack of ground transportation options from IAD, FAA was concerned that unrestricted operations at DCA would hamper growth at IAD.

Exhibit #2 — Primary objectives of the perimeter rule at DCA

Source: MWAA; GAO

4 Mapping the Air-Travel Ecosystem Evolution Over the Past Six Decades

4 | Mapping the Air-Travel Ecosystem Evolution Over the Past Six Decades

The perimeter rule was instituted when air travel was still in its nascency and was reserved for wealthy or corporate passengers. In 1966 fewer than four of every ten passengers were for leisure, compared to over seven in every ten in 2019. Airline operations were also plagued with reliability issues giving rise to the adage, “time to spare, go by air.” The Civil Aeronautics Board (CAB) regulated routes, fares, and market entry of new competitors at a federal level in 1966. Wide-body aircraft did not yet exist, with the Boeing 747 still four years away from flying. However, the air travel ecosystem has seen dramatic changes in the consumer, economic, technological, and industry landscape over the last 60 years, both globally and in Washington, D.C.

Consumer access to air travel has dramatically increased over the last six decades. When the perimeter rule was instituted in 1966, the total annual number of enplaned passengers across the U.S. was less than 110M[10]. In 2019, Atlanta’s Hartsfield Jackson Airport alone saw ~111M yearly passengers. The national number had increased nearly 10-fold to just over 1B enplaned passengers in 2019. The three Washington, D.C., airports boarded over 75M passengers. Airline industry deregulation, accompanied by a growing population and rising household income[11], has made air travel extremely accessible. In the last 50 years, population in Washington, D.C., metro area has increased from 5.1 M to 8.7M and median household income for top one third of the counties has increased by more than 55% (adjusted for inflation in today’s dollars). Loudoun County (IAD’s home county) and other bordering counties[12] have more than tripled in population in the last 50 years. The median household income has also increased significantly with counties such as Loudoun and Fauquier nearly doubling in this period (adjusted for inflation in today’s dollars). Loudoun County, where IAD is located, recorded the highest median household income of any county in 2019. Road access to IAD has also improved with the airport’s connection to I-66, built-in 1983. In November 2022, Silver line metro rail was also extended to IAD bolstering Washington, D.C.’s connectivity with the airport. With these factors, operations at Dulles have grown commensurately. In 1965, Dulles averaged 89 daily operations (take-offs and landings), which has increased by more than 7x to 650 daily operations in 2019.

With the evolution of air traffic, DCA has seen significant infrastructure and operational changes, greatly increasing its ability to handle higher passenger volumes. In the 1960s, DCA operated with airline-specific terminals, such as the American Airlines terminal constructed in 1968. Passengers were required to take buses to the gates to access their flights. The new Terminal 2 (opened in 1997 to replace the smaller airline terminals), Concourse E, and the security checkpoints added with a $1B project journey investment have allowed seamless passenger access across the 58 gates. Implementing newer air-travel technologies and initiatives such as mobile boarding passes and TSA pre-checks has enabled the airport to handle more passenger throughput bypassing traditional capacity bottlenecks. Access to the airport from the city was also improved with the construction of a metro-rail service in 1977, allowing one-way public transportation to the airport.

[10] Airlines for America, Air Transport facts and figures, 1968; accessed via airlines.org

[11] Source: Household income- *Census, Data USA*; Population – *NHGIS*

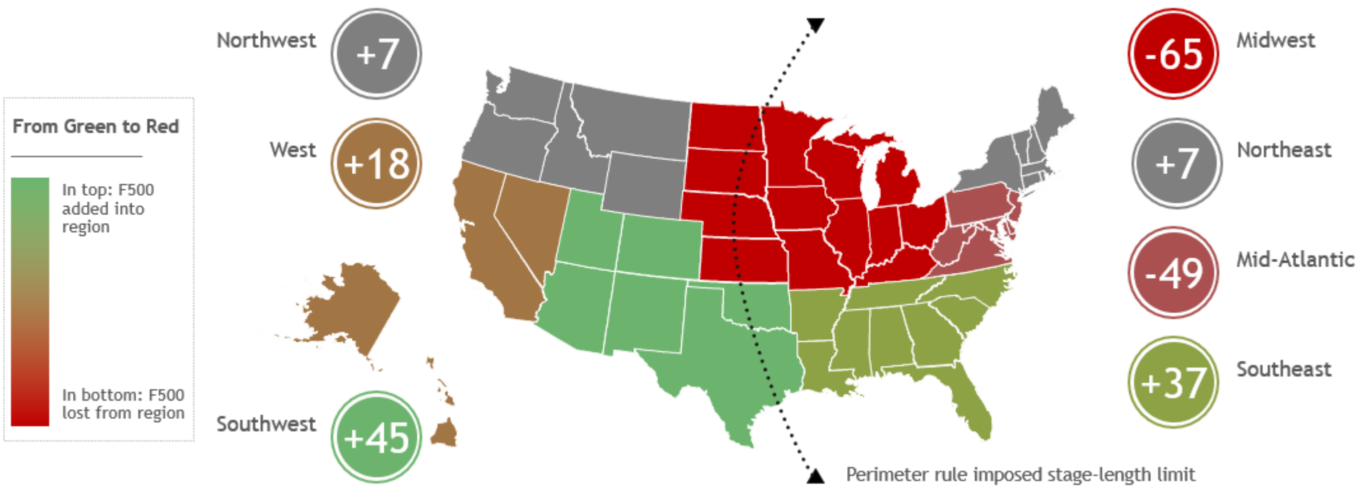
[12] Additional details on list of counties in Section 9

Similarly, there have been significant leaps in aircraft technology. The most common equipment used in the 1960s was the Boeing 707, a quad-engine jet weighing 333K lbs., capable of transporting ~141 passengers and operating with stage one noise limit compliance[13] (over 108 decibels), the lowest level possible, which has since been phased out. In contrast, the most common equipment today is the Boeing 737NG—a two-engine jet weighing under 200K lbs. capable of transporting ~162 passengers and meeting stage five noise limit compliance, the highest standard (~72–89 decibels). As airlines upgrade their fleet, the proportion of new age jets such as Airbus 220 is also increasing rapidly. Airbus has delivered more than 200 aircraft and has a strong order book of more than 760 aircraft worldwide[14]. These new jets provide significant generational improvements on noise and CO_2 emissions, with significantly higher performance than the most stringent standards in place today

The airline industry has also seen broad changes with more hub-and-spoke flying, the advent of airline partnerships, and up-gauging to grow networks. For example, until the late 1970s, given pre-regulation network restrictions, it was common for passengers to change airlines to connect and reach their destination[15]. With the deregulation and operationalization of hub-and-spoke models, the number has fallen to ~10%[16]. To further improve access and partnership, major airline alliances were formed in the late 1990s. Increased air traffic and load factors led to the airline's up-gauging equipment. For instance, U.S. Airline Traffic and Capacity statistics[17] showed that average load factors of ~76% in 1966 have increased to over 86% in 2019 while airline capacity, measured in available seat miles, has increased ~11x. Similarly, the average gauge for U.S. airlines increased 3x from 35 seats/flight in 1966 to 105 seats/flight in 2019.

[13] FAA noise standards, additional details in Section 9
[14] Airbus, July 2022
[15] GAO: Airline ticketing, impact of changes in the Airline Ticket Distribution Industry
[16] IATA: The future of interline
[17] Airlines for America, U.S. Airline Traffic and Capacity March 10, 2022

Exhibit #3 – Changes in the number of Fortune 500 companies in the region from 1966 to 2019



Source: Fortune 500; CapitalIQ

Lastly, over the past 60 years, the U.S. economy has grown considerably. The real GDP per capita in 1966 was ~ $24K,[18] and by 2021 it had increased by ~2.5x to $61K. The growth has been supported by a strong boom in the technology sector, strengthening its roots in beyond-perimeter markets on the U.S. West Coast. In fact, since 1966, the northwest, west, and southwest regions of the U.S. have seen 70 additional Fortune 500 companies emerge in the area, including some of the largest employers, such as Apple and Amazon. In the same period, Fortune 500 presence in Washington, D.C., has grown to house 20 Fortune 500 companies. In addition, given Washington, D.C.'s importance as the nation's capital, over 130 Fortune 500 companies have established an office in the region.

[18] Measured in 2015 dollars, Source: World Bank

5 Evaluation of the Current Effectiveness of the Perimeter Rule in Delivering its Stated Objectives

5 | Evaluation of the Current Effectiveness of the Perimeter Rule in Delivering its Stated Objectives

As the air travel ecosystem has evolved over the past decades, it is critical to understand whether the perimeter rule is meeting or is still required to deliver its original objectives. For that, this report revisits the three overarching goals identified in Section 4.2, namely:

- Protect in-perimeter communities' access to Washington, D.C.
- Protect DCA's air-service reliability
- Protect IAD's growth

5.1 Effectiveness in protecting in-perimeter communities' access to Washington, D.C.

As discussed in Section 3.2, proponents of the perimeter rule assert that the rule ensures airlines provide service to smaller in-perimeter markets. Since these in-perimeter markets tend to be less revenue-generative per flight compared to larger beyond-perimeter markets, proponents state that without the protection of the perimeter rule, airlines are likely to switch flights to service beyond-perimeter markets.

To evaluate the effectiveness of this protection, this report compared the level of access to in-perimeter stations from cities with perimeter rule protection (namely, Washington, D.C., and New York) and those without it, grouped by 'non-coastal hubs' (Atlanta, Chicago, Dallas, Houston) and 'coastal hubs' (Boston, Los Angeles, Philadelphia, Seattle and San Francisco)

A critical barometer for the level of access is the "direct in-perimeter connectivity rate,"[19] which measures the percentage of top similarly sized in-perimeter markets[20] served by non-stop flights. A city with a higher rate serves more in-perimeter destinations with direct access.

If the perimeter rule effectively protected access, cities with the perimeter rule protections would see more of their in-perimeter markets connected by non-stop supply. However, analysis of OAG data for Washington, D.C., and other major metros shows that **metros not impacted by the perimeter rule have higher direct connectivity rates than** metros with the perimeter rule.

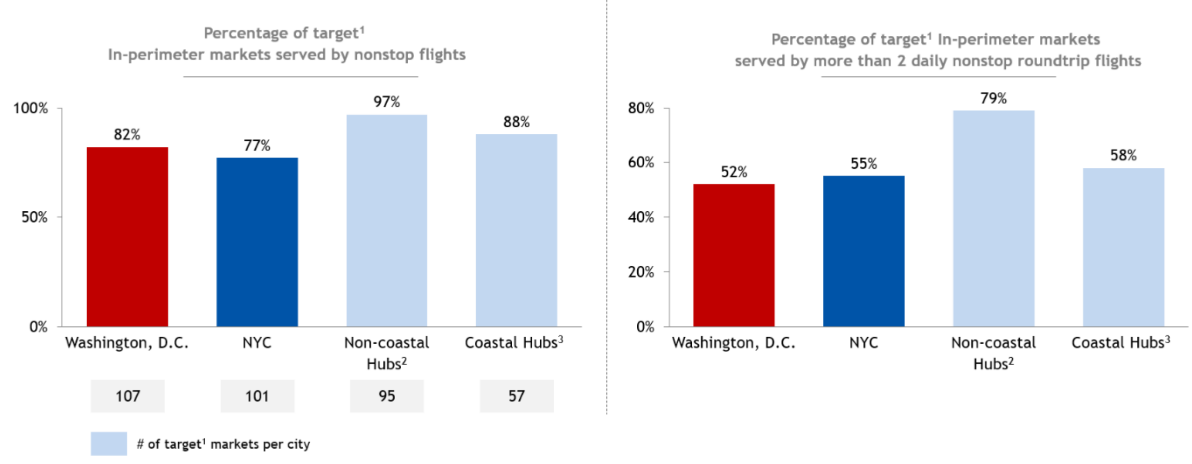
Washington, D.C., and New York, the two metros with an airport limited by the perimeter rule, must catch up to other metros not impacted by it. Washington, D.C., has an 82% connectivity rate vs. coastal and non-coastal hubs, whose connectivity rate is ~88% and ~97% respectively. Therefore, metros unaffected by the perimeter rule fare better in providing high access to in-perimeter markets.

In addition, air service from Washington, D.C., is concentrated in fewer airports. Two or more daily roundtrip flights serve only 52% of the top similarly sized in-perimeter markets. Like the direct connectivity rate analysis findings above, **metros not impacted by the perimeter rule provide more frequent direct access to their top similarly sized in-perimeter markets**.

[19] For additional details on methodology, refer to direct connectivity rate analysis in Section 9

[20] In-perimeter markets with overall annual traffic larger than ~14.5K, excluding top 15 U.S. cities

Exhibit #4 – Level of non-stop access for top in-perimeter markets from target metros in 2019



1: Calculated as # of markets with 2019 O&D traffic larger than 20 PPDEW, which is equivalent to a 20% load factor on a daily roundtrip 100-seater.
Excludes Top 15 US cities by domestic passenger traffic: NYC, CHI, LAX, WAS, ORL, LAS, DFW, DEN, ATL, SEA, SFO, BOS, PHX, HOU, FLL
2: ATL, CHI, DFW, HOU
3: BOS, LAX, MIA, PHL, SEA, SFO
Source: OAG 2019, scheduled flights and booked passengers

The coverage was similar among the in-perimeter destinations served by Washington, D.C., airports. IAD and BWI airports—not impacted by the perimeter rule—provided non-stop coverage to 68 of the 88 markets with non-stop access from Washington, D.C., with DCA only adding 20 unique destinations, each with ~1 daily round trip frequency. Over 55% of the passengers traveling to in-perimeter top similarly sized markets travel to/from IAD and BWI airports.

To ensure that low demand characteristics did not dictate the level of access, the report also analyzed the level and growth rate of Washington, D.C.'s in-perimeter market demand. In 2019, over 35M passengers traveled between Washington, D.C., and its in-perimeter markets. Over the past four years, this number has grown by 20%, well above the average for the top ten metros by passenger traffic.

As a result, the perimeter rule is not effective nor required in providing more non-stop and more frequent access to in-perimeter communities. In fact, to normalize the gap to benchmark stations, Washington, D.C. needs to add ~6 – 16 additional in-perimeter roundtrips to its target markets.

5.2 Effectiveness in protecting DCA's air-service reliability

One of the key original intents of the perimeter rule was to prevent congestion. DCA is one of the five stations identified as high-density traffic airports in the late 1960s based on high delays and congestion. Proponents of the perimeter rule assert that the larger planes used for beyond-perimeter flights will likely increase congestion at DCA by straining landside and airside capacity. This strain would worsen the air-service quality for passengers through delays; therefore, the perimeter rule was believed to be crucial in protecting air-service reliability.

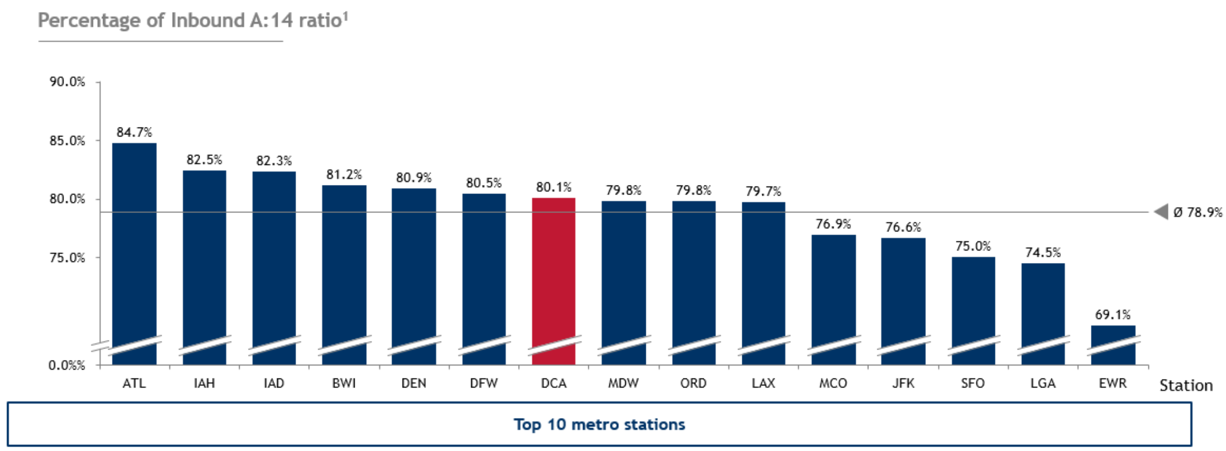
To understand the air-service reliability and its impact on customers, this report analyzed various operational metrics for DCA and other major[21] airports in the top ten metros[22] in the U.S.

- On-time arrival rates—were flights arriving on time?
- Completion factors—were flights operating as planned?
- Block time buffers—how delayed were flights on average?

On-time arrival rates

The A:14 ratio is a commonly used on-time arrival metric that measures the percentage of arrivals within 14:59 minutes of their scheduled time. A high A:14 ratio ensures passengers reach their destinations within a reasonable time and is highly prized by airlines. The metric is also a good proxy for congestion levels, as congestions likely lead to delays and, consequently, worsen this ratio. From 2017 to 2022, excluding 2020 and 2021 due to COVID irregularities, DCA saw an above-average A:14 ratio at ~80.1%[23], implying that less than 20 of every 100 flights are delayed by over 15 mins. Therefore, an above-average A:14 ratio suggests that DCA sees more flights arrive on time and is less congested than a comparable airport.

Exhibit #5 – A:14 rates at top ten metros in 2017–2022



1. A:14 is the percentage of Domestic flights (including Puerto Rico) that arrive within 14:59 minutes of their scheduled arrival time; benchmark stations include the set of airports with at least 10M enplaned pax from the top 10 busiest metros in the US (by enplaned pax)
Note: This analysis does not include 2020 and 2021 data due to COVID irregularities | Source: OAG Ops data 2017-2019 and 2022

Completion factor

Completion factor[24] is a measure of reliability that directly impacts passengers and is defined as the percentage of scheduled inbound and outbound flights from an airport that were not canceled in the

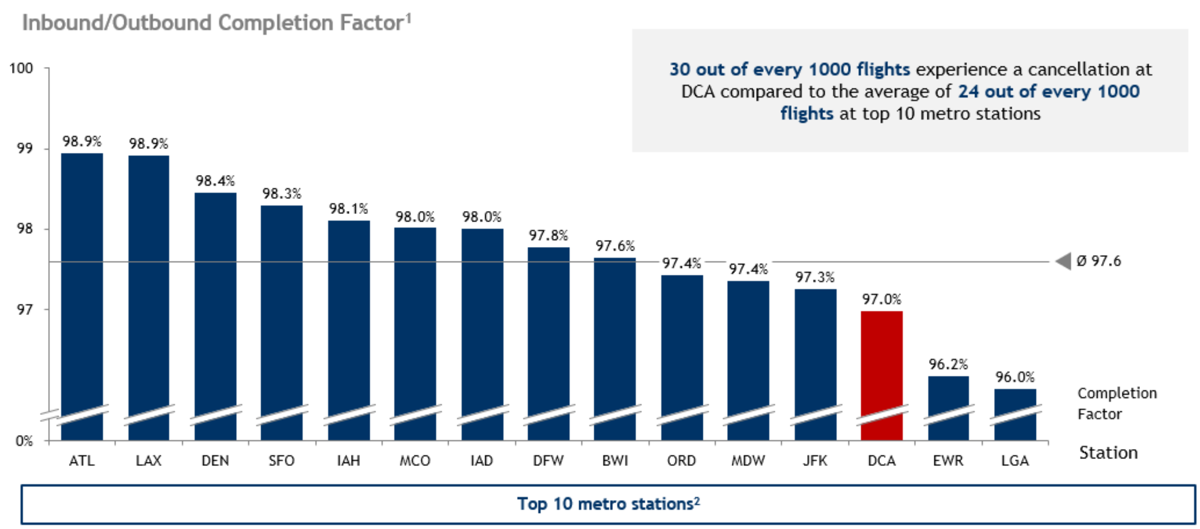
[21] Major stations are defined as stations with at least 10M enplaned passengers per year
[22] Top ten metros are defined as the ten metros by highest number of enplaned passengers (summed across all associated airports within the metro)
[23] For additional details on methodology, refer to A14 ratio analysis in Section 9
[24] For additional details on methodology, refer to completion factor analysis in Section 9

period being analyzed. The overall completion factor of an airport is an excellent proxy to measure an airport's operation resilience, as airports with higher rates generally see more flights completed.

While DCA had above-average arrival rates from 2017 to 2022[25], DCA saw a completion factor of 97%, implying that ~30 of every 1,000 flights were not completed as scheduled. The flight cancellation levels experienced by DCA passengers were ~25% higher than the average at major airports of other top ten metros, despite DCA being a slot capacity-constrained airport with strict regulations around minimum slot usage.

To understand this discrepancy, this report explored various factors. One cause identified in this report was the disparity in completion factors across regional and non-regional aircraft operating at DCA. From 2017 to 2022[26], flights operated by smaller regional aircraft[27] over a 5-year period were 40% more likely to be canceled when compared to their non-regional counterparts.

Exhibit #6 – Completion factor at top ten metros in 2017–2022



1. Completion factor is the percent of tracked Domestic flights (including Puerto Rico) that were not cancelled or diverted; CF = (1 - % of non-cancelled flights)
2. Benchmark stations include the set of airports with at least 10M enplaned pax from the top 10 busiest metros in the US (by enplaned pax)
Note: This analysis does not include 2020 and 2021 data due to COVID irregularities | Source: OAG Ops data 2017-2019 and 2022

Regional aircraft are more susceptible to cancellations due to various factors including, but not limited to, carrier strategies to preserve the reliability of their customer-facing brand, equipment capabilities under difficult operating conditions, and, lately, industry shortage of regional pilots.

DCA has the highest mix of regional aircraft operations among major airports in the top ten U.S. metros, with nearly 60% of all flights at DCA operating with regional aircraft. This is a consequence of the perimeter rule, as in-perimeter flights are more likely to utilize regional equipment, given the demand profile and optimal stage lengths for these markets. For instance, in-perimeter flights from DCA saw an average load factor of 78%, implying that 22 of every 100 seats were empty. The average load factor on

[25] Excluding 2020 and 2021 due to irregularities caused by COVID
[26] Excluding 2020 and 2021 due to irregularities caused by COVID
[27] Defined as scheduled operation aircraft with fewer than 100 seats

beyond-perimeter flights was 88%; therefore, carriers are more likely to use smaller regional equipment for in-perimeter flights.

Consequently, by adding additional beyond- or in-perimeter slot pairs operated by non-regional aircraft, DCA can improve the share of non-regional carriers and, therefore, average reliability. The completion factor analysis shows the variance between DCA and top ten metro stations in the mix of regional and non-regional aircraft could be contributing to as many as 2,000 cancellations per year.

Block-time buffer

Another important measure of air-service reliability at an airport is the block time buffer[28] of flights arriving or departing. The block time is the time between an aircraft pushing back from the departure gate to arriving at the destination. It includes the total taxi times (inbound and outbound) and flying time but excludes some exogenous factors that may drive delays outside of airside congestion (e.g., crew connection issues, delays propagating from previous flights, etc.). Block time buffer is the difference between a flight's actual block time and the scheduled block time, representing net delay minutes. Calculating an airport's block time buffer during its busiest operations enables measurement of the impact of airport congestion on customers in net delay minutes.

Block time buffer is a critical decision parameter in an airline's network strategy, which aims to balance operational reliability and timeliness with the operational efficiency of assets and labor. A high block time buffer will likely result in fewer delays due to more operational resilience although driving high idle time and costs for assets and labor. For an industry with razor-thin margins, these costs of high operational reliability are likely to be passed on to customers in the form of higher fares. Customer benchmark studies by ASCI[29] show that airline passengers rank timeliness satisfaction with top quartile scores among a broad set of air-travel experience categories ranging from quality of booking experience to seat comfort. Being conscious of both costs and customer preference, airlines and airports must strike a socially optimal balance between operational efficiency and reliability. Keeping this in mind, we analyzed how DCA navigates this balance when compared with major airports in the top ten U.S. metros.

To evaluate congestion levels at DCA on a like-to-like basis with other major airports in the top ten U.S. metros[30], this report analyzed the distribution of net delay minutes of scheduled flight operations (excluding wide-bodies). More specifically, this report analyzed the block time performance of the top 10% of busiest flights, where the number of scheduled operations in that hour of operation determines the busyness.

Block-time buffer analysis shows that for the top 10% of busiest flights at DCA, actual block times per operation tended to be, on average, five minutes shorter than scheduled block times, giving the airport a net buffer of five minutes per operation. A similar analysis of the top 10% of busiest flights at major airports in the top ten U.S. metros showed that the difference between actual and scheduled block times was roughly four minutes or a net buffer of four minutes per operation. This implies that DCA outperforms other top ten U.S. metro airports in block time performance by ~1 extra minute.

[28] For additional details on methodology, refer to block time buffer analysis in Section 9

[29] ASCI, Airline Benchmarks - Customer Experience Benchmarks Year-over-Year Industry Trends

[30] Top ten metros are defined as the ten metros by highest number of enplaned passengers (summed across all associated airports within the metro

Therefore, customers experiencing fewer delay minutes at DCA during its most congested instances implies that DCA is less crowded than most major top ten U.S. metro airports. However, normalizing this outperformance to the socially optimal balance could increase airlines' capacity and cost efficiency.

5.3 Effectiveness in protecting IAD's growth

> Between the late 1960s and the 1980s, the Federal government and FAA utilized the perimeter rule to spur air-traffic growth at IAD

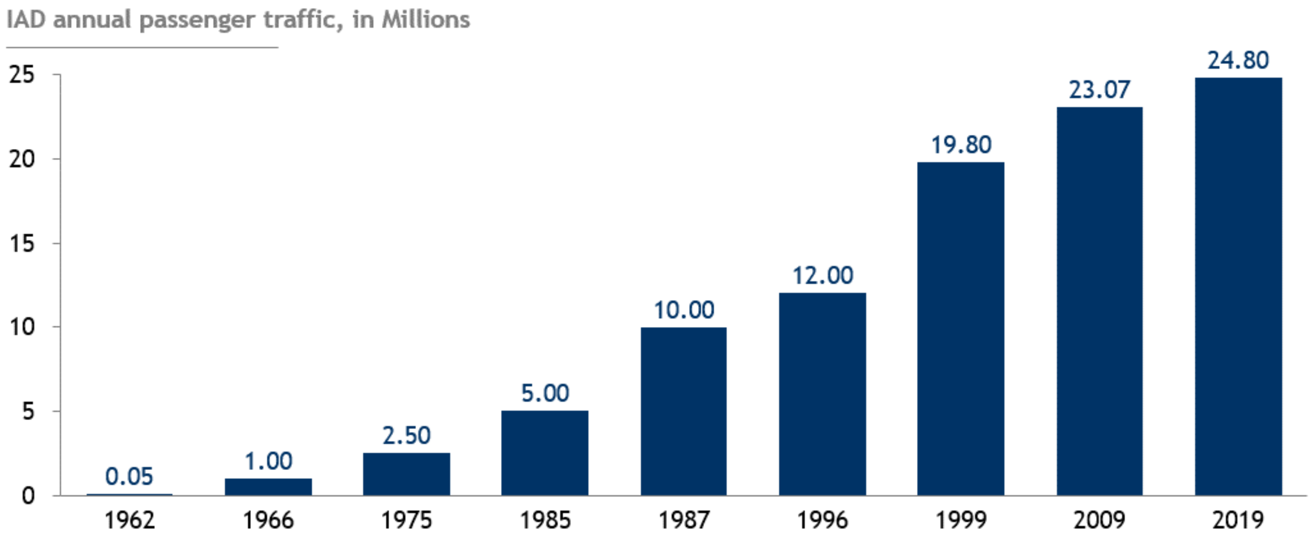
Washington Dulles International (IAD) was opened to flight operations in 1962. Between the late 1960s and the 1980s, the federal government and FAA utilized the perimeter rule to spur air-traffic growth at IAD. The limitations set by the perimeter rule were intended to position DCA as a short-haul traffic station and direct longer flights to IAD. Proponents of the perimeter rule assert that given IAD's larger distance from downtown Washington, D.C., compared to DCA[31] and the lack of public transportation options, the perimeter rule has been crucial in ensuring growth at IAD.

As discussed in Section 4, IAD's passenger volume has grown dramatically in recent decades. To understand whether the perimeter rule still plays a vital role in protecting IAD's growth, it is essential to assess IAD's self-sufficiency—or lack thereof—by looking at several factors:

- The airport preferences of Washington, D.C., air passengers (residents and non-residents)
- The impact on IAD of beyond-perimeter slot exemptions granted at DCA in the past two decades
- The passenger flows at IAD to understand how carriers were utilizing the capacity at the station

[31] IAD is located 30 miles west of D.C., while DCA is located three miles south of D.C.

Exhibit #7 – Growth in passenger volume at IAD since its opening in the period 1962-2019



Source: Fly Dulles for 1962 - 1999; MWAA for 2009 - 2019

IAD has a growing consumer base that does not consider DCA as an option

In a survey[32] of 2,500+ recent passengers on their airport preferences and drivers of choice, only 1/3 of all passengers who flew out of IAD in their last two trips even considered flying out of DCA. Passengers who preferred IAD over other Washington, D.C., airports chose it primarily for better ticket prices, more non-stop flight options, more comprehensive destination options, and more airline carrier choices.

Additionally, five of every six Washington, D.C., surveyed residents who lived in counties[33] housing or bordering IAD chose IAD as their preferred airport[34]. As discussed in Section 4, IAD has seen a rapid increase in population in these counties, more than tripling in population over the past six decades. For example, the entire Minneapolis metro area, served by MSP airport, has a population of 3.69M. In 2019, the counties housing or surrounding IAD airport were home to nearly 3.7M residents, suggesting a solid base of consumers who prefer IAD over other Washington, D.C., airports.

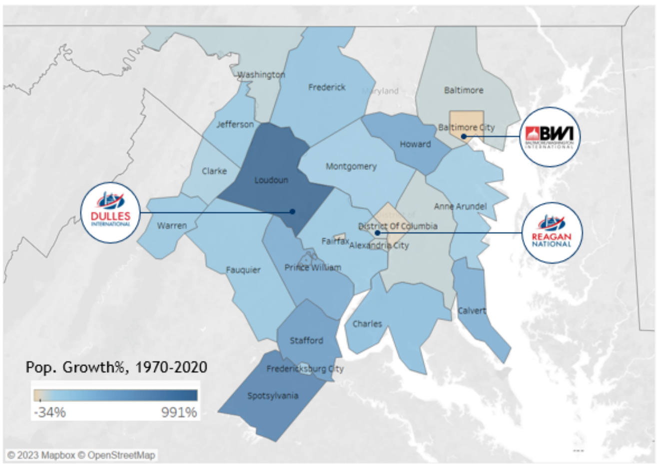
[32] For additional details on methodology, refer to Airport preference analysis in Section 9

[33] Includes Fauquier (VA), Clarke (VA), Fairfax (VA), Prince William (VA), Frederick (MD), Montgomery (MD), Washington (MD), Jefferson (WV)

[34] Consumer survey. Question: "Which one of these airports (Reagan National Airport (DCA), Dulles International Airport (IAD), Baltimore-Washington International Airport (BWI)) do you consider to be your preferred airport?"

Exhibit #8 – Growth in population at IAD since its opening in the period 1970-2020

Washington, D.C., metro area



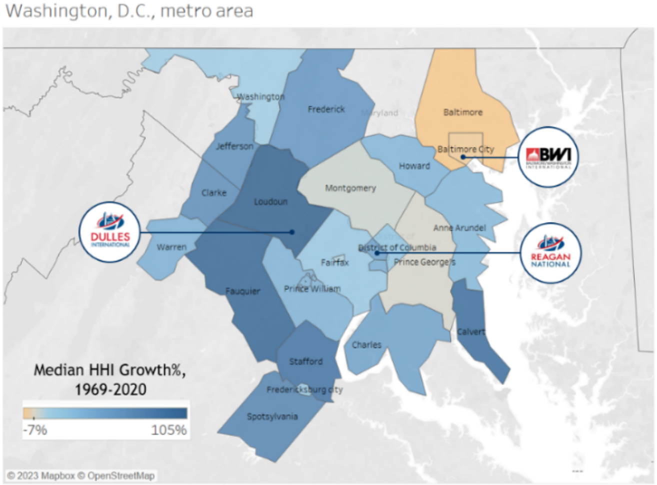
Map based on Longitude (generated) and Latitude (generated). Color shows sum of Pop Growth%. The marks are labeled by Label. Details are shown for State and County.

- Population in Washington, D.C., metro area increased from **5.1M to 8.7M** between 1970-2020
- In the same period, counties closer to IAD[2] experienced higher growth in population, **~164%**
- Loudoun (VA), Spotsylvania (VA), Stafford (VA) and Howard (MD) witnessed **>5X growth**

1. Includes Washington, D.C., Loudoun (VA), Arlington (VA), Fairfax (VA), Prince William (VA), Baltimore (MD), Baltimore City (MD), Anne Arundel (MD), Montgomery (MD), Howard (MD), Prince George (MD), Jefferson (WV), Clarke (VA), Fauquier (VA), Spotsylvania (VA), Stafford (VA), Warren (VA), Alexandria (VA), Fairfax City (VA), Falls Church (VA), Fredericksburg (VA), Manassas (VA), Manassas Park (VA), Calvert (MD), Charles (MD), Frederick (MD), Washington (MD); Manassas & Manassas Park were part of Prince William before 1975, 2. Includes Loudoun (VA), Fairfax (VA), Prince William (VA), Fauquier (VA), Clarke (VA), Jefferson (WV), Frederick (MD), Montgomery (MD), Washington (MD)
Source: NHGIS

Exhibit #9 – Growth in household income at IAD since its opening in the period 1969–2020

Washington, D.C., metro area



Map based on Longitude (generated) and Latitude (generated). Color shows sum of HHI Growth%. The marks are labeled by Label. Details are shown for State and County.

- In Washington, D.C., metro area median household income of the top 1/3rd counties increased by more than 55%
- Top 5 counties with increase in median household incomes- Loudon (VA), Fauquier (VA), Calvert (MD), Stafford (VA) and Spotsylvania (VA)
- Loudoun County (IAD's home county) has nearly doubled its median household income in the last 5 decades.

1. Adjusted for Inflation to 2020 current value, 2. Includes Washington, D.C., Loudoun (VA), Arlington (VA), Fairfax (VA), Prince William (VA), Baltimore (MD), Baltimore City (MD), Anne Arundel (MD), Montgomery (MD), Howard (MD), Prince George (MD), Jefferson (WV), Clarke (VA), Fauquier (VA), Spotsylvania (VA), Stafford (VA), Warren (VA), Alexandria (VA), Fairfax City (VA), Falls Church (VA), Fredericksburg (VA), Manassas (VA), Manassas Park (VA), Calvert (MD), Charles (MD), Frederick (MD), Washington (MD); Manassas & Manassas Park were part of Prince William before 1975, 3. Includes Loudoun (VA), Fairfax (VA), Prince William (VA), Fauquier (VA), Clarke (VA), Jefferson (WV), Frederick (MD), Montgomery (MD), Washington (MD)
Source: Census, Data USA

The strong base of passengers and residents who are unlikely to switch from IAD to DCA even if the perimeter rule was lifted strengthens the belief that the perimeter rule is not required to protect IAD's growth.

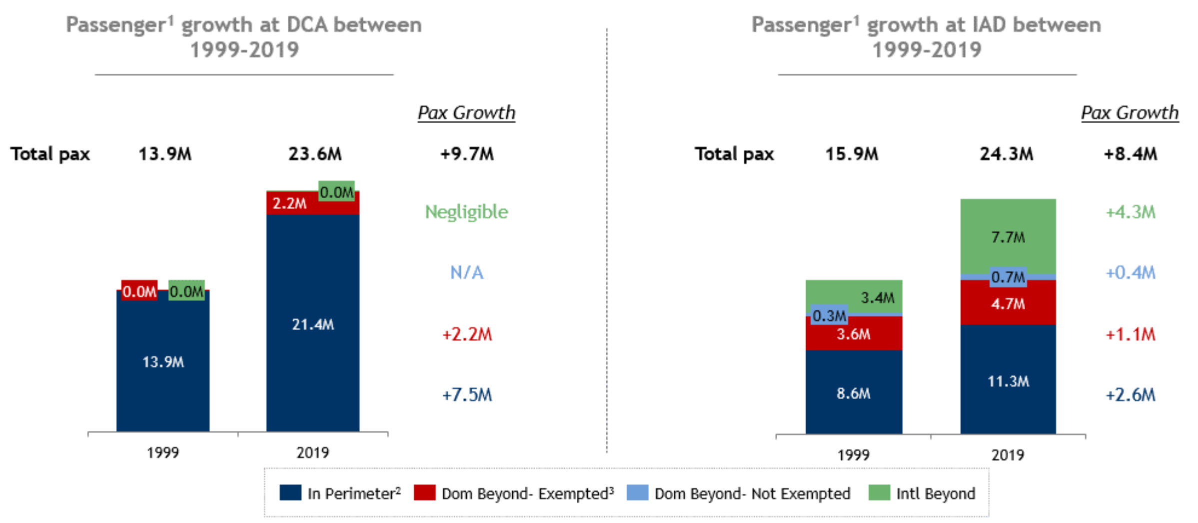
The addition of beyond-perimeter flights at DCA has not negatively impacted the overall passenger growth at IAD

To understand the impact of additional beyond-perimeter flights at DCA, we looked at the passenger volumes on flights operating from IAD and DCA between 1999–2019. The period chosen allows us to understand the impact of 20 daily beyond-perimeter slot pairs authorized at DCA—six slot pairs in 2000, six slot pairs in 2003, and eight slot pairs in 2012 (four of which were converted from existing in-perimeter slot pairs).

Analysis of T-100 segment data[35] highlights significant passenger growth at both DCA and IAD in the past 20 years. Passengers on beyond-perimeter markets grew by 2.2M at DCA driven by perimeter exemption. In parallel, passengers at IAD also grew with 1.4M passengers added on beyond-perimeter domestic markets and 5M passengers on international markets. Despite a reduction of 34K annual seats on beyond-perimeter exempted markets, IAD witnessed growth of 1.1M passengers on these markets, boosting load factors by 20pp to 87% in 2019. Load factor on beyond-perimeter flights is also higher (87% beyond-perimeter vs. ~80% each on in-perimeter and international flights), suggesting latent demand. Similarly, in-perimeter passenger growth of 7.5M passengers at DCA between 1999 to 2019 was accompanied by 2.6M higher number of passengers at IAD in the same period.

Overall, and as observed in Exhibit #10 below, flight passengers at IAD has grown by 50% over the last 20 years to 24M passenger annually in 2019.

Exhibit #10 – Annual inbound and outbound pax from IAD and DCA

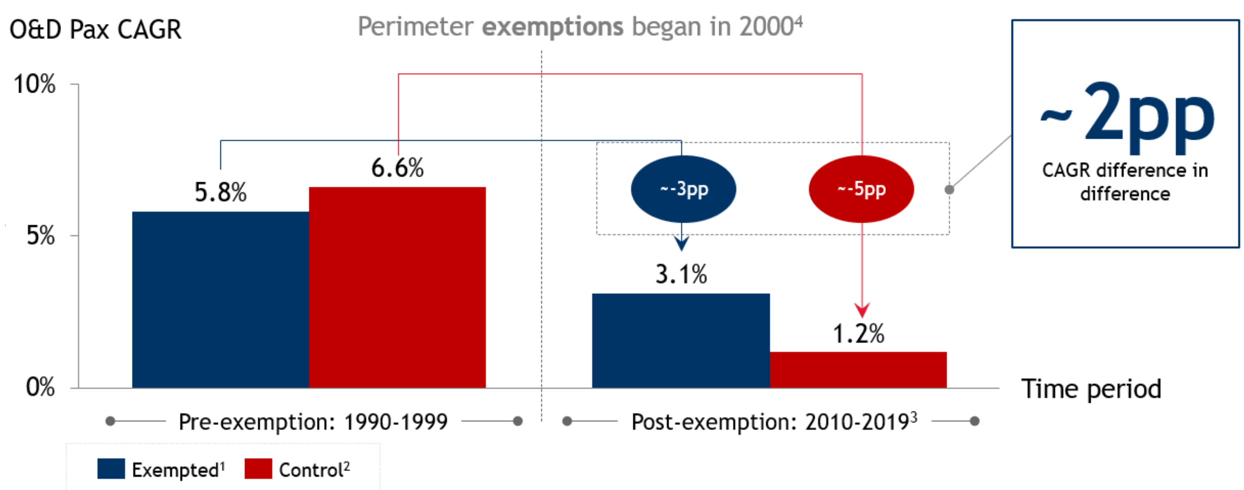


1. Passenger/Pax represents # of inbound + outbound passengers on all flights arriving/departing, 2. Includes both domestic and international markets,
3. Exempted airports- AUS, DEN, LAS, LAX, PDX, PHX, SEA, SFO, SJU, SLC
Source: T-100 data at segment level

[35] For additional details on methodology, refer to the passenger growth analysis in Section 9

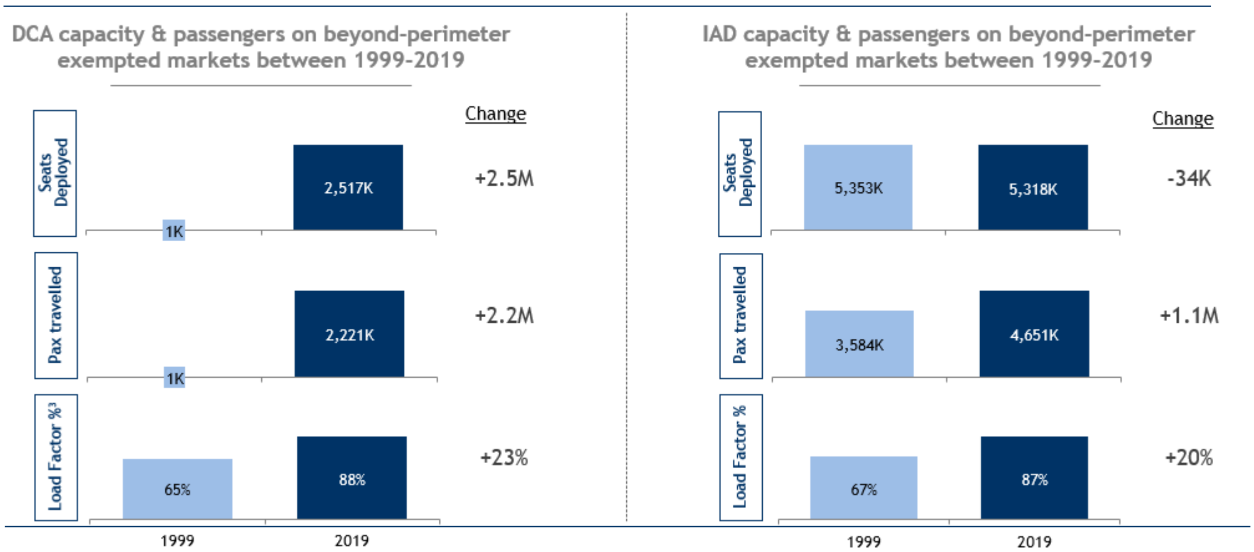
Furthermore, a difference-in-difference regression analysis[36] on the Washington, D.C., markets that gained perimeter exemptions, vs. a control group of the top 30 beyond-perimeter markets without perimeter exemptions by passenger size (which are not served by DCA), show that all beyond-perimeter markets have had positive O&D passenger CAGR before and after perimeter exemptions were granted, suggesting there is sufficient demand for all airports in the D.C. metro. Additionally, this same analysis shows that beyond-perimeter markets that gained exemptions got a 2pp O&D passenger CAGR boost compared to beyond-perimeter markets without perimeter exemptions, demonstrating not only that there is enough demand but that there is also a net-positive effect in terms of O&D passenger growth when perimeter rule exemptions are granted.

Exhibit #12 – O&D passenger growth for beyond-perimeter flights from Washington, D.C.



1. Markets exempted from perimeter-rule: AUS, DEN, LAS, LAX, PDX, PHX, SEA, SFO, SJU, SLC
2. Top 25 non-exempted beyond-perimeter markets, by 2019 O&D passengers where '90-'19 growth was larger than zero: SAN, SAT, SMF, HNL, SJC, ABQ, OAK, TUS, ELP, RNO, BOI, ANC, GEG, OGG, PSP, BZN, BUR, FAT, JAC, SBA, KOA, MSO, MFE, LIH, PSC
3. 2000-2009 period not considered because of major negative events such as 9/11 (2001) and subprime economic crisis (2008)
4. 20 slot pairs granted between 2000 and 2012; 6 in 2000, 6 in 2003 and 8 in 2012

Source: DB1B



1. Passenger/Pax represents # of inbound + outbound passengers on all flights arriving/departing, 2. Exempted airports- AUS, DEN, LAS, LAX, PDX, PHX, SEA, SFO, SJU, SLC,
3. Load Factor% = Total pax traveled/ Total seats deployed

Source: T-100 data at segment level

[36] For additional details on methodology, refer to difference-in-difference analysis in Section 9

To understand this O&D passenger growth further, this report analyzed the impact on air-travel demand when non-stop supply was added in an underserved market. A demand stimulation analysis[37] showed that between 2015–2019, for every 100 additional non-stop seats put in place in a beyond-perimeter market with rule exemption, the O&D demand—both non-stop and with connections—has grown by 90 seats in the same period or a demand stimulation of 90%. This further proves that DCA slot pairs cannot cannibalize IAD growth beyond the perimeter.

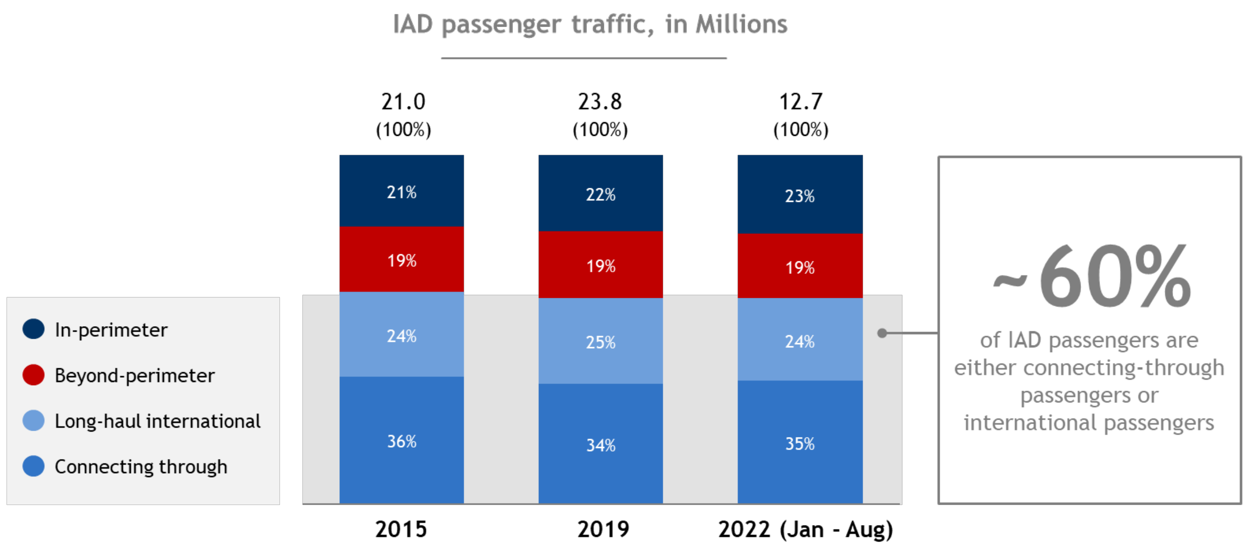
Carriers use IAD as a connecting hub vs. a destination

An essential consideration of the perimeter rule's utility in spurring growth at IAD is to understand how seats from IAD are being used today. In the last two decades, IAD has dramatically shifted capacity towards international operations to strengthen its position as an international connecting hub.

- IAD added ~6M international seats.
- Only 0.2M beyond-perimeter domestic seats were added in the same period.
- 1M seats in-perimeter seats were reduced from IAD

Mix of international seats at IAD increased from ~17% in 1999 to ~35% in 2019. As a result, international and connecting through passengers grew at IAD. As observed in Exhibit #13, in 2019, ~60% of seats from IAD[38] were used by passengers using IAD as a hub to connect to their destination or by long-haul international passengers from Washington, D.C. Origin & Destination (O&D) passengers to beyond-perimeter markets were using less than 20% of the seats from IAD.

Exhibit #13 – Passenger mix at IAD between 2015 and 2022 (January to August)



Source: OAG

[37] For additional details on methodology, refer to demand stimulation analysis in Section 9

[38] For additional details on methodology, refer to the IAD passenger mix analysis in Section 9

The perimeter rule likely has diminishing utility in spurring growth at IAD, given the fast-growing captive base of consumers, strong growth at IAD despite the addition of beyond-perimeter slot pairs at DCA, and carrier strategies aimed at using IAD as an international hub.

To summarize, the findings in this section show that the perimeter rule is not meeting or is unrequired to meet its stated objectives:

Protection of in-perimeter communities' access

Cities without perimeter rule provide higher levels of in-perimeter access

Protection of DCA's air-service reliability & customer experience

High share of regional aircraft mix results in DCA seeing 25% more cancellations than similar metros

Protection of IAD as a newer, fast-growing airport

60% of traffic is either international or passengers connecting through and is expected to further increase with recent investments

- The perimeter rule does not ensure that the Washington, D.C., metro will provide any higher level of access to in-perimeter communities vs. other unprotected metros
- Rule-driven equipment constraints result in DCA seeing 25% higher cancellations than other comparable top metro stations
- The rule is no longer crucial to spur growth since IAD has reached a point of self-sufficiency through a solid consumer base and carrier strategies that use it for purposes other than connecting Washington, D.C., passengers to beyond-perimeter markets

6

Assessment of the Perimeter Rule’s Impact on Communities and Consumers Served by Washington, D.C., Airports

6 | Assessment of the Perimeter Rule's Impact on Communities and Consumers Served by Washington, D.C., Airports

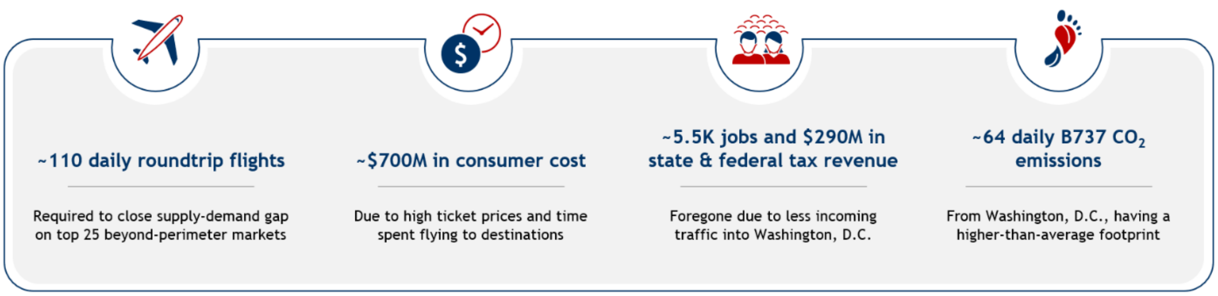
As discussed in Section 5, the perimeter rule no longer meets or is required to deliver on its stated objectives. This section will take a more holistic look to understand the various impacts of the perimeter rule on the communities and consumers served by Washington, D.C., airports—analyzing the various types of passengers traveling to, from, or through one of the three airports and how many were traveling non-stop.

As evidenced, Washington, D.C., has been severely underserving beyond-perimeter markets with requisite non-stop supply compared to other similar metros—a direct impact of the perimeter rule at DCA. Additional slot pairs from DCA would allow other carriers to fulfill the unmet demand that current slot owners are not permitted to support. Washington, D.C., requires ~110 additional daily roundtrips[39] to reach parity with comparable metros in supply-demand for the top 25 beyond-perimeter markets.

The impact of this severe supply-demand misalignment was assessed over a variety of factors that could impact the communities and consumers served by the Washington, D.C., metro:

- Cost burden to beyond-perimeter passengers in terms of tickets prices and productivity costs
- Environmental responsibility in terms of CO_2 footprint for Washington, D.C.
- Forgone economic opportunities for potential jobs and tax revenue for Washington, D.C.

Exhibit #14 – Impact of the perimeter rule in D.C.



Source: OAG; T-100; ICAO; ARC

6.1 The extent of supply-demand misalignment in beyond-perimeter markets

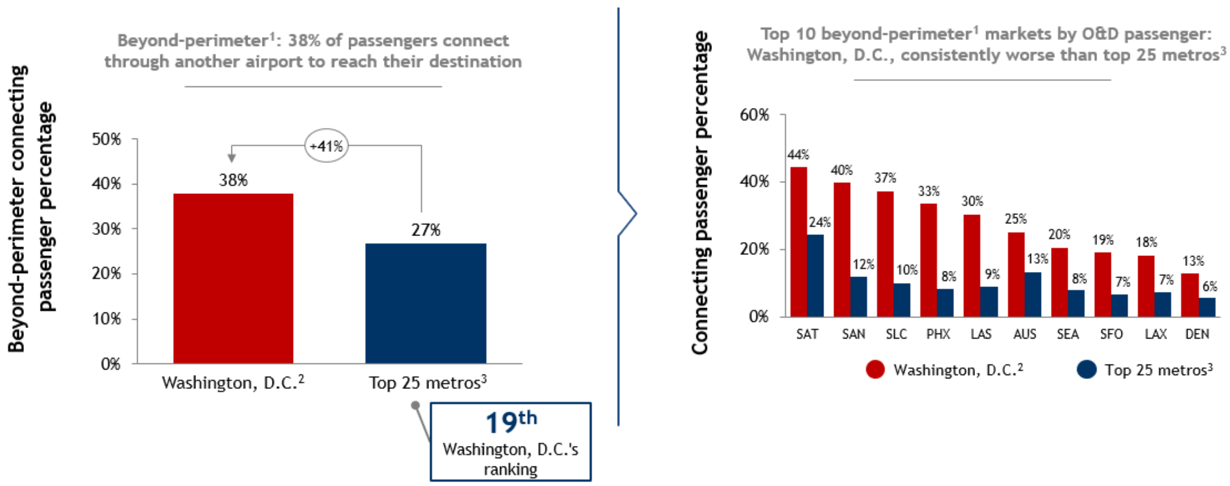
In 2019, over 65M passengers used Washington, D.C., airports:

- ~54% traveled to/from destinations within the 1,250-mile perimeter
- ~22% traveled to/from destinations beyond the 1,250-mile perimeter
- ~12% traveled to/from long-haul international destinations from Washington, D.C.
- ~12% used Washington, D.C., as a connection in their journeys

[39] For additional details on methodology, refer to slot potential analysis in Section 9

As shown in Exhibit #15, more than one in every three passengers traveling between Washington, D.C., and beyond-perimeter destinations had to connect to reach their destination[40]. This ratio was 40% more than the average of the top 25 metros, suggesting the possibility of a supply-demand misalignment from Washington, D.C., to beyond-perimeter markets. For example, 44% of passengers flying from Washington, D.C., to San Antonio had to connect at another airport; that same number is 24% when considering passengers flying from the top 25 metros to San Antonio. When comparing Washington, D.C., to coastal hubs, the difference is even larger as 22% of beyond-perimeter passengers flying out of these hubs had to connect to reach their destination.

Exhibit #15 – Nearly 1.5x more passengers from Washington, D.C., needed to connect to reach their beyond-perimeter destinations in 2019



1. Domestic markets beyond 1,250mi, including SJU
2. Includes Reagan (DCA), Dulles (IAD), Baltimore (BWI)
3. NYC, CHI, LAX, ORL, LAS, DEN, DFW, ATL, SEA, SFO, PHX, BOS, HOU, FLL, SAN, TPA, MSP, PHL, DTT, PDX, AUS, SLC, BNA, MIA, SJC
Source: OAG 2019, scheduled flights & booked passengers

To further understand the extent of supply-demand misalignment, this report evaluated these markets' "supply-demand ratio." The supply-demand ratio[41] is a good measure of how well a market is served with non-stop capacity vs. the overall demand for those destinations, including passengers connected to reach them. The ratio is calculated as the number of total non-stop seats divided by the total passenger demand between two cities.

Carriers from Washington, D.C., supplied 14.1M non-stop seats for the 13.7M passengers traveling to beyond-perimeter destinations in 2019, resulting in a supply-demand ratio of 1.03. For instance, for every 100 passengers traveling to beyond-perimeter destinations from Washington, D.C., only 103 non-stop seats were available. The top 30 to 100 markets[42] show a supply-demand ratio for beyond-perimeter markets slightly over 1.4, almost 40% higher than Washington, D.C.

[40] For additional details on methodology, refer to connecting passenger mix analysis in Section 9

[41] For additional details on methodology, refer to supply-demand ratio analysis in Section 9

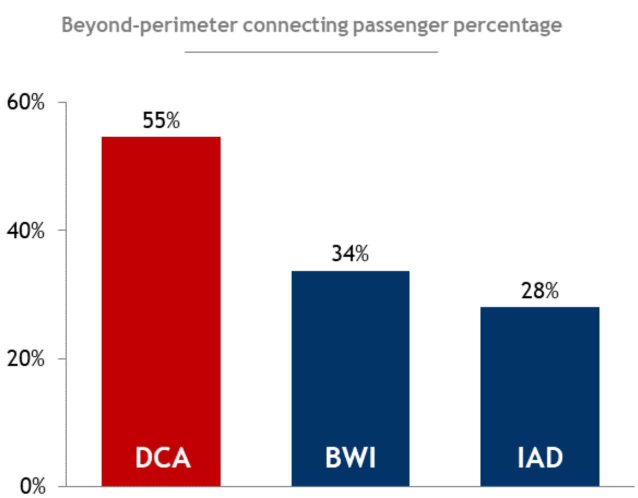
[42] Top 30 to 100 beyond-perimeter domestic markets by passenger traffic (2019) excludes Hawaii, Atlanta, Dallas, Charlotte, and Houston

This finding was consistent across the top beyond-perimeter routes from Washington, D.C.—19 of the top 20 beyond-perimeter destinations, based on non-directional traffic, were underserved with non-stop seats compared to the average of comparable metros. For example, in 2019, San Antonio had ~493K annual passengers traveling to Washington, D.C., but only had ~463K annual non-stop seats on this route, a supply-demand ratio of 0.94.

Depending on their network strategies, airlines will likely protect a portion of non-stop seats to serve the more profitable vs. connecting to destinations via Washington, D.C. For instance, a passenger uses Dulles (IAD) as a connection hub when traveling from Austin to London. As part of their strategy, carriers price both legs (e.g., Austin-Dulles and Dulles-London) at higher fares so these potential leg passengers can give way to the Austin-London passengers.

Analysis of the top 50 underserved routes of the 1,000 most meaningful markets[43] in the United States—including those with an opportunity to add more non-stop seats to serve the demand more effectively—showed that nearly one in every five routes belonged to Washington, D.C., an outsized representation from the nation's capital.

Exhibit #16 – More than 55% of DCA passengers need to connect to reach beyond-perimeter destinations in 2019



1: Domestic markets beyond 1,250mi, including SJU
Source: OAG 2019

For instance, analysis of currently unmet demand suggests that the Austin-Washington, D.C., market can add nearly 60K non-stop roundtrip seats per year[44] to align the supply-demand ratio, without accounting for additional demand stimulated by the new seats added.

In aggregate, for Washington, D.C., to reach supply-demand ratio parity with comparable metros, accounting for additional demand stimulated by the new seats added, ~110 additional roundtrips are required to the top 25 beyond-perimeter markets[45] from the Washington, D.C., metro.

Further, of the three airports within the Washington, D.C., metro, the perimeter rule-constrained DCA had an average supply-demand ratio for beyond-perimeter destinations of ~0.64, implying that there were only 64 non-stop seats available for every 100 passengers traveling from Washington, D.C. This was equivalent to ~45% of the average supply-demand ratio for the top 30 to 100 beyond-perimeter markets. Therefore, as shown in Exhibit #16, over half of Ronald Reagan National Airport passengers had to connect to reach beyond-perimeter markets.

[43] Top 1,000 markets based on 2019 O&D passengers, ranked by supply-demand gap versus benchmark
[44] For additional details on methodology, refer to slot potential analysis in Section 9
[45] Top 25 beyond-perimeter markets to/from Washington, D.C., by supply-demand gap vs. top 30 to 100 U.S. beyond-perimeter markets (2019), excluding Hawaii, Atlanta, Dallas, Charlotte, and Houston

The supply-demand misalignment and the resulting high connection rate have severe implications on communities served by Washington, D.C., ranging from passengers paying higher ticket prices to stifling job growth and tax revenue.

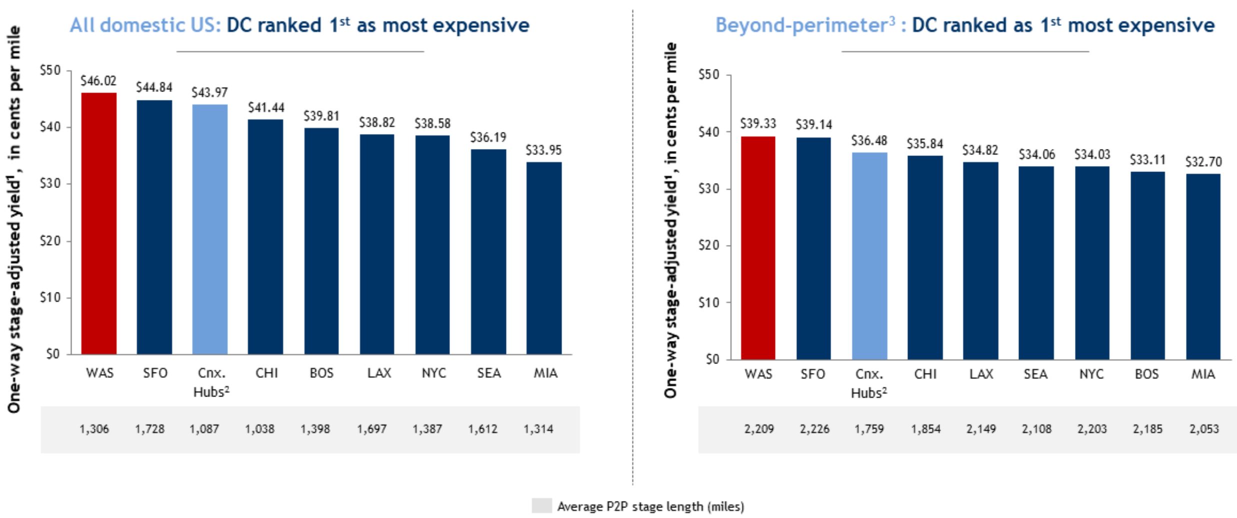
6.2 Perimeter rule's impact on ticket prices for beyond-perimeter consumers

Supply-demand mismatches impact ticket prices for consumers. To understand the effect of this misalignment on pricing for beyond-perimeter markets from Washington, D.C., this report analyzed the ARC dataset[46] to compare actual prices that customers paid in 2022 to travel from Washington, D.C.'s airports and other top ten metro airports to beyond-perimeter destinations[47].

The most effective metric to compare prices is stage-length adjusted yields, an industry standard[48] that allows for a like-to-like comparison of prices across metros.

Compared across all the top ten metros, Washington, D.C., has the most expensive domestic ticket prices. This finding is consistent for beyond-perimeter passengers.

Exhibit #17 – 2022 (January to August) ranking of Washington, D.C., ticket prices when compared to other top metro stations



1: Stage Length Adjustment formula is ((observed stage length/1,000)^.5) times respective city yield ; 2: ATL, DFW, HOU, which have connecting through traffic percentage larger than 45%; 3: Stage length larger than 1,250mi; Note: Yields based on domestic tickets issued through indirect distribution within the US
Source: ARC Jan-Aug 2022

[46] ARC data includes US domestic tickets issued through indirect distribution within the US, and flown from January to August 2022

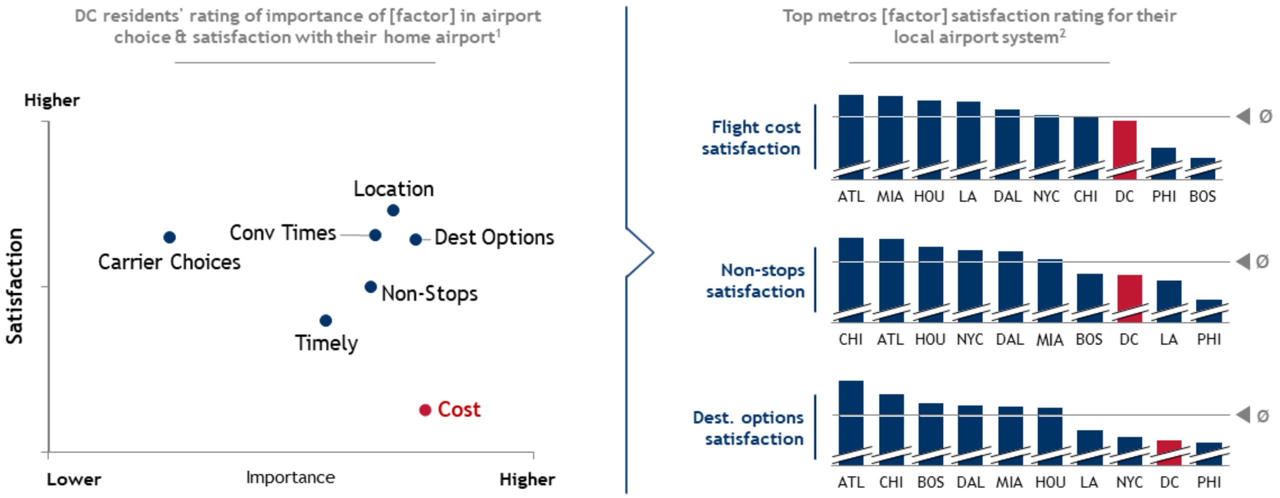
[47] Top ten markets based on ARC passenger data (2019)

[48] Stage-length adjusted yield formula: revenues over passenger-miles multiplied by the square root of stage-length over 1,000

Analysis[49] of these beyond-perimeter ticket prices with supply and demand mismatches (measured by the supply-demand ratio) shows a direct correlation between supply-demand gaps and higher prices, suggesting that passengers from Washington, D.C., are incurring higher fares due to this mismatch.

Findings show that if Washington, D.C., beyond-perimeter tickets were priced at average levels, passengers would save ~$75 (8%) roundtrip, or $500M in consumer value. Adding ~110 roundtrips from Washington, D.C., to the top 25 beyond-perimeter markets is estimated to help reduce fares by ~$25–$100, or ~3-12%.

Exhibit #18 – D.C. residents' rating of importance of [Factor] in choosing which airport to fly out of and satisfaction with their home airport



T-13: Which of these factors is important in determining which airport you want to use? ? (n-2575)
T-14: Thinking about your home airport, how satisfied are you with each of the below factors? (n-2575)
Source: Delta consumer survey

These higher ticket prices also manifest in lower customer satisfaction with Washington, D.C., airports. Surveyed passengers reported lower satisfaction with flight costs, timeliness of flights, and availability of non-stop options when asked what factors matter to them and how satisfied they are with the performance of their home airports regarding those topics. Compared with other major metros, Washington, D.C., satisfaction levels were below average for costs, non-stop flights, and destination options.

6.3 Perimeter rule's impact on productivity for beyond-perimeter business passengers

As discussed in Section 6.1, of the nearly 14M people traveling between Washington, D.C., and beyond-perimeter markets, ~38% of passengers must connect to reach their destinations due to the low supply-demand ratio.

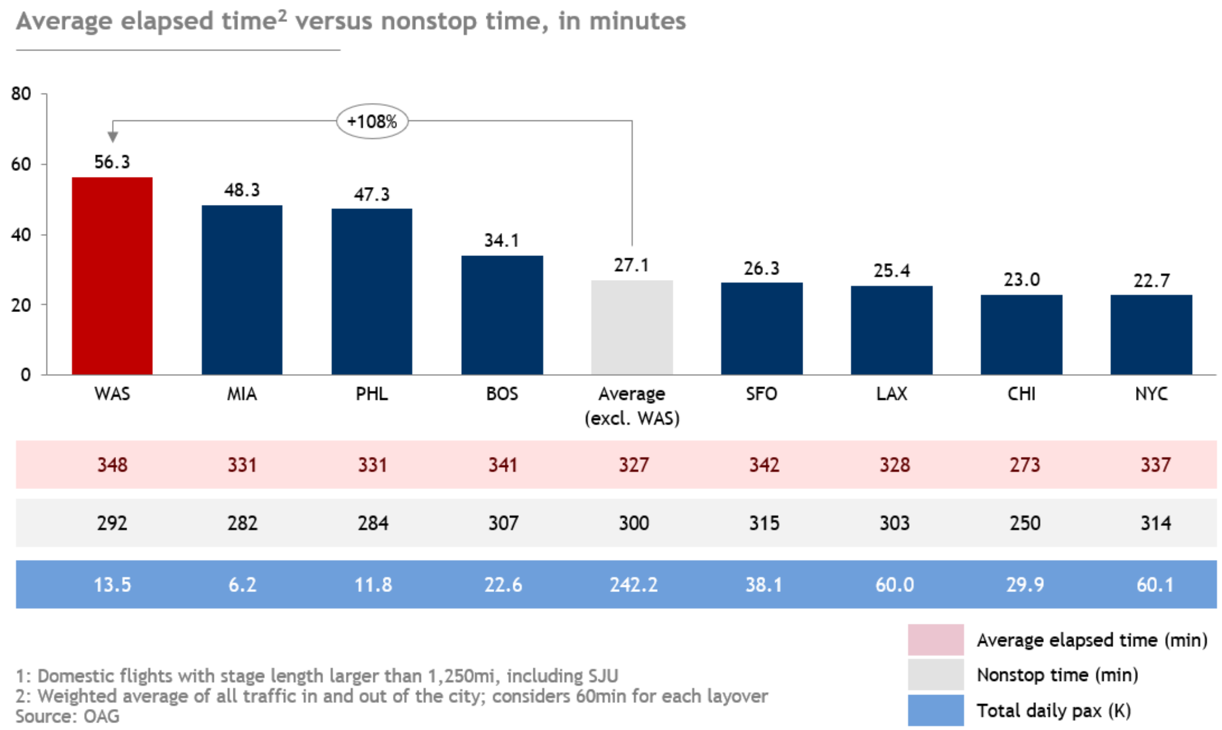
[49] For additional details on methodology, refer to pricing analysis in Section 9

Circuity analysis[50] shows that due to these connections, passengers increase their overall travel time by at least 56 extra minutes per trip due to average added miles traveled and layovers vs. flying nonstop—this is ~108% more compared to other top non-hub metros.

Preliminary findings of time-lost value in connectivity for business passengers can amount to ~$200M[51] annually in lost productivity to consumers.

In addition, a consumer survey found that passengers who access IAD and BWI instead of DCA reported spending 15–20% higher commute time and 23–27% higher commute cost to access these airports, further exacerbating the cost burden—both in monetary terms and in productivity—to access non-stop flights.

Exhibit #19 – Extra time faced by Washington, D.C., passengers due to connections vs. other comparable metros in 2019



6.4 Perimeter rule's impact on forgone jobs and tax revenues for Washington, D.C., metro

Supply-demand misalignments also cost the communities served by Washington, D.C., potential airport jobs and economic value, including tax dollars that could be used for community development. Research by the IMPLAN shows that an increase in connectivity between cities drives multi-fold economic benefits

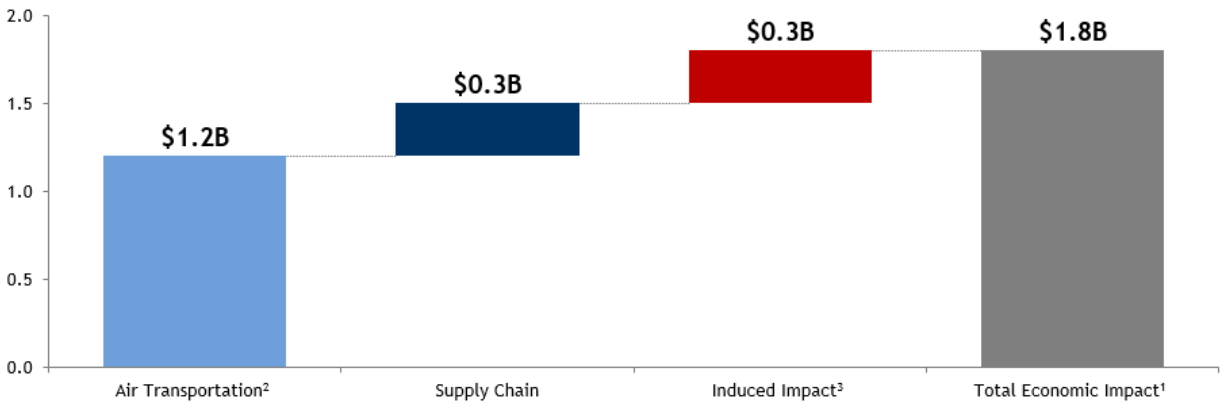
[50] For additional details on methodology, refer to elapsed time analysis in Section 9
[51] For additional details on methodology, refer to productivity analysis in Section 9

in the markets connected through the following categories:

- Direct economic benefits—Value stemming from new jobs and the spending required to sustain the revenue from these markets
- Supply-chain financial benefits—Value arising from business-to-business purchases triggered by the initial spend of the direct economic benefits, e.g., supplier expenditure
- Induced economic benefits—Value resulting from household spending of labor income after removal of taxes, savings, and commuter income

Exhibit #20 – Perimeter rule costs Washington, D.C., $1.8B in foregone economic benefit

Economic Impact¹ , in US $ Billions

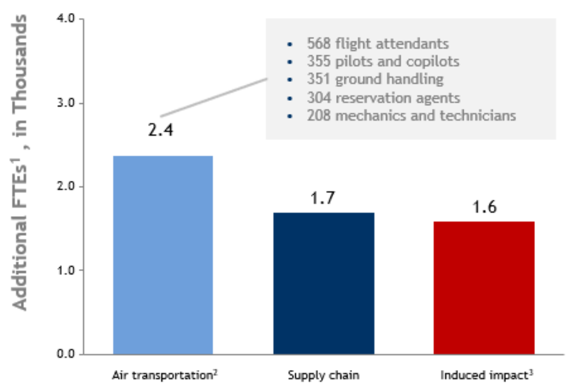


1: Includes District of Columbia, Anne Arundel County (MD), Baltimore City (MD), Fairfax County (VA), Prince William County (VA), Arlington County (VA), Loudoun County (VA), Howard County (MD), Prince George (MD), Montgomery County (MD), Baltimore County (MD). Jointly, these account for ~50% of DC Metro population
2: Values from additional non-DC resident ticket spend
3: Values stemming from household spending of Labor income, after removal of taxes, savings, and commuter income
Source: IMPLAN

This analysis[52] focuses on economic value generated for the Washington, D.C., region and its residents, based on the economic multipliers of its ten largest counties[53] . The research shows that the ~110 additional roundtrips required from Washington, D.C., to the top 25 beyond-perimeter markets will likely be used by ~12K stimulated passengers daily. Accounting for fare benefits, as discussed in Section 6.2, these passengers are likely to generate $1.2B[54] in revenues for airlines. The overall benefit to the economy accounting for supply-chain and induced benefits is valued at $1.8B.

Research by IMPLAN estimates that sustaining these revenues will require the creation of ~5.5K new jobs in Washington, D.C., across the categories described above. For instance, operating these roundtrips will require ~350+

Exhibit #21 – New jobs expected in Washington, D.C., counties as a result of 110 new beyond-perimeter roundtrips



1: Includes District of Columbia, Anne Arundel County (MD), Baltimore City (MD), Fairfax County (VA), Prince William County (VA), Arlington County (VA), Loudoun County (VA), Howard County (MD), Prince George (MD), Montgomery County (MD), Baltimore County (MD). Jointly, these account for ~50% of D.C. Metro population
2: Values from additional non-D.C. resident ticket spend
3: Values stemming from household spending of Labor income, after removal of taxes, savings, and commuter income
Source: IMPLAN

[52] For additional details on methodology, refer to IMPLAN economic analysis in Section 9
[53] District of Columbia, Anne Arundel County (MD), Baltimore City (MD), Fairfax County (VA), Prince William County (VA), Arlington County (VA), Loudoun County (VA), Howard County (MD), Prince George (MD), Montgomery County (MD), Baltimore County (MD). Jointly, these account for ~50% of D.C. Metro population.
[54] Assumes that total ticket revenue is ~$2.4B, which will be split 50% at the origin and 50% at the destination

pilots and co-pilots, ~570+ flight attendants, and ~850 staff, including reservation agents, ground handling, mechanics, and technicians.

Additionally, the economic value and new jobs are expected to boost tax revenues for the ten largest counties and their respective states by ~$175M and federal tax revenues by ~$120M.

6.5 Perimeter rule's impact on CO_2 footprint for Washington, D.C., metro

In the fight against global climate change, aircraft operations are high contributors to harmful CO_2 emissions.

The most effective way to measure airport influence on carbon emissions is to measure the amount of CO_2 emitted per straight-line pax-mile. This measure tells us how many grams of CO_2 were emitted to take a passenger from their origin to their destination. CO_2 emitted per straight-line pax-mile is driven by three major factors:

- **Route circuity**—the incremental CO_2 emissions due to the "extra" miles traveled by passengers to reach their destination and due to a more significant number of CO_2-intensive take-offs and landings
- **Equipment used**—due to a higher share of less-carbon-efficient regional aircraft
- **Load factor**—the incremental CO_2 emissions intensity per passenger associated with transporting fewer passengers in the same equipment

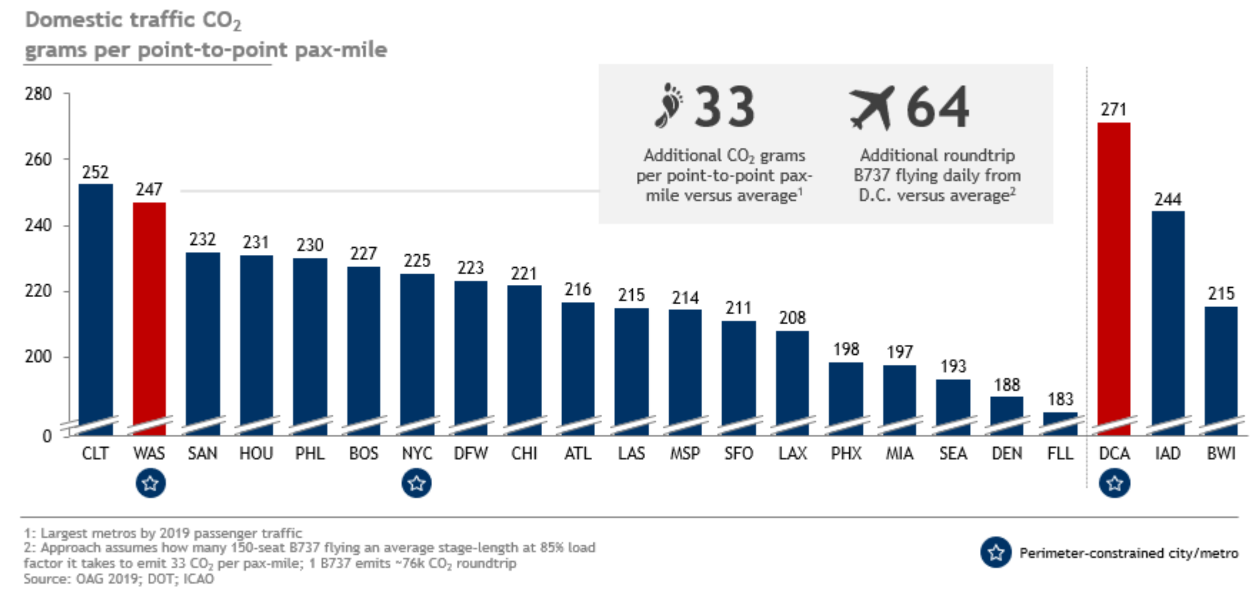
When looking at the following three factors, Washington, D.C., passengers and aircraft operations tend to perform worse than in competitive metros[55]:

- **Passenger flow to D.C. in 2019**—it takes passengers 85% more extra miles to reach their destinations than other top metros. This is a direct impact of the high connection rate discussed earlier and results in millions of additional miles flown
- **Carbon-polluting aircraft**—Washington, D.C., airports have an outsized mix of smaller and inefficient regional aircraft
- **Per passenger, more CO_2 is being burned**—due to low-average load factors, as evidenced by ~22% of in-perimeter seats and ~14% of beyond-perimeter seats flying empty

This results in the Washington, D.C., airport system having the second worst CO_2 footprint per straight-line pax-mile for their domestic operations. Passengers flying out of Washington, D.C., burn 15% more emissions than the average for top metros. The total carbon emissions are equivalent to 1.8M kg annually or 64 extra B737s emissions daily. When looking at individual airports, DCA is by far the worst airport in CO_2 emissions per straight-line pax-mile.

[55] For additional details on methodology, refer to CO_2 analysis in Section 9

Exhibit #22 – Washington, D.C., has the 2nd worst CO_2 footprint among top metros in 2019; DCA had the worst footprint in 2019



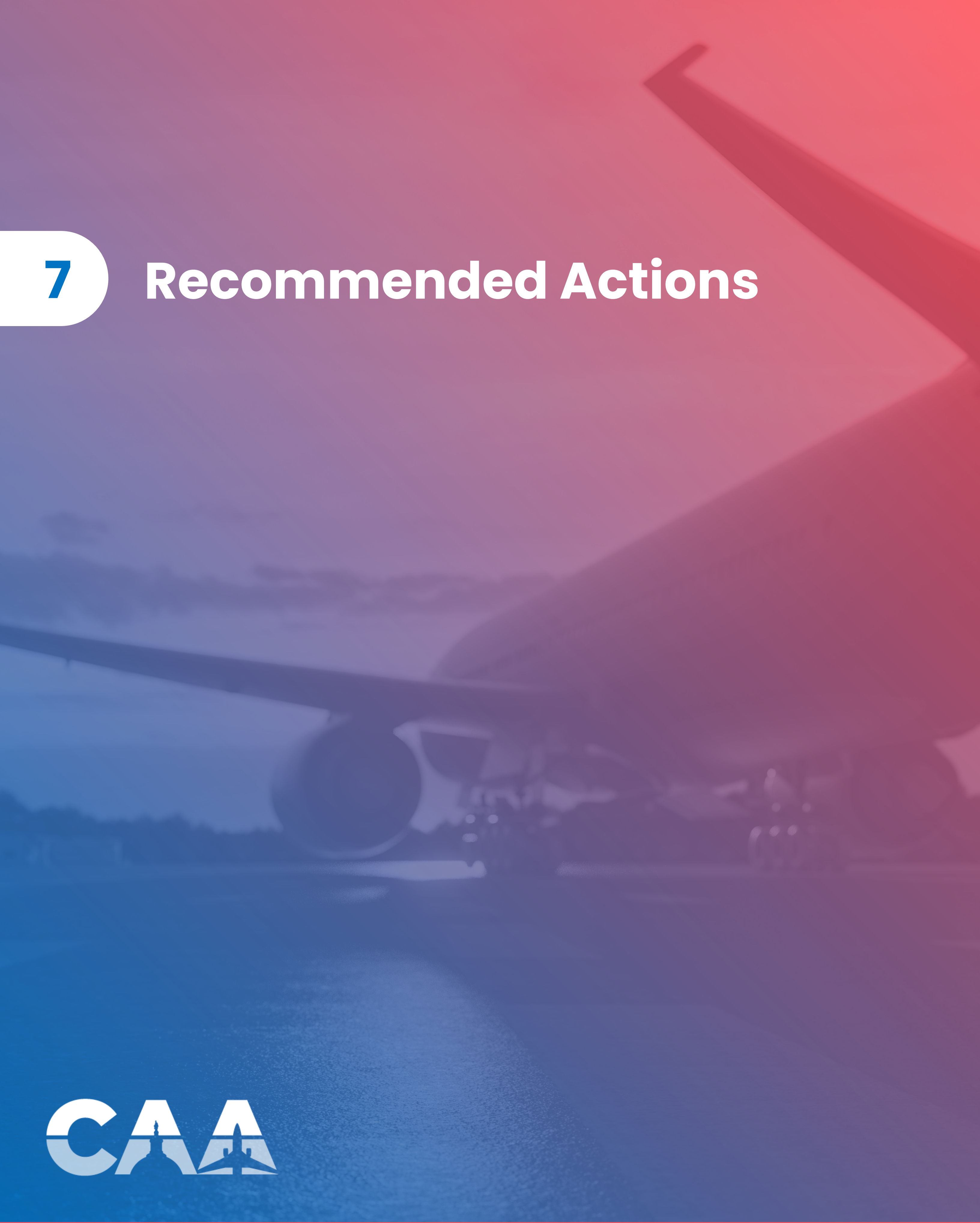
The outsized CO_2 footprint of Washington, D.C., is driven by a high share of in-perimeter flights—a direct impact of the perimeter rule restrictions. In-perimeter flights tend to be more polluting given high route circuity, more operations from less-efficient airplanes, and lower load factor. In-perimeter routes in Washington, D.C., emit ~280 grams of CO_2 emissions per straight-line pax-mile.

By adding more beyond-perimeter capacity, DCA can reduce its CO_2 footprint per straight-line pax-mile by 2–3%.

Therefore, to summarize, the analyses show that the perimeter rule is indirectly, or in some cases directly, harming the communities and consumers served by the Washington, D.C., airports:

- Over 95% of top beyond-perimeter markets are underserved by non-stop capacity due to the perimeter rule driving a severe supply-demand gap for beyond-perimeter markets
- Nearly ~$500M in higher ticket prices as well as ~$200M in lost productivity for consumers due to the gap
- ~5.5K foregone job opportunities, ~$175M in foregone tax revenue for Washington, D.C., metro and ~$115M in federal tax revenue
- DCA presents the worst CO_2 footprint on a per straight-line pax-mile driven by a high share of high carbon-emitting in-perimeter flights

7 Recommended Actions



7 | Recommended Actions

In sections 5 and 6, this report highlighted that the perimeter rule is antiquated, inefficient, and unrequired to deliver its stated objectives. Instead, it harms the communities served by Washington, D.C., airports. Therefore, it is imperative to mitigate the issues faced by these communities. As discussed in Section 6.1, the crux of the above concerns is the supply-demand misalignment, which requires additional ~110 daily roundtrips in non-stop capacity to be added from Washington, D.C., airports to the top 25 beyond-perimeter markets.

To help mitigate the issues that were identified in Section 6, this report recommends the addition of **~20 to 25 new in- and beyond-perimeter slot pairs at DCA** to:

- Create necessary supply to support pent-up demand for beyond-perimeter connectivity
- Reduce pricing through better alignment of supply-demand
- Improve productivity through increased direct access
- Strengthen economic opportunities to support better connectivity

Overall analysis shows that DCA can feasibly support the addition of the recommended new in- and beyond-perimeter slot pairs without sacrificing the protections that the perimeter rule and the high-density rule were intended to support:

- No material impact on air-service reliability
- No material impact on IAD growth
- No material impact on noise pollution for communities near DCA

To summarize, this recommendation would improve beyond-perimeter access by allowing ~2.2K to 2.7K more daily passengers to be connected by non-stop flights to beyond-perimeter markets, reducing flight ticket prices for consumers, improving productivity, creating ~1.0 to 1.3K new jobs in Washington, D.C., providing over ~$320M to $400M in overall economic benefit to the Washington, D.C., counties and adding ~$50M to $70M in additional federal and state tax revenues.

Lastly, focusing on slot pair additions instead of in-perimeter slot pair conversions can mitigate any risk of underserving local communities.

7.1 Impact of additional in- and beyond-perimeter slots at DCA in mitigating the perimeter rule-driven issues

As identified in Section 6.1, ~110 additional daily roundtrips from Washington, D.C., to beyond-perimeter markets are required to reach parity with benchmark metros. Analysis[56] of the current capacity distribution to beyond-perimeter markets showed that BWI, DCA and IAD collectively operated ~24K average daily seats to the top 25 beyond-perimeter markets from Washington, D.C. Of these, BWI operated ~40%, DCA operated ~20% and IAD operated ~40% of the seats. An equitable distribution of the additional daily roundtrips to maintain the current seat share among the airports could help prevent cannibalization, as mentioned in Section 5.3, would result in DCA adding ~20-25 daily roundtrips to beyond-perimeter markets. These extra slots would not change DCA's ranking in terms of domestic

[56] For additional methodology, refer to slot recommendation at DCA analysis in Section 9

passenger traffic[57], which was 18th in 2019. The analysis concludes that adding in- and beyond-perimeter slot pairs at DCA will significantly mitigate the issues created by the perimeter rule.

On creating the necessary supply to support pent-up demand for beyond-perimeter markets

As discussed in Section 6.3, analysis of multiple airports' capacity currently reveals that ~60% of seats being used at IAD are either from passengers connecting through IAD to other destinations, i.e., using IAD as a hub or by long-haul international passengers; this is aligned with the fact that, despite the growth in population and economic activity around IAD, it remains Washington, D.C.,'s least preferred metro area airport based on its location and accessibility[58] . Similarly, six of every ten passengers who fly out of BWI do so because of lower fares offered by its low-cost carriers. BWI Airport is less frequently seen as a valid alternative to IAD and DCA, given that less than two of every ten passengers who flew out of those airports considered BWI as an alternate option. Therefore, under current network and airport structures, both carriers and passengers are incentivized to increase beyond-perimeter capacity from DCA.

Next, analysis of flight records from DCA revealed that beyond-perimeter flights on the average fly with more seats filled than comparable top airports. In addition, as discussed in Section 6.1, the perimeter rule constrained DCA's average supply-demand ratio for beyond-perimeter destinations of ~0.6, meaning there were only six non-stop seats available for every ten passengers wanting to travel to/from DCA to beyond-perimeter markets. Therefore, granting additional slot pairs from DCA to the beyond-perimeter market will significantly ease the pent-up demand. Our recommended slot pairs could provide non-stop access for up to ~2.2K to 2.7K additional daily passengers traveling beyond-perimeter markets.

On reducing pricing through better alignment of supply-demand

As discussed in Section 6.2, large gaps in supply-demand resulted in Washington, D.C., having the most expensive beyond-perimeter ticket fares compared to top metros on a like-for-like basis. Further analysis at an airport level shows that eight of ten passengers from DCA were paying high fares[59] to fly out of DCA. This was nearly double the number of passengers from LGA who had to pay high fares. Therefore, granting additional slot pairs from DCA to the beyond-perimeter market will greatly improve passengers' fares. The recommended slot pairs could reduce average ticket fares by up to ~$25-$100 per roundtrip for passengers from Washington, D.C., traveling to beyond-perimeter markets.

On improving productivity through increased direct access

Over half of the passengers flying from DCA to beyond-perimeter destinations had to connect to reach their destination, as discussed in Section 6.1. This was the highest connecting rate of the Washington, D.C., airports and more than double the connecting rate of the top 25 metros. In Section 6.3, the analysis shows that high connecting rate results in significant productivity losses due to "extra" time spent connecting. Granting ~20 to 25 additional slot pairs from DCA to in- and beyond-perimeter markets is expected to reduce the connecting rate by a quarter from 39% to 31%, driving a commensurate reduction in productivity loss.

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[57] Excluding connecting through traffic. BWI ranked 19th and IAD 43rd

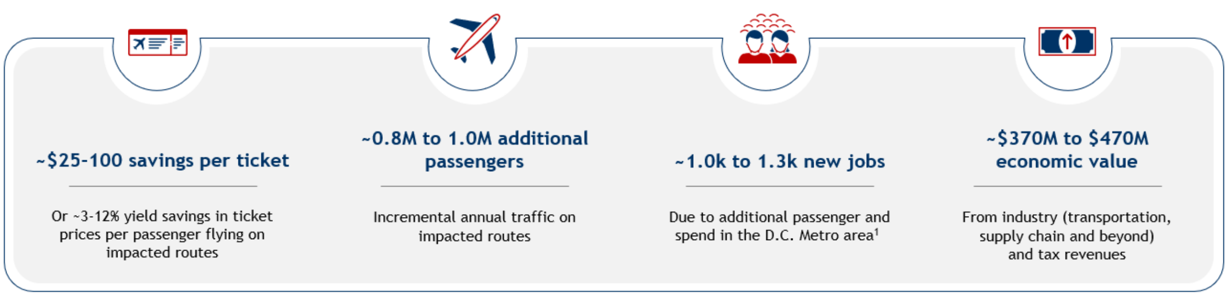
[58] See "Washington-Baltimore Regional Air Passenger Survey – 2019 Draft General Findings", National Capital Region, Transportation Planning Board, March 2020 ("2019 NCR Survey"),

[59] Highest 2 quintiles of fares to same destination across all U.S. cities

On improving economic opportunities to support increased connectivity

In Section 6.4, the analysis concluded that supply-demand mismatches were costing Washington, D.C., communities ~$1.8B in economic opportunities, including ~5.5K new jobs in Washington, D.C., and $290M in forgone tax revenues. By granting ~20 to 25 additional daily slot pairs at DCA, the communities served by this airport will see ~1.0K to 1.3K new jobs, ~$320M to $400M in overall economic benefit to the counties, and ~$50M to $70M in additional federal and state tax revenues.

Exhibit #23 – Impact of the perimeter rule in D.C.



Source: OAG; T-100; ARC; IMPLAN

7.2 Evaluation of DCA's feasibility to support additional in- and beyond-perimeter slot pairs

Proponents of the perimeter rule and high-density rule assert that additional in- and beyond-perimeter flying at DCA will violate the intents of the rule. To validate the assertion and evaluate the feasibility of DCA's ability to support additional in- and beyond-perimeter slot pairs, this report analyzed the impact of this recommendation on the various intents discussed in Section 3.2:

- Protecting DCA's air-service reliability
- Protecting access to in-perimeter communities
- Protecting IAD's growth

In addition to the above factors, the report also looked at potential impacts on noise pollution for communities near DCA.

On the impact on DCA air-service reliability

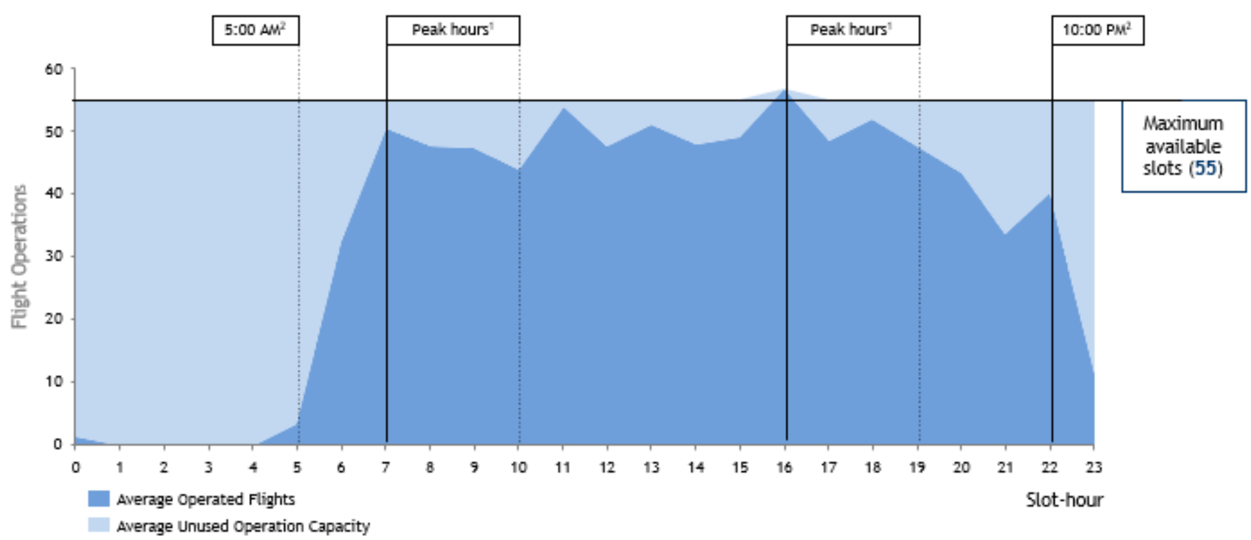
In Section 5.2, our analysis of air-service reliability shows that DCA was outperforming on key operational metrics, such as on-time arrival rates and block buffers, compared to the major airports in the top ten metros. On the other hand, the perimeter rule resulted in a low completion factor, with DCA seeing ~25% more flight cancellations.

Completion factor analysis shows that the recommended additional in- and beyond-perimeter slot pairs at DCA can improve average reliability in terms of completion factor. The above-average cancellation rate at DCA is driven by the highest mix of regional aircraft operations among major airports of the top ten metros, with nearly 60% of all operations at DCA using regional aircraft. Given these markets' demand profiles and optimal stage lengths, in-perimeter flights will likely utilize lower-reliability regional equipment. The addition of 20 to 25 slot pairs could improve completion factor by 3bps[60].

Second, flight operations analysis demonstrates that DCA is under-utilizing its capacity compared to other major airports in the top ten U.S. metros. The addition of the recommended slot pairs would help DCA align its capacity with other major[21] airports while normalizing the significant outperformance on the block time buffer. As discussed in Section 5.2, analysis of like-to-like block time performance at major[21] airports in the top ten U.S. metros shows that actual block times per operation tended to be five minutes shorter than scheduled block times at DCA during its maximum 10% of scheduled busiest instances. The difference between actual and planned block times was roughly four minutes at major airports in the top ten U.S. metros.[22] The block time buffer analysis shows that the extra one-minute block time "outperformance" is equivalent to operating six additional hourly slot pairs at DCA. Therefore, over 15 hours, DCA can feasibly work with ~90 additional daily slot pairs without underperforming major airports in the top ten U.S. metros in delay minutes. Thus, the recommendation of ~20 to 25 additional daily in- and beyond-perimeter slot pairs will cause no material impact on customers.

Further, historical analysis of the operational data at top U.S. airports shows that top U.S. airports are getting busier on average. From 2016 to 2019, the number of take-offs during peak hours at the major

Exhibit #24 – Average number of flight operations at DCA by hours for July 2019



1. Peak hours are 7AM - 10AM and 4PM - 7PM (per GAO report) 2. Inoperable hours are 10PM - 5AM 3. Available operations are considered (55 - operated flights - 1); the 1 operation trim is considered for general aviation, which, per the GAO report, sees fewer than one movement per hour (hence the subtraction)
Note: This analysis investigates Ops data from in July 2019, excluding 2020 data due to COVID-19 irregularities
Source: OAG Ops data

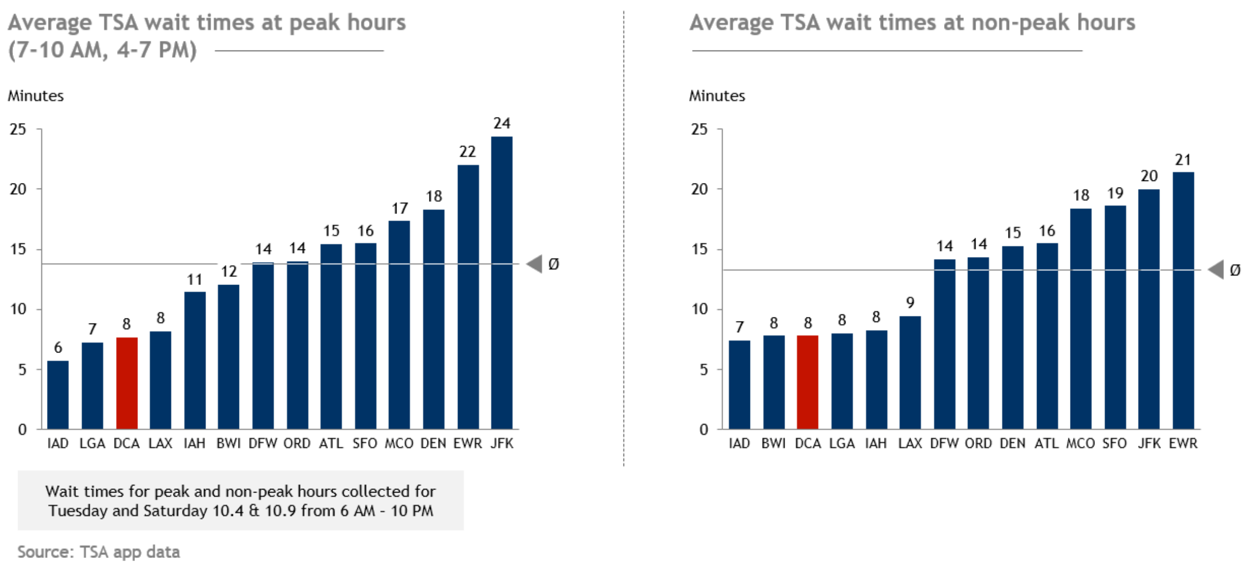
[60] For additional details on methodology, refer to completion factor analysis in Section 9

airports in the top ten U.S. metros increased by ~8%. At the same time, DCA saw a ~17% drop in take-offs during peak hours. These trends suggest that the block-time performance at the major airports in the top ten U.S. metros will further deteriorate in the years to come and increase the performance gap with DCA.

To further understand the current capacity utilization at DCA, the average number of operations (take-offs and landings) was analyzed[61] during each slot hour during July 2019, a traditionally busy summer month. The results showed that DCA had ~50 operations during weekday peak hours and ~41 during non-peak hours. With a slot capacity constraint of 55 hourly slots available, this indicates an additional capacity beyond-perimeter flights could use if additional in- and beyond-perimeter slot pairs were granted. To understand the attractiveness of off-peak hours for beyond-perimeter flights, the report analyzed the percent of beyond-perimeter flights operating in non-peak hours at IAD and BWI—airports without a perimeter rule and slot capacity constraints. The flight operations analysis validates that more than half of the beyond-perimeter flights at these airports were operated during non-peak hours, further proving that adding slot pairs could help improve airport utilization at DCA during non-peak hours.

To further assess slot addition feasibility, gate utilization[62] at DCA was compared with other major airports in the top ten U.S. metros. Gate utilization at DCA is amongst the top quartile and below ATL, DEN and LGA. While addition of 20-25 slot pairs will lead to ~6% increase, gate utilization will continue to be lower than LGA suggesting feasibility to support additional slots.

Exhibit #25 – TSA wait-time comparison at DCA and other top airports



Finally, proponents of the perimeter rule also assert that landside constraints at DCA will likely deteriorate air-service reliability by adding beyond-perimeter slot pairs. Previous reports cited that, in 2019, DCA was utilizing 93% of the total available capacity for TSA screening, a potential bottleneck in

[61] For additional details on methodology, refer to slot usage analysis in Section 9
[62] For additional details on methodology, refer to gate usage analysis in Section 9

landside capacity. However, historical data shows that its wait times at DCA during peak and non-peak hours averaged ~8 mins[63], significantly lower than the average for airports of top U.S. metros. Further, the $1B investment from Project Journey has operationalized two new TSA security checkpoints, increasing the screening capacity available at DCA. The wait times analysis proves that TSA screening is not likely to be an issue when adding new in- and beyond-perimeter slot pairs.

On the impact on protecting access to in-perimeter communities

Adding new slot pairs at DCA will not impact existing in-perimeter access. In fact, as discussed above, DCA can feasibly support addition of ~90 daily slot pairs. Therefore, even with the recommended addition of 20-25 daily in- and beyond-perimeter slot pairs, there is sufficient capacity at DCA to support higher levels of in-perimeter flying in the future.

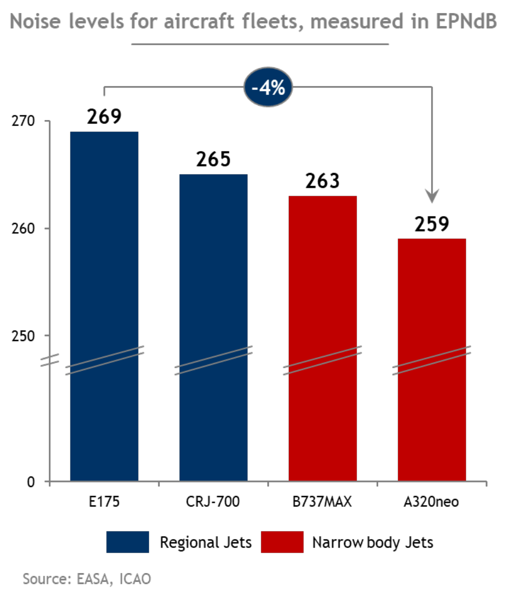
On the impact on IAD growth

As discussed in Section 6.1, the overall number of additional daily roundtrips required from Washington, D.C., to beyond-perimeter markets is estimated at ~110. With the recommendation of granting ~20 to 25 other in- and beyond-perimeter daily slot pairs to DCA, there is sufficient demand for IAD.

Further, as mentioned in Section 5.2, IAD did not see a negative impact on overall passenger growth with additional slot pairs added at DCA in the past 20 years. Carrier strategies at IAD also position it as an international hub, allowing it the opportunity to grow from passengers other than beyond-perimeter markets.

[63] For additional details on methodology, refer to TSA wait-times analysis in Section 9

Exhibit #26 – Noise levels for various equipment



On the impact of noise pollution

The 2019 GAO report on the perimeter rule discussed that several community groups, MWAA, and other proponents were concerned that more beyond-perimeter flights, typically operated with larger narrow-body aircraft, would result in higher noise incidences hurting nearby residences.

Proponents pointed to a significant increase in noise incidences over the past years as more beyond-perimeter slot pairs have opened, leading to more narrow-body aircraft operations. To validate the assertions, this report analyzed the ICAO and FAA noise standards, measurements of noise level certifications of various equipment, and the mix of scheduled fleet operations at DCA over the past ten years (2012–2022). The metric used in the subsequent analysis is cumulative effective perceived noise in decibels (EPNdB), a measure of the relative perceived noisiness of an aircraft pass-by event recorded and summed over three points, approach, lateral, and flyover.

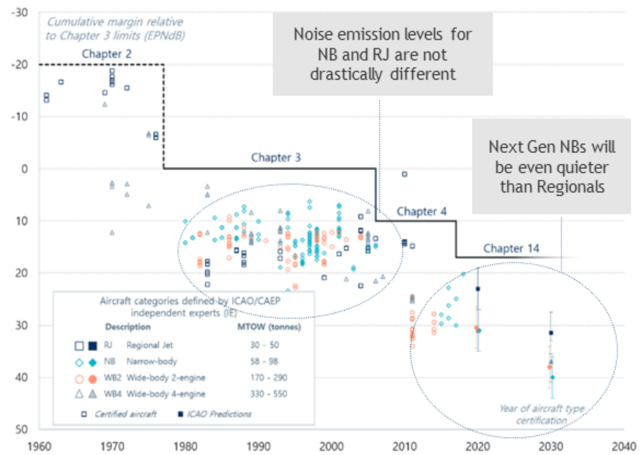
Research[64] of DCA aircraft operations found that the average noise levels have remained flat, despite the fact that the mix of narrow-body aircraft operations has increased over the past ten years. This phenomenon results from an evolution of aircraft technology and the shift of mixed aircraft towards

[64] For additional details on methodology, refer to noise pollution analysis in Section 9

equipment that meets the newer and more stringent noise standard requirements. For instance, the mix of aircraft operations at DCA that meet chapters 4 and 14, the most stringent noise standards, over the past five years (2017–2022) has increased by 5%.

Exhibit #27 – Noise compliance of equipment with ICAO limits

Advances in engine and aircraft technology has resulted in new aircrafts being significantly quieter



Source: EASA; OAG

Further research of ICAO and FAA noise standards shows that noise levels are a function of many factors, including equipment age, certification, and size. For instance, the newer and larger Airbus A320neo narrow-body jets are 4-5% quieter in terms of EPNdB than the older and smaller but most common equipment used at DCA, Embraer E75 regional jets. On average, there is no significant variation between noise levels in decibels between regional and narrow-body equipment.

Additionally, studies show that engine and mainframe technological advances will make aircraft across the board quieter. Committee on Aviation Environment Protection (CAEP) experts estimate that by 2030, narrow-body and regional jets for newly certified aircraft would be 8-10 EPNdB quieter than an aircraft certified in 2020. Furthermore, next-generation narrow-body aircraft are expected to be quieter than next-generation regional aircraft.

> A320neo and B737Max produce ~19-35% smaller footprint of noise incidences over 55dB compared to aircraft used today

While the exact impact on consumers is difficult to estimate, these advances are expected to favor residents and communities surrounding airports. Simulations conducted by external research groups across three airports show that newer variants of the Airbus 320 and Boeing 737 families, the Airbus A320neo and B737MAX, produce ~19-35% smaller footprint of noise incidences over 55dB compared to aircraft typically used today. Future advances in technology are expected to reduce this footprint further.

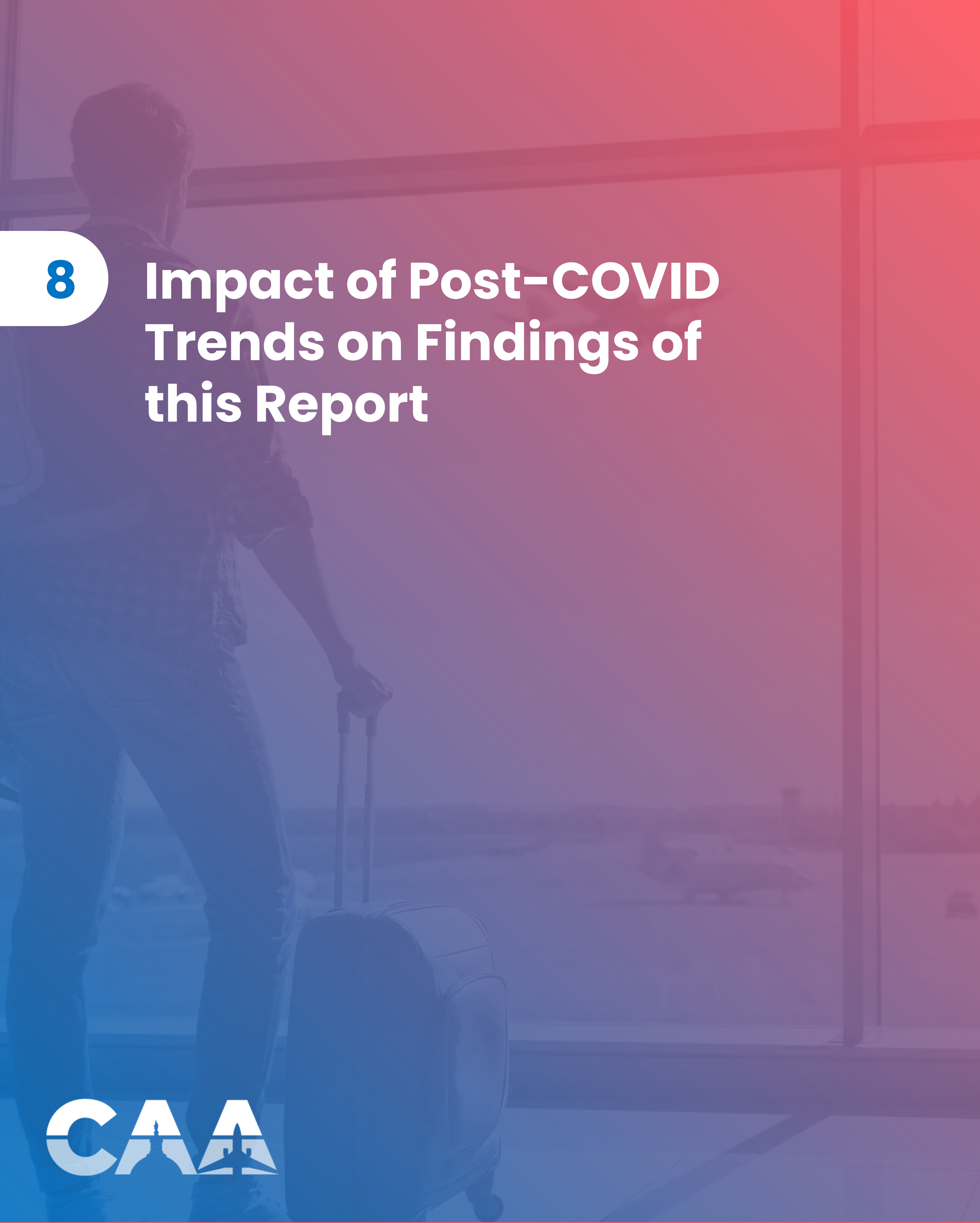
Adding new beyond-perimeter slot pairs at DCA, DoT, and MWAA can improve the mix of narrow-body aircraft operations at DCA and drive a favorable impact on residents and communities surrounding DCA.

To summarize, the recommendation is to grant **<u>~20 to 25 additional daily in- and beyond-perimeter slot pairs at DCA,</u>** thereby improving in- and beyond-perimeter access by allowing up to ~2.2K to 2.7K more daily passengers to be connected by non-stop flights to beyond-perimeter markets, reducing flight ticket prices for consumers, boosting productivity, creating up to ~1.0K to 1.3K new jobs in Washington, D.C., providing over ~$320M to $400M in overall economic benefit to the Washington, D.C., counties, and adding up to ~$50M to $70M in additional federal and state tax revenues.

These additional new in- and beyond-perimeter slot pairs will be crucial to mitigating the unintended harmful consequences of the perimeter rule on the communities served by Washington, D.C., airports.

Lastly, this analysis shows that DCA can feasibly support the addition of ~90 new daily in- and beyond-perimeter slot pairs at DCA without sacrificing the protections that the perimeter rule and the high-density rule were intended to help.

8 Impact of Post-COVID Trends on Findings of this Report



8 | Impact of Post-COVID Trends on Findings of this Report

On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a global pandemic. Consequently, by May 2020, airline traffic[65] in North America had dropped to less than 25% of December 2019 volumes due to the travel restrictions placed by world governments. Since then, airline traffic recovery has been choppy, given the breakout of new COVID-19 variants, the roll-out of vaccines, changes in consumer sentiments, and unrelated geo-political events. As a result, most of the analyses discussed in the previous sections were anchored on 2019 airline travel data to filter out the volatility caused by COVID-19.

However, analyzing the latest air-travel trends in a post-COVID environment further bolsters this report's findings as of November 2022. The analysis shows that a variety of factors noted in the report would continue to exacerbate challenges or support arguments, including:

- Operational reliability issues with a high share of regional aircraft are likely to further deteriorate with factors such as regional pilot shortages
- Recent carrier investments at IAD will further strengthen its growth prospects, limiting the necessity of the perimeter rule to support IAD
- Increasing air-traffic volumes are fast approaching the pre-COVID supply-demand trends, necessitating additional slot pairs

On operational reliability issues due to regional pilot shortages

Industry research shows that due to COVID-19-induced volatility and airline responses, there is a near-term shortage of ~8.8K pilots over 2022-2023[66]. This shortage is expected to drive extreme capacity rationalization within regional carriers, as airlines will be forced to retire their least competitive aircraft. Research expects the rationalization to reduce regional capacity by ~24% of the 2022 level. As discussed in Section 5.2, DCA has the highest share of regional aircraft in operation compared to major airports at the top ten U.S. metros and will likely see an oversized impact of capacity rationalization.

As a result, the addition of beyond-perimeter slot pairs will help improve the share of narrow-body aircraft and further help mitigate the impact of regional pilot shortages on DCA's air-service reliability.

On-carrier investments at IAD further strengthen its growth prospects

As discussed in Section 5.3, carrier strategies are positioning IAD as an international connecting hub. Over 60% of seats are used at IAD for passengers connecting to reach their destinations or for long-haul international travel. In the past months, United Airlines, the leading carrier at IAD, has announced several investments and partnerships to increase passenger traffic at IAD:

- In July 2021, United announced plans to expand its Washington, D.C., region workforce by up to 3,000 well-paying unionized jobs by 2026; United's Dulles hub is expected to gain most of those new jobs. United also announced the plans to open its new Polaris lounge at Dulles, a $41M space to service premium passengers. They also plan to purchase 150 sustainable electric ground service vehicles for Dulles, part of a $100M investment in a new baggage system at the airport.

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[65] IATA, Air passenger global forecast, 2022

[66] Triangulated from a range of public and multi-year employee databases, including FAA Civil Airmen and Cirium fleet projections through 2028.

- In September 2022, United Airlines and Emirates Airlines officially announced they are embarking on a new partnership wherein Emirates will begin injecting traffic into United primarily at Chicago/O'Hare, San Francisco, and Washington/Dulles to create a seamless experience for passengers of both airlines and further improve connectivity.

In addition to the factors discussed in Section 5.3, these investments will likely further strengthen IAD's positioning as an international hub and diminish the perimeter rule's utility in spurring growth at IAD.

On increasing air-traffic volumes fast approaching the pre-COVID supply-demand trends

Recovery in passenger volumes since COVID-19 has been volatile, given the evolving health, political and economic landscape. By September 2022, 1.5 years since WHO declared COVID-19 a global pandemic, global ticket volumes had recovered to ~72% of 2019 volumes. U.S. domestic travel had grown to 75–85% of the 2019 level by ticket volumes[67].

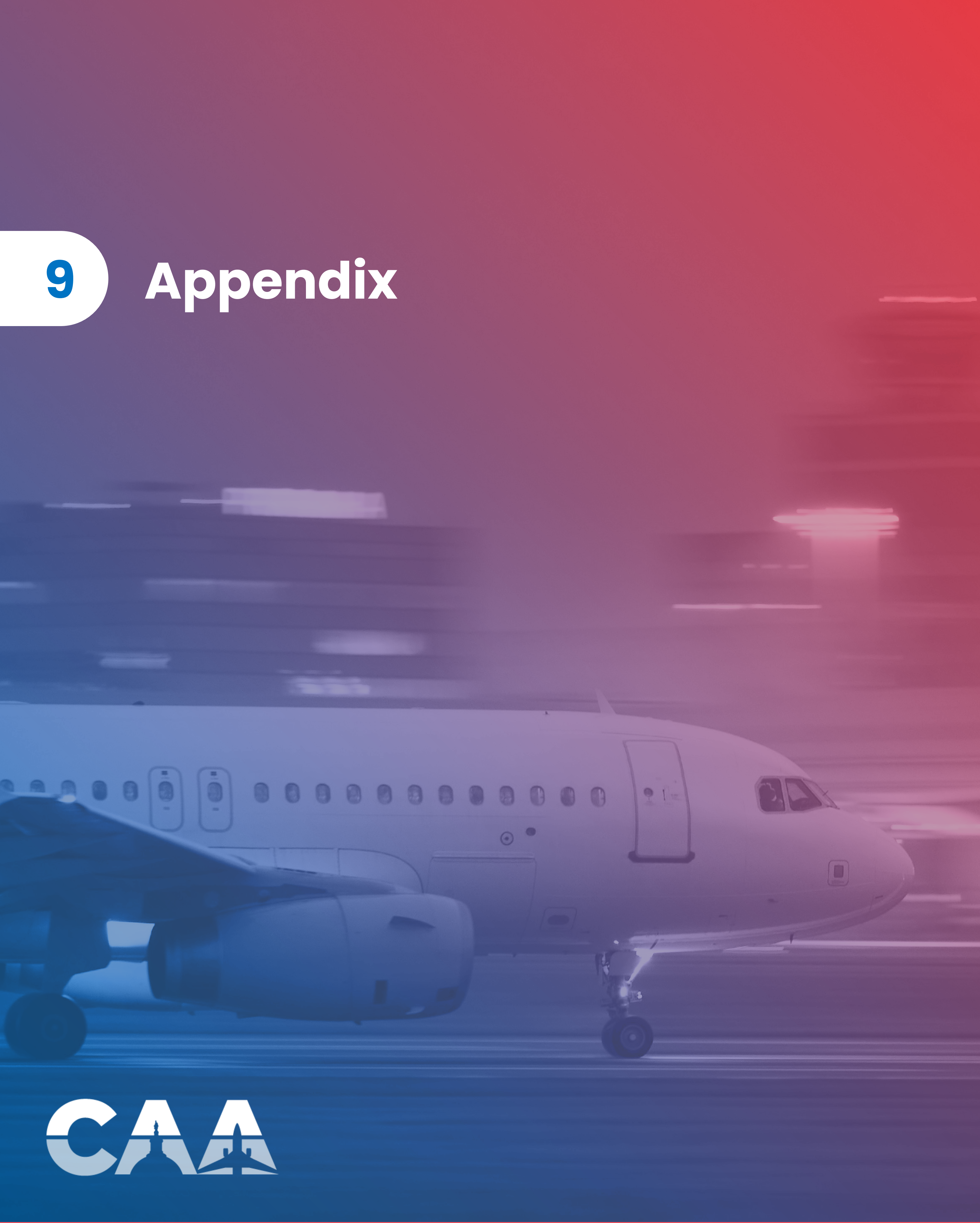
Industry reports suggest that further recovery has been hampered by the emergence of supply-side constraints, primarily labor and skill shortages. Pandemic-induced down-sizing by airports and airlines has seen the organizations unable to respond speedily in ramping up hiring with the re-opening of travel and pent-up demand. Their constraints are seen as mainly temporary in nature.

However, the drivers of demand for air transport remain strong, with industry projections estimating air travel to exceed pre-COVID traffic volumes between 2023 to 2024. Over a longer horizon, the air travel market is expected to continue to see global air passenger journey annual growth of 2–4%, resulting in 2x the number of air passenger journeys in 2040 compared to 2020.

[67] ARC and IATA, ticket volume data as of September 2022; includes tickets issued up to August 21, 2022

To summarize, the latest air travel trends further bolster the need for the additional connectivity outlined in the report.

9 Appendix



9 | Appendix

9.1 Scope and Methodology

This section aims to detail the analyses used in this report. The analyses are organized in the order of the sections used.

Section 2 – Executive summary

Definition of Washington, D.C., metro area

The Washington, D.C., metro area refers to the 27 counties and cities that surround the capital. These include Washington, D.C., Loudoun (VA), Arlington (VA), Fairfax (VA), Prince William (VA), Baltimore (MD), Baltimore City (MD), Anne Arundel (MD), Montgomery (MD), Howard (MD), Prince George (MD), Jefferson (WV), Clarke (VA), Fauquier (VA), Spotsylvania (VA), Stafford (VA), Warren (VA), Alexandria (VA), Fairfax City (VA), Falls Church (VA), Fredericksburg (VA), Manassas (VA), Manassas Park (VA), Calvert (MD), Charles (MD), Washington (MD) and Frederick (MD)

Section 4 – Mapping the air-travel ecosystem evolution over the past six decade

Definition of counties neighboring IAD

The counties neighboring IAD include Fairfax (VA), Prince William (VA), Fauquier (VA), Clarke (VA), Jefferson (WV), Frederick (MD), Montgomery (MD), Washington (MD)

Section 5.1 - Effectiveness in protecting in-perimeter communities' access to Washington, DC

The direct connectivity rate analysis

To understand the effectiveness of the perimeter rule in protecting the access of in-perimeter communities, this report looked at passenger volumes using OAG Traffic and Schedule Analyser data (accessed in September 2022). The analysis was based on O&D passenger and schedule data for 2019 and investigated the in-perimeter access for Washington, D.C., and a set of benchmark metros. In addition to New York, which is also a perimeter-constrained market, this report included airports from the following cities: Atlanta, Chicago, Dallas, Houston, Boston, Los Angeles, Philadelphia, Seattle, and San Francisco. Atlanta, Chicago, Dallas and Houston were chosen since they are the largest U.S. metros by passenger volume (measured as 2019 U.S. passenger traffic). Boston, Los Angeles, Philadelphia, Seattle, San Francisco were chosen due to similar geographic positioning as Washington, D.C., by being "coastal hubs." It is important to note that the airport and city definitions are the ones used by OAG, except Baltimore-Washington International Airport (BWI), which has been manually grouped into the "WAS" city along Reagan National Airport (DCA) and Dulles International Airport (BWI).

In-perimeter connectivity rate is defined as the percentage of the top similarly sized in-perimeter markets served by non-stop flights. These were determined based on non-directional passenger traffic, including any in-perimeter market with more than 14.5k annual O&D passengers. The top 15 markets were excluded from the selected markets as they are large enough not to warrant "protection". In-perimeter markets are those within a 1,250-mile stage length limit from respective metros. The analysis mapped whether each market selected had non-stop scheduled flights based on OAG schedule data. For example, Washington, D.C., had non-stop scheduled flights for 88 of its top 107 similarly sized in-perimeter markets, implying an in-perimeter direct connectivity rate of 82%.

Lastly, for Washington, D.C., and benchmark metros, this analysis also calculated the number of top similarly sized in-perimeter markets served by at least two daily non-stop roundtrip frequencies as measured by OAG's 2019 T-100 data. For example, Washington, D.C., served 56 of its 107 top similarly sized in-perimeter markets with two or more frequencies, implying an in-perimeter direct connectivity rate of 52%.

Section 5.2 - Effectiveness in protecting DCA's air-service reliability

A:14 Ratio Analysis

A useful metric for understanding air service reliability is the A:14 ratio, defined as the ratio of flights arriving at their destination within 15 minutes of their scheduled time. For this A:14 analysis, the report compared DCA to a set of comparable benchmark stations. To be included in this analysis as a benchmark, the report looked at major airports in the top ten U.S. metros. An airport was considered a major airport if it saw at least 10M enplaned passengers in 2019. The top ten U.S. metros were determined by the sum of all enplaned passengers for 2019 across each metro's associated stations. This analysis calculated all enplanement values for benchmark stations and metros using OAG 2019 T-100 data.

The A:14 metric for all analyzed stations was calculated using the OAG historical flight data set. This analysis used historical flight operations data from 2017 to 2022 (accessed in February 2023) that included flights that either arrived or departed from a top 50 U.S. airport, determined by enplanements. The A:14 ratio analysis was conducted from 2017 to 2022, excluding 2020 and 2021 due to COVID irregularities. The analysis only considered flight operations that had valid scheduled and actual arrival and departure times. For each of the analyzed years and stations, the A:14 value was aggregated.

Completion factor analysis

Another measure of air service reliability is completion factor—a metric defined as the percentage of flights completed (not canceled) over a specified period. This report compared DCA to a set of comparable benchmark stations to analyze the completion factor. As a benchmark, this report looked at the major airports of the top ten U.S. metros. An airport was considered a major airport if it saw at least 10M enplaned passengers in 2019. The top ten U.S. metros were determined by the sum of all enplaned passengers for 2019 across each metro's associated stations. This analysis calculated all enplanement values for benchmark stations and metros using OAG 2019 T-100 data.

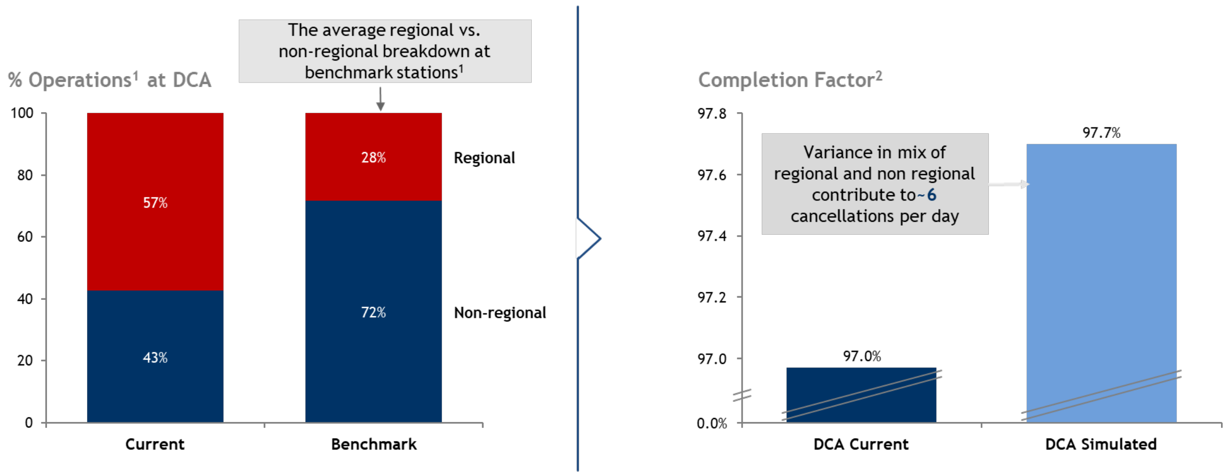
The completion factor metric for all analyzed stations was calculated using the OAG historical flight data set. This analysis used historical flight operations data from 2017 to 2022 that included flights that arrived or departed from a top 50 U.S. airport, ranked by enplanements. The completion factor analysis was conducted from 2017 to 2022, excluding 2020 and 2021 due to COVID irregularities. The overall completion factor was calculated for each analyzed year and station based on the cancellation variable available within the OAG historical flight data. The completion factor in this analysis is defined as the ratio of the total number of operated flights to the total number of scheduled flights, where operated flight is any flight that had a valid departure and arrival time and did not have a cancellation flag.

Two methodologies were used to understand the impact of variance of DCA completion factor with other top U.S. metro airports.

Approach 1 – Simulated normalization of aircraft mix variance

Under this methodology, a simulated completion factor was calculated by adjusting the DCA aircraft mix to the benchmark. This was done by taking the average completion factor by aircraft type (regional v. non-regional) at DCA and adjusting the aircraft mix to match that of benchmark stations. The new completion factor was then multiplied by the total number of operations at DCA to quantify the total number of cancellations.

Exhibit #28 – Approach 1 – Variance in mix of regional and non-regional aircraft could be contributing up to ~2000 annual cancellations at DCA



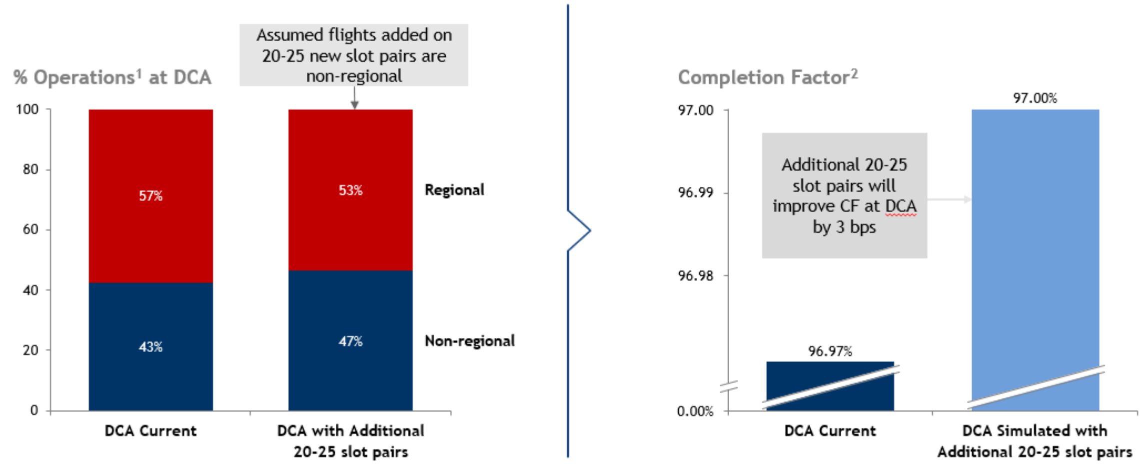
1. Benchmark stations include the set of airports with at least 10M enplaned pax from the top 10 busiest metros in the US (by enplaned pax) 2. An operation in this context is defined as an inbound or outbound Domestic flight (including Puerto Rico) 3. Completion factor is the percent of tracked flights that were not cancelled or diverted; CF = (1 - % of non-cancelled flights)

Note: These are approximations are based on the five-year averages, excluding 2020 and 2021 (due to COVID irregularities) | Source: OAG Ops data 2017-2019 and 2022

Approach 2 – Addition of 20–25 new in- and beyond-perimeter slots at DCA

Under this methodology, a simulated completion factor was calculated by increasing the overall number of slots at DCA. Based on the slot-potential analysis, a range of 20–25 roundtrip slots was used. These markets, whether in- or beyond-perimeter, were assumed to be operated with non-regional narrow-body aircraft. The new aircraft type mix based on addition of new beyond-perimeter slots was weighted with the average completion factor by aircraft type (regional v. non-regional) to estimate the new simulated completion factor.

Exhibit #29 – Approach 2 – Addition of 20-25 new beyond perimeter slot pairs at DCA could improve completion factor by up to 3bps.



1. An operation in this context is defined as an inbound or outbound Domestic flight (including Puerto Rico) 2. Completion factor is the percent of tracked flights that were not cancelled or diverted; CF = (1 - % of non-cancelled flights)
Note: These are approximations are based on the five-year averages, excluding 2020 and 2021 (due to COVID irregularities) | Source: OAG Ops data 2017-2019, and 2022

Block time buffer analysis

The primary objective of the block time buffer analysis discussed in Section 5.2 was to understand the level of congestion at DCA and the true capacity of the station compared to other benchmark stations. A comprehensive metric used in this analysis to understand congestion and capacity is block time past schedule (BTPS).

$$BTPS = actual\ block\ time - scheduled\ block\ time$$

Block time is the duration between when the flight leaves its departing station gate to when it arrives at the arrival station gate. BTPS measures the overall delay minutes experienced by the flight between a flight's scheduled block time vs. its actual block time. A BTPS value at or below zero is desirable, as this implies a flight operates within its scheduled block and is not delayed. BTPS has the advantage that it is not affected by exogenous factors such as arrival delay, crew delay, etc.

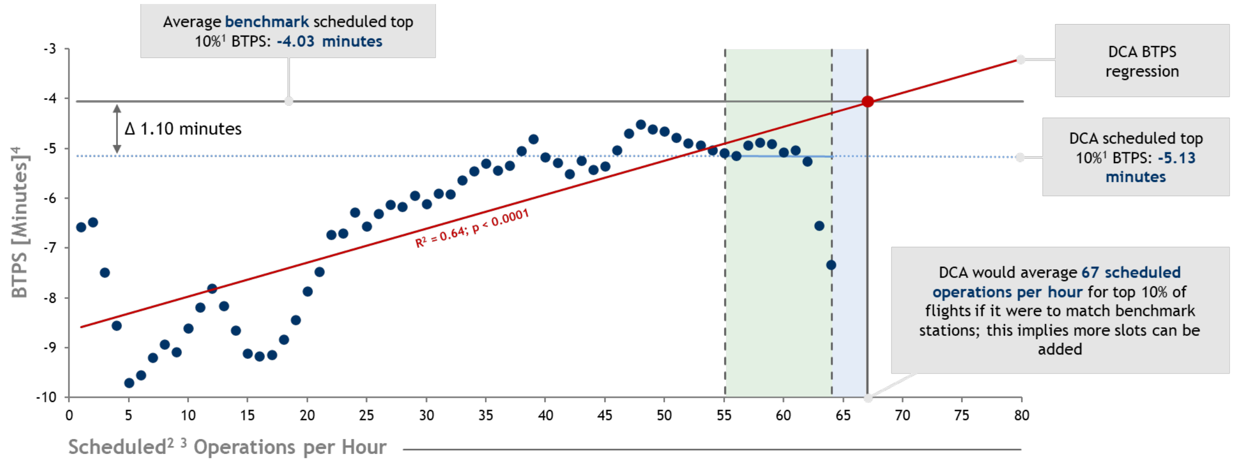
To properly understand the capacity of an airport using BTPS, this report benchmarks the average delay minutes experienced by an airport compared to other major airports at each airport's busiest times. The metric used to measure busyness in this analysis was scheduled operations per hour, a count of both scheduled inbound flights, and scheduled outbound flights that either arrive or depart during a specific slot hour.

The data used for this analysis combines OAG historical flight data, OAG schedules data, and OAG T-100 data for 2017 to 2019. The block time buffer analysis was conducted from 2017 to 2019, excluding 2020 and 2021 due to COVID irregularities. For this analysis, the report compared DCA to a set of comparable benchmark stations. To be included in this analysis as a benchmark, the report looked at major airports in the top ten U.S. metros. An airport was considered a major airport if it saw at least 10M enplaned passengers in 2019. The top ten U.S. metros were determined by the sum of all enplaned passengers for 2019 across each metro's associated stations. This analysis calculated all enplanement values for benchmark stations and metros using OAG 2019 T-100 data. To ensure that this report only considers true scheduled carrier and commuter flights, it only considered flights from the OAG schedules data operating under IATA "J" type service code, which specifies flights that are "normal service" scheduled passenger flights and, importantly, does not include general aviation scheduled operations, such as chartered flights. These schedules were matched with the OAG operations data to get the flight leg level operational data for flights that were truly carrier and commuter flights. A filter was applied to remove outlier values for BTPS and arrival/departure taxi time, excluding any BTPS values greater than three hours or less than three hours and any actual taxi time values less than zero or greater than two hours.

For every year from 2017 to 2019 (excluding 2020 and 2021), every month in the year, every day in the month, and every hour in the day, the number of scheduled operations per hour was counted. Every scheduled inbound and outbound flight within the cleaned historical flight data was assigned, as a new field, the number of scheduled operations per hour value that it helped establish. With this value now calculated for every flight in the historical flight data, the BTPS values for the top 10% of flights (regarding the number of scheduled operations per hour) for each respective station were collected and stored.

The BTPS for every benchmark station was averaged to create a single benchmark top 10% BTPS value. Once this benchmark average value was calculated, a linear regression line was fit between the scheduled number of operations per hour at DCA and the weighted moving average BTPS. This weighted moving average takes the scheduled operations per hour before and after the current value, determines the BTPS for all three values, then averages all three with weights. The weights are determined by the number of flights associated with each scheduled operation per hour value. The linear regression was then extrapolated, and where the benchmark top 10% BTPS met the regression line, the new potential

Exhibit #30 – Normalizing DCA's BTPS variance to top ten major metro airports could allow scheduling of 67 operations per hour



1. Top 10% of flights in respect to (IRT) scheduled operations per hour 2. Benchmark stations include all stations from the top 10 metros (by enplaned pax) with at least 10M enplaned pax/year 3. Scheduled operations are in reference to on/off block times, not takeoff/landing times—this is a proxy for scheduled slots 4. Y-axis values represent rolling averages (-1/+1)
Note: 2020 and 2021 data was excluded from this analysis due to COVID-19 irregularities; inbound/outbound flights are from stations with at least 1,250 outbound pax/year; N = 1,023,509 with a roughly normal distribution, fraying at tails due to low N
Source: OAG Ops data; OAG T-100 data

scheduled operations per hour value was determined. This value was then used to determine how many additional slots DCA could support.

Section 5.3 – Effectiveness in protecting IAD's growth

Passenger growth analysis

The passenger growth analysis between DCA and IAD involved investigating passenger segment flow rates for the two stations for 1999 and 2019. This analysis was accomplished using OAG T-100 data. This analysis included routes that included DCA or IAD as the origin or destination stations. Each route has a stage-length value associated with the origin and destination airports, which was used to determine if it was an in-perimeter or beyond-perimeter route. Any route with a stage length above 1,250 mi is considered beyond perimeter. Beyond-perimeter routes were further segmented into markets with perimeter exemption or no exemption. Perimeter-exempted markets are Austin, Denver, Las Vegas, Los Angeles, Portland, Phoenix, Seattle, San Francisco, San Juan, and Salt Lake City.

For each year, the analysis calculated the number of passengers by route type (domestic vs. international, in-perimeter vs. beyond-perimeter, and exempted vs. not exempted), departing from or arriving at either IAD or DCA. This involved a filter for the year, origin, and destination, where the total number of passengers was summed up for each respective station and year.

We further analyzed passenger growth for beyond-perimeter exempted markets from IAD and DCA, considering changes in the seating capacity from 1999 to 2019. This involved a filter for the year, origin, and destination, where the total number of passengers and seats were summed up for each respective station and year.

Difference-in-difference analysis for beyond-perimeter markets

To understand the impact of waiving the perimeter rule on selected routes, and how that has impacted Washington, D.C., the analysis looked at DoT DB1B data (accessed in March 2023) and compared how O&D passenger CAGR differed over time for perimeter-exempted markets vs. a control group of beyond-perimeter non-exempted markets.

Perimeter-exempted markets are Austin, Denver, Las Vegas, Los Angeles, Portland, Phoenix, Seattle, San Francisco, San Juan and Salt Lake City. The control group was defined as the top 25 beyond-perimeter markets with positive passenger growth between 1990 and 2019; this subset represents ~80% of 2019's total passengers from beyond-perimeter non-exempted markets. Periods compared were 1990-1999, which comprised ten years before the first exemption took place in 2000, and 2010-2019, the latest ten years pre-COVID.

Difference-in-difference is defined as follows:

$$\begin{aligned}\text{Difference-in-difference} &= (\boldsymbol{CAGR}_{\mathbf{2010-2019}} - \boldsymbol{CAGR}_{\mathbf{1990-1999}})_{\boldsymbol{Exempted}} \\ &- (\boldsymbol{CAGR}_{\mathbf{2010-2019}} - \boldsymbol{CAGR}_{\mathbf{1990-1999}})_{\boldsymbol{Control}}\end{aligned}$$

For example, 2pp would imply that waiving the perimeter rule has had a net-positive impact in terms of O&D passenger CAGR.

Demand stimulation analysis

To understand how passenger demand has evolved in markets where additional nonstop seats have been put in place, the analysis looked at the OAG Traffic Analyser and OAG T-100 data (accessed in September 2022). The analysis was based on passenger and capacity data for 2015 and 2019, allowing for evaluation of pre-COVID air traffic trends through the pre-COVID traffic peak. The analysis investigated the Washington, D.C., metro's perimeter-rule exempted destinations and a set of comparable benchmark markets. The benchmark markets used were the top 47 U.S. domestic markets with a lower-than-average 2015 supply-demand ratio (1.80), larger than 25% capacity increase between 2015 and 2019, and more than 400K 2015 passenger traffic.

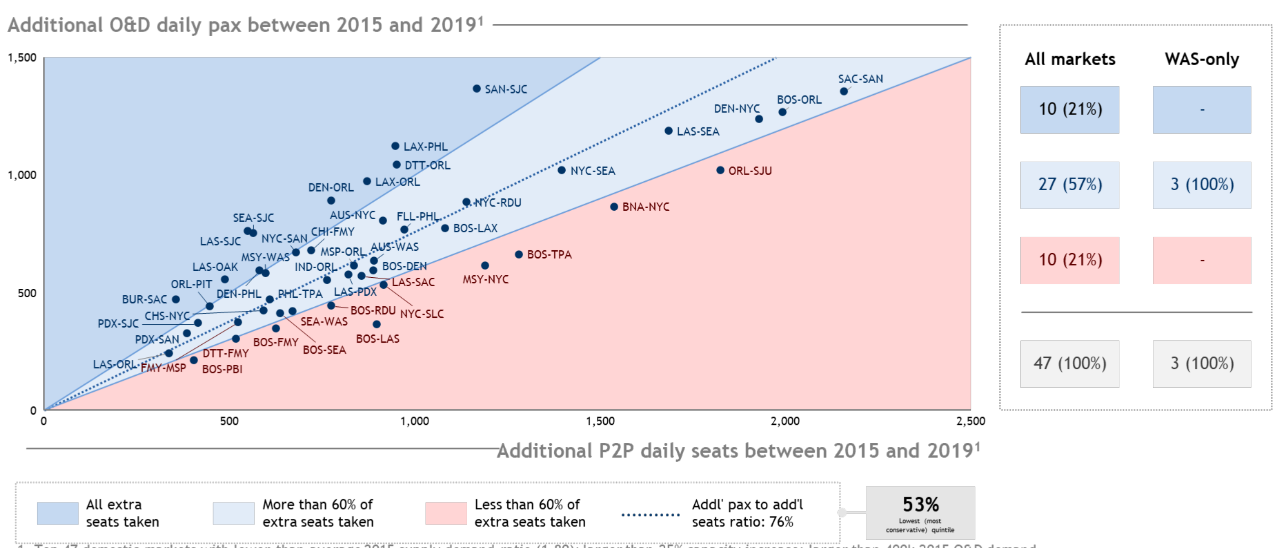
Demand stimulation is defined as the additional O&D passengers to additional seat ratio, which is calculated as the difference of total O&D passengers (nonstop and connecting through another airport to reach their destination) flying a specific market between 2015 and 2019 over the difference of nonstop seats flying that same market between 2015 and 2019:

$$\textbf{Demand stimulation} = \frac{(\boldsymbol{Total\ O\&D\ pax_{2019}} - \boldsymbol{Total\ O\&D\ pax_{2015}})}{(\boldsymbol{Nonstop\ seats_{2019}} - \boldsymbol{Nonstop\ seats_{2015}})}$$

For example, 53% would imply that every 100 nonstop seats added into a given market, stimulated an additional 53 O&D passenger demand in the same market (connecting or nonstop).

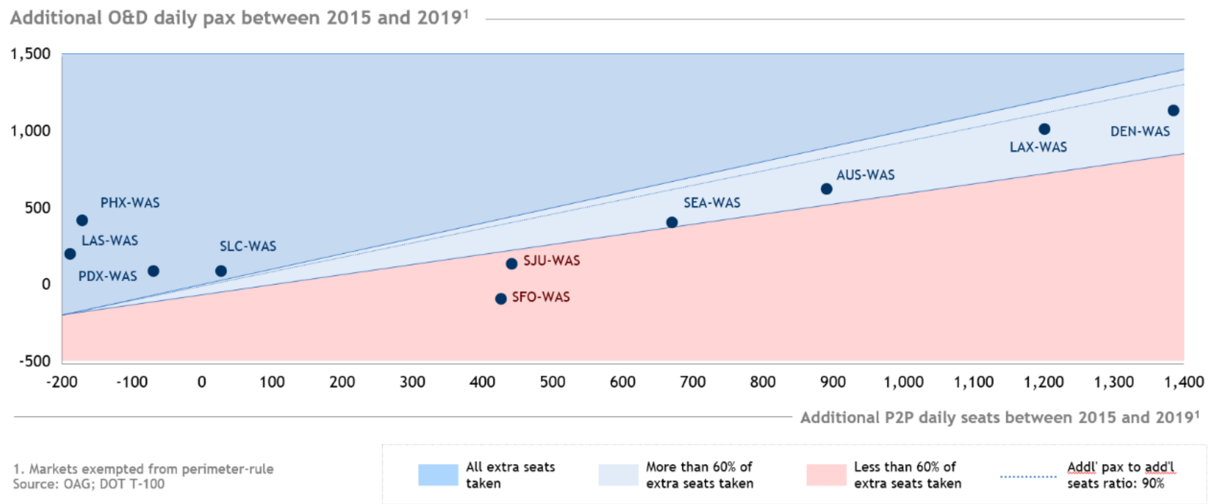
It is important to note that the analysis did not find evidence that proves that the findings change depending on whether Low Cost Carriers seat share increased over time or not.

Exhibit #31 – Addition of 100 seats in a top U.S. market has been accompanied with 76 additional O&D passengers



1. Top 47 domestic markets with lower-than-average 2015 supply demand ratio (1.80); larger than 25% capacity increase; larger than 400k 2015 O&D demand
Note: Passenger stimulation is present regardless of whether LCC seat share increases or decreases
Source: OAG; DOT T-100

Exhibit #32 – Addition of 100 seats in a beyond-perimeter market with rule exemption has been accompanied with 90 additional O&D passengers



Survey Methodology

To better understand what was driving passengers' airport preferences and flight purchasing decisions, as well as impressions of the Washington, D.C., airport system and differences between the three airports, over 2,500 air passengers nationwide were surveyed, including around 400 residents of the Washington, D.C./Baltimore metro area. Including non-residents, over 1,000 passengers in the survey had traveled out of Washington, D.C., area airports within the past year. Additionally, the sample included 150+ residents from each of the top ten major metro areas (New York, Los Angeles, Chicago, Atlanta, Dallas, Philadelphia, Houston, Miami, and Boston). Residency was determined based on residency zip-code provided by the surveyor. Representative population sample quotas were set for demographic sets of age, gender, household income and marital status.

A few qualifiers were set: The survey taker must have traveled by air within the past year and must be at least a 50% decision maker in the households' travel purchases. Passengers who did not meet these two qualifications were removed from the survey results.

The survey focused on four key areas: background, preferred airport sentiment, Washington, D.C. airport impressions, and recent trip decision-making process. For background, this report homed in on metropolitan statistical area (MSA), flights in the past year, the purpose of travel, frequency of business and leisure travel and number of flights within the past year, including flights from Washington, D.C. For preferred airport sentiment, the passengers were asked for their preferred airport in their MSA—if it has multiple airports, likeliness to recommend their airport to calculate NPS scores, and airport importance and satisfaction ratings for a host of factors for their preferred airport, including cost, non-stops, destination options, carrier choices, flight times, timeliness, and location.

For impressions of Washington, D.C., airports, this report filters out any passenger who had not flown out of Washington, D.C., within the past year. Passengers were then asked for their likeliness to recommend each of the three Washington, D.C., airports to calculate the NPS score for each airport. They were also asked about their preferred Washington, D.C., airport and the factors influencing their satisfaction and dissatisfaction with all three airports.

Lastly, this report dove into each consumer's two most recent air travel trips. The survey also gathered information on their flight decision-making process, determining if passengers considered multiple airports and which factors were most critical to their choice. It was also determined if the consumer flew from an airport further from home, what drove that decision, and whether the consumer took a connecting flight to save money on those trips. Finally, the survey gathered information on their commute time, cost, method, and time spent in the check-in/security process.

The data gathered in each section was used to effectively compare the Washington, D.C., system to other major metros with multiple airports in the market to help determine whether Washington, D.C., is effectively servicing its consumers.

Exhibit #33 – Consumer survey sampling details

Topic	Approach
Participants	• Total sample: N = ~2,575, representative of DMV (Washington, D.C., MD, VA) airport passengers by age, gender, and ethnicity • Age: 18-80 • Zip Code: Nationwide
Qualifiers	• Traveler within past year • At least 50% decision-maker within the household on travel purchases
Quotas	• Washington, D.C./Baltimore residents: N = 392 • Top 10 Metro areas: N= 150+ • Non-Washington, D.C./Baltimore Residents: N >= 500+ • Pax who traveled to Washington, D.C.: N=1000+

IAD passenger mix analysis

To understand IAD's passenger traffic composition and evolution over time this report analyzed the OAG Traffic Analyser data (accessed in September 2022). The analysis was based on passenger data from three years —2015, 2019, and 2022—to allow the evaluation of pre-COVID traffic trends, pre-COVID traffic peak, and post-COVID traffic changes. The analysis also investigated the in-perimeter access for Washington, D.C., and a set of benchmark metros. In addition to New York, which is also a perimeter-constrained market, this report included four other top U.S. metros based on 2019 passenger traffic within the set of benchmark stations.

In-perimeter traffic is defined as all passengers whose distance from the origin to the destination was less or equal to 1,250 miles; beyond-perimeter is all passengers whose destination was domestic or San Juan (SJU) and the distance from the origin to the destination was more than 1,250 miles; long-haul international is everything else that either originated or finished at IAD; connecting through all passengers that used IAD as a connecting airport to reach their destination. Please note that connecting passengers have been doubled to consider that every person used two seats: one inbound and one outbound from IAD.

Connecting passenger percentage analysis

To understand how many passengers flying in and out of the Washington, D.C., metro have to connect via another airport to reach their destination vs. other comparable metros, the report looked at OAG Traffic Analyser data (accessed in September 2022). The analysis was based on passenger data for 2019 and investigated the Washington, D.C., metro and a set of comparable benchmark metros (the top 25 metros based on 2019 passenger data were included). As for destinations, the analysis considers beyond-perimeter routes, defined as US-domestic markets with stage lengths larger than 1,250 miles or flown to San Juan airport (SJU). SJU was included as beyond-perimeter due to its perimeter-rule exemption status. Another view is displayed with specific destinations or those with a perimeter-rule exemption from DCA.

Connecting passenger percentage is defined as passengers that did not fly nonstop over total passengers flying in and out of a specific metro or airport. For example, 60% implies that six out of ten passengers flying in or out of a specific metro or airport had to connect somewhere to reach their final destination; in other words, 40% of passengers flew nonstop.

Exhibit 15 shows what is the connecting percentage for each destination in the x-axis when passengers fly from Washington, D.C., or from the top 25 metros. For instance, 44% of passengers flying from Washington, D.C., to San Antonio did not fly nonstop, whereas that number was 24% for passengers flying from the top 25 metros to San Antonio. Important to note that only beyond-perimeter markets whose distance is larger than 1,250 miles were considered within the top 25 metros.

Section 6.1 - Extent of supply-demand misalignment in beyond-perimeter markets

Supply-demand ratio and opportunity index analyses

To understand if there were misalignments between supply and demand in Washington, D.C., metro vs. other comparable metros, the analysis looked at OAG Traffic Analyser data and OAG T-100 data (accessed in September 2022). The analysis investigated the Washington, D.C., metro and a set of comparable benchmark markets, including the top 100 U.S.-wide markets by passenger traffic, excluding Atlanta, Charlotte, Dallas, and Houston. These stations were excluded as they are primarily major connecting hubs, and their supply and demand dynamics differ from an airport that is not a hub; in fact, more than 45% of traffic in these three airports accounted for connecting through traffic. Additionally, Hawaii was excluded, given its long-haul distance.

The supply-demand ratio is defined as the total number of nonstop seats over the total number of O&D passengers on a given market (including nonstop and those who connected at another airport to reach their final destination). A ratio of 1.5 suggests that there are 1.5 nonstop seats for every O&D passenger flying a given market. The supply-demand gap is defined as the difference between a market's supply-demand ratio and a benchmark ratio.

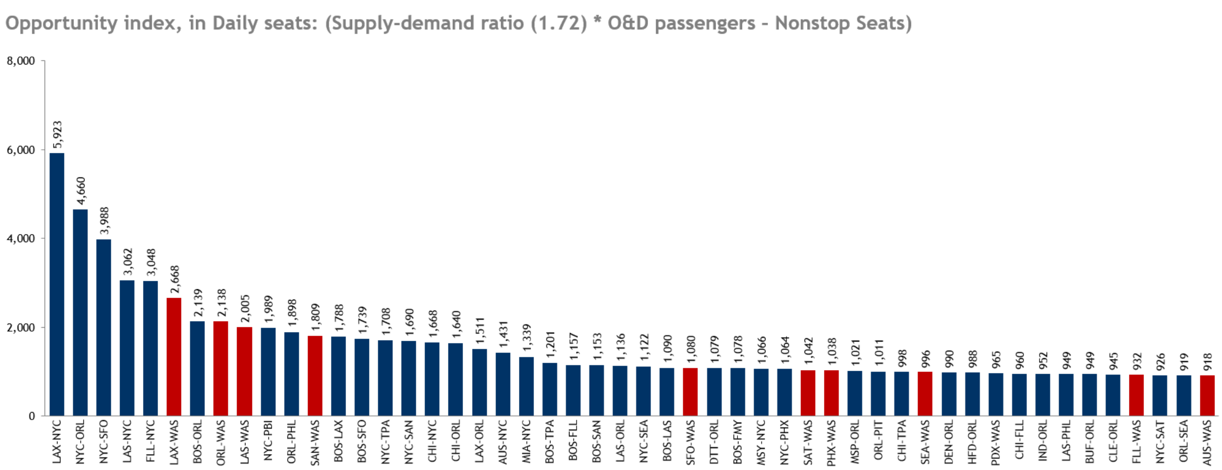
Finally, this analysis created an opportunity index defined by the following formula for each city-pair:

$$\textbf{Opportunity index} = \frac{((\boldsymbol{Benchmark\ supply - demand\ ratio} \times \boldsymbol{O\&D\ passengers}) - \boldsymbol{Nonstop\ seats})}{\mathbf{365}}$$

It is important to note that different benchmarks were used for different purposes. ~1.72, which is for top 100 U.S.-wide markets excluding connecting hubs and Hawaii, was used to show the extent of the supply and demand gap at Washington, D.C., as shown in Exhibit #34. For the slot potential analysis below, a different benchmark was used, which will be thoroughly described in the next section.

For illustrative purposes, as per T-100, LAX-WAS route operated a total of ~2.5M nonstop seats in 2019. The total O&D passengers, as per OAG Traffic Analyser, in the market was ~2M pax in the same time-period. Using a supply-demand ratio of 1.72, as defined above, the overall opportunity in daily seats for LAX-WAS is equal to ~2.7K seats, or ~9.9M seats annually.

Exhibit #34 – Top 50 under-served routes from 1,000 most meaningful U.S. markets based on opportunity index



1: Supply demand ratio for top 100 US markets is 1.72
Source: OAG 2019 domestic US data, excl. connecting hubs (ATL, CLT, DFW, HOU) and Hawaii

Slot potential analysis

To understand the number of beyond-perimeter slot pairs needed to be flown to and from the Washington, D.C., metro to close the supply-demand gap to benchmark levels, the analysis looked at OAG Traffic Analyser and OAG T-100 data (accessed in September 2022). The analysis was based on passenger and capacity data for 2015 and 2019 and investigated the Washington, D.C., metro's top 25 beyond-perimeter routes based on the opportunity index described above; the decision to cut off top beyond-perimeter routes at 25 was made by discarding markets that had less than ~60 daily passengers each way in 2019. The supply-demand benchmark ratio was calculated using the top 30 to 100 U.S.-wide beyond-perimeter markets by passenger traffic, excluding Atlanta, Charlotte, Dallas, Houston, and Hawaii as the first three are connecting hubs whose yields are outliers, and Hawaii is out of reach for DCA's regional and narrow-body aircraft. The rationale for choosing the top 30 to 100 was to compare Washington, D.C.,'s top 25 beyond-perimeter markets to a benchmark that had similar daily passenger flows: D.C. had ~310 average daily roundtrip passengers and the benchmark was ~380 average daily roundtrip passengers.

The capacity potential is defined as the number of additional seats required to bring the supply-demand ratio to benchmark levels, considering that every additional seat will stimulate additional traffic. An iterative formula that converges to the final solution was used for this purpose. The target supply-demand ratio used was 1.40, which is the average ratio of the top 30 to 100 U.S. beyond-perimeter markets, excluding Atlanta, Charlotte, Dallas, Houston, and Hawaii. Demand stimulation factor used was 56%, which is the lowest quintile of the top 47 U.S. domestic markets with a lower-than-average 2015 supply and demand ratio (1.80), larger than 25% capacity increase, and passenger volume larger than 400K in 2015.

Finally, to translate these additional seats into daily slot pairs, we assumed that a 200-seat narrow-body aircraft would fly each slot pair. Modelling of the above inputs showed that ~110 slot pairs are required for the top 25 beyond-perimeter routes to meet the supply-demand benchmark at Washington, D.C.

Airport preferences from a consumer survey

The objective of this analysis was to determine if passengers consider DCA, IAD, and BWI as alternatives when making flight purchasing decisions and the potential impact on IAD of granting additional slots at DCA. The survey also helped to determine which airport passengers prefer in Washington, D.C., and if they are willing to commute further for their preferred airport, as well as what drove their ultimate airport choice - whether that's cost, location, destination options, non-stop options, convenient flight times, road access, public transit access, etc. The analysis also looked at how Washington, D.C.'s system compared to other top metros for each of those factors driving airport choice.

For each trip, passengers were asked if they considered multiple airports on their most recent trip. If so, the passenger was asked to provide the most recent airport they flew out of and the airport they considered. The survey included passengers traveling from other airports as a benchmark for the other cities and then filtered for Washington, D.C., passengers to determine how often passengers who preferred certain airports within Washington, D.C., considered other airports. For example, the survey was filtered for passengers who flew out of IAD and preferred IAD to see how often those passengers considered DCA and BWI and vice versa. It also enables a comparison of Washington, D.C., airports to other benchmark metros with multiple airports to see if Washington, D.C., passengers were more likely to consider another airport than other cities by filtering for the MSA code for each city. There was also a question in the survey asking passengers who considered other airports to define why they chose the airport they ultimately flew out of, which allowed aggregation of the reasoning behind passengers' airport choices.

The complete survey outline is provided in Section 9.2.

Section 6.2 – Perimeter rule's impact on ticket prices for beyond-perimeter consumers

Pricing analysis

To understand how ticket prices for people flying in and out of the Washington, D.C., metro, compare vs. other metros, the analysis looked at ARC data (accessed in October 2022). The analysis is based on ticket data for 2019 and 2022 and investigated the Washington, D.C., metro and a set of comparable benchmark metros; note that ARC data is based on the ticketing date, not the flight date. The top ten metros based on 2019 ticket data were chosen as a benchmark for this analysis. Atlanta, Dallas, and Houston metros were aggregated into "Cnx. Hubs" as they are major connecting hubs, and their supply and demand dynamics differ from an airport that is not a hub; in fact, more than 45% of traffic in these three airports accounted for connecting through traffic. As for destinations, the analysis considers domestic U.S. routes, defined as markets within U.S. territory, and beyond-perimeter routes, defined as domestic markets with stage-length larger than 1,250 mi or flown to San Juan airport (SJU). SJU was included as beyond-perimeter due to its perimeter-rule exemption status.

Yield is defined as the revenue per passenger-mile in cents:

$$\textbf{Yield} = \mathbf{100} \times \frac{\boldsymbol{Revenue}}{\boldsymbol{Passenger} \times \boldsymbol{Distance}}$$

To compare yields more fairly across markets that have different stage lengths, the yields were adjusted using the following formula:

$$\textbf{Stage-length adjusted yield} = \boldsymbol{Yield} \times \sqrt{\frac{\boldsymbol{Distance}}{\mathbf{1000}}}$$

It is important to note that stage-length adjusted yield is an index that allows a comparison between different markets' expensiveness but does not speak to how expensive those markets are in nominal terms; the higher the number, the more expensive the metro is compared to the rest.

Additionally, this analysis used the calculation of the stage-length adjusted yields for each top 50 airport pairs based on 2019 ticket data (e.g., DCA-LAX) and ranked DCA based on how many times the stage-length adjusted yields fell into each quintile for every given destination: bottom 20% is "extremely low," 20–40% is "low," 40–60% is "average," 60–80% is "high," and 80–100% is "extremely high." For illustration purposes, if an airport pair (e.g., DCA-LAX) is classified as "extremely high," it implies that passengers flying from DCA were within the 20% most expensive stage-length adjusted yields vs. other top 50 U.S. airports flying to LAX.

Section 6.3 – Perimeter rule's impact on productivity for beyond-perimeter business passengers

Elapsed time analysis

To understand how much time is spent flying in and out of the Washington, D.C., metro vs. other comparable metros, the analysis looked at the OAG Traffic Analyser and OAG Schedule Analyser data (accessed in September 2022). The analysis was based on elapsed flight time and passenger data for 2019 and investigated the Washington, D.C., metro, and a set of comparable benchmark metros. To be used as a benchmark, NYC, Chicago, Boston, Houston, Atlanta, and Dallas were included as comparable metros considering their size and geographical locations. For destinations, only beyond-perimeter markets were considered in this analysis.

Elapsed time vs. nonstop time is defined as the difference of the total time spent by passengers traveling to their destination minus the time those passengers would have spent if they had flown nonstop. Given OAG data constraints, up to three legs were considered, and an assumption of 60 min per layover was made. Finally, weighted averages of passenger numbers were used to aggregate values across routes.

Productivity analysis

To determine the perimeter rule's impact on productivity for beyond-perimeter passengers, this report looked at two main factors -- flight time and commute time.

For flight time, this report compared the percentage of connections from Washington, D.C., to other top ten metros to understand if passengers had to connect more frequently out of Washington, D.C., than other metros due to the perimeter rule. To compare Washington, D.C.'s, flight times to other top metros, the report used the T-100 data to calculate the percentage of passengers flying nonstop from the top ten major metro markets to see if Washington, D.C., passengers are forced to connect more frequently than passengers in cities of similar size. Next, this report calculated the additional minutes added by the increased connections for the average passenger.

To calculate the economic productivity loss for business travelers, the value of overall annual minutes in connectivity was estimated for Washington, D.C., using the 2016 DoT Value to Travel time-saving Model (VTTS). The VTTS value for general business air travel $63.20 per hour in 2015 dollars. Using the CPI index from the Bureau of Labor Statistics, $63.20 per hour in December 2015 dollars was equivalent to $68.66 per hour in December 2019 dollars. To estimate the ratio of business travel, the distribution of business-related person-trips for 2019 from Euromonitor reports was utilized.

The equation used was as follows,

$$\textbf{Economic productivity loss for Washington, D.C. business travelers} = \\ \textit{Average hours spent in commute} * \textit{Total O\&D passengers from Washington, D.C.} * \\ \textit{Percentage of business traveler trips} * \textit{Marginal value of travel time (VTTS)} =$$

= **$ 202M USD in 2019**

Where,

- Average hours spent in air-travel connection from Washington, D.C = 56 minutes, converted to hours
- Total O&D passengers from Washington, D.C. = 13.7M passengers in 2019
- Percentage of business traveler trips = 23% person-trips
- VTTS = $68.66 / hour

This report compared the commute time to the three Washington, D.C., airports to see if passengers were commuting to airports further from their homes to avoid connecting flights. To determine the commute time lost, survey participants were asked to bucket their commute time on their last two trips: 0–15, 16–30, 31–45, 46–60, 61–90, and 90+. Then, the average of those buckets was used (e.g., 7.5 for 0–15, etc.) for any participant in that bucket to get an average commute time to DCA, IAD, and BWI in minutes for each bucket. The average time was multiplied by the percentage of respondents from DCA, IAD and BWI in those buckets to get the weighted average commute time for an "average" passenger at each of the Washington, D.C., airports. The extra commute loss was calculated as the difference between the commute time for IAD/BWI and DCA. The survey data was then used to see how many passengers in Washington, D.C., had commuted to a farther airport on their most recent trips to see who should be assigned a productivity loss for additional unnecessary commute time.

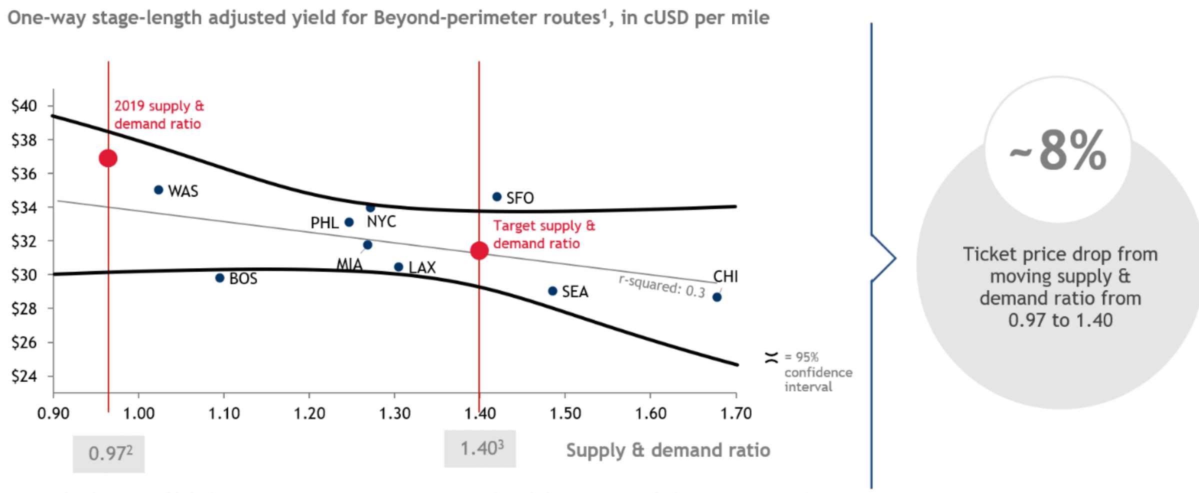
Section 6.4 – Perimeter rule's impact on forgone jobs and tax dollar revenues for Washington, D.C., ***metro***

Pricing analysis

To illustrate how ticket prices could decrease if additional in- or beyond-perimeter slot pairs were added flying in and out of Washington, D.C., metro, the report assumes all additional slot pairs are beyond perimeter slot pairs. This approach allows for modeling model the upper ranges of the impact assuming that in-perimeter flights on an average are less revenue generative. The report accessed OAG Traffic Analyser, OAG T-100 (both accessed in September 2022), and ARC data (accessed in October 2022) as data sources for this analysis. The report was based on passenger, capacity, and ticket data for 2019; note that ARC is based on ticketing date, not flight date. The report investigated the Washington, D.C., metro's beyond-perimeter markets and a set of benchmark metros. In addition to New York, which is also a perimeter-constrained market, this report included airports from the following cities: Chicago, Boston, Los Angeles, Philadelphia, Seattle, and San Francisco. New York and Chicago were chosen since they are the largest U.S. metros by passenger volume (measured as 2019 U.S. passenger traffic). Boston, Los Angeles, Philadelphia, Seattle, and San Francisco were chosen due to similar geographic positioning as Washington, D.C., by being "coastal hubs". Although Atlanta, Dallas, and Houston met the threshold for being included in the largest U.S. metros, they were dropped from the sample due to their major connecting hub nature, which makes them an outlier when comparing it with Washington, D.C.

The methodology of this report was based on running a regression between stage-length adjusted yield and supply-demand ratio for each metro, then calculating what the stage-length adjusted yield drop would be if Washington, D.C., metro's supply-demand ratio met the benchmark level of 1.40. The regression showed that prices would drop by ~8%. Applying this price drop to the top 25 beyond-perimeter markets described in the slot potential analysis, the savings per roundtrip were evaluated to be $63, or ~8%. When applying 95% confidence intervals, the price ranges between ~$25-$100, or ~3-12%.

Exhibit #35 – Stage-length adjusted yield vs. supply & demand ratio



1: Coastal and non-coastal hubs (WAS, BOS, NYC, PHL, MIA, LAX, SFO, SEA, CHI); excludes connecting Hubs (ATL, DFW, HOU, CLT)
2: Supply & demand ratio of top 25 Washington, D.C., routes based on opportunity index
3: Target supply & demand ratio of top 30 to 100 Beyond-perimeter markets (1.40), excl. connecting Hubs (ATL, DFW, HOU, CLT) and Hawaii
Source: OAG 2019 domestic US data; ARC

IMPLAN economic analysis

To evaluate the economic impact (e.g., jobs, money in the metro, tax revenues) of increasing in- or beyond-perimeter slot pairs in Washington, D.C., metro, the report assumes all additional slot pairs are beyond perimeter slot pairs. This approach allows for modeling the upper ranges of the impact assuming that in-perimeter flights on an average are less revenue generative. The report used the inputs-outputs model prepared by IMPLAN (accessed in March 2023). This analysis was based on showing how additional ticket spending due to additional slots would impact the communities nearby. For this analysis, the top ten counties in the Washington, D.C., metro were considered, which captured more than ~50% of the total population of the District of Columbia, Anne Arundel County (MD), Baltimore City (MD), Fairfax County (VA), Prince William County (VA), Arlington County (VA), Loudoun County (VA), Howard County (MD), Prince George (MD), Montgomery County (MD), and Baltimore County (MD).

The methodology calculated the number of pilots and co-pilots required to fly additional slot pairs, assuming an average beyond-perimeter stage length of 2,200 miles, average cruise speed of 500 miles per hour, and a monthly capacity per pilot and copilot of 85 hours. Using this number as an input, the analysis estimated the money required in the air transportation industry to hire the required number of FTEs and cut it by half, which IMPLAN recommends on the assumption that only 50% of the money in the transportation industry will be incremental to the city metro; the rest is part of what Washington, D.C., residents would spend elsewhere if they were not flying. In other words, it assumes that 50% of additional ticket spending is incremental based on additional non-D.C.-based traffic.

Finally, using the dollar input for the air transportation industry, IMPLAN estimated the economic impact for the Washington, D.C., metro, including FTEs and tax revenue, based on the following categories:

- Direct economic benefits—Value stemming from new jobs and the spending required to sustain the revenue from these markets
- Supply-chain economic benefits—Value stemming from business-to-business purchases triggered by the initial spend of the direct economic benefits, e.g., supplier expenditure
- Induced economic benefits—Value stemming from household spending of labor income after removal of taxes, savings, and commuter income

It is important to note that the impact in the Washington, D.C., metro area is estimated using the multipliers of the top ten counties described above.

For more information on IMPLAN's input-output modeling: https://support.implan.com/hc/en-us/articles/360038285254-How-IMPLAN-Works

Section 6.5 – Perimeter rule's impact on CO_2 footprint for Washington, D.C., metro

CO_2 analysis

To compare the levels of carbon emissions from passengers flying in and out of the Washington, DC., metro and DCA airport vs. other metros and airports, this report looked at the OAG Traffic Analyser, the OAG T-100, and ICAO data (accessed in September 2022). The analysis used passenger and capacity data for 2019; and fuel emissions data for 2018, which is the latest available.

For more information regarding fuel emissions data: (https://www.icao.int/environmental-protection/CarbonOffset/Documents/Methodology%20ICAO%20Carbon%20Calculator_v11-2018.pdf).

This report investigated the Washington, D.C., metro, as well as a set of comparable benchmark metros. The top 19 metros based on 2019 passenger data were used as a benchmark in this analysis. As for destinations, the analysis considers domestic U.S. routes, defined as markets within U.S. territory, and beyond-perimeter routes, defined as domestic markets with stage-length larger than 1,250 mi or flown to San Juan airport (SJU). SJU was included as beyond-perimeter due to its perimeter-rule exemption status.

CO_2 per pax-mile is defined as the grams of CO_2 emitted per each mile that a single passenger flies in each route:

$$\textbf{CO}_2\textbf{ per pax-mile (single leg)} = 1000 \times \frac{\textit{Fuel per mile} \times \textit{miles flown} \times 3.16}{\textit{Flown passengers} \times \textit{miles flown}}$$

Fuel per mile is given by ICAO and depends on the equipment type and miles flown. 3.16 is a factor that converts kilos of jet fuel into kilos of CO_2.

The total CO_2 per pax-mile of a passenger that flies more than one leg (e.g., "N" number of legs) is defined by the following formula:

$$\textbf{CO}_2\textbf{ per pax-mile (multiple legs)} = \mathbf{1000} \times \frac{\sum_{leg=i}^{N}(\boldsymbol{Fuel\ per\ mile} \times \boldsymbol{miles\ flown} \times \mathbf{3.16})_i}{\sum_{leg=i}^{N}(\boldsymbol{Flown\ passengers} \times \boldsymbol{miles\ flown})_i}$$

To factor in the incremental pollution caused by excess miles due to route circuity, the previous formula was adapted into the CO_2 per straight-line pax mile, which is defined by the following formula:

$$\textbf{CO}_2\textbf{ per straight-line pax-mile} = \textbf{CO}_2\textbf{ per pax-mile} \times \frac{\sum_{leg=i}^{N}(\boldsymbol{miles\ flown})_i}{\boldsymbol{Nonstop\ distance}}$$

Note that if a passenger flies a route nonstop, then CO_2 per pax-mile and CO2 per straight-line pax-mile are the same.

Finally, the aggregate CO_2 per straight-line pax-mile of a given metro or airport was calculated using the weighted average of all passengers flying in and out.

Section 7.2 – Evaluation of DCA's feasibility support additional in- and beyond-perimeter slots-pair

Slot recommendation at DCA analysis

To understand how many beyond-perimeter slot pairs could be flown to and from DCA, the report looked at the total number of slot pairs to close the supply-and-demand gap in the Washington, D.C., metro (Section 6.4), and OAG T-100 data (accessed in September 2022). This analysis was based on total slot pair opportunity and capacity data for 2019 and the investigation of the beyond-perimeter seat distribution by the airports of Washington, D.C., metro: BWI, DCA, and IAD.

DCA slot pairs are defined as total slot pairs at Washington D.C., metro (as calculated in Section 6.4) multiplied by DCA's top 25 beyond-perimeter market seat share. The top 25 beyond-perimeter markets are those with the largest supply-demand gap vs. the top 30 to 100 U.S.-wide benchmark, excluding connecting hubs and Hawaii.

TSA wait-time analysis

To ensure DCA had the security capacity for additional slots, the report investigated the average TSA wait times at the top ten metro airports for both peak hours (7 to 10 a.m. and 4 to 7 p.m.) and non-peak hours (6 to 7 a.m., 10 a.m. to 4 p.m., and 7 to 10 p.m.). Specifically, the report looked at the average TSA wait times data for both Tuesday and Saturday for each hour slot from 6 a.m. to 10 p.m., to ensure the analysis factored in both a weekday and a weekend day in the sample and that the period reflected hours when all airports were pushing passengers through security.

The averages of the combined wait times for weekdays and weekends at peak and non-peak hours were calculated, and then the airports were ranked based on how they performed. Then, the average of all the airports at peak and non-peak hours was calculated to see how D.C. airports compared to the average.

DCA slot usage analysis

The main objective of the unused slots analysis, as mentioned in Section 7.2, is to understand if there is an additional unused capacity for beyond-perimeter flights, specifically during off-peak hours. Opening unused slots during off-peak hours to beyond-perimeter flying would have a negligible effect on congestion as these flights are strictly constrained. For this analysis, the report focused on weekday operations in the month of July, historically a peak month, and 2019, as it is the most recent year unaffected by COVID. Looking at a peak month creates a conservative view of the number of potential slots that could be made available for beyond-perimeter flying.

The primary data source for this analysis was the OAG historical flight data. Any flight operations included in this analysis had to include DCA as an origin or destination airport, and valid scheduled arrival and departure times. After this filtering was completed, for every slot hour in the day, the number of flights arriving or departing from DCA was counted for the entire month. For example, during the slot hour of 9 a.m. to 10 a.m., the total number of originating and departing flights during this period was counted for every day in July 2019. Once this counting process was complete, the two counts were summed and reduced by a value of one. This subtraction is a proxy for general aviation, which, per the 2020 GAO report, sees fewer than one flight per hour at DCA.

For every slot hour bucket, the summed and adjusted number of arriving and departing flights was subtracted from 55, the maximum number of allowed scheduled slots. The resulting value is the number of unused slots.

Gate usage analysis

The main objective of the gate utilization analysis, as mentioned in Section 7.2, is to understand the potential to improve capacity utilization at DCA. Daily departures per gate were used to measure gate utilization. To be included in this analysis as a benchmark, the report looked at major airports in the top ten U.S. metros. An airport was considered a major airport if it saw at least 10M enplaned passengers in 2019. The top ten U.S. metros were determined by the sum of all enplaned passengers for 2019 across each metro's associated stations. This analysis calculated all enplanement values for benchmark stations and metros using OAG 2019 T-100 data. For this analysis, the report focused on Tuesday operations in the month of July, historically a peak month, and 2019, as it is the most recent year unaffected by COVID. Looking at a peak month creates a conservative view.

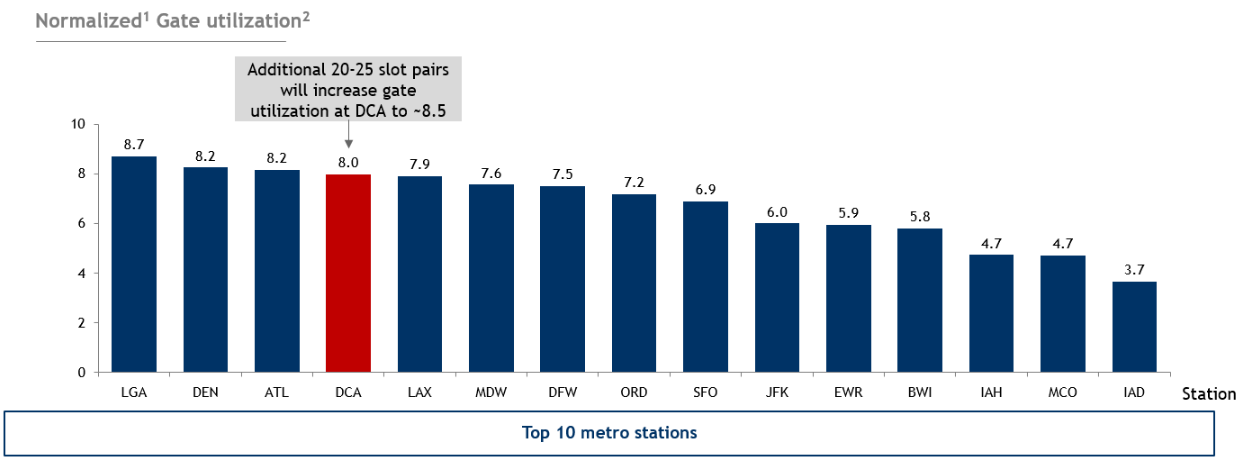
The primary data source for this analysis was the OAG historical flight data and official airport websites for gate information. Any flight operations included in this analysis had to include either DCA or a benchmark station as an origin airport and valid scheduled departure times. An important consideration of gate utilization is the difference in turnaround time (TAT) based on fleet mix and gate capability. Based on industry experience, TAT for North American carriers typically have the following relationship across aircraft types:

- Narrow-body TAT = 1.25 Regional TAT

- Wide-body TAT = 1.5 Regional TAT

Departures were normalized to regional aircraft based on aircraft mix and above-mentioned TAT relationship. Gate utilization was then calculated for each station as average normalized daily departure divided by the total number of gates.

Exhibit #36 – Gate utilization at top ten metros, Jul 2019



1: Turnaround time (TAT) for narrow body and wide body aircrafts is higher than regional aircrafts. Daily departures for each station were normalized to regional aircraft as a baseline. Based on industry benchmarks, TAT for NB and WB are is 1.25 and 1.5 times the TAT for regional aircrafts, respectively 2. Gate utilization is calculated as (Average normalized daily departure/ Total number of gates); benchmark stations include the set of airports with at least 10M enplaned pax from the top 10 busiest metros in the US (by enplaned pax)
Note: This analysis is done for Tuesdays in Jul 2019 to capture peak day and peak month utilization| Source: OAG Ops data Jul 2019, Official airport websites

Noise pollution analysis

To determine if community stakeholders' assertions that bigger planes for beyond-perimeter flights would increase the noise in the area surrounding DCA, this report looked at which planes are flying out of DCA and if there is a noise standard to compare the equipment then.

The FAA has certifications for five stages of aircraft noise, but stage 1 and 2 aircraft are no longer commercially in service. Stage 3 is the highest amount of noise of any commercial aircraft today. The stage 3 standards for takeoff, landing, and sideline measurements range from 89 to 106 decibels (depending on the airplane’s weight and the number of engines). Stage 4 requires a cumulative decrease of ten decibels, while stage 5, the most stringent, requires a decrease of seven decibels from stage 4.

For stage 4 and stage 5 measurements, the margin of individual measuring points must equal stage 3 standards for stage 4 airplanes and not less than one decibel below stage 3 standards for stage 5 airplanes. For stage 4 airplanes, the combination of any two measuring points must have a margin of no less than two decibels below stage 3 standards. These stages allowed this report to effectively compare the noise generated by the equipment typically used at DCA for in-perimeter flights vs. those used for beyond-perimeter flights.

9.2 Consumer Survey

Note for readers: Screening, validation and other path instructions have not been included

Introduction

Thank you for taking the time to complete this survey. All responses will remain confidential and will be viewed in aggregate.

Please click "Continue" to begin.

Section I – Screener

S1. What's your age?

- 0-17
- 18-24
- 25-34
- 35-44
- 45-54
- 55-80
- 81+

S2. What is your gender?

- Male
- Female
- Other/non-binary
- Prefer not to say

S3. Are you of Hispanic or Latino origin?

- Yes, I am of Hispanic or Latino origin?
- No

S4. What is your race or ethnic background?

- White or Caucasian
- Black or African American
- Asian
- American Indian, Alaska Native, Native Hawaiian or other Pacific Islander
- Some other ethnicity *(please specify)*

S5. What was your annual household income in 2021 from all sources of income before taxes? Please consider or estimate how much income your parents/guardians have, if you are still living with them?

- Less than $15,000
- $15,000 to $24,999
- $25,000 to $49,999
- $50,000 to $74,999
- $75,000 to $99,999
- $100,000-$149,999

$150,000-$199,999
$200,000+
Prefer not to answer

S6. What is your current relationship status?
Married
Widowed
Divorced
Single
Separated
In a relationship, but not living with my partner
I prefer not to say

S7. How many people are in your household including yourself?
1
2
3
4
5
6+

S8. What zip code do you live in?

S9. Which of the following have you done in the past year?
Have you [traveled by air] within the past year?
Purchased a car
Eaten at a restaurant
Purchased a cell phone
Flown on an airplane
Purchased groceries
Driven a car
Flown on a blimp
Purchased an 8-track player

S10. Which of the following best describes your role in making decisions regarding your flights when traveling?
Columns:
I am the sole decision maker
I am the primary or joint decision maker, responsible for 50% or more of the decision
I am somewhat involved in the decision, but responsible for less than 50% of the decision
I am not involved in the decision
Rows:
Purchasing appliances for my home
Purchasing flights when traveling
Hiring contractors for my home
Purchasing a new vehicle
Selecting health insurance for myself/my family

S11. How many roundtrip trips by air have you taken in past year?

1
2
3-5
6-10
10+

S12. What was the purpose of your travels in the past year?

Leisure
Business
Both

S13. How many trips have you taken for business in the past year?

1
2
3-5
6-10
10+

S14. How many trips have you taken for leisure in the past year?

1
2
3-5
6-10
10+

S15. How many times have you flown to or from a Washington D.C./Baltimore-area airport (Reagan, Dulles, BWI) within the past year?

0
1
2
3-5
6-10
11+

S16. How many times have you flown to or from the following airports within the past year?

Columns

0
1
2
3-5
6-10
11+

Rows

Reagan National Airport (DCA)
Dulles International Airport (IAD)

Baltimore-Washington International Airport (BWI)

[Only for S8 = Zip code not in the top 10 metro zip codes - NYC, Los Angeles, Chicago Washington D.C, Dallas, Philadelphia, Houston, Atlanta, Miami, Boston zip code]
S17. When traveling from where you live, are there multiple airports you have access to fly out of?
Yes
No

<u>Section II – Travel Satisfaction: Top 10 metro areas</u>

T1. Which of these do you consider to be your preferred airport?
Newark International Airport (EWR)
LaGuardia Airport (LGA)
John F. Kennedy International Airport (JFK)

T2. Which of these do you consider to be your preferred airport?
Los Angeles International Airport (LAX)
John Wayne Airport (SNA)
Hollywood Burbank Airport (BUR)
Ontario International Airport (ONT)
Long Beach Airport (LGB)

T3. Which of these do you consider to be your preferred airport?
O'Hare International Airport (ORD)
Midway International Airport (MDW)
Gary/Chicago International Airport (GYY)

T4. Which of these do you consider to be your preferred airport?
Reagan National Airport (DCA)
Dulles International Airport (IAD)
Baltimore-Washington International Airport (BWI)

T5. Which of these do you consider to be your preferred airport?
Philadelphia International Airport (PHL)
Trenton-Mercer Airport (TTN)

T6. Which of these do you consider to be your preferred airport?
Dallas Fort Worth International Airport (DFW)
Dallas Love Field (DAL)

T7. Which of these do you consider to be your preferred airport?
George Bush Intercontinental Airport (IAH)
William P. Hobby Airport (HOU)

T8. Which of these do you consider to be your preferred airport?
Miami International Airport (MIA)
Fort Lauderdale-Hollywood International Airport (FLL)

T9. Which of these do you consider to be your preferred airport?

Boston Logan International Airport (BOS)
Bradley International Airport (BDL)
Manchester-Boston Regional Airport (MHT)

T10. Which airport do you consider to be your preferred airport?

T11. How likely are you to recommend your preferred airport to your friends and colleagues with 1 being the least likely and 10 being the most likely?

T12. Please rate your level of agreement with the following statements?
Columns:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Rows:

My preferred airport has a convenient location that is easy to get to and from
My preferred airport does not have a convenient location that is easy to get and from
My preferred airport has convenient flight times
My preferred airport has a lot of non-stop flight options
My preferred airport is timely and rarely has delayed or canceled flights
My preferred airport has a variety of different carrier options
My preferred airport offers a strong variety of options for destinations to travel to
My preferred airport has strong public transportation options to and from the airport
My preferred airport makes parking at the airport a seamless and easy process
My preferred airport has sufficient road access to make it easy to drive to or from
My preferred airport has a quick and efficient check-in and security process that enables to get me through in a timely manner
My preferred airport has quality food options and service for the time before flights
My preferred airport has quality lounge offerings

T13. Which of these factors is important in determining which airport you want to use?
Columns:

1. Not important at all
2. Not important
3. Neutral
4. Important
5. Very important

Rows:

Location
Flight cost
Airline carrier choices
Non-stop flight options
Timeliness/minimal delays
Destination options
Convenient flight times

T14. Thinking about your home airport, how satisfied are you with each of the below factors?
Columns:

1. Not satisfied at all
2. Not satisfied
3. Neutral
4. Satisfied
5. Very Satisfied

Rows:

Location
Flight cost
Airline carrier choices
Non-stop flight options
Timeliness/minimal delays
Destination options
Convenient flight times

Section III – DMV Airport Travel Satisfaction

D2. How likely are you to recommend Reagan Airport (DCA) to your friends and colleagues with 1 being the least likely and 10 being the most likely?

D3. Thinking about Reagan National Airport (DCA), rank the top three factors you are most satisfied with at Reagan?

Location
Flight times convenience
Non-stops
Timeliness/lack of delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access
Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight prices
Commute cost

D4. Thinking about Reagan (DCA), rank the top three factors you are least satisfied with at Reagan?

Location
Flight times convenience
Non-stops
Timeliness/delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access

Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight Prices
Commute Cost

D5. How likely are you to recommend Dulles (IAD) to your friends and colleagues with 1 being the least likely and 10 being the most likely?

D6. Thinking about Dulles International Airport (IAD), rank the top three factors you are most satisfied with at Dulles?

Location
Flight times convenience
Non-stops
Timeliness/lack of delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access
Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight Prices
Commute Cost

D7. Thinking about Dulles (IAD), rank the top three factors you are least satisfied with at Dulles?

Location
Flight times convenience
Non-stops
Timeliness/lack of delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access
Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight prices
Commute cost

D8. How likely are you to recommend Baltimore-Washington International (BWI) to your friends and colleagues with 1 being the least likely and 10 being the most likely?

D9. Thinking about Baltimore-Washington International (BWI), rank the top three factors you are most satisfied with at BWI?

Location
Flight times convenience
Non-stops
Timeliness/lack of delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access
Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight prices
Commute cost

D10. Thinking about Baltimore-Washington International (BWI), rank the three factors you are least satisfied with at BWI?

Location
Flight times convenience
Non-stops
Timeliness/lack of delays/cancellations
Carriers/Frequent flier points
Destination offerings
Public transportation access
Parking
Road access
Security/check-in process
Concession offerings
Lounge offerings
Flight prices
Commute cost

D11. What is your preferred Washington D.C./Baltimore area airport?

Reagan (DCA)
Dulles (IAD)
Baltimore-Washington International (BWI)

Section IV – Recent Trips Deep Dives – Most Recent

A1. On your most recent trip, what airport did you fly out of from your home city?

A2. On your most recent trip, did you consider multiple airports?

Yes
No

A3. On your most recent trip, what factor made you choose the airport you chose over another in the area?

Location
Price/Cost
Airline Carrier
Non-stop flight
Convenient flight times
Destination options - international/domestic
Better public transportation
Better parking and access roads
Other

A4. What other airport were you considering flying out of?

A5. If you didn't consider more than one airport on your most recent trip, why did you only consider one airport?

The location of this airport is much more convenient for me than others
This airport is the only one my preferred carrier flies out of
Lack of awareness of other options
Corporate traveler unconcerned with price
Previous flight experience/satisfaction with route/carrier
Other

A6. On your last trip, did you fly from an airport further from home than the closest airport to your home?

Yes
No

A7. What drove the decision to fly from an airport further from home?

Price/Cost
Non-stop options
More convenient flight time
Easier road access
Public transportation options
Airline carrier
Destination options – international/domestic

A8. On your last trip, what was your destination city?

A9. On your last trip, did you have a layover?

Yes
No

A10. If so, what city did you have a layover in?

A11. For this trip, did you take a connecting flight over a non-stop to save money?

Yes
No

A12. On your last trip, did you experience any delays or cancellations?

Yes
No

A13. If you did experience a delay, how long was your delay?

30 mins or less
31-59 mins
1-3 hours
4-6 hours
6-24 hours
Flight cancelled

A14. On your last trip, how many people were in your party including yourself?

1
2
3-5
6-10
11+

A:14. On your last trip, how did you commute to the airport?

Private Car
Rental Car
Taxi
Uber/Lyft
Airport shuttle/limo
Public Transit
Other

A16. On your last trip, how much did your commute cost to the airport?

$0-$9
$10-$30
$31-$50
$51-$75
$76-$100
$101+

A17. On your last trip, how long did it take to commute to the airport from your home?

0-15 minutes
16-30 minutes
31-45 minutes
46-60 minutes
61-90 minutes
91 minutes+

A18. On your last trip, how long did it take to get through the check-in process and security and to your gate after you arrived at the airport?

0-15 minutes
16-30 minutes
31-45 minutes
46-60 minutes
61-90 minutes
91 minutes+

A19. What airline did you fly on your last trip?
[Randomize list]
American Airlines
United
Delta
Southwest
JetBlue
Alaska
Frontier
Spirit
Other

Section IIII – Second Most Recent Trip Deep Dive

B1. On your second most recent trip, what airport did you fly out of from your home city?

B2. On your second most recent trip, did you consider multiple airports?
Yes
No

B3. On your second most recent trip, what factor made you choose the airport you chose over another in the area?
Location
Price/Cost
Airline Carrier
Non-stop flight
Convenient flight times
Destination options - international/domestic
Better public transportation
Better parking and access roads
Other

B4. What other airport were you considering flying out of?

B5. If you didn't consider more than one airport, why did you only consider one airport?
The location of this airport is much more convenient for me than others
This airport is the only one my preferred carrier flies out of
Lack of awareness of other options
Corporate traveler unconcerned with price
Previous flight experience/satisfaction with route/carrier

Other

B6. On your second most recent trip, did you fly from an airport further from home than the closest airport to your home?

Yes
No

B7. What drove the decision to fly from an airport further from home?

[Randomize list]
Price/Cost
Non-stop options
More convenient flight time
Easier road access
Public transportation options
Airline carrier
Destination options – international/domestic

B8. On your second most recent trip, what was your destination city?

B9. On your second most recent trip, did you have a layover?

Yes
No

B10. If so, what city did you have a layover in?

B11. For this trip, did you take a connecting flight over a non-stop to save money?

Yes
No

B12. On your second most recent trip, did you experience any delays or cancellations?

Yes
No

B13. If you did experience a delay, how long was your delay?

30 mins or less
31-59 mins
1-3 hours
4-6 hours
6-24 hours
Flight cancelled

B14. On your second most recent trip, how many people were in your party including yourself?

1
2
3-5
6-10
11+

B15. On your second most recent trip, how did you commute to the airport?
Private Car
Rental Car
Taxi
Uber/Lyft
Airport shuttle/limo
Public Transit
Other

B16. On your second most recent trip, how much did your commute cost to the airport?
$0-$9
$10-$30
$31-$50
$51-$75
$76-$100
$101+

B17. On your second most recent trip, how long did it take to commute to the airport from your home?
0-15 minutes
16-30 minutes
31-45 minutes
46-60 minutes
61-90 minutes
91 minutes+

B18. On your second most recent trip, how long did it take to get through the check-in process and security and to your gate after you arrived at the airport?
0-15 minutes
16-30 minutes
31-45 minutes
46-60 minutes
61-90 minutes
91 minutes+

B19. What airline did you fly on your second most recent trip?
American Airlines
United
Delta
Southwest
JetBlue
Alaska
Frontier
Spirit
Other

Section V – Front/Back Validation

F1. What year were you born?

Section VII – Conclusion

Thank you for taking the time to complete this survey. Your insights will be very helpful to us.


CAA