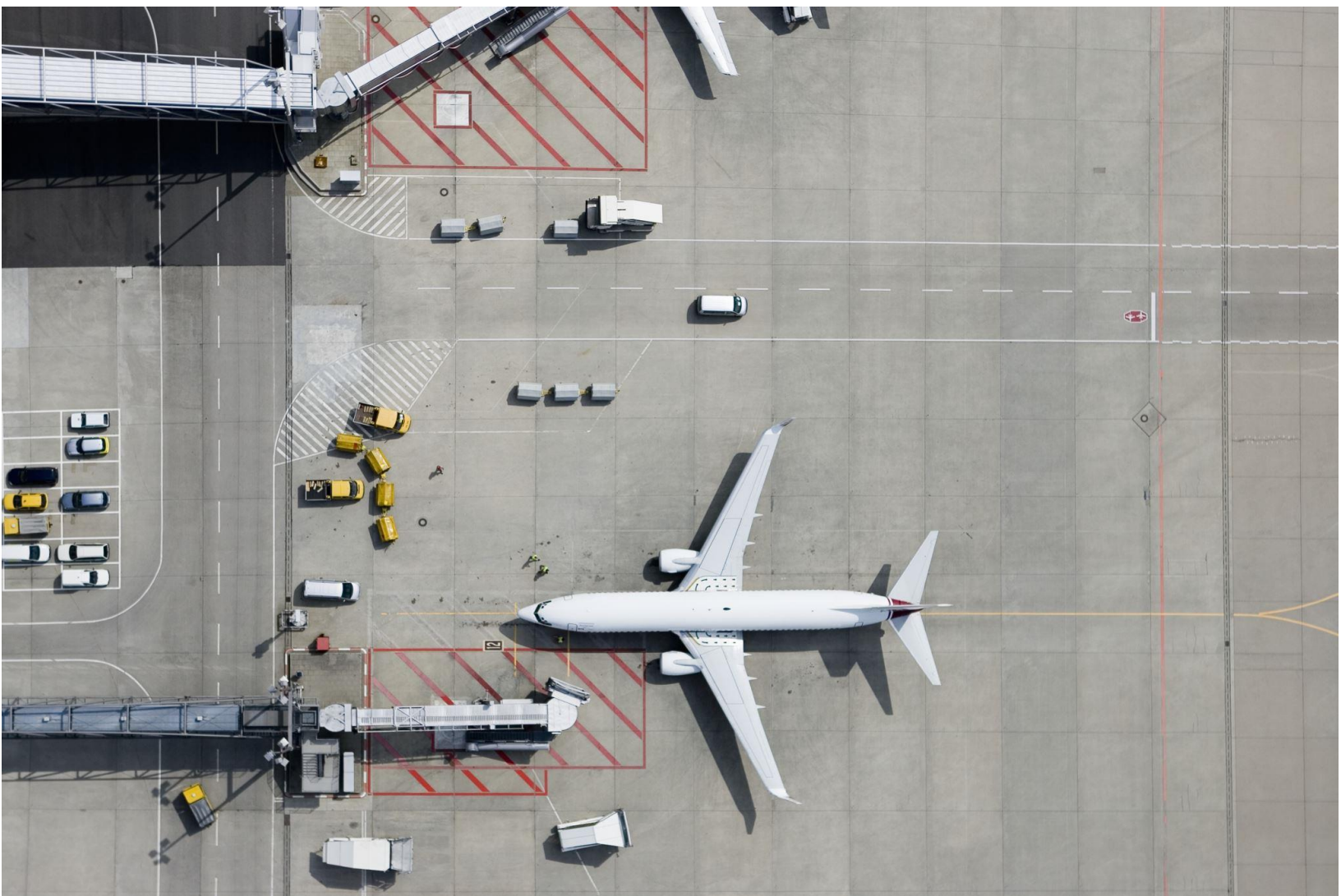


WASHINGTON-BALTIMORE REGIONAL AIR CARGO STUDY

2022 Update

March 2025



National Capital Region
Transportation Planning Board

ABOUT THE TPB

The National Capital Region Transportation Planning Board (TPB) is the federally designated metropolitan planning organization (MPO) for metropolitan Washington. It is responsible for developing and carrying out a continuing, cooperative, and comprehensive transportation planning process in the metropolitan area. Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia and the District of Columbia, local governments, the Washington Metropolitan Area Transit Authority, the Maryland and Virginia General Assemblies, and nonvoting members from the Metropolitan Washington Airports Authority and federal agencies. The TPB is staffed by the Department of Transportation Planning at the Metropolitan Washington Council of Governments (COG).

CREDITS

Author: Olga Perez, Program Planning Specialist

Contributing Editors: Timothy Canan, Program Director, Planning Data and Research; Kenneth Joh, Principal Statistical Survey Analyst

Design: Olga Perez, Program Planning Specialist

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ACKNOWLEDGEMENTS

Staff gratefully acknowledges the continued funding and operational support of our regional airport and air systems planning partners: Federal Aviation Administration (FAA), Maryland Aviation Administration (MAA), Metropolitan Washington Airports Authority (MWAA), District Department of Transportation (DDOT), and Virginia Department of Aviation (DOAV).

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EXECUTIVE SUMMARY

The Metropolitan Washington Council of Governments (COG) last completed the air cargo element of the regional air system plan in 2015. The 2015 Washington-Baltimore Regional Air Cargo Study provided an analysis of existing and future demand for air cargo at Baltimore Washington International Thurgood Marshall Airport (BWI) in Maryland and Washington Dulles International Airport (IAD) in Virginia, as well as an examination of the suitability of current and planned cargo facilities to accommodate future air cargo demand. Moreover, the 2015 Washington-Baltimore Regional Air Cargo Study provided an updated analysis on regional demographic and air cargo trends and forecasts; air cargo facilities and ground access systems at the airports; and current and expected accessibility conditions from the airports to other parts of the region across the region's highway network. This update provides revised data identifying the region's current air cargo needs while anticipating future growth. By analyzing the present circumstances, we aim to project future demands and challenges, ensuring our strategies are forward-looking.

This study was prepared as part of COG's Continuous Airport System Planning (CASP) program, an iterative process that supports the planning, development and operation of airport and airport-serving facilities in the region. The National Capital Region Transportation Planning Board (TPB), which carries out transportation planning at the regional level, oversees the CASP program through its Aviation Technical Subcommittee of the TPB Technical Advisory Committee. The air system planning region is composed of 29 jurisdictions in Maryland, Virginia, West Virginia, and the District of Columbia, and is served by three major commercial service airports: BWI, IAD and Ronald Reagan Washington National Airport (DCA).

To support this growth, the region's air cargo infrastructure must adapt to evolving economic demands. Air cargo has been characterized as the fastest-growing of the transportation modes used for moving freight shipments. Among the various freight modes, which include truck, rail, ship, air and pipeline, air cargo accounts for the smallest share of freight in terms of volume (weight), but it conversely accounts for the largest share in terms of monetary value per unit of weight (typically measured in tons). Air cargo is used to transport high-value commodities and/or commodities requiring just-in-time delivery. These may include medicines and vaccines, fresh food, flowers, or other perishable items, as well as precision-engineered and manufactured electronic components that are frequently part of a larger global supply chain (e.g., semiconductors for consumer devices such as mobile phone, tablets, and televisions).

Historically, the air system planning region has been among the most prosperous in the nation, boasting high educational attainment rates among both residents and workers, as well as leading other regions in developing and utilizing cutting-edge technologies. As such, the demographic and economic composition of the region make it well-suited to benefit from high-value, just-in-time air cargo services. Based on forecasts of population, households and jobs, the planning area is expected to sustain the growth that is underway. Between 2020 and 2050, the number of persons is

expected to increase approximately 25 percent, and households and jobs will each increase by approximately 31 percent. This projected growth points to increased demand for air cargo services in the region provided by BWI and IAD.

Yet as the air system region continues to grow, it faces a challenge: the region's collective population, households, and employers consume more goods than they produce. This trend is resulting in - and will continue to result in - additional in-flows of commodities originating outside of the region (both domestic and international) headed to local destinations by all travel modes (including air cargo) greatly exceeding out-flows of commodities originating within the region being transported to markets outside the region. The region has responded to this trend by successfully marketing its available outgoing belly cargo capacity and connecting a core network of producers, logistics professionals, freight forwarders, and others to have a set of established relationships with regional and single-day drive time producers who need reliable truck-to-air cargo service to move their goods to market.

Moreover, the air cargo industry is forecast to expand worldwide, fueled by long-term increases in worldwide GDP and rapid growth in other markets, such as China, as well as the demand analysis of home deliveries like Amazon, which experienced significant growth during the pandemic. In terms of demand, both BWI and IAD are poised to embrace this growth. BWI has historically served domestic demand for air cargo. That market is expected to continue through the planning period. Contrastingly, IAD's growth in air cargo will be more focused in the international sector during the planning period. Both markets are forecast to grow through the year 2050.

Both BWI and IAD have planned and constructed facilities in a comprehensive manner to ensure efficient transport of air cargo. Both have specialized facilities including climate-controlled warehousing for sensitive items, ramps and apron areas dedicated for air cargo support, Foreign Trade Zones (FTZs), and on-site federal regulators and inspectors to provide necessary clearances for air cargo commodities. BWI and IAD are continuing capital improvement programs designed to establish operational efficiencies and expand capacity for current and future air operations. These improvements are necessary given the presence of competing air cargo services at other airports within a six to eight-hour truck trip from BWI and IAD.

Nevertheless, most of these improvements have been confined to the airports' property footprints or to areas immediately adjacent to the airport. The improvements did not address ground access systems far beyond the airport boundary other than those facilities that directly serve the airports, which can be addressed by the regional surface transportation planning process overseen by the TPB. Accessibility from the airports to other parts of the region will generally be constricted between 2015 and 2050 due to increased traffic volumes, even though regional transportation improvements will be implemented during the period. This constriction has substantial implications for the movement of air cargo goods that are transferred from aircraft onto trucks for final delivery over the highway network. Because air cargo serves a time-sensitive market, impaired accessibility can

undermine efficient delivery of air cargo shipments - and therefore the region's air cargo industry as a whole.

Due to these accessibility issues, it will be important for airport operators and their parent agencies to ensure that ground access considerations are adequately addressed in the regional transportation planning process. At the end of this document, some recommendations have been made based on the analysis of the data gathered. Below is a summary of these recommendations:

- **Invest in Regional Infrastructure Expansion:** To accommodate the anticipated growth in both population and households, regional infrastructure should be a priority for development. Investments in transportation networks, including both roadways and air cargo facilities, will be essential to support the growing demand for goods, services, and housing. Expanding these systems will enhance the region's ability to meet future needs while fostering economic development.
- **Improve Connectivity Between Key Transportation Hubs:** As the region's air cargo market is expected to expand, particularly driven by e-commerce growth, improving the connectivity between major transportation hubs, including airports and freight routes, will be critical. Enhancing road access to and between the region's key airports will streamline the movement of goods, reduce roadway congestion for freight distribution along network, and ensure timely and efficient logistics, supporting the overall growth of the air cargo industry.
- **Support Development in Response to Demographic Shifts:** Current growth projections indicate that between 2020 and 2050, the Washington-Baltimore Air Systems Planning Region will add more than 2 million people and 981 thousand households, suggesting a notable corresponding increase in e-commerce demand. Strategic planning should focus on adapting infrastructure and housing capacity to accommodate this growth. Efforts should be directed toward urban redevelopment, optimizing land use, and enhancing public services to manage growth effectively while maintaining sustainability and quality of life across the region. Moreover, as the region adapts to demographic changes through sustainable urban redevelopment and optimized land use, there is an opportunity to integrate these efforts with air cargo infrastructure planning, ensuring that logistics networks align with evolving community needs and support economic resilience.

INTRODUCTION

The Metropolitan Washington Council of Governments (COG) last completed the air cargo element of the regional air system plan in 2015. The 2015 Washington-Baltimore Regional Air Cargo Study provided an analysis of existing and future demand for air cargo at Baltimore Washington International Thurgood Marshall Airport (BWI) in Maryland and Washington Dulles International Airport (IAD) in Virginia, as well as an examination of the suitability of current and planned cargo facilities to accommodate future air cargo demand. Moreover, the 2015 Washington-Baltimore Regional Air Cargo Study provided an analysis on regional demographic and air cargo trends and forecasts; air cargo facilities and ground access systems at the airports; and current and expected accessibility conditions from the airports to other parts of the region across the region's highway network. The 2022 Air Cargo Element Update builds upon the 2015 study, adding an analysis of home deliveries like Amazon, which grew significantly during the pandemic and impacted regional cargo behavior at IAD and BWI.

Regional Air System Planning

COG, in cooperation with the Federal Aviation Administration (FAA), the District of Columbia Department of Transportation, (DDOT), the Maryland Aviation Administration (MAA), and the Metropolitan Washington Airports Authority (MWAA), has conducted a metropolitan airport system planning process since 1978. This program is closely coordinated with the National Capital Region Transportation Planning Board (TPB), which plays a key role in regional transportation planning, including air cargo and freight mobility. The goal of this Continuous Airport System Planning (CASP) program is to provide a process that supports the planning, development, and operation of airport and airport-serving facilities in a systematic framework for the Washington-Baltimore region.

Transportation planning at the regional level is coordinated in the Washington area by the National Capital Region Transportation Planning Board (TPB), which is staffed by COG's Department of Transportation Planning. The TPB is composed of representatives of the transportation agencies of the states of Maryland, Virginia, and the District of Columbia, local governments, the Washington Metropolitan Area Transit Authority (WMATA), the Maryland and Virginia General Assemblies, and members from the MWAA and federal agencies. Established in 1965, the TPB is the official Metropolitan Planning Organization (MPO) designated by the federal government to carry out the comprehensive regional transportation planning process under the authority of the Federal-Aid Highway Act of 1962, as amended. The TPB's Technical Advisory Committee includes several subcommittees, including the Aviation Technical Subcommittee (ATS), which provides oversight for the CASP program. The Washington-Baltimore Regional Air Cargo Study 2022 was prepared as an element of the CASP work program with the oversight of the Aviation Technical Subcommittee.

As the MPO, the TPB prepares federally mandated Metropolitan Transportation Plan (MTP) and the Transportation Improvement Program (TIP), both most recently updated in 2022, and the next MTP -

Visualize 2050- is currently under development with a key step being the preparation of forecasts. Air passenger forecasts are directly used in the development of forecasts of locally originating ground access (passenger) vehicle trips to the region's three commercial airports. These forecasts of airport trips are included in the travel demand modeling for MTP. While air cargo forecasts are not directly included in the MTP modeling, they are indirectly represented in the origin and destination forecasts for truck travel by Transportation Analysis Zones (TAZs), which model the movement of freight to and from the airports.

As part of this broader regional planning framework, in the Baltimore region, The Baltimore Regional Transportation Board is the Metropolitan Planning Organization (MPO) for the Baltimore region. The BRTB is directly responsible for making sure that any federal money spent on existing and future transportation projects and programs is based on a continuing, cooperative and comprehensive (3-C) planning process. It is composed by the cities of Annapolis and Baltimore, the counties of Anne Arundel, Baltimore, Carroll, Harford, Howard, and Queen Anne's and the Maryland Department of Transportation, the Maryland Department of the Environment, the Maryland Department of Planning, Maryland Transit Administration, and Annapolis Transit.

The Aviation Technical Subcommittee deals specifically with aviation issues related to transportation planning. Such issues include air cargo, ground access travel time, as well as the travel characteristics of regional air passengers. The TPB also has a very active Regional Freight Subcommittee, which focuses on the role of freight - including all modes - in regional transportation. Because air cargo represents one of the modes to transport freight, it is a subject of interest to both the Aviation Technical Subcommittee and the Freight Subcommittee.

Washington-Baltimore Air System Planning Region

Cities and counties making up the Washington-Baltimore air service market area, or the air system planning area, encompass an area larger than those normally within the purview of the Metropolitan Washington Council of Governments (COG) and the Baltimore Metropolitan Council (BMC). From north to south, the air system planning area stretches from Harford County, Maryland on the Susquehanna River at the Pennsylvania border to Spotsylvania County, Virginia, halfway between Washington, DC, and Richmond, VA. From east to west, the air system planning region extends from the Chesapeake Bay to beyond the front range of the Appalachian Mountains. As shown in Figure 1, the 29 jurisdictions and independent that make up the Washington-Baltimore air system planning region include the three major airports: BWI, DCA, and IAD. This update will provide valuable insights to inform infrastructure development and air cargo strategy, ensuring the region can meet the growing demands of the global economy.

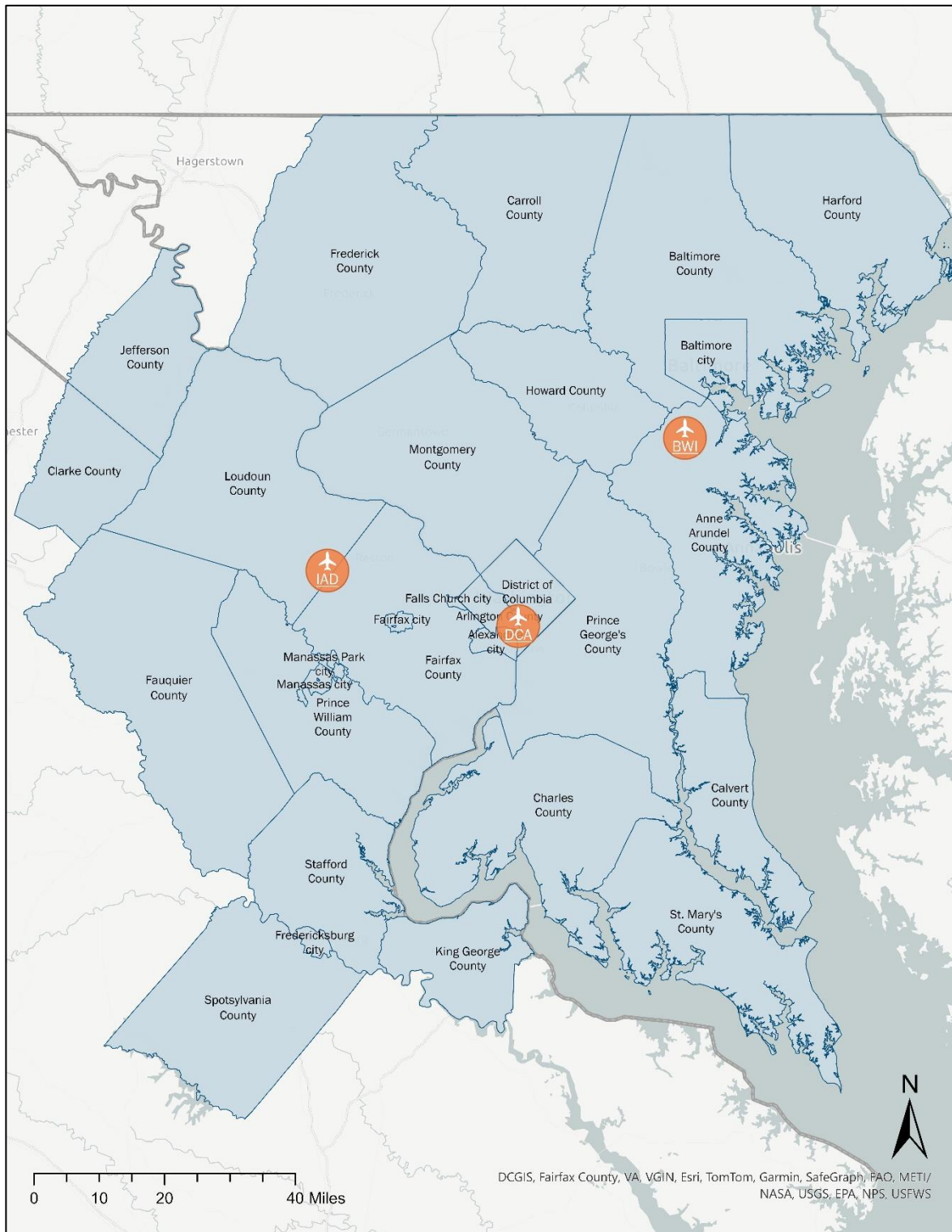


Figure 1. Air System Planning Region Map

Source: MWCOG

AIR CARGO

There are several transport options, or “modes,” when considering freight movement in the region. Commodities can be transported by truck, rail, ship, pipeline, and by air. Appendix 1 contains the mode description from the Freight Analysis Framework (FAF). Air commodities are generally flown for one leg of the commodity’s multimodal journey. These commodities typically reach their final destination by surface transportation, typically on trucks. Consumer goods are often discharged at warehouses in a metropolitan region before being transported in another truck to local vendors. Consumers are able to check the labels and investigate where their products originate. Airports serve as significant economic engines for regional and local economies. As shown in Table 1, nationwide, air cargo is experiencing a robust increasing trend, with both its weight and value showing consistent growth.

In 2017, air cargo represented 6 million tons, accounting for 0.03 percent of total freight by weight. By 2023, it increased 16.7 percent to 7 million tons while keeping its 0.03 percent share of total freight. The projection indicates a further increase to 13 million tons by 2050, a 116.7 percent increase from 2017, representing 0.05 percent of the total freight. In terms of value, air cargo accounted for 6.5 percent of total freight value in 2017 to \$1,226 billion. Furthermore, it increased 0.7 percent in 2023 to \$1,234 billion, with an anticipated rise from 2017 of 103.9 percent reaching \$2.5 billion by 2050, accounting for 6.9% of the total share. These numbers underscore the increasing importance of air cargo in transporting high-value goods, solidifying its role in global trade dynamics.

Table 1. Weight and Value Comparison for all Freight Modes - Nationwide

Mode Name		Weight (Tons - Millions)			Value (Billions Of 2017 \$)		
		2017	2023	2050	2017	2023	2050
Truck	Tons	12,800	12,975	19,304	12,017	11,836	22,475
	%	65%	64%	67%	64%	63%	62%
Rail	Tons	1,616	1,598	1,911	404	391	716
	%	8%	8%	7%	2%	2%	2%
Water	Tons	915	797	1,238	360	295	468
	%	5%	4%	4%	2%	2%	1%
Air (Includes Truck-Air)	Tons	6	7	13	1,226	1,234	2,500
	%	0.03%	0.03%	0.05%	6.5%	6.6%	6.9%
Multiple Modes and Mail	Tons	688	645	1,189	3,926	3,941	8,795
	%	3%	3%	4%	21%	21%	24%
Pipeline	Tons	3,451	4,021	5,102	928	1,010	1,238
	%	17%	20%	18%	5%	5%	3%
Other and Unknown	Tons	102	84	44	45	28	92
	%	1%	0%	0%	0%	0%	0%
No Domestic Mode	Tons	209	114	89	0	0	0
	%	1%	1%	0%	0%	0%	0%
Total	Tons	19,786	20,240	28,890	18,907	18,734	36,283

Source: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5, 2023, <https://www.bts.gov/faf>. Accessed: May 2024

Data do not include imports and exports that pass through the United States from a foreign origin to a foreign destination by any mode.

Based on data extracted from the FAF, version 5.5, 2023, the price per ton by mode of transportation was calculated. An analysis of the price per ton for each transportation mode in Table 2 revealed that air cargo has a significantly higher price compared to the other modes, with a cost of 179.29 USD per ton in 2023. The next highest price is for Multiple Modes and Mail, which is 6.11 USD per ton, 173.18 USD lower than air cargo. The remaining transportation modes recorded prices per ton below 1 USD.

An examination of the projected trends to 2050 indicates that all modes are expected to increase in price, except for the pipeline. While air cargo and Multiple Modes and Mail will continue to have the highest prices per ton, the mode expected to experience the greatest growth is Other and Unknown, with an anticipated increase of 527 percent, followed by rail at 53 percent. Air cargo is expected to grow steadily at 2 percent by 2050, continuing to be the highest value per ton with a great difference over all the rest of the modes.

Table 2. Value per Ton by Mode of Transportation - Nationwide

Value per Ton by Mode (US Dollars)				
Mode Name	2017	2023	2050	% Chg 2023 - 2050
Truck	0.94	0.91	1.16	28%
Rail	0.25	0.24	0.37	53%
Water	0.39	0.37	0.38	2%
Air (Includes Truck-Air)	204.33	179.29	192.31	9%
Multiple Modes and Mail	5.71	6.11	7.40	21%
Pipeline	0.27	0.25	0.24	-3%
Other and Unknown	0.44	0.33	2.07	527%

Other and Unknown includes movements not elsewhere classified such as flyaway aircraft, and shipments for which the mode cannot be determined

Source: MWCOG

Air Cargo Characteristics and Regional Air Cargo Market

Air cargo involves the shipment of commercial freight transported in domestic and international freighter aircraft or even passenger aircraft. Air cargo is used for special commodities that must be transported quickly due to the high value or perishability of the commodity or the speed the commodity needs to be transported over long hauls. Examples of air cargo include goods such as computer chips, automotive parts, pharmaceuticals, medical supplies, and perishable commodities like fruits, fish, vegetables and flowers.

The Washington-Baltimore region is served by the three major airports (BWI, IAD, and DCA), as shown previously in Figure 1. While these three airports are more widely known for their role in transporting thousands of travelers on a daily basis, for movement of goods, or cargo, DCA represents a minor role in the region, with a share of only 0.30 percent in 2023, as shown in Table 3 below. Moreover, the data shows significant fluctuations in annual freight activity from 2017 to 2023. BWI saw a steady increase in freight activity, peaking at 280,690 metric tons in 2021, before declining to 244,365 metric tons in 2023. IAD experienced a notable decrease, starting at 298,683 metric tons in 2017, dropping significantly to 197,916 metric tons in 2020, and stabilizing around 213,162 metric tons by 2023. DCA, with the lowest freight activity, consistently handled under 3,000 metric tons annually. Notably, there was a spike in 2017, when cargo throughput reached 2,830 metric tons. However, since then, the volume has significantly declined, decreasing by more than half to 1,371 metric tons in 2023.

Table 3. Freight Activity at Cargo Airports Serving the Region

Year		Freight Activity at Cargo Airports Serving the Region Total (metric tons)		
		BWI	IAD	DCA
2017	Ton	167,875	298,683	2,830
	%	36%	64%	0.60%
2018	Ton	199,548	300,936	2,336
	%	40%	60%	0.46%
2019	Ton	226,954	273,385	2,178
	%	45%	54%	0.43%
2020	Ton	269,979	197,916	1,326
	%	58%	42%	0.28%
2021	Ton	280,690	225,450	1,307
	%	55%	44%	0.26%
2022	Ton	256,597	226,096	1,689
	%	53%	47%	0.35%
2023	Ton	244,365	213,162	1,371
	%	53%	46%	0.30%

Source: BWI statistics, DCA and IAD Air traffic statistics; National Capital Region Freight Plan, 2023 Update

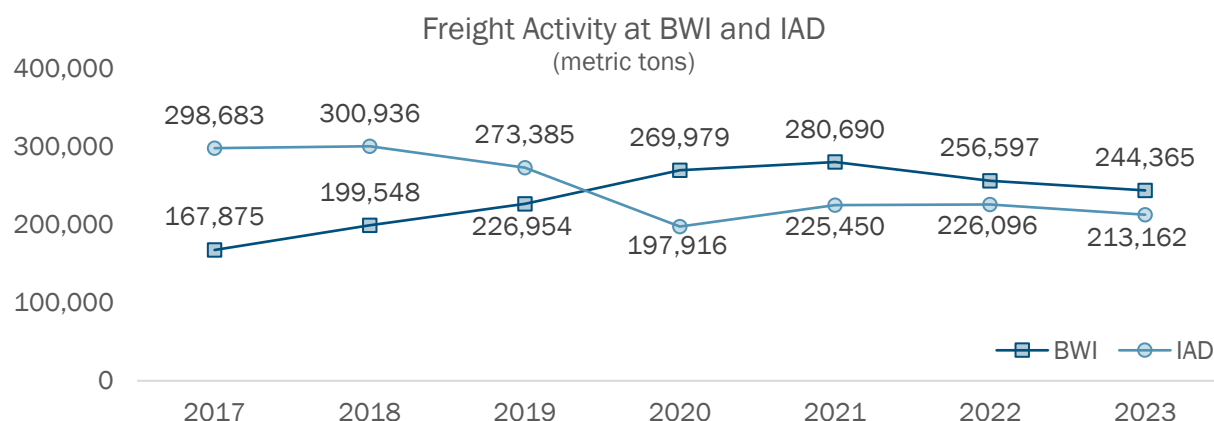


Figure 2. Historical Cargo Activity Trends BWI and IAD

Source: BWI statistics, DCA and IAD Air traffic statistics; National Capital Region Freight Plan, 2023 Update

As shown in Figure 2, an analysis of cargo operations at both airports reveals differences in how they are affected by external factors due to the nature of their cargo handling operations. BWI primarily manages dedicated cargo operations, which tend to be more stable and less influenced by fluctuations in passenger traffic. Since these dedicated cargo flights operate independently of passenger flights, BWI can maintain more consistent cargo volumes, even when other sectors of the aviation industry experience disruptions.

In contrast, IAD predominantly manages belly cargo, which is transported in the cargo holds of commercial passenger flights. This type of cargo is highly dependent on the volume of passenger flight activity, making it more susceptible to disruptions in passenger travel. As a result, fluctuations in commercial passenger flights have a direct and significant impact on cargo volumes at IAD. During the COVID-19 pandemic, this reliance on passenger flights became a critical vulnerability, as the sharp decline in air travel drastically reduced the availability of belly cargo space, leading to a substantial drop in cargo volumes. This distinction between dedicated cargo at BWI and belly cargo at IAD highlights the differing factors that influence the performance of each airport's cargo operations, with IAD being more directly affected by the pandemic's impact on passenger traffic.

The 2023 North American Airport Traffic Summary published by Airports Council International (ACI), as shown in Figure 3, include distribution in the cargo type in 2023 among the two regional airports. When analyzing the distribution of cargo, three primary categories are considered based on the North America Rank (NAM): Mail, Domestic Freight, and International Freight, presented below in Figure 3. The data shows how these categories are distributed across two major airports in the region: BWI and IAD.

The breakdown of cargo volumes reveals that BWI handles 6 percent of International Freight, 71 percent of Domestic Freight, and 13 percent of Mail, while IAD manages 94% of International Freight, 29 percent of Domestic Freight, and 87 percent of Mail. This data highlights that Dulles is

the dominant airport for International Freight and Mail, whereas BWI serves as the primary hub for Domestic Freight.

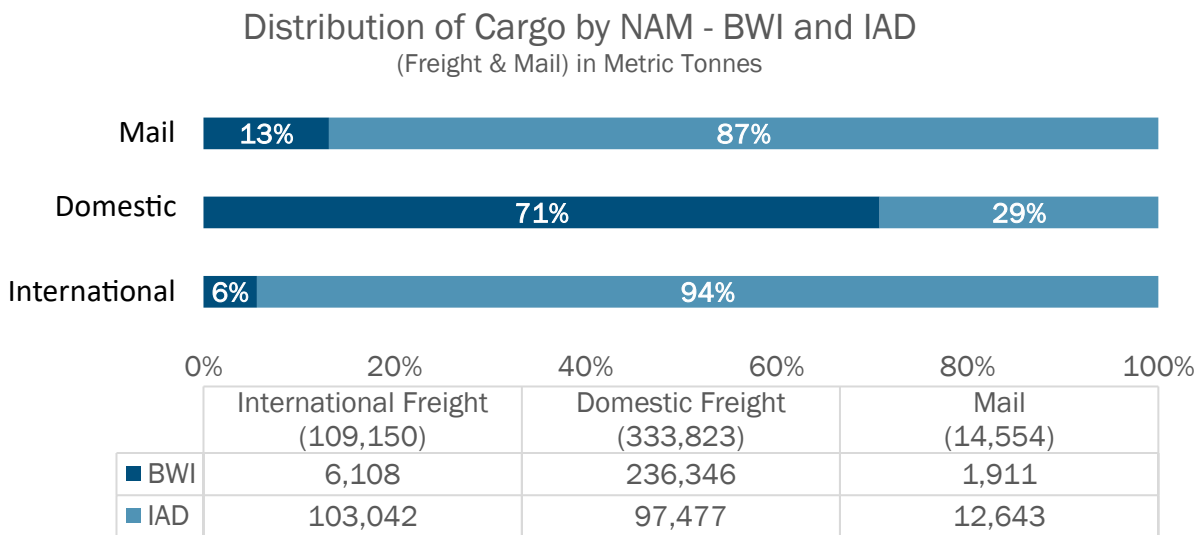


Figure 3. Distribution of Cargo by NAM - BWI and IAD

Source: ACI-NA, 2023 North American Airport Traffic Summary (Cargo).

The distribution of cargo between BWI and IAD supports other data that underscores the complementary roles each airport plays in the regional cargo landscape, which is further analyzed in the report. While Dulles dominates International Freight and Mail, BWI takes the lead in handling Domestic Freight. This division highlights how each airport specializes in different areas, effectively meeting the diverse needs of the region's cargo operations and contributing to a well-balanced and efficient transportation network.

Moreover, the region experienced a reduction in air cargo during 2022 and 2023, reflecting a global trend. Specifically, the decline in cargo in North America can be attributed to a decrease in air cargo traffic between North America and Europe, as well as North America and Asia (IATA, 2023).

BALTIMORE/WASHINGTON INTERNATIONAL THURGOOD MARSHALL AIRPORT

From 2017 to 2023, air cargo at BWI exhibited notable growth and fluctuations as shown in Table 4. Starting with 167,875 metric tons in 2017, the cargo volume increased significantly by 18.9 percent in 2018, followed by another rise of 13.73 percent in 2019. The upward trend continued with an 18.95 percent increase in 2020, and a more modest growth of 3.97 percent in 2021, peaking at 280,690 metric tons. However, this was followed by declines of 8.57 percent in 2022 and 4.76 percent in 2023, ending at 244,365 metric tons. These decreases may be attributed to the COVID-19 pandemic's impact on air cargo demand, which included a surge in 2020-2021 due to increased e-commerce and supply chain disruptions. As global supply chains stabilized in 2022, demand normalized, leading to reduced air cargo volumes (Walton Insights, 2020). Additionally, economic slowdowns, such as inflation and reduced consumer demand, may have also contributed (Supply Market Insights, 2023). Despite the recent decreases, BWI's air cargo activity in 2023 remains substantially higher than in 2017, reflecting overall growth over the period.

Table 4. BWI Cargo growth by year

Growth Compared to the Previous Year (Metric Tons)							
Year	2017	2018	2019	2020	2021	2022	2023
Ton	167,875	199,548	226,954	269,979	280,690	256,597	244,365
% Growth	-	18.9%	13.7%	19.0%	4.0%	-8.6%	-4.8%

When examining the types of cargo, Figure 4 illustrates the distribution between freight and mail at BWI. A significant disparity is observed between them, with the highest percentage of mail recorded in 2018, accounting for 5%. Overall, BWI has experienced a gradual decrease in mail, from 4% in 2017 to 1% in 2023, further increasing the identified disparity.

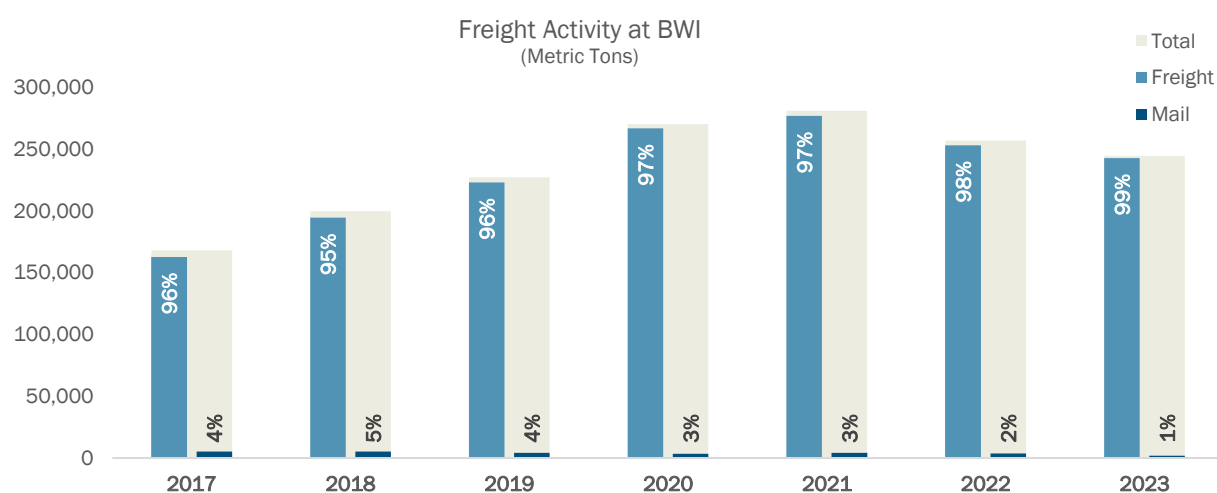


Figure 4. Freight Activity at BWI

Source: BWI Airport, Statistics, <https://bwiairport.com/flying-with-us/about-bwi/statistics/>

WASHINGTON DULLES INTERNATIONAL AIRPORT

In Table 5, From 2017 to 2023, air cargo at IAD experienced notable fluctuations. In 2017, IAD handled 298,683 metric tons, increasing slightly by 0.76 percent to 300,936 metric tons in 2018. In 2019, the volume declined by 9.17 percent to 273,385 metric tons, followed by a significant drop of 27.61 percent in 2020 to 197,916 metric tons. Cargo volume then recovered by 13.91 percent in 2021 to 225,450 metric tons and remained relatively stable with a marginal increase of 0.29 percent in 2022 to 226,096 metric tons. By 2023, the volume had decreased again by 5.73 percent to 213,162 metric tons. Despite these fluctuations, IAD's air cargo volume in 2023 was lower than in 2017, indicating an overall decrease over the period.

Table 5. IAD Cargo growth by year

Growth Compared to the Previous Year (Metric Tons)							
Year	2017	2018	2019	2020	2021	2022	2023
Ton	298,683	300,936	273,385	197,916	225,450	226,096	213,162
% Growth	-	0.76%	-9.17%	-27.61%	13.91%	0.29%	-5.72%

When examining the types of cargo, Figure 5 illustrates the distribution between freight and mail at IAD, revealing a similar disparity to that observed at BWI. However, at IAD, the percentage of mail has been more consistent, remaining at 6 percent throughout 2019, 2020, and 2021. A decrease from 6 percent to 4 percent occurred in 2022, followed by a recovery to 5 percent in 2023, indicating a more linear and stable trend.

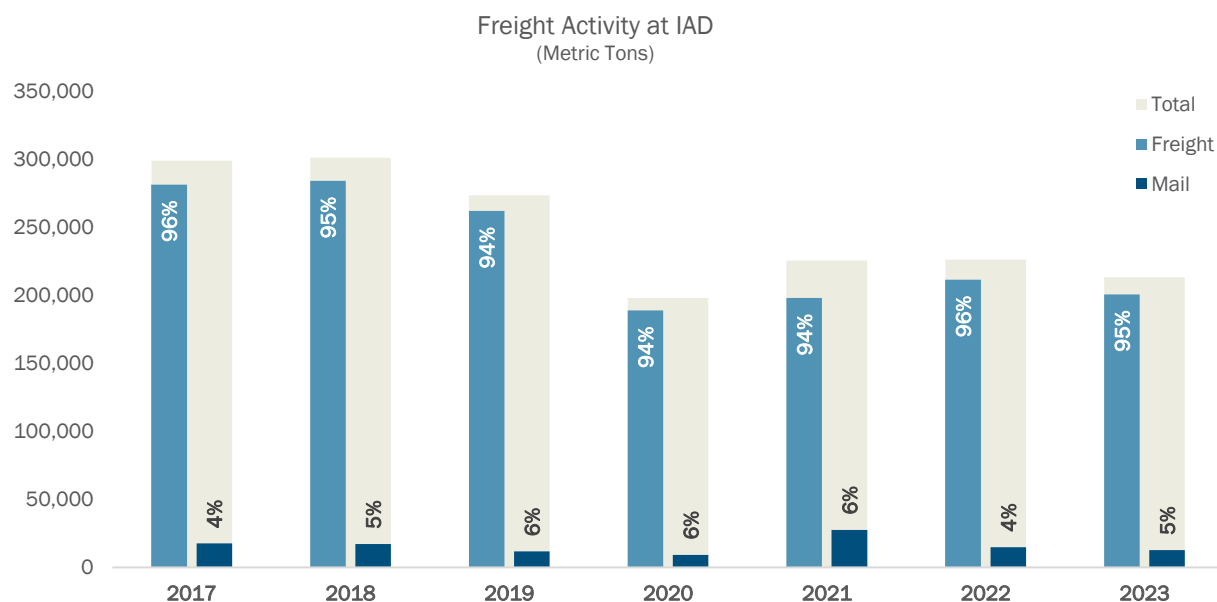


Figure 5. Freight Activity at IAD

Source: 1. MWAA, Air Traffic Statistics, <https://www.mwaa.com/financial-statistics/dulles-air-traffic-statistics/2024-dulles-air-traffic-statistics>

RONALD REAGAN WASHINGTON NATIONAL AIRPORT

DCA is one of the three major airports in the Washington-Baltimore Air System Planning Region, alongside IAD and BWI. However, DCA's role in the air cargo market has greatly diminished due to its smaller size and limited capacity for expansion in comparison to IAD and BWI.

Figure 6 shows that in 2023, BWI and IAD led the regional air cargo market, accounting for 53.25 percent and 46.45 percent of the total cargo volume, respectively. Together, these two airports manage nearly all of the region's air freight, emphasizing their critical roles in the distribution of the air cargo in the Washington-Baltimore region. In contrast, and as described previously, DCA's contribution to the air cargo market was marginal, representing only 0.30 percent of the total freight. This low share highlights DCA's limited role in cargo operations, primarily due to physical space constraints and regulatory limits that prevent further expansion of its cargo facilities. As a result, DCA has shifted its primary focus to passenger travel, optimizing its operations to meet regional demand for commercial flights.

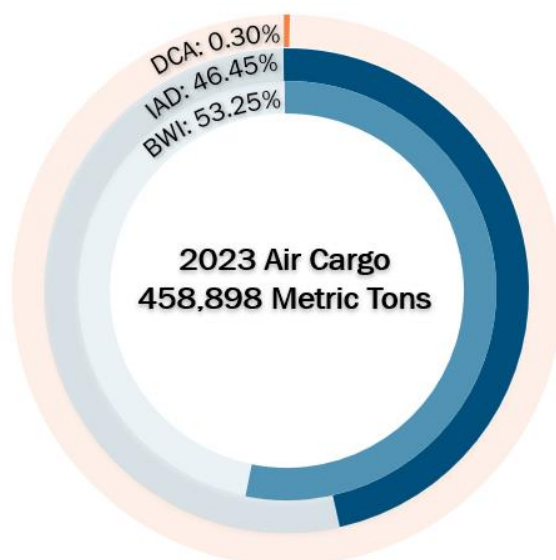


Figure 6. Distribution of Cargo among IAD, BWI, and DCA in 2023

Source: 1. MWWA, Air Traffic Statistics, <https://www.mwaa.com/financial-statistics/dulles-air-traffic-statistics/2024-dulles-air-traffic-statistics/>; 2. BWI Airport, Statistics, <https://bwiairport.com/flying-with-us/about-bwi/statistics/>

Table 6 shows a clear falling trend in air cargo at DCA from 2017 to 2023, marked by significant fluctuations in volume and a major drop in 2020, when cargo decreased by 39.12 percent in a single year. In 2017, DCA handled 2,830 metric tons, which declined by 17.45 percent to 2,336 metric tons in 2018. This descending trend continued in 2019, with a further decrease of 6.77 percent to 2,178 metric tons. The most significant decline occurred in 2020, with cargo volume dropping greatly by 39.12 percent to 1,326 metric tons.

In 2021, the volume remained relatively stable, with a slight decrease of 1.43 percent to 1,307 metric tons, followed by a solid recovery in 2022 with a 29.27 percent increase to 1,689 metric tons. However, by 2023, cargo volume had declined again by 18.84 percent, reaching 1,371 metric tons. Overall, air cargo at DCA experienced a marked decline over the period from 2017 to 2023, with no sustained increases. Although the 2022 recovery was significant, it was not enough to approach 2017 levels. Comparing 2017 to 2023, DCA's air cargo volume saw a substantial overall decrease of 51.6 percent.

Table 6. DCA Cargo growth by year

Growth Compared to the Previous Year (Metric Tons)							
Year	2017	2018	2019	2020	2021	2022	2023
Ton	2,830	2,336	2,178	1,326	1,307	1,689	1,371
% Growth	-	-17.45%	-6.77%	-39.12%	-1.43%	29.27%	-18.84%

As a result, many of the facilities and other infrastructure at DCA have been developed to support air passenger operations at DCA, not air cargo operations. Compared to BWI and IAD, the amount of available land is substantially limited at DCA, making it difficult to develop large-scale air cargo facilities (either on-site or off-site) that would be necessary to make it competitive with BWI and IAD. Moreover, DCA is further constrained by the insufficient runway length needed to accommodate long-haul cargo flights to destinations like Asia, Europe, and other distant locations. As a result, air cargo service at DCA is comparatively insignificant, and not likely to change. Expansion of air cargo capacity at DCA would occur at the expense of air passenger service, which is not likely at DCA given the popularity (and subsequent profitability) of DCA as a passenger airport.

These constraints have significantly impacted its ability to handle large volumes of air cargo. Additionally, DCA's location within an urban setting further restricts its capacity for growth and expansion. The surrounding urban infrastructure and land development, along with the presence of noise regulations, limit the airport's ability to increase cargo operations or expand its facilities. As a result, regional air cargo operations and prospects for future expansion are rather negligible at DCA, underscoring its nearly exclusive role of serving the commercial air passenger market. Consequently, for the purposes of this report, DCA will be excluded from the air cargo data analysis, with the analysis focusing solely on data gathered from IAD and BWI.

INTERNATIONAL AIR CARGO

Airports are similar to ports in that they serve as entry border gateways into the country. As such, it is important to have nearby cargo storage facilities and to maintain efficient surface transportation for truck or rail to move cargo to and from the airport. With the growth expected in air cargo markets, airport planners need to consider the ground access that shippers need to transport the cargo. With growing international economic trade, numerous agencies predict a significant expansion in both domestic and international air cargo markets. Based on data gathered from the Federal Highway Administration (FHWA) Freight Analysis Framework (FAF), as presented in Table 7 below, international cargo markets exhibit higher nationwide freight growth rates compared to regional trends, especially in the projected period from 2023 to 2050. Both nationwide and regional air freight show substantial growth, but the increase is more pronounced at the regional level by 2050. Nationwide other freight categories continue to grow significantly, while regional other freight shows a projected lower growth in weight but a strong increase in value.

Moreover, when comparing international air cargo trends presented in table 7 at both national and regional levels from 2017 to 2023, distinct patterns emerge. Nationally, growth is observed, while regionally, there is a decrease. In contrast, from 2023 to 2050, both national and regional trends are expected to grow, with slightly bigger growth anticipated in the regional sphere, offsetting earlier declines. Furthermore, from 2017 to 2023, air cargo nationwide grew moderately by 5 percent, while the region experienced a 14 percent decrease over the same period. Moreover, by 2050 air cargo is projected to grow by 94 percent nationwide, and 138 percent regional wide. In terms of value, national international air freight increased by 1 percent from 2017 to 2023 and is expected to increase by 101 percent by 2050. Regionally, the value of air freight declined by 2 percent from 2017 to 2023 but is projected to see substantial growth of 111 percent by 2050.

Table 7. Comparison International Cargo - Nation vs. Region.

			Air (includes truck-air)		Other Freight Modes		Total
			% Change		% Change		
US	Weight Tons (millions)	2017	4	-	2,304	-	2,309
		2023	5	5%	2,369	3%	2,374
		2050	9	94%	3,970	68%	3,979
	Value (billions)	2017	1,067	-	2,758	-	3,825
		2023	1,081	1%	2,776	1%	3,857
		2050	2,167	101%	5,694	105%	7,862
REGION	Weight Tons (thousand)	2017	140	-	27,846	-	27,986
		2023	120	-14%	34,491	24%	34,612
		2050	286	138%	50,760	47%	51,047
	Value (millions)	2017	11,605	-	52,555	-	64,160
		2023	11,345	-2%	50,060	-5%	61,404
		2050	23,956	111%	109,984	120%	133,940

Source: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5, 2023, <https://www.bts.gov/faf>

Note: Other Freight Modes comprises Truck, Rail, Water, Multiple modes & mail, Pipeline, and Other and unknown.

These trends indicate robust growth in both areas, with regional air cargo expected to have a percentual growth higher than the national air cargo by 2050. These trends reflect broader economic dynamics and the evolving demands of the logistics and transportation sectors, highlighting the crucial role of freight in supporting economic growth and development.

Moreover, when analyzing the role of international cargo for airports in the national sphere, both BWI (Baltimore/Washington International) and IAD (Washington Dulles International) are listed in the 2023 North American Airport Traffic Rankings for air cargo. In terms of general cargo, BWI ranks 28th, while IAD ranks 29th. However, this trend shifts significantly when focusing specifically on international cargo. As shown in Figure 7, which compares international cargo tonnage at BWI and IAD with the top five airports in the rankings, IAD ranks 19th with 103,042 tons of international freight cargo, whereas BWI ranks 35th with only 6,108 tons.



Figure 7. Comparison of Int'l. Cargo Values: Top 5 Airports in North America in 2023 vs. IAD and BWI
Source: ACI-NA, 2023 North American Airport Traffic Summary (Cargo).

The 2023 North American Airport Traffic Summary published by Airports Council International (ACI), as shown in Table 8, include percentage changes comparing 2023 to 2022, and one important highlight is that when comparing BWI and IAD with the top five ranked airports, most of them show a decline in international cargo volume. Specifically, IAD experienced an 11 percent decline. In contrast, according to the same comparison, JFK and BWI are the only airports that recorded an increase, with BWI demonstrating the most significant growth. Not only did BWI achieve the highest increase within this comparison group, but it also recorded the largest growth in the entire NAM rankings, with a 101 percent increase compared to 2022. For more details, please refer to Appendix 2.

Table 8. Comparison of Int'l. Cargo Values: Top 5 Airports in North America in 2023 vs. IAD and BWI

Airport Name	NAM Rank	Code	Int'l Freight	% Chg 2023 - 2022
Ted Stevens Anchorage International Airport	2	ANC	2,346,567	0%
Miami International Airport	4	MIA	2,021,122	-1%
Los Angeles International Airport	5	LAX	1,351,005	-15%
O'Hare International Airport	6	ORD	1,336,937	-17%
John F. Kennedy International Airport	8	JFK	999,061	2%
Washington Dulles International Airport	29	IAD	103,042	-11%
Baltimore/Washington International Thurgood Marshall Airport	28	BWI	6,108	101%

Source: ACI-NA, 2023 North American Airport Traffic Summary (Cargo).

WASHINGTON-BALTIMORE REGION INDUSTRIAL AND DEMOGRAPHIC PROFILE

POPULATION

The Washington-Baltimore region's status as a major population, employment, and consumer center underscores its critical role on the East Coast and nationwide. In 2023, the Washington-Baltimore Combined Statistical Area (CSA) was ranked as the third most populated region in the United States, highlighting its significant demographic weight. This high population density reflects the region's economic vitality and its appeal as a place to live and work, though it is likely the diversity of industries and employment opportunities that truly drives this attractiveness. A varied economic base is essential for creating a dynamic job market, which in turn supports both local and regional growth. Additionally, the population trends of these Combined Statistical Areas (CSAs) offer important insights into their long-term economic trajectories. For example, when comparing rankings from 2013, the Chicago CSA was in 3rd position, but by 2023, it had been surpassed by the Washington CSA, which saw a modest increase in population while Chicago's declined. A comparison of these areas is provided in Appendix 3. This shift highlights the evolving patterns of economic development and migration across different regions.

Figure 8, which presents the 2023 population estimates for the largest metropolitan areas, further emphasizes the prominence of the Washington-Baltimore CSA in the national panorama.

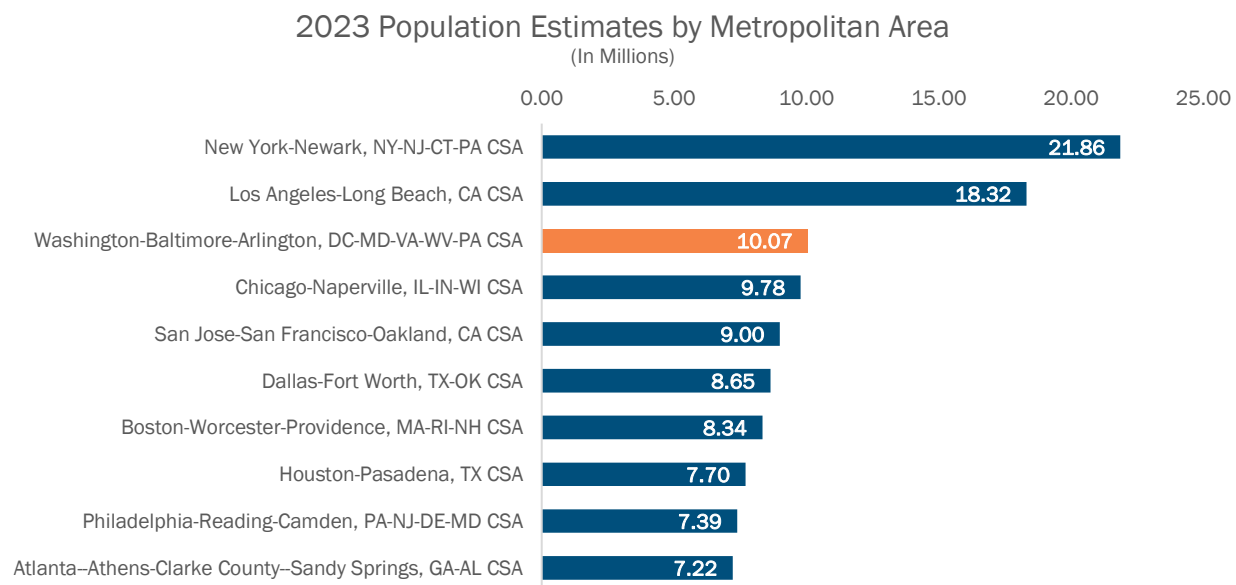


Figure 8. 2023 Population Estimates by Metropolitan Area

Annual Estimates of the Resident Population for Combined Statistical Areas in the United States and Puerto Rico: April 1, 2020 to July 1, 2023 (CSA-EST2023-POP). Source: U.S. Census Bureau, Population Division
Release Date: March 2024

LABOR FORCE AND UNEMPLOYMENT

Based on the data in Table 9 and figure 9, the national unemployment rate increased to 8.1 percent in 2020 before dropping to 3.6 percent by 2023, reflecting a strong nationwide recovery from the COVID-19 pandemic. Regionally, both the Washington and Baltimore metropolitan regions followed similar trends, with unemployment peaking during the COVID-19 pandemic in 2020. In the Washington, DC MSA region, the unemployment rate spiked to 6.4 in 2020 but steadily declined to 2.6 by 2023, highlighting significant economic resilience. The Baltimore MSA region also saw unemployment growth to 6.2 in 2020, followed by a decline to 2.1 in 2023, indicating a strong recovery.

The Washington and Baltimore regions typically enjoy unemployment rates lower than the nation overall, underscoring the relative strength of the job markets in the mid-Atlantic region. During the COVID-19 pandemic, unemployment rates increased nationwide as well in the Washington and Baltimore metropolitan areas to their highest levels in recent years; however, the unemployment rates in the Washington and Baltimore regions remained lower than the national unemployment rate. Moreover, during the peak of the pandemic shutdown in 2020, the nation experienced its highest unemployment rate in recent years of 8.1 percent, compared to the Washington and Baltimore regions, which experienced their highest rates of 6.4 percent and 6.2 percent, respectively. By 2023, pandemic-era increases in unemployment rates were more than offset by robust recovery in the job market, resulting in significantly lower unemployment rates regionally and nationally. For more detailed data, please refer to Appendix 4.

Table 9. Annual Unemployment Rate
Annual Unemployment Rate (Not Seasonally Adjusted)
By Region, Nation, and Year

REGION	2017	2018	2019	2020	2021	2022	2023
Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area	3.6	3.3	3	6.4	4.6	2.9	2.6
Baltimore-Columbia-Towson, MD Metropolitan Statistical Area	4.1	3.9	3.4	6.2	5.0	3.0	2.1
United States	4.4	3.9	3.7	8.1	5.3	3.6	3.6

Source: 1. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LAUDV114789400000003). U.S. Department of Labor. 2. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LAUMT241258000000003). U.S. Department of Labor. 3. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LNU04000000). U.S. Department of Labor. Retrieve data date: April 2024. In percent, not seasonally adjusted.

Analyzing both areas together underscores the region's strong economic recovery, pointing to a resilient consumer market and a solid economic foundation. Notably, in 2023, the two regions compared experienced the lowest unemployment rates among all the years analyzed, emphasizing their continued progress and resilience in the face of economic challenges.

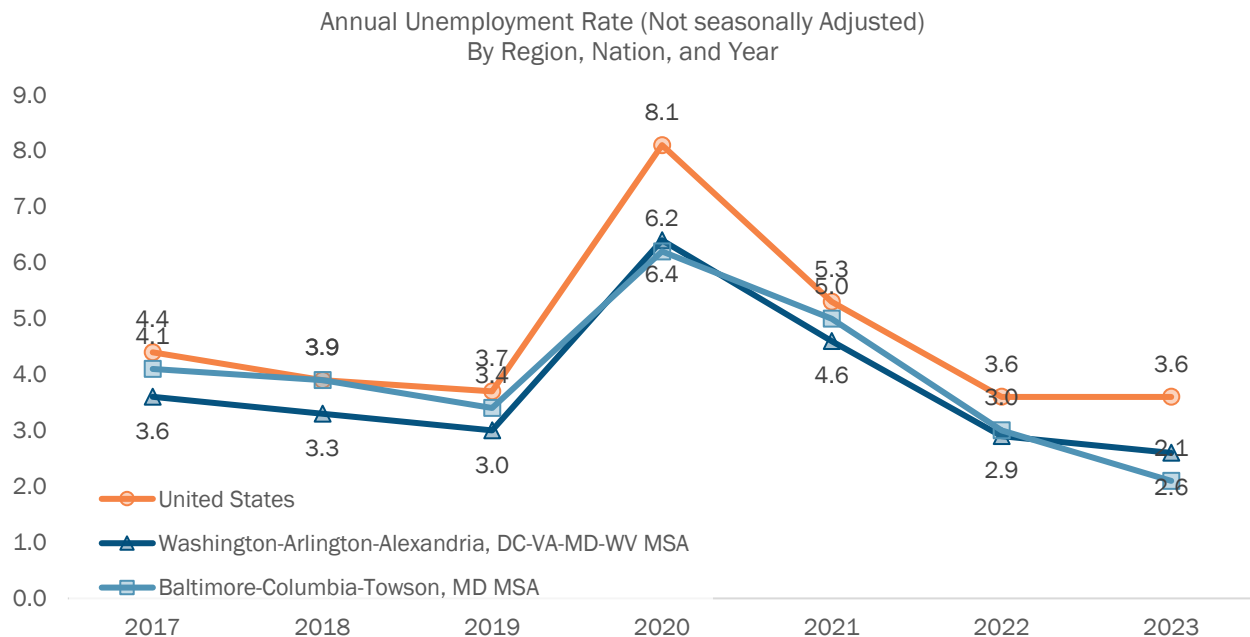


Figure 9. Annual Unemployment Rate (Not seasonally Adjusted)

Source: refer for Table 9

The data presented in Table 10 provides a comprehensive overview of employment statistics for various industries in both the Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area and the Baltimore-Columbia-Towson, MD Metro Area, as well as their combined region. Professional and business services is the dominant industry sector in the combined region's economy, comprising 19.6 percent of total employment. Following closely behind, the educational, healthcare, and social assistance sectors contribute significantly to the workforce, employing 17.9 percent of workers.

Moreover, government employment, particularly at the federal level, remains substantial, accounting for 13.5 percent of total employment. Additionally, government jobs - encompassing federal, state, and local positions - account for about 23 percent, or roughly a quarter, of the total job share. Following, trade, transportation, warehousing, and utilities sectors employ 11.2 percent of total employment in the region. In total, the combined region sustains nearly 4 million jobs, reflecting a diverse and dynamic labor market landscape where each industry plays a unique role in shaping the overall employment landscape.

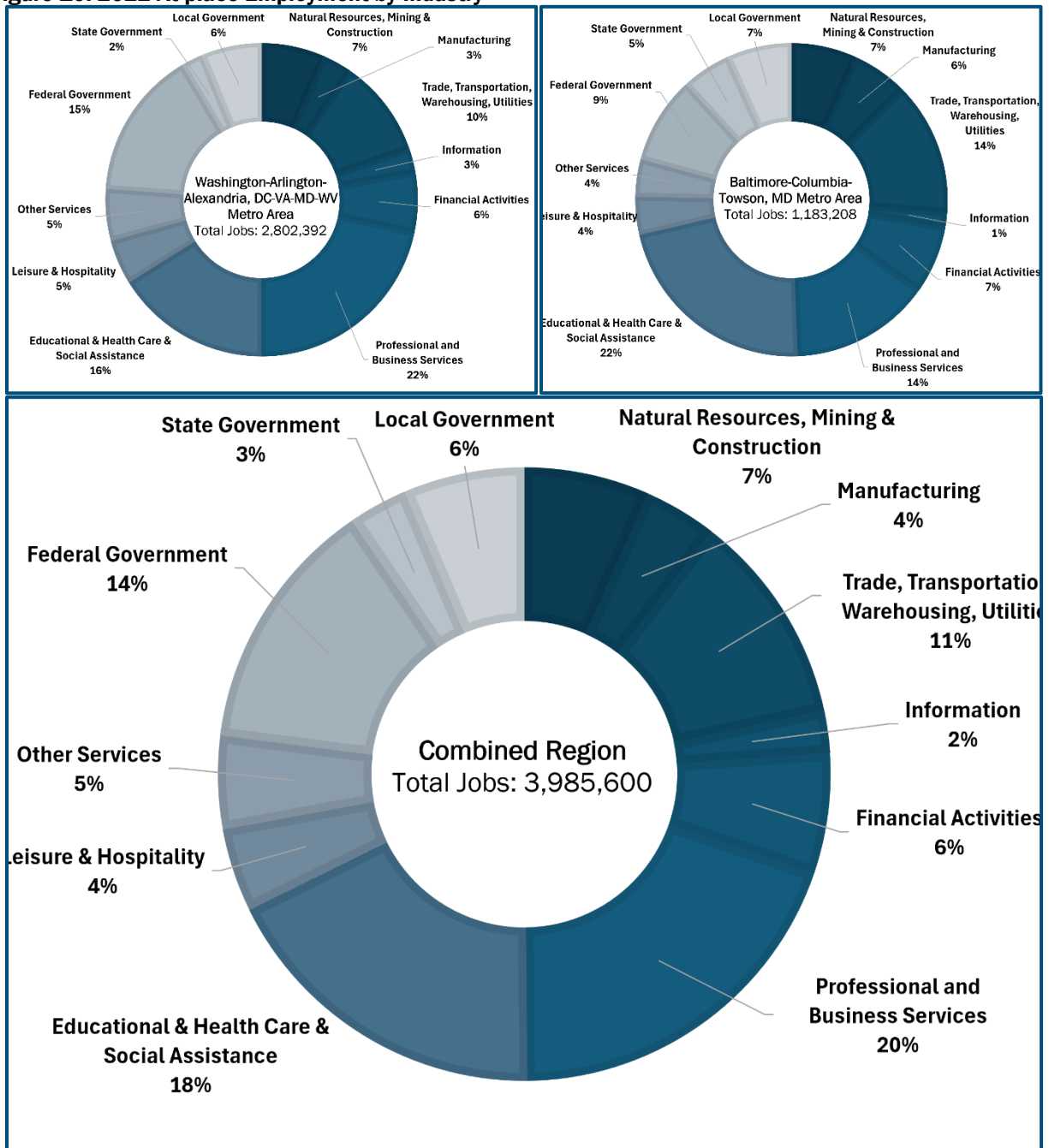
Table 10. 2022 At-place Employment by Industry (In Thousands)

Industry		Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area	Baltimore-Columbia-Towson, MD Metro Area	Combined region
Natural Resources, Mining & Construction	Jobs	183.2	80.2	263.2
	%	6.5%	6.8%	6.6%
Manufacturing	Jobs	84.9	68.2	153.2
	%	3.0%	5.8%	3.8%
Trade, Transportation, Warehousing, Utilities	Jobs	283.3	162.7	445.9
	%	10.1%	13.7%	11.2%
Information	Jobs	69.9	19.0	89.0
	%	2.5%	1.6%	2.2%
Financial Activities	Jobs	173.1	81.7	254.8
	%	6.2%	6.9%	6.4%
Professional and Business Services	Jobs	607.9	172.5	780.3
	%	21.7%	14.6%	19.6%
Educational & Health Care & Social Assistance	Jobs	451.2	260.6	711.8
	%	16.1%	22.0%	17.9%
Leisure & Hospitality	Jobs	129.5	46.5	175.9
	%	4.6%	3.9%	4.4%
Other Services	Jobs	150.1	45.6	195.7
	%	5.4%	3.9%	4.9%
Federal Government	Jobs	431.1	106.7	537.8
	%	15.4%	9.0%	13.5%
State Government	Jobs	63.1	60.2	123.3
	%	2.3%	5.1%	3.1%
Local Government	Jobs	175.0	79.6	254.6
	%	6.2%	6.7%	6.4%
TOTAL NONFARM	Jobs	2,802.4	1,183.2	3,985.6

Source: 1. U.S. Census Bureau. "Class of Worker by Sex for the Full-Time, Year-Round Civilian Employed Population 16 Years and Over." American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2409, 2022. Accessed on March 27, 2024. 2. U.S. Census Bureau, Class of Worker by Sex for the Full-Time, Year-Round Civilian Employed Population 16 Years and Over.

Note: Total may differ due to rounding.

Figure 10. 2022 At-place Employment by Industry



For details on the source review, please refer to Table 10
 Note: Percentages may vary due to rounding.

INCOME

As shown in Table 11, the region reported positive wage growth trend in a six-year period through 2022, with the Washington-Arlington-Alexandria DC-VA-MD-WV MSA leading in wage levels, followed by the Baltimore-Columbia-Towson MSA, both of which consistently surpassed the national average. This growth emphasizes the economic vitality of these metropolitan areas in comparison to the national panorama.

Analyzing per capita income, it consistently has increased across all areas over the six-year period. Nationally, per capita income increased from \$51,004 in 2017 to \$65,470 in 2022, marking a cumulative growth of approximately 28 percent. This steady growth reflects an overall economic expansion.

Moreover, in the Baltimore-Columbia-Towson, MD (MSA), per capita income also has showed a notable increase from \$57,539 in 2017 to \$71,420 in 2022. This represents an increase of about 24 percent. The Baltimore area consistently maintained higher per capita income compared to the national average, suggesting a relatively robust local economy.

Ultimately, the Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) exhibited the highest per capita income among the three regions analyzed. Starting at \$67,897 in 2017, per capita income increased to \$83,010 by 2022, reflecting a 22 percent increase. The consistently higher per capita in this Washington region can be attributed to the concentration of federal government jobs, high-tech industries, and other high-paying sectors that are prevalent in the Washington, D.C. metropolitan area, suggesting a relatively robust local economy and possibly higher living costs. Additionally, higher per capita income, while largely driven by high-paying jobs, is also influenced by demographic factors such as households with multiple income earners. In metropolitan areas, where housing, childcare, and other expenses may be lower, a single income earner may suffice, while in more expensive regions like Washington, D.C., families often rely on more than one income earner to manage the higher costs of living.

Table 11. Per Capita Income

Area Name	Per Capita Income					
	2017	2018	2019	2020	2021	2022
Baltimore-Columbia-Towson, MD (MSA)	57,539	59,432	61,771	65,676	70,023	71,420
Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA)	67,897	70,255	72,199	75,141	81,121	83,010
United States	51,004	53,309	55,547	59,153	64,430	65,470

Source: U.S. Bureau of Economic Analysis. "CAINC4 Personal income and employment by major component", Per capita personal income 4 (Dollars), Metropolitan Statistical Area, Last updated: November 16, 2023– new statistics for 2022; revised statistics for 1979-2021. Note. All dollar estimates are in thousands of current dollars (not adjusted for inflation)

AIR CARGO DEMAND ANALYSIS

This section begins with an analysis of demographic and economic drivers in the region that may affect demand for air cargo services. Indicators such as growing population, workforce and employment provide insight into how regional demand may be sustained or grow. Following that discussion, this section examines the air cargo industry outlook from a macro, global perspective, which is then followed by how this outlook, when considered with demographic and economic drivers in the region, translates into regional demand for air cargo at BWI and IAD.

RESIDENTIAL DEMAND

The Metropolitan Washington Council of Governments (COG) and the Baltimore Metropolitan Council (BMC) prepare population projections for the jurisdictions in the Washington and Baltimore regions, respectively. According to the latest round of forecasts, the air system planning area population is forecast to increase between 2020 and 2050. Table 12 provides population forecasts for all the jurisdictions constituting the Washington-Baltimore air system planning region. Similarly, Table 13 provides the corresponding household forecast in the region for the same years. In general, in the whole region, the number of households is expected to grow slightly faster than the overall population during the same period, which is the result of a continuing trend toward smaller households. Nevertheless, households are typically the key input factor in determining residential demand over a planning period; therefore, transportation investment decisions are usually driven by household and employment forecasts, rather than population and employment forecasts.

POPULATION GROWTH ANALYSIS

Some jurisdictions are projected to experience remarkable population growth by 2050. Particularly, Stafford County, VA, is expected to see a 79.4 percent increase, making it the fastest-growing area in the region. Spotsylvania County, VA, and the City of Fairfax, VA, are also set to grow substantially, with increases of 74.2 percent and 63.8 percent, respectively. Conversely, some jurisdictions are projected to grow slowly. Baltimore City, MD, is expected to see only a 4.1 percent increase, and Baltimore County, MD, will grow by 9.4 percent. Carroll County, MD, and Calvert County, MD, will see modest growth of 8.9 percent and 9.3 percent, respectively, suggesting limited expansion or economic constraints.

When analyzing growth by the actual increase in population numbers, Prince George's County leads with an anticipated increase of 256,549 people by 2050, followed by Fairfax County with an increase of 212,115. This demonstrates that the percentage growth in specific areas may not always reflect the true impact or importance of that growth. High growth percentages may not always equate to high population numbers, especially in areas that are already densely populated. Furthermore, slower growth can indicate stability or nearing build-out, which doesn't necessarily mean a lack of prosperity.

On a broader scale, Virginia jurisdictions will collectively grow by 30.0 percent by 2050, indicating robust overall expansion. Maryland jurisdictions will see a 19.2 percent increase, reflecting steady but slower growth compared to Virginia. The District of Columbia will grow by 22.5 percent, maintaining a steady urban expansion. The total region will witness a 23.1 percent population increase by 2050, underscoring the area's overall growth trend.

As previously mentioned, when looking at the population growth by number rather than percentage, we observe the greatest increase in Maryland, with an addition of 1,053,542 people, followed by Virginia with 896,335 new residents, and the District of Columbia, which is projected to grow by 154,866 people. The complete table showing the population changes is provided in Appendix 5.

In conclusion, while some jurisdictions in the region are projected to experience remarkable population growth by 2050, it's important to note that low or slow growth rates don't necessarily equate to stagnation. For example, both Prince George's County, MD, and Fairfax County, VA, are projected to add a substantial number of people by 2050. Prince George's County is expected to grow by 23.4 percent, adding around 226,000 people, while Fairfax County, despite a slower percentage growth of 18.1 percent, will add approximately 212,000 people. This demonstrates that while percentage growth is an important measure, the actual number of people added can still be significant in both cases. In comparison, while Spotsylvania County, VA, and Stafford County, VA, are projected to see higher percentage growth rates of 74.2 percent and 79.4 percent respectively, the actual number of people added will be 78,000 and 125,000, which, while notable, is smaller in comparison to the increases seen in Prince George's and Fairfax Counties.

Therefore, high percentage growth can occur in areas with smaller populations, while slower growth might indicate stability or that an area is nearing its development limit, rather than stagnating. The earlier analysis focused on percentage changes to show growth patterns, but it's also important to look at actual population numbers and the bigger picture. Even areas with slower growth can still be thriving, with strong economies and infrastructure, supporting long-term stability rather than decline.

Table 12. Population by Jurisdiction

Population by Jurisdiction Washington-Baltimore Air System Planning Region							
	Numbers (Thousands)				Percentage Change in Relation to 2020		
Jurisdiction	2020	2030	2040	2050	2030	2040	2050
District of Columbia	689.5	728.6	787.1	844.4	5.7%	14.2%	22.5%
Virginia Jurisdictions							
Arlington County	238.6	260.2	285.2	311.2	9%	6.8%	30.4%
City of Alexandria	159.5	202	239.8	261.9	26.7%	50.4%	64.2%
City of Fairfax	24.1	32.7	36.1	39.6	35.3%	49.4%	63.8%
City of Falls Church	14.7	18	20.7	23.3	22.9%	41.5%	58.8%
City of Fredericksburg	32.9	36	39.3	43.6	9.4%	19.4%	32.5%
City of Manassas	42.8	46.3	48.5	50.4	8.3%	13.5%	17.9%
City of Manassas Park	17.2	20.4	21.4	22.4	18.7%	24.5%	30.3%
Clarke County	14.8	15.3	16.1	17.2	3.6%	9.2%	16.4%
Fairfax County	1,171.9	1,247.5	1,319	1,384	6.5%	12.6%	18.1%
Fauquier County	73	79.6	87.2	96.1	9.1%	19.5%	31.7%
King George County	265	28.13	319	35.42	8%	19.3%	36%
Loudoun County	421	493.9	529.6	548.5	17.3%	25.8%	30.3%
Prince William County	483.8	536.6	565	579.6	10.9%	16.8%	19.8%
Spotsylvania County	105.1	123.2	148.1	183.1	17.3%	40.9%	74.2%
Stafford County	158	182.1	219.5	283.5	15.3%	38.9%	79.4%
Maryland Jurisdictions							
Anne Arundel County	592.7	646.2	677.4	694.2	9%	14.3%	17.1%
Baltimore City	585.7	596.4	599.2	609.8	1.8%	2.3%	4.1%
Baltimore County	854.5	876.7	909	934.5	2.6%	6.4%	9.4%
Calvert County	92.8	97.3	100.1	101.4	4.9%	7.9%	9.3%
Carroll County	172.9	179.1	184	188.4	3.6%	6.4%	8.9%
Charles County	168	193.6	216.5	242.7	15.2%	28.9%	44.4%
Frederick County	271.7	316.3	368.3	428.8	16.4%	35.5%	57.8%
Harford County	260.9	277.8	293.6	308.8	6.5%	12.5%	18.4%
Howard County	332.3	364	393.6	414.8	9.5%	18.5%	24.8%
Montgomery County	1,061.2	1,118	1,189.6	1,250.7	5.4%	12.1%	17.8%
Prince George's County	967.2	1,033	1,122.7	1,193.8	6.8%	16.1%	23.4%
St. Mary's County	113.8	129.7	144.6	159.5	14%	27.1%	40.2%
West Virginia Jurisdictions							
Jefferson County	57.7	67.3	75.3	82.1	16.7%	30.5%	42.3%
TOTAL REGION	9,204.4	9,946.3	10,667.8	11,333.5	8.1%	15.9%	23.1%

Source: MWCOG Round 10.0 Cooperative Forecast and BMC Round 10 Cooperative Forecast

HOUSEHOLD GROWTH ANALYSIS

Household growth is particularly notable in several areas. Stafford County, VA, stands out with a projected 117.4 percent increase in households, reflecting a substantial increase in residential demand. City of Falls Church, VA, and the City of Fairfax, VA, will see a dramatic 108.5 percent and 74.3 percent growth respectively. The City of Alexandria, VA, will also experience significant household growth at 66.8 percent, indicating strong housing market dynamics.

Jurisdictions like Frederick County, MD, will grow by 58.3 percent, and Charles County, MD, by 51.8 percent, showing substantial increases in household numbers. City of Manassas Park, VA, will see a 47.9 percent growth, and the City of Fredericksburg, VA, a 46.7 percent. This growth may be driven by factors such as employment opportunities or the growing appeal of remote work, combined with a lower cost of living. In contrast, Baltimore City, MD, will have a modest 8 percent growth in households, and Baltimore County, MD, will see a 9.5 percent increase. Calvert County, MD, and Carroll County, MD, will experience household growth of 14 percent and 10.6 percent, respectively, suggesting slower residential development in these regions.

Overall, Virginia jurisdictions are expected to grow by 37.4 percent in households by 2050, indicating a strong trend towards suburban and residential development. Maryland jurisdictions will see a 21.7 percent increase, reflecting steady growth across the jurisdictions. West Virginia will have a significant 47.1% increase in households, driven by its proximity to metropolitan areas and favorable living conditions. The District of Columbia will grow by 41.3 percent in households, reflecting a dynamic urban housing market. The total region will observe a 28.5 percent increase in households by 2050, highlighting a broad trend of rising residential demand.

In conclusion, the projected household growth across the region reflects varying housing development trends. In urbanized areas, the focus is primarily on adding multifamily housing to accommodate growing populations, while in more suburban or distant areas, there is a higher proportion of new single-family homes alongside multifamily options. It is also important to note that slower growth rates in certain jurisdictions do not necessarily indicate stagnation. In some cases, these areas may already have a high number of households, and their growth rates are a result of nearing build-out. Rather than signifying decline, this slower growth can be a sign of stability and ongoing prosperity.

As previously mentioned that while percentage growth can be a useful indicator, it may not always reflect the full scale of growth in absolute terms. Areas with a larger existing population may experience smaller percentage increases, but the actual number of households added can still be significant. For example, the City of Alexandria is projected to add 126,000 households by 2050, reflecting a 66.8 percent increase. While this may seem lower compared to other areas, it still represents a substantial increase in actual household numbers. In contrast, the City of Falls Church is projected to grow by 108.5 percent, but this percentage increase translates to about 12,000 new households.

Table 13. Household by Jurisdiction

Household by Jurisdiction Washington-Baltimore Air System Planning Region							
	Number (Thousands)				percentage change in relation to 2020		
Jurisdiction	2020	2030	2040	2050	2030	2040	2050
District of Columbia	312.4	366.8	407.6	441.4	17.4%	30.5%	41.3%
Virginia Jurisdictions							
Arlington County	109.9	126.2	140	153.6	14.8%	9.6%	39.8%
City of Alexandria	75.6	96.4	115.4	126	27.6%	52.8%	66.8%
City of Fairfax	9.3	13	14.6	16.3	39%	56.6%	74.3%
City of Falls Church	5.8	8.7	10.3	12.1	50.3%	77.6%	108.5%
City of Fredericksburg	11.1	12.3	13.9	16.3	10.6%	25.4%	46.7%
City of Manassas	14	15.1	15.8	16.4	8%	13.1%	17.5%
City of Manassas Park	5.4	6.9	7.4	8	27.6%	37.7%	47.9%
Clarke County	5.8	6.2	6.8	7.6	5.5%	15.8%	30.6%
Fairfax County	417.5	451.2	482.4	510.8	8.1%	15.6%	22.4%
Fauquier County	26.4	29.2	32.3	35.8	10.5%	22.3%	35.8%
King George County	8.8	9.2	10	11.2	5.4%	14%	27.4%
Loudoun County	137.4	161.7	174.7	181.7	17.6%	27.1%	32.2%
Prince William County	153.9	173.4	185.1	191.9	12.7%	20.3%	24.7%
Spotsylvania County	34.6	41	50.8	68.1	18.5%	46.8%	96.7%
Stafford County	49.6	60.9	78.2	107.7	22.9%	57.9%	117.4%
Maryland Jurisdictions							
Anne Arundel County	220	236.8	251.6	260.3	7.6%	14.4%	18.4%
Baltimore City	251.5	260.6	264.3	271.5	3.6%	5.1%	8%
Baltimore County	330	338.4	351.3	361.4	2.6%	6.5%	9.5%
Calvert County	32.8	35.2	36.7	37.3	7.5%	12.1%	14%
Carroll County	63.1	65.6	67.7	69.7	4%	7.4%	10.6%
Charles County	59.1	71.2	80	89.7	20.5%	35.3%	51.8%
Frederick County	98.4	114.5	133.2	155.7	16.4%	35.5%	58.3%
Harford County	98.3	105.7	113.3	120.9	7.6%	15.3%	23%
Howard County	118.7	133.3	147.8	159.7	12.3%	24.5%	34.5%
Montgomery County	386.6	416.5	450	474.3	7.7%	16.4%	22.7%
Prince George's County	342.2	367.4	400.5	425.9	7.4%	17%	24.5%
St. Mary's County	41.8	48.2	54.1	59.7	15.1%	29.4%	42.6%
West Virginia Jurisdictions							
Jefferson County	21.9	25.9	29.3	32.2	18.3%	33.7%	47.1%
TOTAL	3,441.8	3,797.5	4,125.5	4,423.4	10.3%	19.9%	28.5%

Source: MWCOC Round 10.0 Cooperative Forecast and BMC Round 10 Cooperative Forecast

COMMERCIAL DEMAND

The employment data from 2020 to 2050 shown in Table 14 reveals a consistent upward trend across all jurisdictions in the Washington-Baltimore Air System Planning Region. The total employment in the region is projected to grow by 30.2 percent, increasing from 4.9 million in 2020 to 6.4 million by 2050. This trend highlights a robust regional economic expansion driven by various factors, including urbanization, infrastructure development, and the growth of key industries. Employment growth in the District of Columbia is expected to be steady, with a 30 percent increase by 2050. This trend emphasizes the ongoing importance of the nation's capital as a central hub for employment and commercial activities in the region.

Virginia's jurisdictions show a strong growth trend, with employment increasing by 34.2 percent over the 30-year period. Fairfax County and Prince William County, in particular, exhibit high growth rates of 27.8 percent and 52.3 percent, respectively, indicating expanding economic opportunities and increased commercial demand.

Employment in Maryland jurisdictions is projected to grow by 27.6 percent. Baltimore City, Anne Arundel County, Montgomery County, and Howard County all demonstrate upward trends, with particular attention to Frederick County and Harford County, which are expected to see growth rates of 50.1 percent and 61.3 percent, respectively.

Jefferson County in West Virginia shows a growth trend of 48.6 percent, highlighting emerging commercial opportunities despite its smaller employment base. Furthermore, when comparing the employment growth across the different jurisdictions, several key insights emerge:

- **Urban vs. Suburban Growth:** Urban core areas like the District of Columbia and Baltimore City show steady growth, but it is the suburban and exurban areas such as Fairfax County, Prince William County, and various counties in Maryland that exhibit the highest growth rates.
- **High Growth Areas:** Prince William County (52.3 percent), Stafford County (91.5 percent), and Harford County (61.3 percent) stand out as high-growth areas, indicating significant potential for commercial real estate development and infrastructure investment. These areas are likely to become key focal points for investment and development activities.
- **Moderate Growth Areas:** Jurisdictions such as Arlington County, Anne Arundel County, and Montgomery County show moderate growth rates (varying from 26.6 percent to 34 percent), suggesting stable but less explosive growth compared to the high-growth areas. These regions will continue to see consistent demand for commercial and residential developments.
- **Low Growth Areas:** Some jurisdictions, including Clarke County (3.6 percent), Fauquier County (4.7 percent), and Calvert County (12.7 percent), exhibit lower growth rates, indicating relatively stable but limited expansion. These areas might not see as significant commercial development pressures but will still experience gradual economic growth.

Ultimately, the overall trend across the Washington-Baltimore Air System Planning Region is one of significant and sustained employment growth, with varying rates across different jurisdictions. Urban centers like the District of Columbia and Baltimore City will continue to thrive, maintaining their roles as primary employment hubs. However, the most dynamic growth is expected in suburban and exurban areas, particularly in Virginia and Maryland, where the highest employment increases are projected, fueling demand for air cargo services.

This trend demonstrates the continued movement of the region towards a more distributed economic landscape, a trend observed over the past decades, where suburban areas continue to play an increasingly prominent role in the region's economy. Job growth throughout the region, especially in areas where more and faster growth is expected, will continue to fuel increased demand for supportive investments and services, including increases in goods and services provided by the air cargo industry.

Given the significant employment growth across the Washington-Baltimore Air System Planning Region, strategic investments in air cargo infrastructure are crucial. As suburban and exurban areas, especially in Virginia and Maryland, experience dynamic growth, demand for air cargo services will increase. Enhancing infrastructure in both urban and suburban regions will be essential to meet the rising demand driven by economic expansion.

To conclude, when discussing suburban growth in this demand analysis, it is important to recognize that the nature and locations of development are continuously evolving. Suburban development is no longer solely characterized by sprawling greenfield expansion. Instead, the focus has shifted towards optimizing the region's investment in transportation and other infrastructure. This shift in focus means that future growth is being directed towards Regional Activity Centers and areas served by High-Capacity Transit. These areas, found across both urban and suburban parts of the region, serve as effective planning tools to accommodate future demand, ensuring that development is integrated with essential transportation networks and infrastructure. This evolving approach to suburban development aligns with the broader regional growth trends, where suburban and exurban areas are expected to see some of the most significant growth, creating a need for smarter, more strategic development in these areas.

Table 14. At Place Employment by Jurisdiction

At Place Employment by Jurisdiction Washington-Baltimore Air System Planning Region							
	Number (Thousands)				percentage change in relation to 2020		
Jurisdiction	2020	2030	2040	2050	2030	2040	2050
District of Columbia	785.9	886.3	954.4	1,021.6	12.8%	17.5%	30%
Virginia Jurisdictions							
Arlington County	221.6	236.7	266.4	283.7	6.8%	20.2%	28%
City of Alexandria	101.8	99.3	112.8	123.2	-2.5%	10.8%	21.1%
City of Fairfax	20.5	22.3	22.9	23.5	8.8%	11.7%	14.6%
City of Falls Church	12.4	15.4	17.4	19.4	24%	40.4%	57%
City of Fredericksburg	29.7	34.3	40.8	51	15.5%	37.7%	72.1%
City of Manassas	25.3	26.9	28.3	29.3	6.4%	11.5%	15.5%
City of Manassas Park	4.3	5	5.2	5.4	15.3%	20.4%	25.5%
Clarke County	4	4	4.1	4.1	1.2%	2.4%	3.6%
Fairfax County	658.8	750.8	812.5	842	14%	23.3%	27.8%
Fauquier County	24.3	24.6	25	25.4	1.6%	3.1%	4.7%
King George County	12.2	13.8	16	19.6	12.9%	30.7%	60.2%
Loudoun County	187.7	227	251.5	265.8	20.9%	34%	41.7%
Prince William County	161.8	194.4	223.4	246.4	20.1%	38.1%	52.3%
Spotsylvania County	34.6	38.1	42.3	48.4	10%	22.1%	39.7%
Stafford County	43.5	51	61.4	83.2	17.3%	41.3%	91.5%
Maryland Jurisdictions							
Anne Arundel County	340.6	389.8	419	451.5	14.5%	23%	32.6%
Baltimore City	365	396.2	430.4	451	8.5%	17.9%	23.5%
Baltimore County	398.7	425.1	434.6	444.3	6.6%	9%	11.4%
Calvert County	24.2	25.2	26.1	27.3	4.1%	7.9%	12.7%
Carroll County	62.8	65.8	68.8	71.8	4.8%	9.5%	14.3%
Charles County	43.9	49.8	57.4	62.2	13.4%	30.8%	41.8%
Frederick County	108.3	123.8	141.8	162.5	14.3%	31%	50.1%
Harford County	100.7	120.6	141.3	162.5	19.7%	40.2%	61.3%
Howard County	185.6	203.3	232	245.6	9.5%	25%	32.3%
Montgomery County	493.6	545.6	591	636.5	10.5%	19.8%	29%
Prince George's County	343.5	366.8	396.7	435	6.8%	15.5%	26.6%
St. Mary's County	63	69.5	74	78	10.4%	17.5%	23.8%
West Virginia Jurisdictions							
Jefferson County	25.2	30	34	37.5	19%	34.9%	48.6%
TOTAL	4,883.4	5,441.1	5,931.6	6,357.8	11.4%	21.5%	30.2%

Source: MWCOG Forecast Round 10.0 Cooperative and BMC Round Cooperative Forecast

REGIONAL TRENDS AND COMPARISONS

Based on the forecast analysis, residential and employment growth in Virginia's jurisdictions, particularly in smaller cities and suburban areas, is expected to significantly impact the demand for air cargo services. Cities such as Fairfax and Alexandria, along with counties like Stafford and Spotsylvania, are projected to see notable increases in both population and households. These areas are emerging as growth centers, likely due to their strategic locations and development policies. As these regions experience rising residential activity, they will also see a corresponding rise in employment. For example, Stafford County is projected to experience a 91.5 percent increase in employment by 2050, which will further drive demand for air cargo services as local economies expand. The combined increase in population, households, and jobs will push demand for air cargo services in these regions.

In Maryland, the growth pattern is more varied. Some areas, such as Frederick and Charles Counties, are expected to experience faster growth, while others, like Baltimore City, show more modest increases in population and households. However, even in areas with more modest growth, the rising demand for goods and services associated with increasing populations and businesses will still impact air cargo needs. Moreover, counties like Frederick, which are expected to experience a significant increase in employment, will support further demand for air cargo services as businesses expand and commercial activity rises.

The District of Columbia, with its constant growth, is projected to continue its role as a central hub for air cargo services. D.C. is expected to see a 22.5 percent increase in population and a 41.3 percent increase in households by 2050. This population growth, combined with changing family structures, will likely maintain the D.C.'s role as a central economic and logistics hub, driving demand for air cargo services. Similarly, employment is projected to rise steadily in the D.C., reinforcing its importance as a major driver for air cargo.

Comparing the growth patterns across the Washington Air System Planning Region, West Virginia is projected to experience the highest growth rates in both population (42 percent) and households (47 percent) by 2050. However, despite these high percentages, the total increase in population and households will be much smaller compared to larger regions like the District of Columbia, Virginia, and Maryland. The District is expected to add 154,900 people and 441,400 households, Virginia will see an increase of 896,300 people and 1,463,600 households, and Maryland will add 1,053,500 people and 2,486,200 households. In contrast, West Virginia will only add 24,400 people and 32,200 households. While West Virginia's growth rates are the highest, the total growth in the District, Virginia, and Maryland will have a much greater impact on air cargo demand due to the sheer size of the increases.

Looking ahead, as certain jurisdictions experience more rapid growth, the areas currently handling the highest demand for air cargo services will see this demand spread across a broader area. The forecasted growth in population, households, and employment is projected to significantly increase demand for air cargo services. Figure 11 below provides a comparative view of projected population, household, and employment growth across different jurisdictions by 2050.

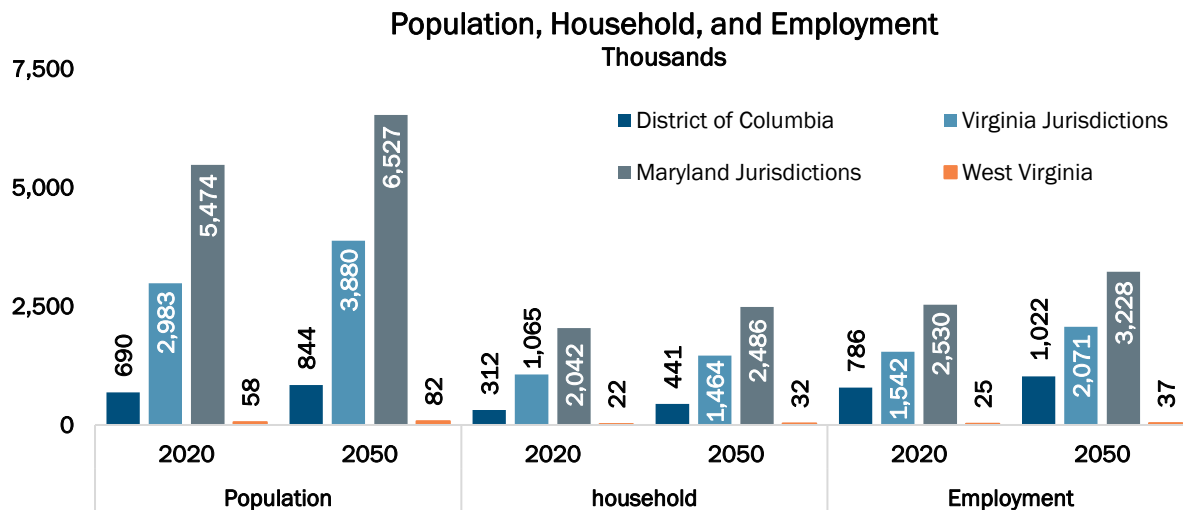


Figure 11. Forecast Population, Household, and Employment by Jurisdiction (Thousands)

Moreover, as residential and employment growth continues to rise across the region, particularly in suburban and growth-center areas, there will be a corresponding increase in the demand for air cargo services. The combination of more people moving into these regions and the resulting expansion of commercial activity underscores the importance of aligning infrastructure development with growth. Concentrating future development in areas with access to high-capacity transit and ensuring that air cargo infrastructure is well-supported will be crucial for managing this growth efficiently. By fostering development in regional activity centers, the region can support sustainable, long-term growth while meeting the needs of both businesses and consumers.

To conclude, when discussing suburban growth in this demand analysis, it is important to recognize that the nature and locations of development are continuously evolving. Suburban development is no longer solely characterized by sprawling greenfield expansion. Instead, the focus has shifted towards optimizing the region's investment in transportation and other infrastructure. This shift in focus means that future growth is being directed towards Regional Activity Centers and areas served by High-Capacity Transit. These areas, found across both urban and suburban parts of the region, serve as effective planning tools to accommodate future demand, ensuring that development is integrated with essential transportation networks and infrastructure. This evolving approach to suburban development aligns with the broader regional growth trends, where suburban and exurban areas are expected to see some of the most significant growth, creating a need for smarter, more strategic development in these areas.

COMMODITIES

Different commodities are transported by freight, each with varying levels of urgency. To meet these needs, there are several modes of transportation: Truck, Rail, Water, Air, and Pipeline. Usually, Air Cargo shares the smallest amount in weight, however, its contribution in terms of value is typically very high compared to other modes.

As mentioned before, air cargo predominantly carries time-sensitive and high-value commodities, such as pharmaceuticals and perishable goods. There are two primary methods for transporting cargo by air: dedicated air freight services and belly cargo, which involves shipping goods in the baggage holds of passenger aircraft.

Additionally, air cargo is often used for long-distance transportation. According to the National Freight Strategic Plan by USDOT (2020), air transportation, combined with multiple modes, mail (including intermodal container shipments), and other/unknown modes, accounted for 51.2 percent of the value of shipments moved over distances greater than 2,000 miles.

The Washington-Baltimore region is served by two airports that have found complementary roles in terms of air cargo. According to the Air Cargo Market Assessment and Facilities Analysis (2023), the two airports have somewhat complementary roles with BWI Marshall being the focal point of area operations by Amazon and UPS, while IAD is a larger regional gateway for FedEx, as well as a major belly cargo hub for United and a U.S. gateway for numerous foreign flag passenger carriers. This is reflected in BWI's orientation towards domestic cargo, while IAD handles a considerably larger share of international cargo.

Additionally, there is a distinct distribution in terms of cargo market share between all-cargo carriers and belly cargo carriers at each airport. Figure 12 shows that Baltimore Cargo is dominated by domestic cargo, accounting for 97 percent of the total, while at IAD, the gap is smaller, with international cargo holding 51 percent of the share. Furthermore, BWI greatly surpasses IAD in cargo operations related to cargo carriers. In contrast, IAD's belly cargo operations significantly exceed those at BWI.

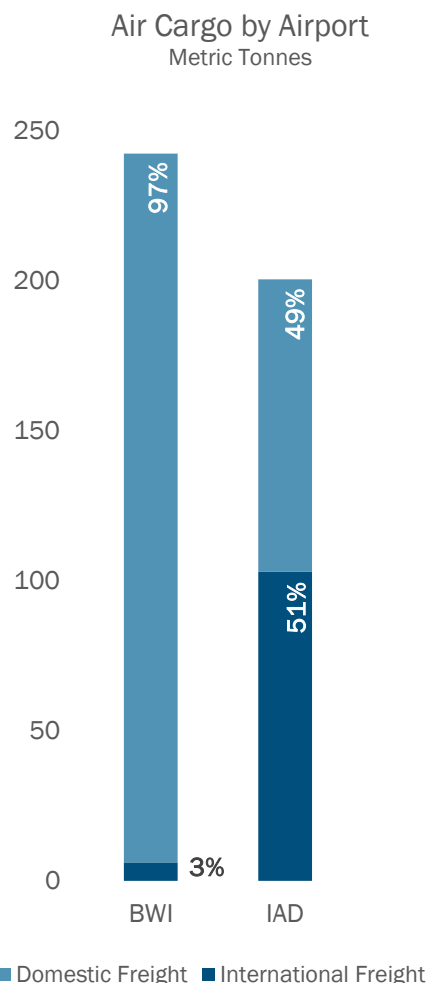


Figure 12. 2022
Domestic/International cargo share in
the region – Metric Tons (Thousands)

Source: ACI-NA, 2023 North American Airport Traffic Summary (Cargo).

Note: Mail information is not included in Figure XX.

Table 15 shows that the commodities accounting for the most weight in the region in 2020 were plastics and rubber, followed by basic chemicals and pharmaceuticals. In terms of value, the leading products were electronic and electrical equipment, pharmaceutical products, and transportation equipment.

Interestingly, when examining value, transportation equipment and precision instruments and apparatus emerged in 3rd and 4th place, respectively, together accounting for about 27 percent. These commodities were not mentioned among the top commodities by tonnage. Additionally, while electronic and electrical equipment accounted for less than 10 percent of the total top 10 commodities by weight, it held a significant 30 percent share in terms of value.

Overall, the top four products accounted for over 50% of the total share in both weight (57 percent) and value (68%). Notably, two of these high-value products did not appear on the weight list. This observation reinforces the trend seen in Table 2 (Pg. 12), which compares price per ton by mode of transportation, highlighting the high value of goods transported by air.

Table 15. Commodity types, Value and Weight, 2020
Washington-Baltimore Air System Planning Region
Commodity Types Handled by Air
 Value and Weight, 2020

Top Tonnage Commodities	Thousands of Tons	Top Value Commodities	Millions of Dollars
Plastic and rubber	44	Electronic and Electrical equipment	2,404
Basic Chemicals	39	Pharmaceutical products	1,170
Pharmaceutical products	24	Transportation equipment	977
Base metal	22	Precision instruments and apparatus	951
Electronic and Electrical equipment	20	Machinery	633
Machinery	17	Miscellaneous manufactured products	497
Other chemical products	15	Other chemical products	399
Motorized and other vehicles	14	Motorized and other vehicles	382
mixed freight	13	Plastic and rubber	344
Other chemical products	13	Articles of base metal	282

Source: National Capital Region Freight Plan (2023). MWCOG

GENERAL AIR CARGO INDUSTRY GROWTH

Air cargo traffic, crucial for both domestic and international freight, express deliveries, and mail, is intricately tied to economic trends at national and global levels. The Federal Aviation Administration (FAA) anticipates that air cargo activity will continue to be influenced by factors such as GDP growth, fuel prices, and trade dynamics. This correlation is clearly observed in domestic revenue ton miles (RTMs), which closely mirror the performance of the U.S. GDP, reflecting the demand for transported goods within the country (FAA, 2024). Meanwhile, Boeing's World Forecast underscores global economic resilience after the pandemic, emphasizing a rebound in GDP and trade of goods. Despite these positive trends, the focus on U.S. air cargo highlights specific factors affecting domestic operations, including regulatory environments and shifts in consumer behavior favoring goods consumption over services (Boeing, 2024).

Air cargo traffic has experienced distinct phases before, during, and after the COVID-19 pandemic, mirroring broader economic trends. Pre-pandemic growth was stable, paralleling GDP increases, with cargo primarily transported via passenger aircraft and dedicated carriers within competitive pressures from other transport modes. During the pandemic, a shift in consumer spending toward goods significantly boosted air cargo demand, resulting in a 20 percent increase in RTMs by 2022, largely managed by all-cargo carriers benefiting from reduced passenger flights.

In addition to its economic importance, air cargo's operational flexibility and responsiveness were crucial during disruptive periods like the COVID-19 pandemic. The ability of all-cargo carriers to rapidly scale up capacity when passenger flights were reduced underscores the sector's agility in meeting sudden surges in demand for essential goods. Looking ahead, advancements in tracking and logistics technology are expected to further enhance efficiency and reliability in air cargo operations, supporting continued growth and adaptation to evolving global trade dynamics. Given its integral role in supply chains across industries, air cargo's resilience and adaptability will continue to play a pivotal role in navigating future economic uncertainties and meeting the evolving demands of global commerce (FAA, 2024; Boeing, 2024).

Post-pandemic normalization in 2023 saw a slight decline in air cargo RTMs from their peak, with domestic and international figures decreasing by 11.3 percent and 6.4 percent, respectively. Looking forward, a 4.3 percent growth in total RTMs is projected for 2024, driven by recovering consumer demand. Long-term forecasts anticipate steady growth in both domestic (2 percent annually) and international (3.6 percent annually) RTMs, with all-cargo carriers expected to gradually increase their market share. This adaptability underscores air cargo's critical role in global trade and its resilience in adjusting to economic shifts and changing consumer preferences (FAA, 2024; Boeing, 2024).

When analyzing Figure 13, we see that in 2018, the total RTMS was 42,759 million, with domestic RTMS at 15,761 million and international RTMS at 26,997 million. By 2022, the total RTMS grew 21 percent to 51,539 million, showing significant growth despite earlier challenges. In 2021, the total

RTMS increased a lot to 51,289 million, indicating a strong recovery for the aviation sector, with both domestic and international RTMS contributing to the increase.

The projections show a dip in 2023 to 47,272 million, but a rebound is expected in 2024 with total RTMS reaching 49,293 million. More growth is anticipated, reaching 51,212 million in 2025. Long-term forecasts show continued growth, with total RTMS projected to be 61,010 million by 2030, 80,050 million by 2040, and 88,814 million by 2044, a total growth of 72 percent compared to 2022. These projections reflect a strong and sustained increase, especially in international RTMS, which significantly contributes to the overall total.

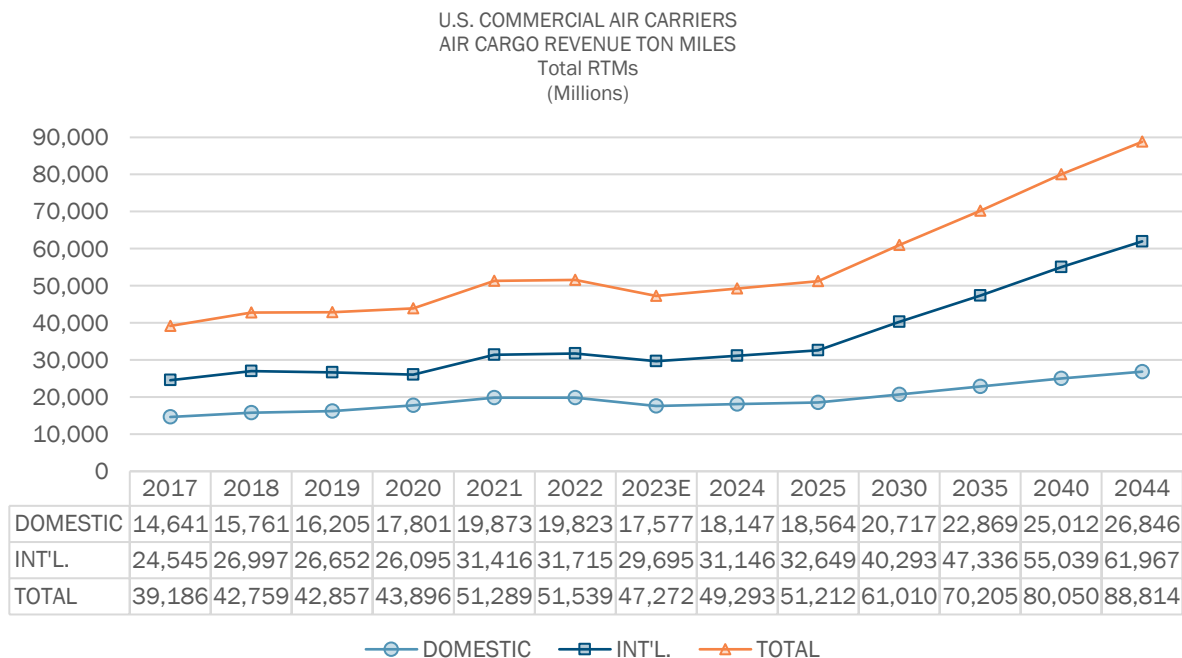


Figure 13. U.S. Air Cargo Revenue Air Carriers

Source: FAA Aerospace Forecast Years 2024-2044, chrome-extension://efaidnbmninnibpcajpcglclefindmkaj/https://www.faa.gov/dataresearch/aviation/aerospaceforecasts/faa-aerospace-forecast-fy-2024-2044

Note: RTMs (Revenue Ton Miles): Measures the volume of freight transported and the distance it is carried. Specifically, one RTM is equal to one ton of cargo transported one mile.

E: Estimated value

AIR CARGO GROWTH IN THE REGION

The air cargo growth in the region has been influenced by various factors, shifting the behavioral patterns at both IAD and BWI, resulting in some uncertainty about the future of cargo operations. As previously mentioned, each airport plays a significant and complementary role in the regional distribution of cargo. Table 16 illustrates the distribution of domestic and international freight for both airports in the region.

For this analysis, regional air cargo demand consists of air freight and air mail that originate or terminate in the market region of Dulles and BWI airports. The overall market region is defined as an eight-state region consisting of North Carolina, Virginia, West Virginia, the District of Columbia, Maryland, Delaware, Pennsylvania, and New Jersey. The region is within 250 miles of one of these airports, or within 500 miles of the airports and not closer to a major cargo airport (such as New York-Kennedy [JFK], Atlanta Hartsfield-Jackson International [ATL], or Chicago-O'Hare [ORD]). This definition is based on analysis of cargo flow patterns, trucking services, and the marketing systems for the air carriers at those airports. (COG, 2008)

Moreover, IAD is the largest airport for international flights, serving over 7 million international passengers and handling 115,711 metric tons of international freight in 2022, which accounts for about 97 percent of the total international freight in the region, according to the 2022 North America Airport Traffic Summary. In contrast, BWI manages most of the domestic freight in the region, handling more than 21 million domestic passengers, and 72 percent of the domestic cargo in the region.

Table 16. 2022 Cargo (Freight & Mail) in Metric Tons

2022 Cargo (Freight & Mail) in Metric Tons							
City/Code	World Ranking	NAM Ranking	Intl. Freight	Domestic Freight	Mail	Total Cargo	TOTAL CARGO % Chg 2022 - 2021
Baltimore MD (BWI)	91	28	3,041 2.6%	249,852 72.3%	3,704 19.9%	256,598 53.2%	-8.6%
Washington DC (IAD)	97	31	115,711 97.4%	95,515 27.7%	14,870 80.1%	226,096 46.8%	0.3%
TOTAL REGION	-	-	118,752	345,367	185,74	482,694	-

Source: Air Cargo International-North America, Accessed April 2023 from <https://airportsCouncil.org/>

Note: the entire table is found in the appendix 1

As previously noted, each of the airports serves as a hub for different cargo companies. IAD serves as a hub for FedEx and is a major belly cargo hub for United, while BWI serves as a hub for Amazon. In Figure 14, we can observe how the shift in cargo slowly happened in the region. By 2017, the

cargo in the region was primarily handled by IAD, which accounted for almost double the cargo handled at BWI.

Following 2017, BWI experienced noticeable growth until 2021. In contrast, IAD experienced a noticeable decrease from 2018 to 2020, especially in 2020 decreasing about 1/3 of the tons, resulting in BWI surpassing IAD in metric tons that year. The trend in the region then shifted, with BWI becoming the airport that handles the most cargo in the region, continuing this trend until 2023. During 2022 and 2023, both airports have seen a slight increase in their metric tons.

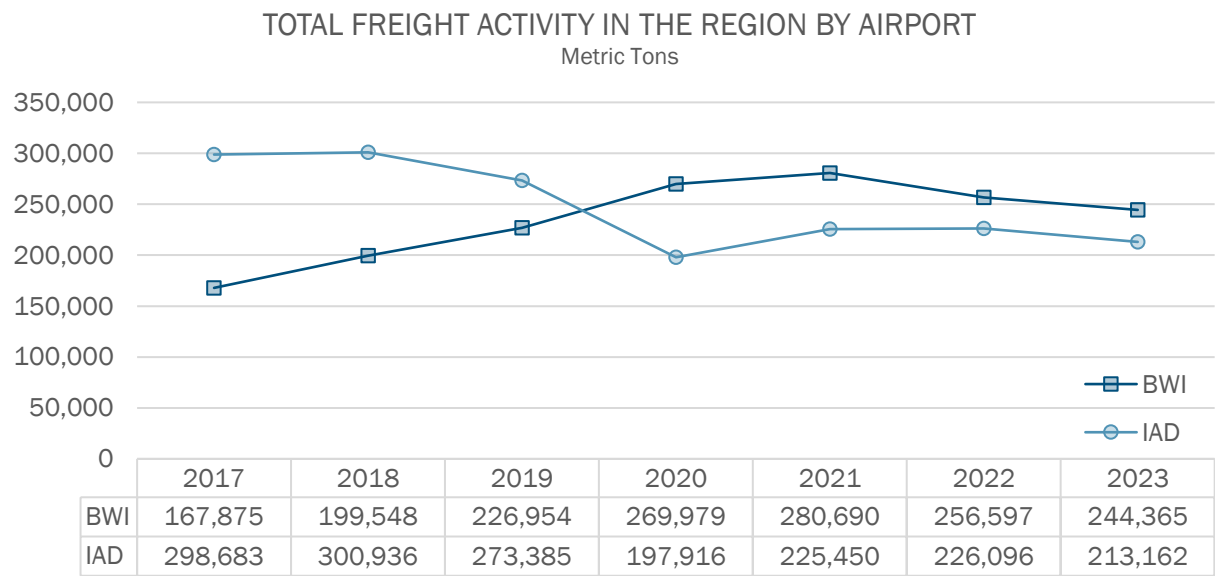


Figure 14. Total Freight Activity in the Region by Airport

Source: 1. MWAA, Air Traffic Statistics, <https://www.mwaa.com/financial-statistics/dulles-air-traffic-statistics/2024-dulles-air-traffic-statistics>; 2. BWI Airport, Statistics, <https://bwiairport.com/flying-with-us/about-bwi/statistics/>

In conclusion, the air cargo growth in the region has been influenced by various factors, resulting in shifting behavioral patterns at both IAD and BWI and introducing some ambiguity about the future of cargo operations. Each airport plays a significant and complementary role in the regional distribution of cargo, as evidenced by the distinct focus areas and strengths of IAD and BWI.

While IAD remains the largest airport for international freight, handling the majority of the region's international cargo, BWI has emerged as the primary handler of domestic freight. This dynamic distribution highlights the importance of both airports in maintaining the region's cargo efficiency. As we observe these evolving trends, it becomes clear that strategic planning and adaptation will be crucial for both airports to continue meeting the demands of air cargo transportation in the coming years.

AIR CARGO IN THE REGION – FORECAST

This section presents the cargo growth projections for both BWI and IAD airports, providing an estimate of future performance based on historical data, trends, and key assumptions. The forecasts for each airport utilize two commonly used methods: **CAGR (Compound Annual Growth Rate)** and **YOY (Year-Over-Year)**. **CAGR** measures the average annual growth rate over a specified period, assuming steady growth each year, with BWI's forecast using a **CAGR of 2.4 percent** from 2024 to 2043. On the other hand, **YOY** compares the year-to-year change, with IAD's forecast using a **YOY growth rate of approximately 2.1 percent** from 2024 to 2045. The following sections will detail these cargo projections for each airport.

Baltimore/Washington International Thurgood Marshall Airport (BWI)

Air cargo forecast at BWI is shown in Figure 15 on the following page. From 2017 to 2021, air cargo at BWI experienced a significant increase, rising from 167,875 to 280,690 metric tons. However, 2022 and 2023 saw a decline. Despite these decreases, air cargo is projected to grow steadily through 2043, with an expected total increase of approximately 91.3 percent from 2023. This projection translates to an average annual growth rate of around two percent through 2043.

This forecast aligns with expected growth in regional population and households, projected to increase by approximately 23 percent and 28 percent respectively from 2020 to 2050 across the entire region. These parallel growth trends suggest that BWI's expected air cargo expansion is consistent with regional demand drivers, indicating a balanced development between cargo capacity and population and household growth in the area.

The alignment of air cargo growth with demographic trends highlights BWI's prominent role in supporting regional economic development and consumer demand. As the population and number of households increase, demand for goods and timely delivery services is expected to grow proportionately, making BWI an essential hub for meeting future freight needs. This steady expansion also positions BWI to capitalize on broader e-commerce growth trends and potential international trade partnerships, reinforcing its role as a critical asset for the region's economic resilience and connectivity in the coming decades.

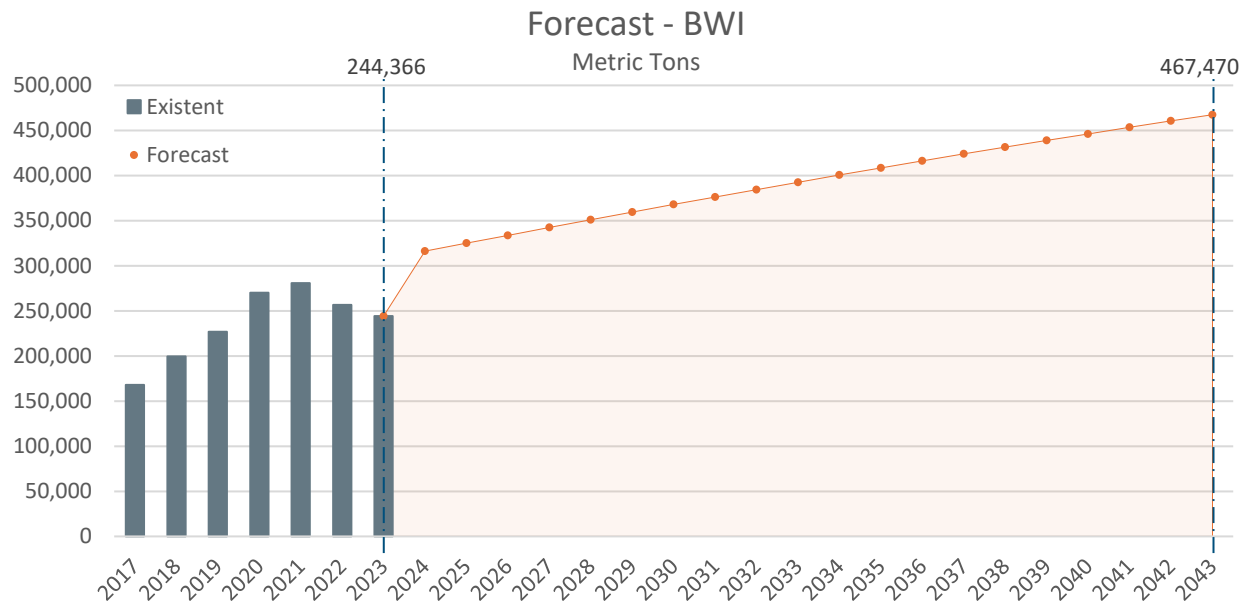


Figure 15. Forecast BWI - Air Cargo

Source: Forecast Data 2018-2043 provided by BWI airport.

- CAGR 2024-2043: 2.4%
- Data 2017-2023 in bar chart are the actual metric ton by year

Dulles International Airport (IAD)

Air cargo trends at IAD are shown in Figure 16. Air cargo trends at IAD are projected to increase steadily from 2023 through 2043. Starting at 213,162 metric tons in 2023, the volume of air cargo is expected to rise each year, reaching 439,749 metric tons by 2043. This represents a cumulative growth of approximately 106.3 percent over the 21-year period, translating to an average annual growth rate of around two percent. This consistent upward trend suggests a stable and sustainable increase in air cargo at IAD, likely driven by expanding demand in both domestic and international markets, as well as increasing reliance on timely delivery for goods due to the growth in e-commerce and global trade activities.

The projected growth in air cargo at IAD aligns with anticipated regional demographic expansion, as both population and household numbers are expected to rise steadily over this period. For instance, regional forecasts predict population growth of around 23 percent and household growth of approximately 28 percent through 2050. This parallel growth trend between air cargo demand and population metrics reflects the region's increasing consumer base, which is likely to drive greater demand for goods and air freight services. Such alignment supports the idea that IAD's infrastructure development and cargo capacity investments will cater to the expanding logistics needs of the region, reinforcing its role as a key logistical hub.

As population and household counts rise, demand for timely and efficient cargo transport services is expected to follow, underscoring IAD's prominent role in ensuring efficient supply chains. The steady growth in air cargo further suggests that IAD will be well-placed to capture opportunities from broader global trade trends and the expansion of e-commerce, positioning it as a cornerstone of the region's economic connectivity and resilience into the mid-21st century.

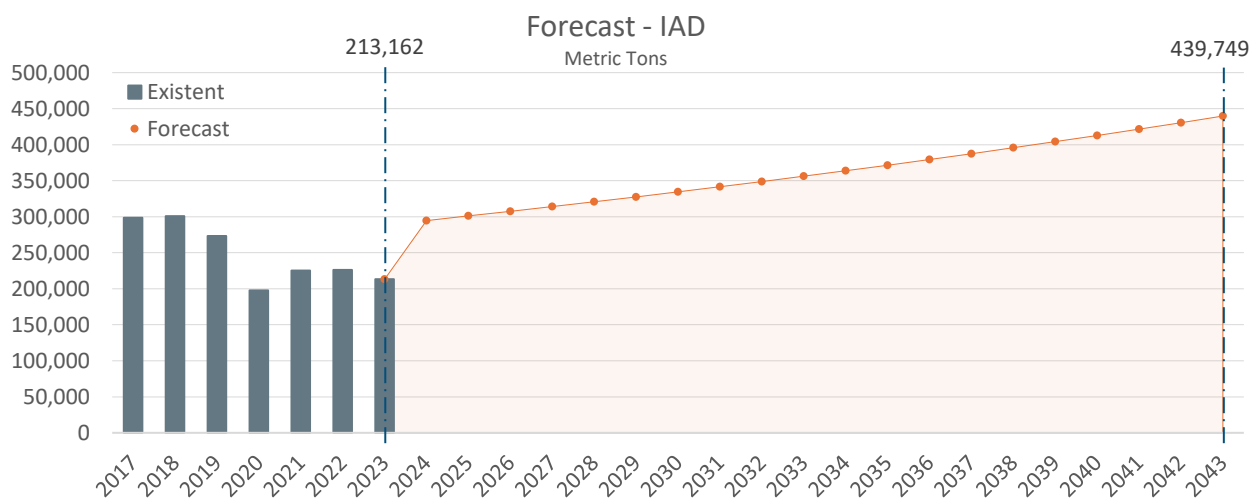


Figure 16. Forecast IAD - Air Cargo

Source: Forecast Data 2024 and 2043 provided by IAD airport.

- YOY 2024-2045: 2.1% approx.
- Data 2017-2023 in bar chart are the actual metric ton by year

Belly Cargo Vs. Freighter

When analyzing the distribution of air cargo between BWI and IAD, it is important to distinguish between two primary types of air cargo: integrator/freighter cargo and belly cargo. Integrator/freighter cargo is transported on dedicated cargo aircraft, providing flexible schedules and routes tailored specifically for freight. Belly cargo, on the other hand, utilizes the available capacity in the cargo holds of passenger planes, operating in alignment with passenger flight schedules. This distinction underscores the complementary roles each airport plays in the region's air cargo network, with each focusing on distinct segments of the market.

As shown in Figure 17, BWI primarily handles freighter cargo, which constituted 91 percent of its total cargo in 2024. This trend is expected to remain consistent, with freighter cargo projected to account for 89 percent of BWI's total cargo in 2043. Conversely, at IAD, the majority of air cargo consists of belly cargo, which represented 73% of the airport's total cargo in 2024. This distribution is also anticipated to remain stable, with belly cargo projected to account for 74 percent of IAD's total cargo by 2043.

This complementary distribution allows the two airports to specialize and support the region's diverse air cargo needs effectively.

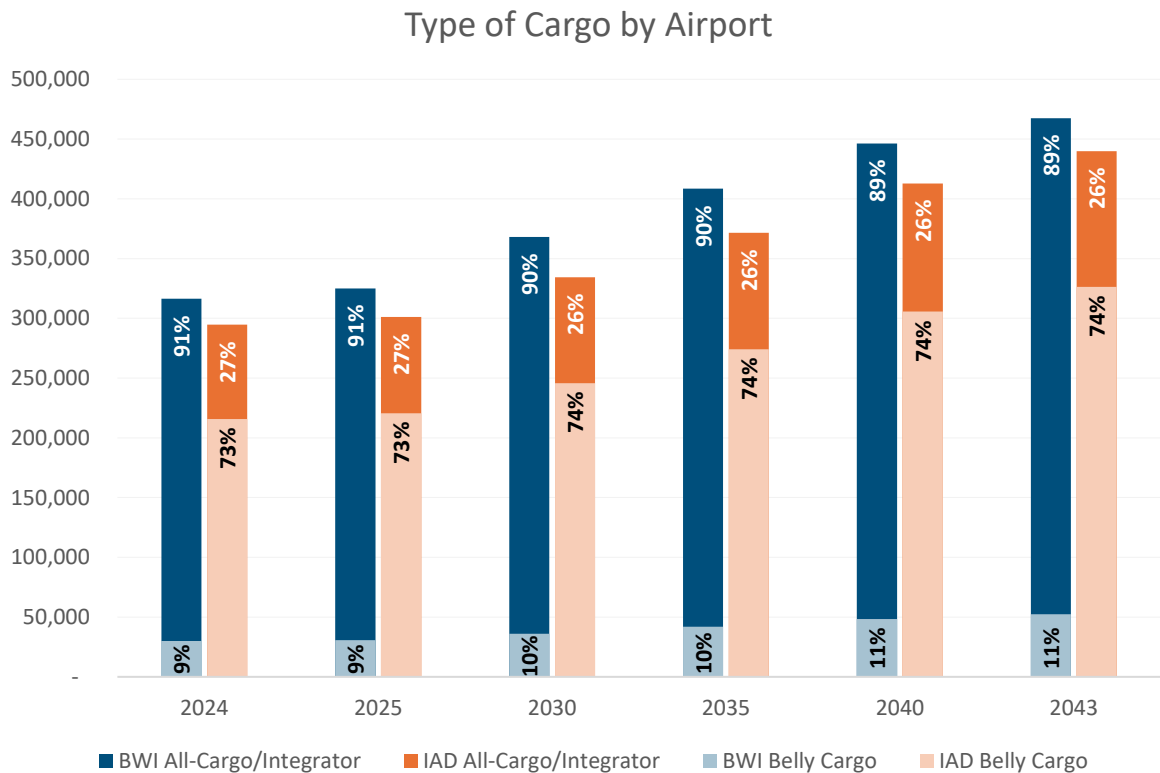


Figure 17. Type of Cargo by Airport
Source: Forecast Data 2024 and 2043 provided by IAD airport and Forecast Data 2018-2043 provided by BWI airport.

DEMAND CONCLUSION

Historically, the region has been among the most prosperous in the nation, boasting high educational attainment rates among residents and workers and leading other regions in developing and utilizing cutting-edge technologies. As such, the demographic and economic composition of the region make it well suited to benefit from high value, just in time air cargo services. Forecasts indicate that population, household, and job growth will continue, with increases of approximately 20 percent to 30 percent expected between 2020 and 2050. This growth will likely drive higher demand for air cargo services at BWI and IAD.

Moreover, the air cargo industry is also projected to expand globally. BWI and IAD are both well-positioned to meet this emerging demand. Historically, BWI has primarily served domestic air cargo needs, while IAD is expected to see growth concentrated in the international sector over the planning period. No data suggests a shift in the current distribution of international and domestic air cargo between these airports, though national trends indicate stronger growth in international cargo through 2043.

The air cargo demand analysis suggests that demand for both domestic and international air cargo services will increase in the coming years. The region's increasing population, expanding number of households, and job growth will require more goods, fueling this demand. Additionally, the region's economic health depends on strong inter-regional commerce as well as growing participation in global trade. Therefore, it is crucial that air cargo services in the region continue to adapt to rising domestic and international demand.

AT-HOME DELIVERY AND E-COMMERCE

At-home delivery has become an integral part of modern life, transforming how goods are transported and received. The convenience of having products delivered directly to consumers' doorsteps has elevated the importance of efficient logistics systems, with air cargo playing a vital role in meeting these expectations. This shift is largely driven by the explosive growth of e-commerce, which has revolutionized shopping habits and significantly increased the volume of goods requiring swift and reliable transportation. As online retail platforms continue to expand, the demand for air cargo services to support at-home delivery grows, emphasizing the need for enhanced airport infrastructure and streamlined operations to keep pace with these evolving consumer trends.

E-commerce has emerged as a key force driving the growth of at-home delivery, reshaping how goods are transported and received. Companies like DHL have responded by offering a comprehensive suite of services tailored to the needs of e-commerce businesses, including parcel delivery, cross-border e-commerce solutions, and e-commerce fulfillment services. These services enable businesses to manage inventory, process orders, and ensure timely delivery to customers across the globe. Similarly, UPS, USPS, and FedEx have developed specialized options to support the growing e-commerce sector, offering services such as expedited shipping, integrated tracking, and scalable logistics solutions. These companies play a critical role in ensuring that goods move seamlessly from production centers to consumers' doorsteps, highlighting the vital connection between air cargo operations and the expanding at-home delivery market.

“More than 90% of air cargo traffic in this region was moved on freighters in 2023, with express carriers alone accounting for over 70% of traffic. The market has seen above-trend growth in recent years, largely due to a 16% annual increase in U.S. e-commerce from 2017 to 2023. While e-commerce growth is projected to slow to high single-digits, expansion into segments such as healthcare, pharmaceuticals, groceries, and perishables will sustain growth and ensure that e-commerce remains an important driver of air cargo demand.” Boeing, 2024. World Air Cargo Forecast 2024-2043.

E-commerce plays a pivotal role in the U.S. air cargo industry, accounting for an estimated 20 percent of total air freight volumes. This growth is driven by consumer demand for faster delivery options, with air freight playing a critical role in meeting time-sensitive logistics needs. U.S.-based e-commerce retailers and logistics partners are heavily investing in expanding air freight capacities and integrating advanced technologies to ensure operational efficiency and sustainability. Notably, around one in five e-commerce packages are currently transported by air, a figure expected to rise to one in three by 2027 (S&P Global Market Intelligence, 2024; STAT Times, 2024).

While specific data on the exact share of air cargo driven exclusively by e-commerce is not readily available, it remains difficult to pinpoint its precise impact on regional air cargo volumes. However, it is widely acknowledged that major e-commerce companies like Amazon have made significant

investments in logistics and air cargo operations to meet increasing demand. Amazon, in particular, operates a dedicated air cargo network and collaborates with several air cargo carriers to support its operations. Companies such as ABX Air, ATI, and Atlas Air are key partners managing Amazon's dedicated cargo flights.

In line with global industry trends, it is estimated that around 20 percent of air cargo worldwide is attributed to e-commerce. This percentage is expected to grow as the online retail market expands and consumer demand for fast shipping continues to rise. Applying this global trend to the regional context, we can estimate that at IAD (Washington Dulles International Airport), where 213,162 metric tons of cargo were reported, approximately 42,500 metric tons is likely driven by e-commerce.

At BWI (Baltimore/Washington International Airport), for example, Amazon's dedicated operations play a critical role in the airport's air cargo activities. According to BWI's statistics, for the 12-month period ending in December 2023, the total air cargo volume was approximately 242,000 metric tons, with Amazon's dedicated operations (ABX Air, ATI, and Atlas Air) accounting for 62 percent of the total air cargo handled. This highlights the growing influence of e-commerce on the airport's cargo operations, particularly as demand for fast and reliable delivery services continues to rise. It also underscores the challenge in estimating the precise impact of e-commerce, as the percentage of air cargo driven by e-commerce may vary significantly between airports.

These insights reflect the broader impact of e-commerce on the air cargo industry, especially in regions where dedicated cargo operations, such as those run by Amazon, contribute significantly to air freight volumes. As e-commerce continues to grow, airports like BWI and IAD are likely to see an even greater shift in their air cargo operations toward meeting the needs of e-commerce logistics.

REGIONAL AIRPORTS CARGO FACILITIES

Cargo facilities were originally designed based on the predominant type of air cargo service occurring at the major airports—belly freight on passenger aircraft. Air cargo facilities were placed within or close proximity to passenger terminals without considering that substantial growth in air cargo facility expansion may be necessary in the future. Most facilities were not planned in a comprehensive manner to support air cargo as a primary activity; rather, they were planned and constructed within the pretext that air cargo operations occurred adjunct to air passenger service.

Rapid expansion of the Washington and Baltimore regions, coupled with the emerging importance of all-cargo carriers, such as Amazon, FedEx, and UPS, prompted the need to rethink air cargo facilities planning and make specific accommodations for consolidated air cargo facilities in airport layout plans (ALPs). The emergence of the importance of air cargo as a substantial revenue generating activity of carriers spawned the need to strategically plan air cargo facilities at major airports. In short, the strategic planning and development of air cargo infrastructure became an economic development necessity for major airports seeking to maintain their competitiveness, if not expand their prominence and desirability. To do otherwise could result in missed opportunities to retain market share among major commercial airports. BWI and IAD are the two commercial airports in the air system planning region containing substantial air cargo operations and infrastructure to support them.

The air cargo demand analysis indicates that air cargo demand is expected to grow in the coming years, with anticipated increases in both domestic and international services. As noted, the region's increasing population, number of households, and job growth will drive a greater need for goods to meet this growing demand. This section provides an overview of the existing facilities and infrastructure at BWI and IAD that support air cargo operations. It also highlights considerations for future facility planning to ensure continued effective accommodation of air cargo needs.

The information used for the cargo facilities was obtained from various sources, including the BWI Cargo Study, the Dulles Airport Master Plan, and the respective airport websites.

Baltimore/Washington International Thurgood Marshall Airport (BWI)

On average, 23 daily cargo flights occur at BWI -departure and arrival included. To support these operations, as well as passenger operations that also carry in-belly cargo shipments, BWI has numerous air cargo and operations facilities. There are three runways operating around the clock. Runway 10 approach of Runway 10/28 has the highest-classified Instrument Landing System (ILS), Category III (CAT III), which is necessary to support aircraft landings in the least favorable weather conditions. This will ensure all types of aircraft can be accommodated in unfavorable conditions. Runway 10/28 is 10,500 feet in length, 15R/33L is 9,500 feet, and 15L/33R is 5,000 feet. BWI encompasses a total of 3,596.3 acres.

Eleven (11) cargo buildings accounting for 665,341 square feet of warehouse space are present to support air cargo operations. This space includes a cold storage facility with direct ramp access to support time-sensitive air cargo shipments such as flowers or other perishables. Such facilities are important components to the supply chain for delivering time-sensitive commodities and are necessary to demonstrate to air cargo users that the quality of their products will not be undermined because of inadequate conditions that may occur in the air cargo shipping process.

Cargo aircraft aprons are located at the North and Midfield Cargo Complexes, with 29 parking positions—17 at North and 12 at Midfield. These facilities enable multiple air cargo operations to be supported simultaneously, which in turn, bolsters the through-put—ultimately resulting in increased capacity for air cargo operations at BWI. This is particularly beneficial to BWI because of its primary focus on domestic air cargo services. Domestic operations are typically supported by more frequent flights but with smaller aircraft. Sufficient throughput is needed to support such operations. BWI is one of the U.S. Fish and Wildlife Service (USFWS) inspection gateway in the mid-Atlantic. USFWS inspectors provide on-site inspection of live animals, fish and game to expedite clearance and ultimate delivery of live air cargo to their final destination.

BWI is a designated international airport and as such, it is both an origin and destination for international air cargo shipments. Permanently-assigned staff from the Department of Homeland Security's (DHS) U.S. Customs and Border Protection (CBP) are located at BWI around the clock for all international air passenger and air cargo operations occurring at the airport. This 24/7 presence helps expedite the flow of air cargo through this key transfer point in the supply chain. Another key facility at BWI that supports efficient air cargo movement is its designation as Foreign Trade Zone (FTZ) 073.

Currently, the cargo infrastructure at BWI is adequate to meet existing demand. However, in preparation for future growth, BWI has identified several critical infrastructures needs to support cargo operations. These include a new integrator cargo development, a multi-tenant ground handler building for airline cargo and ground handling near the passenger terminal, a new belly-freight facility

located near the passenger terminal or existing airline operations, and a general-purpose building to accommodate existing tenants and attract new tenants, such as a flight kitchen, near the passenger terminal.

According to the BWI Marshall Air Cargo Market Assessment and Facilities Analysis (2023), meeting these needs requires planning for the development of an integrator building of 200,000 square feet, ground handler facilities of 190,000 square feet, a facility for Amazon operations of 415,000 square feet, and a general airport support facility of 70,000 square feet. Additionally, the number of parking positions for integrators will need to increase from 10 to 13, with no further expansions required for Amazon aircraft. These enhancements are necessary to accommodate the projected cargo growth by 2043.

Interstate highways are readily accessible to BWI, providing seamless connectivity to major national north-south and east-west routes. This strategic location allows for efficient transportation of goods and passengers, enhancing the airport's role as a critical hub in the regional and national transportation network. Key interstates near BWI include I-95, a primary north-south corridor that links the Mid-Atlantic to the Northeast and Southeast, and I-70, a major east-west route connecting the Mid-Atlantic to the Midwest. Additional details on highway accessibility and their integration with the airport's cargo and passenger operations can be found in the subsequent section, Accessibility Analysis. This robust highway access underscores BWI's logistical advantages, facilitating swift movement of goods to and from the airport and supporting its growth as a vital economic asset.

Dulles International Airport (IAD)

Four runways support operations at IAD, all of which are CAT III ILS. Runways 1C/19C and 1R/19L are both 11,500 feet long, runway 12/30 is 10,500 feet long, and runway 1L/19R, approximately 9,400 feet long and 150 feet wide. A fifth runway 12R-30L, has been planned, but construction of this facility (which will be parallel to runway 12/30) has not been scheduled. Like BWI, Washington Dulles International Airport conducts 24-hour operations.

IAD houses six cargo buildings accounting for 481,084 square feet of warehouses, including a common area and excluding upper-level office space at 70,051 square feet, accounting for approximately 551,000 square feet of operational space. These facilities accommodate specialized services, including refrigerated and heated areas to protect sensitive, perishable shipments; special handling for live animals to provide protection from noise and temperature extremes; and security areas for short-term storage of high value cargo. In addition to the facilities that accommodate air cargo operational capacity, IAD also includes facilities that support expedient transfer of air cargo shipments. These include an FTZ for conducting international trade.

IAD is also a designated international airport and accommodates international air cargo shipment as a result. To help facilitate this, IAD has permanently-assigned staff from DHS CPB to provide continuous customs support for all air passenger and air cargo operations.

The airport property itself is composed of nearly 12,000 acres, and much of the property is still undeveloped. As a result, there is capacity for substantial facility expansion to occur to support the increased carrying capacity that will occur with the completion of new and reconstructed runways. Dulles International Next, is a multi-year construction program that includes \$7 billion worth of airport infrastructure upgrades that will transform passenger comfort, convenience and service (MWAA). This program is part of the master plan for the future development and expansion of Washington Dulles International Airport. It includes the construction of the new Concourse E, a 435,000 square-foot facility, with construction having initiated in November 2023 and plans for completion in 2026. The concourse is designed to accommodate 14 additional gates and provide capacity for larger airlines, enhancing the airport's overall operational efficiency and passenger experience.

With the rapid growth of home delivery companies, IAD is positioning itself to meet the rising demand for air cargo operations. Recognizing the importance of staying ahead of future needs, the airport has identified key growth opportunities to ensure it is fully prepared to handle the projected demand. These plans are based on forecasts outlined in the Regional Stakeholder Working Group Meeting #3 Airport Masterplan Presentation on June 22, 2022. According to the report, approximately 93 acres will be required by 2045 to accommodate the necessary infrastructure for air cargo. This total includes facilities for warehouses, aprons, truck docks, truck staging, and parking, all of which are critical components for efficient cargo handling.

IAD's strategic focus on belly cargo plays a significant role in its development plans. Of the total area, 59 percent (55.1 acres) will be allocated to support belly cargo operations, reflecting the airport's strength in this market segment. The remaining 41 percent (38.7 acres) will be dedicated to all-cargo and integrator operations, ensuring a balanced approach to meet diverse cargo needs.

Breaking the requirements further, 27 percent of the total space (25 acres) is planned for truck docks and staging areas, facilitating efficient ground transportation and loading processes. Another 26 percent (24.2 acres) will be used for aprons to provide space for aircraft parking and cargo loading/unloading. Warehousing will occupy 19 percent (18 acres), serving as a hub for cargo storage and processing. The remaining 28 percent of the area will support auxiliary uses, such as parking, landscaping, and drainage infrastructure, ensuring a well-rounded development plan.

The proposed expansion will be strategically divided into four key zones: the Airport Support area, the Midfield area, the South Development area, and the Southwest Development area. Each zone will serve specific operational and logistical needs, providing a comprehensive framework to accommodate the growing air cargo demand.

Located on the border of Loudoun and Fairfax counties in Virginia, IAD benefits from excellent connectivity, with three limited-access highways and a major primary route near the airport currently undergoing upgrades to limited-access standards. Detailed information about highways is provided in the Accessibility Analysis section.

Cargo Facilities Conclusion

The air cargo market is projected to experience significant growth by 2043, driven by evolving market dynamics and societal trends. This anticipated expansion underscores the importance of strategic planning to address future infrastructure demands. Both Washington Dulles International Airport (IAD) and Baltimore/Washington International Thurgood Marshall Airport (BWI) currently have the capacity to handle today's cargo volumes. However, recognizing the forecasted increase in demand, both airports have outlined growth plans aimed at enhancing their facilities and maintaining operational efficiency. These proactive measures reflect a commitment to supporting the regional economy and ensuring their competitiveness as pivotal hubs in the evolving air cargo landscape.

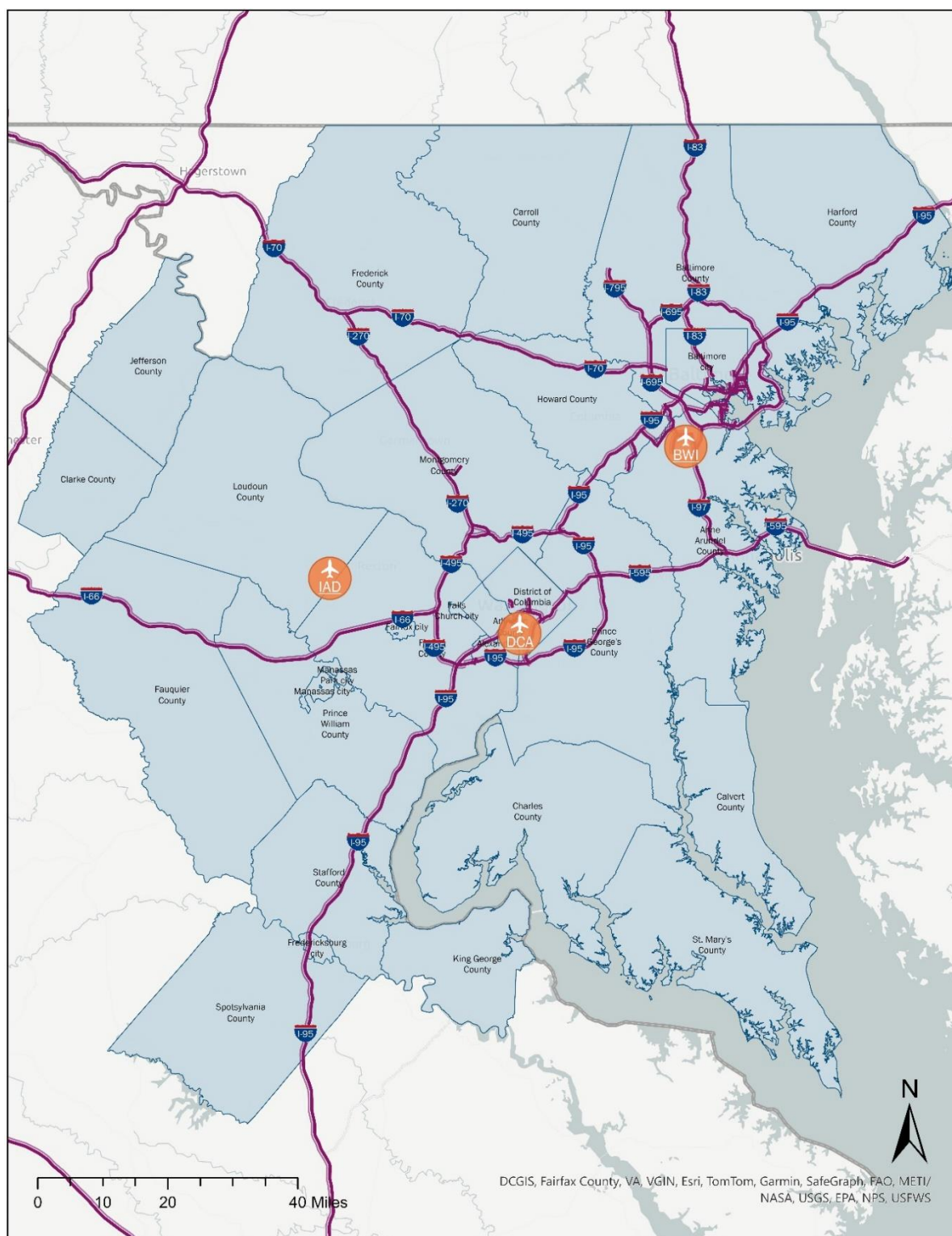
Several key factors are driving this growth, including population and household expansion, which inherently increases the demand for goods and services. Another significant driver is the rapid rise of the e-commerce sector, fueled by the growing preference for home delivery and online retail. These trends necessitate robust cargo-handling capabilities and infrastructure upgrades to support faster and more reliable distribution networks. By aligning their development strategies with comprehensive forecasts, both IAD and BWI are preparing to meet the challenges and opportunities of the future, ensuring they can accommodate increasing volumes while continuing to serve as vital nodes in the global air cargo market.

ACCESSIBILITY ANALISYS

As previously mentioned, the region is composed of 29 counties and independent cities across Washington, D.C., Maryland, Virginia, and West Virginia. This diverse and expansive region is served by a network of critical highways, which are crucial for the movement of goods and freight. Figure 18 illustrates the 2023 National Highway Freight Network (NHFN) as outlined by the Federal Highway Administration (FHWA), highlighting the key routes that facilitate freight movement throughout the region.

In Washington, D.C., the primary NHFN routes include I-395, DC-295, I-295, and I-66, all of which provide significant access for freight traveling through the city. In Maryland, the network is more extensive, including major highways such as I-95, U.S. 50, I-595, I-495, I-97, I-270, I-70, I-695, I-895, I-83, I-195, S-170, and I-795. Of particular importance are I-195, which provides a direct link to Baltimore/Washington International Thurgood Marshall Airport (BWI), and S-170, which encircles the BWI airport, connecting both I-195 and I-97.

In Virginia, the NHFN includes I-495, I-395, I-95, and I-66. While these routes serve as important arteries for freight movement throughout the state, none of them provide direct access to Washington Dulles International Airport (IAD). However, several roads serve as both direct and indirect connectors to the NHFN, which will be analyzed further in the following section. This highlights the need to explore how other non-interstate roads currently support cargo transport, as illustrated in the following map, and facilitate connections between the airports and the nationally recognized freight routes.



When analyzing Figure 19, which highlights the 2022 average daily traffic count for larger trucks (Combination Truck AADT) extracted by the Metropolitan Washington Council of Governments (COG) from the 2022 Highway Performance Monitoring System (HPMS) prepared from the Federal Highway Administration (FHWA) in grey, it becomes clear that the network of roads supporting cargo operations to and from the region's airports is far more extensive than initially apparent. This network spans across all counties and integrates with the National Highway Freight Network (NHFN) routes. Together, these interconnected routes play a vital role in facilitating the efficient movement of goods across the region, ensuring seamless cargo flow to and from the airports.

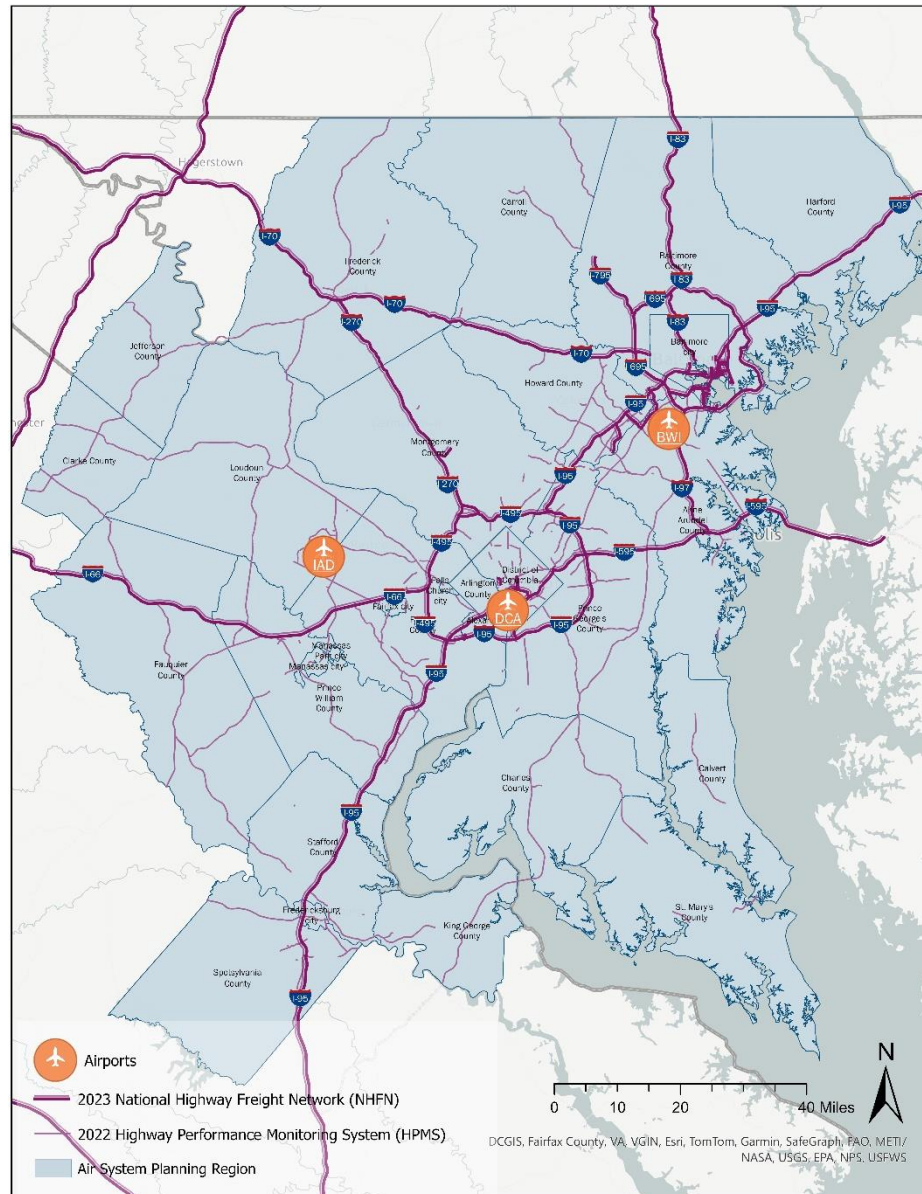


Figure 19. Freight roads in the region

Source: MWCOG

Baltimore/Washington International Thurgood Marshall Airport (BWI)

When examining the surrounding area of each airport, it becomes evident that BWI is strategically well-served by routes included in the National Highway Freight Network (NHFN), as shown in Figure 20, that enhances its accessibility for air cargo operations. The road network surrounding Baltimore/Washington International (BWI) Airport is strategically designed to facilitate easy access and smooth traffic flow for travelers and commuters. This network is anchored by a key ring of roads, including Aviation Boulevard, Dorsey Road, Interstate 97 (I-97), and the Washington-Baltimore Parkway.

These key roads play distinct roles in facilitating different types of traffic. For example, I-97 serves as a major route for freight traveling to and from the airport, while Aviation Boulevard is crucial for access to passenger terminals. Moreover, in the east side a primary route used by trucks is MD Route-100, a key connector linking I-95, Washington Blvd, Washington-Baltimore Parkway, and I-97, which also extends northwest to intersect with Columbia Pike and I-70—a major east-west corridor crucial for regional and interstate freight distribution. MD Route-100 provides a direct link for goods coming from the central Maryland region, facilitating the timely movement of cargo into the airport's air cargo facilities. This route enables smooth cargo flow to central Maryland, western Maryland, and beyond, supporting the movement of goods to and from the port and manufacturing centers.

Additionally, the Baltimore-Washington Parkway, running parallel to I-95, provides a vital secondary corridor connecting BWI with I-895 and I-195, in the northeast. This parkway offers an alternative for freight movement, particularly during peak traffic hours on I-95, which may provide support for a more reliable flow of goods between Baltimore and Washington, D.C. In the north part of BWI, I-695 connects I-95, Washington-Baltimore Parkway, I-97, and Arundel Expy, extending to the east. I-195, starting inside the airport's boundary, plays a central role in connecting the airport directly to both the Washington-Baltimore Parkway and I-895. Combined, these roads provide BWI with a robust transportation network that supports its role as a critical hub for air cargo operations in the region, ensuring continuous integration with ground transportation systems and supporting economic activity along the mid-Atlantic corridor. As the demand for air cargo and freight services continues to grow, this well-established network is positioned to meet future logistical challenges, reinforcing BWI's strategic importance in the region's transportation and economic infrastructure.

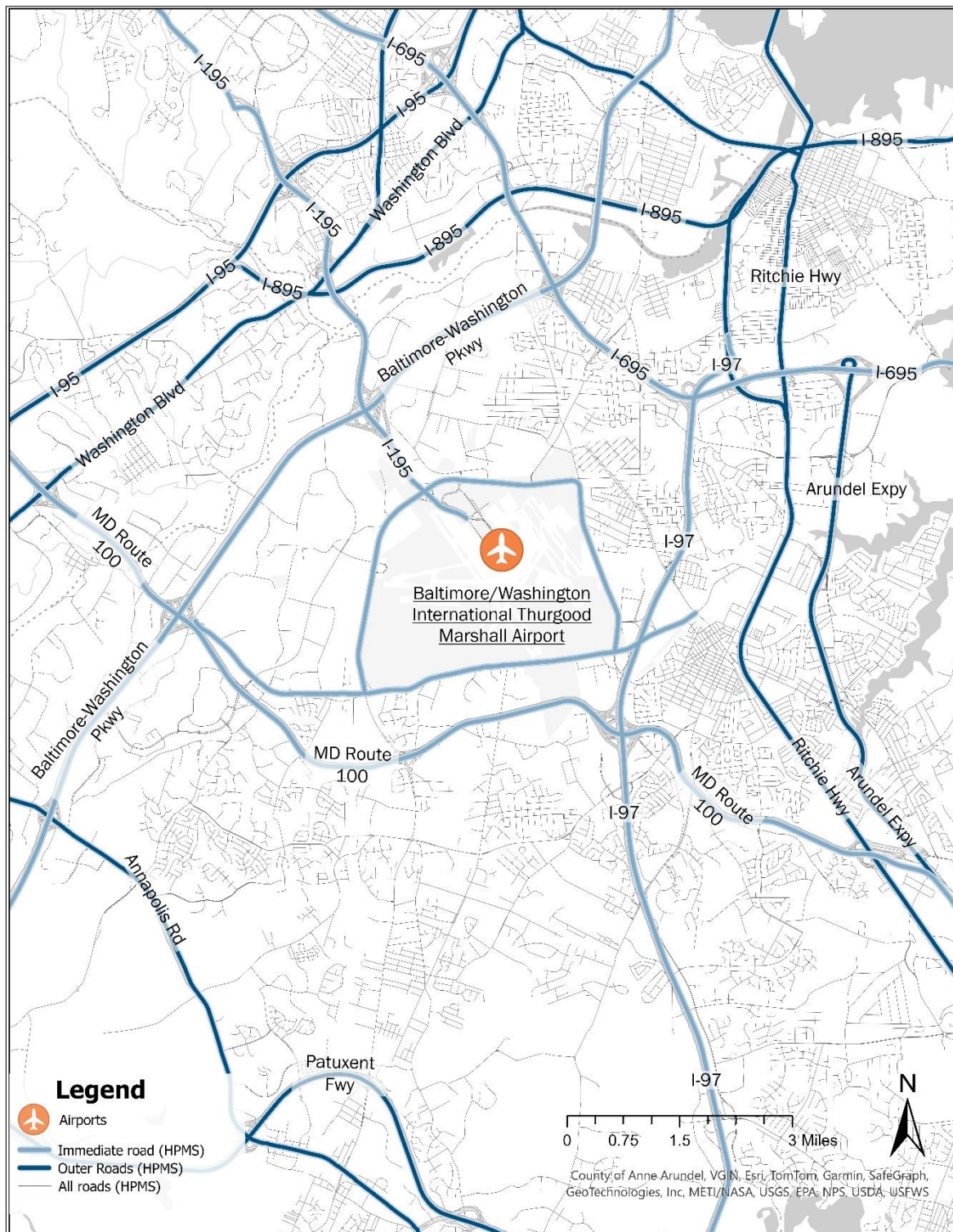


Figure 20. BWI Road Network

Source: MWCOG

Dulles International Airport (IAD)

IAD, as shown in Figure 21 relies heavily on its supporting road network to facilitate cargo movement before connecting to routes included in the National Highway Freight Network (NHFN). The primary connecting roads surrounding the airport are Route-50, Loudoun County Pkwy, Dulles Greenway, and Dulles Access Rd (DTR), that goes directly into Dulles Airport, each playing a critical role in enabling freight traffic. Loudoun County Parkway provides a vital south-to-north connection between the airport's cargo facilities and Route 50. Meanwhile, the Dulles Greenway connects the Leesburg Bypass (Route 7) from the northwest with Route 28, merging with the DTR. This offers a direct link to the greater Washington, D.C. area through its connection with I-66, supporting both passenger and freight movement. Additionally, the Dulles Access Road and DTR connects to I-495, the Capital Beltway, which serves as a crucial hub for accessing regional and interstate destinations. This strategic connection to I-495 allows IAD to tap into a vast network of regional corridors, enhancing its accessibility and reinforcing its position as a key player in the supply chain.

On the eastern side of the airport, Sully Road runs in a north-south direction and is a vital link between IAD and I-66, a key east-west interstate highway. Sully Road also intersects with Route 7, which parallels both I-66 and the Dulles Greenway to the north and provides additional connectivity to I-495 and the east and to I-81 to the west. This intersection at Route 7 improves redundancy in the network, ensuring that if one route faces congestion or closures, alternatives are readily available for freight movement. This configuration enhances the airport's ability to manage cargo traffic efficiently by dispersing freight across multiple routes, reducing potential bottlenecks and ensuring reliable connections to major metropolitan areas. Moreover, the distribution of traffic across these routes helps mitigate the risk of congestion around the airport, especially during peak freight hours.

To the west of the airport, US-15 (James Monroe Hwy) acts as a parallel alternative to Sully Road, offering another corridor for cargo transport. This route also facilitates freight movement to and from more rural areas, extending access to markets in western Virginia and neighboring states. This western corridor is particularly valuable for reaching regions that rely on goods from the airport but may not be as directly connected to the D.C. metro area.

Together, these roads form an integrated network that supports the airport's role as a major freight hub in the mid-Atlantic region. The strategic placement of these routes allows IAD to handle high cargo volumes while maintaining flexibility in routing and minimizing disruptions caused by traffic congestion. Additionally, the proximity to major roadways that link to both urban and rural areas ensures that IAD can service a wide range of industries and markets efficiently. The availability of parallel and intersecting roads ensures that cargo can move efficiently from the airport to distribution centers, manufacturing sites, and key urban areas, reinforcing the airport's importance in the regional and national supply chain.

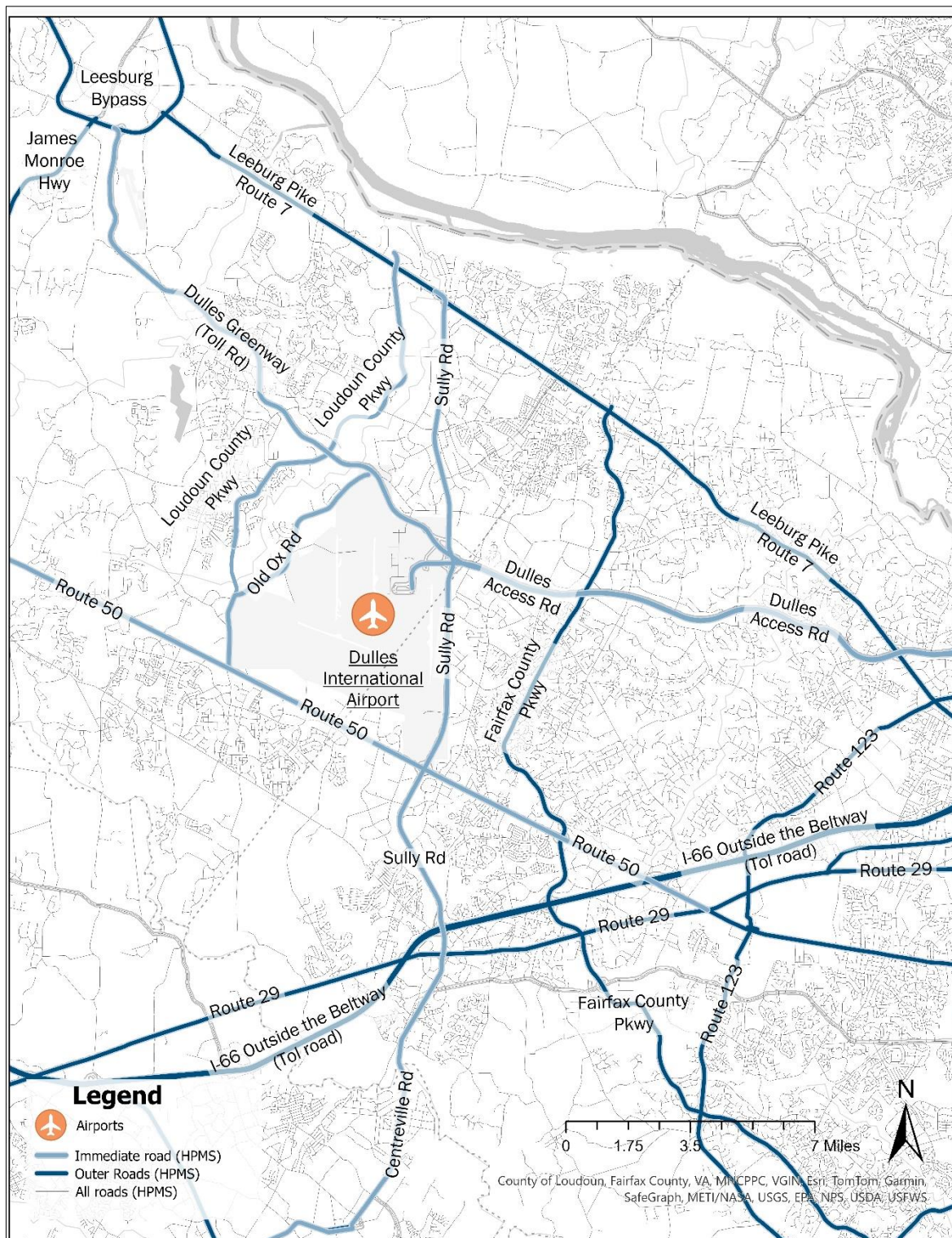


Figure 21. IAD Road Network

Source: MWCOC

RECOMMENDATIONS

Based on the analysis of regional population trends, air cargo growth patterns, and infrastructure needs across the Washington-Baltimore Air System Planning Region, several key recommendations can be made to address the challenges and opportunities identified. These recommendations aim to support the continued growth and development of the region's air cargo sector while ensuring that both existing and emerging demands are met. By focusing on strategic infrastructure investments, aligning growth with regional trends, and optimizing transportation networks, these recommendations provide a roadmap to help the region strengthen its position as a critical hub for air cargo in the coming decades.

Manage Regional Infrastructure:

Given the overall population and household growth across the region, managing investments in transportation infrastructure to enhance carpooling, public transportation, and alleviating road congestion should be prioritized. Fostering more efficient public transit systems, promoting carpooling initiatives, and improving road management will help reduce traffic congestion, improve air quality, and ensure that regional airports can accommodate the growing demand for air cargo while maintaining smooth mobility for residents and businesses.

Strategic Planning for Regional Housing and Services:

While growth rates may vary across the region, the anticipated increase in households will present challenges related to housing, services, and infrastructure. Focused regional coordination will be necessary to ensure that infrastructure is aligned with the region's growth and does not delay the increasing demand. Key strategies, such as urban redevelopment, increasing housing density, and improving transportation networks, will be essential to support the region's projected growth.

Enhance Connectivity between Airports and Regional Markets:

To support the air cargo growth forecasted for IAD and BWI, particularly in the e-commerce sector, there should be an emphasis on improving road accessibility and connectivity between the airports and regional markets. This would help address current challenges in freight transportation, especially for IAD, which faces limited direct access from major highways.

Support E-Commerce Growth Through Targeted Cargo Facilities Expansion:

As the e-commerce sector is expected to be a key driver for air cargo growth, there should be targeted investments in cargo facilities at IAD and BWI to support fast and efficient distribution. This includes expanding handling capacity, enhancing automation in cargo operations, and investing in technology to keep up with the rising demand for fast delivery.

Adapt to Changing Regional Demographics:

Key strategies, such as focusing future growth in areas served by high-capacity transit centers or regional activity centers, will be essential to support the future demand. These strategies will help optimize the use of available space and better accommodate shifting demographic trends and household growth across the region.

Leverage Regional Growth for Economic Development:

The higher growth rates in certain regions suggest that new opportunities may arise for regional economic development. Leveraging population and household growth to attract and retain new businesses, especially those related to logistics and air cargo, could help boost local economies and further support regional infrastructure needs.

APPENDIX 1. MODE DESCRIPTION FROM THE FAF

Code	Mode	Description
1	Truck	Includes private and for-hire truck. Does not include truck that is part of Multiple Modes and Mail or truck moves in conjunction with domestic air cargo.
2	Rail	Includes any common carrier or private railroad. Does not include rail that is part of Multiple Modes and Mail.
3	Water	Includes shallow draft, deep draft, Great Lakes and intra-port shipments. Does not include water that is part of Multiple Modes and Mail.
4	Air (includes truck-air)	Includes shipments move by air or a combination of truck and air in commercial or private aircraft. Includes air freight and air express. In the case of imports and exports by air, domestic moves by ground to and from the port of entry or exit are categorized with Truck.
5	Multiple Modes and Mail	Includes shipments by multiple modes and by parcel delivery services, U.S. Postal Service, or couriers (capped at 150 pounds). This category is not limited to containerized or trailer-on-flatcar shipments.
6	Pipeline	Includes crude petroleum, natural gas, and product pipelines. Note: Does include flows from offshore wells to land which are counted as Water moves by the U.S. Army Corps of Engineers. Does not include pipeline that is part of Multiple Modes and Mail.
7	Other and Unknown	Includes movements not elsewhere classified such as flyaway aircraft, and shipments for which the mode cannot be determined.
8	No Domestic Mode	Includes shipments that have an international mode, but no domestic mode and is limited to import shipments of crude petroleum transferred directly from inbound ships to a U.S. refinery at the zone of entry. This is done to ensure a proper accounting of import flows, while avoiding assigning flows to the domestic transportation network that do not use it.

Source: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5, 2023, <https://www.bts.gov/faf>.

APPENDIX 2. 2023 NORTH AMERICAN AIRPORT TRAFFIC SUMMARY (CARGO)

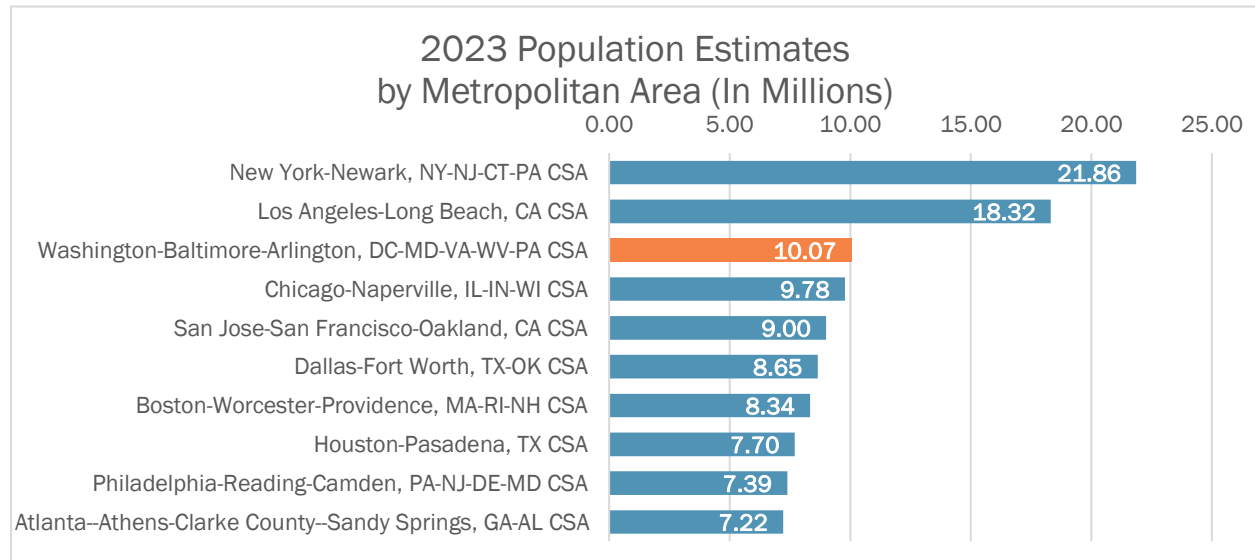
2023 North American Airport Traffic Summary (Cargo)									
Cargo (Freight & Mail) in Metric Tons									
World Rank	NAM Rank	City/State	Airport Name	Airport Code	Int'l. Freight	Domestic Freight	Mail	Total Cargo	
								TOTAL	% Chg 23-22
2	1	Memphis TN	Memphis International Airport	MEM	697,302	3,175,370	8,539	3,881,211	-4%
4	2	Anchorage AK	Ted Stevens Anchorage International Airport	ANC	2,346,567	1,033,807		3,380,374	-2.4%
6	3	Louisville KY	Louisville International Airport	SDF	639,988	1,958,651	129,181	2,727,820	-11.1%
7	4	Miami FL	Miami International Airport	MIA	2,021,122	481,637	22,833	2,525,591	1%
9	5	Los Angeles CA	Los Angeles International Airport	LAX	1,351,005	708,001	71,829	2,130,835	-14.9%
13	6	Chicago IL	O'Hare International Airport	ORD	1,336,937	526,974	42,551	1,906,463	-14.7%
14	7	Cincinnati OH	Cincinnati/Northern Kentucky International Airport	CVG	462,827	1,437,215	228	1,900,270	5.9%
21	8	New York NY	John F. Kennedy International Airport	JFK	999,061	439,284	38,953	1,477,298	2.5%
29	9	Indianapolis IN	Indianapolis International Airport	IND	143,882	838,851	687	983,420	-21.5%
37	10	Ontario CA	LA/Ontario International Airport	ONT	38,016	623,800	43,113	704,929	-9.6%
38	11	Dallas/Fort Worth TX	Dallas/Ft Worth International Airport	DFW	291,254	383,095	27,840	702,189	-14.3%
41	12	Newark NJ	Newark Liberty International Airport	EWR	209,327	421,462	34,767	665,556	-9.1%
46	13	Atlanta GA	Hartsfield-Jackson Atlanta International Airport	ATL	331,763	231,759	15,809	579,331	-15.9%
50	14	Oakland CA	Oakland International Airport	OAK	52,082	504,622	5,029	561,732	-3.9%
51	15	Honolulu HI	Honolulu International Airport	HNL	92,630	404,877	60,523	558,030	-1.9%
54	16	Houston TX	George Bush Intercontinental Airport	IAH	196,834	314,447	12,288	523,569	-3.4%

2023 North American Airport Traffic Summary (Cargo)									
Cargo (Freight & Mail) in Metric Tons									
World Rank	NAM Rank	City/State	Airport Name	Airport Code	Int'l. Freight	Domestic Freight	Mail	Total Cargo	
								TOTAL	% Chg 23-22
57	17	Toronto ON	Toronto Pearson International Airport	YYZ	341,735	147,388	2,081	491,204	-1.4%
58	18	San Francisco CA	San Francisco International Airport	SFO	286,002	177,316	20,782	484,100	-1.4%
59	19	Philadelphia PA	Philadelphia International Airport	PHL	132,350	308,035	34,902	475,287	-16.2%
62	20	Rockford IL	Chicago Rockford International Airport	RFD	27,496	405,287	6,593	439,376	-10.1%
65	21	Seattle WA	Seattle-Tacoma International Airport	SEA	111,979	305,073	0	417,052	-8.6%
78	22	Phoenix AZ	Sky Harbor International Airport	PHX	6,448	306,685	11,989	325,122	-14.2%
79	23	Vancouver BC	Vancouver International Airport	YVR	123,625	181,174	14,234	319,033	5.4%
82	24	Denver CO	Denver International Airport	DEN	27,606	270,650	10,830	309,086	-5.9%
84	25	Fort Worth TX	Fort Worth Alliance	AFW		292,567		292,567	-22.5%
86	26	Portland OR	Portland International Airport	PDX	6,984	265,581	10,167	282,732	-15.1%
91	27	Boston MA	Logan International Airport	BOS	98,437	157,854	5,940	262,230	-14.2%
99	28	Baltimore MD	Baltimore/Washington International Thurgood Marshall Airport	BWI	6,108	236,346	1,911	244,365	-4.8%
102	29	Washington DC	Washington Dulles International Airport	IAD	103,042	97,477	12,643	213,162	-5.7%
105	30	Minneapolis MN	Minneapolis/St Paul International Airport	MSP		192,309	11,334	203,643	-13.9%
109	31	Orlando FL	Orlando International Airport	MCO	22,972	140,094	29,693	192,759	-15.2%
116	32	Calgary AB	Calgary International Airport	YYC	90,115	87,437		177,552	-8.3%
120	33	Charlotte NC	Charlotte Douglas International Airport	CLT	32,545	133,665	7,751	173,961	-7.6%
126	34	Salt Lake City UT	Salt Lake City International Airport	SLC	0	150,747	11,558	162,305	-18.7%
128	35	Hartford CT	Bradley International Airport	BDL	0	155,243	2,535	157,778	-11.6%

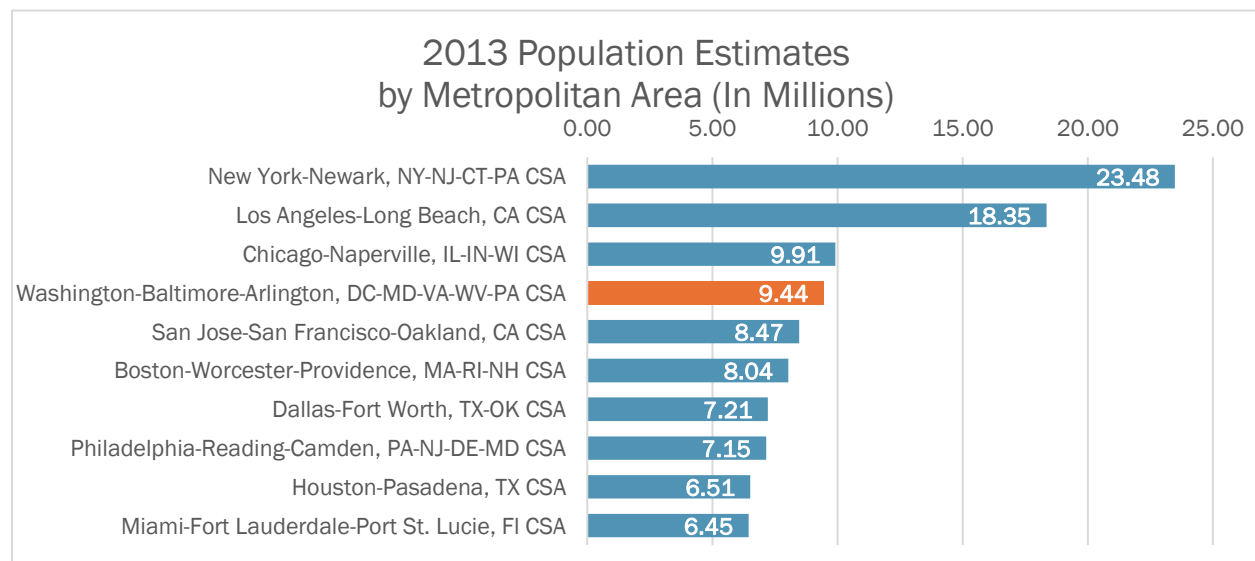
2023 North American Airport Traffic Summary (Cargo)									
Cargo (Freight & Mail) in Metric Tons									
World Rank	NAM Rank	City/State	Airport Name	Airport Code	Int'l. Freight	Domestic Freight	Mail	Total Cargo	
								TOTAL	% Chg 23-22
129	36	Detroit MI	Detroit Metropolitan Wayne County Airport	DTW	41,092	106,619	9,993	157,704	-14.7%
136	37	Tampa FL	Tampa International Airport	TPA	5,664	138,070	5,187	148,921	-32.4%
142	38	Montreal QC	Montreal - Pierre Elliott Trudeau International Airport	YUL		138,751		138,751	9.9%
148	39	Austin TX	Austin-Bergstrom International Airport	AUS	11,069	115,958	1,344	128,371	-8.8%
149	40	Greensboro NC	Piedmont Triad International Airport	GSO		123,979	3,715	127,694	-18.9%
152	41	Allentown PA	Lehigh Valley International Airport	ABE	0	124,991		124,991	15.8%
154	42	San Diego CA	San Diego International Airport	SAN	7,576	107,237	8,132	122,945	-14.8%
156	43	Las Vegas NV	Harry Reid International Airport	LAS	7,299	107,399	4,800	119,498	1%
159	44	Sacramento CA	Sacramento International Airport	SMF	0	99,826	13,557	113,383	-9.7%
162	45	San Antonio TX	San Antonio International Airport	SAT	4,427	80,431	24,780	109,638	-9.9%
163	46	Kansas City MO	Kansas City International Airport	MCI	102	105,789	1,869	107,759	-8.7%
164	47	Manchester NH	Manchester-Boston Regional Airport	MHT	0	106,320	0	106,320	16.7%
173	48	Fort Lauderdale FL	Ft Lauderdale-Hollywood International Airport	FLL	0	94,534	1,062	95,596	-1.2%
176	49	Richmond VA	Richmond International Airport	RIC		93,631	54	93,685	26.9%
179	50	El Paso TX	El Paso International Airport	ELP	3,047	88,941	21	92,009	4.6%

Source: ACI-NA, 2023 North American Airport Traffic Summary (Cargo).

APPENDIX 3. COMPARISON 2013/2023 CSA POPULATION IN THE US



Source: Metropolitan Washington Council of Government, Air Cargo Element – 2015 Update.



Source: Annual Estimates of the Resident Population for Combined Statistical Areas in the United States and Puerto Rico: April 1, 2020 to July 1, 2023 (CSA-EST2023-POP). Source: U.S. Census Bureau, Population Division
Release Date: March 2024

APPENDIX 4. ANNUAL UNEMPLOYMENT RATE WITH PERCENTAGE CHANGE

ANNUAL UNEMPLOYMENT RATE										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
United States										
ANNUAL UNEMPLOYMENT	6.2	5.3	4.9	4.4	3.9	3.7	8.1	5.3	3.6	3.6
Annual Change	-	0.9	0.4	0.5	0.5	0.2	-4.4	2.8	1.7	0
2020-based Change	-	-	-	-	-	-	-	-	4.5	4.5
Washington-Arlington-Alexandria, DC-VA-MD-WV MSA										
ANNUAL UNEMPLOYMENT	5	4.4	3.8	3.6	3.3	3	6.4	4.6	2.9	2.6
Annual Change	-	0.6	0.6	0.2	0.3	0.3	-3.4	1.8	1.7	0.3
2020-based Change	-	-	-	-	-	-	-	-	3.5	3.8
Baltimore-Columbia-Towson, MD MSA										
ANNUAL UNEMPLOYMENT	5.9	5.2	4.4	4.1	3.9	3.4	6.2	5	3	2.1
Annual Change	-	0.7	0.8	0.3	0.2	0.5	-2.8	1.2	2	0.9
2020-based Change	-	-	-	-	-	-	-	-	3.2	4.1

Source: 1. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LAUDV114789400000003). U.S. Department of Labor. 2. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LAUMT241258000000003). U.S. Department of Labor. 3. U.S. Bureau of Labor Statistics. (2024). Employment Situation Summary (Series Id. LNU04000000). U.S. Department of Labor. Retrieve data date: April 2024. In percent, not seasonally adjusted.

APPENDIX 5. FORECAST POPULATION BY JURISDICTION

Population by Jurisdiction
Washington-Baltimore Air System Planning Region
(Thousands)

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
District of Columbia										
District of Columbia	689.5	728.6	787.1	844.4	39.1	97.6	154.9	5.7%	14.2%	22.5%
Virginia Jurisdictions										
Arlington County	238.6	260.2	285.2	311.2	21.5	46.6	72.6	9%	6.8%	30.4%
City of Alexandria	159.5	202	239.8	261.9	42.5	80.4	102.4	26.7%	50.4%	64.2%
City of Fairfax	24.1	32.7	36.1	39.6	8.5	11.9	15.4	35.3%	49.4%	63.8%
City of Falls Church	14.7	18	20.7	23.3	3.4	6.1	8.6	22.9%	41.5%	58.8%
City of Fredericksburg	32.9	36	39.3	43.6	3.1	6.4	10.7	9.4%	19.4%	32.5%
City of Manassas	42.8	46.3	48.5	50.4	3.5	5.8	7.7	8.3%	13.5%	17.9%
City of Manassas Park	17.2	20.4	21.4	22.4	3.2	4.2	5.2	18.7%	24.5%	30.3%
Clarke County	14.8	15.3	16.1	17.2	0.5	1.4	2.4	3.6%	9.2%	16.4%
Fairfax County	1,171.9	1,247.5	1,319	1,384	75.6	147.1	212.1	6.5%	12.6%	18.1%
Fauquier County	73	79.6	87.2	96.1	6.6	14.2	23.1	9.1%	19.5%	31.7%
King George County	26	28.1	31	35.42	2.1	5	9.4	8%	19.3%	36%
Loudoun County	421	493.9	529.6	548.5	73	108.7	127.6	17.3%	25.8%	30.3%
Prince William County	483.8	536.6	565	579.6	52.8	81.2	95.7	10.9%	16.8%	19.8%
Spotsylvania County	105.1	123.2	148.1	183.1	18.1	43	78	17.3%	40.9%	74.2%
Stafford County	158	182.1	219.5	283.5	24.1	61.5	125.5	15.3%	38.9%	79.4%

Table continued on next page

Population by Jurisdiction
Washington-Baltimore Air System Planning Region
(Thousands)

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
Maryland Jurisdictions										
Anne Arundel County	592.7	646.2	677.4	694.2	53.5	84.7	101.5	9%	14.3%	17.1%
Baltimore City	585.7	596.4	599.2	609.8	10.7	13.5	24.1	1.8%	2.3%	4.1%
Baltimore County	854.5	876.7	909	934.5	22.2	54.5	80	2.6%	6.4%	9.4%
Calvert County	92.8	97.3	100.1	101.4	4.6	7.3	8.7	4.9%	7.9%	9.3%
Carroll County	172.9	179.1	184	188.4	6.2	11.1	15.5	3.6%	6.4%	8.9%
Charles County	168	193.6	216.5	242.7	25.6	48.5	74.6	15.2%	28.9%	44.4%
Frederick County	271.7	316.3	368.3	428.8	44.6	96.6	157.1	16.4%	35.5%	57.8%
Harford County	260.9	277.8	293.6	308.8	16.9	32.6	47.9	6.5%	12.5%	18.4%
Howard County	332.3	364	393.6	414.8	31.7	61.3	82.5	9.5%	18.5%	24.8%
Montgomery County	1,061.2	1,118	1,189.6	1,250.7	56.8	128.4	189.4	5.4%	12.1%	17.8%
Prince George's County	967.2	1,033	1,122.7	1,193.8	65.8	155.5	226.5	6.8%	16.1%	23.4%
St. Mary's County	113.8	129.7	144.6	159.5	15.9	30.8	45.7	14%	27.1%	40.2%
West Virginia										
Jefferson County	57.7	67.3	75.3	82.1	9.6	17.6	24.4	16.7%	30.5%	42.3%
Total by State										
District of Columbia	689.5	728.6	787.1	844.4	39.1	97.6	154.9	5.7%	14.2%	22.5%
Virginia Jurisdictions	2,983.3	3,322	3,606.7	3,879.7	338.7	623.4	896.3	11.4%	20.9%	30%
Maryland Jurisdictions	5,473.8	5,828.3	6,198.7	6,527.3	354.5	724.9	1,053.5	6.5%	13.2%	19.2%
West Virginia	57.7	67.3	75.3	82.1	9.6	17.6	24.4	16.7%	30.5%	42.3%
TOTAL	9,204.4	9,946.3	10,667.8	11,333.5	741.9	1,463.5	2,129.2	8.1%	15.9%	23.1%

Source: MWCOG Round 10.0 Cooperative Forecast and BMC Round 10 Cooperative Forecast

APPENDIX 6. FORECAST HOUSEHOLD BY JURISDICTION

Household by Jurisdiction
Washington-Baltimore Air System Planning Region

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
District of Columbia										
District of Columbia	312.4	366.8	407.6	441.4	54.3	95.2	129	17.4%	30.5%	41.3%
Virginia Jurisdictions										
Arlington County	109.9	126.2	140	153.6	16.3	30.1	43.7	14.8%	9.6%	39.8%
City of Alexandria	75.6	96.4	115.4	126	20.8	39.9	50.5	27.6%	52.8%	66.8%
City of Fairfax	9.3	13	14.6	16.3	3.6	5.3	6.9	39%	56.6%	74.3%
City of Falls Church	5.8	8.7	10.3	12.1	2.9	4.5	6.3	50.3%	77.6%	108.5%
City of Fredericksburg	11.1	12.3	13.9	16.3	1.2	2.8	5.2	10.6%	25.4%	46.7%
City of Manassas	14	15.1	15.8	16.4	1.1	1.8	2.4	8%	13.1%	17.5%
City of Manassas Park	5.4	6.9	7.4	8	1.5	2	2.6	27.6%	37.7%	47.9%
Clarke County	5.8	6.2	6.8	7.6	0.3	0.9	1.8	5.5%	15.8%	30.6%
Fairfax County	417.5	451.2	482.4	510.8	33.8	65	93.3	8.1%	15.6%	22.4%
Fauquier County	26.4	29.2	32.3	35.8	2.8	5.9	9.4	10.5%	22.3%	35.8%
King George County	8.8	9.2	10	11.2	0.5	1.2	2.4	5.4%	14%	27.4%
Loudoun County	137.4	161.7	174.7	181.7	24.2	37.2	44.3	17.6%	27.1%	32.2%
Prince William County	153.9	173.4	185.1	191.9	19.5	31.2	38	12.7%	20.3%	24.7%
Spotsylvania County	34.6	41	50.8	68.1	6.4	16.2	33.5	18.5%	46.8%	96.7%
Stafford County	49.6	60.9	78.2	107.7	11.3	28.7	58.2	22.9%	57.9%	117.4%

Table continued on next page

Household by Jurisdiction
Washington-Baltimore Air System Planning Region

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
Maryland Jurisdictions										
Anne Arundel County	220	236.8	251.6	260.3	16.8	31.6	40.4	7.6%	14.4%	18.4%
Baltimore City	251.5	260.6	264.3	271.5	9.1	12.8	20.1	3.6%	5.1%	8%
Baltimore County	330	338.4	351.3	361.4	8.5	21.3	31.5	2.6%	6.5%	9.5%
Calvert County	32.8	35.2	36.7	37.3	2.5	4	4.6	7.5%	12.1%	14%
Carroll County	63.1	65.6	67.7	69.7	2.5	4.7	6.7	4%	7.4%	10.6%
Charles County	59.1	71.2	80	89.7	12.1	20.8	30.6	20.5%	35.3%	51.8%
Frederick County	98.4	114.5	133.2	155.7	16.2	34.9	57.3	16.4%	35.5%	58.3%
Harford County	98.3	105.7	113.3	120.9	7.4	15	22.6	7.6%	15.3%	23%
Howard County	118	133.3	147.8	159.7	14.6	29.1	40.9	12.3%	24.5%	34.5%
Montgomery County	386.6	416.5	450	474.3	29.9	63.4	87.7	7.7%	16.4%	22.7%
Prince George's County	342.2	367.4	400.5	425.9	25.2	58.3	83.7	7.4%	17%	24.5%
St. Mary's County	41.8	48.2	54.1	59.7	6.3	12.3	17.8	15.1%	29.4%	42.6%
West Virginia										
Jefferson County	21.9	25.9	29.3	32.2	4	7.4	10.3	18.3%	33.7%	47.1%
Total by State										
District of Columbia	312.4	366.8	407.6	441.4	54.3	95.2	129	17.4%	30.5%	41.3%
Virginia Jurisdictions	1,065.1	1,211.3	1,337.9	1,463.6	146.3	272.8	398.5	13.7%	25.6%	37.4%
Maryland Jurisdictions	2,042.4	2,193.5	2,350.7	2,486.2	151	308.2	443.8	7.4%	15.1%	21.7%
West Virginia	21.9	25.9	29.3	32.2	4	7.4	10.3	18.3%	33.7%	47.1%
TOTAL	3,441.8	3,797.5	4,125.5	4,423.4	355.7	683.6	981.6	10.3%	19.9%	28.5%

Source: MWCOG Round 10.0 Cooperative Forecast and BMC Round 10 Cooperative Forecast

APPENDIX 6. FORECAST AT PLACE EMPLOYMENT BY JURISDICTION

At Place Employment by Jurisdiction
Washington-Baltimore Air System Planning Region
(Thousands)

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
District of Columbia										
District of Columbia	785.9	886.3	954.4	1,021.6	100.4	137.6	235.7	12.8%	17.5%	30%
Virginia Jurisdictions										
Arlington County	221.6	236.7	266.4	283.7	15.1	44.7	62.1	6.8%	20.2%	28%
City of Alexandria	101.8	99.3	112.8	123.2	-2.6	11	21.4	-2.5%	10.8%	21.1%
City of Fairfax	20.5	22.3	22.9	23.5	1.8	2.4	3	8.8%	11.7%	14.6%
City of Falls Church	12.4	15.4	17.4	19.4	3	5	7.1	24%	40.4%	57%
City of Fredericksburg	29.7	34.3	40.8	51	4.6	11.2	21.4	15.5%	37.7%	72.1%
City of Manassas	25.3	26.9	28.3	29.3	1.6	2.9	3.9	6.4%	11.5%	15.5%
City of Manassas Park	4.3	5	5.2	5.4	0.7	0.9	1.1	15.3%	20.4%	25.5%
Clarke County	4	4	4.1	4.1	0	0.1	0.1	1.2%	2.4%	3.6%
Fairfax County	658.8	750.8	812.5	842	92	153.7	183.2	14%	23.3%	27.8%
Fauquier County	24.3	24.6	25	25.4	0.4	0.8	1.1	1.6%	3.1%	4.7%
King George County	12.2	13.8	16	19.6	1.6	3.8	7.4	12.9%	30.7%	60.2%
Loudoun County	187.7	227	251.5	265.8	39.3	63.9	78.2	20.9%	34%	41.7%
Prince William County	161.8	194.4	223.4	246.4	32.6	61.7	84.7	20.1%	38.1%	52.3%
Spotsylvania County	34.6	38.1	42.3	48.4	3.5	7.7	13.8	10%	22.1%	39.7%
Stafford County	43.5	51	61.4	83.2	7.5	18	39.8	17.3%	41.3%	91.5%

Table continued on next page

At Place Employment by Jurisdiction
Washington-Baltimore Air System Planning Region
(Thousands)

Jurisdiction	Number (Thousands)				Number change in relation to 2020			percentage change in relation to 2020		
	2020	2030	2040	2050	2030	2040	2050	2030	2040	2050
Maryland Jurisdictions										
Anne Arundel County	340.6	389.8	419	451.5	49.3	78.5	110.9	14.5%	23%	32.6%
Baltimore City	365	396.2	430.4	451	31.1	65.3	85.9	8.5%	17.9%	23.5%
Baltimore County	398.7	425.1	434.6	444.3	26.4	35.9	45.6	6.6%	9%	11.4%
Calvert County	24.2	25.2	26.1	27.3	1	1.9	3.1	4.1%	7.9%	12.7%
Carroll County	62.8	65.8	68.8	71.8	3	6	9	4.8%	9.5%	14.3%
Charles County	43.9	49.8	57.4	62.2	5.9	13.5	18.3	13.4%	30.8%	41.8%
Frederick County	108.3	123.8	141.8	162.5	15.5	33.5	54.2	14.3%	31%	50.1%
Harford County	100.7	120.6	141.3	162.5	19.8	40.5	61.8	19.7%	40.2%	61.3%
Howard County	185.6	203.3	232	245.6	17.7	46.4	60	9.5%	25%	32.3%
Montgomery County	493.6	545.6	591	636.5	52.1	97.5	142.9	10.5%	19.8%	29%
Prince George's County	343.5	366.8	396.7	435	23.4	53.2	91.5	6.8%	15.5%	26.6%
St. Mary's County	63	69.5	74	78	6.5	11	15	10.4%	17.5%	23.8%
West Virginia										
Jefferson County	25.2	30	34	37.5	4.8	8.8	12.3	19%	34.9%	48.6%
Total by State										
District of Columbia	785.89	886.26	954.37	1,021.57	100.4	168.5	235.7	12.8%	21.4%	30%
Virginia Jurisdictions	1,542.42	1,743.46	1,930.2	2,070.64	201	387.6	528.2	13%	25.1%	34.2%
Maryland Jurisdictions	2,529.82	2,781.40	3,013.13	3,228.6	251.6	483.3	698.2	9.9%	19.1%	27.6%
West Virginia	25.23	301	343	37.50	4.8	8.8	12.3	19%	34.9%	48.6%
TOTAL	4,883.4	5,441.1	5,931.6	6,357.8	557.8	1,048.2	1,474.4	11.4%	21.5%	30.2%

Source: MWCOG Round 10.0 Cooperative Forecast and BMC Round 10 Cooperative Forecast



National Capital Region
Transportation Planning Board

Metropolitan Washington Council of Governments
777 North Capitol Street NE, Suite 300
Washington, DC 20002

mwcog.org/tpb