

PHL Master Plan Update

Executive Summary – *Facilities Requirements*

Facilities Requirements

The facility requirements chapter determines what additional facilities will be required to accommodate the forecasted aviation and passenger activities. This chapter includes an assessment of the ability of existing facilities to meet current and future demands, as well as a gap analysis when they cannot meet those demands. These demand/capacity analyses assess the capacity of each different part of the airport and identify additional facilities necessary to accommodate the projected demand through the 2040 planning horizon, based on an inventory of existing conditions and approved FAA forecasts. The findings from capacity analyses and facility requirement determinations define **WHAT** the alternatives should provide in order to meet the future demand.

Requirements estimated in this chapter include:

- Airside requirements
- Passenger terminal facility requirements
- Air cargo facility requirements
- Vertiport requirements
- General aviation requirements
- Landside (roadway) requirements
- Aviation support facility requirements

It should be noted that the 2040 PHL MPU was not tasked to address all long-term airfield needs, such as runway length requirements, as this plan is focused on the passenger terminal area. This study does include a high-level airfield capacity analysis and taxiway needs assessment around the terminal complex.

Airside Requirements

Airside Capacity Analysis

To support the PHL Airport Master Plan Update (AMPU), an airfield simulation software model was used (SIMMOD) to assess future airfield capacity. The scenarios that were evaluated assume the current overall runway configuration, while testing different air traffic management enhancements and runway infrastructure upgrades. These simulations were based on 2040 demand projections for aircraft operations.

Summary of Findings

The average annualized delay for the existing airfield in 2019 (8.9 minutes) is already higher than the typical acceptable threshold for large hub airports. Delays are likely to increase as aircraft operations continue to through 2040. Typically, large hub airports average delay is in the 5–6-minute range. Even with more efficient usage of existing runways, 2040 delays would be 18% higher than in 2019 at 11.6 minutes, as small traffic growth drives higher delays when capacity has been reached. The existing airfield does not have adequate capacity to meet the 2040 traffic demand without delays increasing higher than recommended. Meaning, that if the airfield is not expanded, delays would increase but not beyond what has been accommodated in the past.

PHL Master Plan Update

Executive Summary – Facilities Requirements

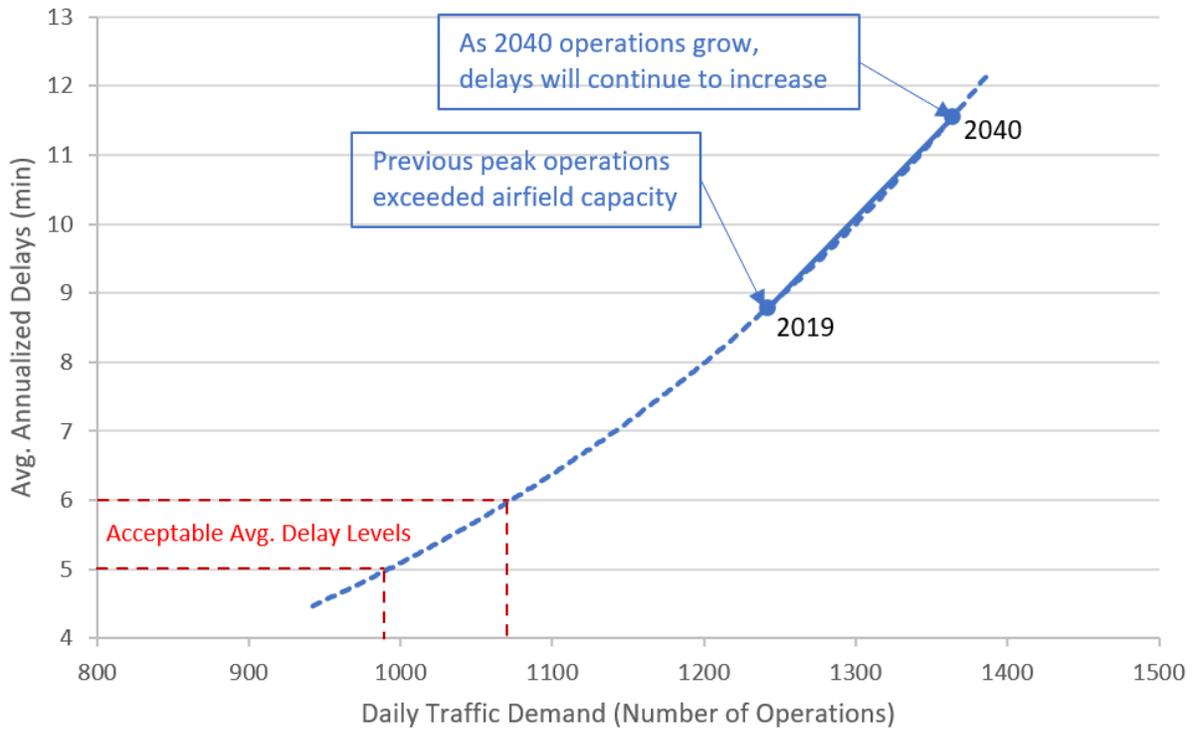


Figure 1. Average Annualized Delays for 2019 and 2040 (Existing Airfield)

Although total air traffic has been forecasted to grow only 10% over 20 years (2040), average annualized delays with the existing airfield layout would grow by more than 30%, from 8.9 minutes to 11.5 minutes.

Several “What if?” academic scenarios were tested to evaluate, from the high-level planning perspective, what airfield enhancements would improve airfield capacity and potentially accommodate the 2040 annual demand of 409,000 aircraft operations. It should be noted that PHL accommodated over 500,000 aircraft operations in the mid-2000s as a reference point. As such, PHL would not achieve complete “gridlock” within the 2040 planning period since the runways are currently managed to accommodate high levels of demand, but improvements are needed to limit delays. With FAA’s NextGen program for modernizing air traffic management in the United States, as well as more modern aircraft and flight procedures, capacity challenges are not a significant threat for PHL in the short-term. However, it is recommended that DOA and FAA begin discussing the process of enhancing current airfield capacity and when the process for considering new or extended runways should be initiated in order to make plans to meet the long-term demand beyond 2040.

Conclusions

The 2040 PHL MPU does not include airfield alternatives analysis as it is focused on the passenger terminal portion of the airport. However, extending Runway 8-26 as was proposed in the 2011 PHL Airport Layout Plan is one possibility. Extending Runway 8-26 to accommodate commercial aircraft larger than regional jets, such as the Boeing 737 or Airbus A320, could significantly reduce airfield delays to less than half of 2019 delays and within acceptable levels. It is recommended that DOA and FAA begin discussions on the process to determine future airfield delay reduction options.

PHL Master Plan Update

Executive Summary – Facilities Requirements

Terminal Area Taxiway system

Most of the 11 terminal concourse alleyways that provide access to and from the runways via Taxiway J are served by a single lane taxilane. This causes aircraft to experience bottlenecks and delays when multiple flights arrive and/or depart at the same time. Dual parallel taxilanes in all the alleyways, as well as a multi-lane taxilane system along the terminal area to serve these alleyways, would provide increased operational flexibility and resilience for aircraft movements between the terminals and the runways. **Figure 2** depicts the proposed taxiway/taxilane improvements proposed near the terminals, which will define the southern limits of future terminal concept plans.

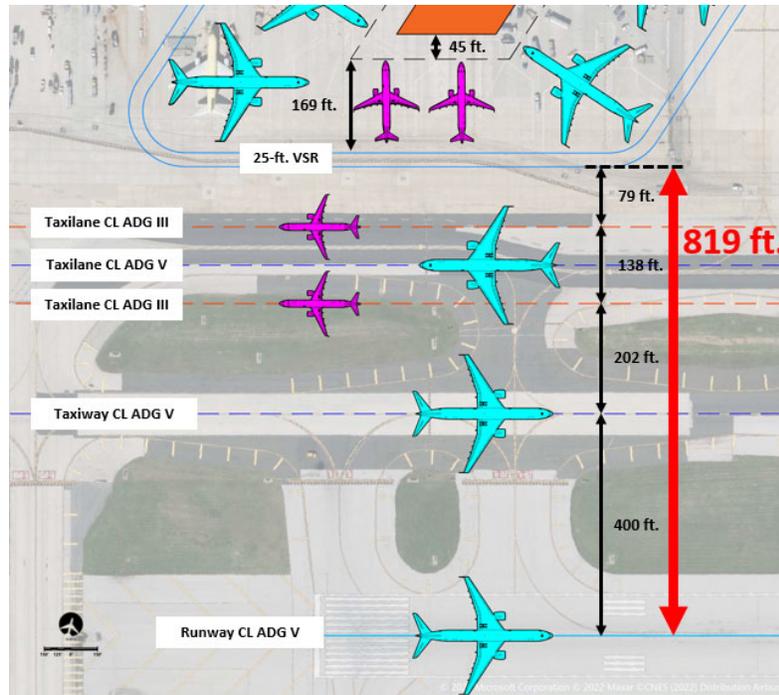


Figure 2. Airside Recommendation for Unimpeded Taxiway Flow

Aircraft De-icing Facilities

Aircraft ground de-icing is required prior to takeoff when any ice or frost contamination occurs on the wings and other aircraft parts—either as light frost, snow, or ice accumulation. PHL has 11 deicing pads, and the airport needs 13 de-icing pads for medium and large aircraft to deliver the required throughput to minimize departure delays. Different options are proposed in the report in order to strengthen capacity and resiliency during winter conditions.

Terminal Facility Requirements

Based on the aviation activity forecast prepared for the PHL Master Plan Update, the annual passenger enplanements are projected to grow from 16.1 million in 2019 to 21.7 million in 2040. The same volumes are projected for passenger deplanements, and they include a substantial growth of low-cost carrier activity through the next 20 years, while maintaining the American Airlines connecting hub. International flights are expected to grow beyond the 2019 levels, but not to a level which requires significant additional capacity. This is anticipated with the shift from more widebody (Boeing 777) aircraft operations to more frequent use of narrowbody (Airbus A321) aircraft.

PHL Master Plan Update

Executive Summary – Facilities Requirements

Gate Requirements

The gate demand assessment takes into consideration the size of aircraft, the market being served, the type of flight (domestic or international), operational requirements such as buffer times between flights, and airline-specific practices and preferences. As of 2022, PHL has 126 gates: 18 gates widebody aircraft-capable (e.g., Boeing 787), 76 gates narrowbody aircraft-capable (e.g., Airbus 320) and 32 regional aircraft gates. Of the 126, 18 can process international arrivals and 108 are for domestic flights only.

By 2040 PHL is projected to need 145 gates total: 20 gates for international and 125 gates for domestic flights. Airlines will be shifting toward long-range narrowbody aircraft (such as the Airbus A321XLR) for international flights, instead of flying large widebody aircraft. Also, there will be a long-term trend toward eliminating the use of smaller regional jets with less than 100 seats and replacing them with larger aircraft (e.g., Airbus A220, Embraer E-Jets).



Source: Airport Guide, 2017

Figure 3. Existing PHL Terminal Gates

Terminal Needs

The terminal evaluation process started with confirming the existing facility areas and functions to determine their capacity to handle current and projected 2040 passenger demands. This continued with developing the optimal facility size and number of processing elements to provide “Optimum” Level of Service (LOS) for travelers and airport operators per International Air Transport Association (IATA) recommendations. This is the standard that commercial service airports use to provide modern, efficient terminals with acceptable customer experience.

Although the forecast passenger activity levels for both 2030 and 2040 were prepared, the terminal facility requirements focus on 2040 needs to accommodate the projected activity for the planning horizon. The facility requirements analysis identifies standard components, quantity requirements, and recommends the minimum square footage by processing module.

Table 1 describes the existing space allocated by function in the existing terminal buildings, the 2019 programmatic requirements should be in place to provide the “optimum” level of customer service expected at hub airports and the 2040 projected space requirements to meet the planning horizon needs. The recommended 2040 space requirements add about 1 million square feet to the existing building.

PHL Master Plan Update
Executive Summary – *Facilities Requirements*

Functional Area	2019 Existing Conditions ¹	2019 Programmatic Requirements	2040 Programmatic Requirements
Check-in Lobby Area	72,161 SF ²	66,000 SF	86,500 SF
Outbound Baggage Area	429,000 SF	525,000 SF	594,000 SF
Passenger Security Screening Checkpoint	58,620 SF	128,000 SF	159,000 SF
Holdroom Area	261,000 SF	384,000 SF	536,000 SF
Domestic Bag Claim Area	243,240 SF	125,000 SF	171,000 SF
Concessions	238,000 SF	257,000 SF	391,000 SF
Federal Inspection Services	217,000 SF	222,000 SF	264,000 SF
Circulation Areas	1,040,000 SF ³	355,000 SF	509,000 SF
Other Functional Support Areas	472,000 SF	646,000 SF	910,000 SF
SUBTOTAL	3,031,000 SF	2,708,000 SF	3,620,000 SF
<i>Allowance for Design/Structural Elements</i>	8%	217,000 SF	290,000 SF
<i>Allowance for Unaccounted Spaces</i>	3%	81,000 SF	109,000 SF
TOTAL AREAS	3,031,000 SF	3,006,000 SF	4,000,000 SF

Table 1. Terminal Facility Requirements Summary

Depth Requirement for Terminal Processing Facility

Depending on the number of levels used and how the terminal processing is laid out, the total depth may vary. However, **Figure 4** shown below depicts typical depths required for the three main functions: Security Check Point, Ticketing Lobby and Baggage Claim Lobby, which if placed on three levels would require a depth of 400 feet. But depending on gate placement and/or number of levels, the depth of the building could be reduced to near 300 linear feet. For planning purposes, the PHL MPU will assume 400 feet is required.



Figure 4. Recommended Terminal Depth Requirements

¹ The figures reported in this column represent total areas across all existing terminals.

² Existing check-in area includes six different locations. As passenger volumes are not distributed equally, some areas are underutilized while others (such as Terminal B/C) are overutilized, causing congestion and poor passenger level of service.

³ Existing circulation areas respond to current facilities' inefficient layout and include connectors between terminals, as well as connectors to baggage claim lobbies, parking structures, hotel, and arrivals curb areas.

PHL Master Plan Update

Executive Summary – *Facilities Requirements*

Air Cargo Facilities

In February 2020, the PHL conducted the West Cargo Development Study that identified the need of increasing cargo capacity to capture an appropriate share of the region’s air cargo movements and establish PHL as a major cargo facility on the east coast. The results of this separate study are included in the PHL MPU.

Vertiport Facilities

While this MPU does not evaluate the market opportunities for advanced air mobility (AAM) in the Greater Philadelphia area, it considers the potential emergence of AAM in the coming years, and the need for a vertiport facility that can facilitate electric Vertical Takeoff and Landing aircraft (eVTOL) operations as part of a mobility offering providing on-demand first & last-mile transport. Appropriately sized facilities for various eVTOL aircraft activity scenarios were evaluated.

General Aviation Facilities

The forecast for general aviation (GA) activity at PHL over the planning period will remain flat in aircraft operations and based aircraft. In general, PHL is capacity-constrained and limits GA infrastructure, relying on the Northeast Philadelphia Airport (PNE) and area reliever facilities to provide additional facilities (hangar, apron, etc.) and capacity. The DOA is currently advancing development opportunities at PNE to create additional capacity to accommodate the general aviation demand. Requirements for future facilities at PHL in the existing developed areas will be determined between the leaseholder(s) and DOA.

Landside Facilities

Landside facilities include access and circulation roadways, terminal curb frontage (for drop-off and pickup areas) and various types of vehicle parking. The MPU estimate for parking need is based on the existing on-airport parking supply in the garage complex and the cellphone lot based on the 2019 passenger mode share⁴. Parking utilization is assumed to remain at the 2019 maximum of 78% utilization.

	Parking type	Capacity
Airport garages	Long-term	12,000
Economy Lot*	Long-term	1,850
Cellphone Waiting Lot	Short-term	150
Employee Lots	Employee	3,700
Off-airport (not owned by PHL nor PPA, 14 lots)	Long-term	13,810
Total parking available		31,510

*Economy Lot partial opening will be discontinued in the future

Table 2. 2019 Parking Capacity

⁴ This passenger mode share reflects existing low transit usage for airport access and reflects a conservative planning assumption. However, DOA’s sustainability goals include improving transit facilities and promoting increased transit mode share.

PHL Master Plan Update
Executive Summary – Facilities Requirements

	Short-Term	Long-Term	Total
Existing Parking Supply (garages/cellphone lot)	992	11,158	12,000
Existing Parking Demand (garages/cellphone lot, current peak parking utilization of 78% assumed)	770	8,700	9,470
2040 Parking Demand (2040/2019 daily seat ratio, assuming short-term/long-term share is constant)	1,000	11,000	12,000
2040 Parking Supply Requirements (2040/2019 daily seat ratio, assuming short-term/long-term share is constant)	1,300	14,300	15,600
Additional 2040 Parking Requirements	+310	+3,200	+3,600

Table 3. Parking Demand Estimate based on Projected Increase in Passengers and 2019 Mode Share not changing

Analysis considered increasing passenger volumes under multiple scenarios such as Transportation Network Companies (TNCs)/taxi and shuttles, could be required to use a unified Ground Transportation Center (GTC), which are any of the transportation centers not located within the restricted security areas of the airport. It is also important to understand the length of terminal curb frontages needed to accommodate passenger pick-ups and drop-offs. Curb frontage requirements are not correlated with on-site airport parking demand. However, the size of the Ground Transportation Center housed within the parking structure may need to be scaled to meet curb frontage demand for loading and unloading if shuttles, taxis, and the Transportation Network Companies or “ride hailing” companies are proposed to be housed there.

	Departures Curb	Arrivals Curb
2019 – Existing	2,248 ft	4,880 ft *
2040 – All vehicle (private vehicles, TNCs, taxis, and shuttles)	3,800 ft	3,600 ft
2040 – Private vehicles, TNCs, and taxis only (shuttles in a GTC)	3,200 ft	2,700 ft
2040 – Private vehicles only (TNCs, taxis, and shuttles GTC)	1,200 ft	1,600 ft

* The existing curb length is significantly longer, as two arrivals roads exist: one for commercial vehicles and another for private vehicles. The decrease in curb requirements for 2040 occurs as most commercial traffic would use the GTC for arrivals.

Table 4. Curb Frontage Requirement Scenarios

Airport Support Requirements

Current issues that impact the efficient maintenance and operation of the airport includes limited maintenance storage capacity that leaves snow removal equipment (especially those operated by contractors) exposed to inclement weather; suboptimal diesel fueling facility that is not adapted to the needs of large trucks; and terminal workshops that are far from the terminal area (opposite side of Runway 17-35). A consolidated facility with the option for airside or landside operations is recommended, with access to the terminal buildings from the workshops. The space needs for the Airport’s maintenance facilities are summarized below.

Existing Area (SF)	Facility Requirements (SF)			Compound Annual Growth Rate	
	2025	2030	2040	2019-2030	2031-2040
155,600	161,900	170,200	197,500	1.0%	1.5%

Table 5. PHL Forecasted Footprint for Airport Maintenance Facilities

PHL Master Plan Update

Executive Summary – *Facilities Requirements*

Fuel Farm Requirements

Currently, PHL has two aircraft fuel farms and one major fueling station. The primary fuel farm facility comprises nine Jet-A storage tanks with a total storage capacity of 14,000,000 gallons. Based on the forecast, PHL has fueling capacity to accommodate future demand, with a potential for approximately 20 days of fuel reserve. Thus, no additional tanks are recommended for the 20-year planning horizon. However, DOA developed its 2022 Sustainability Management Plan, which seeks to reduce GHG and integrate renewables and to incorporate this into new development projects. In light of this, PHL will explore Sustainable Aviation Fuel (SAF), electric charging and hydrogen fuel as aircraft become capable of utilizing these renewable fuels in the future.