CHAPTER 2

PURPOSE AND NEED

2.1 INTRODUCTION

This chapter describes the purpose of the Proposed Action and why it is needed at the O'Hare International Airport (O'Hare). It presents the problems addressed and describes what the Federal Aviation Administration (FAA) seeks to achieve.[1]

The Proposed Action consists of 35 project elements organized in five groups, as described in **Chapter 1**:

- Group 1: Terminal Projects,
- Group 2: On-Airport Hotels,
- Group 3: Airfield and Taxiway Improvements Not Required by the Terminal Projects,
- Group 4: Support Facilities Not Required by the Terminal Projects, and
- Group 5: Air Traffic Actions for Offset Approach Procedures for Runway 10R/28L.

2.2 PURPOSE OF THE PROPOSED ACTION

In general, these improvements are needed at O'Hare to provide adequate terminal, gate, and apron areas, and to efficiently accommodate the existing and projected demand for originating and connecting hub operations and passengers as defined in **Chapter 1**. The specific purposes of the Proposed Action are to:

- Groups 1, 3, and 5: Meet FAA design standards,
- Group 1: Provide terminal facilities that meet industry-recommended standards and modern customer service expectations,
- Group 2: Maintain Chicago Department of Aviation (CDA) financial independence and meet financial obligations,
- Group 4: Maximize employee parking and screening while also optimizing safety and security of goods processing and commercial vehicle holding, and
- Group 5: Retain operational efficiency and prevent additional delay.

The specific needs described in **Section 2.3** were identified based on their ability to help achieve these goals.

[1] Federal Aviation Administration. FAA Order 1050.1F, Environmental Impacts: Policies and Procedures; Washington, D.C. effective July 16, 2015, Paragraph 6-2.1.c., page 6-2.

2.3 NEED FOR THE PROPOSED ACTION

2.3.1 Group 1: Terminal Projects

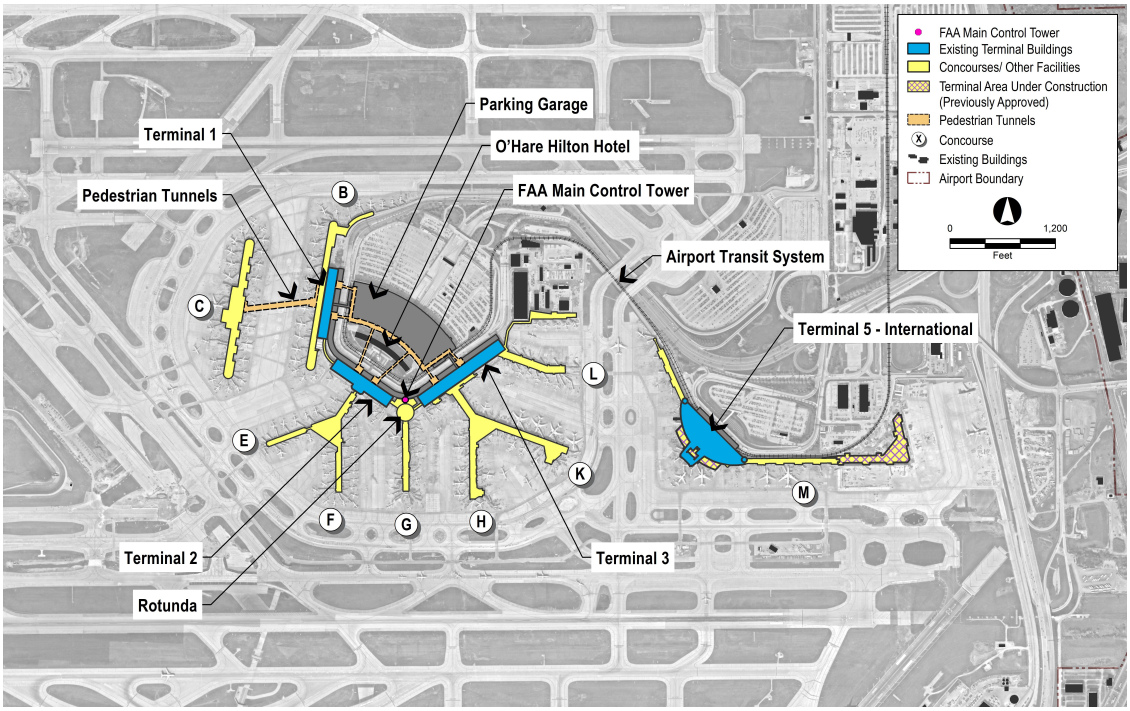
The following five subsections describe the five needs for Group 1: Terminal Projects.

2.3.1.1 Need to Provide Updated Terminal Facilities to Address Those that have Reached the End of Their Design Life

O'Hare's terminal complex was developed in the 1960s, early in the commercial jet aviation era. Terminals 2 and 3 opened in 1962, and the Rotunda was completed in 1963. Terminal facilities were subsequently reconfigured to accommodate hub airlines' emerging needs, which resulted from domestic airline deregulation in the 1980s. Hub airlines require multiple gates in proximity to one another to allow passengers to quickly connect between arriving and departing aircraft. The O'Hare Development Program of the early 1980s resulted in a terminal complex designed to support hub operations for both United Airlines and American Airlines. Development included construction of United Airlines' Terminal 1, expansion of Terminal 3, and construction of Concourse L to meet passenger growth. The O'Hare Development Program tailored the terminal complex to support the airfield layout that existed in the 1980s.

O'Hare's international terminal, Terminal 5, opened in 1993, establishing Chicago as a premier mid-continent international gateway and connecting hub. The Airport Transit System (ATS or "people mover") was built to provide connections between Terminal 5 and the terminal core (encompassing Terminals 1, 2, and 3) and remote parking facilities. **Figure 2-1** depicts the existing O'Hare terminal complex. Pedestrian and baggage tunnels and walkways connect the facilities and are shown on the figure.

FIGURE 2-1
EXISTING O'HARE TERMINAL COMPLEX



Source: CDA, 2021

Many of the facilities and infrastructure components in O'Hare's terminals are functionally outdated. Escalating maintenance and operation costs challenge the airport to efficiently meet forecast demand with the current terminal facilities. Two ongoing challenges include the inability of numerous heating, ventilation, and air conditioning (HVAC) systems to meet cooling demands in already congested terminals and the need for buckets to collect rainwater in terminals to prevent passengers from falling; both are significant passenger inconveniences. A 2015 facilities review and inspection report, prepared for the CDA, documents significant facility maintenance issues.[2] A subsequent (2016) facilities condition assessment[3] identified the need for major facility improvements and recommended redevelopment of Terminal 2, as well as the ATS, underground tunnels (including utility tunnels), and access roads. Items specifically recommended include:

- Replacing infrastructure that has reached its useful life,[4] including:
    - HVAC system in Terminal 1 and Concourse B,
    - HVAC system in Terminal 2,
    - HVAC system in the Rotunda,
    - Leaking windows in Concourses E and F,
    - Leaking windows in the Rotunda,
    - Potable water lines in the Rotunda that are more than 50 years old,
    - Heat Exchangers in the Rotunda, and
    - Heat Exchangers in Terminal 2.
- Addressing water intrusion that has damaged the structural integrity of the pedestrian and baggage tunnels connecting Concourses B and C.
- Replacing mechanical equipment in Terminal 2 due to water and weather infiltration.
- Addressing the lack of redundancy in the utility system that supports the overall terminal core HVAC system.

2.3.1.2 Need to Provide Facilities that Meet Modern Passenger Needs

Substantial changes have occurred in air travel since the O'Hare facilities were built, leading to space allocation challenges in the terminals, including:

- The need for additional and larger security checkpoints, checkpoint staffing and technology, and baggage screening equipment to meet airport passenger, employee, and baggage security requirements.
- The need to meet increased passenger demand for accessible and inclusive facilities and services (e.g., bathrooms, water fountains, waste bins, seating, wheelchair storage, and luggage cart storage); amenities (e.g., information centers, business centers, computer/phone recharging stations, workstations, United Service Organization [USO] facilities, passenger sanctuaries,

[2] Landrum & Brown, Independent Consultant's Report, 2015, Chicago O'Hare International Airport, Facilities Review & Inspection, June 2016.
[3] Chicago Department of Aviation, presentation to the Capital Program Technical Working Group, "Assessment of Minimum Required Investment, Final Review Draft," August 9, 2016.
[4] Chicago Department of Aviation, presentation to the Capital Program Technical Working Group, "Assessment of Minimum Required Investment, Final Review Draft," August 9, 2016.

lactation and nursing mother's rooms, children's play areas, companion care rooms, service animal/pet relief areas); and concessions (e.g., retail, food, and drink).

- The need for enhanced passenger circulation and wayfinding on the secure airside to facilitate passengers navigating through and within terminals to change flights.
- The need for enlarged passenger waiting areas and gate frontage to handle a wider range of aircraft sizes.
- The need to incorporate evolving technology intended to enhance and simplify the customer experience (e.g., self-check-in, e-ticketing, boarding pass printing, etc.).

FAA Advisory Circular 150/5360-13A, Airport Terminal Planning, and numerous Airport Cooperative Research Program (ACRP) reports (i.e., ACRP Report 25 Airport Passenger Terminal Planning and Design Volume 1 Guidebook) identify spatial demands associated with modern air travel. Many spatial demands are associated with the volume of passengers predicted to occur, coupled with required and desired services. Competing spatial demands compromise the current passenger experience at O'Hare due to congestion, obstructions, long lines, lack of seating, and crowded circulation areas. O'Hare's existing terminal facilities do not contain adequate space to accommodate passenger and airport tenant needs associated with modern air travel.

Facility space requirements presented in **Table 2-1** and throughout this section were estimated based on demand forecasts, as detailed in **Chapter 1** and **Appendix B**, and a series of assumptions—informed by stakeholders and industry-recommended standards and guidance—for processing rates, wait time targets, and space templates. The CDA conducted numerous meetings with airline tenant representatives to identify needs specific to O'Hare and to airline codeshare business relationships. Requirements were calculated using a combination of static and dynamic models. Static models are based on forecast peak-period passenger and baggage volumes derived from the representative day flight schedules (RDFS) and methodologies and standards defined by industry guidance, such as ACRP Report 25.[5] Dynamic models are based on forecast passenger and baggage volumes throughout the day derived from the RDFSs and the Comprehensive Airport Simulation Tool,[6] a passenger processing simulation software.

Space requirement calculations estimate how much additional space is needed at O'Hare to meet modern passenger and tenant needs. **Table 2-1** shows that O'Hare needs 51 percent more terminal facility space to accommodate all necessary functions. The airport administration and non-commercial amenities function shows a net decrease in required space due to an estimated decrease in space needed for the landside arrivals hall (meeter and greeter area) and airport administration and support offices. The Transportation Security Administration (TSA) administration and support offices function also shows a net decrease in space required. All other functions require increased space.

[5] Transportation Research Board, Airport Cooperative Research Program, Report 25, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook, 2010.

[6] Ricondo. Prepared for: Chicago Department of Aviation. Draft: Terminal Area Plan (TAP) and Future Airport Layout Plan (ALP) Projects Preliminary Terminal Space Program Requirements. October 2020.

TABLE 2-1
O'HARE TERMINAL FACILITY REQUIREMENTS IN SQUARE FEET

Function	No Action (see note 1)	Total Space Required (see note 2)	Difference (Total Minus No Action)
Check-in	151,140	201,830	50,690
Baggage — Departures	880,910	1,391,170	510,260
Holdrooms	424,890	582,180	157,290
Domestic and Precleared Baggage Claim	91,360	101,830	10,470
Airline Areas	979,130	1,151,740	172,610
TSA Administration and Support Offices	24,710	23,960	-750
Passenger Security Screening Checkpoint	88,630	168,140	79,510
Employee Screening	3,790	5,710	1,920
Federal Inspection Station	172,720	425,760	253,040
Transfers Recheck	8,940	16,610	7,670
Commercial, Retail, and Concessions	339,290	582,360	243,070
Airport Administration and Non-Commercial Amenities (Subtotal) (see note 3)	865,790	792,040	-73,750
Landside Arrivals Hall (Meeter and Greeter Area)	*162,950*	*139,400*	*-23,550*
Administration and Support Offices	*660,020*	*556,180*	*-103,840*
Police	*730*	*2,520*	*1,790*
Federal Agencies	*2,320*	*2,320*	*0*
Amenities	*22,330*	*53,270*	*30,940*
Other Contractors	*17,440*	*38,350*	*20,910*
Functional Areas (see note 4)	246,760	881,030	634,270
Building Allowances	2,028,760	3,208,080	1,179,320
Total	**6,306,820**	**9,532,440**	**3,255,620**

Notes:

1. No Action includes existing space (as of April 2020) and independent utility projects that will provide additional space in the future. Independent utility projects, as shown on the draft O'Hare Future Airport Layout Plan (ALP), have independent need from this EA and have been or will be processed through the National Environmental Policy Act (NEPA) separately from this EA. Chapter 2, Alternatives, describes the No Action in more detail.
2. Total Space Required includes existing space (as of April 2020) to remain as well as the independent utility projects (described in Note 1) along with the future space requirement estimates.
3. Landside arrivals hall, administration and support offices, police, federal agencies, amenities, and other contractor space are included in subtotal for airport administration and non-commercial amenities but are broken out to show why the difference is a negative number.
4. Public restrooms are included under "functional areas."

Source: CDA Terminal and Concourse Space - Existing, No Action Scenario, and Proposed Action Scenario, November 19, 2021

Key functional areas of need include the following, as defined further below:

- Customer Service and Employee Screening Deficiencies in Terminal 2,
- Customer Service Deficiencies in the Rotunda,
- Inadequate Baggage Circulation between Terminals, and
- Inadequate Goods Storage and Circulation.

Customer Service and Employee Screening Deficiencies in Terminal 2

Although modified over time, Terminal 2 is not configured to support the functional needs of a modern terminal associated with passenger and employee screening and processing. For example, Terminal 2 was not designed to accommodate current passenger ticketing/check-in practices such as self-service kiosks and baggage drops. Terminal 2 currently has 14,070 square feet of space available for check-in functions (check-in counters and processing areas, bag and oversize bag drop, curbside counters, and airline ticket office space) (**Table 2-2**).[7] The check-in space, approximately 50 feet deep, is limited by the overall terminal building depth, which ranges from 160 to 180 feet. Based on airline inputs, including quality or level of service goals as well as passenger attributes such as check-in type, Terminal 2 requires approximately 60,460 square feet for check-in functions—more than four times the currently available space.[8] The lack of space limits the ability to accommodate circulation and processing areas for passengers. Queues in front of the check-in counters contribute to constrained public circulation space in the check-in areas; this overflow reaches to the curbfront where passengers wait to enter the terminal. This causes congestion for passengers trying to access the check-in area and entering or exiting the building.

TABLE 2-2
TERMINAL 2 (AND ASSOCIATED CONCOURSES) CHECK-IN AND SECURITY SCREENING SPACE REQUIREMENTS IN SQUARE FEET

Function	No Action	Total Space Required	Difference (Total Minus No Action)
Check-in	14,070	60,460	46,390
Security Checkpoint Lanes	10,540	73,690	63,150
Employee Screening	690	2,610	1,920
Total	**25,300**	**136,760**	**111,460**

Source: CDA, Terminal and Concourse Space—Existing, No Action Scenario, and Proposed Action Scenario, March 18, 2021

The lack of space and crowding extends from the ticketing area to the security checkpoints. Terminal 2 lacks the space for adequate security checkpoints, creating long lines and extended wait times during peak periods. Currently, Terminal 2 has 10,540 square feet of space for security checkpoint passenger screening lanes and support space and 690 square feet for employee screening, pushing the lines for the checkpoints into the same areas where passengers queue at the check-in counters.[9] **Table 2-2** shows that passenger

[7] Chicago Department of Aviation Draft: Existing Terminal and Concourse Space by Function as of April 2020, October 2020.
[8] Ricondo, prepared for Chicago Department of Aviation, Draft: Terminal Area Plan (TAP) and Future Airport Layout Plan (ALP) Projects Preliminary Terminal Space Program Requirements, October 2020.
[9] Chicago Department of Aviation Draft: Existing Terminal and Concourse Space by Function as of April 2020, October 2020.

screening lanes and support space require 73,690 square feet and employee screening lanes and support space require 2,610 square feet at forecast passenger levels (see **Appendix B, Table B-6**).[10]

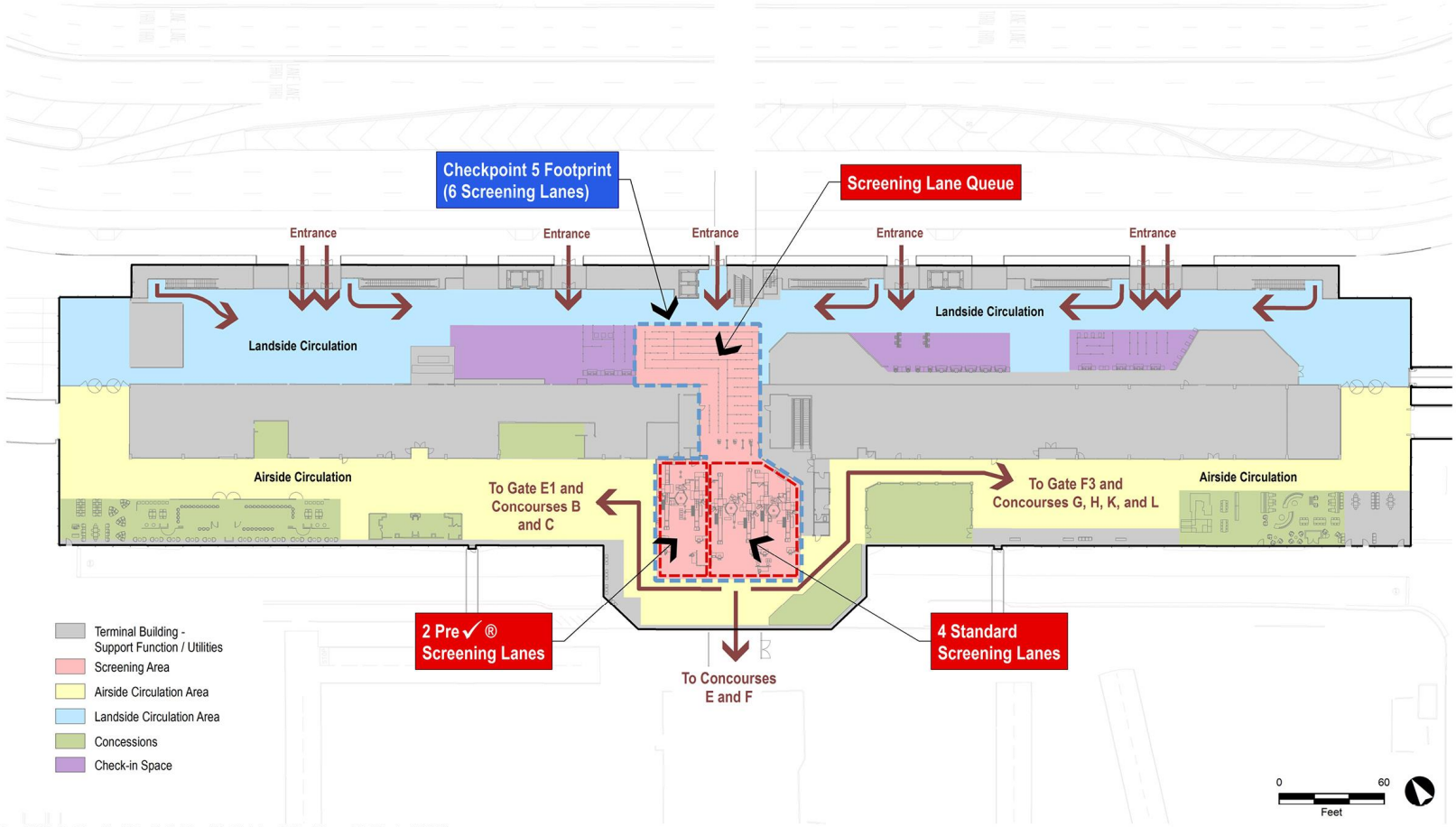
The number of required security lanes is calculated from wait time targets and processing time per passenger for Automated Security Lane equipment based on feedback from the local TSA representative.[11] O'Hare's terminal core currently contains nine passenger security checkpoints with 48 screening lanes. Only one of these checkpoints—Checkpoint 5—is in Terminal 2; Checkpoint 5 has six screening lanes and operates from 4:00 a.m. through 8:30 p.m.[12] **Exhibit 2-1** depicts the existing Terminal 2, Checkpoint 5 layout.

Passengers experience high wait times at the passenger security checkpoint. The resulting queues force passengers transiting through the terminal to weave through crowds waiting in queues, as shown in **Figure 2-2**. An analysis of a two-month sample of TSA wait time data for Checkpoint 5 (July and August 2019)[13] concluded that in 93 percent of all days, TSA's 10-minute maximum wait time goal was exceeded for at least one hour. July and August represent peak months of the year for passenger volume at O'Hare. Daily maximum wait times per hour are shown in **Figure 2-3**. Only four of the sample periods of 62 days met TSA's wait time goal for every hour of the day. Wait times exceeded TSA's goal for an average of 3.5 hours per day, i.e., 20 percent of total operating hours, regardless of it being a weekday or a weekend (see **Figure 2-4**).[14]

FIGURE 2-2
PASSENGER QUEUES AT TERMINAL 2, CHECKPOINT 5

Photo Source: René de Lambert (RenesPoints.com), taken May 2016, retrieved May 2021

[10] Ricondo, prepared for Chicago Department of Aviation. Draft: Terminal Area Plan (TAP) and Future Airport Layout Plan (ALP) Projects Preliminary Terminal Space Program Requirements, October 2020.
[11] Chicago Department of Aviation draft Terminal 2–Checkpoint 5 TSA Wait Time Analysis, February 16, 2021.
[12] Operating hours identified from Chicago Department of Aviation website, (https://www.flychicago.com/ohare/myflight/security/Pages/TSA.aspx), retrieved February 10, 2021.
[13] An additional checkpoint is provided in Terminal 2 for vendors and goods which is not considered in the wait time data because passengers do not use it.
[14] Chicago Department of Aviation Draft Terminal 2–Checkpoint 5 TSA Wait Time Analysis. February 16, 2021.

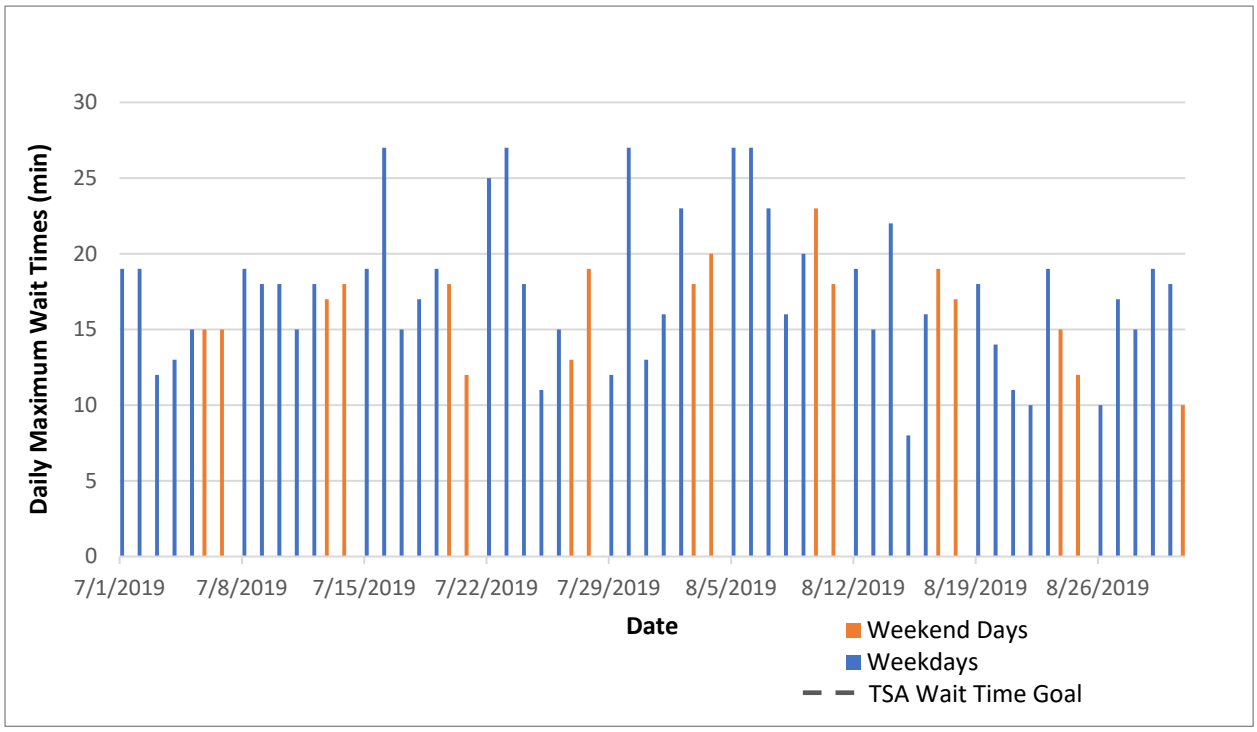


Existing Terminal 2 – Checkpoint 5 Layout

Chicago O'Hare International Airport
Terminal Area Plan and Air Traffic Procedures Environmental Assessment

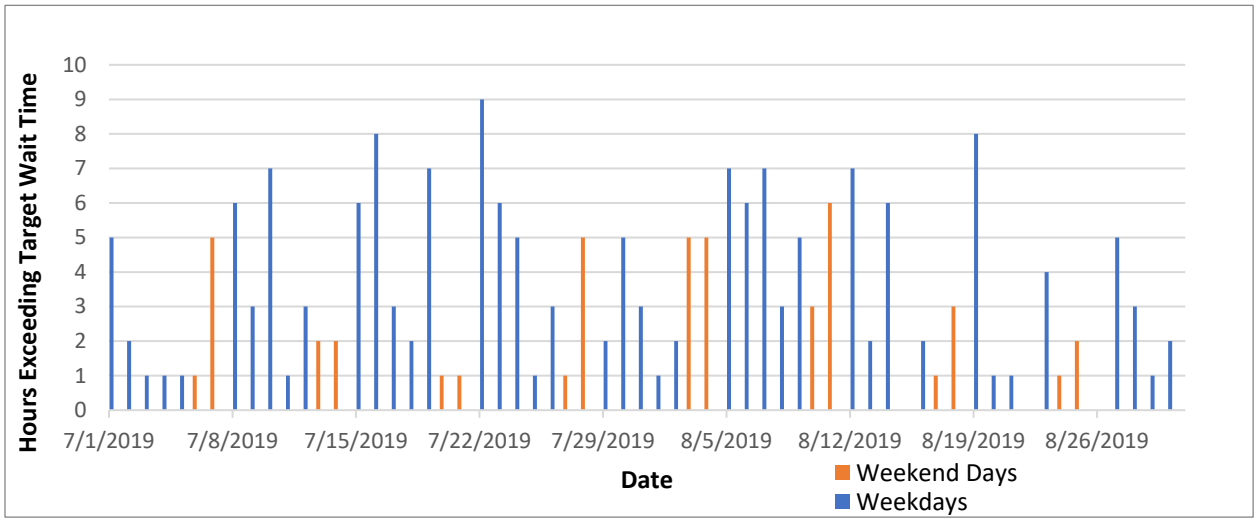
Exhibit 2-1

FIGURE 2-3
DAILY MAXIMUM WAIT TIMES AT TERMINAL 2, CHECKPOINT 5 (JULY/AUGUST 2019)



Source: Chicago Department of Aviation Draft Terminal 2–Checkpoint 5 TSA Wait Time Analysis, February 16, 2021

FIGURE 2-4
TOTAL HOURS EXCEEDING TARGET MAXIMUM WAIT TIME AT TERMINAL 2, CHECKPOINT 5 (JULY/AUGUST 2019)



Source: Chicago Department of Aviation Draft Terminal 2–Checkpoint 5 TSA Wait Time Analysis, February 16, 2021

Terminal 2 lacks space to accommodate the amenities and concessions necessary to meet customer expectations. While Terminal 2 currently has 13,750 square feet dedicated to amenities, 29,210 square feet of space are needed.[15] Airport amenities improve the passenger traveling experience but do not necessarily generate revenue. Examples of amenity spaces include federally-mandated lactation and nursing rooms and federally-recommended information centers.[16] Currently, amenities comprise less than one percent of the total public space in Terminal 2. Amenities are not well located to serve passengers, and their ad hoc accommodation will not adequately serve forecast demand.

Terminal 2 and its associated concourses require 123,540 additional square feet of commercial space to meet future passenger and concessionaire needs. According to estimates displayed in **Table 2-3,** this includes additional space for retail areas, food and beverage areas, duty-free shopping, storage and commissary, and loading docks.

TABLE 2-3
TERMINAL 2 (AND ASSOCIATED CONCOURSES) COMMERCIAL SPACE REQUIREMENTS IN SQUARE FEET

Function	No Action	Total Space Required	Difference (Total minus No Action)
Retail Area	14,140	33,600	19,460
Food and Beverage Area	19,160	67,200	48,040
Duty-free	330	21,300	20,970
Storage and Commissary (back-of-house)	10,230	33,000	22,770
Loading Dock (back-of-house)	0	12,300	12,300
Total	43,860	167,400	123,540

Source: Chicago Department of Aviation Terminal and Concourse Space - Existing, No Action Scenario, and With Project Scenario, March 18, 2021

The CDA examined the effects of narrow concourses on passenger movement and ability to supply amenities. Terminal 2 Concourses E and F, which are each 65 feet wide, must support passenger circulation, holdrooms, concessions spaces, and other functions. By comparison, modern concourses that have gates on both sides are typically 120 feet wide.[17] The narrow concourse widths in Terminal 2 result in passenger circulation bottlenecks due to concession spaces in the corridors. Furthermore, insufficient concourse widths result in undersized holdrooms. As a result, passengers spill into concourse circulation corridors and create additional bottlenecks in passenger flow, as shown in **Figure 2-5**. These passengers often sit on floors or stand directly in passenger circulation corridors, further impeding flow.

[15] Ricondo, prepared for Chicago Department of Aviation; Draft: Terminal Area Plan (TAP) and Future Airport Layout Plan (ALP) Projects Preliminary Terminal Space Program Requirements, October 2020.

[16] Federal Aviation Administration, Advisory Circular 150/5360-13A: Airport Terminal Planning, July 13, 2018.

[17] 120 feet represents a guideline for corridor widths of modern terminals with holdrooms on both sides of a corridor. Ricondo & Associates, Inc., August 2019 (benchmarking of modern typical concourse widths: ranging from 120 to 130 feet for the recently renovated Tom Bradley International Terminal at Los Angeles International Airport, Concourse F at Hartsfield-Jackson Atlanta International Airport, Concourse B at San Francisco International Airport, Concourse A North at Charlotte Douglas International Airport, and Concourse B at LaGuardia Airport).

FIGURE 2-5
TERMINAL 2 HOLDROOMS

Source: CDA, 2021

Based on the existing gate configuration and narrow corridors, holdrooms serving domestic gates at Terminal 2 are approximately 25 percent undersized compared with industry-recommended practices. International standards suggest that holdrooms should have a depth of 30 feet to allow for flexible seating arrangements and passenger circulation.[18] As passenger activity increases over the planning horizon and airlines continue to use larger aircraft with more passengers per aircraft, undersized holdrooms would increasingly degrade the passenger experience.

Public circulation corridors in Terminal 2 and associated concourses currently encompass 110,280 square feet. This space does not accommodate the current flow of passengers (typically with baggage), passenger transport vehicles, and passengers with mobility challenges, some of whom require wheelchairs.[19] This limited space is further congested by service carts that transport concessionaires' goods between storage areas and points of sale. Passenger circulation requires 342,520 square feet of space.[20]

United Airlines operates out of Terminals 1 and 2, requiring a connection between the two. The existing airside (secure) 20-foot-wide walkway bridge linking Terminal 1 and Terminal 2 is undersized, circuitous,

[18] International Air Transport Association Airport Development Reference Manual, 11th Edition, Planning-Passenger Terminal Section 3.4, March 2019.
[19] Chicago Department of Aviation, Terminal and Concourse Space—Existing, No Action Scenario, and With Project Scenario, November 19, 2021.
[20] Chicago Department of Aviation, Terminal and Concourse Space—Existing, No Action Scenario, and With Project Scenario, November 19, 2021.

and confusing to passengers. Today, passengers must exit the main circulation corridor, walk past the security checkpoint, and cross a shorter and narrower walkway to Terminal 2 where another series of turns leads to the terminal's main circulation path. International guidelines recommend 40-foot-wide corridors connecting terminals based on peak hour passenger flows, speed of passengers, and encumbrances (such as baggage, use of carts, and recommended buffers).[21]

Rotunda Customer Service Deficiencies

The Rotunda connects Terminal 2 (to the west), Terminal 3 (to the east), and Concourse G (to the south). Two glass-enclosed, concourse-level walkways connect Terminals 2 and 3 to the Rotunda. Concourse G is attached to the southern perimeter of the Rotunda and connects directly into the Rotunda, as shown in **Exhibit 2-2**.

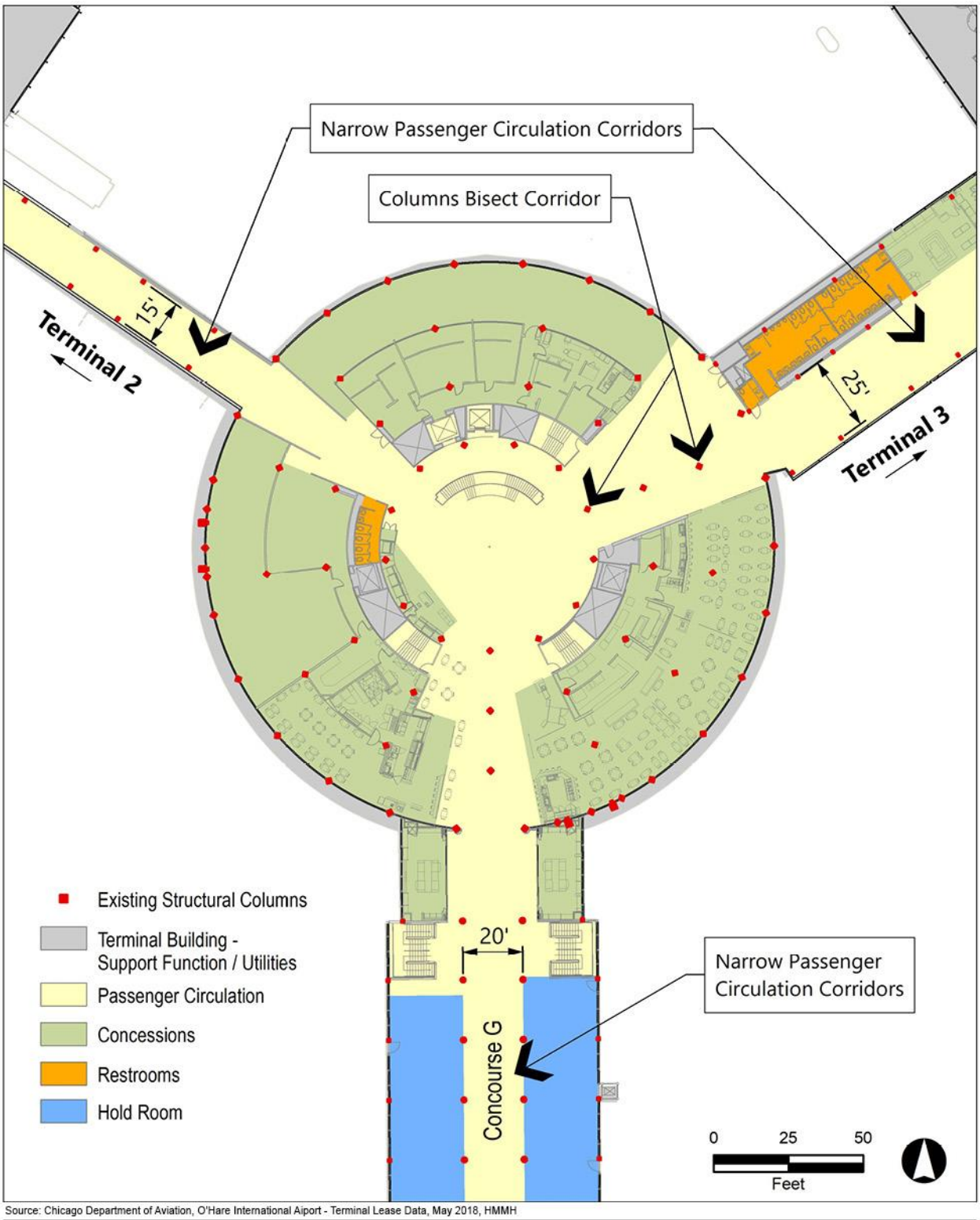
The interior of the Rotunda consists of four levels: the concourse and mezzanine—which are public spaces—and the apron and basement levels—which are not. The spatial arrangement on all levels is heavily influenced by the circular shape of the perimeter wall and subsequent interior walls that together create a series of concentric circles around which interior spaces are organized. The concourse level, which receives the heaviest passenger use, currently houses a restaurant, food court, concessions, and a service animal relief area while also serving as a pass-through for travelers walking between Terminals 2 and 3 and Concourse G. It also houses associated back-of-the-house food preparation areas, coolers, storage areas, and offices. Currently, public space on the mezzanine accommodates a hydroponic garden on the south end, a yoga room on the southwest, a mother's room on the northwest, United Service Organizations of Illinois on the northeast side, and an elevator bay at the north end. Additional offices, a large conference room, and other leased spaces occupy the remaining areas on the mezzanine level, which are divided by removable partition walls. The apron level is used for storage, as detailed in the discussion on Inadequate Goods Storage and Circulation below.

The Rotunda's circular design was intended to allow for seamless integration of the three surrounding buildings, but as activity levels increased, passenger flow has become congested and complicated due to added interior buildouts, insufficient corridor widths, and non-intuitive routings. Today, the path through the Rotunda relies heavily on overhead signs to orient passengers and direct passenger circulation. The non-intuitive routing presents wayfinding challenges and physical constraints that result in bottlenecks to passenger flow.

The Rotunda's connection corridors do not facilitate current and future passenger circulation. The walkway corridor between Terminal 2 and the Rotunda is 15 feet wide, as shown in **Exhibit 2-2** and pictured in the left-hand photo in **Figure 2-6**. Industry-recommended corridor widths are twice the current width. The width of the walkway between the Rotunda and Terminal 3 is roughly 42 feet, with approximately half of that space dedicated to restroom and concession space that constricts passenger flows to an approximately 25-foot-wide zone, as shown in **Exhibit 2-2** and pictured in the right-hand photo in **Figure 2-6**. Industry-recommended standards for this corridor establish the need for a minimum 40-foot-wide airside circulation path, given the functions the corridor supports.[22] Narrow corridors impede passenger flow and wayfinding between terminals and concourses.

[21] Adequate passenger walkway widths were determined based on guidance provided in International Air Transport Association, Airport Development Reference Manual, 11th Edition, Planning-Passenger Terminal Section 3.4, March 2019; John J. Fruin, Metropolitan Association of Urban Designers and Environmental Planners, Inc., Pedestrian Planning and Design, pp. 72-79 (New York, 1971) (collectively referred to as "passenger terminal planning standards").

[22] International Air Transport Association, Airport Development Reference Manual, 11th Edition, Planning-Passenger Terminal Section 3.4, March 2019.



Source: Chicago Department of Aviation, O'Hare International Aiport - Terminal Lease Data, May 2018, HMMH

Chicago O'Hare International Airport

Terminal Area Plan and Air Traffic Procedures Environmental Assessment

Rotunda Floor Plan and Column Locations

Exhibit 2-2

FIGURE 2-6
WALKWAYS BETWEEN THE ROTUNDA AND TERMINAL 2 (ON LEFT) AND THE ROTUNDA AND TERMINAL 3 (ON RIGHT)

Source: Mead & Hunt, 2019

Structural columns in the concourse level of the Rotunda restrict passenger flow, as shown in **Exhibit 2-2.** Clear widths of walkways between the interior columns supporting the Rotunda's mezzanine above are as narrow as 15 feet, creating pinch points for passenger and goods movement. Additionally, their concentric grid arrangement, which is counter to path of travel, requires passengers and service vehicles to make a circuitous path, affecting functionality, route visibility, safety, and level of service. Pinch points result from crowding, increased use of carts for goods circulation, and accommodation of passengers requiring mobility assistance. The concourse level photo in **Figure 2-7** shows the entry to Concourse G and its structural columns, congestion, and narrow corridors. The Rotunda structure, in its current configuration, is unable to accommodate increased passenger volumes and mobility needs.

FIGURE 2-7
WALKWAY FROM ROTUNDA TO CONCOURSE G

Source: CDA, 2021

Inadequate Baggage Circulation between Terminals

Each terminal building/concourse houses its own baggage processing system below the passenger level that operates independently from those contained in the other terminals, leading to operational challenges. For example, when one baggage system is out of service, baggage (including belly cargo items) cannot be automatically rerouted to another system for screening and processing. Because airlines and their codeshare partners operate from different terminals, baggage for connecting passengers must be manually transferred from one terminal to another via mobile ground support equipment (tugs), requiring redundant baggage handling staffing. Also, the baggage system in Terminal 2 is outdated with the screening system in the check-in lobby, requiring manual loading and unloading. The need to transfer baggage manually both within and between terminals contributes to long connection times and missed connections.

Baggage circulation systems need modernization to:

- Improve automation
- Support integration with the TSA's latest baggage security screening systems
- Enhance real-time tracking of bags in the system
- Provide storage capability for early bags
- Provide additional capacity for both originating and transfer baggage

The existing baggage systems are not expandable, precluding incremental expansions to meet increases in baggage processing demand. Baggage function—checked baggage screening, baggage sorting systems, baggage operations, tug and cart ramps, etc.—associated with departures will require 1,391,170 square feet of terminal area space to provide for the expected life span of the terminal. Under the No Action Condition (as defined in **Table 2-1** notes), 880,910 square feet are devoted to these functions, resulting in a need for 510,260 additional square feet of space (or 58 percent).[23] Without sufficient space, the airline tenants must resort to mobile ground support equipment to meet the baggage connection requirements of connecting passengers.

Inadequate Goods Storage and Circulation

Terminal concessionaire goods storage, a back-of-house function, currently resides on the secure airside of the terminals; the storage sites retain inventories of goods before distribution to points of sale. Additional space is necessary for goods storage and goods circulation.

The terminal core contains all back-of-house functions necessary for concessionaires; 70 percent of these spaces are housed in the Rotunda, 20 percent in Terminal 1, and 10 percent in Terminal 2. The primary concessionaire goods storage area used by restaurants on the concourse level is in the central portion of the apron level of the Rotunda, with secondary supplemental storage locations located throughout the terminals. HMS Host, the terminal's primary food service company, uses approximately 70 percent of all back-of-house areas in the terminal core. It leases nearly all the back-of-house area in the Rotunda, which accounts for 80 percent of all HMS Host's back-of-house space. HMS Host receives its goods at the Rotunda, through Security Checkpoint 8,[24] then distributes them via handcarts in the terminals or airside trucks to concessionaires throughout the terminal.

As shown in **Exhibit 2-2**, storage is limited due to the Rotunda's circular shape and structural support columns and is not easily accessible (see the left-hand photo in **Figure 2-8**). Three entrances at the Rotunda's

[23] Chicago Department of Aviation, Terminal and Concourse Space—Existing, No Action Scenario, and With Project Scenario, November 19, 2021.
[24] Security Checkpoint 8 is in Terminal 3 between Concourses K and L.

apron level also serve as loading docks, providing both interior and exterior access, as shown in the right-hand photo in **Figure 2-8**.

FIGURE 2-8
ROTUNDA STORAGE ROOM AND APRON LEVEL EXTERIOR ACCESS DOOR

Source: Mead & Hunt, 2019

The CDA estimates a need for 57,440 additional square feet of space for back-of-house commercial storage and commissary space for retail, food and beverage, and duty-free concessions, along with 18,300 square feet needed for loading docks (see **Table 2-4**). Because the current lack of available storage space results in fragmented storage, concession staff may have to travel greater distances to replenish inventory at the point-of-sale locations. Additionally, distribution of goods from storage requires frequent trips due to limited space at the points of sale. This translates into frequent access trips through security checkpoints and the frequent movement of goods through passenger corridors, adding to congestion and bottlenecks.

TABLE 2-4
TERMINAL CORE (TERMINALS 1, 2, AND 3) COMMERCIAL STORAGE SPACE REQUIREMENTS IN SQUARE FEET

Function	No Action	Total Space Required	Difference (Total Minus No Action)
Storage and Commissary (back-of-house)	78,220	135,660	57,440
Loading Dock (back-of-house)	0	18,300	18,300
Total	**78,220**	**153,960**	**75,740**

Note: The Terminal 2 back-of-house commercial space requirements are included in these totals, in addition to being listed in Table 2-3.
Source: Chicago Department of Aviation, Terminal and Concourse Space - Existing, No Action Scenario, and With Project Scenario, November 19, 2021

2.3.1.3 Need to Facilitate Domestic and International Airline Partner Operations to Ensure that Passengers, Luggage, and Aircraft can Transition between the Two Types of Travel

In the 1990s, United States (U.S.) and foreign airlines formed strategic alliances and codeshare agreements. These alliances enable international airlines to provide domestic connecting passengers a wider variety of destinations through one-ticket transactions. Codeshare agreements allow U.S. and foreign flag airlines to

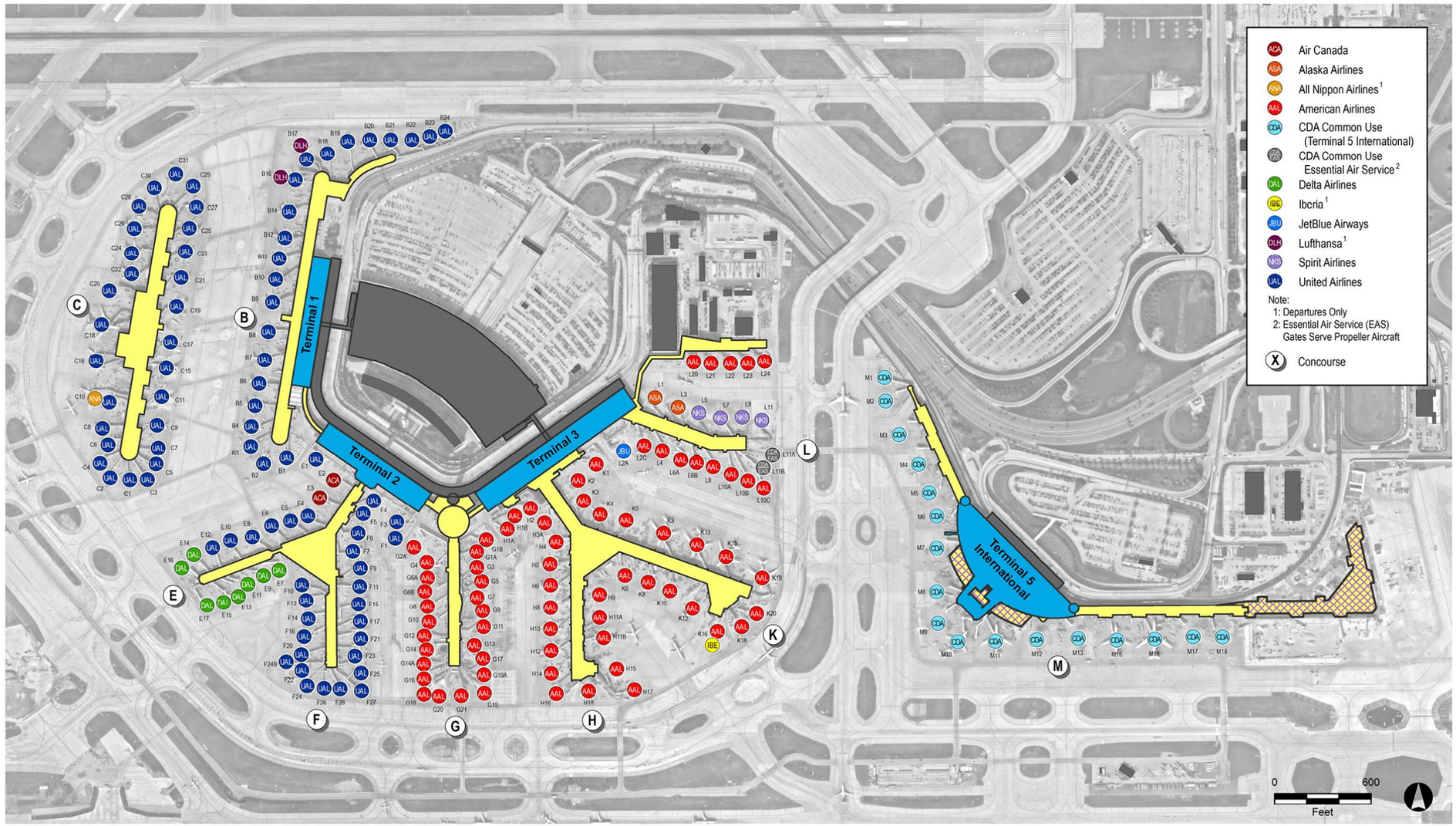
share route structures to certain cities and create markets for city-pairs that otherwise could not support service. Codesharing also creates a need to collocate[25] domestic and international alliance partners to reduce connection time, create baggage transfer efficiencies, and reduce passenger walking distances. These alliances altered terminal needs at O'Hare to accommodate both hub airlines—United Airlines and American Airlines—and their foreign codeshare partners. Current O'Hare terminal size limits the space for codeshare partners to operate within the same terminal, impeding passenger connections between codeshare airlines.

Terminals 1, 2, and 3 serve most of the domestic traffic and international departures of both American Airlines and United Airlines and their respective codeshare partners; these terminals have no international arrivals processing capability. Terminal 5 serves most international departures of foreign flag carriers and all international arrivals (excluding U.S. Customs and Border Protection [CBP] preclearance flights); Terminal 5 is the only O'Hare terminal with a CBP Federal Inspection Station (FIS) facility. **Exhibit 2-3** illustrates airline allocation by gate in each terminal. Integration of international and domestic operations is needed to minimize passenger and baggage transfer between Terminal 5 and the terminal core. International arrivals processing requires that arriving international passengers interact with an Immigration Services Officer before proceeding to baggage claim, customs, and finally the terminal exit. FIS facilities require space for primary processing functions, including self-processing identity-check kiosks, counters for passengers not eligible to use self-processing kiosks, and facilities to support customs declarations. The single FIS processing capability at O'Hare requires a substantial number of international arrivals to use Terminal 5 and constrains the business operation of the codeshares. The airlines operationally prefer to have international arrivals by codeshare partners occur at the same terminal as their departures.

Immigration, agricultural, and customs processing capabilities for international arrivals are limited to the FIS facilities at Terminal 5, which are physically separated from the domestic gates in the terminal core. Because all international arriving passengers (except those from preclearance flights) must be processed through FIS facilities, domestic airlines and their codeshare partners based in Terminals 1, 2, and 3 that operate international flights must operate from multiple terminals. This disconnected operation requires aircraft to arrive at Terminal 5 for deplaning and then be repositioned, by towing, to the airline's domestic gate or that of its codeshare partner. The separation of passenger processing functions among terminals requires extra staffing, affects airline scheduling, and increases minimum connection times between flights as airlines must build time into schedules to account for these operational inefficiencies.[26] Duplicate staffing teams include those needed to ticket passengers, manage gate operations, handle baggage, and transfer baggage manually between terminals.

On a typical day at O'Hare, approximately 200 aircraft are towed from gates to be repositioned, either from an arrival gate to a different gate for departure or to a holding area to allow that gate to be used by other aircraft. On a typical day in 2019, for example, 45 aircraft from O'Hare's hub airlines and their codeshare partners arrived at Terminal 5 and were repositioned to gates in the terminal core for their next departures.[27,28] This split international/domestic operation requires repositioning aircraft from Terminal 5 to another terminal, which increases movements on the airfield and terminal area aprons, thereby

[25] Gates are considered collocated when they are in the same or adjacent terminal facilities.
[26] Minimum connection times are published at airports to enable passengers to understand the risk of missed connections when booking flights. Minimum connection times are the minimum amount of time an airline will allow between two flights. Minimum connect times may vary based on airline, specific airport, time of day, and in some cases specific flights.
[27] This included approximately 30 flights by United Airlines and its codeshare partners, Lufthansa and All Nippon Airways, and approximately 15 flights by American Airlines and its codeshare partners, Japan Airlines and Iberia.
[28] Design Day Flight Schedule (Innovata, June 2019; U.S. Department of Transportation, T 100 and DB1b Survey, June 2019; Sabre Market Intelligence, June 2019; Ricondo & Associates, Inc., June 2019).



Source: HMMH, Landrum & Brown, Ricondo & Associates, Illinois Geospatial Data Clearinghouse, Cook County Government GIS, DuPage County GIS, ESRI

Chicago O'Hare International Airport

Terminal Area Plan and Air Traffic Procedures Environmental Assessment

Existing Terminal Buildings
Concourses/ Other Facilities
Terminal Area Under Construction (Previously Approved)
Existing Buildings

Existing Condition Terminal Gate Layout and Airline Allocation

▶ **Exhibit 2-3**

increasing airfield and apron congestion. Aircraft move slower when towed than when under their own power, so delays can be created by additional towing operations in the terminal core area.

The separation of international and domestic terminal operations also results in connectivity challenges for passengers. Passengers connecting from an international airline to a domestic departing flight typically must travel from Terminal 5 to the terminal core, exiting the secured area after passing through FIS facilities, collecting their baggage, and rechecking their baggage at Terminal 5. If the airline does not provide recheck facilities at Terminal 5, passengers must transport their baggage to their departure terminal for recheck. Of the international passengers processed at Terminal 5 FIS facilities, 40 percent are connecting passengers with a departure from the terminal core.[29]

To access other terminals, most arriving international passengers at Terminal 5 must exit the secure area and travel by the ATS people mover, which involves several level changes to and from the ATS platforms. They must then re-enter the secure area through a security checkpoint at their connecting flight terminal to reach their gate. Because the domestic and international terminals at O'Hare are separated and arriving international passengers cannot remain within security boundaries to make connecting flights, they cannot fully benefit from the seamless link offered by the airline partners. Therefore, improved passenger connectivity between terminals is needed, especially for connections that do not require passengers to exit and re-enter through security checkpoints. Passenger transfer via the ATS increases the time required to make international-domestic connections and leads to high connection times.

The movement of baggage between international arrivals and domestic connections is disconnected and poorly integrated. As discussed in **Section 2.3.1.2**, the baggage processing systems at each terminal function independently, so baggage for connecting flights between two terminals requires manual transport from one system to another. The manual transport of baggage between Terminal 5 and the terminal core requires baggage tugs to cross two taxiways. The crossing of a movement area contributes to airfield congestion and increases air traffic control workload.

Once aircraft are positioned at a gate on arrival, and before their next departure, they undergo servicing functions. These functions can occur simultaneously, such as cleaning the aircraft cabin (an arrival function) and fueling the aircraft for departure (a departure function). For flights towed and repositioned from a Terminal 5 gate to Terminals 1, 2, or 3, the servicing functions occur at their respective arrival and departure gates rather than simultaneously, increasing the total gate occupancy time needed to service an aircraft.

2.3.1.4 Need to Provide Sufficient Gate Frontage and Availability, Gate Flexibility, and Taxiway Connections to Efficiently Accommodate Aircraft Fleet Mix

As airline needs and business models evolve, airlines adjust aircraft sizes to serve their passengers' travel needs. Airlines typically replace older, smaller aircraft with larger, more efficient aircraft that accommodate more seats to cost-effectively carry more passengers. This process is referred to as upgauging.

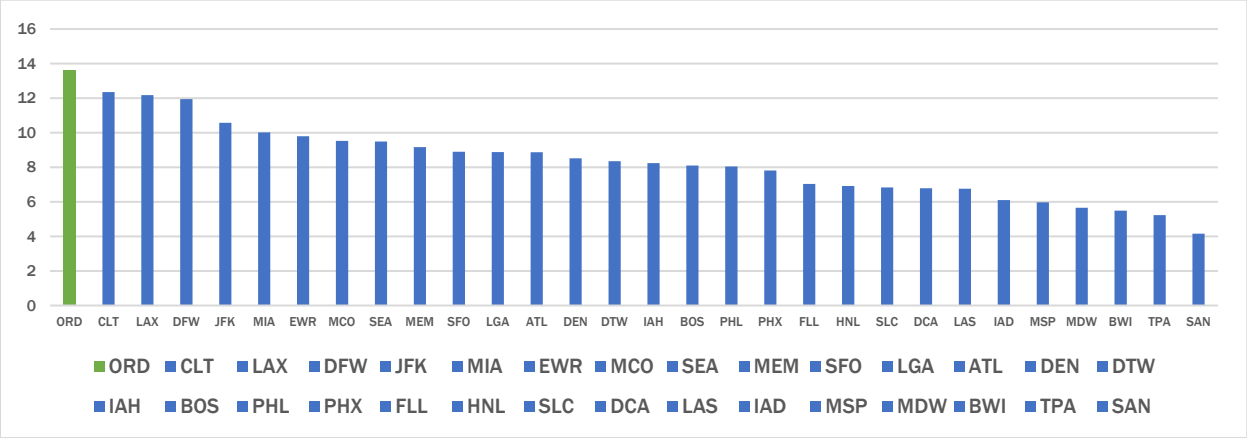
Existing terminal facilities require larger passenger waiting areas and seating at each gate to accommodate the operation of larger aircraft. Additional gate frontage and flexible gates are needed to adapt to changing aircraft fleet mixes, improve gate utilization, and reduce existing delays caused by the current terminal configurations. As shown in **Figure 2-9**, O'Hare had the highest average taxi-in[30] time of all busy U.S.

[29] International arrivals at Terminal 5 from the Design Day Flight Schedule (Innovata, June 2019; U.S. Department of Transportation, T 100 and DB1b Survey, June 2019; Sabre Market Intelligence, June 2019; Ricondo & Associates, Inc., June 2019).

[30] Per the FAA Aviation System Performance Metrics definition, average taxi-in delay is the sum of minutes of taxi-in delay of one minute or more divided by all arrivals; taxi-in delay equals actual taxi-in time minus unimpeded taxi-in time. Although taxi-in delays are not exclusive to delays caused by gate availability, the statistic does capture delays experienced by aircraft waiting for gates at the terminal or at a holdpad position.

commercial airports in 2018 at 13.84 minutes. Most of this time at O'Hare is caused by the distance the aircraft may travel upon landing to reach a gate. Taxi distances at other airports are typically shorter. Another contributor to the average taxi-in time is aircraft having to wait for available appropriately sized gates.[31] Increased gate flexibility, coupled with increased linear gate frontage, could reduce O'Hare's existing operational delays by lessening gate arrival and taxi-in delays.

FIGURE 2-9
AVERAGE TAXI-IN TIME (IN MINUTES), 2018



Source: Aviation System Performance Metrics (ASPM), Airport Taxi Times accessed at https://aspm.faa.gov/apm/sys/TaxiTimes.asp, using the following settings: Calendar Year: 2018, Grouping by Airport, Core Facilities, Standard Report Display, Word Format

Gate Frontage and Availability

The overall trend of upgauging at O'Hare is reflected in increased average seats per departure. In 2010, the average aircraft departing O'Hare had 96.7 seats. By 2019, this had increased to 112.3 seats, and is forecast to grow further to 128.6 seats by 2030 (see **Appendix B**, Figure B-27). As airlines upgauge their fleets, more gate frontage is needed to accommodate larger aircraft. Gate frontage describes the available length (in feet) along concourses used for parking aircraft at a gate; larger aircraft need more frontage than smaller aircraft. Flexible gate frontage allows airlines to have multiple aircraft parking plans. For example, in one plan, the airline might park 13 Group V aircraft, 13 Group III aircraft, and five Group IV aircraft; in another plan, the same linear frontage would allow them to park 15 Group V, 12 Group III, and three Group IV aircraft.[32] Based on upgauging trends and forecast aircraft activity and, as shown in **Table 2-5**, the CDA projected that approximately 25 percent more linear feet of gate frontage could be needed by 2029 to efficiently accommodate the fleet mix predicted to serve O'Hare.

[31] U.S. Department of Transportation, Federal Aviation Administration, Aviation System Performance Metrics (ASPM), Airport Analysis, https://aspm.faa.gov/apm/sys/Main.asp (accessed August 8, 2019).
[32] Aircraft are categorized by group based on their wingspan size. For example, Aircraft Design Group V refers to B777/A330 aircraft, Group IV refers to B767, and Group III refers to B757, B737, and A320.

TABLE 2-5
CDA ANALYSIS OF GATE FRONTAGE REQUIREMENTS IN LINEAR FEET

April 2017	2029	Change
24,770	30,990	+25%

Source: Chicago Department of Aviation, Terminal Area Plan (TAP) and Future Airport Layout Plan (ALP) Projects, Project Descriptions-Appendices, Appendix C, "Summary of Gates and Frontage, Chicago O'Hare International Airport," Exhibit 1-A, February 2022.

Gate Flexibility

Flexible gates would allow O'Hare facilities to efficiently respond to the changing demands of airline fleet sizes, which fluctuate both in the short-term (e.g., hourly, seasonally) and long-term (e.g., fleet upgauging) in response to market conditions. With flexible gate configurations, aircraft of varying sizes—such as one large aircraft or two smaller aircraft—can be accommodated, and transitions between domestic departures/arrivals and international arrivals are easier to facilitate. The ability to "swing" between domestic and international operations provides flexibility to adapt to operational changes and therefore enables increased gate use and avoids the need to tow aircraft between terminals. Swing gates, however, require sterile passageways that prevent international arrivals from mixing with domestic passengers.[33] Improved gate flexibility would reduce the imbalance of demand for departure gate use at the terminal core and arrival gate use at Terminal 5 from international flights. **Table 2-6** includes the total number of gates in each terminal and concourse, specifying the gate type available. **Table 2-6** shows that Concourses E and F do not have enough widebody gates to accommodate operational peaks by large aircraft.

TABLE 2-6
O'HARE EXISTING GATE CAPABILITIES

Number of Gates by Concourse											
	Terminal 1		Terminal 2		Terminal 3				Terminal 5		
Gate Type	B	C	E	F	G	H	K	L	M	Total	% of Total
EAS (see note 1)	0	0	0	0	0	0	0	2	0	2	1.1
Regional Jet (see note 2)	4	8	10	21	26	4	1	8	0	82	44.3
Narrowbody (see note 3)	16	12	7	0	0	13	8	7	2	65	34.1
Widebody (see note 4)	2	8	0	0	0	1	7	0	18	36	19.5
Total Gates	22	28	17	21	26	18	16	17	20	185	100

Source: CDA, TAP Purpose and Need White Paper, March 2020
Notes: EAS = Essential Air Service
1. EAS gates currently serve propeller aircraft.
2. Representative regional jet aircraft include the CRJ-200/700/900.
3. Representative narrowbody aircraft include the A320/321 and B737-900.
4. Representative widebody aircraft include the A330-200, A350, A380, B767-300, B747, and B777-X.

Flexibility would allow O'Hare and airline partners to efficiently accommodate aviation demand by better aligning gate demand with aircraft size and operation type. Airlines schedule flight times and aircraft types

[33] National Academies of Sciences, Engineering, and Medicine 2010, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook; Washington, DC: The National Academies Press, https://doi.org/10.17226/22964.

to serve expected passenger demand in each market and often have a range of appropriately sized aircraft in their fleets to adjust to market demand. The use of larger aircraft typically occurs during the busiest periods of the day. As a result, there is a need for flexible gates that can handle both narrowbody and widebody aircraft. For example, an early morning arrival from Madison, Wisconsin, may operate with a medium narrowbody aircraft because demand is higher at that time of day. The same airline's arrival from Madison in the early afternoon may be on a small regional jet because that aircraft best fits passenger demand. Because of this, certain periods of the day may have a greater percentage of a given aircraft size than is suggested by the annual aircraft fleet mix in **Appendix B**, Figure B-27. The results of the CDA's analysis of O'Hare gate count requirements are shown inTable **2-7**

TABLE 2-7
CDA ANALYSIS OF GATE COUNT REQUIREMENTS

April 2017	2029
185	183–220 (see note)

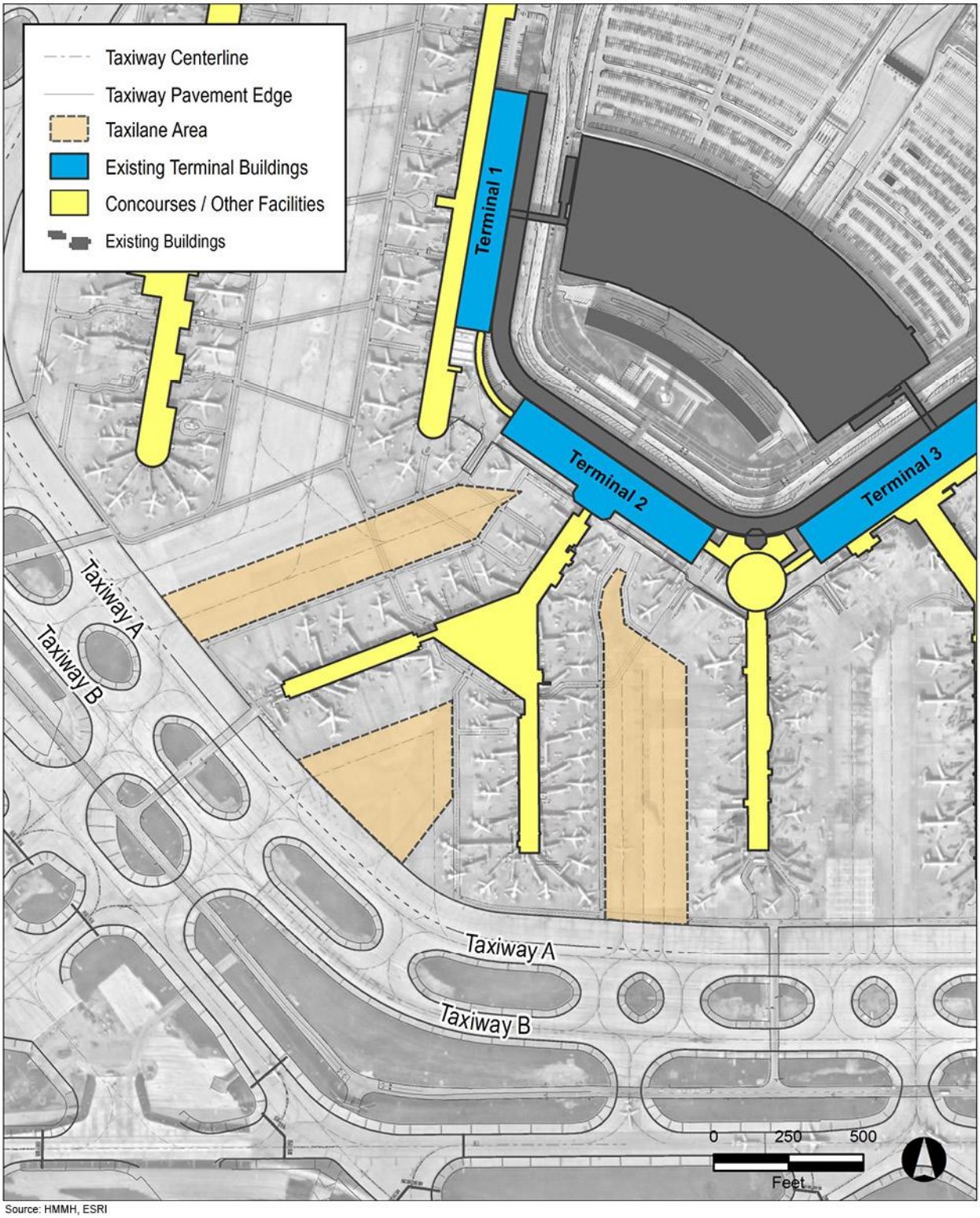
Note: Gate counts are expressed as a range to account for the variability of aircraft parking configurations at flexible gates.
Source: Chicago Department of Aviation, TAP and Future ALP Projects, Project Descriptions-Appendices, Appendix C, "Summary of Gates and Frontage, Chicago O'Hare International Airport," Table 7, February 2022.

Taxiway Connections

Taxilanes are designated routes on the apron pavement serving gates at concourses. Aircraft taxi along taxiways and taxilanes between runways and parking positions at aircraft gates. Near terminal facilities, aircraft exit the airfield movement area and follow taxilanes to parking positions. Taxilanes at O'Hare are not under the direction of air traffic control and are often managed by the CDA or airline operations staff.

The configuration of the apron, or aircraft parking area, and taxiways serving Terminal 2 constrains aircraft flow and restricts the utility of gates at Concourses E and F. **Exhibit 2-4** depicts the existing Terminal 2 taxilanes and Taxiways A and B. Taxiways A and B are two of the most heavily used taxiways at the airport. Arriving aircraft entering the terminal core from Taxiways A and B—the taxiways providing access to the terminal core apron—must stop and hold on the taxiway if departing aircraft are exiting the apron. Taxilanes serving Concourses E and F are narrow, with only one point of access. Movements on these narrow taxilanes are limited. Arriving aircraft must wait for departing aircraft to leave the apron area before proceeding to an empty gate and vice versa, resulting in bottlenecks. The configuration of Concourses E and F restricts the size of aircraft able to use certain gates and maneuverability in these constrained areas, resulting in inefficient use of gate frontage where Concourses E and F join Terminal 2 and each other.

Gates adjacent to taxiways at the ends of the concourses may require pushbacks of aircraft (i.e., exiting a parking position at a gate) onto the taxiway. Pushbacks onto an active taxiway can result in operational deficiencies such as aircraft backups and increased air traffic controller workload. Terminals and corresponding aircraft parking positions are supported by taxiways and service roads, which must meet FAA design standards for the aircraft fleet mix operating at the airport.



Source: HMMH, ESRI

Chicago O'Hare International Airport

Terminal Area Plan and Air Traffic Procedures Environmental Assessment

Existing Terminal 2 Taxilanes

▶ Exhibit 2-4

Two aircraft cannot simultaneously operate in opposite directions on many surface areas on the airport, including proximate aircraft pushing back from gates. For example, an aircraft departing a gate may need to hold at that gate if other aircraft are entering the same apron. Similarly, due to the narrow taxilane and concourse configuration, aircraft are not able to bypass other aircraft waiting to enter a gate. Congestion on the narrow taxilanes is exacerbated by aircraft movements and the need to accommodate vehicles and equipment, including baggage carts, aircraft service equipment, flight kitchen delivery vehicles, and snow melters.

Movements on the apron are further constrained by insufficient apron depth. The configuration of Concourses E and F limits the area available on the apron to accommodate aircraft parking, service roads, and taxilanes. Airlines lease apron areas from the face of a concourse to the edge of the taxilane object-free area to accommodate aircraft parking. Typically, airline leasehold space designated for aircraft parking includes a vehicle service road along the back end of the area. These service roads provide designated routing for ground vehicles on an apron, minimizing the potential for interactions between ground vehicles and aircraft.

The apron depth needed to support the fleet mix operating at O'Hare requires the full airline leasehold for aircraft parking along the south side of Concourse E, leaving no space for a delineated service road in the apron area. As a result, ground vehicle drivers do not have designated lanes. Sufficient apron depth within airline leaseholds is needed to accommodate the designation of vehicle service roads and improve the predictability of interactions between ground vehicles and aircraft. This would enhance the safety of apron operations.

2.3.1.5 Need for Adequately Sized Curbside Facilities and Ground Access to Terminal 5

Terminal 5 has evolved from a primarily international arrivals facility to a facility that includes both international and domestic departing operations, leading to an increased need for departures drop-off capacity. Reconfiguration and expansion of Terminal 5 upper-level (departures) and lower-level (arrivals) curbsides are needed for both passenger drop-offs and pick-ups to improve traffic flow and reduce congestion of vehicles and passengers on the curbside. The Terminal 5 access roadway network also needs to be expanded to meet current and anticipated demand. Additional roadway capacity is needed to improve access to Terminal 5 and to reduce congestion in existing roadway segments and intersections.

Multiple causes result in roadway and curbside traffic congestion at Terminal 5. As of 2020, during the departures level peak, the I-190 Westbound to Bessie Coleman Drive and Terminal 5 entry/exit roadway link and the Terminal 5 entry access roadway operate at a level of service (LOS)[34] D, indicating limited maneuverability and low driving comfort level. **Table 2-8** shows the volume/capacity (V/C) ratios that correspond to each roadway LOS. As shown in **Table 2-9**, conditions remained poor or had eroded from 2016 to 2020 for both roadway links, indicating a pattern that is likely to continue.

TABLE 2-8
ROADWAY LEVEL OF SERVICE RANGES

Level of Service	V/C Range	Description
A	< 0.60	Excellent: Traffic is free-flow with low volumes and high speeds.

[34] The concept of LOS is the "foundation for determining the adequacy of transportation facilities from the perspective of planning, design, and operations," as defined by the Transportation Research Board, National Research Council, Highway Capacity Manual, 2000.

Level of Service	V/C Range	Description
B	0.61 – 0.70	Very Good: Drivers have reasonable freedom to select their speed and lane of operation.
C	0.71 – 0.80	Good: Drivers become restricted in their ability to select their speed or to change lanes.
D	0.81 – 0.90	Fair: Drivers have little freedom to maneuver and driving comfort levels are low.
E	0.91 – 1.00	Poor: Roadway is operating at or near capacity.
F	> 1.00	Failure: Forced flow operations where excessive roadway queuing develops.

Source: Transportation Research Board, National Research Council, Highway Capacity Manual, December 2000

TABLE 2-9
TERMINAL 5 ROADWAY LEVELS OF SERVICE, DEPARTURES LEVEL PEAK

Link	Description	Speed	Number of Lanes	Capacity per Lane	Total Capacity	2016	2020
17	I-190 WB to Bessie Coleman Drive/T5	Entry/Exit Roadway 40 MPH	1	1,530	1,530	D	D
18	T5 Entry Roadway	Terminal Access Roadway 25 MPH	2	1,010	2,020	C	D
19	T5 Parking Entry	Ramps	1	1,010	1,010	C	C
20	T5 Lower-Level Curbside Exit	Terminal Access Roadway 30 MPH	1	1,170	1,170	B	B
21	T5 Upper-Level Curbside Exit	Terminal Access Roadway 30 MPH	1	1,170	1,170	B	C
22	T5 Parking Exit	Ramps	2	1,010	2,020	A	A
23	Recirculation Road at T5	Ramps	1	1,010	1,010	A	A
J	T5 Exit to I-190 EB	Terminal Loop Roadway 35 MPH	1	1,290	1,290	B	C

Note: WB = Westbound, EB = Eastbound
Source: Ricondo & Associates, Inc., July 2021

As of 2020, the Terminal 5 entry roadway, lower-level curbside exit, and Terminal 5 exit to I-190 Eastbound operate at a LOS E during the arrivals level peak. As shown in **Table 2-10**, these three roadway links operate at or near capacity. All three links have shown a decrease in LOS since 2016, and this trend can be expected to continue.

Table 2-9 and **2-10** show the roadway LOS on all key roadway links for the departures and arrivals peaks, respectively.

TABLE 2-10
TERMINAL 5 ROADWAY LEVELS OF SERVICE, ARRIVALS LEVEL PEAK

Link	Description	Speed	Number of Lanes	Capacity per Lane	Total Capacity	2016	2020
17	I-190 WB to Bessie Coleman Drive/T5	Entry/Exit Roadway 40 MPH	1	1,530	1,530	C	C
18	T5 Entry Roadway	Terminal Access Roadway 25 MPH	2	1,010	2,020	C	E
19	T5 Parking Entry	Ramps	1	1,010	1,010	C	D
20	T5 Lower-Level Curbside Exit	Terminal Access Roadway 30 MPH	1	1,170	1,170	D	E
21	T5 Upper-Level Curbside Exit	Terminal Access Roadway 30 MPH	1	1,170	1,170	A	A
22	T5 Parking Exit	Ramps	2	1,010	2,020	A	A
23	Recirculation Road at T5	Ramps	1	1,010	1,010	B	B
J	T5 Exit to I-190 EB	Terminal Loop Roadway 35 MPH	1	1,290	1,290	C	E

Note: EB = Eastbound
Source: Ricondo & Associates, Inc., July 2021

The intersection of Bessie Coleman Drive and Balmoral Avenue is the intersection that provides access to Terminal 5. As of 2020, the Bessie Coleman Drive and Balmoral Avenue Intersection operated at a fair LOS overall and in each direction (LOS D) except southbound (LOS C), as shown in **Table 2-11** and **2-12**. In 2016, the intersection operated at LOS C for every direction except southbound, which indicates a decrease in conditions over time which can be expected to continue.

TABLE 2-11
INTERSECTION LEVELS OF SERVICE RANGES

Level of Service	Control Delay (Seconds per Vehicle)	Condition
A	Less than or equal to 10	Excellent
B	10–20	Very Good
C	20–35	Good
D	35–55	Fair
E	55–80	Poor
F	Greater than 80	Failure

Source: Transportation Research Board, National Research Council, Highway Capacity Manual, December 2000

TABLE 2-12
BESSIE COLEMAN DRIVE/BALMORAL AVENUE INTERSECTION LEVELS OF SERVICE

	2016	2020
Northbound	C	D
Southbound	B	C
Eastbound	C	D
Westbound	C	D
Overall	C	D

Source: Ricondo & Associates, Inc., July 2021

Curbside LOS ranges are described in **Table 2-13. Table 2-14** shows the projected curbside utilization and LOS of existing curbside facilities at Terminal 5. It shows that the Terminal 5 departures at curbside level experienced LOS D in both 2016 and 2020, meaning vehicle maneuverability is restricted due to frequent double- and triple-parking. Based on this trend, future conditions would be expected to worsen.

TABLE 2-13
CURBSIDE LEVEL OF SERVICE RANGES

Level of Service	Range	Condition
A	0–90%	Excellent: Drivers experience no interference from pedestrians or other motorists.
B	91%–110%	Very Good: Relatively free-flow conditions exist with limited double-parking.
C	111%–130%	Good: Double-parking near doors is common with intermittent triple-parking.
D	131%–170%	Fair: Vehicle maneuverability is restricted due to frequent double- or triple-parking.
E	171%–200%	Poor: Significant delays and queues due to double- or triple-parking throughout the curbside.
F	Greater than 201%	Failure: Motorists are unable to access/depart curbside; there is significant queuing along the entry road.

Source: Ricondo & Associates, Inc., July 2021 (based on information published in Airport Cooperative Research Program, ACRP Report 40, Airport Curbside and Terminal Area Roadway Operations, July 2010)

TABLE 2-14
PROJECTED CURBSIDE UTILIZATION AND LEVEL OF SERVICE OF EXISTING FACILITIES

	2016	2020
Departures Level Curbside		
Curbside Utilization	150%	163%
Curbside LOS	D	D
Required Length for Optimal LOS C (in feet)	627	788
Required Length for Optimal LOS D (in feet)	479	603
Existing Curbside Length Available (in feet)	544	628
Roadway Volume/Capacity	0.22	0.48
Roadway LOS	A	A
Arrivals Level Outer Curbside		
Curbside Utilization	97%	95%
Curbside LOS	C	C
Required Length for Optimal LOS C (in feet)	685	675
Required Length for Optimal LOS D (in feet)	596	587
Existing Curbside Length Available (in feet)	709	709
Roadway Volume/Capacity	0.23	0.39
Roadway LOS	A	A
Arrivals Level Inner Curbside		
Curbside Utilization	55%	72%
Curbside LOS	A	B
Required Length for Optimal LOS C (in feet)	180	235
Required Length for Optimal LOS D (in feet)	157	204
Existing Curbside Length Available (in feet)	327	327
Roadway Volume/Capacity	0.37	0.52
Roadway LOS	A	A

Note: The city taxi loading zone on the arrivals level inner curbside is not analyzed as part of the curbside LOS because it is a first-in, first-out queue managed by a dispatcher.
Source: Ricondo & Associates, Inc., July 2021

2.3.2 Group 2: On-Airport Hotels

The CDA is a self-supporting enterprise fund of the City of Chicago (City); neither the City nor State of Illinois tax revenues fund the cost of developing, improving, or operating O'Hare. As a result, revenue collected at the airport offsets the costs of operating and maintaining facilities. Airport operating costs and debt service obligations are funded with FAA grants, passenger facility charge revenue, bond proceeds, aeronautical or airline revenue (e.g., landing fees and terminal rental and use charges), and non-aeronautical revenue (e.g., concessions, vehicle parking, vehicle rentals, and real estate). Within the boundaries of FAA grant assurances, airport-generated revenues may be used for any operating or capital expense of the airport, providing airports with financial flexibility. As shown in **Table 2-15**, both

aeronautical revenue and non-aeronautical revenue generated at O'Hare have increased since 2017 due to landing fee increases, rent increases, and concessions revenue. Additionally, ownership of the Hilton O'Hare on-airport hotel was transferred to the City on January 1, 2019—when the 30-year hotel lease ended—making it an additional revenue source.[35]

TABLE 2-15
O'HARE TOTAL OPERATING REVENUES 2017–2019 IN THOUSANDS OF DOLLARS

Revenue Source	2017	2018	2019
Landing Fees	300,247	336,168	370,945
Terminal Rental and use Charges	350,727	373,765	440,325
Other Rentals and Fueling System Fees	62,905	84,513	113,567
Concessions (including Vehicle Parking, Vehicle Rentals, Restaurants, News and Gifts, Hilton O'Hare Hotel, Other)	257,421	260,623	322,147
Reimbursements	4,879	6,844	6,501
Total Operating Revenues	976,179	1,061,913	1,253,485

Source: City of Chicago, Chicago O'Hare International Airport, an Enterprise Fund of the City of Chicago; Comprehensive Annual Financial Report For the Years Ended December 31, 2019 and 2018, Page 78, accessed April 22, 2021 at https://www.chicago.gov/content/dam/city/depts/fin/supp_info/CAFR/2019CAFR/OHare2019.pdf

Airports benchmark themselves on a cost-per-enplanement[36] basis relative to their peer airports. Cost per enplanement measures the relative cost of an airport's airline rates and charges compared to the number of enplaned passengers.[37] At O'Hare, the airline cost per enplaned passenger for 2019 was $18.35.[38] Airports cannot rely on increasing revenue streams solely by charging tenants more or they will become less competitive, which is why non-aeronautical revenue is a critical income source. The CDA and the Signatory Airlines signed a 15-year Airline Use and Lease Agreement that went into effect May 12, 2018. This agreement sets forth the City's financial and operational arrangements with the Signatory Airlines and provides contractual support of the Signatory Airlines for certain obligations issued to fund the Airport Capital Program.

2.3.2.1 Need to Increase Non-Aeronautical Revenue

The CDA maintains costs and revenues in a prudent financial manner by managing operating expenses, targeting capital expenditures for projects that efficiently allow for airport growth, serve the traveling public, and maintain existing infrastructure. Non-aeronautical revenue streams improve O'Hare's financial self-sustainability by providing diverse financial resources to help meet its obligations today and in the future. In 2019, O'Hare generated approximately $322 million in non-aeronautical revenues specifically

[35] City of Chicago, Chicago O'Hare International Airport, an Enterprise Fund of the City of Chicago; comprehensive Annual Financial Report for the Years Ended December 31, 2019 and 2018, pg. 12, accessed April 22, 2021 at https://www.chicago.gov/content/dam/city/depts/fin/supp_info/CAFR/2019CAFR/OHare2019.pdf.

[36] ACRP defines an enplaned passenger as a passenger who boards an aircraft at the airport; this includes domestic and international passengers and passengers who deplane and reboard to continue their journey from the airport. Source: National Academies of Sciences, Engineering, and Medicine, 2011, Resource Guide to Airport Performance Indicators, pg. 242, Washington, DC: The National Academies Press, https://doi.org/10.17226/17645.

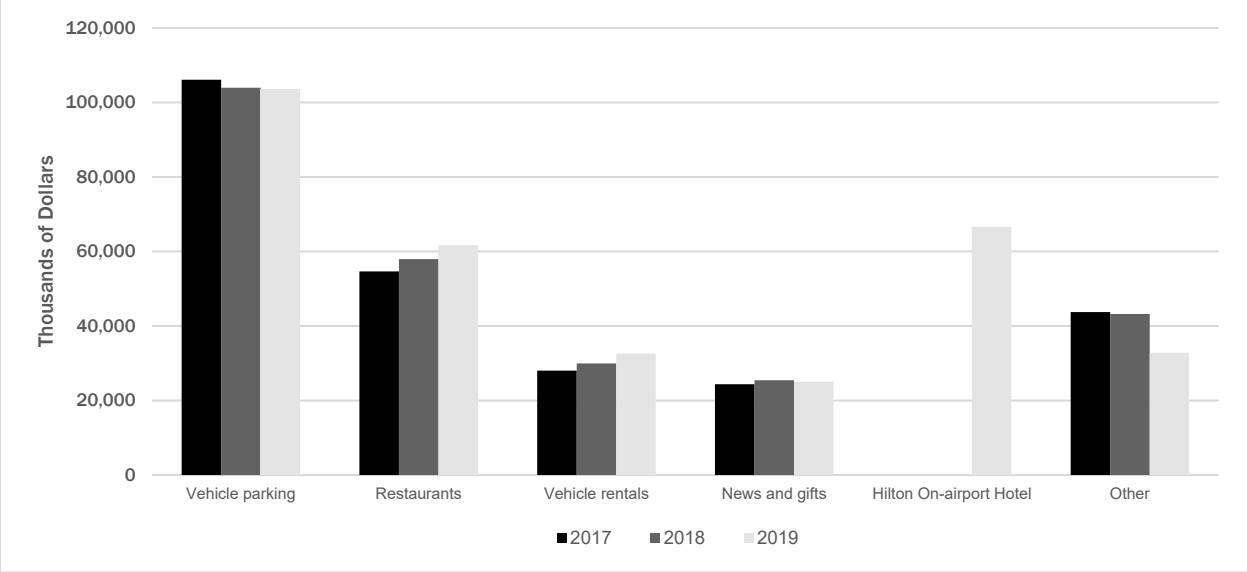
[37] Industry White Paper, Aircraft Operating and Delay Cost per Enplanement, prepared for Airports Council International–North America, prepared by Ricondo & Associates, Inc., accessed April 22, 2021 at https://airportscouncil.org/wp-content/uploads/2018/08/white_paper_measuring_aircraft_operating_costs_and_delay_20140620.pdf.

[38] City of Chicago, Chicago O'Hare International Airport, an Enterprise Fund of the City of Chicago; comprehensive Annual Financial Report For the Years Ended December 31, 2019 and 2018, pg. 87, accessed April 22, 2021 at https://www.chicago.gov/content/dam/city/depts/fin/supp_info/CAFR/2019CAFR/OHare2019.pdf.

related to concessions including vehicle parking, vehicle rentals, restaurants, news and gifts, and hotel revenues; in 2018, O'Hare generated $261 million in concessions. The 2019 increase is attributed to the additional revenue from the Hilton hotel.

Figure 2-10 shows that vehicle parking and restaurants represent the highest-grossing non-aeronautical revenue sources over the three-year period of 2017–2019. It also notes that on-airport hotels present an opportunity to increase non-aeronautical revenue. Demand for hotel space is evident due to the proliferation of hotels around the airport. A total of 27 hotels exist within three miles of the O'Hare terminal core (see **Table 2-16** and **Exhibit 2-5**). Demand for conference and convention centers is also evident, with seven such facilities available within three miles of the terminal core.

FIGURE 2-10
NON-AERONAUTICAL REVENUES BY CATEGORY IN THOUSANDS OF DOLLARS

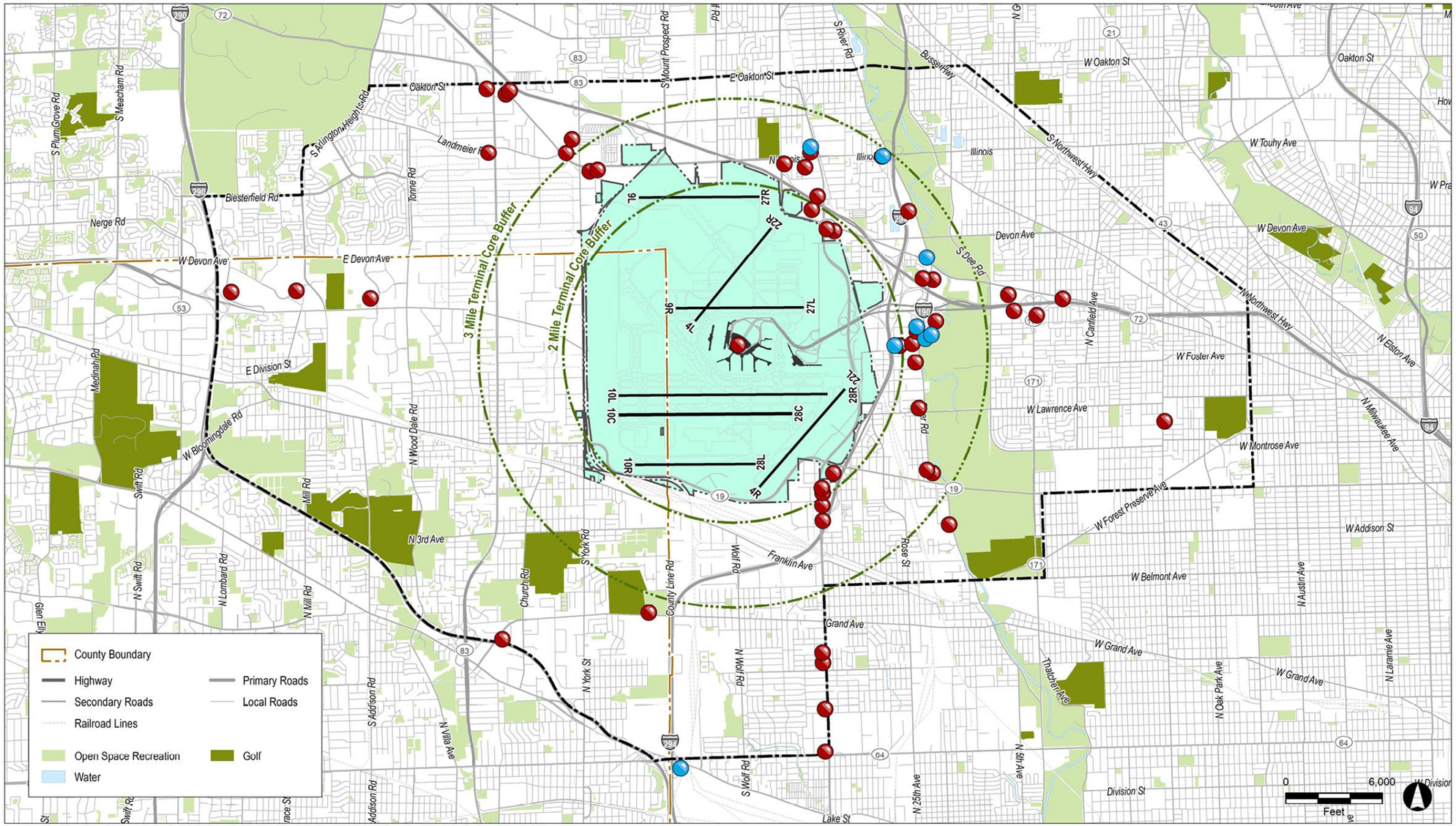


Source: City of Chicago, Chicago O'Hare International Airport, an Enterprise Fund of the City of Chicago; comprehensive Annual Financial Report For the Years Ended December 31, 2019 and 2018, pg. 87, accessed April 22, 2021 at https://www.chicago.gov/content/dam/city/depts/fin/supp_info/CAFR/2019CAFR/OHare2019.pdf

TABLE 2-16
HOTEL AND CONVENTION HALLS IN THE STUDY AREA

	2-Mile Buffer	3-Mile Buffer	Study Area
Hotels	8	27	48
Convention Centers	1	7	7

Note: Values are cumulative.
Source: HMMH, 2021



Chicago O'Hare International Airport

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Hotel and Convention Center Locations in the Study Area

▸ Exhibit 2-5

Enhancing passenger concession offerings and overall experience increases non-aeronautical revenue streams that could contribute to the airport's self-sustainability. Surplus revenues from non-aeronautical utilization of the airport can subsidize its aeronautical costs. When aeronautical users of O'Hare can operate at rates and charges below the cost of providing the aviation facilities and services, it benefits both aeronautical users and the traveling public.[39]

2.3.3 Group 3: Airfield and Taxiway Improvements Not Required by the Terminal Projects

The following three subsections describe the three needs for Group 3, Airfield and Taxiway Improvements Not Required by the Terminal Projects.

2.3.3.1 Need to Provide Additional Temporary Aircraft Parking Positions

A temporary United Airlines employee parking lot was constructed in October 2018 to ameliorate parking needs affected by construction of Runway 9C/27C.[40] This temporary lot comprises approximately 3,600 employee parking spaces on roughly 23 acres. It is located directly northeast of the terminal core and north of Terminal 5 on a site south of the Bravo Holdpad as shown in **Exhibit 2-6**. Holdpads are airfield pavement areas dedicated to holding aircraft while they are temporarily waiting for a gate or position in the departure queue.

The temporary lot and commercial vehicle holding area require relocation due to existing and projected demand for additional holdpad space at the Bravo location. Specifically, the Bravo Holdpad must be expanded to provide aircraft hardstand pavement with access to the airfield taxiway and runway system. Due to airfield changes over the last five years at O'Hare, holdpads have been removed to accommodate taxiways necessary for aircraft movement, including the holdpad previously located southeast of Terminal 5 and an additional holdpad previously located near the west end of Runway 10L/28R. Holdpad space is still necessary to position aircraft during storm events at O'Hare and when awaiting departure to destination airports. Additional space is also needed for staging and storage of deicing equipment southeast of the Bravo Holdpad and the expansion of the Commercial Vehicle Holding Area.

2.3.3.2 Need for Runway 28R Blast Pad to Meet FAA Standards

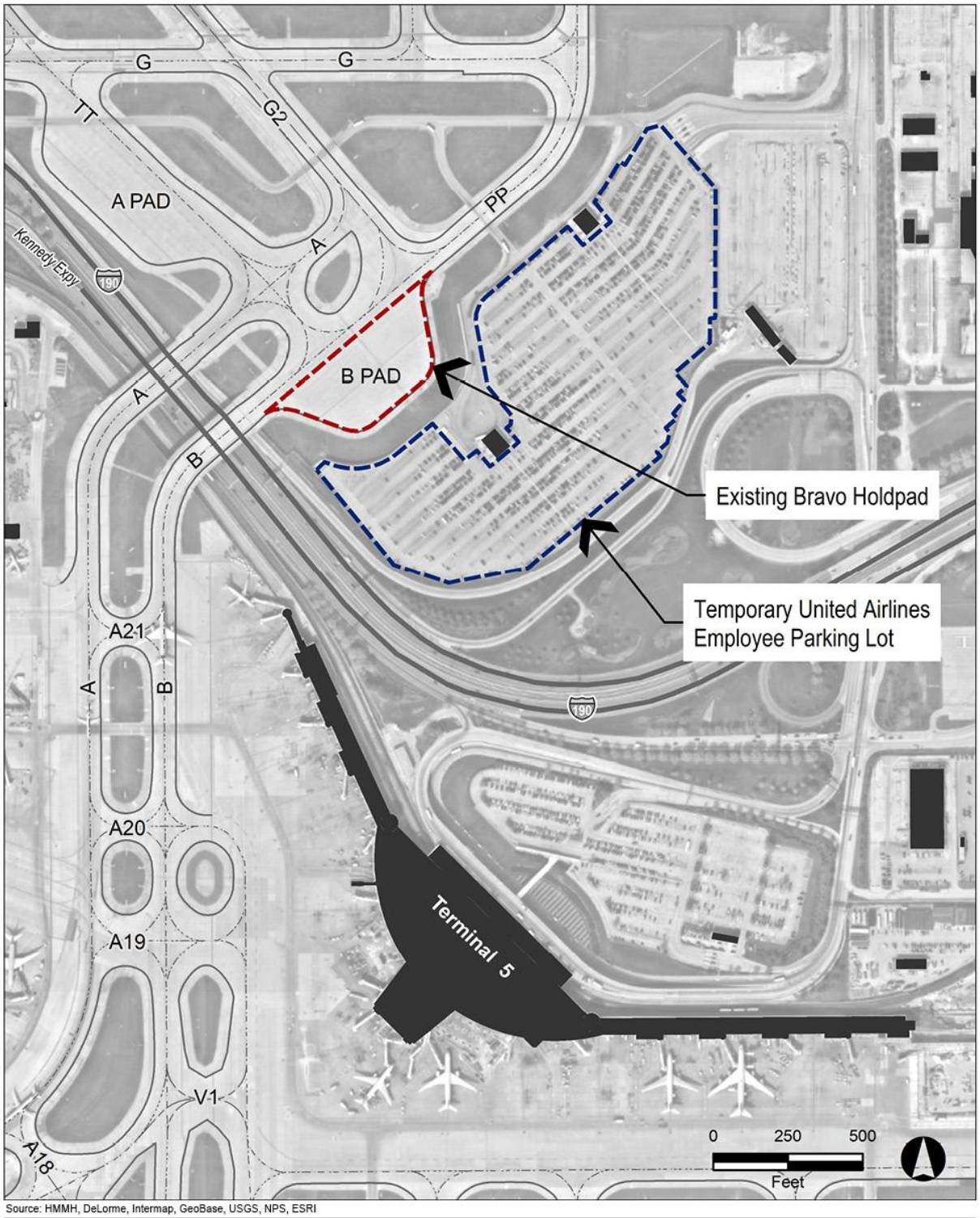
The blast pad for Runway 28R (formerly Runway 27L) was originally constructed at 150 feet wide. The standard width for Design Group V Aircraft Approach Category and Airplane Design Group is 220 feet wide. Therefore, the blast pad must be expanded by 70 feet in width to meet FAA standards.

2.3.3.3 Need to Improve Efficiency and Reduce Aircraft Occupancy Time on Runway 9L/27R

The addition of two high-speed exit taxiways from Runway 9L/27R is needed to increase efficiency and reduce the time that arriving aircraft spend on the runway. High-speed exit taxiways would provide the ability for aircraft to leave the runway approximately 800 feet earlier than the existing exits, thereby reducing runway occupancy time.

[39] U.S. Department of Transportation, Federal Aviation Administration, Order 5190.6B, FAA Airport Compliance Manual, September 30, 2009.

[40] Ricondo & Associates, Inc., "Temporary United Airlines Employee Parking Lot Relocation," O'Hare Modernization Program Environmental Impact Statement Re-Evaluation Memorandum, prepared April 3, 2018, revised April 6, 2018, approved April 12, 2018.



Source: HMMH, DeLorme, Intermap, GeoBase, USGS, NPS, ESRI

Chicago O'Hare International Airport

Terminal Area Plan and Air Traffic Procedures Environmental Assessment

Existing Bravo Holdpad and Temporary United Airlines Employee Parking Lot

▶ Exhibit 2-6

2.3.4 Group 4: Support Facilities Not Required by the Terminal Projects

The following two subsections describe the two needs for Group 4, Support Facilities Not Required by the Terminal Projects.

2.3.4.1 Need to Provide Additional Airline Employee Parking

Existing on-airport employee parking includes a mix of separate parking lots dispersed around O'Hare. This includes vehicle parking lots in the airline hangar maintenance areas (referred to as the Northwest Maintenance Area);[41] the temporary United Airlines employee parking lot located south of the existing Bravo Holdpad; surface lots along Bessie Coleman Drive; and lots along Mannheim Road near the Airport Maintenance Complex. These facilities accommodate airline, airline maintenance, cargo, security, various tenants, terminal concessions, CDA, airport, and other commercial operations employee parking.

Additional airline employee parking is needed. Although O'Hare has 8,300 existing on-airport parking spaces dedicated to airline employees, airlines expect to hire additional employees to manage the forecast passenger and aircraft operations growth at the airport. The CDA estimates a future need for 11,000 airline employee spaces. This estimate is based on the existing 8,300 airline employee spaces and a blended growth rate of annual enplaned passengers and aircraft operations totaling 2,700 new spaces.[42]

Insufficient future airline employee parking spaces may require airlines to utilize off-airport parking facilities for staff, which could increase airline operating costs to shuttle employees between off-airport facilities and the airport. This practice would also increase terminal area roadway congestion due to additional shuttle bus operations. Moving airline employees to public parking lots (i.e., Lots A-H) could impact public parking availability and revenue, since this is not a high land use priority for the terminal core area and has low revenue generation (relative to public parking). Insufficient parking capacity may also lead to staffing constraints, which could inhibit airlines' ability to meet passenger demand.

2.3.4.2 Need to Safely and Efficiently Process Goods Currently Being Brought into the Terminal Core

Storage and distribution of goods at O'Hare is inefficient and constrained because it occurs in disaggregated, repurposed facilities not designed to support the current volume or the enhanced security requirements that have evolved since construction. Limited space is available in the terminal core, and goods storage is neither the highest priority nor the best use of this space. Existing goods storage, distribution, and security screening practices lead to inefficiencies, even at current volumes of goods processing. Therefore, a centralized distribution and receiving facility is needed to efficiently accommodate goods processing, storage, and distribution—both today and in the future—as passenger activity increases.

Delivery of all goods—terminal concessions, food, beverage, and custodial supplies—stocked and sold or otherwise used at O'Hare's terminals occurs through limited security entry points, either at terminal building security screening checkpoints or through airfield Guard Post 7 or Guard Post 8 security checkpoints. **Table 2-17** summarizes the 2019 estimated volume of goods delivered by terminal core delivery location—Guard Post 7, Guard Post 8, and some, but not all, the landside delivery areas at the terminal core. **Table 2-17** also provides forecast goods volumes anticipated in 2030 for the terminal core. The forecast goods volume estimates are based on the growth rate of enplaned passengers.

[41] The Northwest Maintenance Area is in the northwest part of the airfield between Runway 9L-27R and Runway 9R-27L, east of Taxiway Z, and west of the Scenic Holdpad in the vicinity of future Runway 9C-27C.
[42] 8,300 existing + 2,700 estimated additional required spaces = 11,000 spaces.

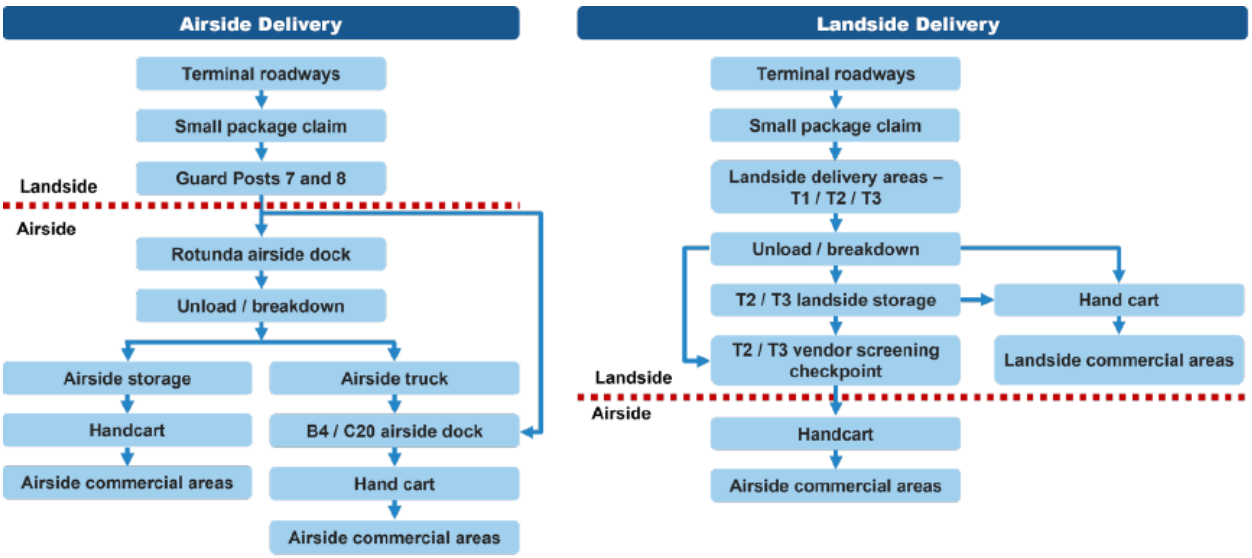
TABLE 2-17
TERMINAL CORE ANNUAL DELIVERY VOLUME IN CUBIC FEET

Delivery Location	2019	Forecast Volume (2030)
Guard Post 7	2,100,000	2,700,000
Guard Post 8	3,700,000	4,700,000
Landside Delivery Areas	5,900,000	7,400,000
Total	**11,700,000**	**14,800,000**

Note: Volumes are rounded to the nearest 100,000 cubic feet.
Source: Chicago Department of Aviation, July 2021

Two methods exist for screening goods, depending on which tenant is accepting delivery of the goods. **Figure 2-11** presents the two methods for delivering and moving goods from the landside to the terminals.

FIGURE 2-11
PROCESSES FOR MOVING GOODS FROM LANDSIDE TO AIRSIDE



Source: Ricondo & Associates, Inc., July 2021

HMS Host and Duty Free International are the primary concessionaires that drop off goods at the terminals via the airside delivery points. These concessionaires access the airside portion of the airport via Guard Post 7 or 8 and utilize airside docks located at the Rotunda and near Gate B4 at Concourse B. In 2019, HMS Host food and beverage outlets were responsible for approximately 75 percent of the food and beverage sales in the terminal core.[43] Duty Free International manages and operates duty-free commercial outlets in the terminal core and receives all duty-free goods at the Gate B4 airside dock, located adjacent to its bonded storage facilities. Deliveries to other commercial tenants must occur via the landside delivery areas.

Currently, any landside deliveries by vendors and concessionaires who are not permitted to access the airside portion of the airport are received on the lower level between Terminals 1 and 2 and between Terminals 2 and 3. Delivery trucks park landside (outside the terminal) and transport goods via handcarts

[43] Specific sales data is not available, as it is commercially sensitive.

into the terminal for goods screening. Goods are then delivered directly to either the commercial unit or storage areas.

The existing goods delivery process has multiple deficiencies. Delivery trucks use public roadways and park adjacent to the passenger terminals, posing potential security and safety risks. Delivery trucks and goods are not screened by X-ray equipment prior to entering the terminal area, and they mix with passenger vehicular traffic, posing further potential security and safety risks. Airport security industry trade groups recommend that two broad practices related to goods delivery be implemented at airports to promote safe and secure operations:

1. Conduct X-ray screening of all goods bound for terminals and
2. Deliver all goods bound for terminals to a remote consolidated receiving facility, where goods are delivered landside, screened, and delivered airside to terminals via trucks.[44]

At the terminal core, restrictions limit truck deliveries to the overnight period (10:00 p.m. to 6:00 a.m.) to avoid using the terminal roadways during peak times. This restriction, however, prevents flexibility for concessionaires and vendors if deliveries are late or need to be rescheduled outside of the permitted delivery window. A consolidated receiving facility located away from the terminals would eliminate restrictions on delivery times.

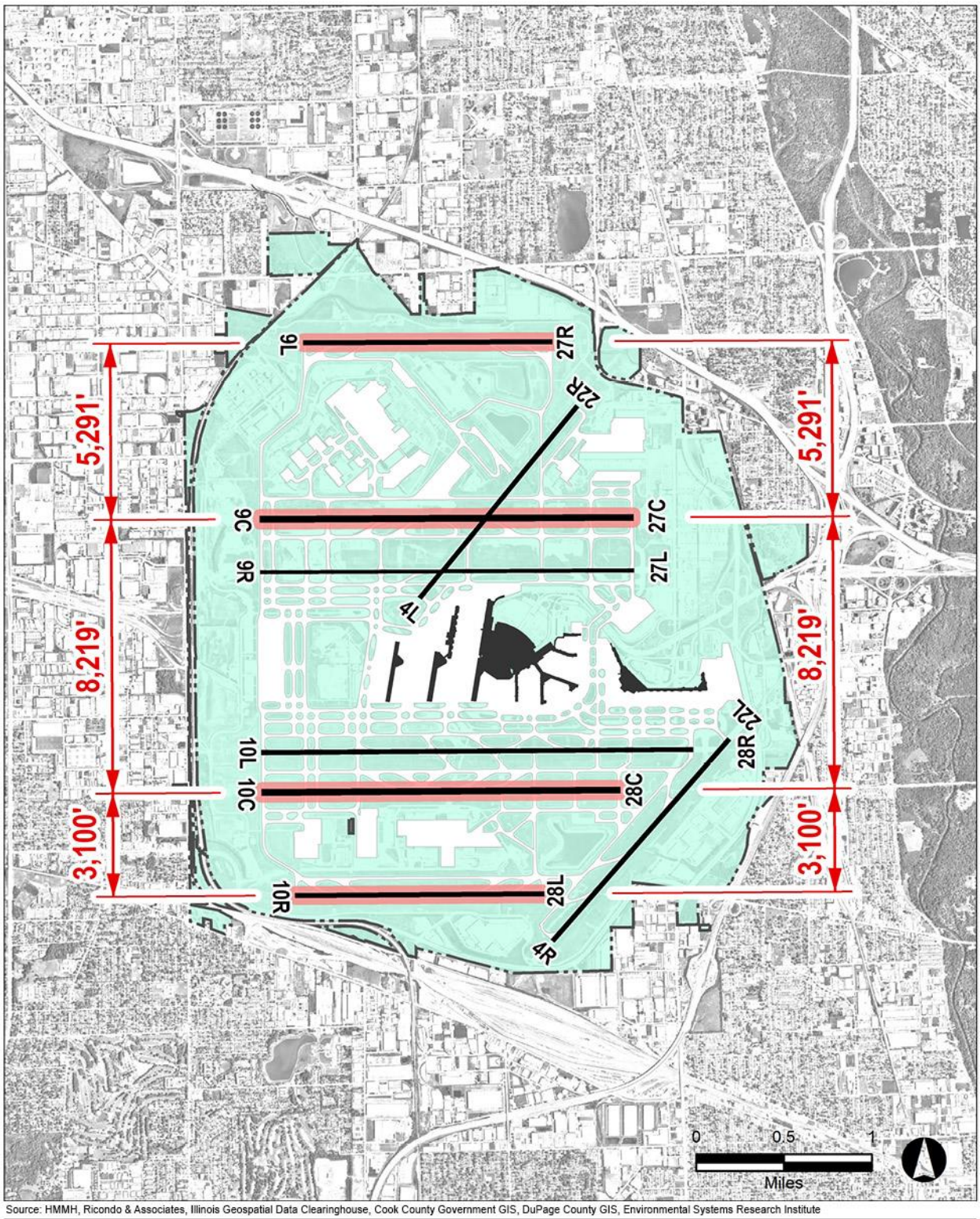
Due to limited storage immediately adjacent to the loading docks, goods must be transported from the loading dock to the storage area soon after delivery. Current operations require concessionaires to devote more employee time to manage goods delivery than if a back-of-house and loading dock area properly sized to accommodate goods delivery, storage, and distribution were available. Additionally, only two current delivery locations, the Gate B4 dock and the Rotunda dock, are adequately sized for delivery trucks (i.e., the loading dock height aligns to the truck bed height). Most goods delivered airside are taken to these areas. Goods are then delivered via hand carts to individual commercial units through public circulation corridors also used by passengers.

2.3.5 Group 5: Air Traffic Actions for Offset Approach Procedures for Runway 10R/28L

2.3.5.1 Need to have Efficient Approach Capabilities for Independent, Simultaneous Approaches, Especially in Poor Weather During East and West Flow Operations, that Would Enable Use of Runway 10R or Runway 28L when Runway 10C or 28C is in Use, Respectively

The Record of Decision (ROD) for the 2005 O'Hare Modernization Program (OMP) Environmental Impact Statement (EIS) approved reconfiguration of the airfield and its associated supporting airspace procedures. The reconfigured airfield consists of two sets of parallel runways. Six of the eight runways run parallel in an east/west orientation and the two additional parallel runways run northeast/southwest. **Exhibit 2-7** shows the runway layout and the lateral separation distances between the main arrival runways in the east/west orientation at O'Hare. Of O'Hare's six parallel runways in east/west orientation, the two southernmost runways—Runway 10C/28C and Runway 10R/28L—are spaced 3,100 feet apart laterally.

[44] National Safe Skies Alliance, PARAS 004 Recommended Security Guidelines for Airport Planning, Design, and Construction (page 89), April 2017.



Source: HMMH, Ricondo & Associates, Illinois Geospatial Data Clearinghouse, Cook County Government GIS, DuPage County GIS, Environmental Systems Research Institute

Chicago O'Hare International Airport

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Main Arrival Runways and Separation Distances

See Exhibit 1-1 for the 2018 runway layout.

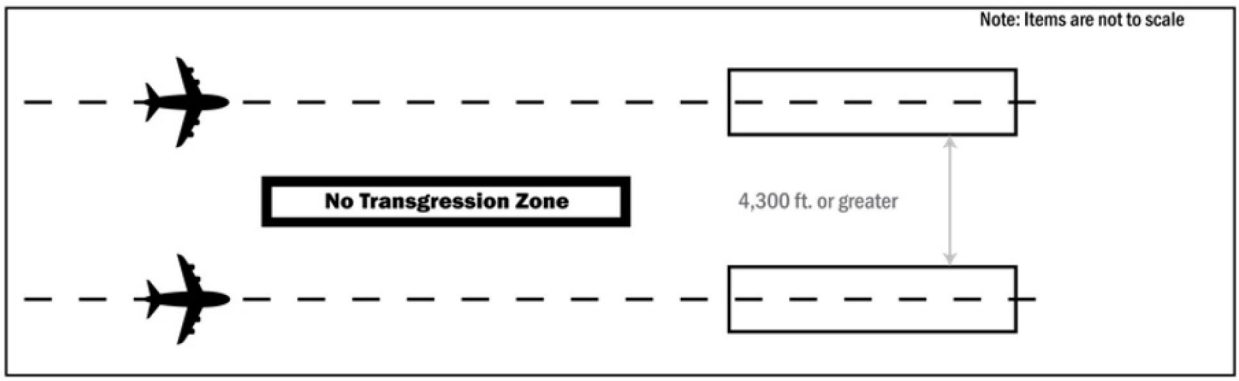
Exhibit 2-7

In accordance with FAA air traffic criteria, Runway 10C/28C and Runway 10R/28L are considered "closely spaced" parallel runways. Air traffic controllers use different sequencing and separation techniques to ensure safety for aircraft arrivals on closely spaced parallel runways than for runways that are further apart. **Exhibit 2-8** depicts the various operational scenarios for approaches based on the distance (separation) between parallel runways. FAA Air Traffic Control procedures are needed to achieve the design operating capability of the airfield runway complex.

- Simultaneous ***independent*** parallel approaches allow for arrivals on each runway that do not depend on spacing from aircraft approaching another runway. ***Independent*** parallel approaches rely on air traffic control procedures, enhanced equipment, personnel, and other techniques to maintain aircraft separation, the specifics of which vary depending on runway spacing. As shown in the top graphic of **Exhibit 2-8**, simultaneous ***independent*** approaches to widely spaced parallel runways are possible when the runways are more than 4,300 feet apart. Generally, the advantage of widely spaced parallel runways is that they permit independent departures and arrivals for each runway regardless of what activity may occur on another parallel runway.[45]
- Simultaneous ***independent*** approaches to closely spaced parallel runways—those spaced 3,000 to 3,600 feet apart—require that one of the approach courses be offset from the extended centerline, as shown in the middle graphic of **Exhibit 2-8**. The allowable offset air traffic approach angle design standard ranges from 2.5 to 3 degrees. An offset angle of less than 2.5 degrees does not achieve the necessary separation required for independence from aircraft on other runways and thus would not be more efficient. An offset angle greater than 3 degrees increases the risk of incursion into the no-transgression zone[46] between the parallel runways by the aircraft on the offset air traffic approach and thus is not allowed.
- ***Dependent*** parallel operational scenarios occur when aircraft approaching one runway influence the sequencing of aircraft approaching the other. As shown in the bottom graphic of **Exhibit 2-8**, simultaneous ***dependent*** approaches rely on staggering the aircraft—diagonal separation—from aircraft approaching the other adjacent, parallel runway. ***Independent*** approaches to parallel runways achieve greater throughput during peak periods by allowing equal numbers of aircraft arrival operations compared to dependent approaches. However, depending on the degree of "all-weather" capability desired, independent approaches that accomplish greater throughput also require enhanced procedures, additional training of aircrews, and often more FAA equipment and staffing than dependent approaches.

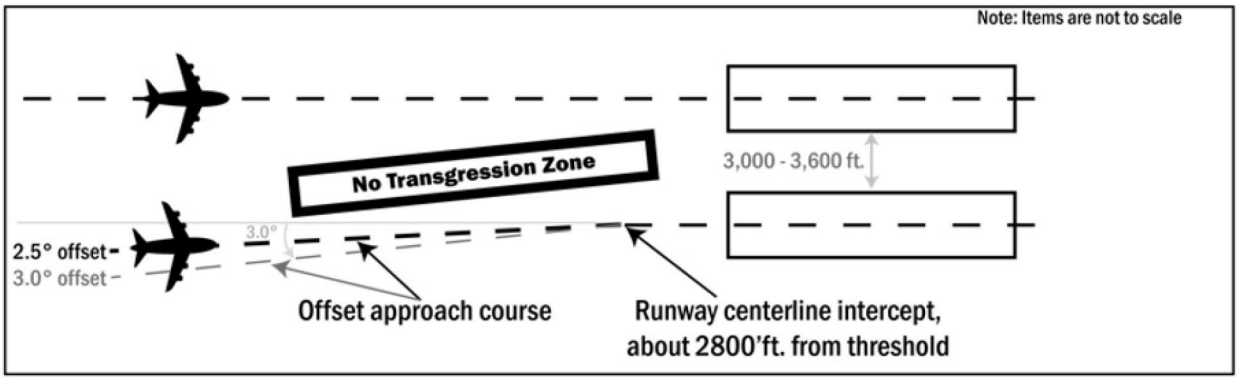
[45] Chicago Department of Aviation, Chicago O'Hare International Airport Parallel Runways White Paper, December 18, 2020, accessed April 14, 2021 at https://www.flychicago.com/SiteCollectionDocuments/Community/Noise/OHare/AO101/WhitePaper-ParallelRunwaysupdated2020.12.18.pdf

[46] FAA JO 7110.65Z defines the no-transgression zone as a 2,000-foot-wide zone located equidistant between parallel runway approach courses in which flight is normally not allowed.



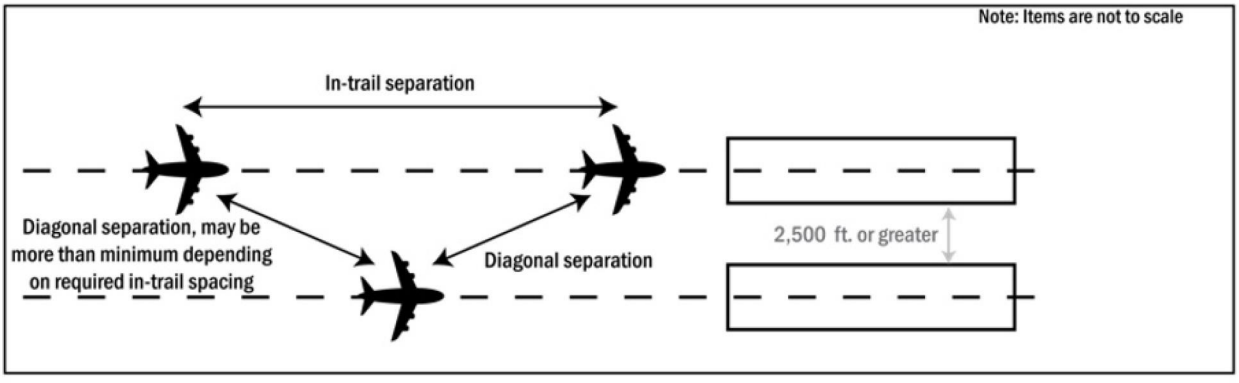
Simultaneous Independent Approaches to Widely Spaced Parallel Runways

- Runway centerlines spaced at least 4,300 feet apart



Simultaneous Independent Approaches to Closely Spaced Parallel Runways

- Runway centerlines spaced at 3,000 to 3,600 feet apart
- "Independent" requires that one of the approach courses be offset from extended centerline by 2.5 to 3 degrees



Simultaneous Dependent Approaches

- Runway centerlines spaced 2,500 feet or greater, except for specific procedures approved with less runway spacing
- Staggered approaches

Approach Operational Scenarios

▶ Exhibit 2-8

Source: HMMH 2021; graphic derived from Information contained in FAA JO 7110.65X, USTERPS (FAAO 8260.3E), and FAA JO 7110.308C

Following the issuance of the 2005 OMP EIS/ROD, which approved the lateral spacing between the two southernmost runways (Runway 10C/28C and Runway10R/28L), and prior to the opening of Runway 10R/28L in 2015, the FAA updated its national airspace operating rules to improve the safety and efficiency of simultaneous arrivals[47] on closely spaced parallel runways. Given the 3,100 feet of lateral spacing between Runways 10C/28C and 10R/28L, simultaneous independent approaches to these closely spaced parallel runways[48] require using an offset final approach course to the southernmost runway in accordance with FAA JO Order 7110.65.[49]

The 2015 Re-Evaluation of the OMP EIS assumed that arrivals on Runway 10R/28L would have a temporary 2.5 degree offset air traffic approach until buildout of the OMP. The offset angle of 2.5 degrees was chosen because, unless other constraints such as terrain or tall structures exist, the smallest degree of offset is always preferred for pilot familiarity with standardized, stabilized approach techniques. The 2015 Re-Evaluation disclosed the temporary impacts of the interim use of the Runway 10R/28L offset air traffic approach but stated that they were no longer assumed to exist after completion of the OMP.

Retaining the offset air traffic approach capabilities enables the continued use of simultaneous independent arrivals and allows for increased efficiency, especially in poor weather during east flow operations (for the Runway 10R offset). This enables O'Hare to make use of its design operating capability.

Table 2-18 shows that the maximum arrivals per hour in east flow drops from 176 arrivals with the offset air traffic approach to 132—a reduction of 44 arrivals, or 25 percent—without the offset air traffic approach in a Visual Flight Rules (VFR)[50] ***with*** Land and Hold Short Operations (LAHSO) configuration. The east flow VFR ***without*** LAHSO configuration is similar, dropping from 154 arrivals per hour with the offset air traffic approach to 110—a reduction of 44 arrivals, or 29 percent—without the offset air traffic approach. The maximum arrivals per hour in west flow drops from 176 arrivals with the offset air traffic approach to 132—a reduction of 44 arrivals, or 25 percent—without the offset air traffic approach in a VFR ***with*** LAHSO configuration. The west flow VFR ***without*** LAHSO configuration drops from 132 arrivals per hour with the offset air traffic approach to 110—a reduction of 22 arrivals, or 17 percent—without the offset air traffic approach. In Instrument Meteorological Conditions (IMC)[51] conditions, there is no change.[52] The 2005 OMP EIS/ROD did not include the use of offset air traffic approaches for the southernmost east/west parallel runway, Runway 10R/28L, because current parallel runway operational criteria in Order 7110.65Z had not been developed at that time. As previously noted, the criteria have subsequently been established, requiring environmental review and approval for a permanent offset to achieve the design capability.

[47] Simultaneous independent parallel approaches allow for arrivals on each runway that do not depend on the volume of traffic on approach to another runway.
[48] The relevant applicable standard is when runways are laterally separated between 3,000 feet and 3,600 feet.
[49] FAA JO 7110.65Z, paragraph 5-9-7(a)(2) for separation standards controllers applies. See also FAA Order 8260.3E United States Standard for Terminal Instrument Procedures (TERPS), Appendix E, Section 3 for design standards for such procedures.
[50] VFR specify certain kinds of operations/rules under which the flight is governed during certain kinds of weather conditions.
[51] IMC refers to weather conditions themselves (ceiling and visibility).
[52] Per O'Hare FAA Air Traffic Control Tower Staff.

TABLE 2-18
SIMULTANEOUS HOURLY ARRIVAL RATES FOR VFR CONDITIONS

Condition	With Offset	No Offset	Percent Reduction (%)
East Flow VFR with LAHSO	176	132	25
East Flow VFR without LAHSO	154	110	29
West Flow VFR with LAHSO	176 (see note)	132	25
West Flow VFR without LAHSO	132 (see note)	110	17

Source: CDA, TAP and ATP EA–With Project Full Build Airfield Capacity for Noise and Air Quality Modeling; TAP and ATP EA–No Project Full Build Airfield Capacity for Noise and Air Quality Modeling, 2020
Note: Runway 22L is not available for departures when Runway 28L is in use for arrivals.