

How Airports Work

You've probably been to airports many times -- they are so familiar you may not pay much attention to them anymore. But if you go behind the scenes, airports are amazing "mini-cities," providing services to all sorts of people and companies. Air travelers, airlines, private pilots and freight carriers all use airports in completely different ways.

You can get an idea of just how amazing airports are when you consider this: At a typical large airport in the United States, over 100-million people can flow through in just one year. When you consider that the population of the United States is only 300-million or so, that's a pretty startling statistic!



Photo courtesy [Denver International Airport](#)
Control tower and terminals at Denver International Airport

In this edition of [HowStuffWorks](#), we will take a look at airports and all of the different things they do for us when we travel!

Tons of People

Any major airport has lots of customers, most of them passengers. Atlanta's Hartsfield International Airport, for example, handles 2,400 flights every day (one flight every 40 seconds, 24 hours a day!) carrying hundreds of thousands of people. That adds up to 72-million domestic and 78-million international passengers passing through Hartsfield each year. That's a lot of people, and most of those 150-million are going to want to grab a bite, use the restroom, maybe buy a magazine...

To meet passengers' needs, an airport must:

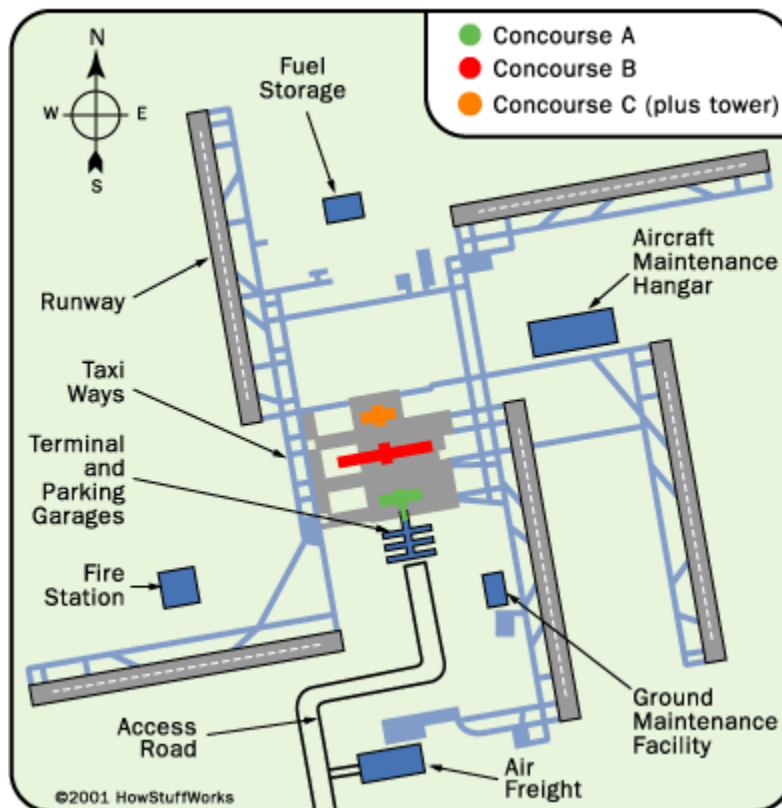
- be accessible by roadways and public transportation, plus have plenty of parking
- have areas for ticketing, check-in and [baggage handling](#)

- keep the passengers [safe](#)
- offer food and other services
- maintain areas for the [customs service](#)
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Airports have other customers to take care of, too.

- [Airlines](#) need space for [airplanes](#), facilities for routine maintenance, [jet fuel](#) and places for passengers and [flight crews](#) while on the ground.
- [Air-freight companies](#) need space for loading and unloading cargo airplanes.
- [Pilots](#) and other crew members need runways, aircraft fuel, air-traffic information, facilities for aircraft storage and maintenance and places to relax while on the ground.

Airports have facilities to meet all of these needs. They have runways, ground concourses, terminals, fuel depots, hangars and a control tower, to name a few.



A typical airport layout, based on the layout of [Denver International Airport](#)

Generally, airport services can be classified as **groundside** and **airside**. Let's take a look at what's involved in each category.

Ground Transportation

An airport can't exist in isolation. It depends on a massive surface-transportation system so that people can get to and from the airport, park and get from place to place within the airport structure

itself. While your first thought about an airport is air travel, **ground transportation** is pretty crucial to an airport's operation.

The busiest airport in the world is Atlanta's Hartsfield International Airport. Here are some ways ground transportation is critical to that airport:

- **Roads** allow access to and from the airport: In Atlanta, four interstate highways move traffic to and from Hartsfield. There's also a station for MARTA trains to connect into the city's rapid transit system.
- **Parking** allows short- and long-term storage of [automobiles](#). Parking can be on or off airport grounds, and some parking systems are run by private vendors under airport regulation. Hartsfield has 30,000 public parking spaces.
- **Passenger drop-off and pick-up areas** make it easier for passengers to get into the terminals, although they are often plagued by traffic congestion because so many people are trying to get in and out.
- **Rental car companies** serve airports. Hartsfield has eight rental car companies on airport grounds and another three off airport grounds.
- **Shuttle services** provide passengers with transportation to local hotels and off-site parking facilities. Hartsfield is served by 18 hotel/motel shuttle buses.
- **Private transportation** is available in the form of limousines, vans and taxis.
- **Public transportation** (such as municipal buses and subways) may have stations at an airport. Besides the MARTA station at Hartsfield, 12 bus lines (public and private) serve the airport.
- **Internal subway trains and trams** may be available to help passengers get to the terminal gates from the concourse. Hartsfield's People Mover is a 3.5-mile (5.6-km) loop track that has 13 stations serving six concourses with nine four-car trains; the trip is two minutes between stations.



Photo courtesy [Denver International Airport](#)
**Jeppesen Terminal (middle), showing access road,
passenger drop-off/pick-up areas (left) and parking
garages (right)**

Now that we know about ground transportation, let's move on to the core of the airport: concourses and terminals.

Concourses and Terminals

At a busy airport like Atlanta's Hartsfield International, 2,400 flights take off and land every day. That means that, every day, perhaps as many as 300,000 people move through the airport and need certain services. Airports provide those services in their **concourses** and **terminals**, the heart of any airport. There you'll find the space for airlines to handle ticket sales, passenger check-in, baggage handling and claims.

While the terms are often used interchangeably, we'll define **concourses** as the long halls and large, open areas where you'll find shops, restaurants and lounges, and **terminals** as long halls lined by the gates where you board and disembark airplanes. Atlanta's Hartsfield airport has 5.7-million square feet (529,547 square meters) of concourses and terminals -- that's 130 acres!



Photo courtesy [British Airways](#)
British Airways Concorde lounge at New York's Kennedy Airport

Most of the time, and in most airports, concourse areas are accessible to the general public (passengers and non-passengers). The gate areas may be restricted by [airport security](#) to ticket-holding passengers only, especially during alerts (for instance, during the Gulf War, non-passengers could not pass security points). Generally, airport security and/or [customs](#) lie between the concourse and the gates.



Photo courtesy [Denver International Airport](#)
Inside Jeppeson Terminal are numerous shops, lounges, restaurants and courtyards.

t Hartsfield's concourses, there are:

- 75 food and beverage vendors (most of these are owned and staffed by private companies)
- 82 retail and convenience stores (also owned and staffed privately)
- 21 staffed service outlets (places where you can get your shoes shined or connect to the Internet)

The food that passengers eat while onboard the airplane is usually provided by private companies contracted by one or more airlines at an airport. The food is prepared in a building that is off the airport grounds, shipped to the airport by truck and loaded onto the plane by the catering company's personnel. For example, SkyChefs is one of the catering contractors at Denver International Airport. They prepare and load thousands of meals per day for various airlines.

[Airline freight](#) and private air-freight services such as Fed Ex and DHL may have their own terminals at the airport.



Photo courtesy [British Airways](#)
**British Airways World Cargo Center in London
Heathrow Airport**

Gates

The gates are where the airplanes park for passenger boarding and deplaning. Passengers wait in the immediate area of each gate to board the plane. Gates are rented by each [airline](#) from the airport authority, and some airlines may rent a whole terminal building in their "[hub](#)" airport, in which case the rental fee alone can run into the millions of dollars.



Photo courtesy [British Airways](#)
Planes parked at the gates of terminals for passenger boarding and deplaning

Routine airplane maintenance, such as washing, de-icing and refueling, is done by airline personnel while the plane is parked at the gate. In some cases, other maintenance tasks might be performed at the gate, possibly with passengers onboard the plane -- it is not uncommon to sit on a plane at the gate while maintenance personnel replace something like a [hydraulic brake line](#) on an aircraft.



Photo courtesy [British Airways](#)
Maintenance crews wash an airplane at the gate.

Airline baggage handlers load and unload baggage at the gates using baggage trucks and conveyors (see [How Baggage Handling Works](#) to learn all about this system).

The funny and interesting problem that most airports face is that airplanes and their gates are very large compared to people. At an airport like Hartsfield, there are literally miles of gates. This can mean a whole lot of walking at any big airport.

Runways

Runways are amazing -- a typical one is about 2 miles long, as wide as a 16-lane highway and about 3 feet thick!

Think about this: A fully-loaded 777 or 747-400 weighs about 850,000 pounds (385,554 kg). Imagine a rough landing where 850,000 pounds slams down hard onto the runway. Runways have to be specially constructed to take that strain without cracking or, worse, buckling. As they're designing runways, engineers have to consider the number of wheels an airplane has, how far apart those wheels are and the size of the tires. As planes get bigger and bigger, runways have to be re-built to accommodate the increased stresses.

When the Denver International Airport was built, it took 2.5-million cubic yards of concrete to create five 12,000-foot runways, plus taxiways and aprons. First, 6 feet of compacted soil was put down; then, a foot-deep layer of soil was spread, topped by an 8-inch-thick cement-treated base; that was followed by 17 inches of concrete paving.

Main runways are usually oriented to line up with the prevailing wind patterns so that airplanes can take-off into the wind and land with it. Local and ground [air traffic controllers](#) determine which runways are used for take-off and which for landing, taking into account weather, wind and air-traffic conditions. In some airports, main runways cross each other, so the controllers have to pay even closer attention.



Photo courtesy [Lufthansa](#)

A 747 Jumbo Jet lands on a main runway.

Planes use **taxi runways** to get from the gate to a main runway for take-off and from a main runway to the gate after landing. **Ground controllers** direct ground traffic from the airport's [tower](#). Airline ground personnel assist with the push-back and arrival of aircraft in the gate areas, driving the tugs that push the aircraft back and directing traffic with those glowing wands.



Photo courtesy [Lufthansa](#)
A 747 Jumbo Jet is directed to the gate from the taxi runway.

Now let's take a quick look at how airports provide jet fuel.

Fuel

Airplanes almost always have to refuel between flights, and jumbo jets love fuel. A 747 can consume up to a gallon (4 liters) of fuel per second, and "filling up the tanks" takes tens of thousands of gallons of fuel. This huge appetite means that a busy airport can sell millions of gallons of gas every day. At Denver International Airport, fuel comes into the fuel-storage depot through a pipeline at rates that vary from 46,300 to 92,400 gallons per hour (175,264 to 349,772 liters per hour). The depot can also receive fuel from tanker trucks. The fuel is stored in three unloading islands, each with six, 3,000,000-gallon (11,356,235-liter) storage tanks, a meter station and dedicated pump that can handle 300 gallons (1,136 liters) per minute.



Photos courtesy [Denver International Airport](#)
**View of Denver International Airport showing the
three fuel islands in the background**

In some airports, fuel trucks carry fuel from the storage depot to the airplane for refueling. In others, fuel is pumped through underground pipes directly to the terminals.

Safety

Airports have their own crews to handle fire and emergency medical services (EMS). An airport may have several fire/EMS stations on the ground because the [Federal Aviation Administration \(FAA\)](#) requires that emergency crews be able to reach the midpoint of a runway within 3 to 5 minutes. The crews are usually employees of the city or municipality and are stationed at the airport.

Airports also have their own police crews. Some airport police are members of the city or municipality assigned to the airport, while others are from private security companies contracted to patrol the airport grounds (such as the perimeter fences that limit access to the airfield) and to operate the security inspection points within the terminals (read [How Airport Security Works](#) to learn more). Finally, airports must have crews for collecting and disposing trash, keeping terminals clean (some janitorial services are run by airlines or airline cooperatives) and keeping runways clear during foul weather.



Photos courtesy [Denver International Airport](#)
Snow-removal crews keep runways open.

Without snow-removal crews, aircraft would be grounded whenever a storm hit.

Airport Management

If you have been keeping track of some of the statistics in the previous sections, you can see that airports are huge businesses. For example, you saw that a big airport can have over a hundred acres of floor space in the terminals, millions of cubic yards of concrete in the runways and hundreds of people staffing the facilities.

If you look at a page like [this one](#), you can see just how big the business is. Denver's airport cost about \$5-billion to build, and operating costs are \$160-million per year.

Commercial airports are publicly owned and generally financed through municipal bonds. Airports typically own all of their facilities and make money by leasing them to [airlines](#), [air-freight companies](#) and retail shops and services, as well as by charging for services like fuel and parking and through fees and taxes on airline tickets. The revenues pay off the municipal debt and cover the operating costs. Airports often require other sources of funding as well, such as airport bonds and government grants. But most airports are self-sustaining businesses once they become operational.

About 90 percent of employees at airports work for private companies, such as airlines, contractors and concessions. Most of the remaining 10 percent work directly for the airport as administrators, terminal- and grounds-maintenance personnel and safety crews. [Air traffic controllers](#) are employees of the federal government. Airports have their own departments of finance, personnel, administration and public relations, much like any city or municipality.

Flight Delays

One of the major reasons for delays is bad weather. Another major cause is a bit less atmospheric: Many U.S. airports are operating above capacity, which causes air-traffic delays. One good solution is to build more runways, except that it takes approximately 10 to 15 years to build new runways because of the laws and regulations that govern their construction. A major focus for reducing delays is on increasing the efficiency of our [air traffic control system](#).

Airports with regularly scheduled flights are regulated by the Federal Aviation Administration (FAA) and must also follow local and state government regulations. For more information on airports, see [Airline Handbook: Airports](#) and check out the links on the next page.

Lots More Information

Related HowStuffWorks Links

- [How Airport Security Works](#)
- [How Air Traffic Control Works](#)
- [How Black Boxes Work](#)
- [How Baggage Handling Works](#)
- [How Airlines Work](#)
- [How Becoming An Airline Pilot Works](#)
- [How Airline Crews Work](#)
- [How Customs Works](#)
- [How Airline Freight Works](#)
- [How the Federal Aviation Administration Works](#)
- [How Airplanes Work](#)
- [How Concorde Works](#)
- [How Radar Works](#)
- [How Oil Refining Works](#)
- [How Gas Turbine Engines \(and Jet Engines\) Work](#)
- [How Helicopters Work](#)
- [Do commercial jumbo-jets have locks on the doors and ignition keys?](#)
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- [How does an EPIRB distress radio work?](#)
- [How do they start jet engines on airplanes?](#)

Other Great Links

- [Landings.com](#)
- [International Airports Portal](#)
- [The Airwise Airport Guide](#)
- [Airports.com: Links to Major Airports](#)
- [Airports Council International](#)
- [AirportsAmerica.com](#)
- [America's Future in Airport Infrastructure](#)
- [AirportNet: American Association of Airport Executives](#)
- [Airline Handbook chapter 7: Airports](#)

- [Airport Diagrams](#)
- [Denver International Airport](#)
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