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AIRPORT OPERATIONS

Private pilot · Knowledge test and checkride · AIM chapter 2 and 4

RUNWAY MARKINGS

Runway paint is white. It tells you which runway you're on, where to land and where you may not.

Marking	What it looks like	What it means
Designator	Large white number, plus L, C or R on parallel runways	The magnetic heading rounded to the nearest 10°, with the last zero dropped. Runway 22 points about 220° magnetic
Centerline	White dashes down the middle	Keep the nose wheel on it
Threshold	White stripes across the start of the runway	The start of the runway that's usable for landing. Number of stripes can show runway width
Aiming point	Two wide white bars about 1,000 ft past the threshold	A visual aim point on instrument runways
Touchdown zone	Pairs of white bars in 500 ft steps	Distance from the threshold on precision runways
Displaced threshold	A white bar across the runway, with white arrows leading up to it	The landing threshold is farther down the runway
Blast pad or stopway	Yellow chevrons pointing toward the runway	Not for taxi, takeoff or landing
Closed runway or taxiway	Large yellow or white X	Don't use it for anything
Runway shoulder	Yellow diagonal stripes beside the runway	Not able to hold an airplane's weight

Displaced threshold

The pavement before a displaced threshold is still runway, with limits.

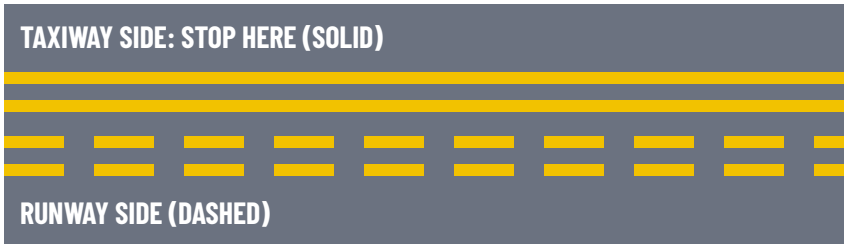
- **Takeoff:** you may use it, in either direction.
- **Landing rollout:** you may roll onto it from the opposite direction.

- **Landing:** you may not touch down on it. Touch down past the threshold bar.
- **Taxi:** you may taxi on it.

Hold short markings

These are yellow and they matter more than any other paint on the airport.

- **Runway holding position:** four yellow lines across the taxiway, two solid and two dashed. The solid lines are on your side when you're taxiing toward the runway. Stop before the solid lines unless you're cleared onto the runway.
- **Leaving a runway:** you're clear only when the whole airplane is past the dashed side of the hold short lines.
- **ILS critical area:** a yellow ladder across the taxiway. Hold short of it when the tower tells you to.
- **LAHSO:** a land and hold short position on a runway, shown with hold short lines across it plus in-pavement lights at some airports. Tower may ask you to stop short of an intersecting runway after landing.



TAXIWAY MARKINGS

Taxiway paint is yellow. It keeps you on the pavement and stops you before runways.

- **Centerline:** a single solid yellow line. Keep the nose wheel on it.
- **Enhanced centerline:** yellow dashes on both sides of the centerline for the last 150 ft before a runway holding position. It warns you a runway is just ahead.
- **Edge markings:** two solid yellow lines mean the edge of the taxiway, with unusable pavement beyond. Two dashed yellow lines mean the edge of a taxiway next to more usable pavement, such as a ramp.
- **Holding position:** see the hold short markings above.
- **Geographic position markings:** a pink circle with a black-and-white number, used on some low-visibility taxi routes as reporting points.
- **Surface-painted signs:** a red box with white letters on the pavement is a painted holding position sign. A yellow box with black letters gives direction. A black box with yellow letters gives your location.

AIRPORT SIGNS

Signs follow a color code. The color tells you what kind of sign it is before you read it.



HOLDING POSITION | NO ENTRY | LOCATION | DIRECTION | DESTINATION



INFORMATION

Sign	Colors	Meaning
Runway holding position	Red with white text, e.g. "4-22"	You're at a runway. Hold short unless cleared. The numbers show the runway's directions as you face the sign
ILS critical area or runway approach area	Red with white text	Hold here when told to
No entry	Red with a white circle and bar	Aircraft may not enter, often a one-way area
Location	Black with yellow text and a yellow border	The taxiway or runway you're on now
Direction	Yellow with black text and an arrow	Which way a taxiway goes from an intersection
Destination	Yellow with black text and an arrow	The way to a place, such as a runway, ramp or fuel
Information	Yellow with black text	Facts such as radio frequency areas or noise rules
Runway distance remaining	Black with a white number	Thousands of feet of runway left

- **Boundary signs:** a yellow sign with a black hold-short pattern marks the edge of a protected area. Pass it when leaving the runway and you're clear.
- **Memory hook:** red means stop and ask, black tells you where you are, yellow tells you where to go.

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AIRPORT LIGHTING

Lights carry the same information at night, plus a few extra things you can't see by day.

Rotating beacons

Flashes	Type of airport
White and green	Lighted civil land airport
Two quick whites between greens	Military airport
White and yellow	Lighted water airport (seaplane base)
Green, yellow and white	Heliport

- **Beacon on in daylight** at an airport in Class B, C, D or E surface area may mean the weather is below basic VFR: ceiling under 1,000 ft or visibility under 3 SM. Don't rely on it; check the weather.

Runway and taxiway lights

- **Runway edge lights:** white. On instrument runways, the last 2,000 ft show yellow toward you as a caution zone.
- **Threshold lights:** green toward an airplane landing, red toward an airplane at the far end. Red means the end of the runway.
- **REIL:** a pair of flashing white lights at the threshold to help you spot the runway end.
- **Approach lights:** lines of lights leading to the runway on instrument runways. They help you find the runway in poor visibility.
- **Taxiway edge lights:** blue. **Taxiway centerline lights:** green.
- **Runway guard lights:** pairs of flashing yellow lights at hold short positions.

Pilot-controlled lighting

At many non-towered fields you turn on the lights from the cockpit by keying the mic on the CTAF.

Clicks within 5 seconds	Intensity
7	High
5	Medium
3	Low

- Start with 7 clicks to make sure they come on, then step down. The lights usually stay on for 15 minutes; click again on short final to restart the timer.
- Check the Chart Supplement for the frequency and which lights are on the system.

VISUAL GLIDESLOPE INDICATORS

These lights tell you whether you're above, on or below the glidepath, usually about 3°.

PAPI

A single row of four lights, usually on the left side of the runway.

Lights seen	Meaning
4 white	Well above the glidepath
3 white, 1 red	Slightly high
2 white, 2 red	On the glidepath
1 white, 3 red	Slightly low
4 red	Well below. Climb or level off

VASI

- **Two-bar VASI:** near and far bars. Red over white: on glidepath ("red over white, you're all right"). White over white: high. Red over red: low ("red over red, you're dead").
- **Three-bar VASI:** has a second glidepath for tall aircraft with the cockpit far above the wheels. Small airplanes use the lower two bars.
- **Safe obstacle clearance:** typically 10° either side of the extended centerline out to 4 nm.

Other types

- **Tri-color:** one light. Amber is high, green is on the glidepath, red is low.
- **Pulsating (PVASI):** one light. Steady white is on, pulsing white is high, steady red is slightly low, pulsing red is well below.
- When a glideslope light is installed, stay at or above it until a lower altitude is needed for a safe landing (14 CFR 91.129 and 91.130 at towered fields; good practice everywhere).

WIND AND TRAFFIC INDICATORS

At a non-towered field, these tell you which way to land before you hear a single radio call.

- **Wind sock:** the open end points downwind, so the wind blows from the narrow end. Full extension is about 15 kt. A limp sock means light wind.
- **Segmented circle:** a ring of markers around the wind indicator that shows the airport layout.
- **Landing strip indicators:** L-shaped markers beside the circle show the runways.
- **Traffic pattern indicators:** the short legs of the L show the turn direction. Picture the L as the base leg and final: if the short leg points right, it's right traffic for that runway.
- **Tetrahedron:** a landing direction indicator. The pointed nose points into the wind, the direction you land. It may be manually set, so check the wind sock too.

TRAFFIC PATTERNS

Most airports use the same rectangle. Fly it the same way every time so others know where to look for you.

- **Direction:** left turns unless the Chart Supplement or a segmented circle says right.
- **Altitude:** usually 1,000 ft AGL for piston airplanes. Check the Chart Supplement.
- **Entry:** the standard is a 45° entry to the middle of the downwind leg, at pattern altitude. Other entries are allowed; announce them clearly.
- **Crossing midfield:** fly over the field at least 500 ft above pattern altitude, descend on the far side, and join the downwind on the 45°. AC 90-66 also describes crossing midfield at pattern altitude and turning into the downwind; check its current recommendations.
- **Straight-in:** allowed, but don't take priority over airplanes already in the pattern.
- **Departing:** climb straight out or turn 45° toward the side of the pattern after you reach pattern altitude, unless the airport asks otherwise.
- **Climb to within 300 ft** of pattern altitude before turning crosswind.
- **Recommended practices:** AC 90-66 (check for the current revision) covers non-towered airport operations. See Radio Calls for Our Flying for the calls.

WAKE TURBULENCE

Every wing makes wingtip vortices. Behind a big airplane they can roll a Cherokee faster than you can stop it.

- **How they form:** high-pressure air under the wing curls around the tip toward the low-pressure air on top. Vortices start at rotation and stop at touchdown.
- **Worst case:** a **heavy, clean, slow** airplane: high weight, gear and flaps up, low speed.
- **Where they go:** they sink about **300–500 fpm** and level off about **500–900 ft** below the airplane's flight path. Near the ground they spread sideways at about 2–3 kt.
- **Crosswind:** a light crosswind of about **3–7 kt** can hold the upwind vortex over the runway. A light quartering tailwind can push vortices into the touchdown zone.

Avoiding them

- **Landing behind a larger airplane, same runway:** stay at or above its flight path and land beyond its touchdown point.
- **Taking off behind a larger airplane that just took off:** rotate before its rotation point and climb above its path, or wait.
- **Taking off behind a larger airplane that just landed:** rotate beyond its touchdown point.
- **Parallel and crossing runways:** watch for vortices drifting over from the other runway. Stay above the larger airplane's path when crossing it.
- **Waiting:** ATC normally gives at least 2 minutes behind a large airplane in some cases. At a non-towered field, waiting 2 to 3 minutes is a good rule.
- **Helicopters:** a hovering or slow helicopter makes strong downwash and vortices. Keep well clear, at least three rotor diameters.

RUNWAY INCURSIONS AND HOT SPOTS

A runway incursion is any wrong presence of an airplane, vehicle or person on a runway.
Most come from confusion while taxiing.

- **Know your route before you move.** Study the airport diagram and write down the taxi clearance.
- **Read back every hold short instruction** with your call sign. "Hold short of Runway 22, Cherokee [tail]."
- **"Line up and wait"** means taxi onto the runway and stop. It's not a takeoff clearance.
- **Crossing a runway** needs an explicit clearance at a towered field. At a non-towered field, look both ways, announce, then cross promptly.
- **Hot spots** are places where incursions have happened before. They're circled on FAA airport diagrams and described in the Chart Supplement.
- **Lost on the ground?** Stop. Tell ground control you're unsure of your position and ask for **progressive taxi** instructions. Never guess onto a runway.
- **Clear the runway** and stop past the hold short lines before you do your after-landing items.

LAHSO

- You may decline a land and hold short clearance. Say "unable" if you're not sure you can stop.
- **A student pilot may not accept a LAHSO clearance.**
- If you accept, you must stop before the hold short point unless an emergency makes that unsafe. Know the available landing distance before you accept.

TOWERED AND NON-TOWERED FIELDS

The airport is the same; who does the sequencing changes.

- **Towered:** you need a clearance to taxi onto or cross a runway, and to take off and land. Ground control handles the taxiways. Two-way radio contact is needed to enter Class D airspace.
- **Non-towered:** pilots sequence themselves on the CTAF. Announce your position and intentions, and look outside.
- **Tower closed:** a towered field's CTAF is usually the tower frequency. The airspace often changes class; check the Chart Supplement.
- The full calls are in Radio Calls for Our Flying. The rules are in Regulations for Private Pilots.

AIRPORT DIAGRAMS AND THE CHART SUPPLEMENT

Before you fly somewhere new, read its Chart Supplement entry and look at the diagram.

- **Chart Supplement entry:** field elevation, runways with length, width, surface and traffic pattern direction, lighting and how to turn it on, fuel, attended hours, frequencies, nearby navaids and remarks such as wildlife, noise rules and closed runways.
- **Airport diagrams:** published for many larger airports. They show runways, taxiways, hot spots, ramp areas and the field elevation.

- **The legend** at the front of the Chart Supplement explains every abbreviation. Read it once.
- **NOTAMs** override the Chart Supplement. Runway closures and lighting outages show up there first.

AT KONZ

How this applies at our home field. The details are in the KONZ Airport Guide.

- **Runway 4/22 is the only runway in use.** Runway 17/35 is closed.
- **Runway 22 has a 428 ft displaced threshold.** Touch down past the threshold bar. You may use the displaced part for takeoff and rollout.
- **PAPIs are reported inoperative.** Check the NOTAMs and fly your own glidepath.
- **Pilot-controlled lighting** is on the CTAF, **123.0**.

SELF-CHECK

Tap a question to see the answer.

What do two solid and two dashed yellow lines across a taxiway mean?

A runway holding position. Stop on the solid side unless you're cleared onto the runway. You've cleared the runway only when the whole airplane is past the dashed side.

What may you use the pavement before a displaced threshold for?

Taxi, takeoff in either direction, and landing rollout from the opposite direction. You may not touch down on it.

What do yellow chevrons before a runway mean?

A blast pad or stopway. Don't use it for taxi, takeoff or landing.

What does a black sign with a yellow letter and border tell you?

Your location: the taxiway or runway you're on now.

What does a red sign with white numbers like "4-22" mean?

A runway holding position. You're about to enter Runway 4/22. Hold short unless you're cleared.

What does a white and green rotating beacon mean? What if it's on during the day?

A lighted civil land airport. On in daylight inside a Class B, C, D or E surface area, it may mean the weather is below basic VFR.

On a PAPI, what do 2 white and 2 red lights mean?

You're on the glidepath.

On a two-bar VASI, what does white over white mean?
You're above the glidepath.

What color are taxiway edge lights?
Blue. Taxiway centerline lights are green.

How many clicks turn pilot-controlled lighting to high intensity?
Seven clicks within 5 seconds.

Which way does the wind blow relative to a wind sock?
From the narrow end, the one tied to the pole, toward the open end. A fully extended sock means about 15 kt.

When is wake turbulence worst?
Behind a heavy, clean, slow airplane.

You're landing behind a larger airplane on the same runway. How do you avoid its wake?
Stay at or above its flight path and touch down beyond its touchdown point.

Can a student pilot accept a LAHSO clearance?
No. Any pilot may also decline one.

You're lost on the taxiways at a towered airport. What do you do?
Stop, tell ground control, and ask for progressive taxi instructions.

SOURCES

These are the references behind this guide. Check the current editions.

- Aeronautical Information Manual (AIM), chapter 2 (aeronautical lighting and airport marking aids) and chapter 4 (air traffic control, airport operations, wake turbulence in chapter 7).
- FAA AC 150/5340-1, Standards for Airport Markings.
- FAA AC 150/5340-18, Standards for Airport Sign Systems.
- FAA AC 90-66, Non-Towered Airport Flight Operations (current revision).
- Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25), chapter on airport operations.
- Chart Supplement, legend and airport entries.
- Study aid only. Confirm everything against the current AIM, Chart Supplement and NOTAMs.

Training aid only, not flight instruction. The POH in the airplane and its placards win: check every number against them, and fly with your CFI.