

# Task VI.C: Airport Runway and Taxiway Signs, Markings, and Lighting

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## Lesson Overview

### Objective

To familiarize the student with the various markings and lights on an airport.

### Reference

- AOPA Safety Advisor No.2 “Operations at Towered Airports” in Appendix
- AIM

### Key Elements

1. Runway Incursion Avoidance
2. If Unclear, Ask

### Elements

1. Runway Incursion Avoidance
2. Runway Markings
3. Taxiway Markings
4. Holding Position Markings
5. Other Markings

6. Airport Signs
7. Airport Lighting and Other Airport Visual Aids

### **Equipment**

- White board
- Markers
- References
- iPad

### **Schedule**

1. Discuss objectives
2. Review material
3. Development
4. Conclusion

### **Instructor Actions**

1. Discuss lesson objectives
2. Present lecture
3. Questions
4. Homework

### **Student Actions**

Participate in discussion Take notes

### **Completion Standards**

The lesson is complete when the instructor determines that the student has adequate knowledge of airport and runway markings and lights by giving an oral or written exam.

## **Instructor Notes**

### **Attention**

Looking outside now (or on the next flight), make note of the number of signs, markings and lights you see. How many of them do you understand? How many are unfamiliar?

### **Overview**

Review Objectives and Elements/Key ideas

### **What**

The markings and signs used at airports, which provide direction and assist pilots in airport operations.

### **Why**

Understanding the markings and signs will greatly assist in avoiding runway incursions and provide the ability to more easily maneuver throughout any airport complex.

# Lesson Details

## Runway Incursion Avoidance

1. Be aware of the airplane's position and be aware of other aircraft and vehicle operations on the airport
2. Read back all runway crossing and/or hold short instructions
3. Review the Taxi Diagrams as part of preflight planning, before landing, and while taxiing as needed
4. Know airport signage
5. Review NOTAMs for information regarding runway/taxiway closures and construction areas
6. Request progressive taxi instructions from ATC when unsure of the taxi route
7. Check for traffic before crossing any runway hold line and before entering a taxiway
8. Turn on aircraft lights and the rotating beacon or strobe lights when taxiing
9. When landing, clear the runway as soon as possible, and wait for taxi instructions before moving
10. Study and use proper phraseology in order to understand and respond to ground control instructions
11. Write down complex taxi instructions at unfamiliar airports
12. Failure to use proper runway incursion avoidance procedures
  - a. Do not cross hold short lines until you have been cleared for T/O or to taxi onto/across a runway
  - b. Without a control tower, look both ways and announce your intentions before proceeding
  - c. Never taxi onto the runway when there is a plane on final approach

## Runway Markings

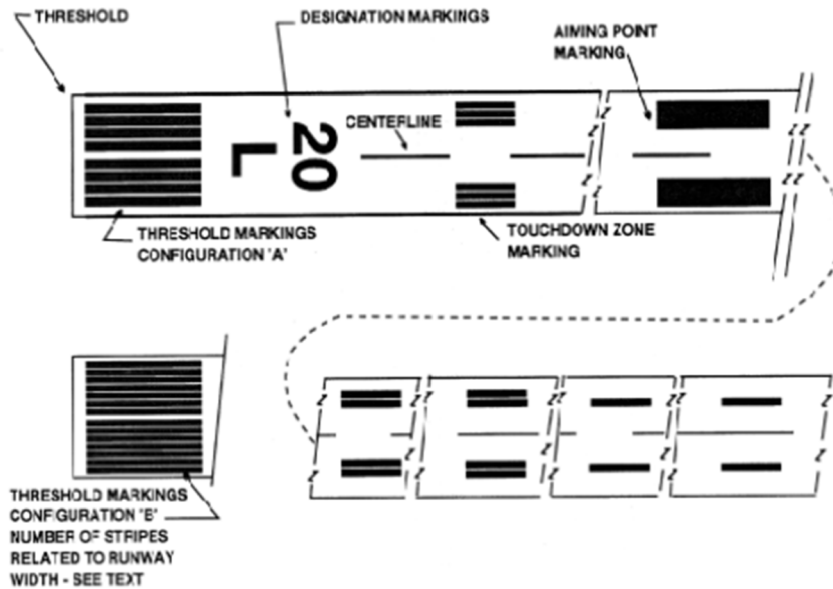
### General

- There are three types of markings for runways
  - Visual; Nonprecision Instrument; Precision Instrument

Marking Element	Visual Runway	Nonprecision Instrument Runway	Precision Instrument Runway
Designation	X	X	X
Centerline	X	X	X
Threshold	X <sup>1</sup>	X	X
Aiming Point	X <sup>2</sup>	X	X
Touchdown Zone			X
Side Stripes			X

<sup>1</sup> On runways used, or intended to be used, by international commercial transports.  
<sup>2</sup> On runways 4,000 feet (1200 m) or longer used by jet aircraft.

### Precision Instrument Runway Markings



### Runway Designators

- Purpose - To identify/differentiate runways from the approach end
  - The whole number nearest one-tenth the magnetic azimuth of the runway (To Magnetic N)
  - Letters differentiate between left (L), right ®, and center © runways
- Markings - Large white numbers

### Runway Centerline Marking

- Purpose - Identifies the center of the runway providing alignment guidance during T/O and LDG
- Markings - A line of uniformly spaced stripes and gaps

### Runway Aiming Point Markings

- Purpose - Serves as a visual aiming point for a landing aircraft
- Markings - Broad white stripe on each side of the centerline, approx 1,000' from the threshold

### Runway Touchdown Zone Markers

- Purpose - Identifies the touchdown zone for LDG ops and provide distance info in 500'

increments

- Markings - Groups of 1, 2, and 3 rectangular bars in pairs about the runway centerline


## Runway Side Stripe Markings

- Purpose - Delineate the edges of the runway providing a contrast between the runway and shoulder
- Markings - Continuous white stripes located on each side of the runway

## Runway Shoulder Markings

- Purpose — May be used with side stripes to identify pavement areas not intended for aircraft use
- Markings - Yellow stripes

## Runway Threshold Markings

- Purpose — Identifies the beginning of the runway available for landing
- Markings - 8 longitudinal stripes of uniform dimensions placed about the centerline (A)
  - The number of stripes is related to runway width (B):
  - 

## Threshold can be Displaced or Relocated

### Displaced Threshold (DT)

1. A threshold at a point on the runway other than the designated beginning of the runway
2. Reduces the amount of runway available for landings
  - a. The portion behind it is for T/Os either direction and LDGs from the opposite direction
    - i. Can be used for taxiing, takeoff, and landing rollout
3. Markings
  - a. A 10' wide white threshold bar is located across the runway at the displaced threshold
    - i. White arrow heads are located across the runway just prior to the threshold bar
    - ii. White arrows are down the centerline between the runway and displaced threshold
  - iii. Demarcation Line
    - A. Purpose - Delineates the DT from a blast pad/stopway/ taxiway prior to the runway
    - B. Markings - 3 feet wide and yellow
  - iv. Chevrons
    - A. Purpose - Show areas aligned with the runway that are unusable for taxi, T/O, LDG
    - B. Markings - Yellow arrows

## Relocated Threshold

1. Sometimes construction or other activities require the threshold to be relocated
2. A NOTAM should be issued identifying the portion of the runway is closed
  - a. EX. 10/28 W 900 CLSD
3. Markings — Identification can vary, as the duration of the relocation varies
  - a. Common practice is to use a 10' wide white threshold bar across the runway
  - b. Runway lights between the old threshold and new threshold will not be illuminated
  - c. Runway markings in this area may or may not be showing

## Blast pad/Stopway Area

- The blast pad area is an area where a propeller or jet blast can dissipate without creating a hazard
- Stopway is paved in to provide space to decelerate/stop in the event of an aborted T/O (Chevrons)

# Taxiway Markings

## Taxiway General Information

- Taxiways should have centerline/runway holding position markings whenever intersecting a runway
- Edge markings separate the taxiway from areas not for aircraft use or define taxiway edges
- May have shoulder/hold position markings for ILS critical areas and taxiway/taxiway intersections

## Taxiway Centerline Markings

- Normal Centerline
  - Purpose - Provides a visual cue to permit taxiing along a designated path (aircraft kept over line)
    - Markings - A single continuous yellow line that is 6`" — 12`" wide
- Enhanced Centerline
  - Purpose - Same as above but at larger commercial airports to warn that a runway hold position marking is being approached and unless cleared to cross the aircraft should prepare to stop
  - Markings - A parallel line of yellow dashes on either side of the normal taxiway centerline
    - Centerlines are enhanced for a max of 150' prior to a runway holding position marking

## Taxiway Edge Markings

- Purpose - Defines the edge of the taxiway (usually when edge doesn't match up with pavement)
- 2 types of markings, depending on whether the aircraft is supposed to cross the taxiway edge
  - Continuous Markings
    - Purpose - Define the taxiway edge from the shoulder/paved surface not for use by aircraft
    - Markings - Continuous double yellow line with each line at least 6' wide and 6' apart
  - Dashed Markings
    - Purpose - Define the taxiway edge when adjoining pavement is intended for aircraft (Apron)
    - Markings - Broken double yellow line ( 6`" wide/spaced 6`" apart, 15' long and 25' apart)

## Taxi Shoulder Markings

- Purpose - Paved shoulders prevent erosion but they may not support aircraft
- Markings - Taxiway edge markings will usually define this area
  - If confusion exists to the side of use, yellow shoulder markings are used

## Surface Painted Taxiway Direction Signs

- Purpose - When it isn't possible to offer direction signs at intersections, or to supplement such signs
- Markings — Surface painted location signs with a yellow background and black inscription
  - Adjacent to the centerline with signs indicating left turns on the left side of the centerline and vice versa

## Surface Painted Location Signs

- Purpose - Supplement location signs alongside the taxiway assisting in confirming the designation of the taxiway on
- Markings - Black background with a yellow inscription, R of center

## Geographic Position Markings

- Purpose - Identifies aircraft location during low visibility operations
- Markings - Left of the taxiway centerline in the direction of taxiing
  - A circle with an outer black ring, inner white ring and a pink circle
    - When on dark pavements the white/black ring are reversed
  - Designated with either a number or a number and a letter
    - Number corresponds with consecutive position on the route

# Holding Position Markings

## General Information - Holding Position Markings

- Show where an aircraft is supposed to stop when approaching a runway (Hold on the solid side)
- 4 yellow lines (2 Solid/2 Dashed) spaced 6`" or 12`" apart across the width of the taxiway/runway
  - 3 locations where runway hold lines are encountered: 1Taxiways; 2Runways; 3Approach Areas

## Runway Holding Position Markings on Taxiways

- Purpose - Identify where to stop without a clearance onto the runway
  - Always stop so that no part extends beyond the hold markers
  - Don't cross w/o clearance/ample separation at uncontrolled airports

## Runway Holding Position Markings on Runways

- Purpose - Only installed if normally used for LAHSO or taxiing operations
  - Must stop before markings/exit prior to reaching the position
- Markings - Sign (white inscription/red background) next to hold markings
  - Markings are placed on the runway prior to the intersection

## Taxiways Located in Runway Approach Area

- Purpose - Hold aircraft on taxiway so it does not interfere with ops

## Holding Position Markings for Instrument Landing System (ILS)

- Purpose — Hold aircraft when the ILS critical area is being protected
- Markings - 2 yellow solid lines 2' apart joined by pairs of solid lines 10' apart across the taxiway

## Holding Position Markings for Taxiway/Taxiway Intersections

- Purpose - Installed on taxiways where ATC normally holds aircraft short of a taxiway intersection
- Markings - Single dashed line extending across the width of the taxiway
  - If requested to HS of a taxiway w/o marking, provide adequate clearance from the taxiway

## Surface Painted Holding Position Signs

- Purpose - Used to supplement the signs located at the holding position
  - Normally used when the width of the holding position on the taxiway is greater than 200'
- Markings - Red background/white inscription, L of center, on the holding side, prior to hold lines



# Other Markings

## Vehicle Roadway Markings

- Purpose - Used to define a path for vehicle ops on or crossing areas also intended for aircraft
- Markings - White solid line delineates each edge and a dashed line separates lanes
  - In lieu of the solid lines, zipper markings may be used to delineate edges

## VOR Receiver Checkpoint Markings

- Purpose - Allow the pilot to check aircraft instruments with navigational aid signals
- Markings - A painted circle with an arrow in the middle (Arrow is aligned toward the facility)
  - Located, with a sign, on the apron/taxiway
  - Sign shows the VOR station ID letter, course for the check, and DME data (if necessary)
  - Black letters/numerals on a yellow background

## Nonmovement Area Boundary Markings

- Purpose - Delineates the movement area (The area under air traffic control)
- Markings - 2 yellow lines (one solid and one dashed) 6`" in width
  - Solid line is the nonmovement area side, the dashed line is the movement area side

## Marking and Lighting of Permanently Closed Runways

- Purpose - For runways and taxiways which are permanently closed
- Markings - The lighting circuits will be disconnected
  - The runway threshold, designation, and touchdown markings are obliterated
  - Yellow crosses are placed at each end of the runway and at 1,000' intervals

## Temporarily Closed Runways and Taxiways

- Purpose - To provide a visual indication to pilots that a runway is temporarily closed
- Markings - Yellow crosses are placed on the runway at each end
  - A raised lighted yellow cross may be placed on each end of the runway instead
  - A visual indication may not be present depending on the reason for closure, duration of the closure, configuration and the existence and hours of operation of an airport control tower
    - Check NOTAMs and the ATIS for information
  - Closed taxiways are treated as hazardous areas and blockaded; no part of the aircraft may enter
    - As an alternative, a yellow cross may be installed at each entrance to the taxiway

# Airport Signs

## General Signs

- Six types of signs installed on airfields
  - Mandatory Instruction; Location; Direction; Destination; Info; Runway Distance Remaining

## Mandatory Instruction Signs

- Purpose - Denote entrance to runway or critical area/area where aircraft are prohibited
- Markings - Red background with a white inscription

## Typical Mandatory Signs and Applications

### Runway Holding Position Sign

- Located at the hold position on taxiways intersecting runways/runways intersecting runways
- The sign states the designation of the intersecting runway

### Runway Approach Area Holding Position Sign

- Used when necessary to hold aircraft on a taxiway in a runway approach/departure area so it doesn't interfere with runway ops

### ILS Critical Area Holding Position Sign

- ILS system is being used, and it's necessary to hold at a location other than the Hold Markers
- The sign will have the inscription "ILS" and will be located adjacent to the holding position marking on the taxiway

### No Entry Sign

- Prohibits an aircraft from entering an area
- Typically on a taxiway intended to be used only in 1 direction or vehicle intersections of that may be mistaken as a taxiway/movement surface

## Location Signs

- Purpose - Identify either a taxiway or runway on which the aircraft is located
  - Other location signs provide a visual cue to assist in determining when an area has been exited

### Taxiway Location Sign

- Purpose - Along taxiways to indicate location
- Markings - Black background with yellow inscription and border

## **Runway Location Sign**

- Purpose - Complement compass info; typically installed where the proximity of runways to one another could cause confusion as to which runway the pilot is on
- Markings - Black background with a yellow inscription (Runway #)/ border

## **Runway Boundary Sign**

- Purpose - Provides a visual cue to use as a guide in deciding when “clear of the runway”
  - Adjacent to the hold markings on the pavement
  - Visible when exiting the runway
- Markings - Yellow background/black inscription depicting the hold markings

## **ILS Critical Area Boundary Sign**

- Purpose - Provides a visual cue to use as a guide in deciding when clear of the ILS critical area
  - Adjacent to ILS hold markings and can be seen leaving the critical area
- Markings - Yellow background/black inscription depicting ILS hold markings

## **Direction Signs**

- Purpose - Identify the designations of intersecting taxiways leading out of an intersection
  - Designations and their arrows are arranged clockwise from the 1st taxiway on the pilot’s left
- Markings - Yellow background/black inscription with an arrow indicating the turn direction

## **Destination Signs**

- Purpose - Indicates a destination on the airport
  - Destinations commonly shown are
    - Runways
    - Aprons
    - Terminals
    - Military Areas
    - Civil Aviation Areas
    - Cargo Areas
    - International Areas
    - FBOs
- Markings - Yellow background/black inscription indicating a destination on the airport
  - Always have an arrow showing the direction of the taxiing route to that destination sign

## Information Signs

- Purpose - Used to provide a pilot with information on such things as:
  - Areas the tower can't see, radio frequencies, and noise abatement procedures
- Markings - Yellow Background with a black inscription

## Runway Distance Remaining Signs

- Purpose - Used to inform the pilot the amount of distance remaining on the runway
  - The number on the sign indicates the thousands of feet of landing runway remaining
- Markings - Black background/white numeral inscription one 1/both sides of the runway

☐CE - Failure to comply with airport, runway, taxiway signs and markings

- Make sure you know the meaning and purpose of all the signs and markings
- If unsure, stop and ask ATC for clarification

# Airport Lighting and Other Airport Visual Aids

## Approach Light Systems (ALS)

- Purpose - The basic means to transition from IFR to VFR for landing
- Explanation - A configuration of signal lights starting at the landing threshold and extending into the approach area

## Visual Glideslope Indicators

### Visual Approach Slope Indicator (VASI)

- Purpose - Provide visual descent guidance information during approach
- Explanation - The lights are visible from 3-5 miles during day and up to 20 or more at night
  - Safe obstruction clearance within +/- 100 of the centerline and 4 NM from the threshold
- Configurations
  - 2,4,6,12, or 16 light units arranged in bars
    - Arranged as near, middle, and far bars (Mid provide another glide path for high cockpits)
    - VASIs of 2,4, or 6 light units are located on one side of the runway (usually the left)
    - VASIs consisting of 12 or 16 light units are located on both sides of the runway
  - Most installations consist of 2 bars and may consist of 2,4, or 12 light units

### Two Bar VASIs

- Provide one visual glide path, normally set at 30

### Three Bar VASIs

- Provide two visual glide paths
  - The lower glide path is provided by the near and middle bars and is normally set to 30
    - Some locations may have up to 4.50 glide paths for proper obstacle clearance
  - The upper glide path is provided by the middle and far bars and is normally set 1/40 higher

### How it Works

- Each unit projects light with an upper white segment and a lower red segment
- The light units are arranged so that the pilot will see the combinations of lights below:
- 2-bar VASI
- For other VASI configurations

## Precision Approach Path Indicator (PAPI)

### General PAPI information

- Lights arranged to provide visual decent guidance information during the approach to a runway
- Uses light units similar to the VASI but in a single row of either 2 or 4 light units

### Configuration

#### Tri-Color Systems

- Normally a single unit projecting a 3-color visual approach path into the final approach area
- Glide Path Indications
  - Below - Red
  - Above- Amber
  - On - Green
- Useful Range
  - Day — 1/2 to 1 mile
- Night — Up to 5 miles (depending on the visibility)

#### Pulsating Systems

- Normally a single unit projecting a 2-color visual approach path into the final approach area
- Glide Path Indications
  - Slightly Below - Steady red
  - Below - Pulsating red
  - On - Steady white
  - Slightly Above - Pulsating white

- Above - Faster pulsating white
  - Pulsating increases as the aircraft gets further above/below the glide slope
- Useful Range
  - During the Day, 4 miles and at Night, up to 10 miles

## **Runway End Identifier Lights (REIL)**

- General - Installed to provide rapid/positive identification of the approach end of a runway
- Configuration - A pair of synchronized flashing lights located on each side of the runway threshold
- Effective for:
  - Identification of a runway surrounded by a preponderance of other lighting
  - Identification of a runway which lacks contrast with the surrounding terrain
  - Identification of a runway during reduced visibility

## **Runway Edge Light Systems (HIRL, MIRL, LIRL)**

- General - Outline the edges of runways during periods of darkness or restricted visibility conditions
  - Classified according to the intensity or brightness they are capable of producing
    - High Intensity (HIRL); Medium Intensity (MIRL); Low Intensity (LIRL) a HIRL and MIRL have variable intensity controls
- Configuration
  - Runway edge lights — White
    - Instrument runways — Turn yellow the last 2,000' or half the runway, whichever is shorter
- Lights marking the end of the runway — Red/Green
  - Red is emitted toward the runway to indicate the end of the runway to a departing aircraft
  - Green is emitted outward from the runway end to indicate the threshold to landing aircraft

## **In-runway Lighting**

### **Runway Centerline Lighting System (RCLS)**

- General - Installed on some precision runways to facilitate landing under adverse conditions
- Configuration
  - Located along the runway centerline and are spaced at 50' intervals
  - From the landing threshold, the lights are white until the last 3,000' of the runway a White lights begin to alternate with red for 2,000', and the last 1,000' all lights are red

## **Touchdown Zone Lights (TDZL)**

- General - On some precision runways, indicating the TD zone with adverse visibility conditions
- Configuration
  - Two rows of transverse light bars disposed symmetrically about the runway centerline
  - Steady burning white lights starting 100' beyond the landing threshold and extending to 3,000' beyond the landing threshold or to the midpoint of the runway, whichever is less

## **Taxiway Centerline Lead-Off Lights**

- General
  - Provide visual guidance to persons exiting the runway
  - Color coded to warn: In runway environment/ILS critical area, whichever is more restrictive
- Configuration
  - Alternate green/yellow lights are installed, beginning with green, from the runway centerline to 1 light position beyond the runway hold position/ILS critical area hold position

## **Taxiway Centerline Lead-on Lights**

- General
  - Provide visual guidance to persons entering the runway
  - Warn: In the runway environment/ILS critical area, whichever is more conservative
- Configuration
  - Color coded with the same pattern as lead-off lights
  - Bidirectional (i.e., 1 side emits light for the lead-on function the other for the lead-off)

## **Land and Hold Short Lights**

- General
  - Used to indicate the hold short point on certain runways which are approved for LAHSO
    - Where installed, the lights will be on anytime LAHSO is in effect and off when not
- Configuration - A row of pulsing white lights installed across the runway at the hold short point

## **Control of Lighting Systems**

- Operation of approach light systems and runway lighting is controlled by the control tower/FSS
  - Pilots may request the lights be turned on or off

## **Pilot Control of Airport Lighting**

- Radio control of lighting is available at some airports by keying the aircraft's microphone
  - Often available w/o specified hours for lighting and with no tower/FSS or when they're closed

- All lighting systems which are radio controlled at an airport operate on the same frequency
  - The CTAF is used to activate the lights at most airports, but other frequencies may also be used
    - The frequency is in the AFD/the standard instrument approach procedures publications
    - It is not identified on the sectional charts

## **Airport Beacons**

- Vertical light distribution to make them more effective from 1o to 10o above the horizon
  - They can be seen well above and below this peak spread
- Light Projection
  - Omnidirectional capacitor discharge device
  - Rotate at a constant speed
- Flashes
  - 24-30 per min for airports/landmarks/points on federal airways; 30-45 per min for heliports

## **Colors and Combinations of Beacons**

- White and Green — Lighted land airport
- \*Green alone — Lighted land airport
- White and Yellow — Lighted water airport
- \*Yellow alone — Lighted water airport
- Green, Yellow, and White — Lighted heliport
  - Green/Yellow alone is used w/a white & green/white & yellow beacon display, respectively

## **Military Beacons**

- Two quick white followed by a green flash

## **Operation during the day**

- In Class B, C, D and E surface areas, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000'
  - Don't rely solely on the airport beacon to indicate if weather conditions are IFR or VFR
    - There is no regulatory requirement for daylight operation

## **Taxiway Lights**

### **Taxiway Edge Lights**

- Purpose - Outline the edges of taxiways during periods of darkness or restricted visibility
- Configuration - Emit blue light



## Taxiway Centerline Lights

- Purpose - Used to facilitate ground traffic under low visibility conditions
- Configuration - Steady burning green lights along the centerline

## Clearance Bar Lights

- Purpose - Installed to increase the conspicuity of the holding position in low visibility conditions
  - May also be installed to indicate the location of an intersecting taxiway during darkness
- Configuration - Three in pavement steady burning yellow lights

## Runway Guard Lights

- Purpose - Enhance the conspicuity of taxiway/runway intersections
- Configuration - Either a pair of elevated flashing yellow lights on either side of the taxiway, or a row of in pavement yellow lights across the entire taxiway, at the runway hold marking

## Stop Bar Lights

- Purpose - Confirm ATC clearances to enter/cross the active runway in low visibility conditions
- Configuration - Row of red, unidirectional, steady burning in pavement lights installed across the entire taxiway at the runway hold position, and elevated steady-burning red lights on each side
  - Following ATC clearance, the stop bar is turned off and the lead-on lights are turned on

- Never cross a red illuminated stop bar even if they have received ATC clearance If after crossing, the lead-on lights extinguish, hold position and contact ATC for instruction □□

## Conclusion

It is important to understand the meaning of the airport, runway and taxiway signs, markings, and lighting for safety as well as to avoid runway incursions. If you are confused or have a question, do not proceed. Stop the aircraft and ask ATC.

## ACS Requirements

To determine that the applicant:

1. Exhibits instructional knowledge of the elements of airport, runway and taxiway signs, markings, and lighting by describing:
  - a. Identification and proper interpretation of airport, runway and taxiway signs and markings, with emphasis on runway incursion avoidance.
  - b. Identification and proper interpretation of airport, runway and taxiway lighting, with

emphasis on runway incursion avoidance.

2. Exhibits instructional knowledge of common errors related to airport, runway and taxiway signs, markings, and lighting by describing:
  - a. Failure to comply with airport, runway and taxiway signs and markings.
  - b. Failure to comply with airport, runway and taxiway lighting.
  - c. Failure to use proper runway incursion avoidance procedures.
3. Demonstrates and simultaneously explains airport, runway and taxiway signs, markings, and lighting from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to airport, runway and taxiway signs, markings, and lighting.