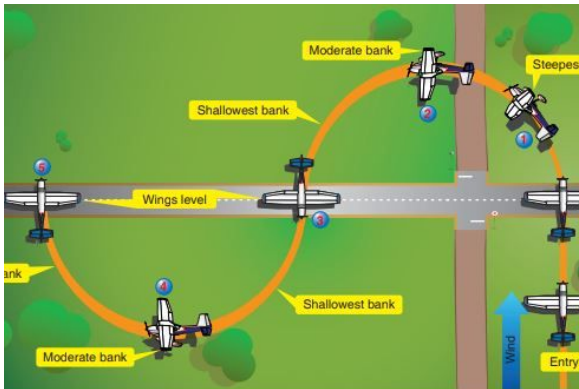


S-Turns across a Road

Objective	
<p>To ensure the applicant learns the purpose of and can exhibit a clear understanding of the S-Turns Across a Road maneuver and how to perform the maneuver properly.</p>	
Purpose	
<p>The S-Turns across a Road maneuver is a more advanced ground reference maneuver, demonstrating how wind greatly affects turn radius, and requiring the pilot to vary bank angle to maintain a desired ground track as the relative wind direction changes. It also builds skills related to aircraft coordination through a wide range of bank angles.</p>	
Schedule	Equipment
<ul style="list-style-type: none"> ● Ground Lesson: 15 minutes ● Initial <ul style="list-style-type: none"> ■ Flight 1: 40 minutes - <i>Introduction to Maneuver</i> ■ Flight 2: 40 minutes - <i>Improve Proficiency (Dual)</i> ● Solo <ul style="list-style-type: none"> ■ Flight 3: 20 minutes - <i>Improve Proficiency</i> ● Pre-Checkride <ul style="list-style-type: none"> ■ Flight 4: 20 minutes - <i>Demonstrate Proficiency</i> ● Debrief: 10 minutes (<i>per flight</i>) 	<ul style="list-style-type: none"> ● n/a
Student Actions	Instructor Actions
<ul style="list-style-type: none"> ● Ask any questions, receive study material for the next lesson. ● Watch linked video. ● Review listed references. 	<ul style="list-style-type: none"> ● Deliver the ground lesson (below). ● Demonstrate the maneuver in flight. ● Debrief after each flight.
Completion Standards	
<ul style="list-style-type: none"> ● Ground: Student can explain the purpose of the maneuver and how to execute it properly. ● Flight: Student can perform the maneuver to the applicable ACS standards. <ul style="list-style-type: none"> ○ See expanded Completion Standards below. 	

References

- ERAUSpecialVFR - "S Turns"
 - YouTube - <https://www.youtube.com/watch?v=JEVKxX3CVK4>
- FAA-H-8083-3B (Airplane Flying Handbook) - Chapter 6, Page 10-11 [Maneuver Description]
- FAA-S-ACS-6B (Private Pilot ACS) - Area V Task B Skill 3b
- FAA-S-8081-6D (CFI PTS) - Area X Task B

Ground Lesson Outline

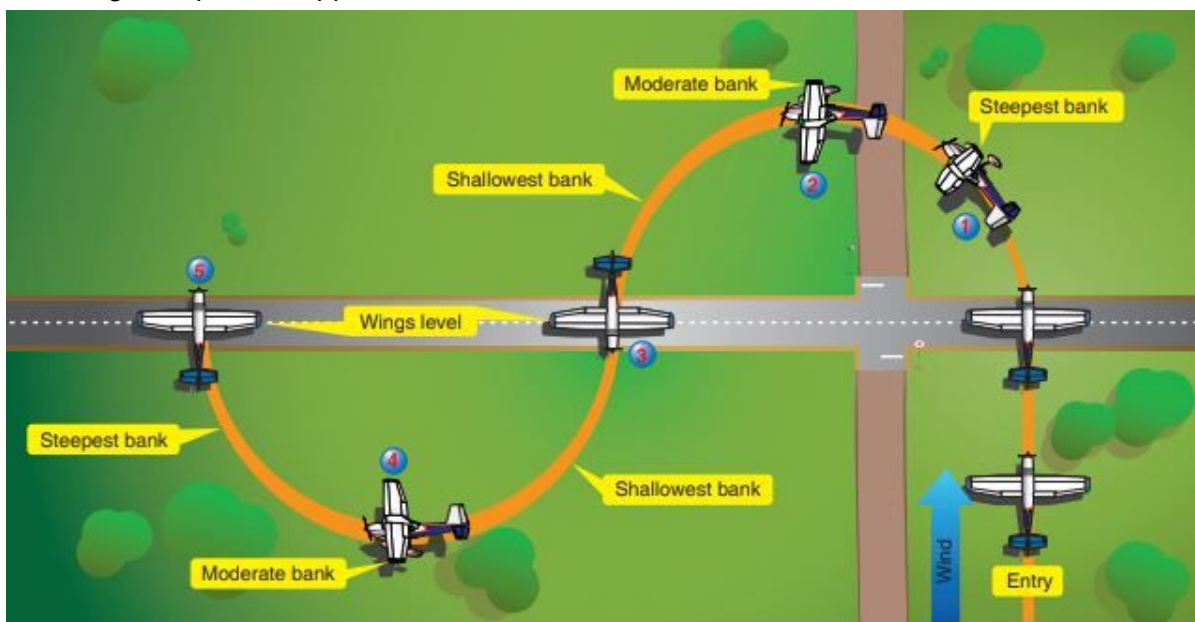
- S-Turns Across a Road
- Wind, Bank, and Rate of Turn
- Ground Reference Maneuvers
 - Selecting a road or line
- Two Loops
 - Downwind
 - Upwind
- Symmetry
- Coordination
- Safety considerations
 - Use of checklists
 - Emergency Landing Area
 - Visual traffic scanning
- Maneuver Description - step-by-step
 - Entry position, airspeed, etc.
- Expanded Completion Standards

Common Errors

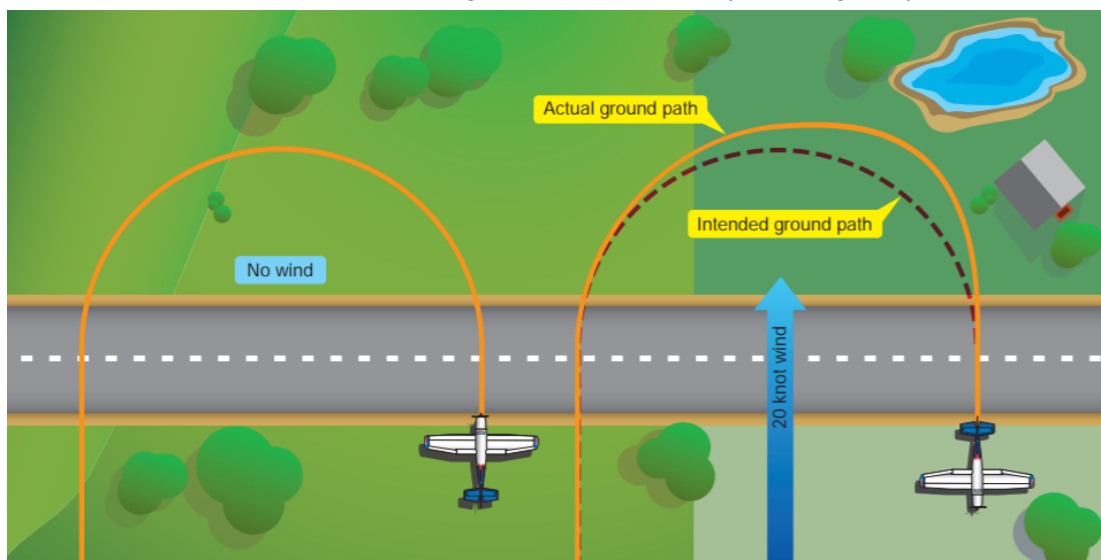
- Failure to adequately clear the area above, below, and on either side of the airplane for safety hazards, initially and throughout the maneuver.
- Selection of a ground reference where there is no suitable emergency landing area within gliding distance.
- **Failure to properly assess wind direction.**
- Failure to establish a constant, level altitude prior to entering the maneuver.
- **Failure to maintain altitude or airspeed during the maneuver.**
- Failure to manipulate the flight controls in a smooth and continuous manner.
- **Failure to properly divide attention between controlling the airplane and maintaining proper orientation with the ground references.**
- **Uncoordinated use of flight controls.**
- **Improper correction for wind drift.**
- **An unsymmetrical ground track.**

Ground Lesson Content

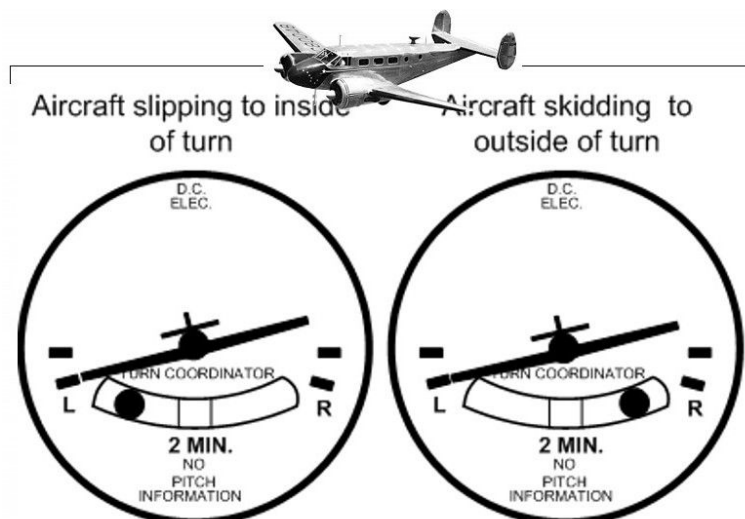
- S-Turns Across a Road** - The S-Turns Across a Road maneuver is a more advanced ground reference maneuver that mainly demonstrates that correcting for wind in turns requires adjusting the *bank angle*. The object of the maneuver is to fly two semicircles or 'loops' of constant radius, crossing a reference line (road, canal, etc.) with the wings level exactly at the end of each loop, and then performing a loop in the opposite direction.



- Wind, Bank, and Rate of Turn** - During straight-and-level flight, an airplane can correct for the wind by flying at a *wind correction angle*, however during turning flight, this tactic doesn't work. Instead, the **rate of turn**, and therefore the bank angle, is used to keep the airplane flying on the desired ground track.
- As the airplane flies into the wind, or **upwind**, it flies slower over the ground, and therefore needs *less* rate of turn. As the airplane flies with the wind, or **downwind**, it needs *more* rate of turn. An airplane which does not correct for the wind during turns will instead fly an irregularly curved path:



- **Ground Reference Maneuvers** - The maneuver is a **ground reference maneuver**, meaning it is performed by reference to a prominent line on the ground. For this maneuver, any prominent line on the ground can be chosen, as long as it is in a relatively unpopulated area. Because the maneuver will be flown close to the ground, it should be chosen within gliding distance of an emergency landing site.
- Before the maneuver can be started, the wind direction needs to be determined. Look for smoke, flags, or other indications of wind on the ground. The maneuver is started on the *downwind* portion, meaning the airplane is flying *with* the wind.
- The airplane should begin far enough away from the line so that it can be flying straight and level, directly downwind, and cross perpendicular to the line.
- **Two Loops** - The maneuver can be broken into *two loops*:
 - **Downwind** loop - Start a turn in the desired direction. Initially a **steep bank angle** is required, with the bank angle gradually reducing as the airplane approaches the 180 degree point, heading back upwind to cross the reference line again.
 - **Upwind** loop - Start a turn in the *opposite* direction. Initially a very **shallow bank angle** is required, with the bank angle gradually increasing as the airplane returns to the downwind portion, completing the loop and crossing the reference line again.
- **Symmetry** - The progress of the turn should be monitored visually, continuously glancing between the reference line to judge the symmetry of the loops and the flight instruments. The goal is to maintain the symmetric loops by continually changing the bank angle, and to maintain the same altitude and airspeed as at the beginning of the maneuver. The airplane should cross the reference line perpendicular each time.
- Any normal cruise airspeed below *maneuvering speed* (V_a) can be chosen, and the maneuver is normally flown in the clean configuration.
- **Coordination** - Because this maneuver is flown close to the ground and involves turning, it is important to pay close attention to flying with proper coordination. As the airplane rolls into and out of turns, the rudder must be used to keep 'the ball' in the center. This avoids *slips* and *skids*, which create the risk of a stall or spin. The turn coordinate is shown below:



- **Safety Considerations**
 - **Checklists** - Pilots should complete a pre-maneuver checklist before beginning the maneuver.

- **Emergency Landing Area** - Due to the risks involved with maneuvering at low altitude, pilots should select a suitable emergency landing area.
- **Visual Traffic Scanning** - Pilots must remember to keep up their traffic scan throughout the maneuver.

Maneuver Description

- **Selecting a Ground Reference** - Select a prominent line feature on the ground, which is easy to identify. It should be in an unpopulated area and clear of hazards on the ground. A long, straight road is usually a good choice. *Because this maneuver is performed so close to the ground (below 1,000ft AGL), make sure that the chosen ground reference is near a suitable emergency landing area, as gliding distance will be almost zero.*
- **Entry Position and Heading** - First, the wind direction should be identified. Look for smoke, flags, or other signs of surface wind direction. If none are available, the ATIS or METAR of a local airport can be used to estimate. Plan to enter the *downwind* portion of the maneuver, perpendicular to the reference line.
- **Altitude** - This maneuver should be performed at **600 to 1,000ft AGL**.
- **Bank** - Since this maneuver involves maneuvering at low altitude, the bank angle should be *less than 45 degrees*. It will be necessary to bank more when heading downwind, and less when heading upwind. Maintain a constant radius semicircle and cross perpendicular to the reference line again upwind. Repeat in the opposite direction.
- **Airspeed** - The maneuver must be started at less than **V_a** (maneuvering speed). Choose a normal level cruise flight airspeed and power setting, at least 5-10 knots below **V_a**.
- **Coordination** - The entire maneuver should be flown in coordinated flight. The varying bank angle will require more or less rudder throughout the maneuver. Attention should be given to proper rudder input during turns.
- **Recovery** - After making the number of turns requested, recover to straight and level flight.
- **This is a visual maneuver!** Eyes should remain outside the cockpit as much as possible to scan for traffic and ensure proper tracking of the ground references. *In particular, this is a very low altitude maneuver. Keep a careful watch for obstructions or other ground hazards.*

Expanded Completion Standards

- The pilot can explain the purpose of the S-Turns across a Road ground reference maneuver and how the various factors affect the performance of the maneuver.
- The pilot can perform the maneuver to the following standards:
 - Pilot clears the area, performs a pre-maneuver checklist, establishes a speed *below V_a*, and selects an appropriate altitude for maneuver entry, **between 600 and 1,000 feet AGL**.
 - Pilot selects a suitable ground reference line, free from any ground hazards.
 - Pilot enters the maneuver perpendicular to the reference line.
 - Pilot applies proper wind correction by continuously adjusting the bank angle to maintain symmetrical loops and reverses turn direction directly over the reference line.
 - Pilot divides attention between accurate, *coordinated airplane control* and outside visual references.