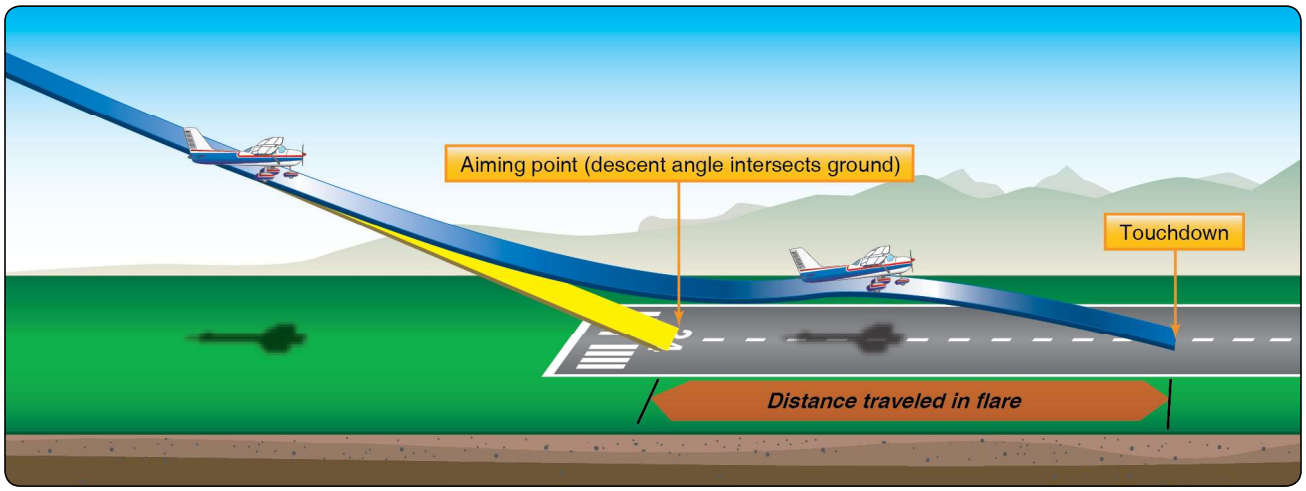

Figure 9-5. *Stabilized approach.*

To the pilot, the aiming point appears to be stationary. It does not appear to move under the nose of the aircraft and does not appear to move forward away from the aircraft. This feature identifies the aiming point—it does not move. However, objects in front of and beyond the aiming point do appear to move as the distance is closed, and they appear to move in opposite directions! For a constant angle glide path, the distance between the horizon and the aiming point remains constant. If descending at a constant angle and the distance between the perceived aiming point and the horizon appears to increase (aiming point moving down away from the horizon), then the true aiming point is farther down the runway. If the distance between the perceived aiming point and the horizon decreases, meaning that the aiming point is moving up toward the horizon, the true aiming point is closer than perceived.

During instruction in landings, one of the important skills a pilot acquires is how to use visual cues to discern the true aiming point from any distance out on final approach. From this, the pilot determines if the current glide path will result in either an under or overshoot. Note that the aiming point is not where the airplane actually touches down. Since the pilot reduces the rate of descent during the round out (flare), the actual touchdown occurs farther down the runway. Considering float during round out, the pilot is also able to predict the point of touchdown with some accuracy.

When the airplane is established on final approach, the shape of the runway image also presents clues as to what should be done to maintain a stabilized approach to a safe landing.

Obviously, a runway is normally shaped in the form of an elongated rectangle. When viewed from the air during the approach, the phenomenon, known as perspective, causes the runway to assume the shape of a trapezoid with the far end looking narrower than the approach end and the edge lines converging ahead.

As an airplane continues down the glide path at a constant angle (stabilized), the image the pilot sees is still trapezoidal, but of proportionately larger dimensions. In other words, during a stabilized approach, the runway shape does not change. [*Figure 9-6*]

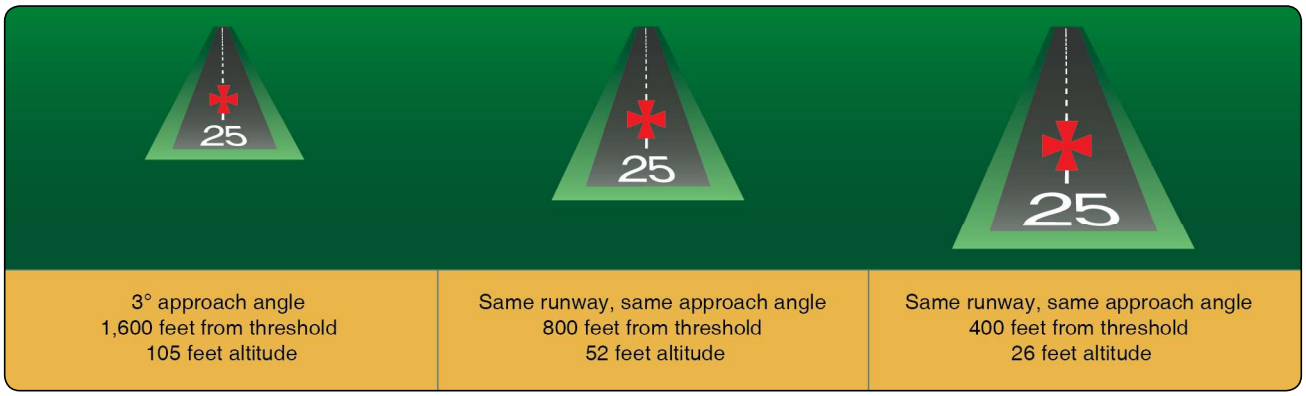

Figure 9-6. *Runway shape during stabilized approach.*

If the approach becomes shallow, the runway appears to shorten and become wider. Conversely, if the approach is steepened, the runway appears to become longer and narrower. [*Figure 9-7*]

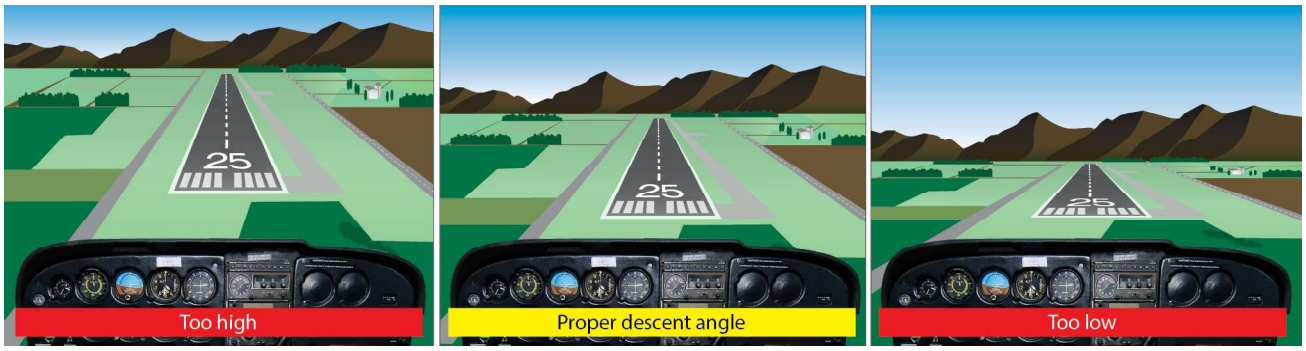

Figure 9-7. *Change in runway shape if approach becomes narrow or steep.*

Immediately after rolling out on final approach, the pilot adjusts the pitch attitude, power, and trim so that the airplane is descending directly toward the aiming point at the appropriate airspeed in the landing configuration. If it appears that the airplane is going to overshoot the desired landing spot, a steeper approach results by reducing power and lowering the pitch attitude to maintain airspeed. If available and not fully extended, the pilot may further extend the flaps. If the desired landing spot is being undershot and a shallower approach is needed, the pilot increases both power and pitch attitude to reduce the descent angle. Once the approach is set up and control pressures removed with trim, the pilot is free to devote significant attention toward outside references and use the available visual cues to fine tune the approach. The pilot should not stare at any one place, but rather scan from one point to another, such as from the aiming point to the horizon, to any objects along the runway, to an area well short of the runway, and back to the aiming point. This makes it easier to perceive any deviation from the desired glide path and determine if the airplane is proceeding directly toward the aiming point. The pilot should also glance at the airspeed indicator periodically and correct for any airspeed deviation.

Pilots normally establish a stabilized approach before short final. The round out, touchdown, and landing roll are much easier to accomplish when preceded by a stabilized final approach, which reduces the chance of a landing mishap. Therefore, deviations from the desired glide path should be detected and corrected early so that the magnitude of corrections during the later portion of the approach is small. If the approach is very high or very low, it may not be possible to establish a stabilized approach, and the pilot normally executes a go-around. If the airplane is initially low and undershooting the aiming point, the pilot may intercept the desired glide path by increasing pitch attitude and adding power to level off while maintaining the correct airspeed. This may necessitate a substantial increase in power if the aircraft is operating on the backside of the power curve. As the airplane intercepts the desired glide path, the pilot reduces power and pitches down to remain on the glide path. Retracting the flaps to correct for an undershoot creates an unnecessary risk. It may cause a sudden decrease in lift, an excessive sink rate, and an aggravated unstable condition.

If the approach is too high or too low, it may not be possible to establish a stabilized approach, and the pilot should execute a go-around. Typically, pilots go-around if unable to establish a stabilized approach by 500 ft above airport elevation in visual meteorological conditions (VMC) or 1,000 ft above airport elevation in instrument conditions (IMC). For a typical GA piston aircraft in a traffic pattern, an immediate go-around should be initiated if the approach becomes unstabilized below 300 ft AGL.

Pilots may consider the following elements when attempting to set up and fly a stabilized approach to landing. The pilot should focus on the elements that lead to a stabilized approach rather than the order of the elements or the insistence on meeting all of the approach criteria. For a typical piston aircraft, an approach is stabilized when the following criteria are met:

1. **Glide path.** Typically a constant 3 degrees to the touchdown zone on the runway (obstructions permitting).
2. **Heading.** The aircraft tracks the centerline to the runway with only minor heading/pitch changes necessary to correct for wind or turbulence to maintain alignment. Bank angle normally limited to 15 degrees once established on final.
3. **Airspeed.** The aircraft speed is within +10 /-5 KIAS of the recommended landing speed specified in the AFM, $1.3V_{SO}$, or on approved placards/markings. If the pilot applies a gust factor, indicated airspeed should not decay below the recommended landing speed.
4. **Configuration.** The aircraft is in the correct landing configuration with flaps as required; landing gear extended, and is in trim.
5. **Descent rate.** A descent rate (generally 500-1000 fpm for light general aviation aircraft) makes for a safe approach. Minimal adjustments to the descent rate as the airplane approaches the runway provide an additional indication of a stabilized and safe approach. If using a descent rate in excess of 500 fpm due to approach considerations, the pilot should reduce the descent rate prior to 300 ft AGL.
6. **Power setting.** The pilot should use a power setting appropriate for the aircraft configuration and not below the minimum power for approach as defined by the AFM.
7. **Briefings and checklists.** Completing all briefings and checklists prior to initiating the approach (except the landing checklist), ensures the pilot can focus on the elements listed above.