Federal Aviation Administration, DOT  § 25.111

§ 25.111 Takeoff path.

(a) The takeoff path extends from a standing start to a point in the takeoff at which the airplane is 1,500 feet above the takeoff surface, or at which the transition from the takeoff to the en route configuration is completed and \( V_{FTO} \) is reached, whichever point is higher. In addition—

(1) The takeoff path must be based on the procedures prescribed in §25.101(f);

(2) The airplane must be accelerated on the ground to \( V_{EF} \), at which point the critical engine must be made inoperative and remain inoperative for the rest of the takeoff; and

(3) After reaching \( V_{EF} \), the airplane must be accelerated to \( V_{2} \).

(b) During the acceleration to speed \( V_{2} \), the nose gear may be raised off the ground at a speed not less than \( V_{R} \). However, landing gear retraction may not be begun until the airplane is airborne.

(c) During the takeoff path determination in accordance with paragraphs (a) and (b) of this section—

(1) The slope of the airborne part of the takeoff path must be positive at each point;

(2) The airplane must reach \( V_{2} \) before it is 35 feet above the takeoff surface and must continue at a speed as close as practicable, but not less than \( V_{2} \), until it is 400 feet above the takeoff surface;

(3) At each point along the takeoff path, starting at the point at which the airplane reaches 400 feet above the takeoff surface, the available gradient of climb may not be less than—

(i) 1.2 percent for two-engine airplanes;

(ii) 1.5 percent for three-engine airplanes; and

(iii) 1.7 percent for four-engine airplanes.

(4) The airplane configuration may not be changed, except for gear retraction and automatic propeller feathering, and no change in power or thrust that requires action by the pilot may be made until the airplane is 400 feet above the takeoff surface; and

(5) If §25.105(a)(2) requires the takeoff path to be determined for flight in icing conditions, the airborne part of the takeoff must be based on the airplane drag:

(i) With the takeoff ice accretion defined in appendix C, from a height of 35 feet above the takeoff surface up to the point where the airplane is 400 feet above the takeoff surface; and

(ii) With the final takeoff ice accretion defined in appendix C, from the point where the airplane is 400 feet above the takeoff surface to the end of the takeoff path.

(d) The takeoff path must be determined by a continuous demonstrated takeoff or by synthesis from segments. If the takeoff path is determined by the segmental method—

(1) The segments must be clearly defined and must be related to the distinct changes in the configuration, power or thrust, and speed;

(2) The weight of the airplane, the configuration, and the power or thrust must be constant throughout each segment and must correspond to the most critical condition prevailing in the segment;

(3) The flight path must be based on the airplane’s performance without ground effect; and

(4) The takeoff path data must be checked by continuous demonstrated
§ 25.113 Takeoff distance and takeoff run.

(a) Takeoff distance on a dry runway is the greater of—

(1) The horizontal distance along the takeoff path from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface, determined under §25.111 for a dry runway; or

(2) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with §25.111.

(b) Takeoff distance on a wet runway is the greater of—

(1) The takeoff distance on a dry runway determined in accordance with paragraph (a) of this section; or

(2) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface, determined under §25.111 for a wet runway.

(c) If the takeoff distance does not include a clearway, the takeoff run is equal to the takeoff distance. If the takeoff distance includes a clearway—

(1) The takeoff run on a dry runway is the greater of—

(i) The horizontal distance along the takeoff path from the start of the takeoff to a point equidistant between the point at which $V_{LOF}$ is reached and the point at which the airplane is 35 feet above the takeoff surface, as determined under §25.111 for a dry runway; or

(ii) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point at which $V_{LOF}$ is reached and the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with §25.111.

(2) The takeoff run on a wet runway is the greater of—

(i) The horizontal distance along the takeoff path from the start of the takeoff to the point at which the airplane is 15 feet above the takeoff surface, achieved in a manner consistent with the achievement of $V_2$ before reaching 35 feet above the takeoff surface, as determined under §25.111 for a wet runway; or

(ii) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point at which $V_{LOF}$ is reached and the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with §25.111.

§ 25.115 Takeoff flight path.

(a) The takeoff flight path shall be considered to begin 35 feet above the takeoff surface at the end of the takeoff distance determined in accordance with §25.113(a) or (b), as appropriate for the runway surface condition.

(b) The net takeoff flight path data must be determined so that they represent the actual takeoff flight paths (determined in accordance with §25.111 and with paragraph (a) of this section) reduced at each point by a gradient of climb equal to—

(1) 0.8 percent for two-engine airplanes;

(2) 0.9 percent for three-engine airplanes; and

(3) 1.0 percent for four-engine airplanes.