

LANDING GEAR LOADS by Martin Hollmann

The 14 Code of Federal Regulation (CFR), Part 23 states that the limit inertia load factor for the design of aircraft landing gears must be determined by a drop test or by some rational means. Since a drop test is not possible during the design phase we must look to a rational means to design the landing gears. This analysis is that means.

The main landing gears on an aircraft may be viewed by looking at the aircraft from the front as shown in figure 1. The shock absorption of the landing shock occurs just as the tires touch the runway and continues as the tire and landing gear leg deflect and absorb the energy of the vertical sink velocity, V_s , of the landing aircraft. A simplified view of the two conditions of landing are shown in figure 2. Each condition in figure 2 is the same view as figure 1 but the landing gear and tires have been represented by a single spring with a spring constant of K in lb/inch or in lb/feet. To convert simply multiply lb/in. by 12 to get lb/ft.

According to Paragraph 23.473 (d) of Part 23, the velocity V_s depends on the wing loading Wt/S for the aircraft at landing weight as shown in equation 1.

$$V_s = 4.4(Wt/S)^{1/4} \quad (1)$$

Where,

V_s is in feet per second

Wt is the landing weight of the aircraft in pounds

S is the wing area in square feet

For aircraft weighing less than 12,600 lbs, Part 23 also states that when Wt/S is equal to or larger than 26.9 psf, V_s needs to be no larger than 10 fps. If Wt/S is equal to or smaller than 6.4 psf, V_s is equal to and cannot be smaller than 7 fps.

Now if we look at condition 1 in figure 2, when the wheels are just beginning to touch the runway at time = 0, the kinetic energy is

$$K.E. = Wt V_s^2 / (2 g) \quad (2)$$

Where,

g is the acceleration of one gravity equal to 32.2 feet/second²

Paragraph 23.473 (b)(1), Part 23 allows the landing weight, Wt , to equal 0.95 x gross weight, W .

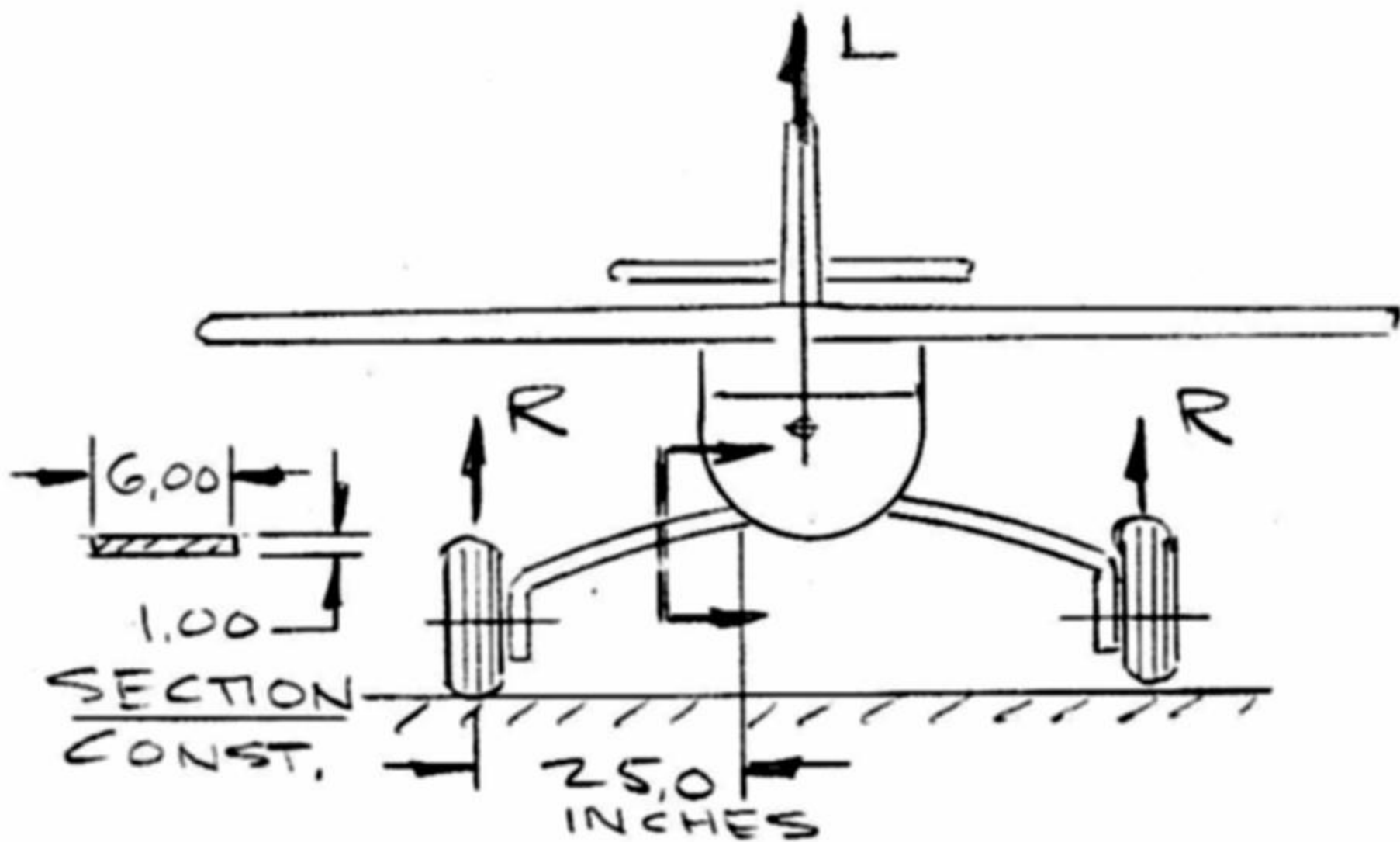


Figure 1. A View Aft of the Aircraft showing the Landing Gear Dimensions and Forces.

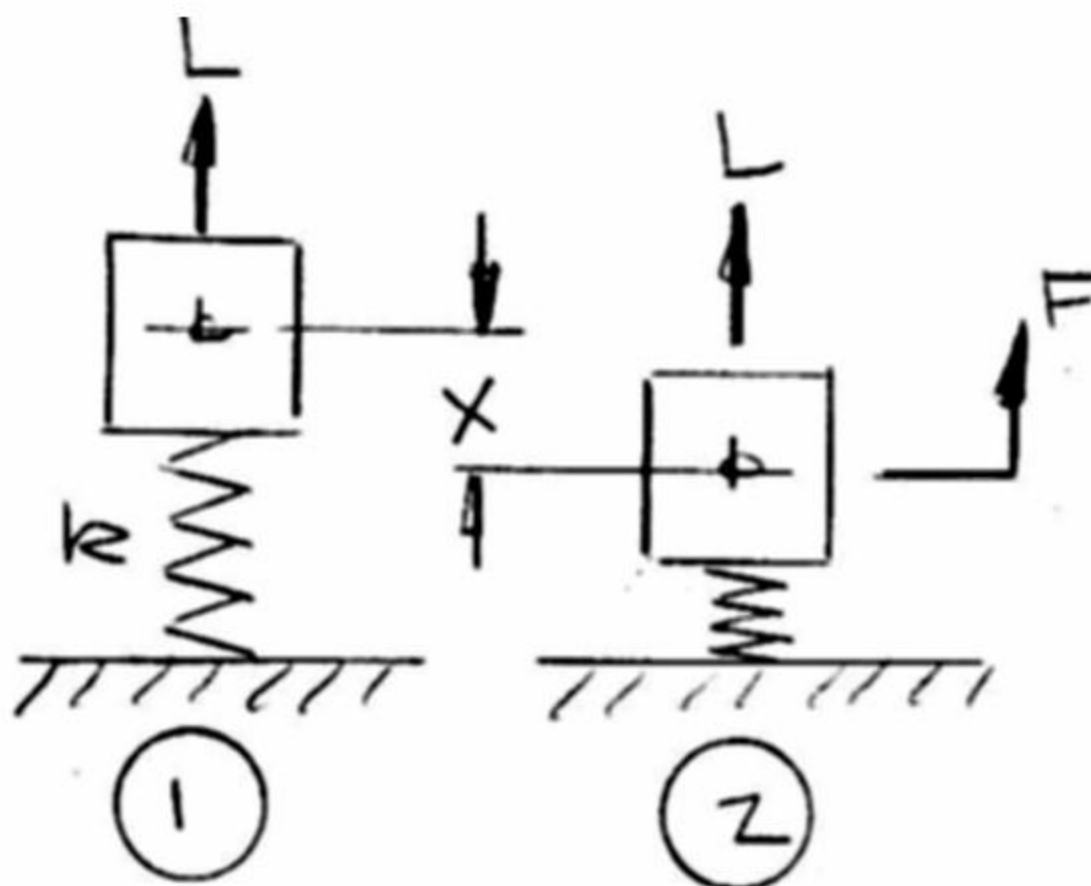


Figure 2. Two Conditions For the Landing Gear Stroke. Same as Figure 1 except Landing Gears are shown by a Spring.

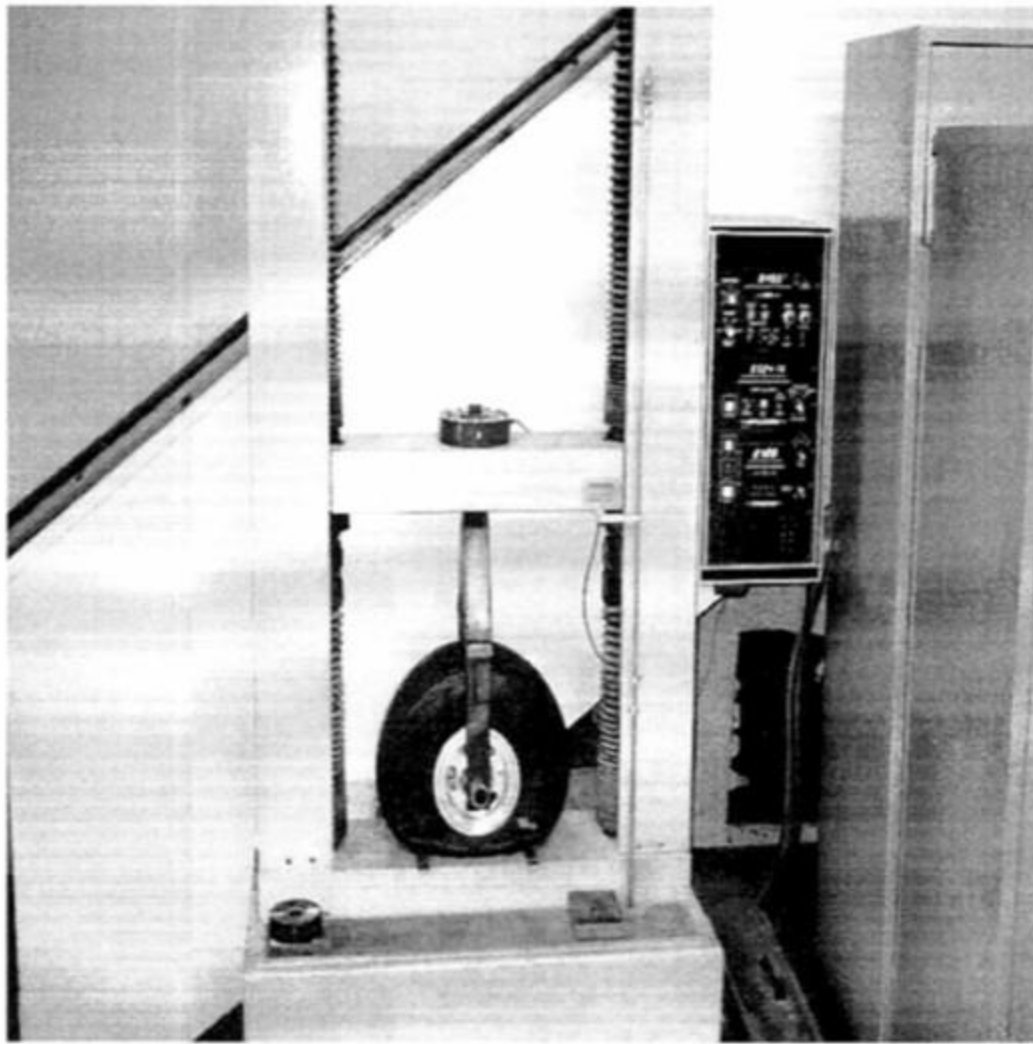


Figure 3. Testing the Tire Deflection under a Load of up to 6,500 lbs.

Table 1. The Load/Deflection of a 6.00 x 6 Tire with 6 plies and a 5.00 x 5 Tire with 6 plies for Various Tire Pressures.

6.00 x 6 Tire

5.00 x 5 Tire

