**Physics Calculations Related to Fall Objects**

Various calculations are needed in order to predict the potential severity of a fall or falling objects. The ability of an object, such as a hard hat, to withstand the force of impact and pressure of impact is dependent upon the tensile, compression, shear, puncture, and bending stress the object can withstand. Injury may occur due to transferred energy to a person’s body or the direct impact forces. Additionally, the time available for absorption of impact forces (absorption rate) will also affect the severity of the injury. When estimating potential severity of injury, factors to consider include velocity upon impact, rate of deceleration, and pressure of impact. These calculations show how critical fall prevention and protection equipment to prevent injuries.

**Terms to define:**

Velocity (ft/s): The rate of change in position of an object divided by the time of travel.

Rate of Declaration (ft/s2): This is the rate at which an object slows down. Deceleration is the final velocity minus the initial velocity.

Pressure of Impact (lb./in2): This is the force applied over the surface area the falling object hits.

**Force of Impact Formula:**

$$F\_{i}=\frac{Wa}{g}$$

Where:

Fi = force of impact (pounds of force)

W = object weight (lb.)

a = rate of deceleration (ft/s2)

g = acceleration due to gravity (32.2 ft/s2)

**Pressure of Impact Formula:**

$$P\_{i}=\frac{F\_{i}}{A\_{i}}$$

Where:

Pi = pressure of impact (force per unit area in lb./in2)

Fi = force of impact (pounds force)

Ai = surface area of impact (in2)

An example to review includes implement hitches falling on a worker’s foot.

In this example the weight of the implement hitch is 500 pounds. This will represent the object weight. The hitch falls a total of 1.5 ft with a rate of deceleration of 1,164 ft/s2. The area of the top of a worker’s foot is approximately 18 in2. Solve for the force of impact and the pressure of impact using the formulas provided.

$F\_{i}$ = \_\_\_\_\_

$P\_{i}$ = \_\_\_\_\_