

$$M := 360000 \cdot \text{lb} \quad g = 9.807 \text{ m s}^{-2} \quad M = 163.293 \text{ tonne} \quad \text{ton} := 1000 \cdot \text{kgf}$$

We need to determine the initial velocity at the distance of impact.

$$v_0 := 0 \cdot \frac{\text{m}}{\text{s}} \quad v(t) := v_0 + g \cdot t$$

$$s(T) := \int_{0 \text{ sec}}^T v(t) \, dt \quad \int_{0 \text{ sec}}^T v(t) \, dt \rightarrow \frac{1}{2} \cdot T^2 \cdot g$$

so for a 15 m distance time of impact is $h := 15 \cdot \text{m}$

$$t_{\text{impact}} := \sqrt{\frac{2 \cdot h}{g}} \quad t_{\text{impact}} = 1.749 \text{ s}$$

at which time velocity of impact is

$$v_{\text{impact}} := v(t_{\text{impact}}) \quad v_{\text{impact}} = 17.152 \frac{\text{m}}{\text{sec}}$$

Now to test the prediction of the website of the average force for a descent of 15.2 mm we see that the velocity of the body reduces from 17.152 m/sec to 0 whilst, so going 15.2 mm at say the average speed of $17.152/2 = 8.576$ m/sec whilst stopping. This means that the time employed in stopping can be considered to be

$$\Delta_{\text{stop}} := 15.2 \cdot \text{mm}$$

$$t_{\text{stopping}} := \frac{\Delta_{\text{stop}}}{\frac{v_{\text{impact}}}{2}} \quad t_{\text{stopping}} = 1.772 \times 10^{-3} \text{ s}$$

a formula that assumes the linear reduction of velocity whilst stopping, introduced only for a first evaluation of the average braking force whilst stopping.

(we may alternatively or later consider other regimes of stopping such constant deceleration whilst stopping or some other law whilst stopping more in accord with impact experiment)

So one estimate of the average imparted impact force whilst stopping with a linear reduction of velocity along time is

$$F := \frac{M \cdot v_{\text{impact}}}{t_{\text{stopping}}} \quad F = 1.611 \times 10^5 \text{ ton}$$

This force is 1000 times the weight of the body. So either I have been in error whilst dealing with the website or the website is in error by such scaling factor. I examine the question and the site is OK and I was in error. As anyone following these errant considerations may have been thinking, it would be rare that a falling body may have been causing just the static weight force upon impact. Doing own's homework always solves that; by this estimate we see that even some averaged force amounts to 1000 times the weight if we want to reduce the penetration to 15 mm.

In any case this latest estimation (or even the first if the imparted force had been properly read by me) shows that the kinetic energy (as observed by others) will cause a force of such magnitude that will

rupture the slab and so (seeing the stress estimates by the far lower solicitations above considered) as concluded by delagina damage to the buried pipe is more than likely.

A proper statement of the evolution of the force during the impact whilst stopping requires a proper complete statement of the movement whilst stopping.

