# Guard Rail Impact Test

**Test set-up:**
The test set-up consisted of one 8'-0" wide section of Steel King Industries' 42"-tall 'Steel Guard' with two lev-els of three-ribbed rails. The posts are HSS4x4x¼ square tubing, ASTM A500, grade B, Fy min = 46 ksi, and the rails are 14½"-tall x 11ga, ASTM A1011 hot-rolled carbon steel, Type B, Fy min = 30 ksi. The end of each rail is attached to the guardrail post using three ½-13x5 grade 5 HHMB with a whiz lock nut. Each post is anchored to the floor using four ¾"φ mechanical expansion anchor bolts.

**Test procedure:**
The test procedure consists of driving an 8000# sit-down counterbalance with pneumatic tires into the 'Steel Guard' set-up. The forklift is traveling at 5 miles/hour or 7.33 feet/second at initial impact with the guardrail. The forklift is driven in reverse so as not to puncture the rails with the forks and to better distribute the impact force between both rails.

**Test results:**
The impact stopping time is assumed to be one second. The dent made in the guardrail measured 6 inches or ½ foot. The dent in the forklift is assumed to be zero. There was no observed damage to the concrete floor. There was no indication that any anchor bolt had loosened, bent, or pulled-out. Impact force equation: The equation for determining the force of an impact is as follows:

$$F = m * V^2 / 2 / (\delta c + \delta b) \text{ where}$$

$$F \equiv \text{impact force (lbs)}$$

$$m \equiv \text{vehicle mass} = 8000\# / 32.2 \text{ ft/sec}^2 = 250 \text{ lbs-sec}^2/\text{ft}$$

$$V \equiv \text{vehicle velocity} = 7.33 \text{ ft/sec}$$

$$\delta c \equiv \text{dent dimension in vehicle} = 0$$

$$\delta b \equiv \text{dent dimension in barrier} = .5 \text{ ft}$$

$$F = 250 * 7.33^2 / 2 / (0 + .5) = 13,400 \text{ lbs.}$$

**Test conclusion:**
From the results of this test along with other component testing, Steel King Industries rates its 42"-tall 'Steel Guard' guardrail with two levels of three-ribbed rails for an impact force (load) of 13,000 lbs.

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