

RoughDeck™

LOW-PROFILE FLOOR SCALES



Today's Floor Scale Market Offers Vast Differences in Price *and* Quality

Certain low-profile floor scales seem, at first glance, to be rather unbelievable bargains. Industry competition is intense for this large market, and the wide range of prices reflect this competition. List prices on the most popular sizes have dropped dramatically in the last few years. In fact, you can now purchase a 4' x 4' low-profile scale for 50% less than what the average 4' x 4' scale sold for almost 10 years ago!

This large price differential exists because of the introduction of several lightweight, light-duty floor scales. These scales, in the 4' x 4' size, may weigh as little as 180 lbs, as contrasted to 320 lbs for a heavy-duty model like the RoughDeck. To the casual observer, all floor scales look nearly identical on the surface—a steel platform 3" to 4" high, four beam load cells, four adjustable feet, and usually a junction box. Further muddying the waters, many of these scales are NTEP Class III, 5000d in some capacities, giving the illusion that all low-profile floor scales are equal and will stand up to the toughest industrial use. They aren't, and some won't, but only controlled testing and a close look at construction details reveal why. This technical bulletin summarizes the results of such testing and explains the important quality details to look for in a heavy-duty, low-profile floor scale.

Extensive Testing Highlights Differences

Staff engineers at Rice Lake Weighing Systems conducted a comprehensive floor scale testing program prior to the RoughDeck introduction. Many competitive floor scale designs were rigorously tested, and when the tests were completed, we saw major differences between heavy-duty floor scales and the new breed of light-duty scales.

Light-Duty vs Heavy-Duty

Light-duty floor scales are useful when weighing relatively light loads that are evenly distributed on the deck. Controlled loading of these scales is also necessary to prevent the introduction of damaging point loads from wheeled material handling equipment.

Heavy-duty scales, designed from the ground up for severe use, are necessary for long-term accuracy in tougher applications like the following:

- Concentrated loading in the center of the platform

- Off-center or edge loading with concentrated loads
- Ramp-equipped scales loaded by pallet jacks which may generate very heavy concentrated loads at the wheels
- Scales subjected to any degree of shock loading (shock of load on scale)
- Pit scales

Linearity, Hysteresis, Zero Return

When we aggressively tested competitive low-profile scales to capacity, our engineers found that the lowest-priced, lightweight scales had serious problems with linearity, hysteresis, and return to zero. Many of these lightweight scale decks flexed alarmingly with concentrated test loads. This abnormal deflection significantly impacted the linearity and hysteresis of the tested scales. Also in testing, these light-duty scales would often not return to zero after capacity loading. These problems were caused by poor foot design that allowed extraneous forces to be applied to the load cells.

The Design Challenge

Our engineers determined that these two design challenges—minimizing deck deflection and isolating the cells from extraneous forces—were the two most important keys to low-profile floor scale accuracy and long life.



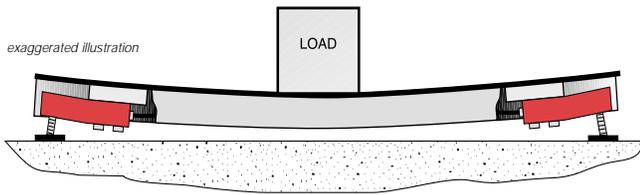
Low profile scales must withstand tremendous bending stresses on shallow deck structures supported only at the corners. Unless the deck structure is carefully engineered, concentrated loads will deflect the deck to a degree that destroys accuracy and may even cause the deck to take a permanent set.

In addition, loaded pallet jacks can generate very concentrated loads beneath their wheels. A lightweight deck plate lacking adequate underdeck support can become warped by the heavy point loads under the wheels.

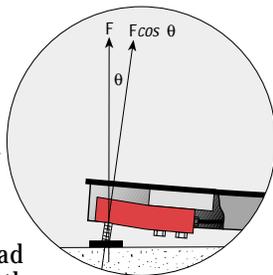
Likewise, accuracy is affected by loading the scale with forklifts or other wheeled material handling equipment that bump or jog the scale, introducing side forces to the load cells.

Platform Structure and Top Plate Design

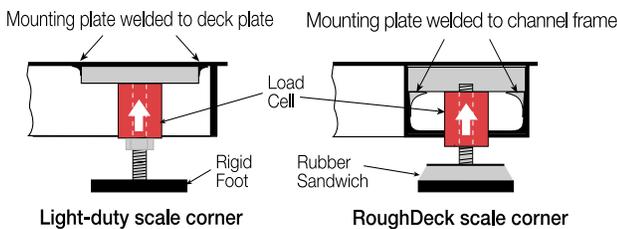
Low-profile decks need extreme rigidity to minimize deflection under severe loading conditions (typical of pallet jacks) or other concentrated loads. The exaggerated figure below illustrates the problems of deck and load cell deflection.



Load cells normally deflect under load, but when the deck also flexes, the load cells deflect from level, making the centerline through the load hole no longer vertical. If the load cell deflects through angle θ , the load sensed by the cell is only the $F \cos \theta$ component of the total force F . A torque is also present if the foot does not allow the threaded stem to rotate with the load cell. The greater the deck deflection, the greater the impact on accuracy. If θ is just 5° , the cosine error alone is .4%.

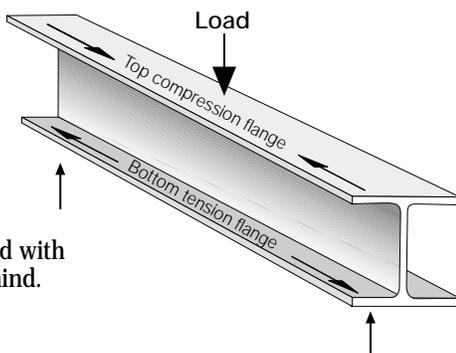


Localized deflection of the load cell mount plate also increases the error. A load cell mounting plate welded directly to a poorly-supported deck plate will deflect if the deck plate dishes under load. To prevent the load cell mount plate from deflecting, it should be attached to a heavy support frame member rather than to the deck plate.

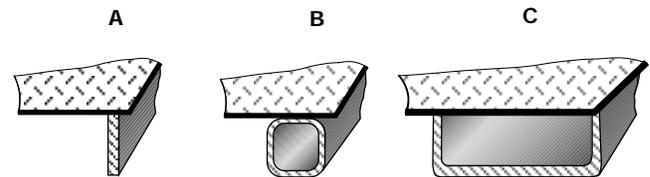


Good Supports Work Like Rigid I-Beams

To minimize deflection and stress under load, the scale's structural supports should function in the same manner as I-beams; the scale's deck plate acts as the compression flange and is connected by a vertical web to the bottom portion of the support that functions as a tension flange. An I-beam efficiently puts the material where it is most needed, in the top and bottom flanges. Scale structures should be designed with that principle in mind.



In our testing, we were surprised to find that many manufacturers had not taken advantage of this basic engineering concept to provide rigidity to their platform structures. To illustrate, various cross sections of low-profile floor scale supports are shown below.



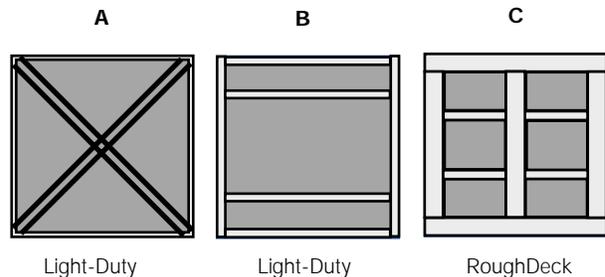
Scale A lacks a bottom flange entirely and therefore loses any I-beam advantage. Scale B uses a lightweight tubing structure and derives some I-beam benefit from the bottom section of the tubing acting as a tension "flange." The RoughDeck, by welding a heavy 6" channel to the deck plate, takes advantage of the deck plate as the compression flange and the 6" wide channel as the tension flange, providing exceptional rigidity. It should be noted that a very heavy top plate does not compensate for support members that lack a bottom flange.

Underdeck Supports

Underdeck structural support members should be engineered to meet two design goals:

- Minimize deck deflection in all directions
- Support the deck top plate adequately to prevent localized warping from heavy point loads over large, unsupported areas

Several designs used in low-profile scales are shown below:



Scale A uses double flat bar stock in a central "X" with a single flat bar around the perimeter. This design lacks intermediate supports to prevent the top plate dishing in the triangular-shaped areas, and the entire platform tends to deflect excessively from loads placed toward the center of one edge.

Scale B uses 2" x 2" tube supports and is more rigid in one direction than in the other. This design also leaves a large unsupported area at the center of the deck prone to dishing.

The RoughDeck design is equally rigid in both directions and provides good support to the top plate both along each edge and through the center. Intermediate supports are added to reduce unsupported areas that might otherwise result in the top plate dishing under heavy point loads.



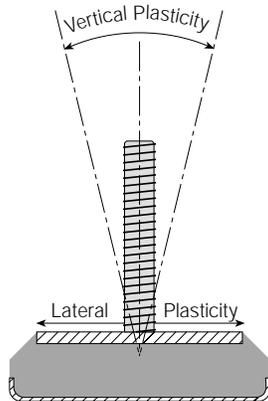
This design has proven so superior that the RoughDeck carries a full five-year, all-inclusive warranty.

Dependable Accuracy from the Bottom Up

Accuracy Requires a Specialized Foot

No matter how much steel is built into the platform, there will be some deck deflection under load. Also by design, load cells deflect under load; therefore, a good foot design must:

- Accommodate the unavoidable deflections in the platform and load cells
- Compensate for uneven floors
- Accommodate side impacts so the scale's return-to-zero is not impaired



Many foot designs cannot meet all these criteria. The RoughDeck was engineered to use a steel and neoprene sandwich design called SUREFOOT™. A steel cup sits on the floor and is bonded by a pliable neoprene cushion to a steel top plate with attached threaded stem. This pliable sandwich allows the stem and top plate some plasticity to move laterally and tilt independently of the bottom steel cup. This allows the foot to accommodate small deflections and uneven floors.

We found that many scales retained side loads and suffered from poor return to zero when bumped laterally. The slight plasticity flow of the SUREFOOT design eliminates such residual side loads and provides excellent return to zero.

Load Cell and Cable Protection

The unique channel structure of the RoughDeck provides enclosed protection for underdeck components so they can't be ripped out through rough handling and use.

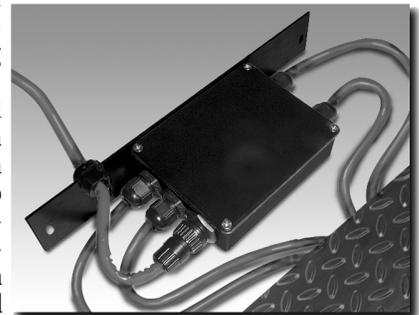
Load cells are recessed within the 6" channels, and conduit lies within the channels to ease pushing load cell cables through and deter rodent damage to cables. A 20' length of hostile environment indicator cable is included to complete the installation.

The HP model includes our new RL30000W NTEP Certified load cells that feature high-quality alloy steel and a welded seal. An improved strain relief on the cable entry helps provide additional protection from contaminants.

Junction Box Accessibility

Many industrial floor scales do not include a summing board with potentiometers, and cannot be accurately calibrated.

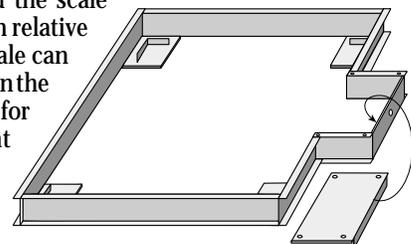
All RoughDeck stainless steel models have a NEMA 4X stainless steel junction box, while mild steel models include an aluminum NEMA 4 junction box. All RoughDeck models use a signal-trim summing board within the junction box with individual potentiometers for each load cell. The aluminum junction box also includes a panel-mounted, male quick-connect to mate up with a 20' cable with a molded female connector, reducing setup time.



The RoughDeck junction box is protected within the deck and channels, and is mounted as a handy slide-out tray that eases setup and service access. The RoughDeck side-entry tray allows an unbroken deck surface to guard against water and dirt infiltration.

Versatility for Pit Mounting

All RoughDeck scales can be pit mounted using our rigid channel pit frames. Each frame is the exact depth needed for the installation, so it can be used as a concrete form when pouring the pit. Each frame has a covered compartment for accessing the scale's slide-out J-box, and corner plates with integral stops to hold the scale feet in correct position relative to the pit wall. Any scale can be ordered with holes in the deck above each foot for adjusting foot height easily through the deck with a screwdriver.



NOTE: Additional structural reinforcements may cause the design of heavy-capacity models (10K to 30K) to differ from diagrams shown.