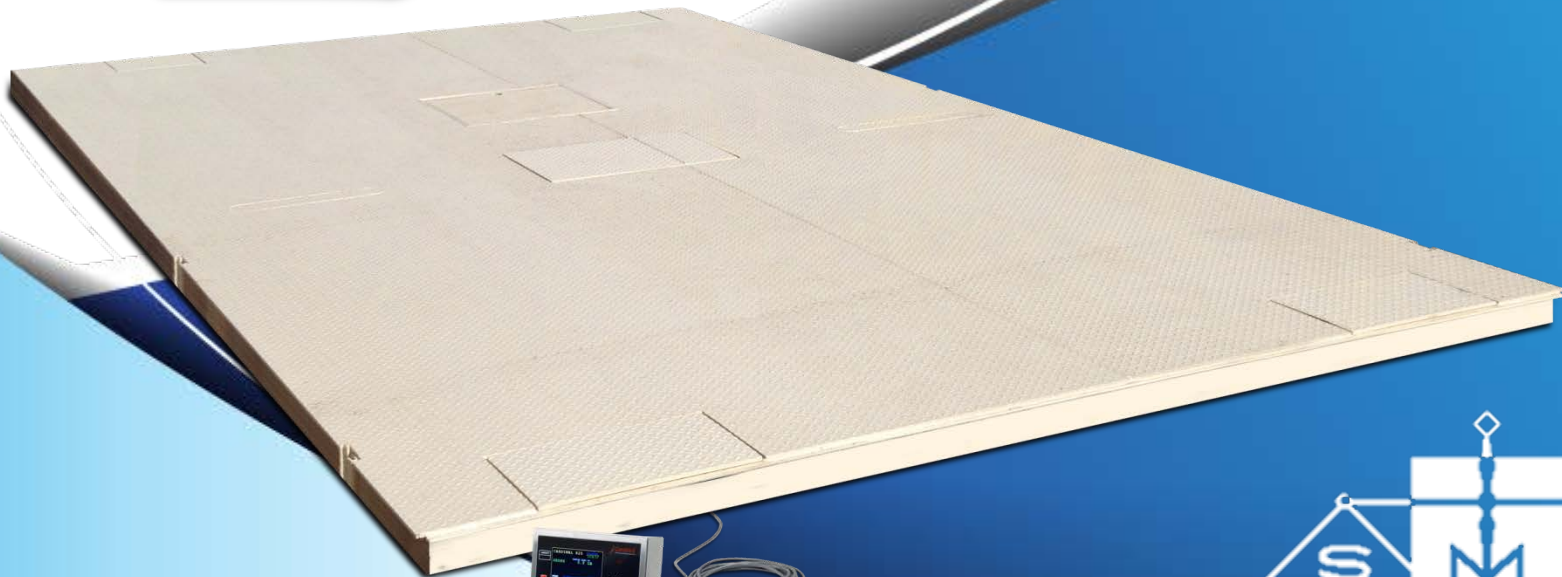


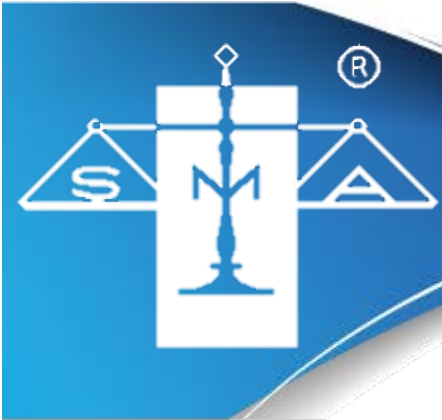
# VMIN DISCUSSION





# What is $V_{\text{MIN}}$ ?

According to NIST Handbook 44,  $V_{\text{min}}$  is the smallest load cell verification interval, expressed in units of mass, into which the load cell measuring range can be divided.  $V_{\text{min}}$  is specified by the load cell manufacturer and verified during evaluation by NTEP or OIML.



# How do you know if the $V_{\text{MIN}}$ is appropriate for the application?

**S.5.4 of NIST Handbook 44 states:**

**For scales without a lever system:**

$$V_{\text{min}} \leq \frac{d}{\sqrt{N}}$$

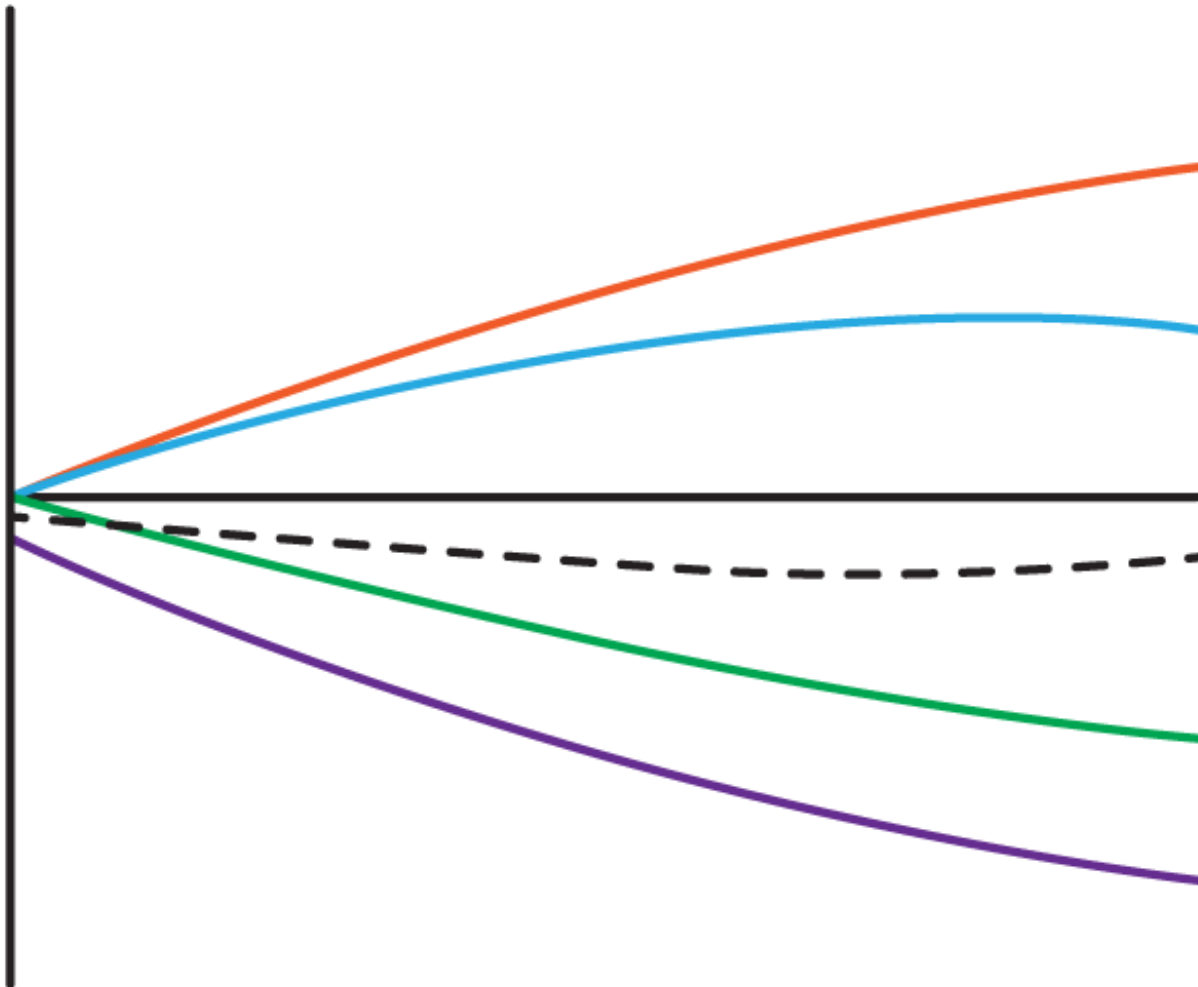
**Where:**

**d = scale division**

**N = number of load cells**

# Load Cell Errors

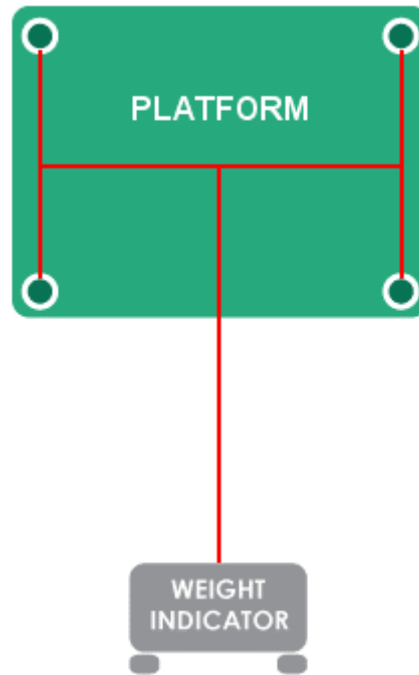
- Can be positive or negative
- Square root is used to address randomness of errors



$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

Cell 1	●
Cell 2	●
Cell 3	●
Cell 4	●
TOTAL	---

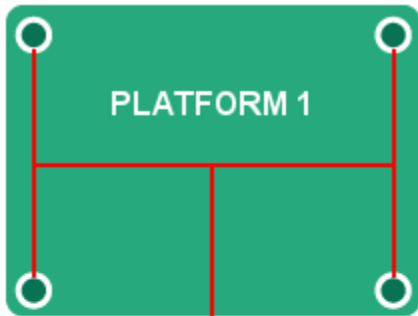
# Single Load Receiver



$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

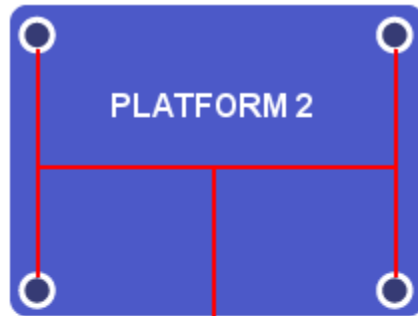
# Three Independent Load Receivers

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$



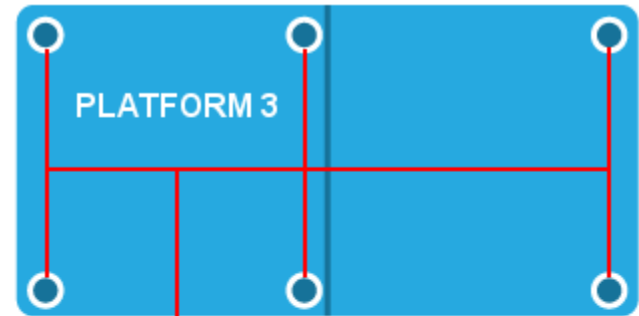
WEIGHT  
INDICATOR 1

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$



WEIGHT  
INDICATOR 2

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$



WEIGHT  
INDICATOR 3



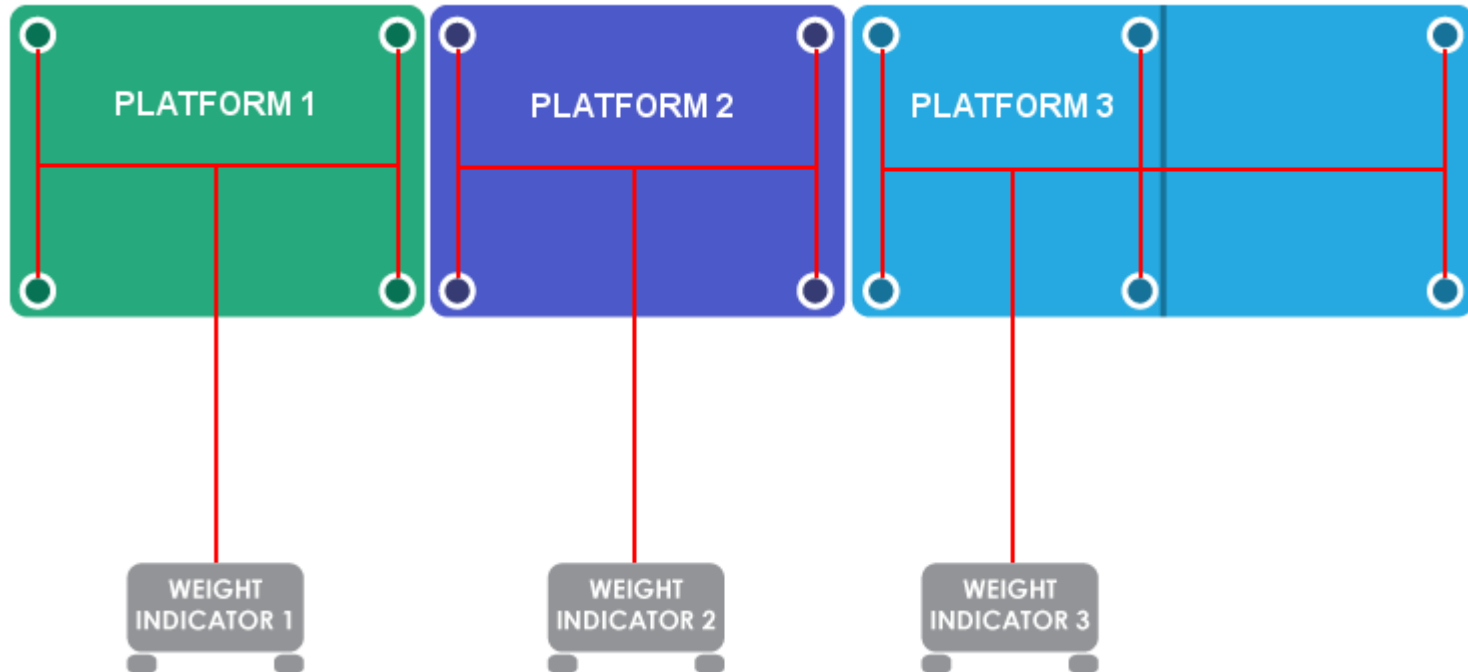
# Three Independent Load Receivers

PLACED END-TO-END, BUT NOT TOUCHING

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

$$V_{\min} \leq \frac{d}{\sqrt{N}}$$





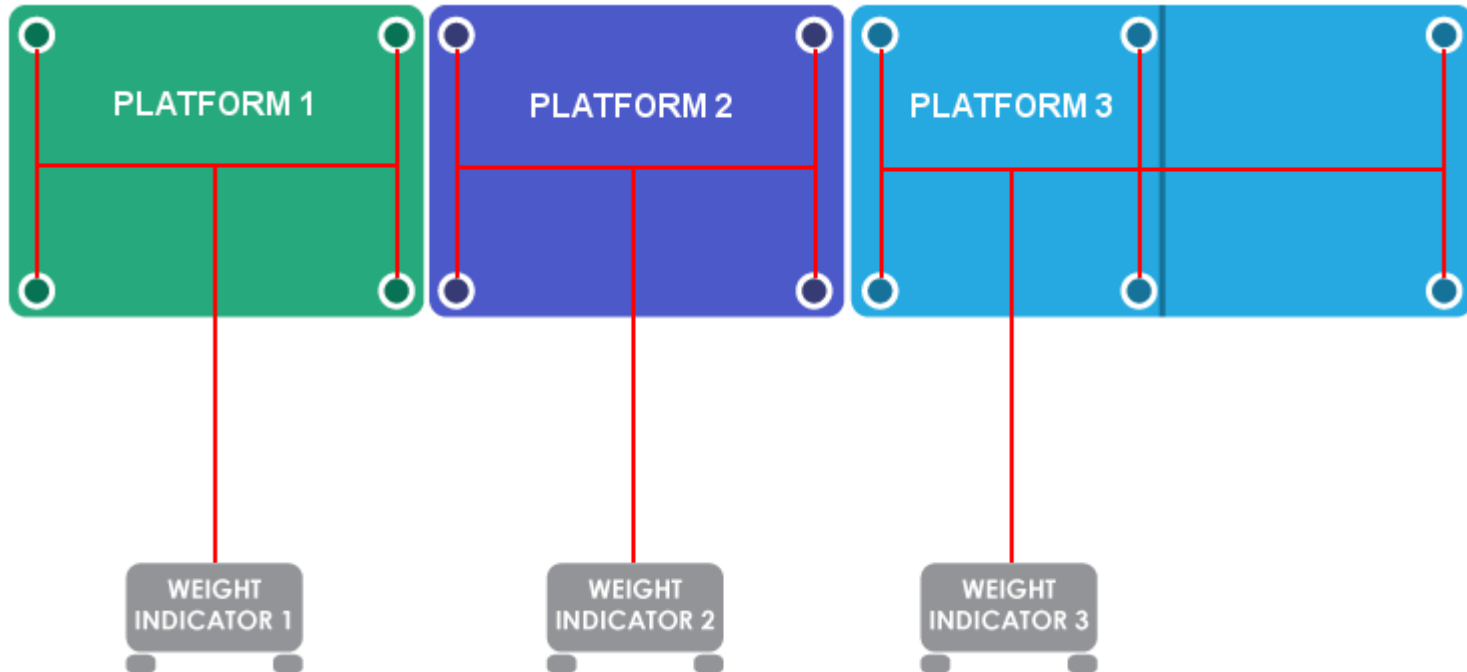
# Three Independent Load Receivers

PLACED END-TO-END, BUT NOT TOUCHING

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{6}}$$





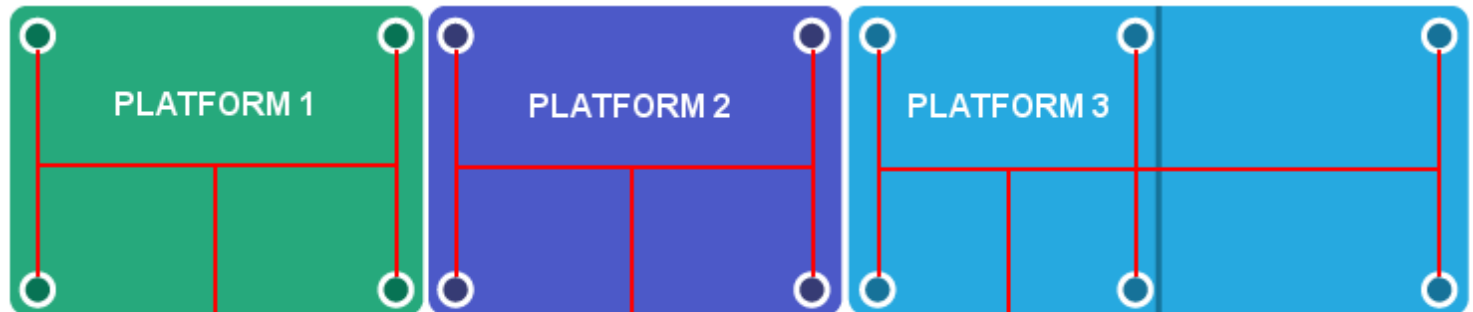
# Three Independent Load Receivers

WITH SINGLE INDICATOR AND SEPARATE DISPLAYED WEIGHTS

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{6}}$$



Platform 3	200
Platform 2	400
Platform 1	100





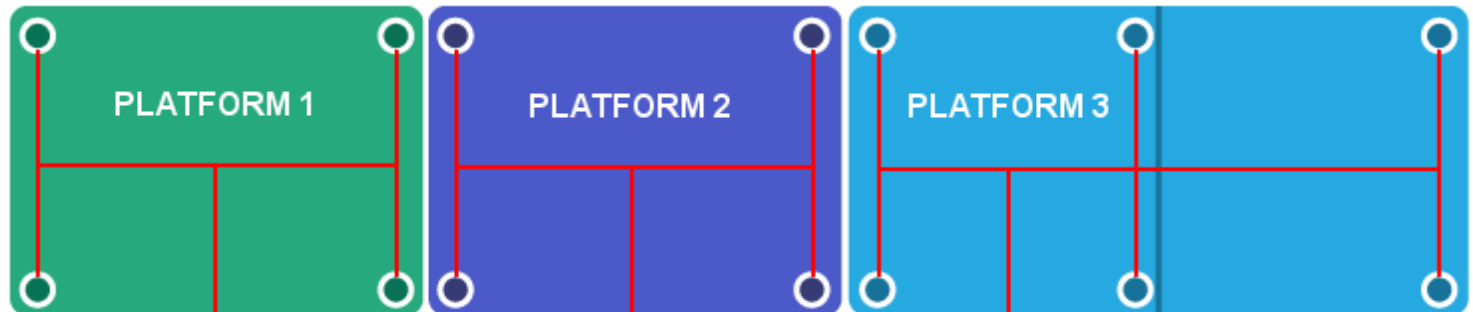
# Three Independent Load Receivers

WITH SINGLE INDICATOR AND SEPARATE DISPLAYED AND TOTAL WEIGHTS

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{4}}$$

$$V_{\min} \leq \frac{20}{\sqrt{6}}$$



Platform 3	200
Platform 2	400
Platform 1	100
<b>TOTAL</b>	<b>700</b>

~~$$V_{\min} \leq \frac{20}{\sqrt{14}}$$~~

# Total Weight Display



- Sum of individual load receiver weight readings.
- It is **NOT** a fourth scale.
- It has no measuring function in the calculation of the total weight. It is simply the mathematical summation and nothing else.
- Because there is no measurement function, there is no scale and therefore not subject to  $V_{MIN}$  requirements.



# UR.3.3 Single-Draft Vehicle Weighing

A vehicle or a coupled-vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each of such vehicle or individual elements of such coupled combination. However, the weight of:

- A. A coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or
- B. A vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

**Note:** This paragraph does not apply to highway-law-enforcement scales and scales used for the collection of statistical data.

(Added 1992)



## **LOAD RECEIVERS COMMONLY FOUND IN COMMERCIAL VEHICLE WEIGHING AND OTHER APPLICATIONS:**

- Have their own weight displays for each load receiver
- Each load receiver has its own unique serial number and security seal
- May have a single catalog number that lists the individual load receivers comprising the system
- Have a single total weight display that sums the individual load receiver weight displays
- Comply with T.N. 4.4. for Shift or Section Tests

