# Preparing for legislation on verification of container weights

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The work by the Maritime Safety Committee (MSC), within the auspices of the International Maritime Organization (IMO), on the verification of container weights prior to loading on to a ship is progressing. Currently, expectations are that legislation will come into force in 2017 at the latest, and possibly in 2016.

Many terminal operators are concerned about how to comply with the upcoming legislation, and how it will impact on logistic flows in terminals.

One of the challenges facing terminals is how to weigh containers with little or no impact on operations. Transferring containers to separate weighing stations will affect productivity. Terminals are likely to need additional space and transportation capacity to cope effectively.

Solutions that weigh containers as part of existing logistic flows and operations will therefore deliver significant advantages for terminal operators.

## Weighing alternatives

This article outlines technologies that are available for managing weighing or verifying weight. It should be noted that requirements for weight accuracy is not included in the current draft text from the IMO and will likely put further constraints on available options. The discussion here indicates what level of accuracy can be expected from the various options available.

Three different types of weighing or load measurement devices will be discussed: commonly available weigh bridges; load sensing devices in cranes and other lifting equipment and load sensing devices fitted to, or integrated into spreader twistlocks.

### Weigh bridges

The first system that comes to mind when looking at weighing a container is the weigh bridge. Weigh bridges are a long-established and recognised technology to measure the weight of a vehicle. When the weight of the container being carried by a vehicle is of interest, the tare weight of the vehicle must be deducted. The measuring accuracy of the weigh bridge is very high but the tare weight deduction process either introduces additional inaccuracies or becomes complicated and time consuming.

If a standard vehicle tare weight is used, the inaccuracy comes from such things as variations in fuel level, driver weight and the weight of miscellaneous materials also loaded in the vehicle. These may seem like minor aspects when considering a truck carrying a 40ft container, but it easily adds up to a few hundred kilos, thereby significantly affecting the accuracy of the container weighing process. The alternative to using a standard tare weight is to include weighing of the unloaded vehicle in the process. This will give an accurate vehicle tare weight and ultimately, an accurate container weight, but it adds steps to the process which takes time and uses terminal resources.

Using weigh bridges to weigh containers is likely to result in changes to the internal logistics of most existing terminals. All containers entering terminals by road would have to pass through the weighing station. The most critical factor in this scenario would be to have sufficient weigh bridges to avoid the bottlenecks and resulting congestion.

Containers arriving by train or sea (for transhipment) would have to be sent to a weighing station, a step which is uncommon in terminal logistics today. This additional step would tie transporting vehicles to specific containers for longer periods of time ultimately resulting in additional resources being needed to handle the same container volumes. Sufficient resources in terms of weigh bridges and transportation space therefore need to be allocated to avoid congestion and delays.

Another situation which would require a specific process to be in place is where vehicles arrive at the terminal gate with two twenty-foot containers loaded. Weigh bridges can only determine combined weight. Because containers have to be weighed separately, this would imply a relatively complicated process involving not only the truck carrying the equipment but also terminal resources to facilitate the loading and unloading of the containers.

### Load sensing devices in cranes or other lifting equipment

The second type of load measuring device is, in effect, several devices with common features. This group includes load sensors and devices on ship-to-shore (STS) cranes; rubber-tyred gantry (RTG) cranes; rail-mounted gantry (RMG) cranes; mobile harbour cranes; reach stackers; straddle carriers and so on. Most of the load sensing devices in this group are used for safety and/or stability systems, but the information is available to provide weight information with some limitations as outlined below.

The biggest question mark related to these systems is accuracy. Will the accuracy of these systems meet the requirements to come? The answer is most probably no, but until the requirements are defined, this option should be mentioned. Sensors in these devices are typically fitted to rope and chain anchors, in trollies or on booms. Distance from the container, and

| | Weigh Bridges | Crane Solutions | Spreader Twistlocks |
|---|---|---|---|
| Accuracy | 0.2-0.5% of full scale | 3-5% of full scale | 0.5-1% of full scale |
| Twin lift | Only total weight | Only total weight | 0.5-1% of full scale |
| Effect on terminal operation | Yes | No | No |

Figure 1: Summary of weighing solution characteristics.

the dynamic effect this introduces adds to inaccuracy. These systems will typically have a measuring accuracy of plus or minus five percent.

The second issue with this group of systems is that they will not be able to weigh individual 20-foot containers when lifted in twin mode. Other means to weigh individual units would have to be employed resulting in additional steps in the terminal's logistics flow. However, one of the advantages these systems offer is that they are used during the normal lifting cycle. No extra time is required for weighing, with the exception of twin-twenty lifts. Neither do these systems require any extra space or separate lifting equipment.

### Load sensing devices on or in the twistlocks of spreaders

These types of devices are slowly catching the interest of the market. This technology is also being used in various safety-related applications, but the features of the system related to weighing are also attractive. The measuring accuracy of these systems is typically within plus or minus one percent. This is not as accurate as the weigh bridge, but it is within a range that can be considered a realistic requirement from the IMO. When installed on spreader twistlocks, these systems also have the advantage of only measuring the container weight as it is directly connected to the container without intermediate wires, chains or other load adding structures.

Weighing is done as part of the normal lifting cycle, and operations remain unaffected. Algorithms are integrated in the systems to determine the weight of the container from the load pattern generated throughout the lift cycle. This also means that no additional inter-terminal logistics are required which enables operations to function as normal.

Measuring the load on each twistlock engaged in the container corner castings implies that determining the weight of individual 20-foot containers even when lifted in twin-mode is possible. One of the topics often discussed when twistlock-based weighing is considered, is where to install these systems. Installing them on the STS cranes for weighing is commonly regarded as too late in the process. The value of obtaining weight data when a container is in the air being loaded is limited. What happens if a container is falsely declared or even overweight? A preferable position is to install the systems on yard handling equipment. In the vast majority of terminals, containers pass through yards at some point and this is therefore a good option for installing twistlock-based weighing systems.

Load sensing devices on or in the twistlocks of spreaders have a measuring accuracy within plus or minus one percent


## In summary

When verification of container weighing becomes mandatory, there are several weighing solutions available, each with different characteristics, each with their own strengths and weaknesses. Overall, it is not possible to say that one solution is better than another. The specific characteristics and requirements of individual terminals will have to be considered, and will impact system selection accordingly. See Figure 1 for a summary of the factors and characteristics described in this text.

## About the author

Mr. Lars Meurling is the vice chairman of the PEMA Safety Committee. Lars is a member of PEMA representing his company Bromma. Bromma was one of the first companies joining PEMA and has been a member since 2004. Mr. Meurling holds the MSc degree in Engineering Physics from Uppsala University in Uppsala, Sweden. He is based at Bromma headquarters in Stockholm, Sweden where he serves as the Marketing Director.

## About the organisation

Founded in 2004, PEMA provides a forum and public voice for the global port equipment and technology sectors. The association has seen strong growth in recent years, and now has nearly 70 member companies representing all facets of the industry including crane, equipment and component manufacturers; automation, software and technology providers; consultants and other experts.

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