



 Strainstall

THE OPTIONS

FOR PORTS OFFERING VGM COMPLIANCE

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There are numerous candidate systems and technologies that are capable of delivering the required accuracy of measurement required under the new SOLAS regulations. Not all, however, are particularly practical in terms of their ability to operate as a part of the existing flow of cargo between consignor and recipient.

This paper reviews the options available to ports with some of the considerations that port operators may take into account when making choices about how to provide a VGM service to their customers.

WEIGHBRIDGES

Weighbridges are proven technology for the measurement of gross vehicle weight and provide this to a high degree of accuracy. However, weighbridges do not in themselves directly deliver the required gross mass of the container required by SOLAS. Instead, to arrive at this figure the tare weight of the vehicle (including both the tractor and chassis/trailer as appropriate) plus the mass of any fuel in the tank, additional items carried and the driver, must all be subtracted in order to deliver an accurate container weight.

Some have suggested using various

declared 'standard' vehicle weight figures such as mass in running order (MIRO), but there are two problems with this approach. Firstly, these standard weights are an approximation based on assumptions regarding the vehicle variables (such as quantity of fuel carried) but the regulations do not allow for the estimation of the container weight.

By subtracting an estimation of the vehicle weight to arrive at a weight for the container inevitably means that the weight of the container is also an estimate. The second problem with this approach is that even if you except the principal of estimation to arrive at a container weight, if you consider the effect of the vehicle variables on the container weight tolerance you conclude that these effects could put you beyond the enforcement threshold for container weight. For example, most trucks have a 500 litre fuel tank giving a variable of 425kg between a full and empty tank. If your container weight is 8000kgs then this variable alone could result in an error of over 5% on your container weight. If the effect of the other variables is added to the accuracy tolerance of the weighbridge itself it is easy to see how you could end up being

well over the enforcement tolerance for the container VGM.

This means that you must weigh the truck and trailer again once the container has been removed in order to subtract an accurate value for the weight of the container in isolation. To achieve this some ports are considering weighing the truck / trailer combination again with the container removed. Although this would almost certainly give an accurate VGM in compliance with the SOLAS regulations, it does add an additional weighing process giving the potential for delays with bottlenecks at the gates. Alternatively, some are considering locating a reach stacker or another container handling crane at the weighbridge in order to temporarily lift off each container as it comes over the weighbridge, but again this is going to result in delays at the gate and will require a dedicated container handler and driver giving a high cost.

For some ports who already have weighbridges, this maybe a good short term solution, but is not a cost effective solution in the long term.

In addition, where a vehicle is used to convey more than one container, simply

dividing the total mass – after subtracting the effective vehicle tare weight – is not acceptable under the new regulations as a means of calculating individual container weights. In this instance three weighing operations may be required or each container lifted off at the weighbridge separately and then together to obtain the necessary VGM.

From the perspective of cost, weighbridges represent a reasonable capital investment in themselves, but often the civil works associated with their installation and operation can be significant. A lower cost alternative is to use weigh in motion type weighbridges, but these have been designed typically to detect overweight vehicles and are not sufficiently accurate across the weight range for SOLAS VGM purposes. Operating costs to obtain a VGM using weighbridges vary depending on how it is used to obtain a VGM as highlighted above, but are likely to be high.

For some shipping operations – particularly where vehicle weights are required for other purposes and hence access to an existing weighbridge is readily available – this may provide a pragmatic if operationally complex route to SOLAS container VGM compliance. In most cases, however, an alternative based on integration of container weighing into equipment already used for container handling within the terminal is likely to

be operationally less disruptive and more cost-effective than installing weighbridges specifically for the purpose of obtaining a VGM.

CONTAINER HANDLING CRANE SOLUTIONS

Crane based solutions offer an attractive alternative to using weighbridges. These systems obtain VGM data during the course of the normal port container handling operations and so require no change to the current port operating procedures whatsoever. Arguably crane based solutions are the only solution to obtain the VGM without any additional time or procedural impact in the whole shipping supply chain and therefore are the most cost effective solution overall. There are different options available to retrofit to existing equipment which are discussed below, but importantly no modification work is required to the spreader or crane to install these systems, they directly replace existing elements of the system making installation quick, easy and low cost.

TWIST-LOCK BASED SOLUTIONS

Solutions integrated with spreader twist-locks offer at first sight perhaps the most attractive approach to accurate container weight measurement. The need for robustness here is, however, significant. It is widely accepted that the most abused

part of a crane is the spreader mechanism, which is exposed to numerous impact loads that can be significant. Any measurement solution must be sufficiently robust to withstand these repeated loading cycles and excess loads while also maintaining its calibration accuracy.

A key consideration for such a solution is whether the measurement technology is integrated within the consumable parts – the twist-locks themselves – or instead within their associated collars or other non-consumables.

There are two reasons that favour the latter approach: firstly, twist-locks need to be replaced on a regular maintenance cycle, meaning that any measurement system integrated within them must be removed with the obsolete part and either replaced or reinstalled and recalibrated in the new replacement locks. The more complex and sophisticated the measurement equipment incorporated into the twist-lock, the more expensive and potentially disruptive to operations its replacement is likely to be. Secondly, twist-locks are not ideally designed for load measurement purposes, and due to the aggressive duty they are subjected to, they are susceptible to the type of damage which while acceptable for normal operations, may compromise the accuracy or calibration of any measurement systems integrated within them.

Dynamic Weighbridges for SOLAS Method 1 Weighing

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For ports wishing to implement a twist-lock based container VGM system, solutions based on durable and long-lasting strain gauge instrumented twist lock collars give the best option. This approach offers the best available form of twist-lock based solution in terms of cost, accuracy and long term durability.

LOAD PINS INTEGRATED INTO THE SPREADER HEADBLOCK

Load pins offer perhaps the most well-proven, robust, cost effective and accurate means of weight measurement, and can be integrated into a wide range of port and terminal equipment. This is a mature, cost-effective and highly accurate technology proven across a wide range of industries.

There are two key advantages of using pins in the headblock. Firstly, they do not need to be replaced and will last the lifetime of the crane / spreader arrangement and are essentially maintenance free with greasing achieved through automatic or manual greasing in the same way as the pin it replaces. Secondly, the accuracy of the system will remain stable over the lifetime of the system as, unlike the twistlock solutions, the pins are remote from the possibility of damage caused by the constant connecting and disconnecting of containers.

This solution is likely to yield the lowest

ongoing operating cost as the entire system lasts the lifetime of the crane, there is no service or maintenance requirements and only requires annual verification to check the system remains within accuracy tolerances.

CALIBRATION VS VERIFICATION

For systems that are fitted as part of the permanent equipment of the crane / spreader arrangement, the load cells are provided calibrated to a high accuracy and provided these load cells do not get physically damaged there is no need to ever recalibrate them. However, in order to verify that the system is undamaged and reading correctly, a simple on site verification using test weights should be conducted, usually on a frequency of every 12 months. This is a simple and quick process that can be undertaken by the ports themselves and does not need OEM service intervention enabling costs to be minimised.

For systems where the twistlocks themselves become the load cells, each time the twistlocks are replaced as part of the regular replacement schedule they will have to be replaced with pre calibrated twistlocks or the system will have to be calibrated with the new cells on site which typically is a more onerous process than simple verification.

For weighbridges, on site servicing

and calibration requirements are well established. However, the requirements for obtaining a VGM may require multiple weighing operations in order to obtain a VGM as highlighted above. Therefore the utilisation of existing weighbridges is going to increase significantly making any outages for calibration, maintenance or servicing work a potential cause of significant disruption to port operations.

ACCURACY CONSIDERATIONS

Traditional weighbridges themselves are typically very accurate but weigh in motion systems are significantly less accurate. As highlighted above however, when using weighbridges the accuracy of the VGM is dominated by how the vehicle weight is tared to obtain the VGM for the container rather than the accuracy of the weighbridge.

For crane based systems, the system is directly weighing the container so the accuracy of the VGM is based on the accuracy of the weighing system. Crane based systems are typically slightly less accurate than weighbridges but their accuracy is more than sufficient for the purposes of SOLAS.

A crucial consideration regarding the accuracy claims of candidate systems and suppliers, is whether they are expressed in terms of a percentage of the maximum

load (often referred to as the percentage of Full Scale or Rated Capacity) or across the full working range of the system (often expressed as percentage of Applied Load). This is important, as an accuracy of $\pm 1\%$ of Rated Capacity for a 40 tonne system, for example, will only provide an accuracy of $\pm 400\text{kg}$ across the working range giving the potential for a 10% error when lifting a 4 tonne load.

To ensure full worst case compliance with SOLAS therefore, we have ensured that our VGM solutions are highly accurate across the full range of possible container weights and not just at high loads. As such, our customers are assured that their equipment will be compliant from the very lightest to beyond the maximum allowable weight of a loaded container.

TOS INTEGRATION

For weighbridges the VGM will most likely be fed into the TOS manually once the VGM has been calculated by removing the tared vehicle weight. With several weighing operations needed to calculate the VGM it may be difficult to automate this procedure and care will be needed to avoid errors.

For crane based systems most are designed to provide the VGM weight data automatically in standard data formats that can be received by the TOS. The systems typically integrate with the crane PLC and provide a time stamp with each VGM to allow the TOS to automatically associate

the VGM with a particular container. No driver intervention is required eliminating the possibility of human error.

CONCLUSIONS

For ports who already have existing weighbridges, if an acceptable and cost effective procedure for taring off the vehicle weight can be established then this will give a solution for obtaining a VGM in the short term. However, due to the procedural complexities associated with the use of

weighbridges, there is a risk of disruption and delays to port operations. For those ports without existing weighbridges, this option is unlikely to be cost effective and a crane based system is likely to be lower cost in terms of both capital and operating costs giving the most cost effective route to obtain a VGM. With these systems having no impact on port operations these solutions are likely to minimise disruption and delays associated with obtaining a VGM for the new SOLAS amendment.

ABOUT THE AUTHOR

Simon graduated with a degree in mechanical engineering from Cambridge University in 2001 and after a short spell at Ineos Chlor joined James Fisher and Sons plc in 2004 where he became Managing Director of one of their subsidiary companies, RMS Ltd, supplying specialist downhole equipment for the oil industry. After the successful acquisition and merger of Pumptools Ltd to form RMSpumptools Simon moved to the Isle of Wight to run Strainstall Ltd, another James Fisher group company in 2011. Strainstall supplies load monitoring products and solutions into many industries all over the world, in recent years expanding with new products and targeting new markets. In the last two years Strainstall has developed, and is now supplying it's Container Weight System (CWSTM) specifically designed

to retrofit to existing ports container handling equipment to meet the upcoming requirements of the SOLAS amendment.

ABOUT THE ORGANISATION

Strainstall is a member of the James Fisher & Sons plc group. The company is a broad-based engineering business, specialising in load measurement and sensor based safety technology. Based in Cowes, Isle of Wight, it has long been associated with the manufacture of standard and bespoke load cells, and has over 50 years' experience in assisting industries to operate safely by ensuring that structures, equipment and infrastructure are safe to use.

ENQUIRIES

www.strainstall.com



Safety first

Container Weight Declaration

The SOLAS amendment contains a new rule as of 1 July 2016. Shippers have to verify the total weight of all loaded containers via the Container Weight Declaration. The Sea Module of our online software solution DGOffice prepares this container handling certificate for you within a few easy steps. Visit our website for more information and apply for a free demo version!

For all your other Dangerous Goods activities, via any mode of transport, or handling, storage, production, and more, DGOffice provides all necessary regulatory information and prepares required documents.



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