

# Intelligent Decision Support for Compliance Options for IMO SOLAS VGM Regulations

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## *Abstract*

*The International Maritime Organization (IMO) has adopted amendments to its Safety of Life at Sea (SOLAS) Convention setting new rules to weigh all the containers before they are loaded in a view to reduce the casualties in sea. This is a concern now, as not all ports are ready to accommodate this change. To investigate the impact of these regulations, we reviewed literature, conducted interviews, visited several ports and sought an amicable solution, which is inline with the existing processes at the port in a seamless way. We identify the major advances in weighing systems and highlight a few gaps with the current procedures. In this article, we propose a Decision Support System that can connect to the common Databases and use machine-learning techniques to adapt to the regulations. We also propose a Mobile Application (APP) to notify the user about the status of the container at various levels in the port.*

## INTRODUCTION

In this paper we are tackling the complexity of compliance issues that ports and terminals will face and have to make decisions. Under the new rules, a VGM can be declared using one of two methods; Method 1, weighing the complete container including all contents after it has been packed (or) Method 2, weighing all the cargo and contents of the container and adding those weights to the container's tare weight as indicated on the door end of the container. In order to carry out our research, we planned to design a simulator to analyze policies and simulate containers with a randomizer. The simulator should be able to randomly assign one of the specified behaviors of the container. Our aim for this project is to make an analytical proof in order to answer our research questions. This is the only method we found so far that relates to container weighing management

and compliance, therefore it seems to be the right approach.

Our aim being to make an analytical proof, we wish to simulate for different cases of containers arriving with differing weights, ports randomly and collect the data. This data can be used to create a proof. More specifically, we want to make a proof of a statement (e.g. "Database X contains a valid Weight about Container C"), thus we will acquire the ability to do so.

Data collected from research is obtained. Analysis will be done to check whether our scheme works or not. After the check, two groups will be formed i.e. working schemes and non-working schemes. From these results, we will be able to conclude about our solution.

A perfect simulation is not possible because only a pseudo random generator exists in programming languages. Therefore, we wish to interview the novice and experts of this field to get an insight on the problem.

## PROBLEM DESCRIPTION

The following problems, as identified by PEMA (Port Equipment Manufacturer's Association), are considered critical into developing any solution for the Verified Gross Mass (VGM). In complying with the new rules, a variety of commercial, operational and technical decisions need to be taken; since ports are not obliged to provide VGM as a service, but equally are not allowed to load a container without a VGM. This leads to issues that require Intelligent Decision Support Systems to handle the following:

1. *What is the impact of VGM on container port and terminal processes, in terms of physical handling and data flows?*

2. *What are the key legal requirements and technology options for weighing containers in ports and terminals to enable VGM compliance?*
3. *What are the pros and cons of weighing containers in ports and terminals versus elsewhere in the supply chain (i.e., at shipper premises, pack house etc)?*
4. *How should VGM compliance best be managed between the different parties involved – shipper, freight forwarder, shipping line, port, terminal?*
5. *How can container terminals incorporate VGM as a free or paid service without disrupting operational productivity?*
6. *What could (worst case) and should (best case) happen when containers arrive at a terminal without a VGM?*

## SOLUTION METHODS

As shipping happens across borders, there are many legal regulations that need to be adhered. In order to ensure safety, there is a new policy to ensure that only cargo having an approved VGM would be allowed into the port and others will either have to be re-weighed or sent back to Freight-forwarder or shipper.

With the current technology, it is possible to embed computational capability in every object. As the weighing process can happen anywhere in the system, it is best to have a locked, foolproof metering system that can record the weight of the cargo and immediately record it in the database. With that there can only be one database and each unique id of cargo will have a weight record. This data can be used to generate QR codes, which can easily be scanned. Also for storing and processing of the data, low cost computers like Raspberry Pi or Beagle bone can be used by creating clusters and using Hadoop.

Another alternative to this is weighing everything at once and this can be made possible by using PLCs and hooking sensors to weigh the container and record it in the database. A decision support system can be designed and integrated with an Android Application. The decision support system should be able to carry out the following operations:

1. Access the latest records with weights and unique ids in the database.
2. Should be able to access and update the status of the container at different levels in the port.
3. Map the recorded weight of the container to one in

the database.

4. Compare the differences in weights with the permissibility limits.
5. Should be able to take decisions as to whether or not the container can be loaded.
6. Able to calculate and invoice the penalties in case of non-compliance to shipper for the wrong declaration.
7. Access the type of goods being shipped and map it with weather conditions.
8. As containers are weighed at the port of exit, intermediate ports and port of entry, DSS should be able to raise an alarm for the containers that were halted at or arriving from ports prone to pirate attacks.

The solution that we propose is a low cost solution and therefore the overhead for weighing should not be too much but it is still unavoidable to have an overhead as the new process needs to be attended to with some effort. The biggest advantage is that there will be a standardised structure and flow which will potentially make container movement seamless but at a cost.

Process of Weighing the cargo has to be distributed and at the same time monitored. This can be made possible by having foolproof metering devices that can remotely send data to the cloud server. Currently, many containers are equipped with RFID, seals, barcodes and other id and sensor technology. The information pertaining to weight of the container's shipment can be updated and cross checked with the packing list and Bill of Lading to ensure accuracy as well as to identify responsibility in the activity of shipping in the supply chain.

As non-compliance can lead to casualties, it is best for ports to accept only those containers that adhere to the rules. However, this will have disastrous effects in shipping and may lead to huge losses. In case a container arrives without a VGM, it will have to be weighed at the first port of exit and has to be recorded into database for further retrieval and use of it.

## REFERENCES:

- [1]. <http://www.imo.org/en/About/Pages/Default.aspx>

[2].<http://www.imo.org/en/KnowledgeCentre/ShipsAndShippingFactsAndFigures/TheRoleandImportanceofInternationalShipping/Pages/TheRoleAndImportanceOfInternationalShipping.aspx>

[3].<http://www.worldshipping.org/industry-issues/safety/cargo-weight>