COMPLIANCE OPTIONS FOR IMO SOLAS VGM REGULATIONS

REPORT FROM EM NORMANDIE WINNINGTEAM AT PEMA STUDENT CHALLENGE 2016

Sai Tejaswi KARRI, Charlotte LEBOURG, Jawad SIDIQI, Chenhua WANG

Preface: Dr. Alexandre Lavissière

PEMA
PORT EQUIPMENT MANUFACTURERS ASSOCIATION

EM NORMANDIE

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Doctor Alexandre Lavissière

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This document is a report produced by the students of EM Normandie. The findings, interpretations, and conclusions expressed in this document do not necessarily reflect the views of the Executive Directors of EM Normandie or its stakeholders.

This report has been presented to the 4th Port Equipment Manufacturers Association (PEMA) Student Challenge at TOC Europe 2016. It received the first prize of the challenge attributed by an international jury of professionals.

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 over 100 member companies representing all facets of the industry, including crane, equipment and component manufacturers, automation and software and technology providers.

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Port Equipment Manufacturers Association (PEAM) for this opportunity and the organization of the challenge;

The jury for this challenge and especially DP World Institute, HHLA, FEPORT, TBA and World Cargo News;

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HAROPA

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Charlotte LEBOURG joined Ecole de Management de Normandie after a "classe préparatoire". In her last year of Master Degree she chose the supply Chain specialization and is working at the same time as administrative and commercial assistant in PGS Group, a pallet producer. Before that she worked one year as export assistant in Sika, an industrial chemical company.

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Ecole de Management de Normandie :

Founded in Le Havre in 1871, Ecole de Management de Normandie is one of the oldest established French business schools. Among the best Business Schools in the world, EM Normandie holds AACSB and EPAS accreditations and it operates 5 campuses in Caen, Deauville, Le Havre, Paris & Oxford.

Professionalization plays a leading role in the School's pedagogical approach. A definite must for students, daily immersion in the business environment gives them the opportunity to apply the academic knowledge acquired during class in the field. The majority of EM Normandie programs offer several months minimum in a work placement.

EM Normandie has a strong concentration in Logistics with a dedicated Bachelor Degree in International Logistics, two Masters in International Logistics & Port Management and Supply Chain Management, a MBA in International Transports and the Institute of Port Education and Research (IPER), known as a leader in the training of port executives in the world.

Sai Tejaswi KARRI

Charlotte LEBOURG

Chenhua WANG

Jawad SIDIQI

Jean-Guy BERNARD
Director-General
EM Normandie

FOREWORDS

Ecole de Management de Normandie trains talents who are becoming managers all along the path of their education. Pedagogy of the school relies on close relationships between professors, students and the business environment. Training periods, missions for companies, gap years abroad, apprenticeships and business games are among the tools that make our students operational managers when it comes to confronting what they learned with the constraints of decision making in companies.

EM Normandie staff is, therefore, very proud when a team of students, especially such an international crew, coached by our permanent professors reaches the final of such a contest and then wins it. PEMA is an important professional association in the port industry and its Student Challenge is a reference for managers of the sector worldwide. It is important for us to be part of this kind of event. International logistics and port management is one of the specialties in our business school and in our port of Le Havre. While students were the architects of this victory, they were able to rely on the foundation of the port community of Le Havre that was available to answer their questions and guide them about this very specific topic.

As a Director-General, I am therefore very proud to have students who receive such international recognition by providing innovative solutions and recommendations to the port communities around the world.

Jean Guy Bernard

Director-General EM Normandie

The generalization of container transport, the gigantism of the latest generation of container ships, the opportunities offered by information technology are all developments that have transformed the concept of maritime shipping, and the responsibility assumed thereon by the captain.

The mastery of new risks requires the involvement of all actors in the supply chain of maritime transport and the new verification rules on containers gross mass, or more simply, "weighing" containers are, in this sense, a quite iconic case.

It is both a security progress and a remarkable evolution in order to respond to a problem. Container weighing alone certainly does not solve all problems and its implementation presents challenges; it is however for each of the players to ensure that the new rules are a real step forward in the overall control of security of the transport chain.

This document prepared by the students of Ecole de Management de Normandie in Le Havre participates undoubtedly in a better understanding of the issues and the context of the new rules, as well as guarantees their success. Therefore, the Permanent Representation of France to IMO is happy to be able to contribute modestly in the forewords and in addressing our most sincere congratulations to these young authors.

H.E. Nicole Taillefer

French Ambassador,
Permanent Representative to the International Maritime Organisation

PREFACE

When the International Maritime Organization amended the Safety of Life at Sea Convention (SOLAS) to require a declared verified gross weight as a condition to load containers on vessels, the whole supply chain community started to raise questions about the implementation of this requirement due no later than July 1st, 2016. France's maritime domain is the world's second largest. In addition, one of the major actors of container transports is French. Therefore, in France, it has been important to involve the port community, shippers, governments as well as scholars, in steering committees aimed at facilitating trade in compliance with this new SOLAS Amendment.

In this context, EM Normandie launched, jointly with other maritime oriented universities in the world and their port communities, a research project involving scholars as well as students. As a consequence, PEMA Student Challenge was very welcome by our business school and we have been able to provide guidelines and key contacts for our students to analyze the topic of this year.

Since we are a business school with one of our strategic concentrations in international logistics and port management, our PEMA Student Challenge team provided not only a technical solution that meets handlers requirements, but also a complete solution to be implemented. We teach our students that strategic innovation can also be an organizational innovation. This is exactly what they provided with an efficient technical solution based on existing technology, that meets the time pressure of application of the SOLAS Amendment. They also provided an adapted approach for major container based ports as well as smaller ports needing to load containers in compliance with the VGM Amendment. And more than the cost, the emphasis was put on process, responsibility and timeline which are today, at an operational level the real constraints of implementation of such projects. In that sense, our team provided a turnkey solution; and the whole school is proud of them for such a pragmatic solution, based on intense work, knowledge and dedication. The result of the contest and this first prize are well-merited.

Dr. Alexandre Lavissière

Research-Professor in Stategy, Logistics and International Business
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INTRODUCTION

2016 celebrates the 60th birthday of intermodal containers. In just six decades, more than 60% of worldwide shipment are transported by containers according to WTO. Containers became a major actor in worldwide trade. Containers are standardized and fit to three means of transportation: rail, road, air and sea. This innovation dated to 1956 developed intermodal transportation and supported the development of worldwide trade. In this article the focus is made on the maritime transportation, which represent today 80% of global trade according to the International Maritime Organization. For the past three decades, maritime transportation has been growing annually by around 3% (UNCTAD, 2015).

The International Maritime Organization (IMO) is a United Nation agency regulating the worldwide maritime transportation. An amendment has been added to one of its convention, the SOLAS, responsible for the Safety of Life at Sea. This amendment concerns the Verified Gross Mass of containers.

In this article, the problem, which has generated this new amendment of SOLAS, will firstly be analyzed. Secondly the legal aspects and the impact of the Verified Gross Mass Amendment on the different actors of the supply chain will be examined to understand the challenges for the sector. Our solution will then be presented.

CHAPTER 1: PROBLEM ANALYSIS

The International Maritime Organization (IMO) is a specialized agency of the United Nations regulating maritime transportation. Nowadays IMO is in charge of maritime safety, maritime security (including the fight against piracy) and protecting the maritime environment. In 1974 the Safety of Life at Sea (SOLAS) has been signed by 162 contracting States, which are representing 99% of flag in the worldwide merchant shipments. By committing to the SOLAS convention, the flag States were engaging their ships to comply with the minimum safety standards in different fields: construction, equipment and operation. This convention, which was brought into force in 1980, is responsible for creating procedures in order to make maritime transport safe.

The SOLAS convention is constantly implemented to fit the development of maritime transportation. Chapters VI regulations 1 and 2 of SOLAS determine the procedure linked to the weights of carried cargos, including the declaration of gross mass. Indeed, it is clearly specified: “The shipper shall provide the master or his representative with appropriate information on the cargo sufficiently in advance of loading to enable the precaution which may be necessary for proper stowage and safe carriage of the cargo to be put into effect. Such information shall be confirmed in writing and by appropriate shipping documents prior to loading the cargo on the ship”.

Usually the charger is declaring through the bill of lading the weight of the cargo, and the tare is added to this weigh in order to determine approximately the global mass of the container.

However, in recent years’ numerous accidents due to mis-declared container weights have grasped attention of SOLAS to review the current container weighing procedure. Few examples are:

- In February 2007 on the container ship MV Limari in Damietta: the load on three rows of a stack was exceeding by more than 300% the declared weight. As container weights

were mis-declared, ship planners could not allocate efficiently the containers, which lead to the collapse of a container stack.

- In February 2011 in Darwin port a container fell 12 meters. The declared weight was 4 tons, when the real one was 28 tons. Two workers had to run to avoid the falling containers.
- In June 2011 the container ship Deneb in Algeciras: during an unloading process in Algeciras, the ship was destabilized forcing the crew to escape the ship. Ship's instability was caused by 16 overloaded containers (out of a total of 168 containers) whose weight was four times higher than the declared one. Fuel and oils were shipped on that vessel. This incident generated major polluting risks.

Through these examples the risks linked to overloaded containers are highlighted: human, economic and environmental. The safety of workers on port, and on the vessel, and the maritime environment are threatened by mis-declaration because the authorities cannot plan efficiently the handling and the loading of these containers. The economic stake is also crucial. Incidents generate delay, loss of productivity and financial loss, which are key points for insurances and companies.

Considering all these parameters, the SOLAS convention has created an amendment to ensure the verification of the gross mass of containers. It will be implemented on the 1er of July 2016.

Two methods have been determined to establish VGM:

- Method 1 consists in weighing the containers including the cargo, the container tare and the lashing materials
- Method 2 consists in adding the container tare to the weight of content and cargo by calculation

The verification of the gross mass is meant to reduce the number of overloaded containers, to raise awareness of shippers about the importance of an accurate declaration and increase the safety for handling and transportation operation.

CHAPTER 2: RESPONSIBILITY AND LEGISLATION CHALLENGES EACH ACTOR

2.1 Responsibility and commitment

The SOLAS Amendment on the Verified Gross Mass is binding the interests of the different actors. Liability is now shared between all the actors all over the supply chain. The damages caused by a mis-declared container can now be attributable to the captain of the ship; if he had good reasons to suspect an overload for example. To protect its own interests, the captain can require a control before loading. But as the responsibility is shared, the location of the control structure is not determined. In the following table, the main actors of the supply chain are determined with their role regarding VGM and their interests in this new amendment.

Main Actors	Role in the VGM process	Why is VGM rule in their own interest?
Shipper: the party on the bill of lading	The shipper is responsible for declaring VGM.	Less risks of containers loss at sea.
Ship planner: in charge of establishing the container loading plans on vessel	The weight is decisive to make the plans.	Fewer uncertainties regarding the gap between the declared and real weight of container
Ship captain: chief of a vessel, he is working for a shipping line	Ship captains are responsible for the accepting a container or not on their ship	VGM amendment reduces the risks linked to the lack of stability of ships, the wreck
Terminal Operator: management of cargo containers movements	VGM Control point (explanation later in this paper)	A better control of their flows and less risks for the workers.

2.2 VGM control

In order to avoid actors ignoring this new regulation, controls must be implemented in the supply chain.

Shippers can determine their VGM if their calculation method is approved by the SOLAS (method 2). The first control is the certification of the calculation method. However, the diversity of products shipped worldwide makes unlikely an accurate control of VMG by a third party or authorities thanks to this method. Actual weighing of the container seems to be an easier solution for the controlling institution.

However actual weighing using method 1 supposes an investment in material. As the responsibility are shared the controlling point is not clearly determined.

Here is a figure representing the overall supply chain.

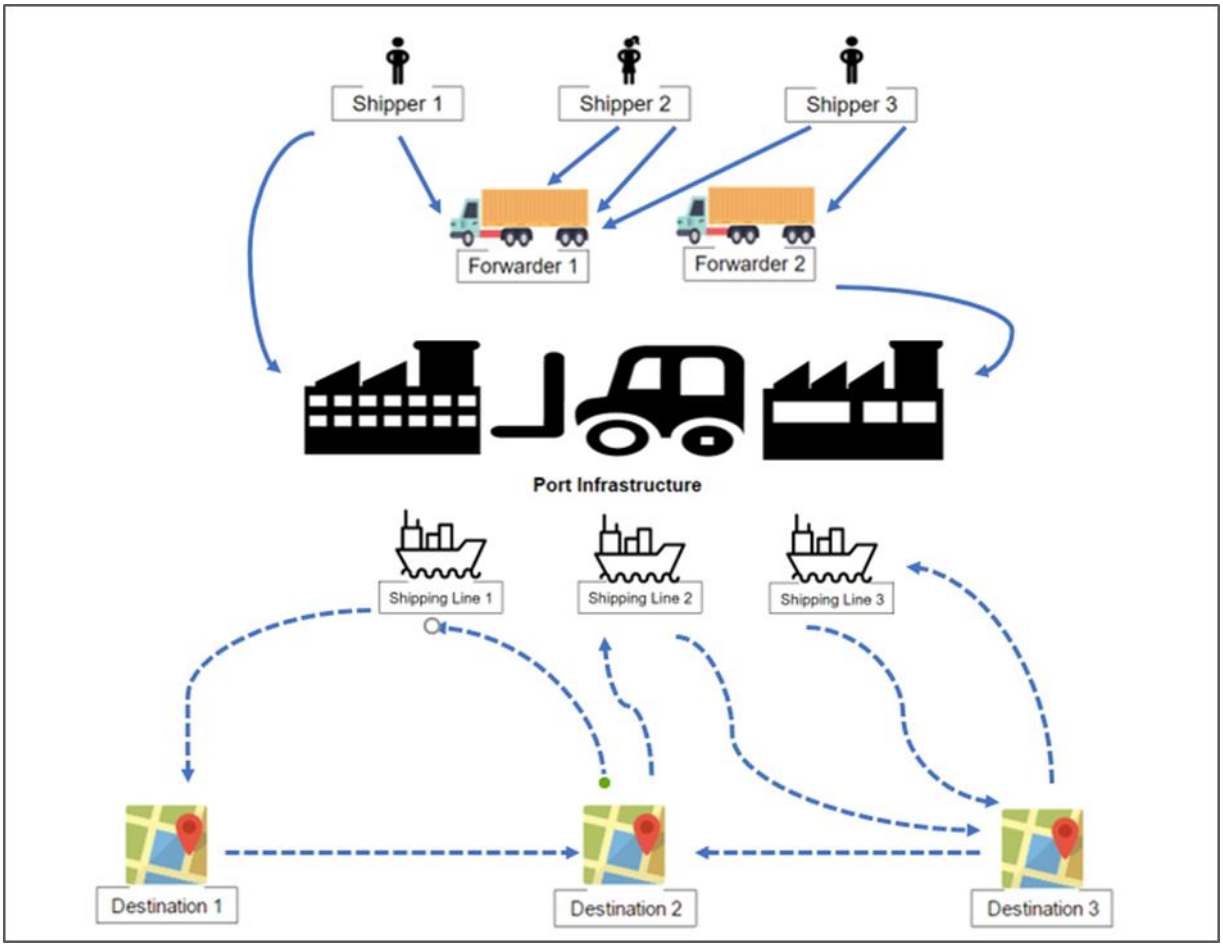


Figure 1: Scheme representing Supply Chain

Considering the overall supply chain before a container is loaded on a vessel, port represent the convergence point of containers shipped by different companies. As the port is the

bottleneck on this supply chain. The amortization of the investments needed will be the fastest at this point. Port is consequently the most strategic location for the implementation of a containers' weighing service meeting the SOLAS requirements (method 1).

Shippers using method 2 are first controlled by the SOLAS, as their calculation method should be certified. However, for the control in ports, the method 1 is faster, more accurate and productive as it doesn't require to analyse the calculation process.

In port the controlling policy with method 1 shall have three orientations:

- Random controls: these control occurs on randomly picked containers
- Targeting controls. This type of control is based on three parameters: the shipper, the method used to determine VGM and the content. Each controlled container is registered to build a data base of shippers. Shippers who have already mis-declared containers shall be more controlled. If the method used to weigh container is calculation (method 2), risks linked to mis-declaration are higher, so the percentage of controls must also be higher. The content is also a key data. Calculation method cannot accurately weigh some raw material such as tree trunk. Otherwise finished products have more often standardised packaging, which are respecting a certain weigh. Thanks to the custom declaration, the container content is known and classified through numbers. A list of potentially "hard to weigh" products must be established to focus then the controls on these containers.
- Last minute checking on demand of ship captain: considering that last-minute verification generates a loss in productivity or even the loading cancellation of this specific container. This situation shall be avoided through port and terminal internal regulation and control.

However even if the port is regarding the productivity over the supply chain, the most strategic location to implement controls, the port has no real obligation in the VGM case. Indeed, shippers and ship captains are responsible regarding the law for the VGM declaration. But port authorities and terminal operators have no legal implication. However, the VGM brings two main advantages for the port. First it increases securities. The case of the Darwin port in February 2011 shows that the weight of a container has an impact on the used handling material. A wrong using of material can generate major incidents, and risks for workers. Second being the bottleneck in the supply chain gives a local monopoly to ports. This situation can be used to generate a new source of revenue for port's authorities.

2.3 Port and pricing policy

The internal policy of port has to evolve with the new VGM amendment. A parameter shall be added to the actual requirements for a container to enter a port. Then the management of VGM control has to be detailed, so that each scenario is considered. A pricing policy of the port services concerning VGM has to be determined.

First a container without a VGM declaration shall not be able to enter the port area. Each entering containers shall pay a fee.

Second the port decides at the unloading point whether the VGM is controlled or not. In case of a control, two possibilities: either the VGM is correct (+/- the tolerance rate) and the container can be unloaded and stored; either the VGM is not correct. The port has three opportunities after the detection of a mis-declared container:

- The container is refused at the port entry and the shipper is charged with a penalty
- The port is proposing a third party service: the shipper chooses before arriving in port that if the VGM is wrong then he will be charged with a fee so that the third party service will set the rectified declaration for him. However, if the shipper refuses this option, then the container is only refused at the port entry.
- The port imposed the use of a third party service if the container's declaration is wrong. The shipper has no choice but to pay the fee if the port detects a mis-declaration during control.

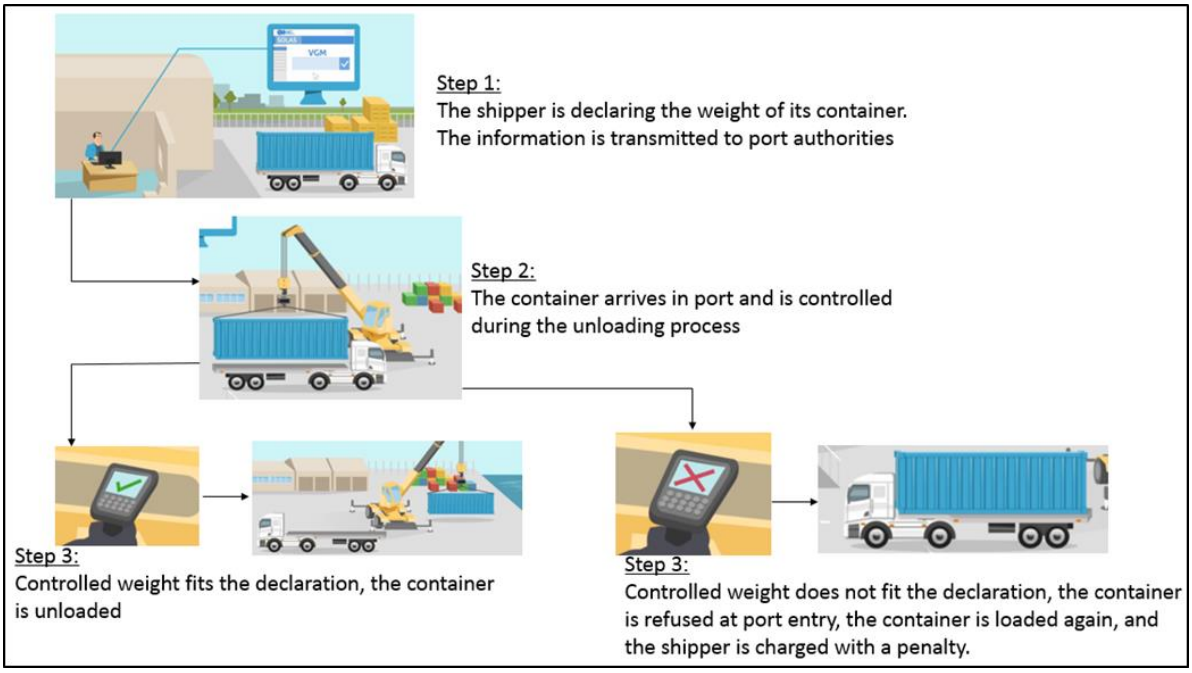


Figure 2: Control process

Declared VGM by shipper is supposed to be accurate, if a difference (+/- the national tolerance rate) is noticed a penalty will be charged to the shipper. The tolerance rate for the VGM is defined by the country where the container is loaded. Ports must also determine the percentage of control and adapt their infrastructure according to it, by buying machines or hiring a third-party company.

Port authorities can make this activity profitable and generates profit through an accurate pricing regulation. We propose the port to charge a minimal and unique fee to each container entering the port. A penalty will also be charged to controlled containers, which were mis-declared. This solution is cost effective because the machine will fast be profitable for the port, adding a new source of revenue. The port can also propose a third-party service of certified weighing for containers.

CHAPTER 3: OUR SOLUTION

This Chapter presents our solution from three aspects - physical weighing, information flow and timeline.

Generally, we propose to weigh the container during the daily operational lifting, such as loading/unloading/moving container. Then, the VGM information will be transferred through standard EDI message among various logistic actors.

3.1 Physical weighing

This section presents the process of physical weighing with two equipments – electronic hanging scale and container weight system.

The method 1 is used to get VGM in this solution, which is weigh the container with an approved device after it has been stuffed and sealed. The physical weighing is embedded into daily operational container lifting. Therefore, it can take place in multiple stages during the container transportation, such as loading on truck in shipper's warehouse, unloading from barge/train, regular moving in container yard. This surely provides more flexibility for the designing process for getting VGM and VGM compliance control.

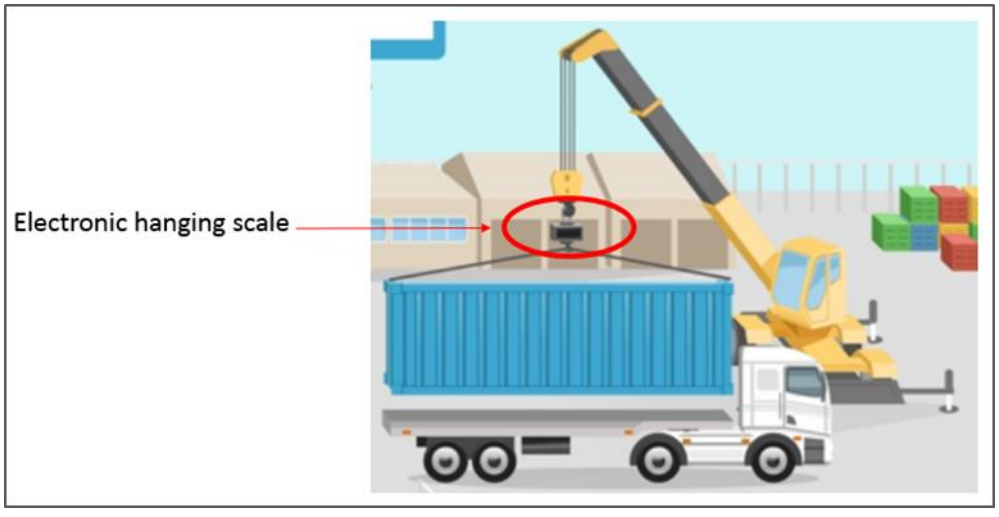


Figure 3: weighing container during lifting

There are two weighing equipments proposed:

- Electronic hanging scale: for lifting container with rope and hook like crane.
- Container weight system: for lifting container with spreader.

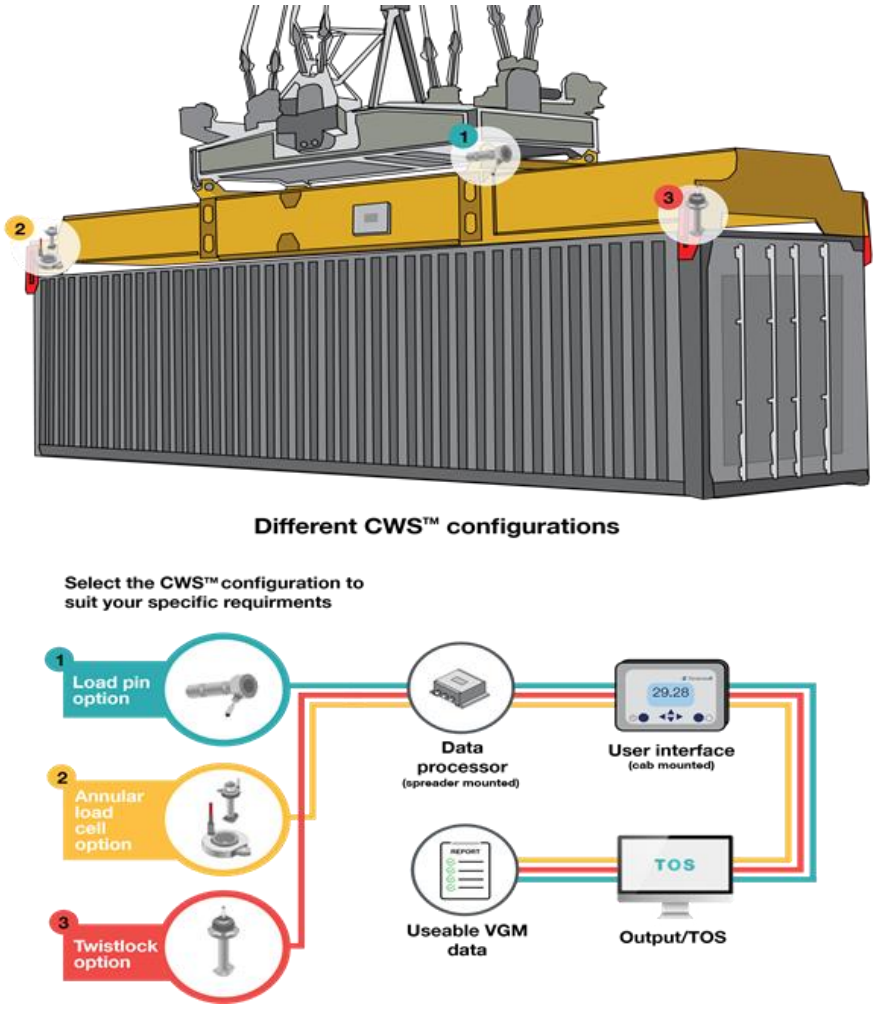


Figure 4: Strainstall's Container Weight System

The electronic hanging scale is a balance linked to lifting equipment such as crane by hook used to weigh during lifting. (See above figure 3)

Container weight system (Strainstall, 2016) is a weighing system in which there are sensors integrated in spreader used to weigh the container during lifting. This system also provides full data access support. Below figure describes three options for implementing sensor in spreader and the data handling process.

Both of them can provide a high accuracy (around +/-1%), low productivity impact (several seconds/container) and without requirement of additional space and equipment. The use of these two weighing equipments depends on the existing lifting equipment and infrastructure

in place and on the control rate decided by authority. Below is a short summary for these two weighing equipment.

	Electronic hanging scale	Container weight system
Description	A balance linked to lifting equipment such as crane by hook used to weigh container during lifting.	A weighing system in which there are sensors integrated in spreader used to weigh the container during lifting.
Accuracy	High (best: +/- 1%)	High (+/- 1.5%)
Estimate Cost	$100-$1000	$300-$1000
Productivity impact	Low	Low
Requirement for additional space and equipment	None	None

To sum up, this physical weighing solution provides low productivity impact, high accuracy, high weighing process flexibility, high intermediate transportation compatibility, high lifting equipment compatibility, possibility of IT support, possibility of 100% control with low cost, possibility of real time weighing (with container weight system) and possibility of low cost solution (with electronic hanging scale).

3.2 Information flow

This section presents the information flow during weighing process and VGM information transferring among logistic actors. It also provides detail information solution for initial stage, maturing stage and mature stage of VGM implementation.

For method 1, the weight will be measured by weighing equipment, passed to in filed interface or paper to record and confirm by operator and transferred to information system or paper/digital transferring application. (see below blue route)

For method 2, the weight will be calculated and transferred to information system or paper/digital transferring application. (see below green route)Then the VGM information will be communicated and transferred among various logistic actors through unique format EDI message.

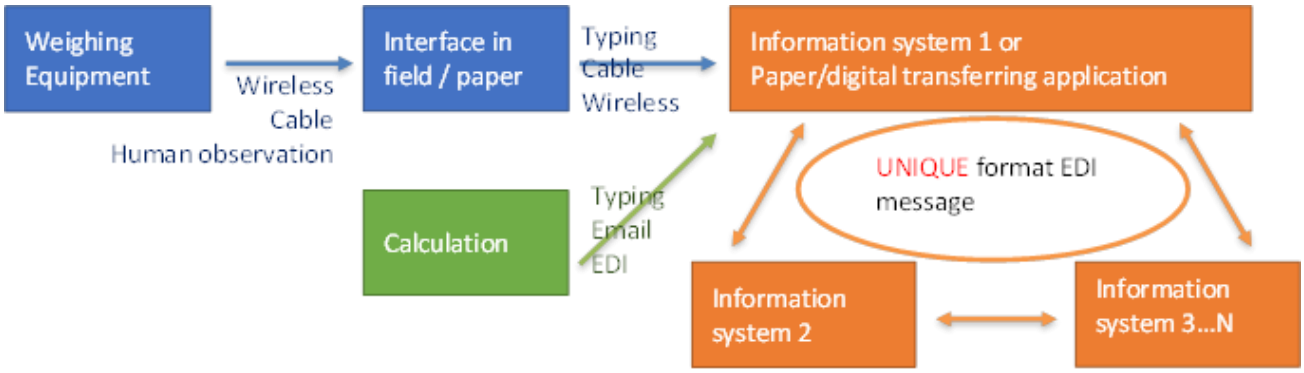


Figure 5: Information flow

Below paragraphs explain some definitions:

Interface in field/paper form: it's used for record VGM in field, can be an APP in mobile phone/tablet, interface in embedded terminal, an excel sheet, a pdf form or just a paper.

Paper/digital transferring application: it's an application providing an interface to enter or consolidate VGM data, used to transfer data from paper (human-readable information) to standard EDI message (program-readable information), providing data validation to ensure the data quality and mainly designed for initial stage of VGM implementation. It can be an excel sheet with macro, standard pdf form with interactive objects or web-form.

Unique format EDI message: It's standard EDI messages used to transfer VGM information among various logistic actors. It should follow a standard regular predefined according to the VGM document and agreed by all the participants worldwide. A new EDI message 'VERMAS' (SMDG,2016) specifically in relation to VGM has been developed by SMDG (Ship-planning Message Design Group). In reality, it can be just simple *.txt file which can be easily transferred by email or other ways.

To sum up, this information flow solution mainly provides below benefits:

- **Flexibility: i**nformation flow within each logistic actor is allowed to be various and flexible. Internal operation change doesn't have any influence to external information exchange.
- **Easy and low cost for information exchange:** all the EDI messages among actors following same standard allows logistic actors to exchange information through a network pattern instead of a traditional chain pattern. This will also lead to low information exchange cost as each actor only need to develop one data transferring tool instead of sometimes one per client.

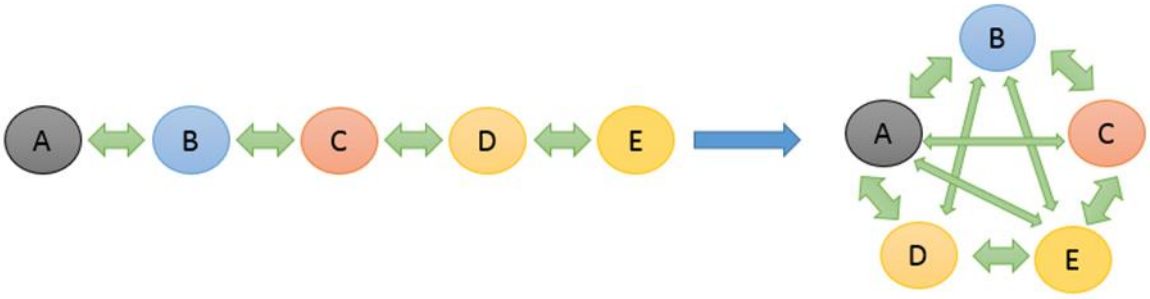


Figure 6: Chain pattern and network pattern of information exchange

- **Possible to have a very low shared cost for software:** as all logistic actors will follow the same information exchange standard, they can use common software tools for information transferring within single actor and among various actors. For example, they can use same mobile phone/tablet APP to record and transfer VGM information, same excel sheet/pdf form to generate EDI messages. In other words, for software, standard allows sharing, the more sharing (users), the lower shared cost.
- **Possible for future evolution:** as all information is organized with same standard, It's easy to gather data from various logistic actors and implement data mining/statistics analysis, whose result can be used to optimize VGM compliance checking or other further analysis/research. Section 3.3.3 will present more details.

Later three sub-sections present respectively detail information solution for initial stage, maturing stage and mature stage of VGM implementation, enabling a progressive implementation according to the country and the investment dedicated.

3.3.1 IT SOLUTION FOR INITIAL STAGE: TRIANGLE OF PDF FORM, EXCEL SHEET AND STANDARD EDI

This section provides a detail information solution for initial stage of VGM implementation, mainly presenting three tools – PDF form, Excel sheet and standard EDI.

Standard PDF form with interactive objects and data validation:

It's a standard PDF form created according to standard EDI specifications, with interactive objects and data validation, shared and used by all logistic actors worldwide. It provides:

1. A decent, beautiful and rigorous form for business and operation use, which makes people be more serious for the responsibility, allows operator to have a quick global view for each container and make some comments/note on it.

2. High quality data (program-readable) and allow to batch data extract, which allows to auto consolidate its data into excel sheet or use its data to generate standard EDI messages.

Excel sheet with data validation:

It's an excel sheet in which each column should be well defined according to standard EDI specifications in aspect of data format and data validation rules (Ex: container number should be mandatory and with 4 Letter and 7 figures.) Its main functions are:

1. consolidate multiple container VGM information into one sheet, allow batch creating and editing, provide a global view of multiple container.
2. Provide high quality data(program-readable) and allow to generate single PDF form and standard EDI message.

Standard EDI message:

It's standard EDI messageAll follow a standard specifications accepted and used by all actors (Ex: VERMAS specification by SMDG). It allows to:

1. exchange information easily among various logistic actors and different IT systems.
2. Extract information back to other information format like PDF form or excel sheet.

Below is a picture presenting the triangle of information interconversion among these three formats.

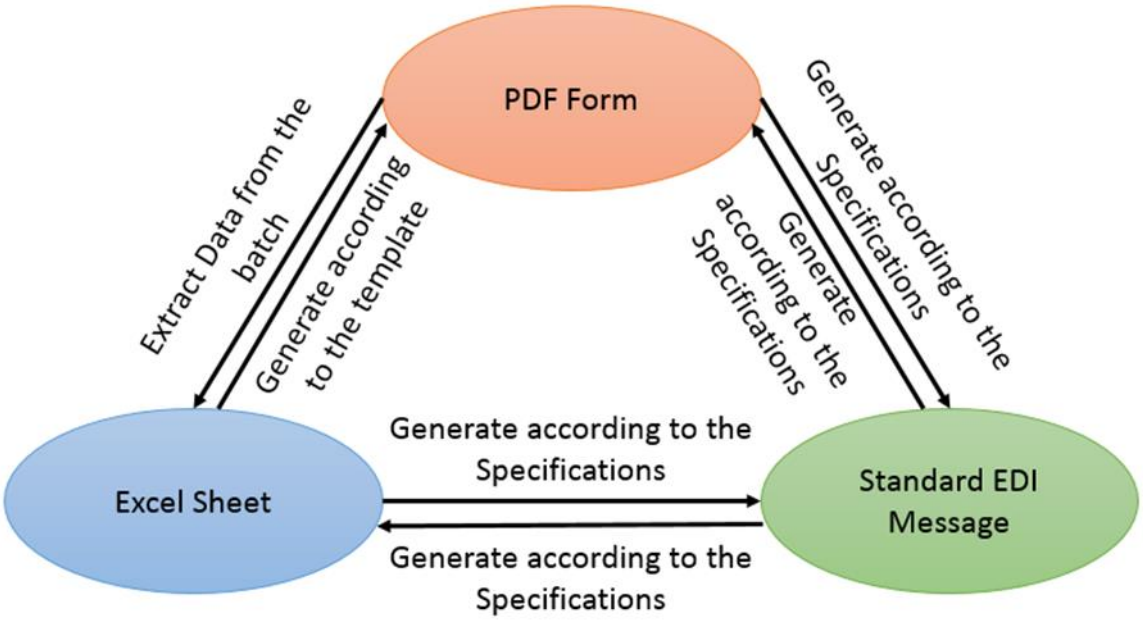


Figure 7: Triangle of information interconversion

To sum up, this solution mainly provides below benefits:

- **Easy, fast and low cost to develop:** compared with specific IT system module it costs much less. In addition, as these three tools are standard tools which can be used by all logistic actors, the shared cost can be very low (almost free).
- **Flexibility:** the operator can decide one between Excel sheet and PDF form as main working tool and use it to generate standard EDI message. In addition, Excel sheet and PDF form format are easy to edit/change/update.
- **Possibility for auto operation:** as all data are standard and program-readable, many data transferring and operations can be done by programme, which leads to effectiveness and efficiency. (Ex: standard PDF form allows to batch extract instead of various formats which leads to human reading.)
- **Lower risk of human error/data transferring error**
- **Paperless office:** all information operations can be done without printing. (use PDF form as paper file which allows operators to make comments like paper, add additional columns in excel sheet for comments)

3.3.2 IT SOLUTION FOR MATURING STAGE: IT SYSTEM

This section presents IT system for maturing stage of VGM implementation.

After the initial stage, the operation process has been well established. The data formats, rules, interface and demand have been well designed and tested. It's better to develop a IT system in order to maintain the same standard and promote further effectiveness and efficiency.

3.3.3 IT SOLUTION FOR MATURE STAGE: DATA MINING AND STATISTICS BASED CONTROLLING SYSTEM

This section presents further solution for mature stage of VGM implementation, mainly introducing the possibility of data mining and statistics based controlling system.

During the maturing stage, all data are well organized and stored in IT system. It's easy to gather data from various actors. As all data can be gathered via standard format, it's feasible and convenient to do data mining and statistics analysis, whose result can be used to optimize VGM compliance controlling.

Example:

According to the HS code (Harmonized System), POL (port of loading), shipper and other information, it's possible to determine that goods with some specific characteristics have a higher risk of overweight or incompliance of VGM.

3.3 Timeline

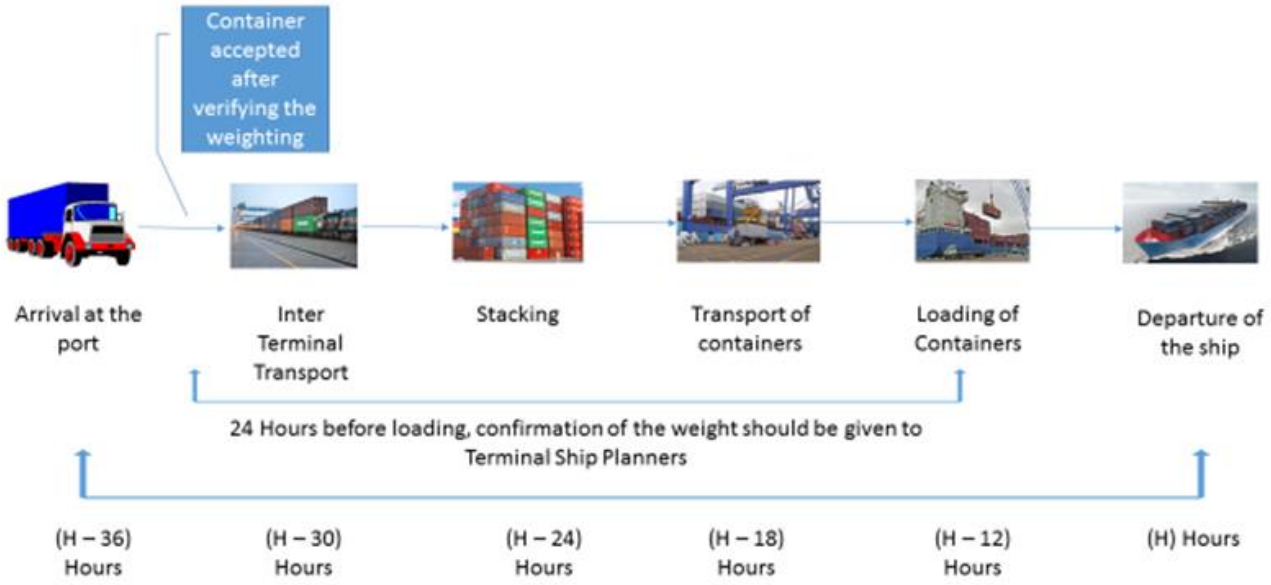


Figure 8: Timeline of receiving the order before loading

Timing is one of the major issues in loading a vessel, because not only the container needs to be physically ready when the vessel calls at the port, but also because the flow of information in major ports is essential and time constraint. In case of use of method 2, the containers has already been weighed and the timing of information flow is not so important, however in case of method 1, the flow of information is crucial since the ship planner requires the weight of the container to prepare the loading and provide a slot on the terminal in order to optimize loading operation. The timeline becomes, therefore, a challenging aspect. The weight certificate should be submitted to the terminal ship planner at least 24 hours before loading.

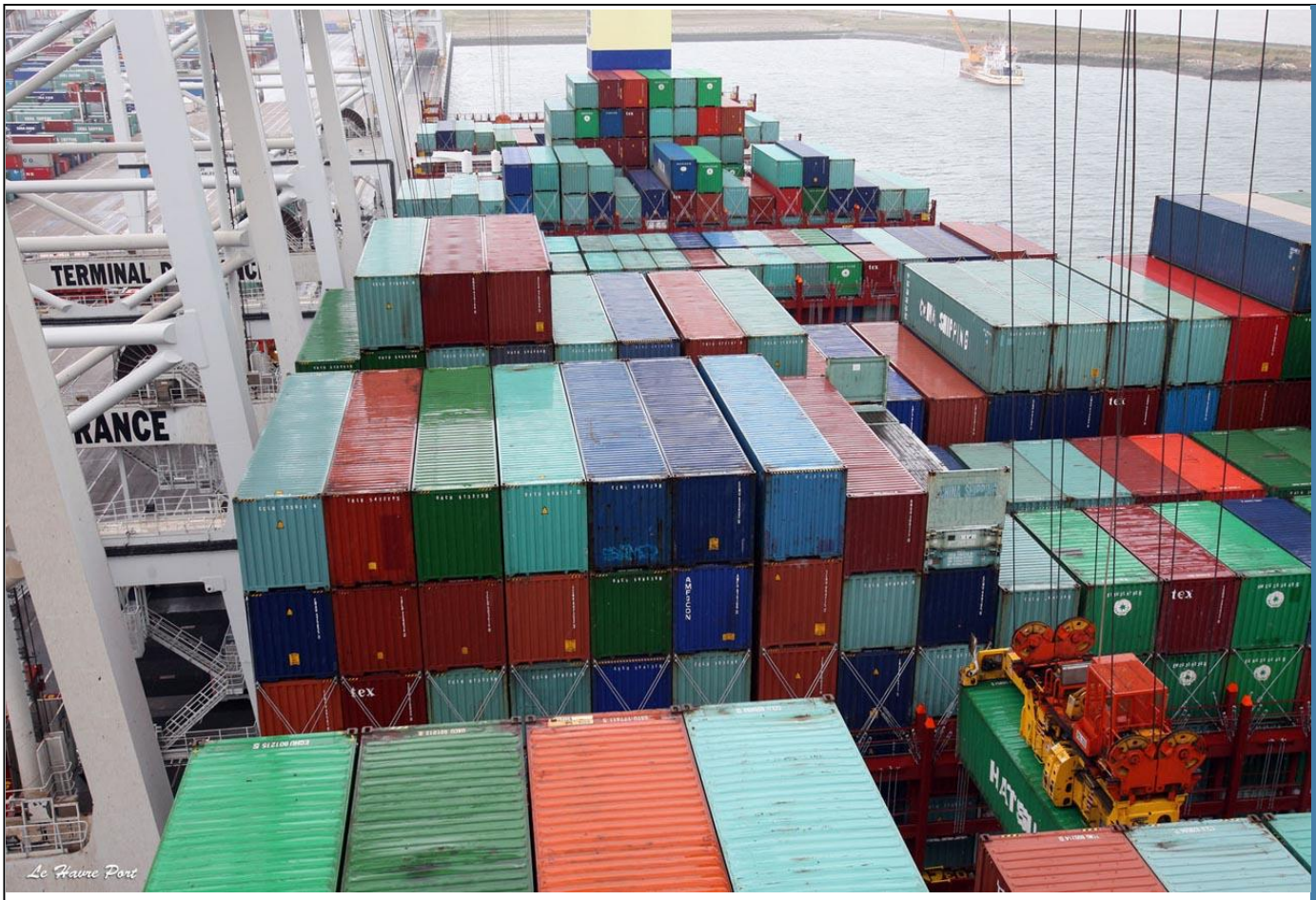
The implementation time for this procedure depends upon the reactive conditions of both the port and the service operators and once our solution is implemented and well mastered by all parties the gain provided by the fact containers are weighed during an already scheduled operation (i.e. unloading from approach mode), will become a real key success factor of our solution that will bring safety through a certificated and very precise weighing method at low cost and no waste of time.

CHAPTER 4: CONCLUSION

Our solution is proposing to implement controlling policy at the entry of ports. Ports are the bottleneck of the overall supply chain, consequently their location is strategic for control operation. Our solution is innovative as it can be adapted on current unloading equipment reducing consequently the investment needed and the loss of productivity. As the policy must be worldwide implemented, different stages have been designed according to the desired control rate, the country, the level of maturity of the port, the specificity of the port terminal (hub, dedicated, general cargo, …) and the investment dedicated. This flexibility allows a progressive implementation. As the solution is profitable; progression is possible through the reinvestment of profits in the development of controlling infrastructures. Finally, our solution is innovative, cost-effective, productive and flexible. "

Technical solution is surely important in this case, but what is really at stake is the process management, on which we have clearly emphasized in this report and in our entire project.

With our project, we offer a solution which is developed in terms of technical specifications, information flow specifications, timeliness specifications and responsibility transfer specifications.



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