



The Specialization of Roll Trailer Platforms as a Key Element in Ro-Ro Ports. A Study for the Port of Santander.

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ABSTRACT

In recent years Ro-Ro traffic has undergone major changes, the most significant being heavy loads transport in break bulk or static cargo, in other words, the transport of bulky and heavy loads in conventional general cargo ships has moved to Ro-Ro vessels over rolling platforms. Nowadays due to the high cost and fragility of these goods they must be handled with the utmost care. In this article we deal with the transformation suffered by this type of maritime traffic and the development in Ro-Ro vessels cargo equipment, analyzing the traffic data for such goods at Port of Santander in Spain in the last ten years and discussing how it has affected the increasing amount of goods in vessels' size and specialization.

1. Introduction

The port of Santander, Bay of Biscay (Spain) (APS, 2007) has lately increased the traffic of ro-ro ships, increasing movement of goods too. The port facilities have had to be adapted to the lengths of these ships, modifying the docks and ramps in order to accept and to work simultaneously with several ships. This fact lead to the use of the available ramps by the "car carrier feeder vessels" which are vessels of about 100 m in length, while the larger ro-ro ships do not need to use these ramps using their own ones by resting them directly on the dock. The port of Santander has made a major investment in recent years, up to 10 million euros, replacing the old floating ramps by a double ramp to facilitate the work of two ships at the same time and increasing the capacity from 80 tons per ramp up to 120 tons. (Fig. 1)

The new Ro-Ro specialized cargo equipment, the roll trailer platforms, have enabled that the great goods move from being

Figure 1: New ro-ro ramp pier Raos 8/ Port of Santander.



Source: Web Port of Santander Authorities

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transported in conventional cargo ships to be carried on Ro-Ro ships, with the consequent savings in cargo handling and the increase of safety in cargo operations on board. This fact also decreases the lashing time on board because in general cargo ships it is necessary to weld structures to the hold floor for securing the goods on board and in Ro-Ro vessels these operations are carried out by lashing chains, turnbuckles, shackles, straps or slings that are made fast in the eyebolts and rings or inkwells available in the holds of Ro-Ro ships (Poulios, Themelis *et al.*, 2008), (Poulios, Themelis *et al.*, 2009).

Due to the increasing size of the pieces that are loaded, it was necessary to increase the capacities of Ro-Ro vessels, expanding the capacity of cargo ramps in terms of strength and size. It was also necessary to develop new systems to transport this kind of cargo on board this type of ships (Blanco *et al.*, 2010)

Presently the problem that exists in transporting oversized cargo in break bulk is their high costs and the difficulty in handling, so this type of shipments require a high level of specialization. There are companies that are exclusively dedicated to plan the transport of loads like these, looking for the best routes, handling equipment, land and sea transport and proper ships. (Sanchez *et al.*, 2013).

These companies such as Geodis Wilson (GEODIS, 2014) have developed different equipment to handle the product as quickly and safely as possible so they can offer full service offering:

- Cost efficiency and load management.
- Complete monitoring during loading and unloading.
- Search for the most competitive rate.
- Management continues at each stage of the shipment.
- Lashing loads and equipment needed.
- Permits required.

Another important factor to consider is the preparation of the goods for transport (Sanchez, *et al.*, 2013). They need be properly packed for export, using whatever necessary means such as boxes, crates, tarpaulins, plastic, avoiding damages to the goods during the continuous manipulations, making a package valid for different means of transport until they reach the destination.

It is important to note that the load must be properly latched in different means of transportation (truck and ship).

The damage to the cargo is common in the transportation business, so it is necessary to emphasize the use of good packaging for correctly handling and lashing to avoid costly consequences, because don't forget that we are always talking about very valuable and fragile goods.

Due to the increasing volume of goods shipped, new equipment to handle them has been developed to allow cargo operations in Ro-Ro ships. Not many years ago this type of cargo was transported in conventional general cargo vessels, needing the use of cranes to load and unload the goods on board, which increased the risks of the operations on board.

Figure 2: Shipment of large parts difficult to handle.



Source: Authors

Figure 3: Plastic packaging example.



Source: Authors

Figure 4: Example of different loads.



Source: Authors

Wallenius Wilhelmsen Shipping (WWL, 2014) not only have they invested a lot of money and time to design vessels capable of carrying these goods with huge dimensions and weights, increasing vessel sizes, width and load capacity of the ramps and increasing the width and height of the cellars or garages. They have also invested in researching and developing new cargo equipment, usually adapting the equipment to the size of a particular piece.

This company transports all types of static cargo, which by definition includes any cargo that must be lifted or towed on board using special trailers. There are experts in the field of transportation of general break bulk products and other non-containerized cargo, which often require special handling and specialized solutions (Blanco *et al.*, 2010).

Goods mainly transported in these type of ships are: cars, rolling equipment, breakbulk, machinery and machine tools, power generation equipment, rail cars, boats and yachts, and mining equipment.

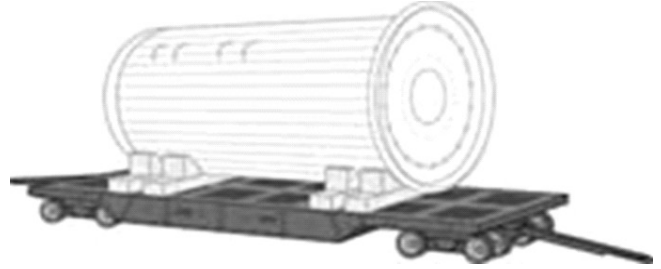
The size and weight of the machinery being shipped determine the type of equipment used to load, stow and discharge the cargo.

2. Methodology and Data

To understand and analyze the causes of this gradual increase of ro-ro traffic we have taken as a spatial field the port of Santander, Spain. Firstly we will make an exhaustive description of the new equipment employed, their origin and evolution as well as profits. Data and original images taken in the port, will help us understand the reason for the inclusion of these items in the ro-ro terminal. We have subsequently collected ro-ro traffic data for a period of thirteen years, covering the time-frame from 2001-2013.

The data has been grouped in to two different types of traffic groups for analysis; in one hand the type of car carrier ships only loading cars and in the other hand the ro-ro vessels that carry both cars and rolling freight and machinery. First separately and finally the total data is analyzed.

Figure 5: SAMSON WWL.



Source: (WWL, 2014)

3. Most Recent Equipment Develop

Different equipment developed by WWL (WWL, 2014):

3.1. Samson Heavy-Lift Trailer - for Small & Medium-Sized Heavy Cargo

The Samson heavy-lift trailer is specially designed by WWL (WWL, 2014) and well suited for lifts, such as transformers, generators and turbines.

For cargo weighing between 120 and 180 Tons, we use our own specially designed Samson heavy-lift trailers

For cargo that exceeds the capacity of our own equipment, Wallenius Wilhelmsen (WWL, 2014) utilises jack-up trailers (Ayers, 1983), also known as cometto trailers, which can be configured to the exact requirements of the cargo. Towing or trailering cargo on board eliminates the risk of potential damage during lift-on/lift-off operations.

- Capacity: 2v per rail car.
- Maximum cargo length: 3-12 m.
- Turning radius: 43 m.

3.2. trailers - for Large, Heavy Cargo

Roll trailers are designed for Ro-Ro transport of heavy and large cargo units, but can also be used for most types of general cargo and containers. Our fleet of roll trailers ranging from 20' up to 80' with capacity from 25 to 140 metric tonnes. WWL (WWL, 2014) also provide roll trailers fitted with rails for carrying rail cars with bobbies attached. If roll trailers are required to be modified to carry any special cargo, this will be 'tailor-made' as per requirements.

Roll trailers are also frequently used for transporting cargo into and out of the lower decks of a vessel, where the cargo is taken off the trailer and stowed loose and secured

- Capacity: 25 - 140 Tons.
- Maximum width: 2.50 m.
- Maximum height when stowed: 0.85 m.
- Maximum length (in feet): 20, 30, 40, 60, 80.
- Acceptable rear trailer overhang: 3 m (based on standard 100 Tons. Roll trailer.

Figure 6: WWL RT.



Source: Author

Figure 7: WWL JACK UP TRAILER.



Source: Authors

3.3. Jack-Up Trailer, for Exceptionally Heavy Cargo

Jack-up trailers are purposely built for carrying exceptionally heavy cargo. A jackup-trailer (Ayers, 1983) consists of sections of four axles, which can be configured to suit the weight and size of the cargo to be carried. Most trailers have individual hydraulics on each axle and all wheel sets can turn.

Jack-up, or cometto trailers are built to carry exceptionally heavy cargo weighing several hundred Tons. A jackup trailer consists of four-axle sections that can be configured to carry cargo of almost any size and weight.

The largest configuration is 12 axles long by 8 m wide and rests on 192 wheels.

Before transferring onto a jack-up trailer, the cargo is placed on beams and support blocks in the terminal. Steel support blocks are required for heavy units that weigh 120 Tons or more. For cargo weighing less than 120 Tons, heavy timber support blocks may be used. Cargo specialists use the built-in hydraulic system to lower the trailer into position to take on cargo, carefully placing the trailer beneath the cargo. Once in the correct position, the trailer is elevated, carrying the full weight of the cargo and steel beams. The support blocks are then removed and the trailer is towed on board by one or more heavy-duty tow trucks. Once the trailer is in the correct position on board, support blocks are placed under the beams. The trailer is lowered until the full weight of the cargo rests on the support blocks. The trailer is then removed and the cargo secured. This operation is reversed at the port of discharge.

- Maximum gross weight: up to 380 Tons.
- Configurations units in four axles section maximum configuration: 12 axles x 8 m wide.
- Maximum size and weight: Customized.

3.4. Air Shuttle Trailer and Greenhofer, for Railcars with Bogies Attached

The Air shuttle has been constructed for loading and discharging assembled rail cars, e.g. with rail bogies attached. The Greenhofer is a smaller variant of the Air Shuttle and as such, it functions much in the same way. Railcars simply roll on to and off of the trailers. This process saves time, cuts costs and improves the overall quality of service provided.

- Capacity: 47,5 Tons.
- Maximum length (adjustable): 21,35 m.
- Maximum width: 2,45 m.
- Maximum Height (when stowed): 0,55 -0,84 m
- Greenhofer Capacity: 15 Tons.
- Maximum cargo length: 25 m

3.5. Rubber Tyre Bogies - for Railcar Shells

The RTB (Rubber tyre bogies) concept was developed for under-deck Ro-Ro service for railcars shipped with or without bogies attached. RTBs are fitted with air brakes. WWL's RTBs have road permits for use in the USA.

- Number of units: 2 per railcar shell
- Capacity: 45 Tons.
- Maximum length, width and height: Customized

Figure 8: WWL RT WITH RAILS.



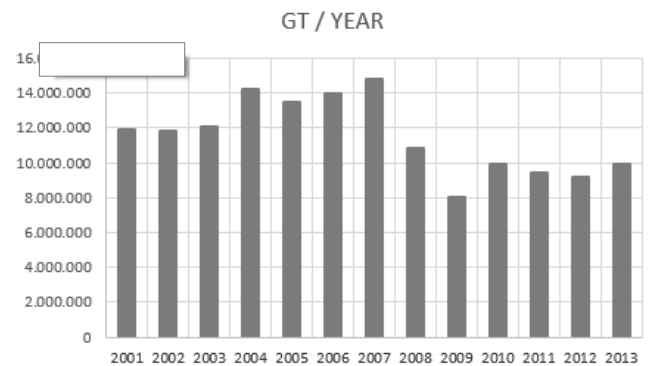
Source: Authors

Figure 10: WWL BOLSTER.



Source: Authors

Figure 11: Curve GT per year.



Source: Authors

Figure 9: WWL RUBBER TYRE BOGIES (WWL, 2014).



Source: (WWL, 2014)

3.6. Bolsters, for Heavy, Bulky Cargo

A bolster is ideal for cargo too heavy or too bulky to fit into a container. Shippers can collect bolsters for stuffing at their own premises, and consignees can pick up the loaded bolsters at our terminals in the discharge port.

- Capacity: 23,5 Tons.
- Maximum length: 6,10 m.
- Maximum height (when stowed): 0,23 m.
- Maximum width: 2,44 m.

4. Ro-Ro Vessel Statistics in Port of Santander from 2001-2013

The evolution of the total RO-RO vessel traffic in Port of Santander (APS, 2007) in the last decade is shown in the two following graphics, describing the evolution in total GT per year and in vessels per year.

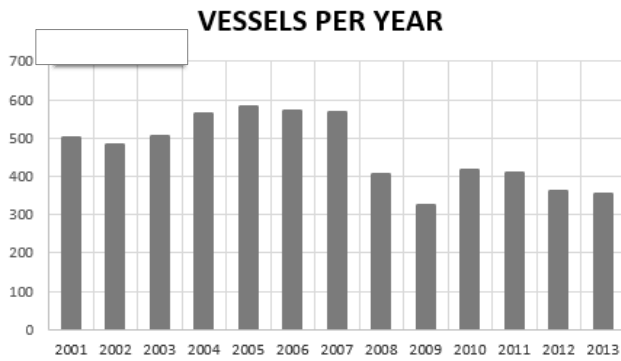
We can see that the curves are very similar and in the next graph we can also appreciate that the average GT has a tendency

Table 1: The evolution of the total RO-RO vessel traffic in Port of Santander (Pier Raos 8).

YEAR	VESSELS PER YEAR	GT	Average GT	CARGO CARS	GT CARS	CARGO CARS + RORO+ BB	GT
2001	500	11.936.505	23.873	335	9.324.009	165	2.612.496
2002	481	11.847.955	24.632	263	3.010.537	218	8.837.418
2003	505	12.100.951	23.962	312	4.046.875	193	8.054.076
2004	565	14.183.718	25.104	319	3.452.534	246	10.731.184
2005	581	13.507.532	23.249	350	3.693.169	231	9.814.363
2006	570	13.962.535	24.496	330	3.848.391	240	10.114.144
2007	568	14.793.314	26.045	350	6.026.063	218	8.767.251
2008	404	10.863.243	26.889	282	6.538.665	122	4.324.578
2009	325	7.984.220	24.567	215	3.330.419	110	4.653.801
2010	415	9.934.921	23.940	293	4.419.641	122	5.515.280
2011	408	9.409.613	23.063	310	4.838.916	98	4.570.697
2012	360	9.209.392	25.582	238	3.806.304	122	5.403.088
2013	355	9.926.993	27.963	226	3.756.535	129	6.170.458

Source: Authors

Figure 12: Curve Vessels per year.



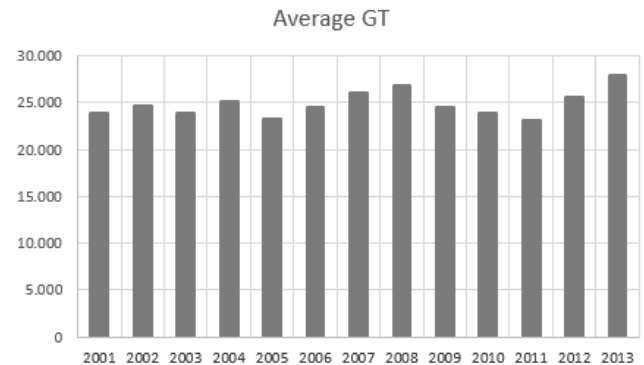
Source: Authors

to increase until 2008 where it begins to decline and in 2012 the tendency is rising again.

If we pay attention to the graphs in figures 11 & 12 and compare them with this last one which indicates the average tonnage of vessels entered in the port of Santander in the last 10 years, we can see that in 2011 and 2012 the difference in trend is clear, because in this last graph the trend is increasing, which indicates that even though the total number of vessels and the total GT is lesser, the vessel size has increased.

The import through the Port of Santander of new machinery (machine tools, mining equipment, big dumpers 777) used for construction by large companies like Caterpillar and Volvo during the economic crisis (2009-2011) have suffered a drastic decrease and have seen their import volume decreased almost in 90%, but this decrease in the volume of import cargo was replaced in part in the subsequent years by a rise of the volume of export of second hand machinery to developing countries.

Figure 13: Curve Average GT per year.



Source: Authors

Since mid-2011 a growing number of large tonnage RO-RO ships start to arrive at the port of Santander to load second hand construction machinery because of the increasing need for this machinery in ports of South America like Panama (construction works in the Panama channel), Peru railway system, New Zealand and Australia, where they are also beginning to build public infrastructure and look for second hand machinery.

Also starting 2011 the export through Port of Santander (APS, 2007) of large trains manufactured in Spain that depart toward Peru (Callao), New Zealand and Australia. This kind of merchandise is very large and needs very special and careful handling that does the above cited company WWL (WWL, 2014). This transport means that the Port of Santander receives an entry of two large ships of 60,000 tones monthly.

If we look at the percentages, 63% of the 6037 vessels docked at Raos Pier in Santander in the last 13 years, were vessels mostly loaded only with cars and the other 37% of remaining

ships loaded with machinery, cars and merchandise oversized in BB.

Table 2: (APS, 2007; S P, 2014)

YEAR	VESSELS PER YEAR	CARGO CARS	CARGO CARS + RORO+ BB
2001	500	67%	33%
2002	481	55%	45%
2003	505	62%	38%
2004	565	56%	44%
2005	581	60%	40%
2006	570	58%	42%
2007	570	62%	38%
2008	404	70%	30%
2009	325	66%	34%
2010	415	71%	29%
2011	408	76%	24%
2012	360	66%	34%
2013	373	64%	36%

Source: Authors

It has been displayed that vessels that load mainly cars, feeders vessels (small Ro-Ro ships) that make regular routes between any port in Europe and Santander, transporting cars that have been loaded in ports such as Zeebrugge, Southampton and Le Havre proceeding from non-EU ports with destination Santander. In these ports the transshipment of cars from transoceanic ships to (smaller) feeders vessels is done and they are finally discharged into Port of Santander.

In the other hand is the opposite case, in the port of Santander (APS, 2007) huge pieces and cars are loaded onto feeder ships and they are transhipped in ports such as Zeebrugge, Southampton and Le Havre to ocean vessels which would transport this cargo to its final destination.

The other ships (car + Ro-Ro + BB cargo) are the vessels making transoceanic lines, bound for America, Africa, New Zealand, Australia ... loaded with cars, Ro-Ro cargo (agricultural and construction equipment) and oversized merchandise.

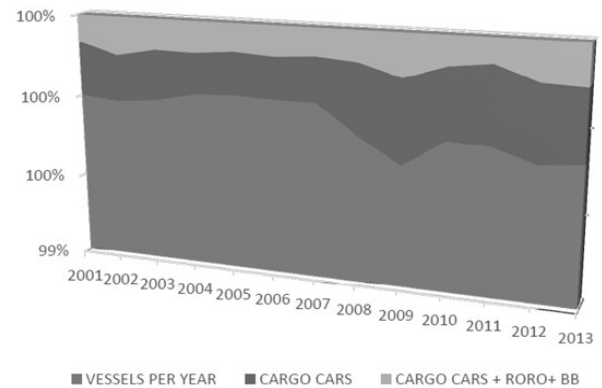
We can see in these graphs that during the last three years the number of ships has increased due to the load of Ro-Ro cargo and BB merchandise, and the number of vessels coming to load cars is declining proportionally.

5. Conclusion

The trend of the increasing size of ships is a result of the increase in size of the goods, and this explains the need for companies to develop new equipment to transport increasingly heavy and bulky goods, not always weight gain associated with increasing size, this implies great difficulty in the development of devices that allow them to easily and safely handle such goods.

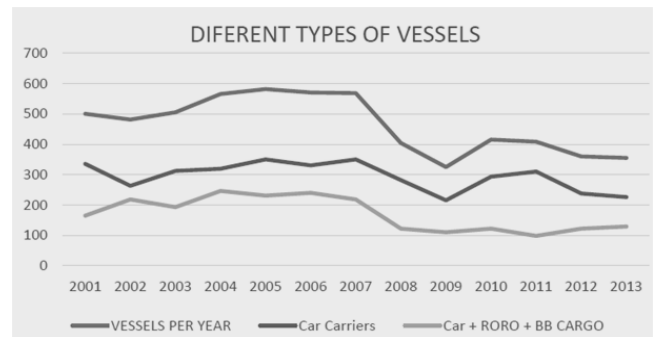
Companies develop new charging equipment that caters to the type and size of the goods. We can see the change in the form of product handling, the tendency is to change the use

Figure 14: Curve % Vessels types per year.



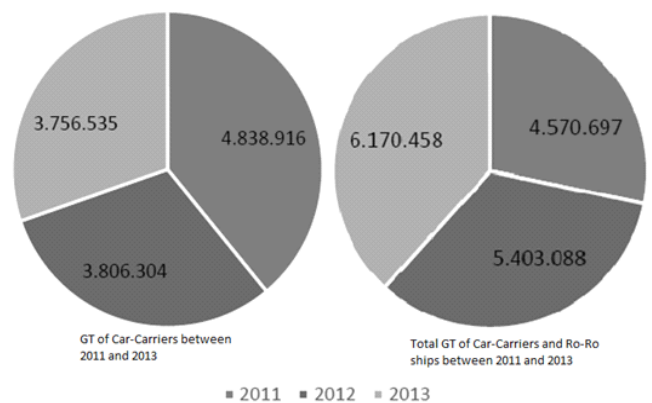
Source: Authors

Figure 15: Curve with several types of vessels.



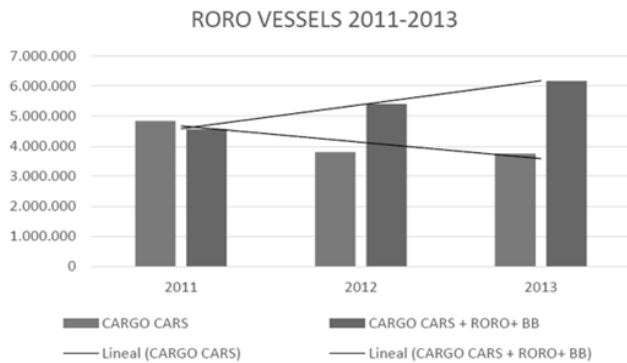
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Figure 16: GT values 2011-2013.



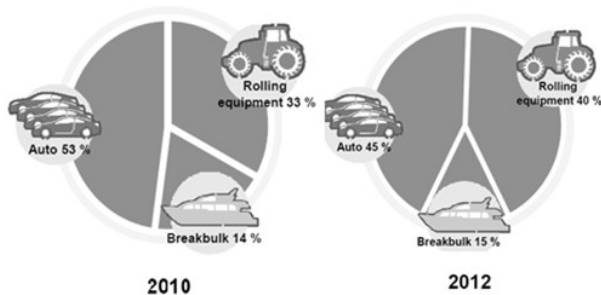
Source: Authors

Figure 17: Tendency of GT values 2011-2013.



Source: Authors

Figure 18: Evolution of global ro-ro traffic between 2010 and 2012.



Source: Wallenius Wilhelmsen Logistics Website

of conventional vessel roll-on/roll-off vessels and thus make safer, cheaper and faster handling of large goods. As we can see in the graph in figure 18 worldwide traffic has also been affected; shipping of cars has decreased an 8% from 2010-2012, whereas BB goods and machinery has increased that same percentage, meaning that the shipment of heavy and large goods, which include construction machinery like large BB goods that

need specific handling equipment, like the one described in this article has increased 8% between 2010-2012. It has gone from 47% to 55%, meaning that more than half the goods shipped in large RO-RO ships are not cars.

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