

IMMINGHAM EASTERN RO-RO TERMINAL



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PIANC

The World Association for Waterborne
Transport Infrastructure

THE DESIGN OF TERMINALS FOR RORO AND ROPAX VESSELS



MarCom Working Group Report N° 167 – 2023

PIANC REPORT N° 167

MARITIME NAVIGATION COMMISSION

THE DESIGN OF TERMINALS FOR RORO AND ROPAX VESSELS

September 2023

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This report has been produced by an international Working Group convened by the Maritime Navigation Commission (MarCom). Members of the Working Group represent several countries and are acknowledged experts in their profession.

The objective of this report is to provide information and recommendations on good practice. Conformity is not obligatory and engineering judgement should be used in its application, especially in special circumstances. This report should be seen as an expert guidance and state-of-the-art on this particular subject. PIANC disclaims all responsibility in the event that this report should be presented as an official standard.

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6.6.3.3 Taking Account of the Cargo Type Proportions

It is obvious that knowing the proportion of cars to trucks is essential to the success of terminal planning.

It is less obvious is that there is a radical difference in parking and marshalling space requirements between accompanied trucks and unaccompanied trailers. This is discussed in detail in Section 6.7.3 but in summary the issues are as follows:

- The marshalling arrangements for accompanied trucks usually consist of long rows of nose to tail parking, which is a very efficient parking configuration.
- The parking arrangements for unaccompanied trailers require that each trailer can be randomly accessed when the collecting truck driver arrives at the port.
- The most efficient random access truck parking layout uses greater than 40 % more area per unit than a nose to tail marshalling arrangement.
- If the timetabling of the service requires fast drive through parking bays, this increases to more than double the area of nose to tail marshalling.
- For unaccompanied trailers it is also necessary to allow for a dwell time in the terminal, say an average of 1.5 days. For a port handling 2 sailings per day in the terminal this leads to a requirement for three times the numbers of parking spaces.

This explains why it is so important to ensure that the proportion of accompanied trucks to unaccompanied trailers is completely understood.

Furthermore, if land is already limited, it is important to give consideration to whether there is a possibility that the demand for unaccompanied trailers might increase and thus alter the proportions. An example arising from the expansion of the European Union gives some insight into the factors that can have such an effect as follows:

- Until the 1990s the increase in wages and living standards in the EU was believed to result in a greater demand for unaccompanied trailer trades to save the cost of paying for Western European driver time during the voyage.
- After the expansion of the EU to 28 nations in 2004, there was a sudden availability of lower waged drivers from Eastern Europe, which was believed to lead to a move back to accompanied freight. The costs of paying driver time in the voyage was reduced and the same cheaper drivers could also serve at a very competitive rate in the destination country.
- It is therefore valid to consider what might happen if the wages in Eastern Europe catch up with those in Western Europe. This might lead to a renewal of demand for the unaccompanied trailer mode, which, based on the outline explanation above, could require 4 times more area than the accompanied trade that it might replace.

In most cases, the ports and shipping lines often specialise on one or other mode of trade, so the issue is not as controversial as it might be. However, there are many mixed use terminals and for these the judgement on the truck/trailer proportions is of critical importance.

6.6.3.4 Dwell Time Issues

Since one of the attractions of the RoRo mode is the speed of throughput and therefore the ability to serve 'just in time' logistics operations, dwell times in RoRo terminals can be expected to be small.

Table 6-3 sets out recommended dwell time assumptions for planning purposes for a range of cargo types. Most of the assumptions originate from PIANC WG 158: "Masterplans for the Development of Existing Ports". [9]

In the case of RoRo, commercial considerations mean there is a reluctance to reveal detailed information about terminal performance. However, the values listed in Table 6-3 are arrived at from confidential studies in the past, recent project work and interviews with RoRo terminal operators.

One example is displayed in Figure 6.7 and Figure 6.8. This particular example, using data gained from a terminal in Ireland, gives support to a conclusion that:

- The dwell time for unaccompanied trailers arriving for embarkation is usually less than a day
- The dwell time for unaccompanied trailers departing following disembarkation is an average of less than 2 days.
- The dwell time for accompanied trucks arriving for embarkation is only a few hours.

Trade	Recommended Dwell Times for planning purposes	Information source
Containers – Full	5 to 10 days	PIANC WG 158, Section 6.2.5
Containers – empty	7 to 14 days	PIANC WG 158, Section 6.2.5
RoRo Trade Cars	7 to 10 days	PIANC WG 158, Section 6.3.6
General Cargo	10 to 15 days	PIANC WG 158, Section 6.4.6
Dry Bulk	Not usually defined as dwell times (storage capacity recommendations based on inventory turnover per year).	PIANC WG 158, Section 6.5.6
Liquid Bulk	Defined by process engineering	No guidance given in PIANC Report 158
RoRo Freight (accompanied trucks and unaccompanied trailers) Embarkation	Usually less than a day dwell time – (entry to the terminal controlled by the operators).	PIANC WG 167 research
RoRo Accompanied trucks Disembarkation	Usually no dwell time unless customs processes require it.	PIANC WG 167 research
RoRo Unaccompanied trailers Disembarkation	1.5 to 4 days	PIANC WG 167 research
Containers on RoRo (embarkation and disembarkation)	2 to 3 days	PIANC WG 167 research

Table 6-3: Comparison of dwell times for different trades, including RoRo (Source for various trades: PIANC WG 158 [9]. Source for 'Maritime Bridge' RoRo, PIANC WG 167 research)

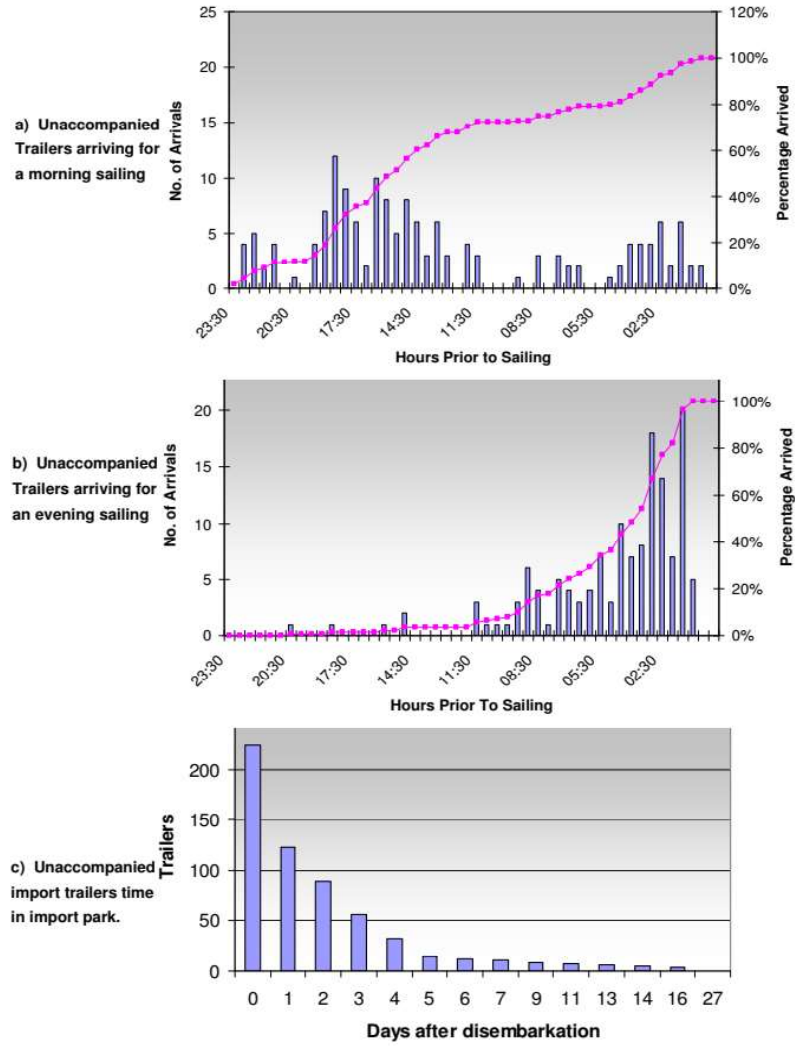


Figure 6.7: Arriving and departing unaccompanied trailer movements through a terminal (Source: Conference paper, Stephen Osborn, 2008)

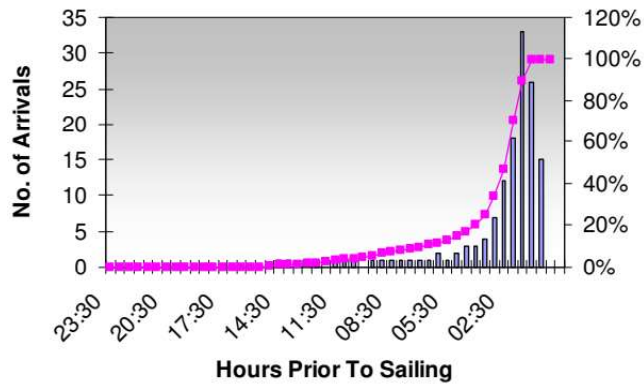


Figure 6.8: Arriving accompanied truck movements through a terminal (Source: Conference paper, Stephen Osborn, 2008)

However, views about dwell time within the industry are mixed.

In a recent new development project (prior to 2020), the operators required that the terminal be designed based on 1.5 days dwell time for import unaccompanied trailers and 2 days dwell time for containers on RoRo in both directions. This was based on experience at an adjacent operating terminal.

On the other hand, another operator recommends that a dwell time of 4 days should be assumed based on experience in an existing operating terminal.

The data in Figure 6.7 and Figure 6.8 was obtained at the height of international trade before the financial crash in 2008, whereas the engagement with terminal operators discussed above took place after the financial crash. Trade volumes reduced by about 20 % at the time of the crash and had only just begun to reach figures similar to the volumes experienced before the crash at the start of the 2020 COVID-19 crisis. This means that pressure on terminal land has not been great and operational policies have been able to be more relaxed, so the larger assumed dwell times might be the result of a relaxed policy rather than what is actually necessary. For instance, at one port, hauliers are allowed to leave trailers in the port for up to 4 days without charge. A change in this policy to reduce that time appears to be practical and could be implemented if excessive dwelling of trailers causes the available area to become too small.

A careful discussion with the potential operator is the best way to decide on a reliable policy, but in the absence of any additional data or guidance it is suggested that the following dwell times can be assumed:

- For embarking accompanied trucks or passenger cars – minimum dwell time, i.e. allow for one shipload (see Note below).
- For disembarking accompanied trucks or passenger cars – allow for one shipload between vessel and terminal 'out' gate unless customs rules require that a substantial inspection process is required, in which case allowance should be made to comply with local regulations.
- For embarking unaccompanied trailers – allow 0.25 days dwell time, i.e. normally parking for one shipload is required but for ports with multiple sailings allow for combinations based on 0.25 days dwell.
- For disembarking unaccompanied trailers – allow 2 days dwell time.
- For embarking and disembarking containers on RoRo – allow 2 days dwell time each way.

NOTE: It must be appreciated that the assumption of minimal dwell time for embarking accompanied trucks and cars is partly a result of management policies at the port. If vehicles are not permitted in until sailing is imminent, there can be a risk of arriving trucks and cars simply parking in the streets outside, and this can be a nuisance to the people living and working in the neighbourhood of the port.

The calculation for the numbers of parking slots for disembarking unaccompanied trailers should be based on the sailing timetables. For instance:

- For a typical route of 2 sailings per day with vessels of 150 trailer capacity:
 - Assuming that the load factor is 60 %, the typical ship carrying will be $0.6 \times 150 = 90$
 - Based on 2 days dwell time, 4 ships will berth during that period.
 - Allowing 20 % for peaking of the service, the number of parking slots required is $1.2 \times 4 \times 90 = 432$.
- For a route with 3 sailings per day with vessels of 120 capacity:
 - Assuming that the load factor is 70 %, the typical ship carrying will be $0.7 \times 120 = 84$

- Based on 2 days dwell time, 6 ships will berth during that period.
- Allowing 20 % for peaking of the service, the number of parking slots required is $1.2 \times 6 \times 84 = 605$.

If there are more berths the numbers will increase accordingly.

The same type of calculation will be performed for containers on RoRo, in other words the assessment approach is different from that recommended for container terminals in PIANC WG 158 [9].

6.6.4 The 'Port Visit' Group of Trades

These groups of trade include trade cars or other trade vehicles, i.e. cars or vehicles that are being delivered for export or import sales. This type of trade has already been dealt with in PIANC WG 158: "Masterplans for Existing Ports" [9], so the remainder of this section includes information from that report for convenience. This current report only highlights specific differences where need be.

6.6.4.1 Trade Forecasting

Trade forecasting has been discussed in Section 6.6.1 above. However, unlike the 'Marine Bridge' type RoRo services, it is also necessary to forecast 'parcel size' (the amount of cargo dropped off or loaded at the port) because these ships are usually visiting a port as part of a long voyage visiting many ports. Knowing the typical parcel size is necessary to allow space to be allocated for a typical maximum shipload.

The parcel size can usually be derived from:

- historical port shipping statistics (total cargo throughput/numbers of vessels calling)
- specific historic or predicted information on parcel sizes obtained from the port in question

6.6.4.2 Taking Account of Vessel Capacity

Vessel capacity is not in itself a key parameter for 'Port Visit' RoRo terminals. However, the trade and berth throughput capacity, when compared with the forecast, may confirm that vessels of a certain size need to visit the port, and this can impact on the size of berths required. The forecast parcel size and the expected dwell times are the parameters that will define the areas that need to be allocated in the terminals.

6.6.4.3 Taking Account of Vessel Timetabling

The productivity and lengths of berths required should be assessed using the conventional port planning analysis as PIANC WG 158 [9] as follows:

$$C_b = P \times N \times n_{hy} \times m_b$$

where:

C_b = productivity of the berth	(units per year)
P = productivity (capacity) of the RoRo ramp	(units per hour)
N = number of RoRo ramps per vessel.	(-)
n_{hy} = number of operational hours per year at the berth	(hours/year)
m_b = berth occupancy factor	(-)