# A SOLUTION FOR EXPORTING GRAIN IN THE RAIN

## A closer look at how to eliminate lost time due to rain in grain export terminals

Despite technical advancements in transport unloading systems, grain storage facilities, ship loading solutions and terminal operating systems, grain export terminals still suffer annual capacity losses of up to 30% due to rain. Technical Director, Ryan Hare, uses Brazil as a case study to explore the application of a new marine terminal concept that eliminates rain downtime during ship loading activities.

### *A Positive Outlook for Grain Trade by Sea*

Grain has been transported across borders and shipped across oceans for more than 3,000 years. Evolving from incidental shipments on the Phoenician's keel-hulled vessels to tens of thousands of tonnes shipped in specialised bulk carriers, the maritime grain trade has grown into the millions of tonnes and billion-dollar business we witness today.

Throughout history, grain trade has spiked following advancement of communication, improvement in technology and development of infrastructure. Industrialisation in the 19th century was followed by exponential growth in grain trade, which is expected to reach record highs in 2021.

As the global demand for grains climbed, the geographic distribution of trade flows changed. Population growth and changing demographics, economic growth, weather conditions, protectionist policies, domestic subsidies and changing consumption patterns have all influenced the flow of grains around the world.

The United States has always had a strong foothold in the grain export market, alongside Canada, Argentina and Australia. However, several disruptors in the 1970's, including the US grain export embargo, led buyers to diversify their supply. Brazil entered as an alternative and emerged as a major exporter by the end of the 1970's. In more recent years, Brazil has benefited from the United States' trade war with China, which ultimately put Brazil in poll position for soybean exports.

Over the last three decades, Brazil has made substantial investments in production expansion, transport infrastructure improvements and port capacity, which has facilitated its rise to the top. With a positive market outlook, Brazil's role as a major grain exporter is set to continue and drive further demand for additional port capacity in the southern states, new developments in the north and improved hinterland transport logistics.

## *Rainfall Dampens Grain Export Capacity*

Unlike container terminals or some breakbulk operations, grain terminals are unable to operate in the rain since it compromises the quality of the cargo being loaded onto the vessel.

During rainfall events, ship loading operations are suspended until the rain passes. Depending on the duration of the rainfall event and the extent of operational planning (or lack of), a temporary capacity bottleneck can be experienced, leading to delays in shipments.

As with many of the primary grain export locations (United States, Canada and Argentina), many Brazilian grain export terminals are subject to adverse weather conditions, including a high frequency and/or long duration of rainfall events.

Specific locations that spring to mind are the Ports of Santos and Paranaguá. Both locations are essential to Brazil's export capacity and are subject to extreme seasonal variations in monthly rainfall. Whilst it rains throughout most of the year, the maximum rainfall occurs during October and March. Recent data from the Port of Paranaguá reports that the volume of rain in January 2021 was significantly higher than in January 2020, with the number of days downtime in month increasing from 7 days in 2020 to 12.6 days in 2021.[1]

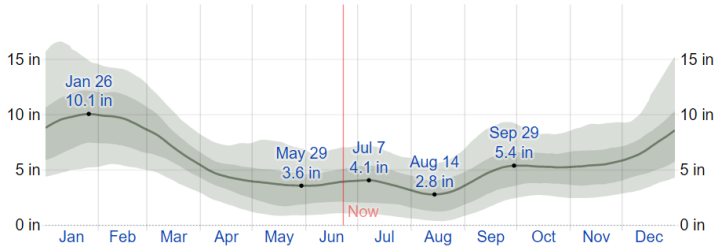



Figure 1 – Average Monthly Rainfall in Paranaguá[2]

On average, terminals in these locations can lose between 25% and 30% of operational time due to rainfall. Whilst the wettest months rarely coincide with peak season exports, there is an overlap and operational capacity is still hampered. Considering the importance of these ports in Brazil's agribulk export supply chain, this is a huge inefficiency both in terms of export capacity and investments.

## *Infrastructure Bottlenecks and Limited Solutions*

The technology to forecast rainfall events has existed for a long time and historical rainfall data in most locations is readily obtainable for analysis. So, the problem is not the unprompted nature of rainfall events or the lack of operational planning. The issue lies with the lack of infrastructure to operate in the rain.

Presently, the party responsible for the planning and design of a greenfield or brownfield expansion development will consider downtime and lost time events when dimensioning plant and infrastructure at the terminal. The downtime and lost time may include events such as

[1] https://www.noticiasagricolas.com.br/noticias/agronegocio/279308-porto-registra-aumento-na-paralisacao-de-operacao-por-chuva.html#.YNJQMehKhPY

[2] https://weatherspark.com/y/30045/Average-Weather-in-Paranagu%C3%A1-Brazil-Year-Round

preventative and corrective maintenance and shipping delays such as approach, mooring and preload/post loading activities.

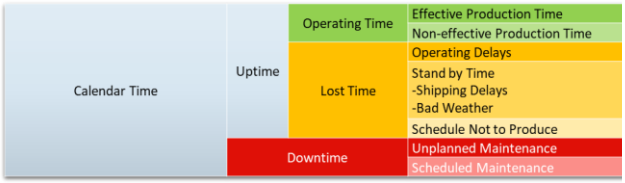



Figure 2 – Port Terminal Availability[3]

On top of this, the planned berth utilisation is considered to avoid high occupancy levels and long vessel waiting times, reducing the available operating time further.

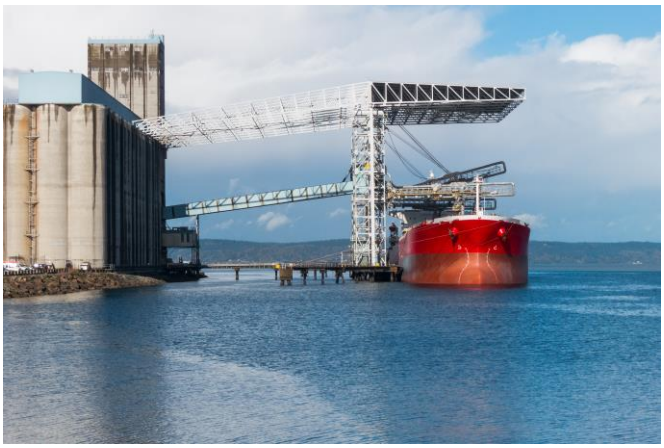
Whilst these downtime events are applicable to most export terminals, terminals such as those in Santos and Paranaguá are also subject to high levels of lost time due to rain.

Using a greenfield export terminal with a 2,000 mt/h nominal ship loading capacity as an example, this terminal could be subject to some 30% to 45% lost time, of which 25% to 40% relates to rainfall. So, when considering a total of 8,760 calendar hours, lost time events and single berth commitment levels, as little as 2,600 hours remain available for loading vessels; that's equivalent to 3.5 out of 12-months in a year.

## *A Safe Haven Solution on the Horizon*

To date, the solutions to overcome this inefficiency have been limited. The traditional approach is to dimension plant and infrastructure such that the terminal and supply chain can offer sufficient capacity during the available hours. The consequence of this approach is that the nominal capacity of the handling systems is far greater than required, and on average the plant is underutilised.

In Tacoma, United States, there has been some attempt to provide a solution to the problem. TEMCO implemented a cantilevered roof to protect ship loading during heavy rainfall. Despite being an innovative solution, this structure does not prevent rain blown from the sides and may not be fully effective in other locations.



As an alternative, WSP has been working on a "Safe Haven" concept, whereby the entire berth is covered, providing fully enclosed ship loading operations. This is a relatively new concept in the marine terminal sector, one which has recently been implemented by Arcelor Mittal at North Port in Ghent. The scale is much smaller and targeted for coastal vessels and waterway barges handling breakbulk, however it is a concept that can be scaled up in the right conditions.

As always, it is a trade-off between capital expenses relating to the additional infrastructure and the capacity gained from increased operating availability. There is no one-size-fits-all and the solution will ultimately depend on the design vessel, neighbouring facilities, ship navigation and ground and climatic conditions.

Despite the roof structure being more than double the length of a football pitch, the truss

[3] WSP

and frame structure is nothing new. The challenge lies in the shiploader design, marine structures, embankment defences, fender and ship impact protection and manoeuvring the ship to and from the berth. Innovative technology such as docking, automoor and winching systems can aid navigation, whilst new ship loading concepts can minimise crane dimensions and the roof height.

In the right circumstances, the benefits of the “Safe Haven” solution outweigh the additional costs. Eliminating lost time due to rain could increase loading availability by roughly 20% and practical ship loading capacity by roughly 50%. A terminal designed to handle 6 million metric tonnes per annum (Mmtpa) in the wet, for example, could achieve up to 9Mmtpa adopting the “Safe Haven” concept. The numbers speak for themselves. Such an innovative solution enables agribulk ports to significantly optimize their operations, all year around, rain or shine.

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