Vessel Time in Port Comparison - Minimum vs Additional Berths at the Port of Vancouver

QUORUM CORPORATION
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Contents

Summary

Time spent in port by bulk vessels calling to the Port of Vancouver to load grain has different characteristics depending how many berths were required to complete loading. The trend is that vessels spend longer in port the more times they reposition to berth, either from visiting multiple terminals or from re-visiting the same terminal. It is important to bear in mind that the differentiation within time in port is characterized by the number of terminals and berths involved, but the differences are not *caused* by it. The reasons for loading at multiple terminals or revisiting the same terminal in one voyage go farther back in the supply chain.

Multiple terminal trips are known in advance of the vessel arriving to port because it is arranged through shipping lines to charter part of a vessel. The commodity, grade, and terminals are specified in the charter party agreements to meet the sales contract with the customer. Having multiple terminals share a vessel is not indicative of inefficiencies in the supply chain as they are intentional. In fact, situations in which multiple terminals share a vessel are standard practice within the marine shipping industry or, in the case of Fraser Grain Terminal, are an operational necessity. Smaller vessels, as with containerized grain, provide an option for fulfilling lower volume sales but have a higher per-tonne cost than panamax vessels. This cost structure makes sharing vessels financially attractive for shippers.

Revisiting a terminal several times to complete loading, however, can be indicative of problems within the supply chain – most notably with cargo supply. In most cases, terminal operators will prefer to fully load a vessel in a single visit alongside and are unable to so when the grain designated for the vessel is not entirely available. Partially loading a vessel then vacating the berth is done in response to the prevailing conditions while the vessel is already in port. Such situations are generally not intentionally planned for. Having only one berth complete a vessel minimizes costs through fewer movements within the port and fewer reconfigurations of terminal operations.

Grain voyages that completed with the minimum number of berths taken cleared port an average of 7.0 days quicker than those that needed to revisit any terminal. This trend holds for both single terminal and multiple terminal trips. Single terminal voyages saw an average time in port of 11.9 days for minimum berth trips and 19.5 days otherwise, a difference of 7.6 days. Multiple terminal trips saw a similar average extension to total time in port of 7.2 days for additional berths, rising to 24.9 days instead of the 17.7 days of minimum berth voyages.

A critical element of the extended time in port is that most of that time is accrued at one of the port's shared anchorages. Of the overall difference of 7.0 days, 5.5 of them, almost 80%, were at anchor with the remaining 1.5 days alongside one of the terminals involved. Anchorage utilization has been a topic of discussion for the Port of Vancouver for some years now, primarily through the port's own Active Vessel Traffic Management (AVTM) initiative, and, more recently, as part of Bill C-33. The AVTM is part of a modernization undertaking to ensure that the port can meet the projected growth in demand. Anchorage management is a critical part of the effort and focuses on community and environmental impacts in addition to the operational need for anchorage capacity.

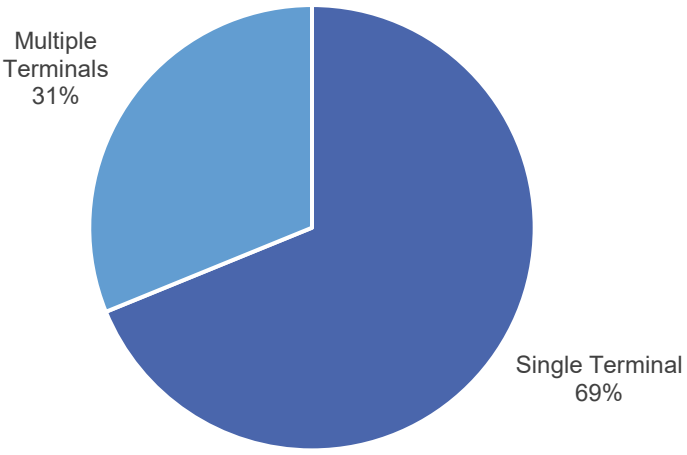
Bill C-33, the "Strengthening the Port System and Railway Safety in Canada Act", as of May 2024, has a proposed clause that would allow port authorities to compel vessels that exceed 14 days at anchor around the Southern Gulf Islands to vacate the area. The proposal, in it's current phrasing, would disproportionately affect grain and coal shippers who most regularly see their vessels exceed the limit. Improving the supply chain to better align the receipt of cargo at marine terminals with the arrival of the vessels chartered to move it overseas would reduce the occurrence of additional berths and, in turn, reduce occurrences of extended stay at anchorages.

Grain Sector

This analysis has categorized grain voyages based on the number of terminals (single or multiple) and the number of berths (minimum or additional) involved while in port[1]. The first distinction, the number of terminals that load onto a vessel, is planned for in advance. Both single and multiple terminal trips are standard practice, such that vessels loading from several grain terminals is not reflective of any supply chain issues. The number of berths required, however, might indicate problems as it is more reactionary to supply chain conditions when vessels are already in port.

Over two thirds (69%) of the grain vessels that called to port loaded at one terminal only (Figure 1). This is largely due to the vertical integration of Canada's grain industry, wherein most grain exports are handled by major shippers who own both extensive primary-elevator networks and marine terminals. The remaining 31% of trips, still a significant portion of the total volume, took on grain at more than one terminal.

Figure 1 - Breakdown of Grain Vessel Trips by Number of Terminals (Jan 2017 – Apr 2024)



The commercial structure of the Canadian grain industry and infrastructure at the Port of Vancouver both promote the proportion of grain vessels that load at multiple terminals. Other industries, as shown later in Sector Comparison, do not see this occur as often. There are three primary reasons that this is more common in the grain industry:

1. Fraser River draft restrictions

   Fraser Grain Terminal (FGT) is located on the Fraser River in Vancouver, where draft restrictions prevent a panamax vessel from fully loading with grain. As such, it is common for vessels to first load at FGT then proceed to an inner harbour grain terminal to finish loading.

2. Parcel shipments

   Several shippers sharing a vessel is commonly referred to as "parcel shipments", wherein each exporter use a portion of the capacity in separate holds. Parcel shipments will generally have one contract for each shipper involved, and the destination ports do not need to be the same.

[1] Refer to Appendix A: Port Call Categorization for examples

Not all sales need the full capacity of a panamax vessel and parcel shipping offers a way for smaller volume contracts to benefit from lower per-tonne costs of higher capacity vessels. Booking smaller vessels or moving to containerized grain are other ways that lower volume sales can be shipped, but they do not have the same financial benefits as sharing one large cargo ship.

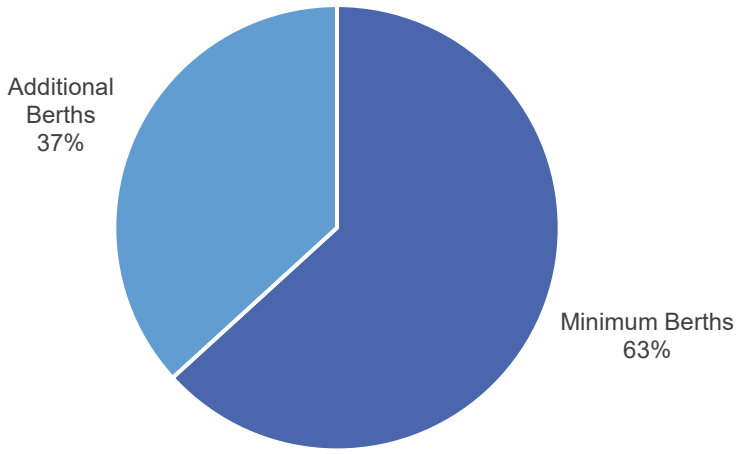
In addition to providing more competitive opportunities for smaller shippers, sharing a larger vessel in this way further promotes efficiencies by reducing the number of vessels calling to port, in turn easing port congestion and lowering emissions.

3. Terminal Ownership

Grain terminal ownership at the Port of Vancouver is such that some companies have interests in several terminals, whether they be controlling, minority, or contractual. These interests allow more flexibility in which terminals will fulfill any given sale order for those shippers. Part of this flexibility is that individual terminals can specialize in which commodities they handle.

When a vessel needs to move alongside the same terminal more than once during a trip it can be indicative of problems within the supply chain, most notably limited flow of grain into the port terminals. In most cases, terminal operators will prefer to fully load a vessel in a single visit alongside. Even in cases where multiple terminals are involved, each terminal will aim to complete their portion by bringing the vessel to dock only once. Trips with the minimum number of berths occurred for 63% of all grain vessels and is considered the typical scenario at the Port of Vancouver.

Figure 2 - Breakdown of Grain Vessel Trips by Number of Berths Taken (Jan 2017 to Apr 2024)



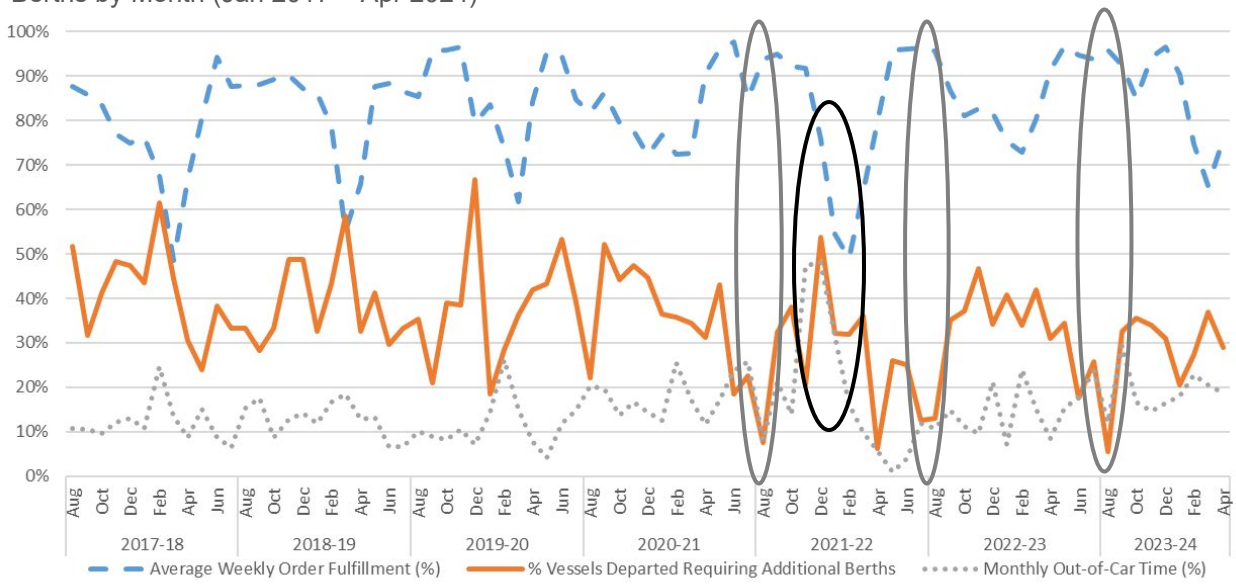
Terminal operators generally do not plan their schedules to have a vessel partially load, reposition to anchor, then return later to finish loading. Doing so incurs additional costs to move the vessel and reconfigure the terminal to load a different ship. These additional movements are done to maintain terminal fluidity whenever necessary.

The predominant reason that a vessel would not finish loading in a single stop alongside a terminal is that the cargo wasn't fully available. Grain exporters contend with various product types and grading that complicate the land-side logistics necessary to match cargo with the vessel chartered to deliver it overseas. As a product intended for human consumption, great care, and scrutiny, is applied to ensure the quality of the cargo is consistent with the customer order and meets standards for food safety. Shippers plan when grain will be pulled into country terminals from producers, when railcars should be delivered, and when the vessel should arrive to port. More often the case will be that producers deliver on time, vessels arrive on time, but rail service is not provided during the week requested.

Delays in getting the right product to the terminal at the right time contribute to circumstances where vessels may partially load with the cargo immediately available then return to anchor to wait for the rest of it. In the meantime, the terminal will remain productive by loading to another vessel in their program provided they have the cargo to do so. Furthermore, capacity constraints with terminal storage may require partial loading and repositioning of vessels to and from anchorages to maintain adequate space to receive inbound railcars.

Rail performance can be measured through order fulfilment and out-of-car time. Order fulfilment, calculated by the Ag Transport Coalition (ATC), measures what percentage of railcars were delivered empty to their members' country elevators against the total number ordered for that week. Out-of-car time (OCT) is a Grain Monitoring Program measure (GMP Table 5C-5 M) that describes the proportion of hours that terminal elevators were staffed and expecting railcars that were not delivered. High order fulfilment indicates that grain shippers are receiving their railcars in the weeks they requested at the country origins. Low out-of-car time indicates that port terminals are receiving railcars when anticipated.

Figure 3 - Order Fulfillment, Out-of-Car Time and Proportion of Vessels that required Additional Berths by Month (Jan 2017 – Apr 2024)



Source: Ag Transport Coalition (Order Fulfillment), GMP Data Warehouse (Vessels Cleared)

Figure 3 highlights the relationship between how many vessels needed additional berths to complete loading and the rail performance metrics. Months where a high proportion of vessels needed to revisit a terminal tend to align with months that had lower order fulfilment and higher out-of-car time, indicating weaker rail performance. To be clear, not all changes to the railway metrics are within their control, but regardless of the cause of worsening performance, operations at the port are impacted. November of the 2021-22 crop year (circled in black) saw massive flooding that washed out road and rail access to the Port of Vancouver. Understandably, order fulfilment and out-of-car time suffered following the natural disaster – as did port performance. More than half of all vessels in December 2021 needed additional berths to complete loading.

The November 2021 flood is only one example of disruptions throughout the supply chain – fires, blockades, severe cold, derailments, and labour action are other examples of unexpected events that cause sudden degradation in order fulfilment and out-of-car time.

In contrast, periods with a low proportion of vessels partially loading tend to occur alongside periods of strong rail performance metrics. Examples are August of the last three crop years (circled in grey) where order fulfilment was near 100% and out-of-car time was below 10%. Each of the years shows August with a lower proportion of vessels that required additional berths than the rest of the year. It is worth noting that August generally has lower demands on both rail traffic and port terminal throughput which may

contribute to increased fluidity as the system is built to handle the higher volume of peak shipping periods.

Order fulfilment and out-of-car time provide insight into overall rail supply and capacity but are not the only aspects to consider. Additional berths may be required even during periods of consistent rail service. For example, if the grain is not arriving in the sequence requested to match the vessel scheduling, partially loading a ship may be necessary to maintain fluidity in terminal storage. Vessels at berth without the required grain will generally be repositioned to an anchorage so the terminal can remain productive by loading a different vessel. During other interruptions, such as for inclement weather, terminal operators tend not to reposition the vessel since the grain is available and can be loaded once the disruption has ended.

With many varied circumstances possible throughout the grain supply chain, it is impossible to fully describe all situations that might result additional berths taken. Some other examples include:

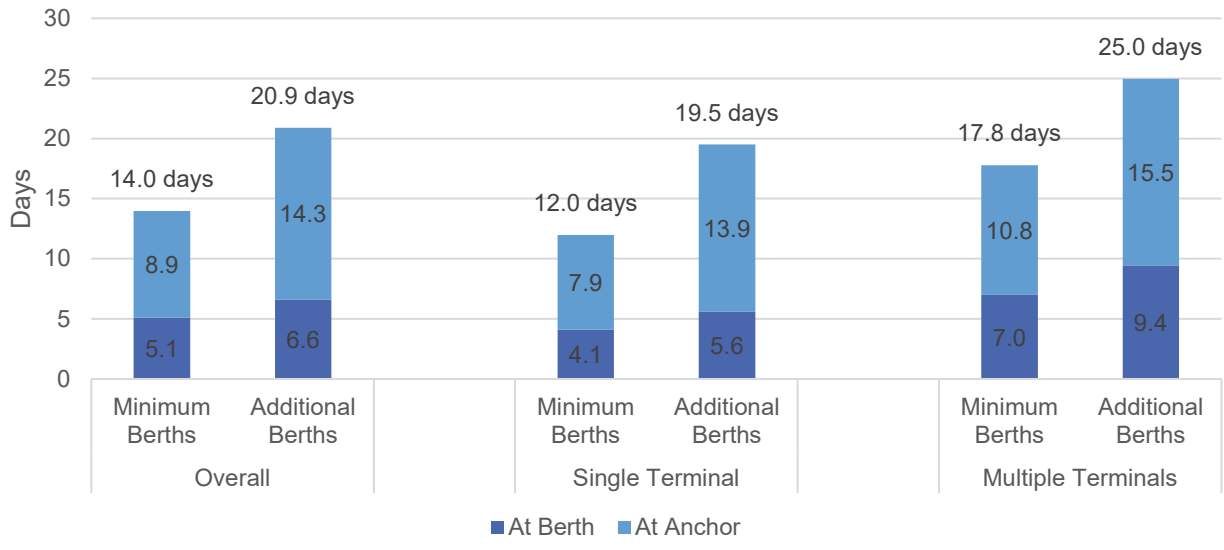
- Commercial decisions to prioritize or de-prioritize certain sales.
- Grain failing to meet grade specifications customer requirements when inspected during loading.
- Unexpected terminal or vessel maintenance that requires vacating the berth prior to finishing.

Impact of Needing Additional Berths

Grain vessels that were unable to complete loading with the minimum number of berths saw an average increase of at least 7.0 days to the total time in port (Figure 5). Almost 80% of the extended time in port were spent at anchor, 5.5 days, which puts more pressure on the port as it makes use of shared infrastructure.

The increased time in port observed is consistent when drilling into single or multiple terminal voyages. Single terminal trips saw a 7.6-day extension, from 11.9 to 19.5 average days in port, split 79% toward anchorage utilization which rose from 7.8 to 13.8 days. Multiple terminal trips were lengthened by 7.2 days, of which 4.8 days (66%) occurred at anchor.

Figure 4 - Average Days in Port for Grain Vessels by Berths Taken (Jan 2017 – Apr 2024)



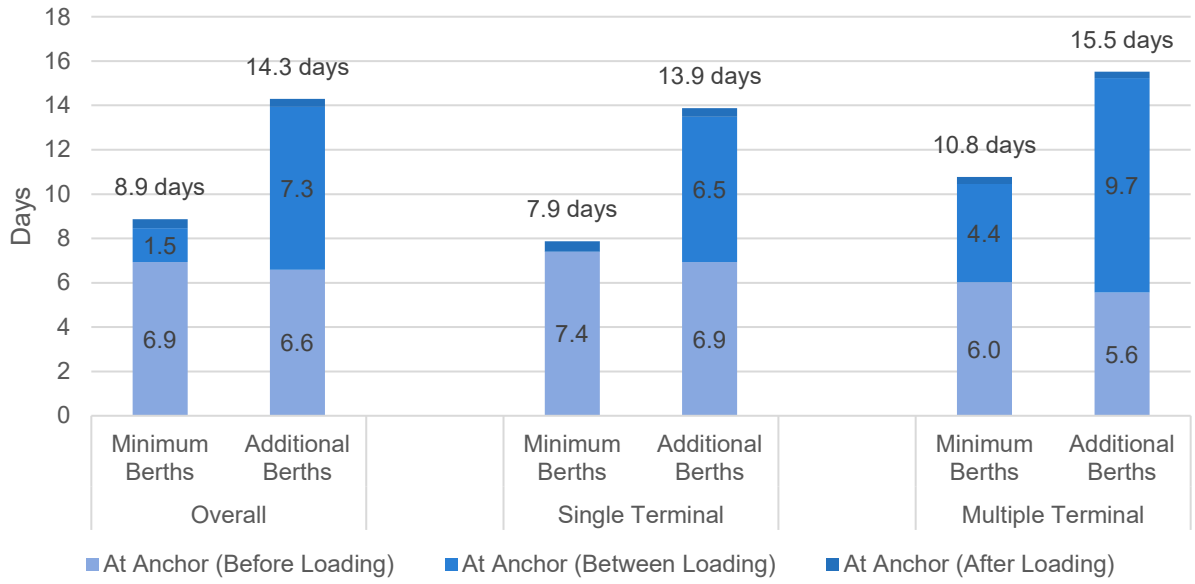
While the total loading time should be similar for the same volume of cargo, there are other activities that must take place before loading can begin after a vessel is repositioned to berth which leads to an overall increase in time at berth. Overall, time at berth was 1.5 days longer on voyages with additional berths.

The preponderance of extra days at anchor occurred between loading instances (Figure 5). Vessels must wait somewhere until the rest of the cargo is ready, and the terminal berth is clear to move back for final

loading. An exception is for terminals with two berth faces, which have more leeway before it's necessary to vacate the berth as loading to a second vessel can occur without repositioning the one lacking product.

Time at anchor before or after loading are comparatively unaffected by the number of berths required. There was a minor reduction in the average time waiting before loading of 0.3 to 0.5 days, but it was not significant enough to offset total increase in anchorage use between loading instances. Anchorage use after loading is almost exclusively for fumigation which has a consistent duration.

Figure 5 - Breakdown of Time at Anchor for Grain Vessel Trips by Number of Berths Taken (Jan 2017 – Apr 2024)



Time at berth is less of a concern for port congestion as it does not make the same use of shared resources such as anchorages, pilots, and tugs. However, there is motivation to minimize time at berth for terminal operators who prefer not to have idle time when they have a full program and could instead be loading to a separate ship. Anchorages provide a means for terminal managers to optimize their operations when handling multiple vessels in the same period.

The delay seen when vessels took additional berths is primarily caused by a mismatch between what the vessel requires and what is in terminal storage or is imminently inbound with railcars. If the scale of these mismatches could be reduced there would be less partial vessel loading and anchorage use would decrease accordingly. There are several ways in which this might be achieved:

- Near Time arrival for vessels
    - Communication between terminals, ports, and shipping agents may allow for adjusting vessel speeds to change the arrival date to better align with the terminal's readiness to load[2].
    - There are limitations to how practical near-time arrival is for the grain industry. The need to inspect each vessel for food safety before they can load any cargo necessitates scheduling arrival dates ahead of the terminal's readiness to load.
- Consistency in rail service
    - Clear service obligations that are consistently met would facilitate logistics planning and execution for shippers.

[2] A comprehensive study on Near-Time Arrival was completed by the Chamber of Shipping and is available on their website at https://shippingmatters.ca/cos-near-time-arrival-project/

- Port of Vancouver initiatives
    - Active Vessel Traffic Management and its component piece of Anchorage Management is underway and aims to improve the supply chain in ways that may reduce how often vessels require additional berths.

Terminals with Two Berth Faces

Grain terminals with multiple berth faces have more leeway in when vessels need to reposition to anchorage versus when they can remain alongside the terminal. On average, terminals with two berths had one fewer day of anchorage time per vessel, but 3.5 more days of time at berth (Table 1). The net result that their vessels are typically in port longer but make less use of shared port infrastructure.

Table 1 - Single Terminal Grain Trips* by Count of Berth Faces (Jan 2017 – Apr 2024)

# Berth Faces	Average Days in Port	Average Days at Berth	Average Days at Anchor
1	14.1	3.7	10.4
2	16.6	7.2	9.4

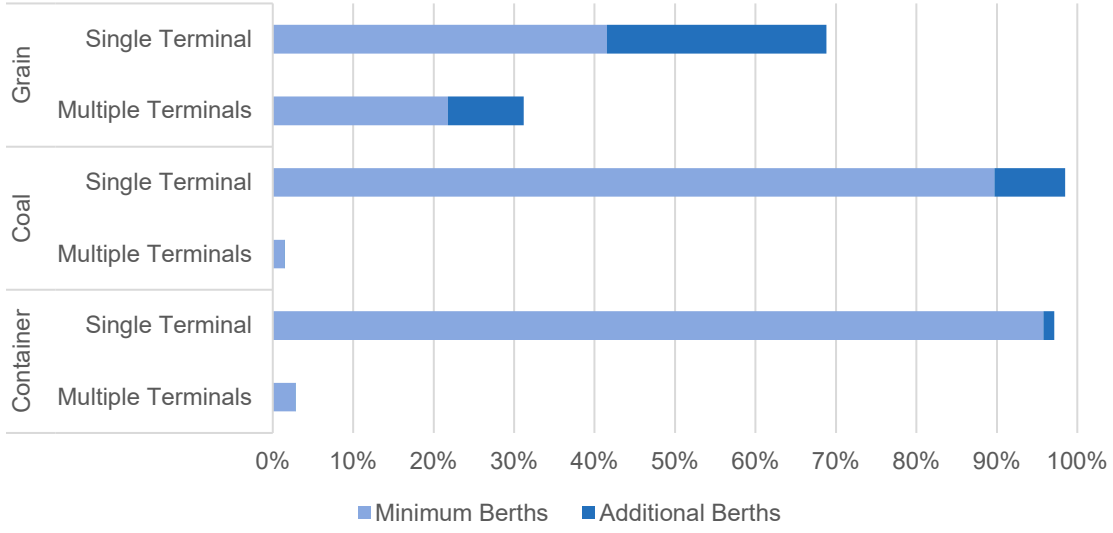
* Multiple Terminal trips are excluded since time at anchor cannot be conclusively attributed to each terminal

Sector Comparison

The grain sector is distinct from coal and container exports in the proportion of vessels which take on cargo at multiple terminals during a single port call or required additional berths (Figure 6). The coal sector has a meaningful proportion of trips requiring additional berths; however, it is only 9% of trips, which is significantly less than the grain sector's 37%. Container voyages do not regularly revisit a terminal during the same port call.

Operational differences between sectors and the products handled contribute to why additional berths may be more common for some industries. Grain, and to a lesser extent coal, is a highly differentiated product mix with varied commodities and grades exported. Aligning a more specific cargo, which often requires blending different grades to meet a customer's needs, complicates the logistics of getting the right product in place. Furthermore, bulk shipping operates under a different model than container shipping.

Figure 6 - Vessel Classifications by Sector (Jan 2017 – Apr 2024)

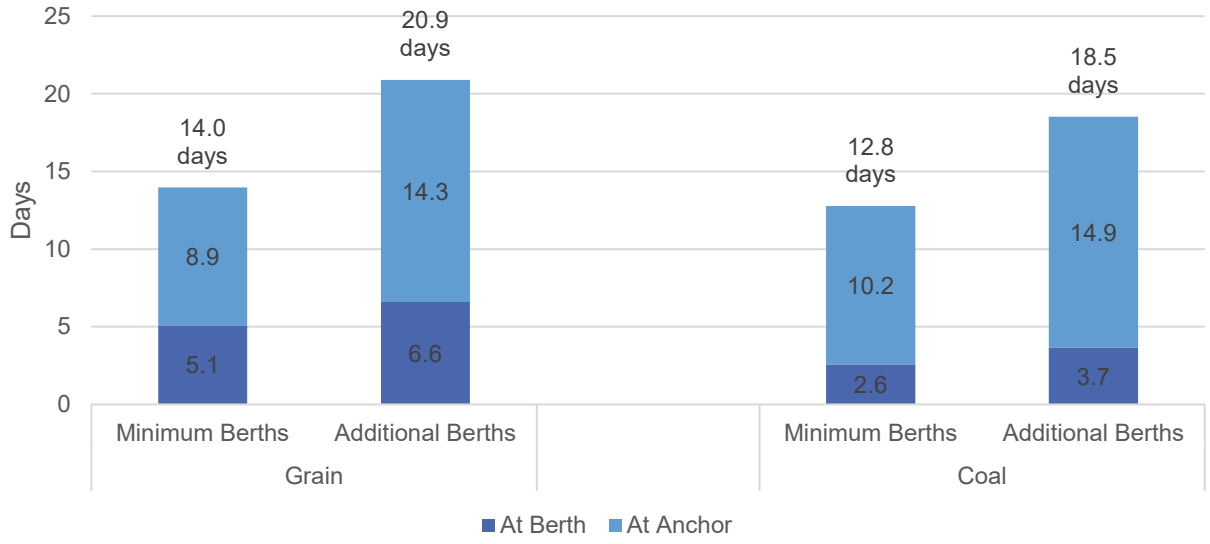


Container lines operate more like a bus service moving regularly between ports with set arrival and departure windows. There is more incentive for a container ship to maintain the schedule than to wait for delayed product so issues with land transportation, be it rail, trucking, or transloading, do not get pushed fully into vessel delays. A shipper can “miss the bus” if their containers are not ready before the cutoff dates. Bulk carriers often operate on a voyage-charter, wherein the shipper has ordered a vessel to arrive at a certain lay time, pass inspection, and carry a specific cargo from their terminal to a specific destination. In such a charter, the ship’s captain must wait for the agreed upon cargo before it can depart – any delays in getting product to the port directly impacts vessel time in port.

Container ships or coal vessels visiting multiple terminals do not occur as a matter of typical operations, accounting for less than 2% of total trips for each commodity.

As seen with grain vessels, when additional berths are required for coal vessels there is also an extension to time in port that heavily favours anchorage use. Of the prolonged 5.7 days in port of additional berth trips, 4.7 (82%) of them occurred at anchor (Figure 7).

Figure 7 - Grain and Coal Trips by Berths (Jan 2017 – Apr 2024)



Bill C-33 Anchorage Limit Analysis

Bill C-33 includes an amendment to the Marine Transportation Security Act that proposes a limit of 14 cumulative days at anchor within an area around the Southern Gulf Islands. The relevant except is as follows, and Figure 8 on the following page shows the area described by the schedule:

> *Anchorage of more than 14 days*[3]
>
> ***(1.1)*** *If a vessel has been anchored in the area described in the schedule for more than 14 days, the Minister shall direct the vessel to proceed, in accordance with any instructions the Minister may give regarding the route and manner of proceeding, to a place specified by the Minister that is outside of the area and to remain outside of the area for a period specified by the Minister.*

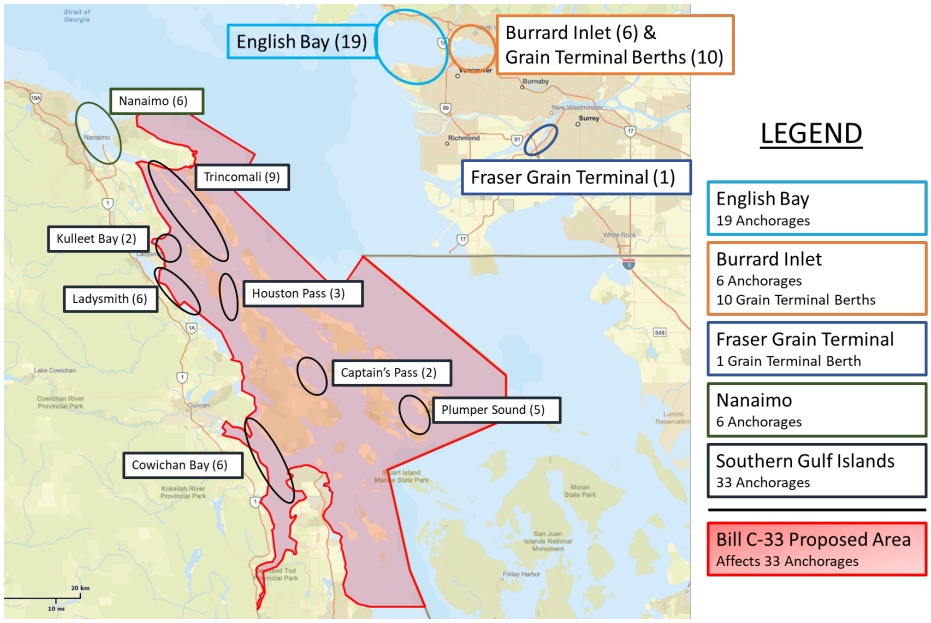
All 33 anchorages within the Southern Gulf Islands are contained within the area described by the schedule of Bill C-33. The remaining anchorages utilized within the ports of Vancouver and Nanaimo are separate and are not part of the proposed 14-day limit. However, the Port of Vancouver imposes a 7-day restriction on time at anchor within English Bay. When vessels exceed that limit, they can be required to

[3] https://www.parl.ca/DocumentViewer/en/44-1/bill/C-33/second-reading (Accessed May 2024)

reposition to another anchorage if the port needs that anchorage for another vessel. Commonly, vessels will reposition from an English Bay anchorage to a Southern Gulf Island anchorage if they have exceeded the port's 7-day limit.

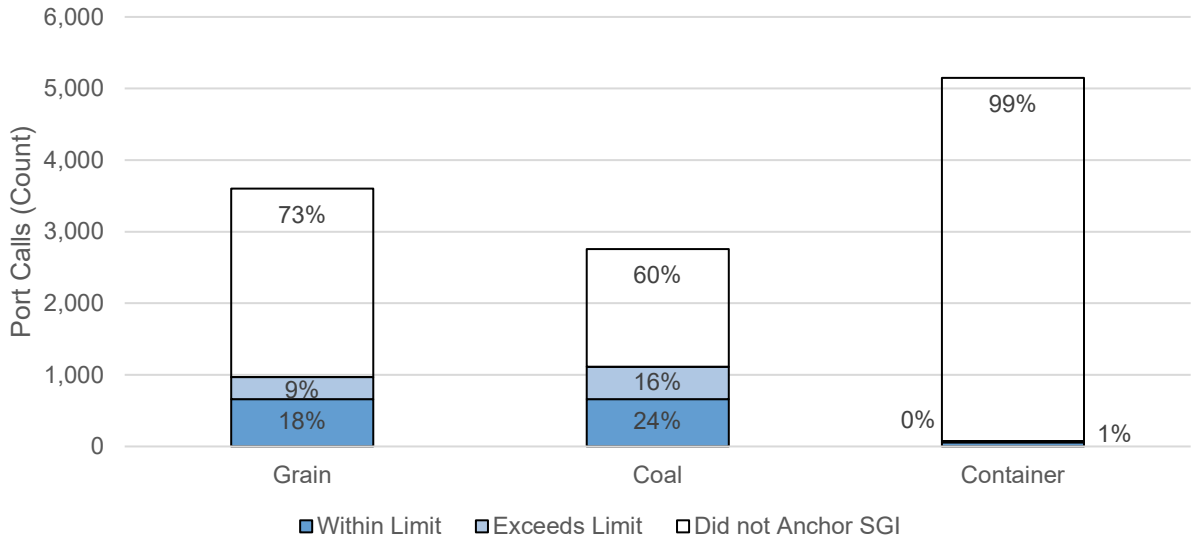
In a scenario where the 7-day limit in English Bay and 14-day limit in Southern Gulf Islands are enforced, vessels which exceed both will have nowhere to take anchor. A concern is that these vessels would be required to vacate the port and dwell outside Canadian waters or seek use of the limited number of anchorages at the Port of Nanaimo or Royal Roads near Victoria and Esquimalt.

Figure 8 - Anchorage and Grain Terminals by Region for Port of Vancouver, Port of Nanaimo, and Southern Gulf Islands



The estimated impact that Bill C-33's proposed limit to time at anchor has to each sector varies greatly. Usage of Southern Gulf Island anchorages, for any duration, occurred for the grain sector in 27% of port calls and 40% for the coal sector (Figure 9). Of those voyages, coal had the most incidence of exceeding the 14-day limit at 16% of all coal voyages. The grain sector saw 9% of all voyages during the period exceed the limit. Container ships rarely take anchor in the area with just over 1% anchoring for any duration and less than 1% exceeding the limit.

Figure 9 - Usage of Southern Gulf Island Anchorages by Sector and 14-Day Limit (Total 2017 – 2024 April)



Data Sources

Vessel Movement

The Pacific Pilotage Authority supplies vessel movement data to Quorum Corporation through our role as the Grain Monitor.

The period examined includes all vessels which departed from Vancouver between January 1, 2017, and April 30, 2024. Table 3 provides the breakdown of vessel calls throughout the period.

Table 2 - Breakdown of Port Calls by Commodity Group, Port of Vancouver 2017-01-01 to 2024-04-30

Commodity Group	Vessel Calls
Grain	3,550
Coal	2,719
Container	5,077

In its role as Grain Monitor, Quorum Corp. has additional data that can provide more insight and detail into the movements of grain vessels; however, these data are not considered so that sector comparisons use the same methodology within this analysis. As such, the grain measures reported here may differ from those published in Grain Monitoring Program reports that cover the same period.

Order Fulfilment

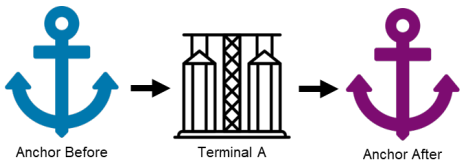
Data on railway order fulfilment is taken from Ag Transport Coalition weekly reports posted at https://agtransportcoalition.com/.

Appendix A: Port Call Categorization

These graphics depict examples of the difference categorizations of voyages used throughout the analysis. There are other configurations possible with vessel movement between terminals and anchorages that fit the categorizations described below - for instance not every vessel requires anchorage before or after loading. The critical piece is how many different terminals are involved, and whether any terminal was revisited during the port call.

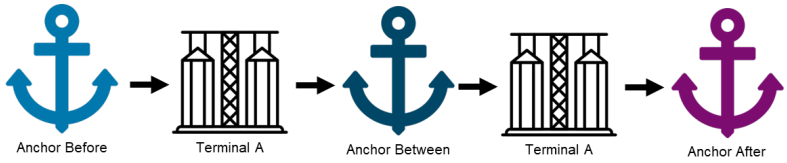
Single Terminal with Minimum Berths

Only one terminal loads to the vessel and completes loading in only one stop at berth.



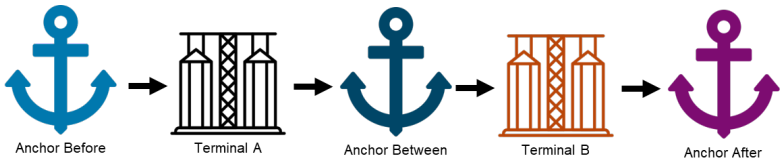
Single Terminal with Additional Berths

Only one terminal loads to the vessel but it was unable to complete loading in one berthing. Time at anchor is necessary while the ship is partially loaded.



Multiple Terminals with Minimum Berths

More than one terminal loads to the vessel but it stops at each terminal only once.



Multiple Terminals with Additional Berths

More than one terminal loads to the vessel and one of the terminals was unable to complete their portion in a single instance alongside.