

## General Goods - Supply Chain Benchmarking Report

Report for the Department of Infrastructure, Transport, Regional Development and Communications

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# Executive Summary and Scope

## **EXECUTIVE SUMMARY**

The term "general goods" refers to general household cargo such as plasticware, furniture, clothes, electronics, and home appliances. General goods are typically containerised for overseas shipping to standardise the cargo, allowing for efficient movement of freight. The efficiency of the general goods supply chain is important as it impacts the total cost of imported and locally manufactured consumer goods, which are a significant input into household budgets.

#### <u>Scope</u>

This paper's scope covers the flow of general goods from port of importation to distribution centres. Exports and domestic movements from manufacturers or distribution centres to retailers are excluded from this paper's scope.

While general goods are typically distributed to many destinations, movements usually follow one of two main 'flows'. In the first flow, the destination of goods is close to the point of importation, therefore movements are shorter and are undertaken via road.

## Key flow #1 – Movement from port to nearby distribution centres



Figure 1: Typical supply chain of imported general goods by flow (country agnostic)

In the second flow, goods are transported a moderate or significant distance from the port to regional areas or inland urban centres. Given the longer distance, transport of goods in the second flow more often involves multiple modes of transport.

#### Key flow #2 – Movement to distribution centres located a moderate/significant distance from port



Figure 2: Typical supply chain of imported general goods by flow (country agnostic)

<sup>1</sup> Ports Australia, Trade Statistics, 2019

The U.K and Europe (specifically Germany, Belgium and the Netherlands or GBN) have been selected as comparative countries for Australia's general goods supply chain as they both import consumer goods in considerable volumes. They also have some geographical and demographical features that are similar to Australia.

With limited local manufacturing, Australia imports over 4 million twenty-foot equivalent units (TEUs) of general goods annually. While Australia has 14 ports that accept containers, the five ports situated in Australia's most populated cities handle 98% of Australia's total volume.<sup>1</sup> Once goods have arrived at port, the average distance and the direction that containers travel varies by port and end destination; however, most containers travel short distances by road from major ports to nearby distribution centres (key flow #1).

Ports in the U.K. handle c.5.2 million TEU imports annually, with the main ports largely concentrated in the Southeast.<sup>2</sup> The majority of the U.K.'s general goods imports tend to travel longer distances than Australia's as national distribution centres are typically located in the Midlands (around c.3 hours and 240km from the key ports). Both Australia and the U.K utilise road more than rail to transport general goods (c.80% vs c.20%). Average freight costs in the U.K. are broadly similar to GBN, according to industry participants, at AUD c.\$0.19 per tonne-kilometre (tkm) for road and AUD c.\$0.03 per tkm for rail.

Rotterdam and Antwerp are the largest container ports in Europe, serving as gateways for imports to the continent. GBN relies on an additional mode of transport via barge movement along waterways. Like Australia, key flows from Rotterdam and Antwerp favour transport via road. Road freight rates in GBN are AUD c.\$0.19 per tkm, while rail costs are c. AUD \$0.03 per tkm. Barge costs are relatively low, at AUD \$0.05 and AUD \$0.04 per tkm for medium and large ships respectively.

## **KEY FINDINGS & AREAS FOR FURTHER INVESTIGATION**

- General goods freight rates were found to be similar in the U.K. and GBN, but road freight costs were higher than in Australia, while rail freight costs were lower than in Australia.
- Further investigation would be warranted to understand the likely causes of this cost differential.

<sup>2</sup> U.K. Department for Transport: U.K. Port Freight Statistics 2019

Australian Supply Chain Overview

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## AUSTRALIAN SUPPLY CHAIN OVERVIEW

#### Generic general goods supply chain

General goods broadly refer to a wide range of products that are transported in containers. Examples of general goods include plasticware, furniture, electronic, clothes and home appliances. General goods are mostly imported from countries with significant manufacturing capabilities, such China and the U.S.



Figure 1: Top 5 countries for container port throughput 2019 (Source: UNCTAD Statistics)

Containerised freight is a key component of the general goods supply chain. The universal rectangular cuboid container shape allows goods of different shapes and sizes to be bundled together and moved in the same efficient way. Containers are available in 20-foot lengths - equating to one TEU or 40-foot lengths (equating to 2 TEUs), enabling transport of cargo weights up to 28t and 31t respectively. A variety of container types are available such as refrigerated or food grade to allow transport of a diverse range of goods.

Containers carrying export cargo are sent offshore, while new containers are brought in through containerised imports. Universally, countries with efficient general goods supply chains minimise the amount of 'empty container' movement within the supply chain while ensuring that containers are still in the correct place to be used for goods when and where needed.

## Key flow #1 – Movement to distribution centres near the port



Figure 2: Typical movement of containerised freight to distribution centre (country agnostic)

Shorter trips are typically not suited to a multiple mode journey. Here, road is usually the best mode, given its flexibility for last mile delivery

#### Key flow #2 – Movement to distribution centres located a moderate or significant distance from the port



Figure 3: Typical supply chain of imported general goods by flow for multi-modal journeys (country agnostic)

Notably, the price of moving general goods may not always be directly proportional to the distance travelled or input costs of movement. In many cases, containers are significantly cheaper to move in one direction of travel than the other to fill otherwise empty containers. In addition, freight that is moved to areas outside of the typical "flow" of containers can be more costly than freight that moves with other containers in significant volumes.

#### General good supply chain in Australia



Figure 4: Number of containers imported into Australia by port (Ports Australia)

In 2019, 4.1m TEUs were imported into Australia. Major Australian ports in Melbourne, Port Botany, Brisbane, Fremantle and Adelaide, collectively serviced 98% of Australia's general goods imports with the remainder arriving via minor ports.



Figure 5: Australia's major and minor port locations that receive containers

#### Key supply chain flows

The majority of general goods transport in Australia is undertaken by road. The average distance and the direction that general goods travel varies by port and destination; however, most goods travel short distances to urban areas and in the direction of warehousing facilities (refer to examples 1 and 2).

## Key flow #1 – Movement to distribution centres near the port

Reflecting their role as key trade gateways since early settlement, major Australian ports are typically located in urban areas with high population density. Despite rail having, on average, a lower cost per/km than road, it is not competitive over short distances due to the additional pick up and drop off costs associated with transporting containers to and from rail. Therefore, general goods moved to distribution centres near port are mostly transported via road to customer warehousing facilities in urban locations. A short trip via road (c.50km) costs AUD c.\$300. Rail is not used for short distance movements as it is not cost competitive.

#### **Example 1 - Port Botany**

According to 2016 data, more than 80% of full import containers arriving at Port Botany are delivered within 40 kilometres of the Port.<sup>3</sup> Less than 1% of full import containers are destined for regional areas and less than 2% destined for the Central Coast, Newcastle and Hunter regions.

The majority of containers are distributed west from Port Botany, with Western Sydney receiving the most containers given centralised warehousing is commonplace in this region.

#### Example 2 – Fremantle Port

According to 2017 data, nearly half of containers (41.7%) were unpacked between 20-30km from Fremantle Port with a total of c.85% under 30km.<sup>4</sup> Only 3.5% were unpacked over 100km away in line with WA's population distribution. Fremantle Port reports the highest share of rail service with 20.1% of TEU throughput being distributed via rail (2018-19 data). Share of rail at Port Botany was between 14.6 and 19.2% throughout 2020 while Brisbane port utilises rail only for 2-3% of TEU exports.

#### Key flow #2 – Movement to distribution centres located a moderate or significant distance from the port

In Australia, regions outside of the key urban centres are serviced by different forms of ground transport, and often involving more than one mode.

In order to move general goods using multiple modes, containers are taken by road or shuttle to intermodal terminals. These terminals can be located at the port or inland (at freight precincts) and have machinery such as cranes that can facilitate transfer of containers to trailers and trains for domestic distribution via road and rail.

For example, Darwin port receives c.12,000 TEUs, which is used to service the wider Northern Territory area. General goods are also moved into the Northern Territory from South Australia along the Adelaide to Darwin rail corridor (c.3,000km) and by road.<sup>5</sup> Road freight costs per TEU are AUD c.\$800 for a medium trip (c.150-200km) and AUD c.\$2,500 for a long trip (c.800km). Rail costs are estimated to be AUD c.\$500-600 for a medium trip and AUD c.\$1,250-1,500 for a long trip.

#### General goods freight data in Australia

Cost per tkm (AUD), TEU	Medium trip	Long trip
Road	\$0.125	\$0.08-0.10
Rail	\$0.07	\$0.05

Table 1: General goods freight data in Australia by trip length for road and rail.

<sup>4</sup> Fremantle Ports, Container movement study, 2017

<sup>5</sup> Ports Australia, Trade Statistics, 2019

<sup>&</sup>lt;sup>3</sup> KPMG, Quay Conclusions: finding the best choices for additional port capacity in NSW, 2019



# Basis for International Comparison

## BASIS FOR INTERNATIONAL COMPARISON

The U.K. and Europe have been chosen as suitable comparative regions for Australia's general goods supply chain as they are all strong importers of general goods, specifically from Asia and the U.S.. In addition, both regions have some geographical and/or comparable key supply chain flows that enable benchmarking with Australia.

#### **The United Kingdom**

The U.K. and Australian general goods supply chains have the following similar features:

- Both countries import significant amounts of goods from large manufacturers such as the U.S. and Asia.
- Both countries use a combination of road and rail to move general goods from their port of import to its final destination.
- Both countries receive the vast share of imported general goods from a small number of ports (i.e., the major ports) suggesting a similar supply chain structure.

While the U.K. and Australian supply chains are similar, there are notable distinctions between them that need to be considered when interpreting the data in this report:

- The U.K. has a larger population and has a higher population density, suggesting there are likely to be more "high volume" routes that impact freight cost.
- Due to its location, the U.K. tends to be visited by larger container ships, receiving higher volumes of containers at any one time.
- There are a greater number of large populations centres away from the coastline, whereas Australia's major cities (other than Canberra) are all on the coast.

## Europe (Germany, Belgium, the Netherlands)

In order to examine the general goods supply chain in western Europe, this report has examined imports into the Port of Rotterdam and the Port of Antwerp that travel short, medium and large distances to distribution centres in Germany, Belgium and the Netherlands (GBN). This was chosen as a reasonable catchment area for goods from two major ports and allows examination of a substantial set of journeys from port to distribution centres than simply looking at any individual country in Europe.

The GBN and Australian general supply chains have the following similar features:

- Both regions import significant amounts of goods from large manufacturing origins such as the U.S. and Asia.
- Both areas have a large landmass enabling comparison of similar distanced distribution routes.

While the GBN and Australian general goods supply chains are similar, there are notable distinctions between the domestic supply chains that need to be considered when interpreting the data in this report:

- While Australia's supply chain relies predominantly on road and rail, Europe also uses a barge system to move freight shorter distances on inland waterways. This enhances Europe's distribution capacity and reduces reliance on road and rail, while increasing the complexity of the supply chain.
- General goods moving through GBN are moving across borders (e.g., from the Netherlands to Germany). While there is largely free travel within the European Union, there are inevitable regulatory discrepancies between specific member states such as speed limits which can impact the otherwise optimal flow of goods through the supply chain.
- European Union policy may have impact supply chains in a way that, while in the best interests of the entire union, may affect the economics of an individual journey. For example, particular countries may be required to buy set goods from other countries as part of larger trade arrangements, impacting the otherwise organic flow of trade.
- There are a greater number of large population centres away from the coastline.
- GBN are important trading routes in and out of Europe, potentially affecting shipping costs and frequency of service



# U.K. Comparison

## **U.K. SUPPLY CHAIN**

#### General goods in the U.K.

The U.K. is net importer of consumer goods, with the majority of imports coming from Asia and the Americas. Imports also come from Europe, either manufactured there or transhipped from other markets to the U.K. The U.K.'s ports handled 10.5 million TEUs in 2019.<sup>6</sup> Of this, 5.2 million TEUs were in 40-foot containers making up the bulk of tonnage.<sup>7</sup>



Figure 6: Containerised freight in tonnes (source: U.K. Department for Transport: U.K. ports data, 2021 edition)

General goods arrive at major ports, which are largely concentrated in the Southeast of the U.K. Ships usually carry c.5,000-6,000 containers per load.



Figure 7: Containerised freight throughput by port (source: U.K. Government Ports data, 2021 edition)

#### Key supply chain flows

Once arriving at a port, containers are transferred via road or rail. Rail modal share varies between ports and ranges from an estimated 15-35%.



Figure 8: Modal splits by port (source: interview with industry participants)

Once transferred to road or rail, containers are moved around the U.K.. Rail journeys involve at least a road leg to move containers from the rail line to the distribution centre

## Key flow #1 – Movement to distribution centres near to the port

Short distance trips, such as from London Gateway to London City (including nearby areas such as Essex) are typically done by road. These general goods are moved to distribution centres within a 100km maximum radius of the port with journeys taking c.1 hour on average.

#### Key flow #2 – Movement to distribution centres located a moderate or significant distance from the port

National distribution centres are located outside of the major cities, generally in the Midlands, as this offers a central location to serve domestic suppliers, ports and regional distribution centres.

Travel to the Midlands takes c.3 hours from the key ports (around 240km). The corridor is served by both road and rail, with major intermodal logistics terminals and container parks that help facilitate multi-modal journeys.

<sup>&</sup>lt;sup>6</sup> U.K. Department for Transport: U.K Port Freight Statistics 2019

<sup>&</sup>lt;sup>7</sup> U.K. Department for Transport: U.K, ports data, 2021



Figure 9: Key flows from major container ports to the Midlands

Region	% of warehousing space (>5000m <sup>2</sup> ), 2017
East of England	10%
East midlands	17%
London	6%
North east	3%
North west	15%
South east	10%
South west	6%
Wales	3%
West midlands	16%
Yorkshire and the Humber	12%

Table 2: Key warehouse locations (source: U.K. Government Office for Science, 2019<sup>8</sup>

Once reaching the Midlands area, general goods can be forwarded on to the north, particularly Scotland (including Aberdeen, Glasgow and Edinburgh) involving an onward journey of around 500-650km by road and rail.



Figure 10: Key longer haul flows from the Midlands

#### General goods freight data in the U.K.

The cost of general goods freight varies significantly by mode. Industry participants have suggested that cost of movement per tkm is the same as in Europe on a like-for-like basis.

Total cost per tkm (AUD) by mode	Road (Semi-trailer truck)	Rail (excluding road leg)
\$/tkm	0.19	0.03

Table 3: Key transport data (source: Pantia, 2018)

<sup>&</sup>lt;sup>8</sup> <u>Understanding the U.K. Freight Transport System, Government</u> Office for Science (2019)

**Europe Comparison** 

## **EUROPE SUPPLY CHAIN**

#### **General goods in Europe**

In 2019, total container port throughput in Europe was c.105 million TEUs with Rotterdam and Antwerp accounting for the largest volumes at 14.8 million and 11.7 million respectively (refer figure 1).<sup>9</sup>



Figure 11: Top ports in Europe by TEU throughput (Source: Port Economics)

General goods movements across Europe are vast and complex due to the multitude of different freight flows spanning many countries. This report focuses on import freight flows from the two largest ports, Rotterdam and Antwerp and key container movements from these ports within Belgium, the Netherlands and Germany.

#### Key supply chain flows

After arriving at Rotterdam or Antwerp ports, containers are transported from the vessel to distribution centres and/or customer sites across the Netherlands, Belgium and Southern Germany; key distribution hubs are located in locations like Amsterdam, Cologne and Munich, as well as other areas such as Frankfurt, Stuttgart and Augsburg. Northern Germany is predominantly serviced by Hamburg Port and therefore is not a key transport route from Rotterdam or Antwerp (refer figure 2).



Figure 12: Location of top 3 European ports and main distribution centres serviced by Rotterdam and Antwerp (source: interview with industry participants)

Mode share for movement from the ports differs, with Rotterdam using much more barging than Antwerp (table 4). Both rail and barge require drayage (short distance ground transport) via trailer to and from the railway or canal.

	Road	Barge	Rail
Rotterdam	50-60%	30-40%	5-10%
Antwerp	70-80%	10-15%	5%

Table 4: Estimated distribution of transport modality for containers by port (source: interview with industry participants)

Of the total general goods imported into Rotterdam, c.20-30% are destined for the Netherlands domestic market with the remainder heading to Belgium, Southern Germany, Austria and beyond.

## Key flow #1 – Movement to distribution centres near to the port

Short-haul movements of general goods (c.50km) take c.1 hour maximum and are undertaken on road only. Distances over 70-80km are serviced by both barge and road.

Pricing is based on distance, number of containers and opening hours of distribution centres. A typical delivery within 50km would cost between AUD c.\$400-600.<sup>10</sup>

<sup>&</sup>lt;sup>9</sup> PortEconomics.eu

<sup>&</sup>lt;sup>10</sup> Interviews with: Senior VP, major E.U. freight provider; Former MD and Director of Transportation of E.U. arm of global logistics provider



Figure 13: Example short-haul trip

Key flow #2 – Movement to distribution centres located a moderate or significant distance from the port (multi-modal long distance)



Figure 14: Example medium distance trip

Medium distance trips from these ports are around 200-300km and likely involve goods entering Germany. While transit documents are required, trucks are not stopped at the border and are cleared once arrived at distribution centres, ensuring relatively seamless transit through different countries.

Rotterdam Port is serviced by the Betuweroute which is a 160km double track dedicated freight rail line that extends into Germany. Approximately 20% of containers are distributed via rail with the remainder distributed via roads.

Rail (inc. end drayage of approx. 20-30km) is typically c.25% less expensive than road which costs AUD c.\$600-1000 for medium haul trips.<sup>11</sup> However, rail must adhere to specific journey times and is constrained in capacity. Rail is also less time efficient, taking up to an additional 12 hours to reach its destination. Road drayage to and from rail requires precise scheduling which is difficult to execute. The average trip duration via road to Cologne is 6-8 hours, while rail trips can take a day or more depending on scheduling.



Figure 15: Example long-haul trip

Many TEUs imported into Rotterdam and Antwerp Ports travel long distances (>500km) to destinations such as Munich, or cities in Austria, Switzerland, and France.

Long-haul trips, such as Antwerp to distribution hubs in Munich, do not materially differ in terms of mode share compared to medium distance trips. However, road costs are higher on a per km basis given pricing must cover driver over-time and/or the multiple drivers required for longer haul trips. As a result, a typical long-haul journey costs AUD c.\$2,500-3,500 per delivery.<sup>12</sup> In this instance, rail is expected to cost c.\$850-2,300 partly due to the efficiency of rail over longer distances, while longer road trips require multiple drivers.

The typical duration of a long-haul trip to Munich is 12-14 hours and an additional 1-2 days via rail due to difficulty scheduling drayage and general rail scheduling.

#### General goods freight data in GBN

Total cost per tkm (AUD) by mode	Road (Semi- trailer truck)	Barge	Rail
\$/tkm	0.19	Small: 0.14 Medium: 0.05 Large: 0.04	0.03

Table 5: Key transport data (source: Pantia, 2018)

<sup>&</sup>lt;sup>11</sup> Interviews with: Senior VP, major E.U. freight provider; Former MD and Director of Transportation of E.U. arm of global logistics provider

<sup>&</sup>lt;sup>12</sup> Interviews with: Senior VP, major E.U. freight provider; Former MD and Director of Transportation of E.U. arm of global logistics provider



# Data comparison

## **DATA COMPARISON**

A high-level summary of the key freight metrics for each region is shown in the table below.

Estimates	Australia ( <i>CSIRO</i> )	υ.κ.	GBN
Est containers imported (TEU)	c.4.1m	c.5.2m <sup>13</sup>	Rotterdam: c.7.7m Antwerp: c.5.6m Total: c.13.3m <sup>14</sup>
Annual tonnes moved (c. million)	29.6	42.4 <sup>15</sup>	108.7 <sup>16</sup>
Annual net tkm (c. million)	13,517	8,476 <sup>17</sup>	27,200 <sup>18</sup>
Annual trailers / shipments (c.000)	2,028	2,900 <sup>19</sup>	7,444 <sup>20</sup>
Cost of movement from point of importation to distribution centre (\$AUD per tkm)	Road: \$0.08-0.125 Rail: \$0.05-0.07	Road: \$0.19 Rail: \$0.03 <sup>21</sup>	Road: \$0.19 Rail: \$0.03 Waterways: small ships: \$0.14, medium ships: \$0.05, large ships: \$0.04 <sup>22</sup>
Total transport costs (c.\$m)	2,562	1,215 <sup>23</sup>	2,745 <sup>24</sup>
Average trip distance (km)		Short trip (c.50kms) Medium trip (c.150-200kms) Long trip (c.800km) <sup>25</sup>	
Average trip length (hours)	1-2	3	4

<sup>15</sup> U.K. Government port statistics

<sup>16</sup> Container imports for Rotterdam + Antwerp using UK average weight per TEU (8.15T)

<sup>17</sup> Estimate of intermodal tkm for rail + maritime from UK office of road and rail (6.77bn), grossed up assuming 40/60% Other/road split (weighted by port based on expert IV) and apportioned for inbound as a % of all TEUs (50%)

<sup>18</sup> Estimate based on multiplying total tonnes (c.109m) by midpoint of average journey distance (c.250km) <sup>19</sup> Applied tonnes per trailer from CSIRO modelling to UK tonnes

<sup>20</sup> Applied tonnes per trailer from the CSIRO data to EU tonnes

<sup>21</sup> Same as GBN, based on interviews with industry participants <sup>22</sup> Pantia (2018)

<sup>23</sup> Estimated based on cost of movement per tkm to total tkm based on modal split provided by industry participants <sup>24</sup> Estimated based on modal split provided by industry participants from each port to total cost of movement to get average weighted cost of movement per tkm. Total weighted cost of movement ' annual tkm estimate

<sup>25</sup> Estimates are based on the three trip "types" discussed in this report (short, medium, long) and do not represent a weighted average

<sup>&</sup>lt;sup>13</sup> U.K. Government port statistics

<sup>&</sup>lt;sup>14</sup> Port websites

## FREIGHT DATA COMPARISON SUMMARY

The supply chain for general goods is extremely important due to its prevalence all over the world. Furthermore, the efficiency of the general goods supply chain has an impact on the total cost of consumer goods, which are a significant input into household budgets. The volume of container imports in Australia is high relative to its population at c.4.1m TEUs, compared to c.5.2m in the U.K and c.13.3m in GBN (Rotterdam and Antwerp ports only). The average trip duration in Australia is estimated to be lower (1-2 hours) than in the U.K. (3 hours) or GBN (4 hours) as the main container ports are co-located with the major urban centres that are almost all on the coast of Australia.

Freight rates for general goods differ slightly between regions, with GBN and the U.K. costing AUD c.0.19 for road and AUD c.0.4 for rail per tkm. GBN also relies heavily on waterways, which ranges from AUD c.0.4 - 0.14 per tkm. Australia's freight rates for road are lower, at AUD c.0.08-0.125, while rail costs are higher at AUD c.0.05-0.08 per tkm. Modal split also differs between regions, leading to a different total freight cost, when combined with average trip distance / duration.

The following table provides a cost comparison by freight length and mode. Importantly, Australia freight is shorter on average than in GBN and U.K. as discussed earlier in this report. Therefore, this table should not be taken in isolation but rather be interpreted in the context of the broader report.

\$ estimate per TEU moved	Road			Rail journey (including road drayage)	
	Short	Medium	Long	Medium	Long
Australia	c.\$300	\$800	\$2,500	\$500-600	\$1,250-1,500
U.K and GBN	c.\$400-600	\$600-1,000	\$2,500-3,500	\$400-500	\$850 - \$2,300

Questions for further examination, beyond the scope of this report could include

- The drivers of a lower cost general goods freight by road in Australia versus the U.K. and GBN, and a higher cost of general goods freight by rail in Australia versus the U.K. and GBN.
- The examination of the costs of general goods freight on pallets (outside of shipping containers) between regions.

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