# International Comparison of Australia's Freight and Supply Chain Performance

## Final Report - Cement

### December 2020

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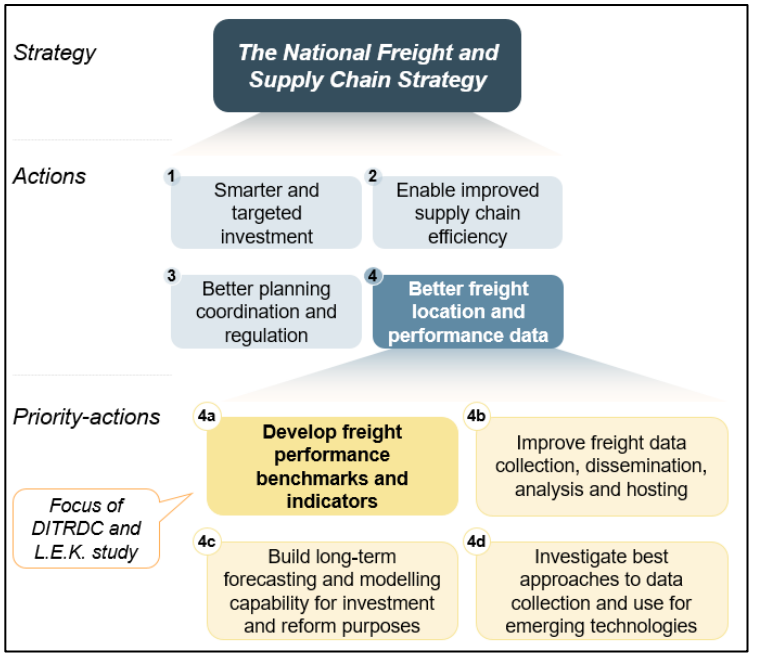
# Executive Summary - Overview

- The purpose of the National Freight and Supply Chain strategy is to help Australia manage the projected 35% growth in freight volumes between 2018 and 2040, while tackling underlying productivity. This study addresses the priority action of developing freight and performance benchmarks and indicators. The vision for this priority action includes:
  - providing improved performance data to the freight sector
  - supporting infrastructure planning and investment
  - making Australia's supply chains more sustainable and competitive

- This study is a second step towards developing a broader set of comparative benchmarks for key Australian supply chains, providing improved performance data to the freight sector, and follows the initial 'pilot' study undertaken on the waste and wine supply chains in 2019. Through significant consultation with the broader freight sector, and specific industry groups, the grain (wheat) and cement supply chains were selected for review. International comparators were selected to enable a relevant comparison:
  - the wheat supply chain was compared with the comparator (and competitor) supply chains in Canada and Ukraine
  - the cement supply chain was compared with the supply chains in north-west USA, and France

- In general, this study has found that there is a paucity of data available on supply chain quality including safety, emissions, and supply chain performance. This is a gap that will be important to fill as supply chain monitoring is improved

- This report is prepared for open publication, building on detailed information collected and analysed by LEK for the Department which is confidential



# Executive Summary – Cement

**Cement supply chain**

- Freight accounts for c.55% and depot and port costs represent c.25% and 20% of the cement industry's supply chain costs, respectively. Road freight accounts for c.60% of the total cost of freight to the industry
- A number of inherent differences in the supply chains of Australia and comparator countries affect the nature and efficiency of these supply chains. These include:
  - Australia's higher reliance on cement imports (and coastal shipping) than the US (Northeast) and France
  - the extensive use of intermediate storage (depots) in Australia versus employment of direct delivery models to end users, due to an extensive network of plants (France) and short haulage distances from port terminals to demand (US)
  - the well-developed road networks of international comparators that support higher heavy vehicle capacities and less restrictive curfews
  - an emphasis on national (rather than local) regulation in France, while in the US, government involvement is generally state-based, and planning and investment is left primarily to commercial interests
- Industry consultation identified key issues of road transport driver supply, coastal shipping legislation and regulation, and port capacity and loading efficiency, which were contributing towards higher supply chain costs. International benchmarking validated most of these concerns with findings that:
  - Australian road freight rates are relatively more expensive particularly in metro areas due to higher driver costs, higher vehicle compliance costs and inconsistent heavy vehicle regulation
  - Shorter haul coastal shipping rates are higher cost, although these have not been benchmarked. Longer haul Australian coastal shipping rates (2,000km+) are in line with overseas rates for similar distances, and with blue water rates for similar pneumatic unloading vessels
  - Australian headline port costs are cheaper than US and French comparators, for different reasons, mainly low throughput unloading infrastructure in the US and taxes and charges in France. However, Australian industry reports that lack of berth access drives significant demurrage costs

# International benchmarking can provide significant value for government and industry stakeholders to identify and prioritise supply chain improvements

Benchmarking reveals the type of (**industry and government**) data that exists and identifies the critical gaps to be filled to build a **shared evidence base for decision making**

Benchmarking provides clarity of the **key supply chain issues** and highlights the major similarities and differences between supply chains (i.e. **drivers of efficiency and competitiveness**)

Benchmarking provides benefits to stakeholders by defining the current state and identifying future system wide supply chain requirements allowing them to **act with greater collaboration and co-ordination in planning** for supply chain improvements

Benchmarking provides information to help **prioritise key supply chain and infrastructure improvements** and investment, and **respond and plan for current and future supply chain disruptions** (e.g. COVID, bushfires and climate change)

# This study addresses a priority action of the National Freight and Supply Chain Strategy

*Strategy*

***The National Freight and Supply Chain Strategy***

*Actions*

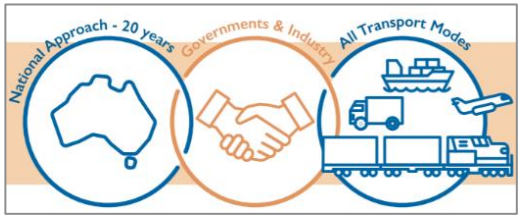
1. Smarter and targeted investment
2. Enable improved supply chain efficiency
3. Better planning coordination and regulation
4. **Better freight location and performance data**

*Priority-actions*

- 4a **Develop freight performance benchmarks and indicators**
- 4b Improve freight data collection, dissemination, analysis and hosting
- 4c Build long-term forecasting and modelling capability for investment and reform purposes
- 4d Investigate best approaches to data collection and use for emerging technologies

*Focus of DITRDC and L.E.K. study*

- The need for a national strategy is underpinned by a **projected growth** of over 35 percent in freight volumes from 2018 to 2040, particularly concentrated in urban areas
- The competitiveness of Australian exports has been impacted by **plateauing freight productivity and costs**
- Australia's freight and supply chains need to **build resilience to meet emerging issues** associated with natural disasters and climate risk, security and cyber threats and increasing community demands to improve safety and environmental outcomes




Source: Freight Australia; L.E.K. research



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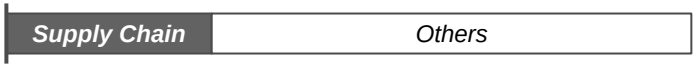
# Through stakeholder and industry consultation, the Cement supply chain was selected for review

## Why Cement?

- **11.4m tonnes**
- **A$15b**
- **30k employees**
- **3% vol. compound annual growth**

The supply chain accounts for **c.30%** of the total price of cement




Almost 50% of cement is derived from imported cement or imported clinker


Most cement production comes from the east coast, with the largest being QLD with c.32%

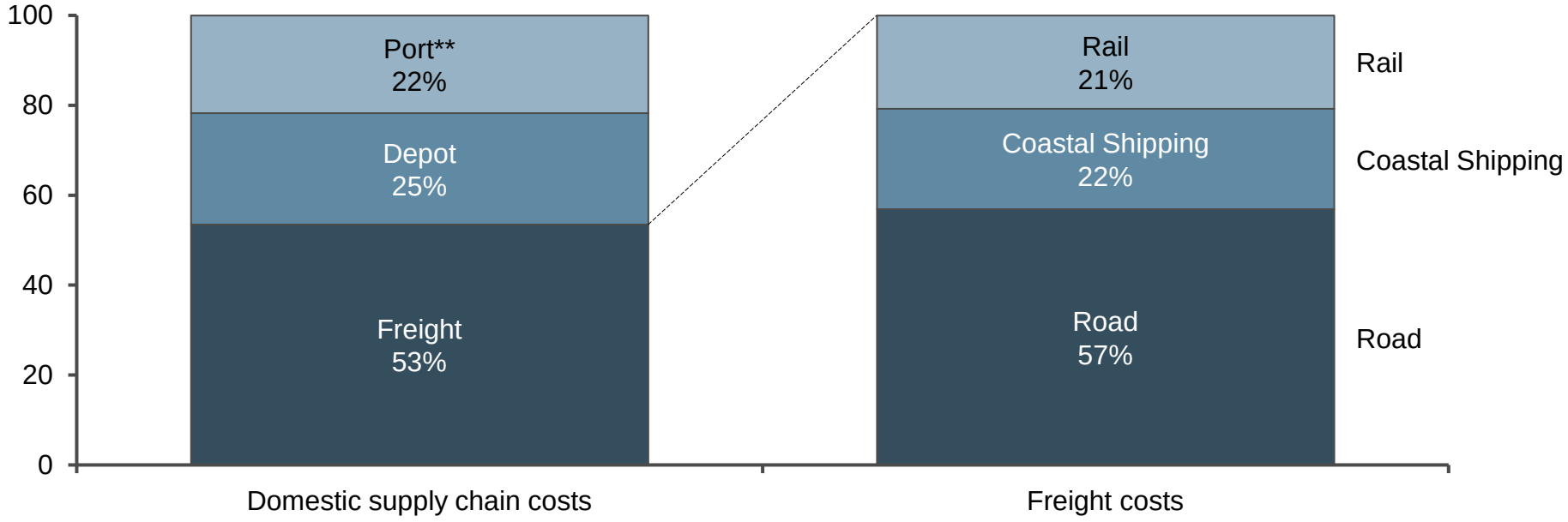

Significant competitive tensions between major industry players, leading to limited data sharing – limited data available on relative efficiency vs. international comparators

The industry is in the top tier of trucking fleets in Australia

**Adherence to selection criteria**
Low High

# Freight accounts for c.55% of cement supply chain costs, with road, coastal shipping and rail accounting for c.60%, c.20% and c.20% each

**Weighted average cement and clinker supply chain costs – Adelaide Brighton, Boral, Cement Australia***
Percent (AUD per tonne)



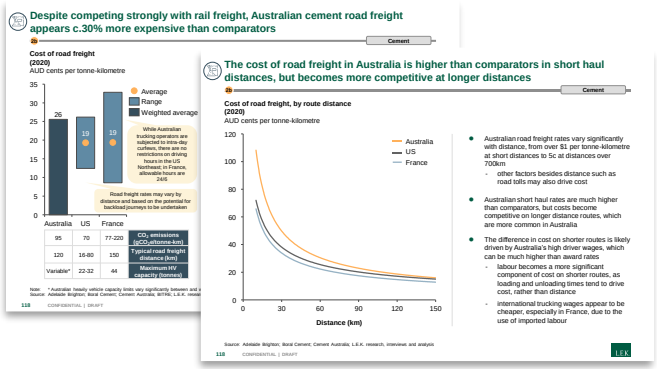

**$470-660M**

The domestic cement supply chain costs the industry an estimated c.$470-660M per year

Note: * Includes movements of locally produced and imported cement and clinker; ** Excludes trucking, equipment, survey and demurrage
Source: ABS; Adelaide Brighton; Boral; Cement Australia; L.E.K. research and analysis

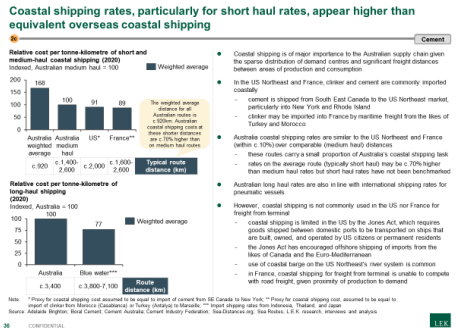
# Benchmarking confirmed road freight as a supply chain priority, but Australian port and coastal shipping costs appear similar to comparators'

## Road transport 2b



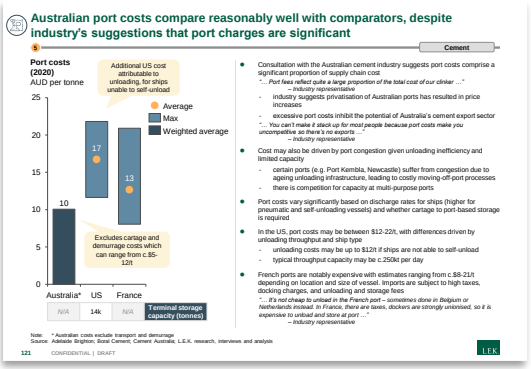

- Road freight accounts for c.60% of cement and clinker freight in Australia
- Road freight rates are relatively more expensive than comparators
- High driver wages and inconsistent heavy vehicle regulation are key drivers of the higher costs
- Intraday curfews, which are less common in the US and France, are also contributors to cost and inefficiency

## Coastal shipping 2c




- Coastal shipping accounts for c.20% of cement and clinker freight in Australia
- Australian shipping distances are typically shorter and higher cost per km.
- Pneumatic vessel rates for longer Australian routes are similar to blue water rates for similar distances
- Australian rates have risen in response to regulatory constraints and limited domestic coastal shipping competition, supporting the competitiveness of imports over domestic production

## Domestic port 5




- Australian port costs are relatively cheaper than in the US and France. In comparator countries, low port capacity alongside factors such as taxes, docking charges and low throughput infrastructure may elevate costs
- Limited wharf access driven by low port capacity and congestion issues may add significant demurrage cost at Australian ports
- Wharf industrial activity in Australia has remained a key issue over a number of years

# Key cement supply chain findings

**The supply chain accounts for a significant proportion of the cost of cement**

**Australia's domestic supply chain accounts for c.25-35% of the price of cement, equivalent to c.$470-660M cost annually** – freight, port costs, and depot costs account for c.55%, c.25%, and c.20% of supply chain costs respectively

**Australia's supply chain costs are similar to comparators**

**Australia compares reasonably well on most elements of the supply chain with the US Northeast and France (e.g. rail and depot charges) but underperforms on road freight** – Australian road freight is more expensive than comparators; coastal shipping and port charges are broadly comparable to overseas rates

**Cement road freight rates are particularly high**

**Road freight compares most unfavourably, costing c.26c/t-km in Australia, c.30% higher than the US Northeast and France** – Australian road freight rates are negatively impacted by factors such as high driver wages, variable heavy vehicle regulation driving sub-optimal vehicle combinations, high vehicle compliance costs, restrictive curfews, urban congestion and delays, particularly in metro areas – long haul road rates are often more reasonable

**Australia's unique short haul coastal shipping routes make for difficult global comparisons**

**Australian shorter haul coastal shipping routes are relatively higher cost (than long haul routes) although these have not been benchmarked,** due to difficultly of making global comparisons. Coastal shipping rates for dedicated pneumatic vessels over 2000km+ sectors are similar to overseas benchmarks and blue water rates over comparable distances

**Depot storage charges are also comparable to overseas**

**Australian depot storage and handling is more expensive than in France but cheaper than the US Northeast, costing c.$11/t on average vs. c.$7/t and c.$13/t respectively** – depot storage is less common overseas however, as delivery direct-to-customer and the greater availability of port terminal storage capacity reduces the need for intermediate storage

**Australian port access is the key challenge, rather than headline costs**

**Australian port costs appear reasonable, c.20-40% less than comparators** – port costs in the US Northeast and France range significantly and can be driven higher by low throughput unloading infrastructure, high taxes and docking charges. However, limited access to dedicated infrastructure drives port congestion and increases demurrage costs which can be material



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# Context and purpose

- The purpose of the National Freight and Supply Chain strategy is to help Australia manage the projected 35% growth in freight volumes between 2018 and 2040, while tackling underlying productivity

- This study addresses the priority action of developing freight and performance benchmarks and indicators. The vision for this priority action includes:
  - providing improved performance data to the freight sector
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  - making Australia's supply chains more sustainable and competitive

- L.E.K. has been engaged by the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC, the "department") to a detailed benchmarking study of two priority supply chains, after an initial "pilot" study was undertaken on the waste and wine industries in 2019
  - this second supply chain study focusses on Australia's grain and cement supply chains against global comparators of Canada and Ukraine (for grain) and United States (Northeast) and France (for cement)

- The study was completed over 10 weeks from September to November, 2020 and investigated a number of areas, including
  - identification of key issues experienced with both grain and cement supply chains
  - benchmarked supply chains' performance against selected global comparators
  - high-level assessment and comparison of the approaches undertaken to infrastructure planning and investment

# This study addresses a priority action of the National Freight and Supply Chain Strategy

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*Focus of DITRDC and L.E.K. study*

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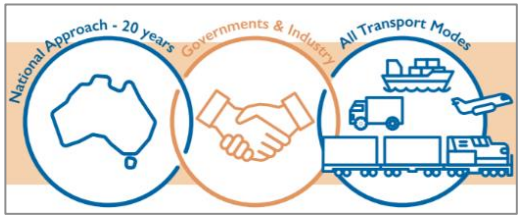


Source: Freight Australia; L.E.K. research



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# The objective of the study is to improve the competitiveness of Australia's Supply Chains by providing improved performance data to the freight sector

## Key problems

- There is lack of access and availability of data to measure, monitor and evaluate Australia's supply chain costs, service levels & efficiency versus competing markets
- Stakeholders lack a single source of truth to effectively understand, plan, regulate, and invest to improve supply chain efficiency and freight operations
- Better data can help inform initiatives to improve supply chain resilience highlighted by COVID, bushfires, climate change impacts etc.

## Objective: Improve the competitiveness of Australia's Supply Chains

A 'call to action' for stakeholders to come together to support planning, development and investment into making Australia's supply chains sustainable and competitive

### Sub-objectives

- Build broad consensus on a set of priority supply chain actions, acknowledging
  - the importance of a broadly agreed fact base to building consensus
  - the need for clarity about investment priorities at a system wide level
- Contribute to the National Freight Data Hub for strategic planning, operation, and evaluation of Australia's freight system
- Support COVID-19 recovery efforts through identification of supply chain opportunities and improvements

### Outcomes

- Development of freight performance benchmarks and indicators for Australia's key import and export supply chains
- Development of an evidenced based view of key freight flows and their comparative performance
- Development of simple, repeatable and accessible benchmarks to analyse supply chain cost, service levels and efficiency
- Tracking the fulfilment of the National Freight and Supply Chain Strategy
- Identification of freight and supply chain priorities for improvement

## Benefits for key stakeholders

| Industry Bodies | Government | Corporates |
|---|---|---|
| Enhanced collaboration & co-ordination to integrate and optimise supply chain outcomes | Track the progress and impact of policy, regulation and investment, through the National Freight and Supply Chain Strategy | Improved efficiency and international competitiveness, enabled by data transparency |

***"…Nationally co-ordinated and well planned freight systems supporting a strong and prosperous Australia…"***



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# Consultation with Government and industry bodies highlighted broad alignment on the potential benefits of the study and the need for better data utilisation

***Considerations***

- **Industry is challenged by land use planning decisions** and restricted access to transport
  *"… We face a number of challenges in terms of long term land use planning decisions and access to transport routes, rail for example…"*
  *– Cement industry representative*
- **There is a current lack of available or accessible data** to support the prioritisation of investment opportunities
  *"… Big issue for us is around the current lack of detailed data around investment opportunities for freight. …"*
  *– Cement industry representative*
  *"… Data is one that's going to be a challenge through the project …"*
  *– Grain industry representative*

***Potential benefits***

- **Track** the progress and impact of the National Freight and Supply Chain Strategy
  *"… One benefit is getting ability to repeat and track progress overtime across a range of different supply chains to see if freight strategy is having an impact…"*
  *– Government representative*
- **Identify** common issues across multiple supply chains and prioritise these for remediation
  *"… This kind of benchmarking approach can make a shared baseline …"*
  *– Government representative*
- **Improve** accessibility, transparency and shared understanding of supply chains by centralising data
  *"… It can help inform effective decision making, investment and operational efficiency …"*
  *– Grain representative*

***Data utilisation and visualisation***

- **Data should be presented in a simple, repeatable, and accessible format**
  *"… Having something to provide industry in a simple but meaningful way. Hopefully something we can repeat with consistency…"*
  *– Government representative*
- **Data should be stored in a central location** (it is currently fragmented and/or inaccessible)
  *"… We've got such varying data sets and data ownerships. Grain has ABARES and ABS and lots of data in different places which is problematic…"*
  *– Grain representative*

**There was broad agreement across representatives from both industries with the identified problems:**

- There is a lack of available data to measure, monitor and evaluate Australia's supply chain performance versus competing markets
- Stakeholders lack a single source of truth to better optimise decisions about planning, investment and improve freight operations

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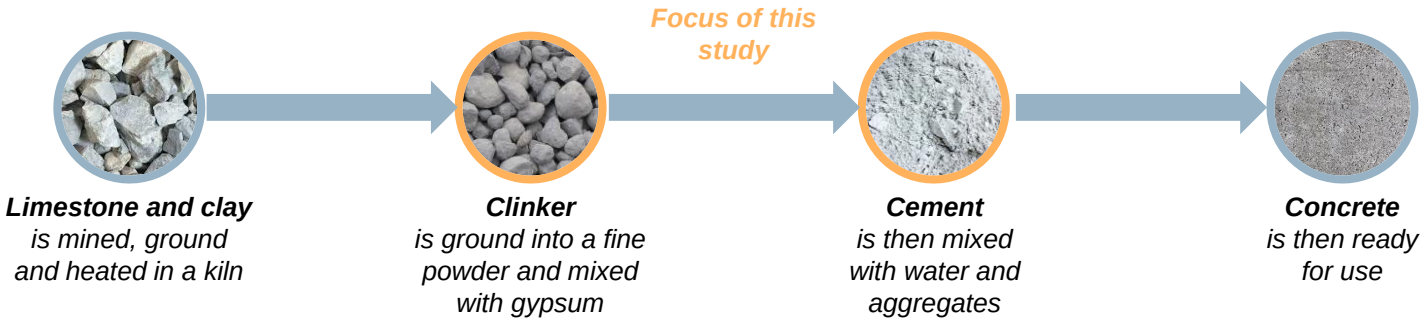
# Cement is produced locally from domestic and imported clinker, but also imported as a finished product

## Concrete manufacturing process



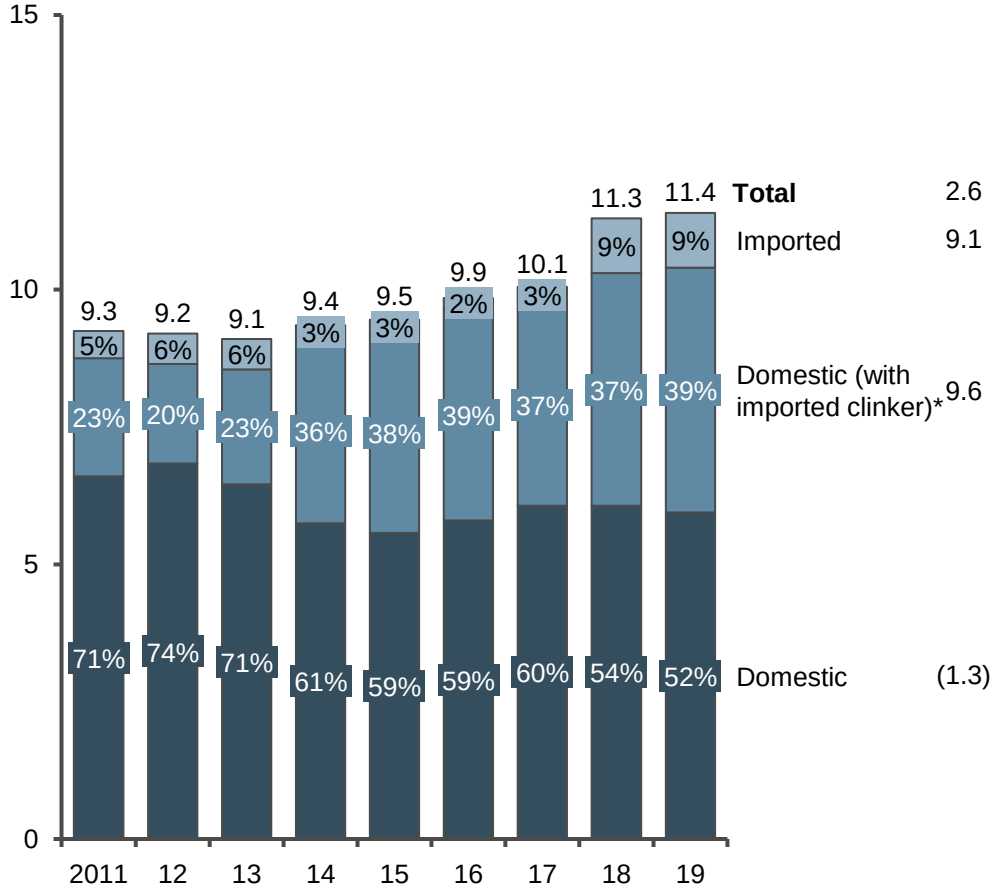

- Clinker is a nodular material that once cooled, milled into a fine powder and combined with 2-3% of gypsum, can be packaged and distributed to the market in bulk as cement
- The cement industry is increasingly substituting clinker with supplementary cementitious materials (SCMs), lowering the industry's carbon footprint
- Cement is the key reactive binding ingredient in concrete
- Cement is produced locally or imported as a finished product

Source: CIF; L.E.K. research and analysis

# The Australian cement industry is increasingly reliant on imported clinker and cement due to growing demand and access to low cost Asian supply

**Cement production and imports (FY2011-19)**

Millions of tonnes

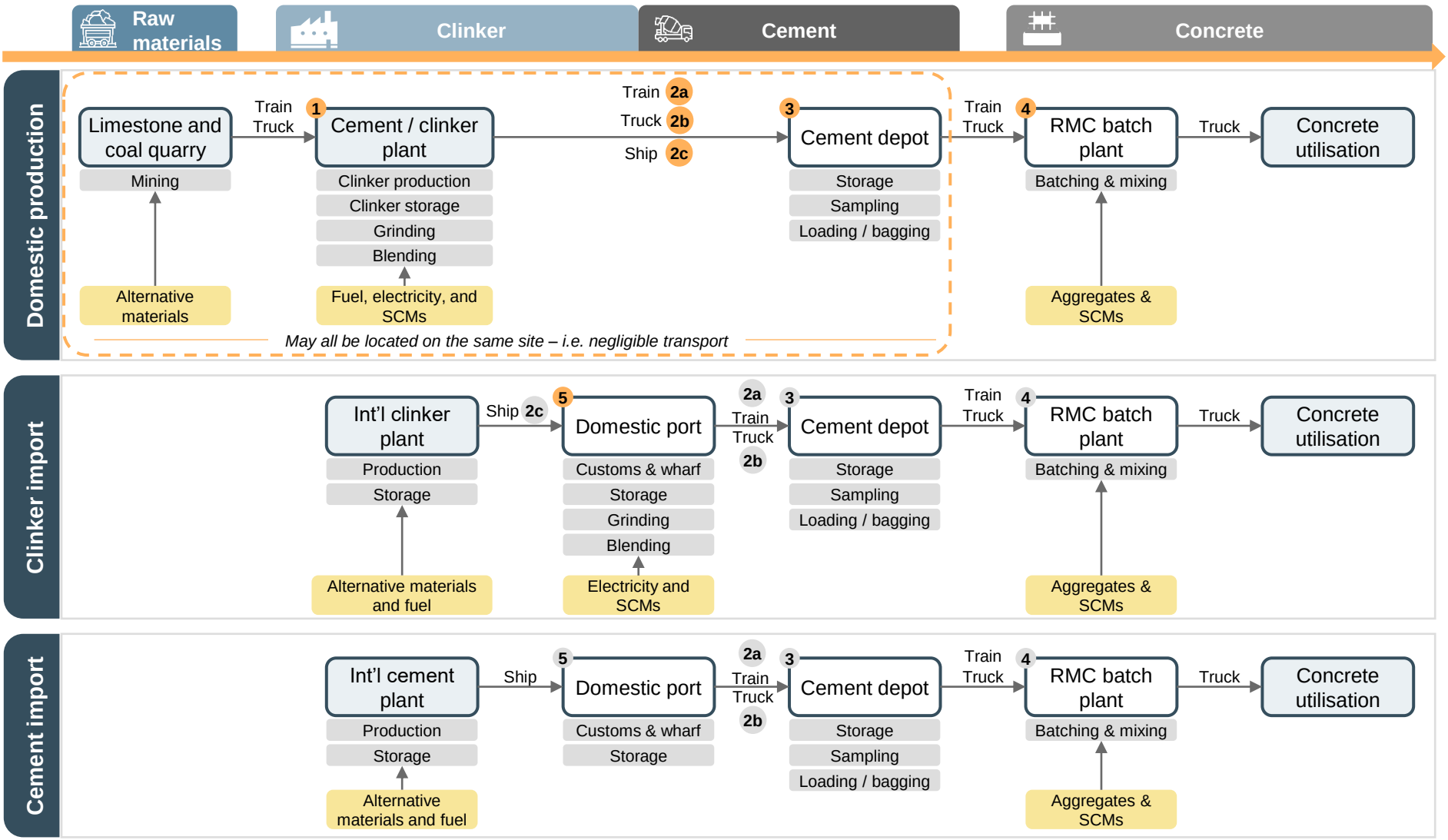



- Total cement consumption has increased steadily by c.3% p.a. since 2011, driven by growing demand from major infrastructure projects and the broader construction market
- Domestic production accounts for c.91% of cement volume in Australia although c.43% of domestically produced cement is manufactured from imported clinker
- Over the last 20 years, the Australian industry has migrated from almost entirely local supply to a model today where 50% of product is imported as clinker or cement
  - closure of smaller, less efficient cement plants (e.g. Cement Australia mothballing its Kandos plant in 2011 and Boral mothballing its Maldon cement kiln in 2013)
  - access to low cost imported cement, fueled by the growth of the Asian exporters
  - investment in import infrastructure
- The value of building commencements and engineering construction activity is expected to rebound after FY2020 with a projected annual growth of c.5% FY2020-25F. This is driven by improving economic conditions and rising population growth, potentially increasing cement demand

Note: * Domestic cement from imported clinker volumes estimated by adjusting total clinker import volumes to estimated equivalent cement production volumes, based on L.E.K. experience

Source: CIF; Credit Suisse Report; L.E.K. research and analysis

# Three supply chain archetypes exist to describe the majority of cement and clinker produced, imported and moved in Australia




Source: Ecole Française du Béton EFB; L.E.K. research

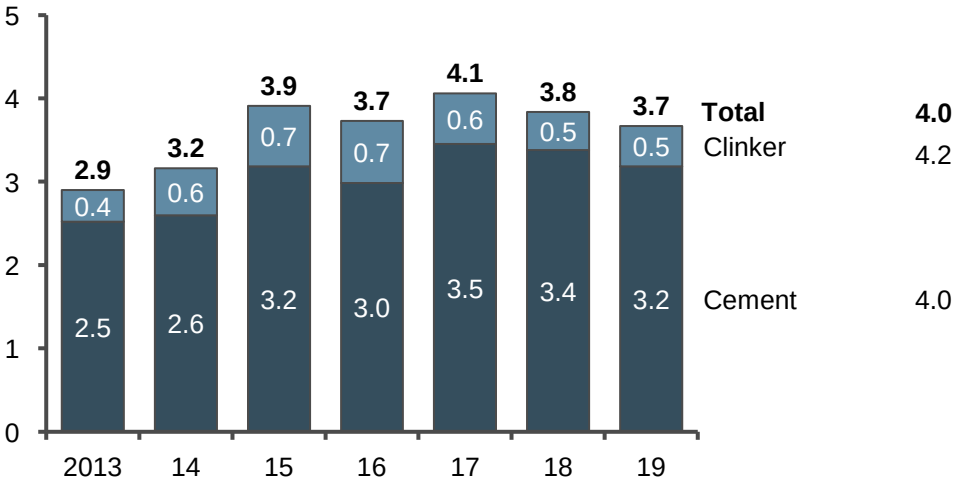
**Key**

Function / Cost | Out of scope | Other inputs

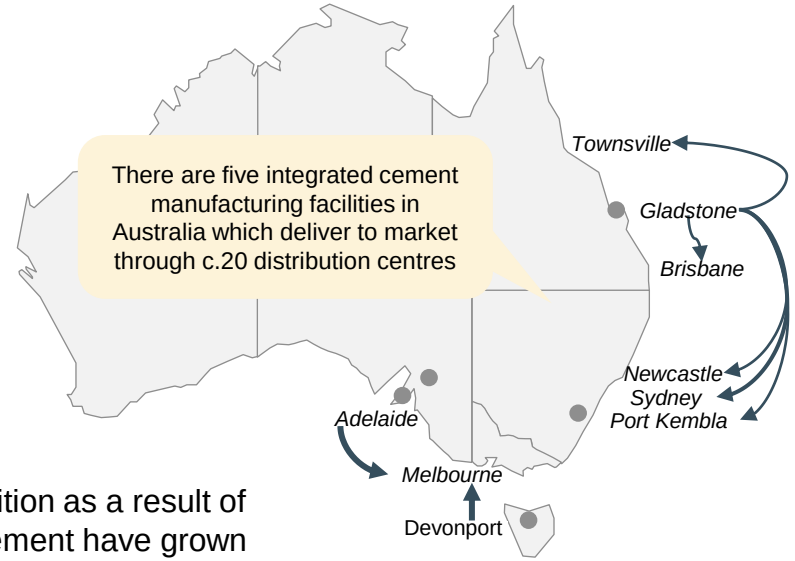
# Total coastal shipping of clinker and cement has increased c.4% p.a. since 2013 despite increases in cost associated with cabotage arrangements

**Clinker and cement coastal shipping volumes (2013-19)**

Millions of tonnes




**Coastal voyages volume flows* (2019)**




- Despite rising costs associated with limited coastal shipping competition as a result of cabotage arrangements, coastal shipping volumes for clinker and cement have grown c.4% p.a. since 2013
- Major coastal shipping routes for cement are from Devonport to Melbourne, Adelaide to Melbourne and from Gladstone to Newcastle, Sydney and Townsville
- Significant volumes of clinker are also shipped from Gladstone to Brisbane and Port Kembla

Note: * Routes that have flows <100,000MT are not included
Source: Infrastructure Australia; L.E.K. research and analysis

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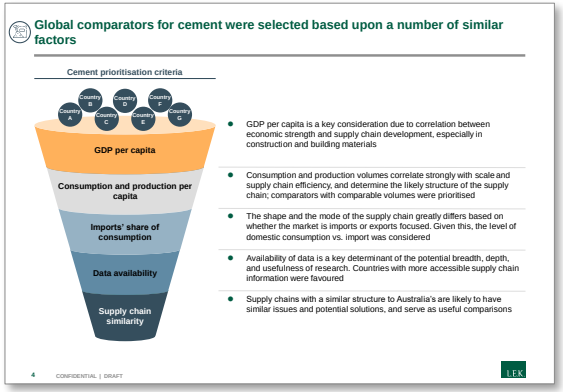
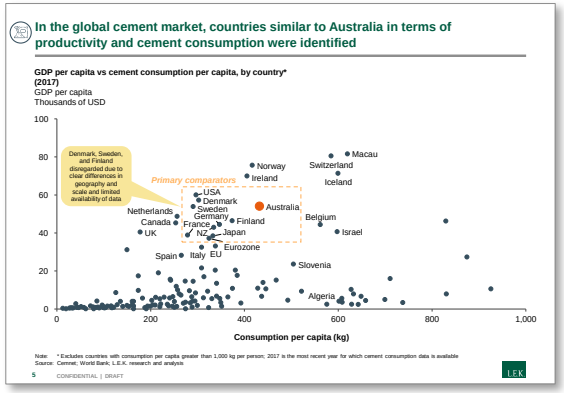
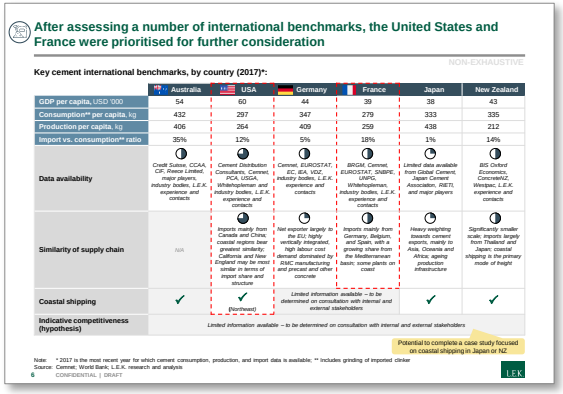
# International comparators were selected after assessing a number of factors including scale, import-export mix, and supply chain similarity

## Cement comparator prioritisation




### United States (Northeast)

- Similar levels of **economic development, consumption and production** per capita
- **Net importer** of clinker / cement
- Northeast states import by **coastal shipping**

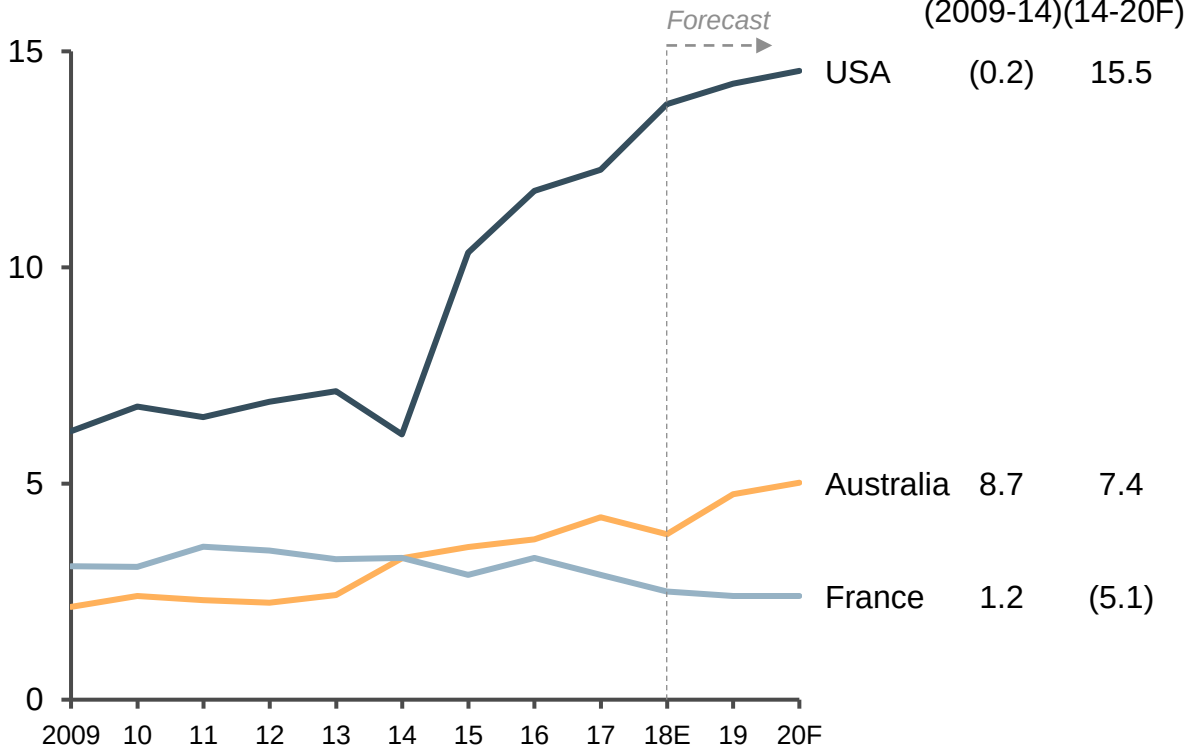
### France

- Similar levels of **economic development, consumption and production** per capita
- **Net importer** of clinker / cement
- **Coastal imports** via Mediterranean seaports

Source: AEGIC; Cemnet; Food and Agriculture Organization of the United Nations; Statistics Canada; USDA; World Bank; L.E.K. research and analysis

# Despite high growth in US cement imports, US and French markets are less reliant on imports than Australia

**Cement import volumes – Australia, USA, France (2008-20F)**
Millions of tonnes




| | CAGR%* (2009-14) | CAGR%* (14-20F) |
|---|---|---|
| USA | (0.2) | 15.5 |
| Australia | 8.7 | 7.4 |
| France | 1.2 | (5.1) |

| 2009 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18E | 19 | 20F | Import penetration (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 10 | 9 | 9 | 9 | 7 | 11 | 12 | 13 | 14 | 14 | 14 | USA |
| 20 | 21 | 20 | 22 | 27 | 35 | 37 | 36 | 40 | 35 | 43 | 45 | Australia |
| 15 | 16 | 17 | 17 | 17 | 18 | 17 | 19 | 16 | 14 | 13 | 13 | France |

- Imports have become an increasingly important part of Australia's cement supply chain in recent years, in response to domestic cost pressures associated with coastal trading
  - imports account for c.40% of Australia's cement demand
  - this has increased steadily from c.20% in 2012
  - import volumes have grown c.7-9% p.a. since 2009
- By contrast, the US and French markets are more domestic; imports only account for c.15% of consumption, even despite significant growth in US cement demand in recent years
  - US cement consumption has grown c.16% p.a. since 2014 while French consumption has declined c.5% p.a.

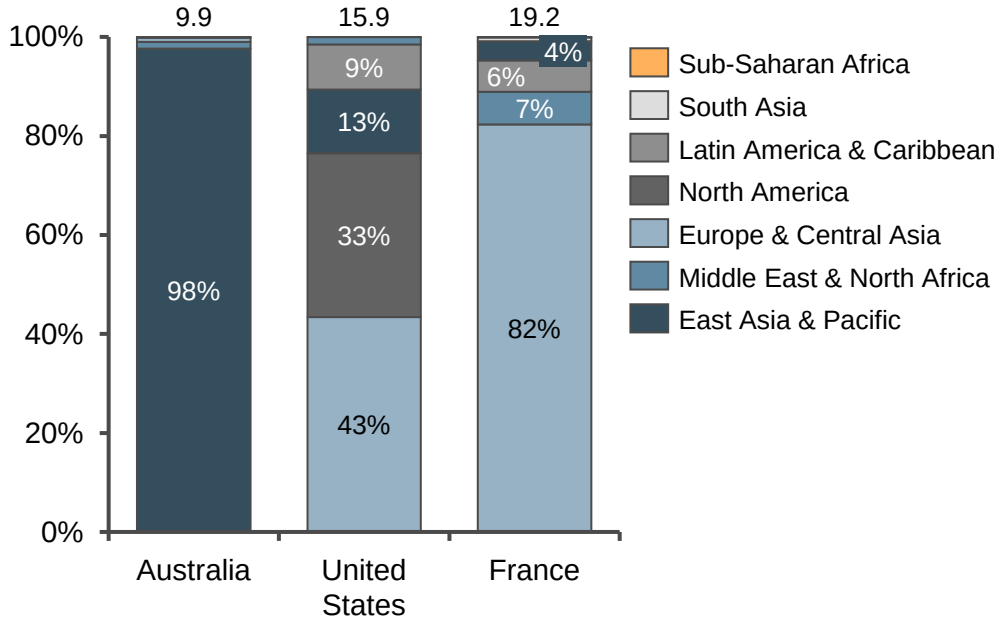
Source: CemNet; L.E.K. research, interviews and analysis



L.E.K.

# The majority of US cement and clinker imports come from Europe and Canada; French imports are largely sourced from other Western European countries

**Cement and clinker imports by region – Australia, USA, France (2019)**
Percent (Millions of tonnes)



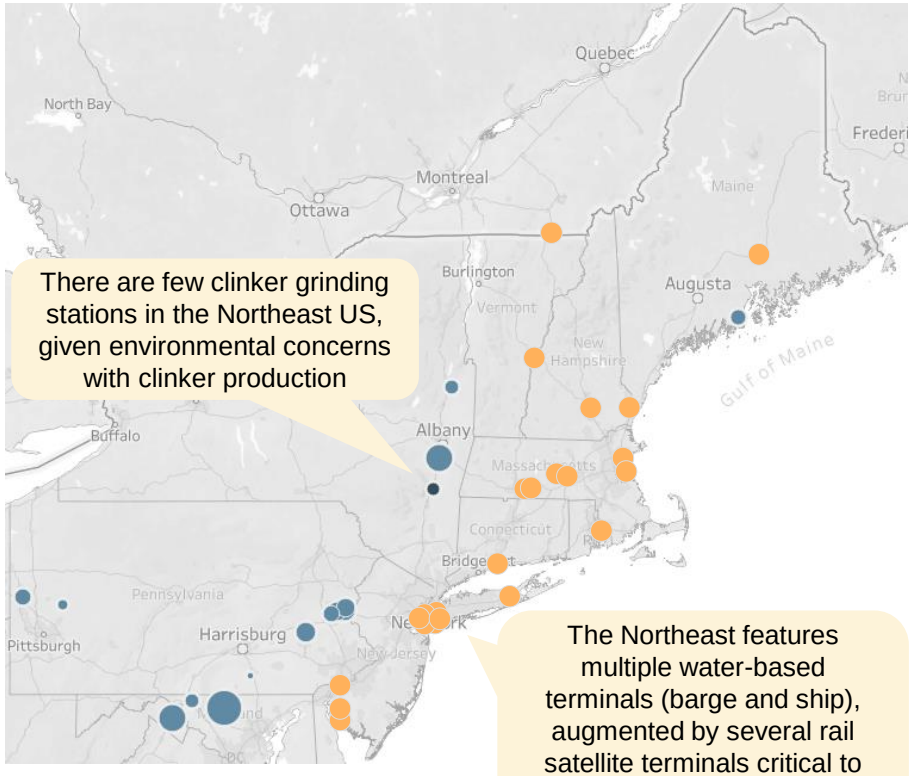

| Top import countries | | | | |
|---|---|---|---|---|
| | 1 | Japan | Canada | Belgium |
| | 2 | Indonesia | Turkey | Spain |
| | 3 | Thailand | Greece | Luxembourg |
| | 4 | China | Mexico | Ireland |
| | 5 | Malaysia | China | Germany |

- Australia is heavily reliant on East Asian countries such as Japan (c.37%), Indonesia (c.29%) and Thailand (c.15%) for its supply of cement and clinker
- The US receives c.43% of its imports by ocean freight from the Euro-Mediterranean, largely in the form of cement, from countries such as Turkey (c.25%) and Greece (c.12%)
- Canada is also a major supplier to the US (c.32%), with cement crossing the North American border by truck or coastal shipping
- France receives the vast majority of its imported cement (c.82%) from other European countries, mostly over land from Western Europe
  - exporters such as Belgium and the Netherlands import clinker from Turkey or Greece by coastal shipping before re-exporting to France

Source: UNComtrade; L.E.K. research and analysis

# The US Northeast's supply chain is characterised by a reliance on water-based freight, proximity of supply and demand, and limited storage capacity

**US Northeast cement plants (2020) and port terminals (2018)**

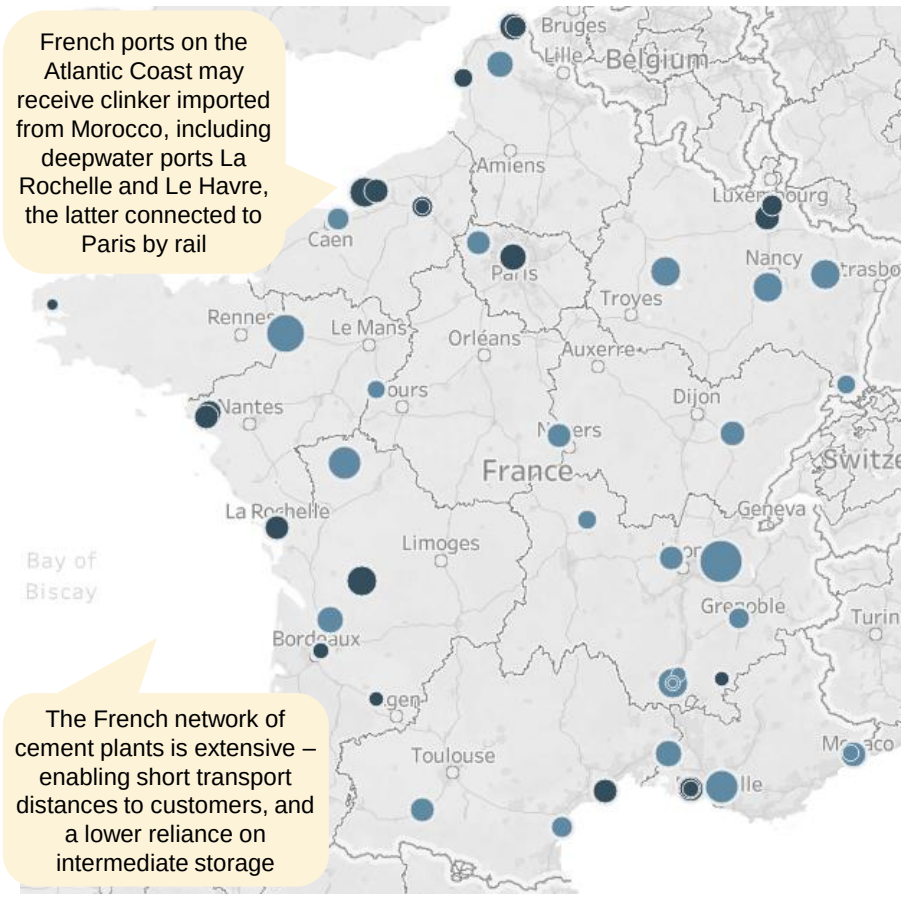



- Cement is largely produced domestically or imported from Canada by coastal shipping or the Euro-Mediterranean by ocean freight. Clinker imports are minimal, given environmental concerns
- The majority of freight to terminals in the US Northeast is water-based, either by coastal barge (via the river system) or by ocean freight
- Ex-terminal storage capacity is limited given constraints on available land; cement is largely stored at port terminals and delivered direct to customers
- Trucking is the most significant mode from terminal as demand centres are generally located close to the water-based terminals, at distances between 20-80km
- Rail serves only a small portion of demand (c.15-20% in interior New England) given short transport distances, small cement volumes and high prices driven by low levels of competition
- Planning and investment is largely driven by commercial interests – government involvement is state-based and minor. Port terminals are typically owned by cement companies

Source: CemNet; L.E.K. research, interviews and analysis

# The French market is predominantly domestic and supplied directly by an extensive network of plants, mostly via road freight

**France cement plants (2020)***




- The French cement market is predominantly a domestic market, only supplied in part over land from other Western European cement plants or with Greek or Turkish clinker by ocean freight
- The road network is very well developed, and trucking is the main mode of transportation of cement (c.90-95% of volume), owing to relatively short transport distances to demand (c.150km)
- Depot capacity is extremely limited – most of the cement is delivered direct to customer
- Rail is more commonly used for the transport of clinker (c.50% of volume) on the well-established rail line from the Atlantic Coast; only c.1-2% of cement volume is carried over rail given low reliability and accessibility
- The poor reliability and high cost of unloading at French ports has discouraged importation at French ports, motivating the industry to import via Belgium and other Western European countries
- Regulation is largely enacted at the national or European level – local regulation is less common
- Environmental regulation is relatively strong in France – e.g. clinker imports must be declared, tax on fuel is high, and there are concerns in the industry over a potential $CO_2$ tax and freight emissions tax

Note: * Does not include port terminal locations
Source: CemNet; L.E.K. research, interviews and analysis

# KPIs have been identified to benchmark the competitiveness of the cement supply chain at each stage

| | Stage | KPIs | Description |
|---|---|---|---|
| 1 | Integrated clinker and cement plant | *No KPIs interrogated* | |
| 2a | Rail transport | Cost per tonne kilometre | Cost of rail freight from plant or port to depot or RMC batch plant |
| | | Carbon emissions per tonne kilometre | Carbon emissions associated with rail freight from plant or port depot or RMC batch plant |
| 2b | Road transport | Cost per tonne kilometre | Cost of road freight from plant or port to depot or RMC batch plant |
| | | Carbon emissions per tonne kilometre | Carbon emissions associated with road freight from plant or port to depot or RMC batch plant |
| | | Maximum heavy vehicle (HV) capacity | Maximum heavy vehicle capacity allowed on roads |
| 2c | Coastal shipping | Cost per tonne kilometre | Cost of sea freight between domestic ports |
| | | Carbon emissions per tonne kilometre | Carbon emissions associated with sea freight between domestic ports |
| 3 | Cement depot | Storage and handling cost per tonne | Depot costs associated with unloading, storage, and loading |
| | | Storage capacity (tonnes per day) | Available capacity of cement depots |
| | | Allowable truck hours [depot & batch] | Daily hours of truck operation allowed (i.e. curfew restrictions) |
| 4 | RMC batch plant | Batch plant capacity (tonnes per day) | Available capacity of RMC batch plants |
| 5 | Domestic port | Port handling costs | Cost of inloading and outloading cement or clinker at port |
| | | Port capacity (tonnes per day) | Available capacity of cement port terminals |
| | | Distance to demand (kilometres) | Relative distance of port to centre of demand (i.e. CBD) |
| | All (safety) | Lost Time Injury Frequency Rate | Overall safety of the supply chain, assessed based on the number of lost time injuries occurring in a workplace per 1 million hours worked |

# Australia's supply chain benchmarks well overall, with trucking costs and coastal shipping confirmed as key areas for improvement

| | Stage | KPIs | Australia | US (Northeast*) | France |
|---|---|---|---|---|---|
| 1 | Integrated clinker and cement plant | *No KPIs interrogated* | | | |
| 2a | Rail transport | Cost per tonne kilometre | | | |
| | | Carbon emissions per tonne kilometre | | | |
| 2b | Road transport | Cost per tonne kilometre | | | |
| | | Carbon emissions per tonne kilometre | | | |
| | | Maximum heavy vehicle (HV) capacity | | | |
| 2c | Coastal shipping | Cost per tonne kilometre | | | |
| 3 | Cement depot | Storage and handling cost per tonne | | | |
| | | Storage capacity (tonnes) | | | |
| | | Allowable truck hours [depot & batch] | | | |
| 4 | RMC batch plant | Batch plant capacity (tonnes per day) | *Not publicly available* | | |
| 5 | Domestic port | Port handling costs | | | |
| | | Port storage capacity (tonnes) | *N/A* | | *N/A* |
| | | Distance to demand (kilometres) | | | |
| | All (safety) | Lost Time Injury Frequency Rate | | | |

Strong performer | Neutral | Weaker performer

Note: * Specific to the Northeast where applicable; general United States used where required
Source: L.E.K. research, interviews and analysis

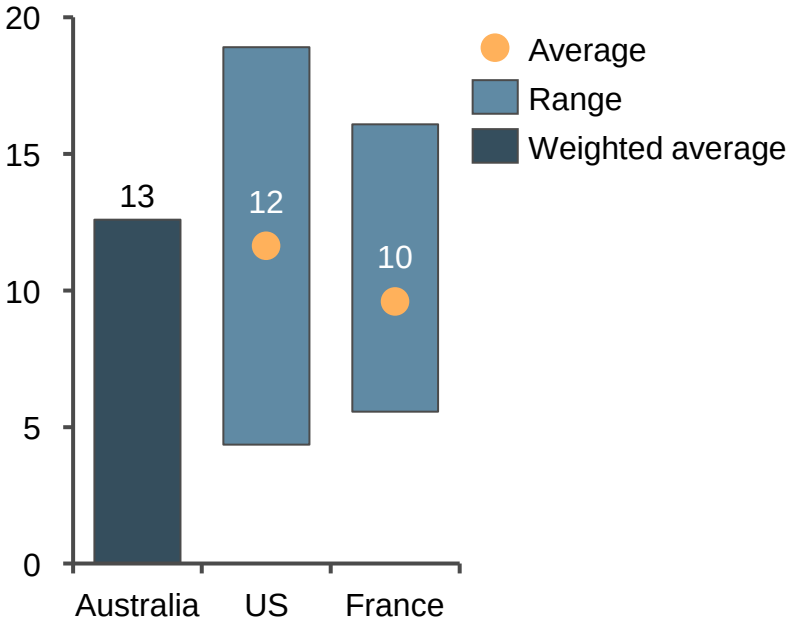


L.E.K.

# Australian rail costs appear similar to comparators' despite the many issues identified within Australia

2a

**Cost of rail freight (2020)**
AUD cents per tonne-kilometre




| Australia | US | France | |
|---|---|---|---|
| 10 | *22* | 2 | $CO_2$ emissions ($gCO_2e$/tonne-km) |
| 370 | 0-1,000+ | 180 | Typical rail freight distance (km) |

US rail freight ranges from c.4c/t-km at 0-100km to c.19c/tkm at distances greater than 1,000 km. There is limited rail freight in the US Northeast given proximity of terminals to demand centres

- There is limited rail freight of cement in the US Northeast and France, given the proximity of production or ports to centres of demand
- Delivery direct to customer (not via depot storage) is common. Customer infrastructure is not often integrated with rail, restricting rail's accessibility
- Benchmarking against these comparators may therefore be imperfect, potentially masking relatively high rail costs in Australia
- The weighted average cost of rail freight in Australia is c.13c/t-km, with cost largely driven by variable rail infrastructure quality and poor integration with other modes
  - rail networks are not well-integrated with port terminal infrastructure
  - a lack of intermodal facilities drives a high cost of transfer to / from road freight
- In the US Northeast, rail freight is unable to compete with trucking or coastal barge at the short distances travelled (c.20-80km), and may cost up to c.19c/t-km at the shortest freight distances
  - low volume coupled with old, inefficient and unconsolidated infrastructure drives up cost
- French cement rail freight can also be expensive, costing c.6-16c/t-km, driven by short freight distances, low volume, poor integration with port terminal infrastructure, and inconsistency of performance
  - rail is predominantly used for transport of clinker (c.50% modal share) but only accounts for c.1-2% of cement transport
  - rail modal share is expected to increase in response to environmental pressure, given its lower emissivity relative to road freight
- Australian rail freight is c.5x more emissive than France, where c.55% of rail lines are electrified, but half as emissive as the US where all rail freight lines are diesel-operated

Source: Adelaide Brighton; Boral Cement; Cement Australia; BITRE; Press articles; L.E.K. research, interviews and analysis



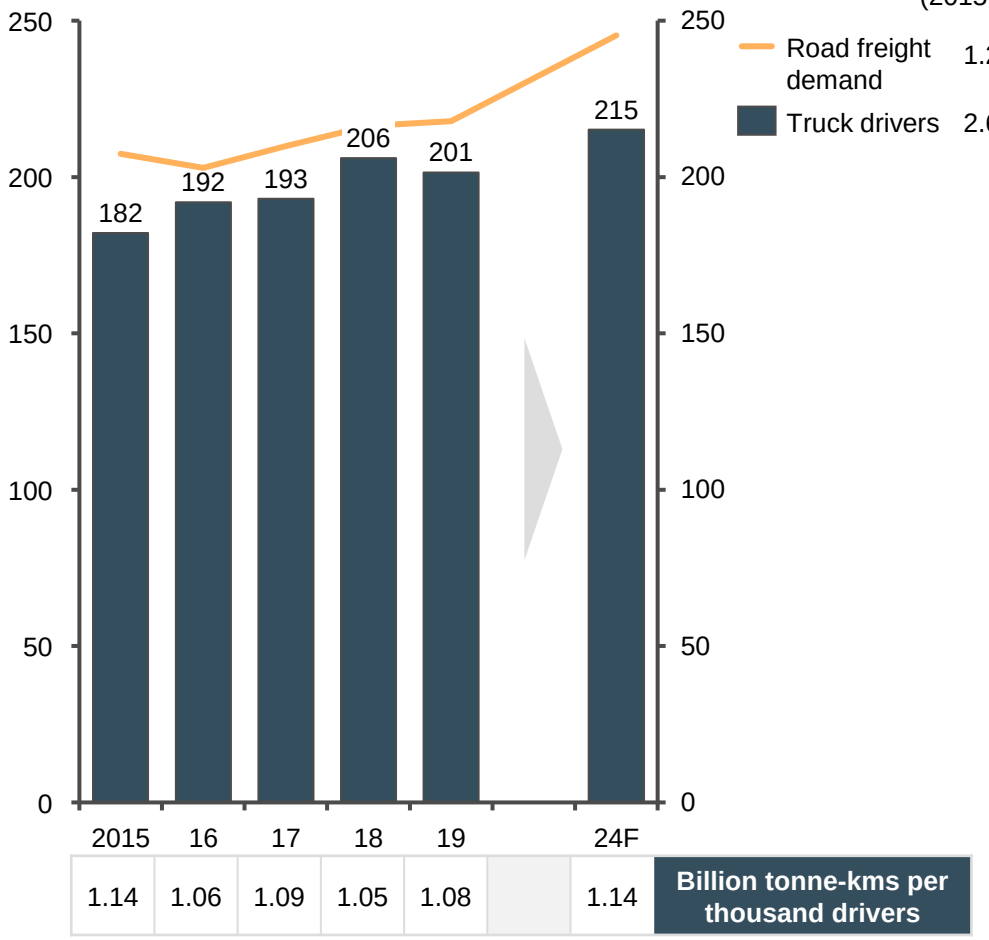
L.E.K.

# A shortage of heavy vehicle drivers in the cement industry is driving a high cost of labour particularly in metropolitan areas

2b

**Number of truck drivers* (2015-19, 24F)**
Thousands

**Road freight demand* (2015-19, 24F)**
Billions of tonne-kilometres




| | CAGR% (2015-19) | CAGR% (19-24F) |
|---|---|---|
| Road freight demand | 1.2 | 2.4 |
| Truck drivers | 2.6 | 1.3 |

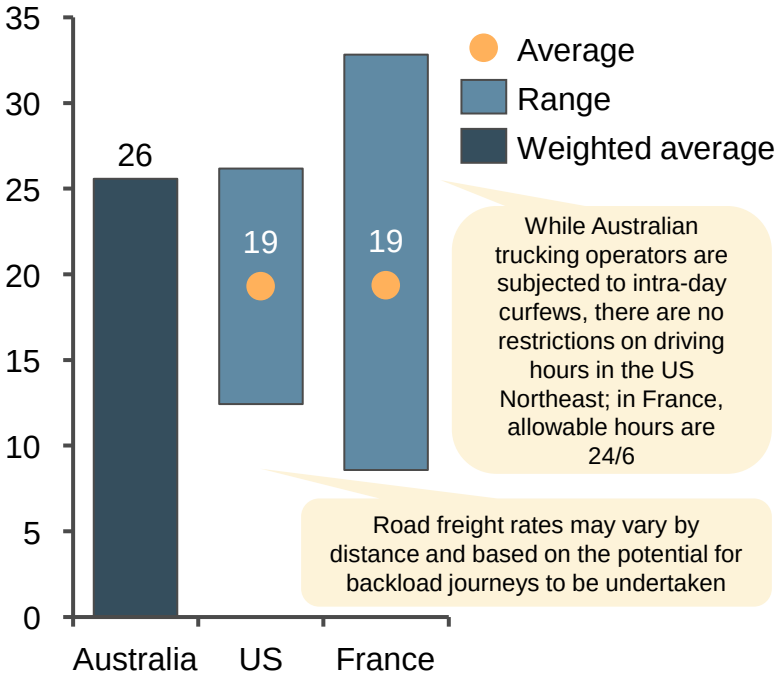
- The **shortage of drivers** is largely driven by the relatively **poor perception of the truck driving industry and profession,** and **strict licensing requirements**
  - the perception that the sector has low wage growth, is unsafe and requires long hours deters new entrants into the workforce
  - strict requirements to receive a skilled heavy vehicle driver licence are a further barrier to filling the industry's skills shortage
  - the traditional lack of women in the role is persistent and also a barrier to growing driver numbers
- Cement companies **may pay heavy vehicle drivers up to c.50% above award rates** in order to attract people to the role
- **Road freight demand is forecast to grow more strongly** than the number of truck drivers in Australia, signaling a potential worsening of this situation in future
- These issues have been **temporarily exacerbated by COVID-19** and border closures, as companies heavily rely on international and interstate drivers

Note: * Numbers and forecasts are pre-COVID-19 and may not reflect current status, road freight forecasts use actual and reference case scenario
Source: JobOutlook; BITRE; Press articles; L.E.K. research and analysis

# Australian cement road freight appears c.30% more expensive than comparators

2b

**Cost of road freight (2020)**
AUD cents per tonne-kilometre




| Australia | US | France | |
|---|---|---|---|
| 95 | 70 | 70 | $CO_2$ emissions ($gCO_2e$/tonne-km) |
| 120 | 16-80 | 150 | Typical road freight distance (km) |
| Variable* | 22-32 | 44 | Maximum HV capacity (tonnes) |

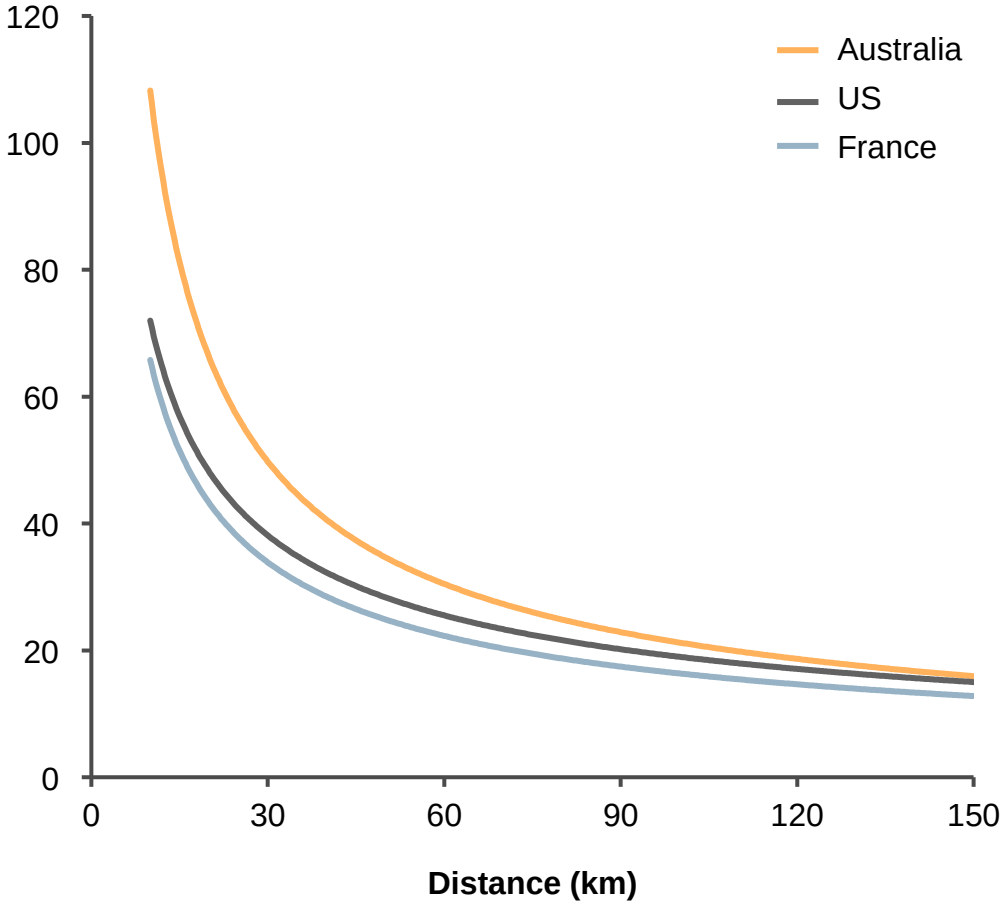
- The weighted average cost of cement trucking in Australia is c.26c/t-km, likely driven by high driver wages and inconsistent heavy vehicle capacity regulation
  - downstream trucking operations particularly in metro areas are also impacted by urban congestion and intra-day curfews, which vary by region
  - a shortage of drivers has impacted labour cost, which can be substantial at short transport distances where time is a more significant driver of cost than distance (e.g. downstream deliveries)
- Australian cement road freight appears c.30% more expensive than comparators, although the gap on long haul routes may be smaller than this. There are a range of contributing factors to the lower costs seen in the US:
  - lower labour cost, lower cost of diesel (c.20% less than Australia) and lower capital costs including taxes and duties
  - an absence of trucking curfews, with trucks allowed to operate 24/7
- France provides a good benchmark on road freight rates for Australia, with cost estimates ranging significantly from c.9c/t-km to c.33c/t-km
  - road holds c.90-95% share owing to the proximity of cement supply and demand (c.150km transport distances are common)
  - the French road network is well developed and maintained, supported in large part by significant private or public-private ownership
  - low road freight rates are supported by the use of cheaper foreign labour
  - maximum heavy vehicle capacity is higher in France, 44t, and consistent across the nation, contributing to trucking efficiency
  - truck operating times are not restricted during the day, although trucking is not allowed on Sundays – individual drivers are only allowed to drive a maximum 10 hours before a daily rest period
- Australian emissions per tonne-kilometre from road freight appear comparable to the US and France. Differences may be driven by the use of sub-optimal vehicle configurations in response to inconsistent capacity regulation

Note: * Australian heavily vehicle capacity limits vary significantly between and within states, depending on the capacity of the road infrastructure available
Source: Adelaide Brighton; Boral Cement; Cement Australia; BITRE; L.E.K. research, interviews and analysis

# The cost of road freight in Australia is higher than comparators in short haul distances, but becomes more competitive at longer distances

2b

**Cost of road freight, by route distance (2020)**
AUD cents per tonne-kilometre



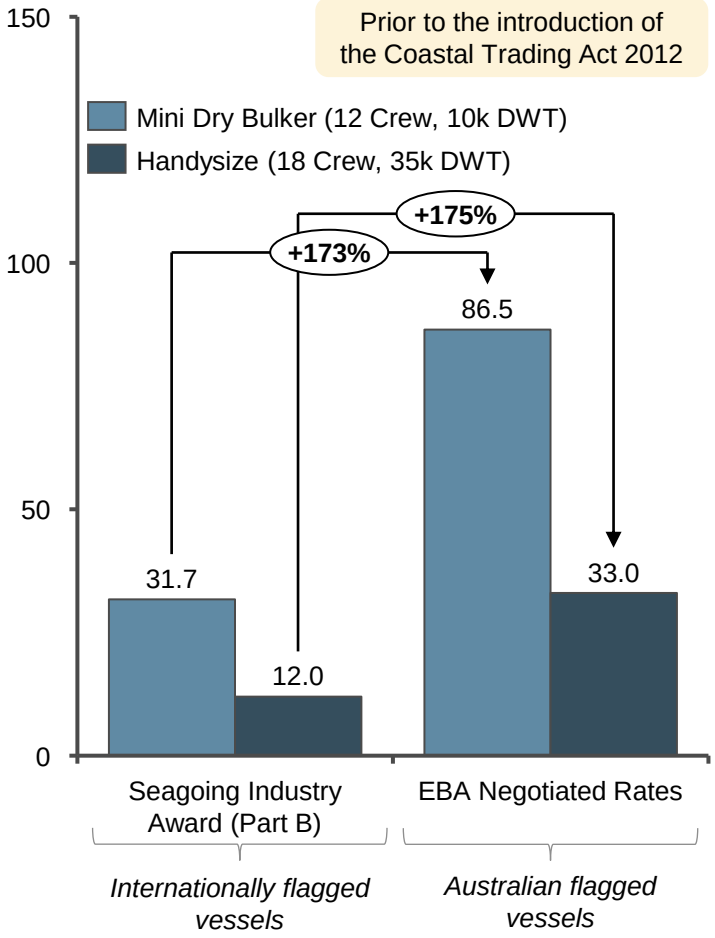

- Australian road freight rates vary significantly with distance, from over $1 per tonne-kilometre at short distances to 5c at distances over 700km
  - other factors besides distance such as road tolls may also drive cost
- Australian short haul rates are much higher than comparators, but costs become competitive on longer distance routes, which are more common in Australia
- The difference in cost on shorter routes is likely driven by Australia's high driver wages, which can be much higher than award rates
  - labour becomes a more significant component of cost on shorter routes, as loading and unloading times tend to drive cost, rather than distance
  - international trucking wages appear to be cheaper, especially in France, due to the use of imported labour

Source: Adelaide Brighton; Boral Cement; Cement Australia; L.E.K. research, interviews and analysis

# Cabotage arrangements have increased the cost of coastal shipping for the cement industry, reducing the competitiveness of local production

2c

**Daily crew rates for vessels carrying domestic cargoes (2012)**
AUD cents per dry-weight tonne**




- In 2012, modelling predicted that the proposed regulation would increase dry bulk coastal shipping costs by c.16%
- Industry consultation suggests that the introduction of the Coastal Trading Act in 2012 has indeed significantly increased the cost of coastal shipping, by impeding foreign shipping lines from effectively competing with Australian vessels for domestic trade
  - cabotage legislation reserves shipping capacity for Australian ships, and has deterred international players from the market
  - this has effectively created a single participant in the coastal shipping of clinker and cement
  - lack of competition has driven up the cost of ocean freight to the extent that imports from Asia are now cost competitive with domestically produced cement

*"… It currently costs more to ship cement products from one Australian port to another than to import the product directly from Asia …"*
*– Industry representative*

*"… It's 10-20% cheaper to import cement into Townsville from Asia, than sending it up from Brisbane due to coastal shipping cost … Even if you've got spare capacity, it's cheaper to import from other countries. Coastal shipping isn't helpful at all …"*
*– Company representative*

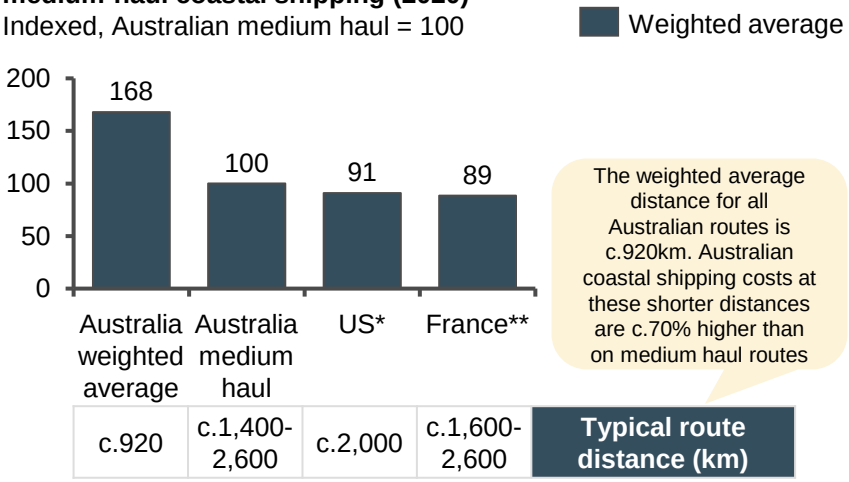
- Australian vessels have an inherently higher cost structure than international vessels
  - key differentiating factors with international ships include: higher labour costs, tax, safety and other laws
  - a 2012 analysis showed that Australian crews' wages were almost triple those of international crews. Given labour may comprise up to c.40% of the operating cost of coastal freight, this is a meaningful difference

Note: * 2012 dollars; ** Maximum dry-weight vessel tonnage assumed (mini dry bulker vessels are typically < 10k DWT, handysize vessels 10-35k DWT)
Source: ACCC; National Bulk Commodities Group Inc; L.E.K. research and analysis

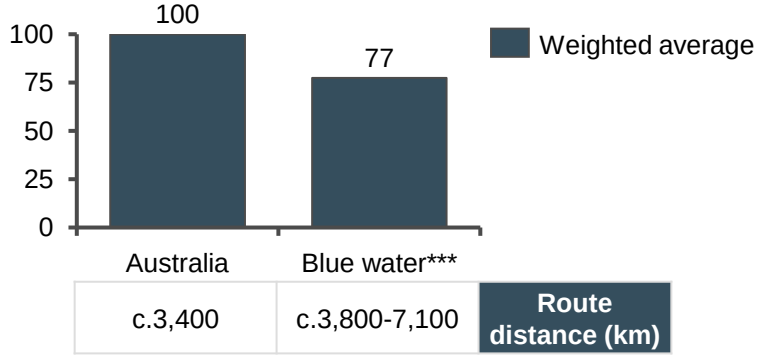
# Coastal shipping rates, particularly for short haul rates, appear higher than equivalent overseas coastal shipping

2c

**Relative cost per tonne-kilometre of short and medium-haul coastal shipping (2020)**
Indexed, Australian medium haul = 100




**Relative cost per tonne-kilometre of long-haul shipping (2020)**
Indexed, Australia = 100




- Coastal shipping is of major importance to the Australian supply chain given the sparse distribution of demand centres and significant freight distances between areas of production and consumption
- In the US Northeast and France, clinker and cement are commonly imported coastally
  - cement is shipped from South East Canada to the US Northeast market, particularly into New York and Rhode Island
  - clinker may be imported into France by maritime freight from the likes of Turkey and Morocco
- Australia coastal shipping rates are c. 10% higher than the US Northeast and France over comparable (medium haul) distances
  - these routes carry a small proportion of Australia's coastal shipping task
  - rates on the average route (typically short haul) may be c.70% higher than medium haul rates but short haul rates have not been benchmarked
- However, domestic coastal shipping is not commonly used in the US nor France for freight from terminal
  - coastal shipping is limited in the US by the Jones Act, which requires goods shipped between domestic ports to be transported on ships that are built, owned, and operated by US citizens or permanent residents
  - the Jones Act has encouraged offshore shipping of imports from the likes of Canada and the Euro-Mediterranean
  - use of coastal barge on the US Northeast's river system is common
  - in France, coastal shipping for freight from terminal is unable to compete with road freight, given proximity of production to demand

Note: * Proxy for coastal shipping cost assumed to be equal to import of cement from SE Canada to New York; ** Proxy for coastal shipping cost, assumed to be equal to import of clinker from Morocco (Casablanca) or Turkey (Antalya) to Marseille; *** Import shipping rates from Indonesia, Thailand, and Japan
Source: Adelaide Brighton; Boral Cement; Cement Australia; Cement Industry Federation; Sea-Distances.org; Sea Routes; L.E.K. research, interviews and analysis

# Low depot / batch plant capacity drives low levels of inventory across the supply chain, making it vulnerable to disruption

3 4

**Low depot / batch plant capacity**

- Depot and batch plant **capacity is restricted by small site footprint and limited availability of land**

  *"… The depots and batch plants are effectively built on postage stamps. There are height issues and constraints on available space, that ends up generating a hand to mouth approach …"*
  *– Company representative*

- **Port storage capacity is similarly constrained** due to competition for space with other port users and residential developments

  *"… the multi user model leads to a lack of private storage and costly moving off-port processes …"*
  *– Company representative*

**Limited finished goods inventory**

- Low storage capacity **reduces the available inventory** across the supply chain, and restricts the industry's ability to respond flexibly, efficiently and cost-effectively to demand

  *"… Biggest thing is there is 8 days of finished good materials at any time anywhere in the country. The ability to have more than 8 days' storage is just not there … Getting access at ports to build large scale capacity for store isn't there …"*
  *– Company representative*

  *"… To avoid stockouts, you'll order additional trucks and then have a surplus for a while. If you had a more efficient system, you wouldn't need to do that and it'd create a broader efficiency …"*
  *– Company representative*

**Vulnerable to supply chain disruption**

- The industry operates on a 'replenishment model' whereby depot and batch plant stocks are frequently topped up
- The supply chain is **reliant on "just in time" deliveries,** with **minimal resilience to disruptions, delays, or demand shocks**
  - for example, the industry is highly dependent on the success of single shipments given vessel loads significantly outweigh stored supply – vessel delays can cause significant supply shortages

**Congestion of key freight routes restricts fast freight**

- **Urbanisation in close proximity to industrial areas increases congestion** on roads and rail, impeding on-time delivery
- **Implementation of curfews** further restricts the ability of cement companies to respond flexibly, and adds to the road congestion issue

  *"… There are more truck on roads during key periods, instead of an replenishment framework that allows you to top up overnight…"*
  *– Company representative*

Source: L.E.K. research and interviews

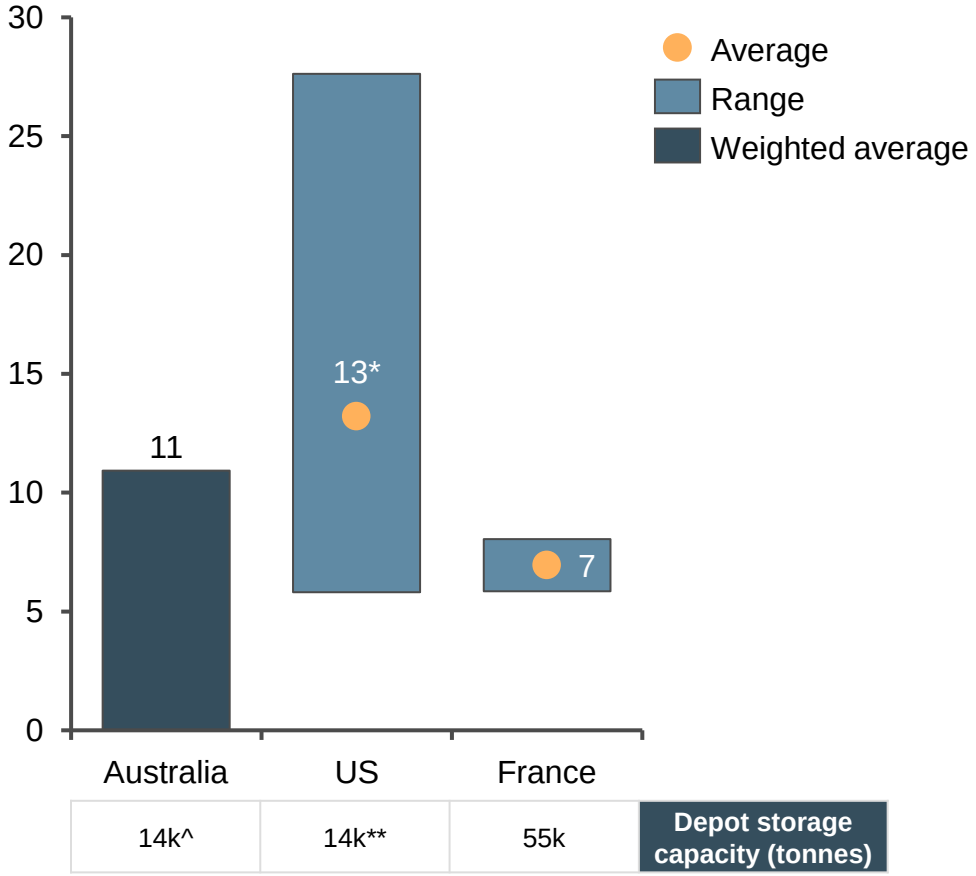


L.E.K.

# Australia's depot costs are slightly lower than the US but higher than France, although depots are not commonly part of these comparators' supply chains

3

**Depot costs (2020)**
AUD per tonne




- Australia is more reliant on intermediate storage (depots) than the US Northeast or France, as its more sparsely distributed population inhibits delivery direct to customer
- The US Northeast and France tend to deliver cement directly from plants or ports, utilising storage capacity at port when required

  *"… The terminal has purpose-built storage so cement is brought in there, stored and then goes direct to customer from the terminal. There is no such thing as a depot …"*
  *– US Northeast cement industry representative*

  - France has a highly distributed network of smaller cement plants, negating the requirement to have depots in many regions
- Australia's average depot storage and handling costs lie between the US Northeast's and France's, at c.$11/t

Note: ^ Depot capacity in Australia is highly variable – value shown is an average of all depots for which data was provided; * US average cost is the average unloading and terminal operating cost, weighted by terminal storage capacity; ** US depot storage capacity is New England's average terminal storage capacity (terminals are typically used as depots)
Source: Adelaide Brighton; Boral Cement; Cement Australia; PCA; L.E.K. research, interviews and analysis

# Urbanisation of historically industrial areas may discourage future investment in port infrastructure and potentially risks urban port terminals' long-term viability

5

## Case study: Glebe Island Port


- Hanson Construction Materials' proposed development of a new aggregate handling facility and concrete batch plant at Glebe Island has received significant opposition from the surrounding Pyrmont community (the most densely populated suburb in Australia)
  - the facilities would serve Inner Sydney's infrastructure boom, limiting truck movements through the city
  - the development application is yet to be approved
  - in order to meet standards on visual, air quality, traffic and noise impacts, the development will incur additional operating costs
- Residents unsuccessfully opposed the construction of the adjacent 24-hour multi-user shipping facility, which was planned and subsequently also approved by the Port Authority of NSW*
  - in response to opposition, the Port Authority promised a precinct-wide noise policy and mandatory protocols for all vessels
- The continued tension between residents and industry may inhibit the Hanson development, or add construction and operating cost

- The increasing urbanisation of historically industrial areas has created tensions, construction delays and additional costs that may discourage investment in supply chain infrastructure
- 'Urban encroachment' and the competition between industrial and residential land zones is of particular concern to the cement industry given cement demand is commonly located in large metropolitan cities
  - the proximity of cement port terminals to demand centres enables cement companies to rapidly service demand at a relatively low freight cost
- Residential opposition to the development and utilisation of port terminal infrastructure creates concerns within industry over the long-term viability of key ports, as 'working ports'
  - especially those in NSW, where Glebe Island and White Bay are the only deep-water wharves in Sydney Harbour that can handle bulk construction materials
  - concerns have also been raised over the relocation of inner-city port assets to more remote areas, further from demand, which would increase freight costs and delivery times
  - the additional freight cost of cementitious materials to the Sydney market from remote port locations is estimated to be about $15/t (c.2.5% of the price of premixed concrete)

Similarly, industry has expressed concerns that Melbourne's Fishermans Bend urban renewal project may present material risk for the viability of the Melbourne Cement Facility, however the industry acknowledges current planning by the state government appears to be addressing this risk

Note: * The Port Authority of NSW approved its own development plan
Source: CCAA; Port Authority of NSW; Victorian Coastal Shipping Review; L.E.K. research and analysis



L.E.K.

# Industry participants suggest that port privatisations have driven increases in port charges; limitations on capacity and dedicated infrastructure are also concerns

5

## Case study: Australian port privatisations


- Governments have privatised much of Australia's port infrastructure in the past decade, including the Port of Brisbane 2010, Ports Botany and Kembla 2013, Port of Newcastle 2014, Port of Darwin 2015, Port of Melbourne 2016
- In some cases, increases in port charges have followed privatisation as ports tend to operate with limited competition for services
- Industry submissions have noted that increasing port visit costs (including navigation services charge, wharfage, berth hire, infrastructure levies, pilotage and towage) are a key factor in reduced coastal shipping activity

*"… Our experience has been that when a port is transferred to private ownership, price has gone up but service hasn't necessarily followed. In fact, we've seen a diminishment of service in some areas …"*
*– Company representative*

## Port costs have increased at privatised ports in some instances

- Some industry participants suggest that privatised ports tend to have higher costs than publicly-owned ports
- However, higher costs may be driven by renewed private investment in port infrastructure

*"… Level of investment really depends on the port. Some privatised ports, like Geelong, are investing in new unloading facilities. It's a commercially driven decision …"*
*– Company representative*

## There is limited dedicated capacity available at port for the cement industry

- Cement companies must often compete with other industries for port storage and berth capacity and often lack dedicated infrastructure

*"… No dedicated ports, you're not there with your own infrastructure, so moving off ports is a process as well …"*
*– Company representative*

## Ageing infrastructure at some ports drives loading inefficiency, congestion and higher port costs

- Outdated in/outloading infrastructure and competition for capacity at certain ports, such as Newcastle and Port Kembla, drive port congestion

*"… At some ports we have issues with port congestion – Newcastle in particular …"*
*– Company representative*

*"… There are some port issues around loading efficiency … Port Kembla suffers from congestion… There are lots of ships still lifting and dropping (so slow) and it's exposed to dust and wind which can slow the discharge rate …"*
*– Company representative*

Source: ACCC; L.E.K. research and interviews

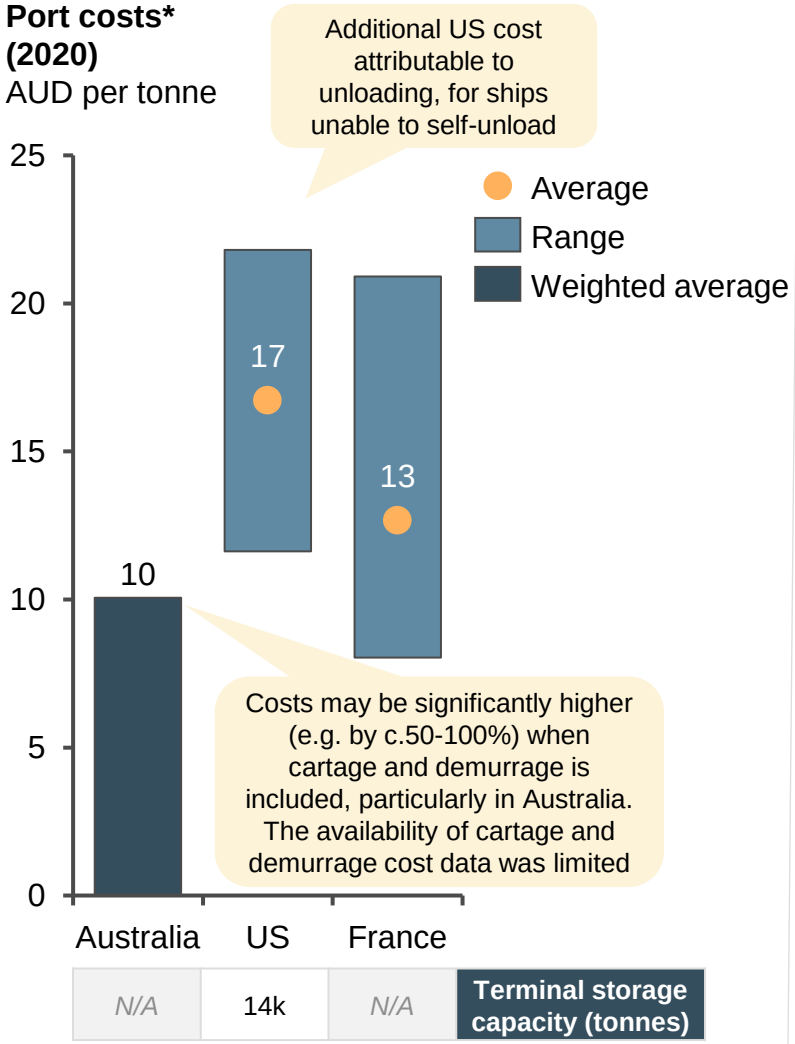


L.E.K.

# Despite this, Australian direct port costs compare reasonably well with comparators

5

**Port costs* (2020)**
AUD per tonne




- Consultation with the Australian cement industry suggests port costs comprise a significant proportion of supply chain cost
  *"… Port fees reflect quite a large proportion of the total cost of our clinker …"*
  *– Industry representative*
  - industry suggests privatisation of Australian ports has resulted in price increases and that excessive port costs inhibit the potential export of Australian cement

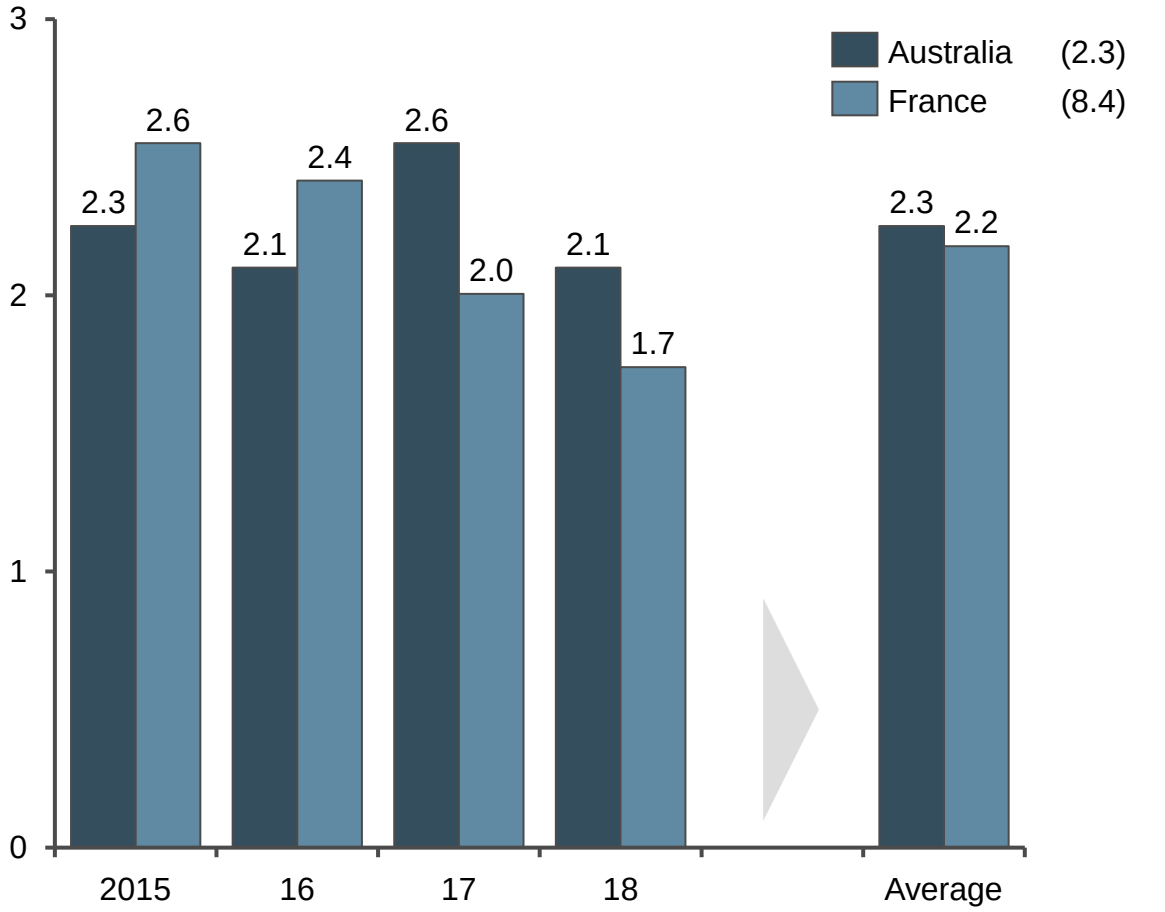
  *"… You can't make it stack up for most people because port costs make you uncompetitive so there's no exports …"*
  *– Industry representative*
- Cost may also be driven by port congestion given unloading inefficiency and limited capacity
  - certain ports (e.g. Port Kembla, Newcastle) suffer from congestion due to ageing unloading infrastructure, leading to costly moving-off-port processes
  - there is competition for capacity at multi-purpose ports
  - the lack of dedicated infrastructure for cement and port congestion generates significant demurrage and cartage costs for the industry
- Port costs vary based on discharge rates for ships (higher for pneumatic and self-unloading vessels) and whether cartage to port-based storage is required
- Wharf industrial activity in Australia has remained a key issue over a number of years
- In the US, port costs may be between $12-22/t, with differences driven by unloading throughput and ship type
  - unloading costs may be up to $12/t if ships are not able to self-unload
  - typical throughput capacity may be c.250kt per day
- French ports are notably expensive with estimates ranging from c.$8-21/t depending on location and size of vessel. Imports are subject to high taxes, docking charges, and unloading and storage fees

  *"… It's not cheap to unload in the French port – sometimes done in Belgium or Netherlands instead. In France, there are taxes, dockers are strongly unionised, so it is expensive to unload and store at port …"*
  *– Industry representative*

Note: * Excludes trucking, equipment, survey and demurrage
Source: Adelaide Brighton; Boral Cement; Cement Australia; L.E.K. research, interviews and analysis

# Australian injury rates in the cement industry are similar to France

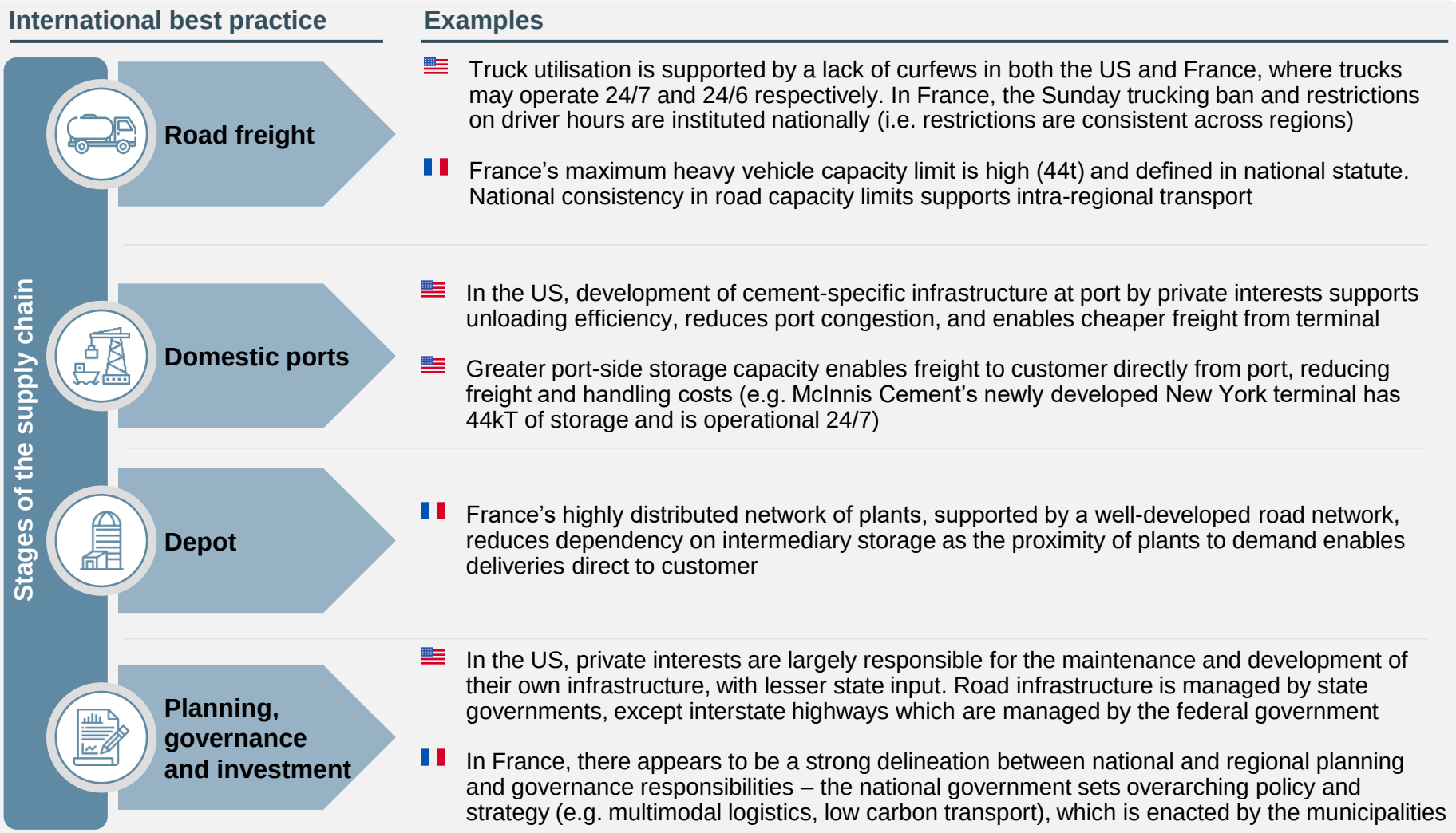
**Cement LTIFR***
**(2015-19)**
Lost time injuries per million hours




- Australia's Lost Time Injury Frequency Rate (LTIFR) is broadly comparable with France the four-year average of Australia's LTIFR is 2.3 compared with 2.1 in France
  - U.S. data was insufficient to make any relevant comparisons
- Australia's slightly higher rate may be due to great transparency and reporting of injuries incurred and not necessarily representative of malpractice or lack of safety – Australian workers are incentivised to report incidents under WorkCover
- There is an overall downwards trend as companies become more safety conscious and set goals to lower injury rates
  - this downward trend is consistent with other common safety indicators, such as the total recordable injury frequency rate

Note: * Averages of available group data, France includes Heidelberg group and LFH Europe
Source: Adelaide Brighton, Boral, Cement Australia, LafargeHolcim and Heidelberg; L.E.K. research and analysis

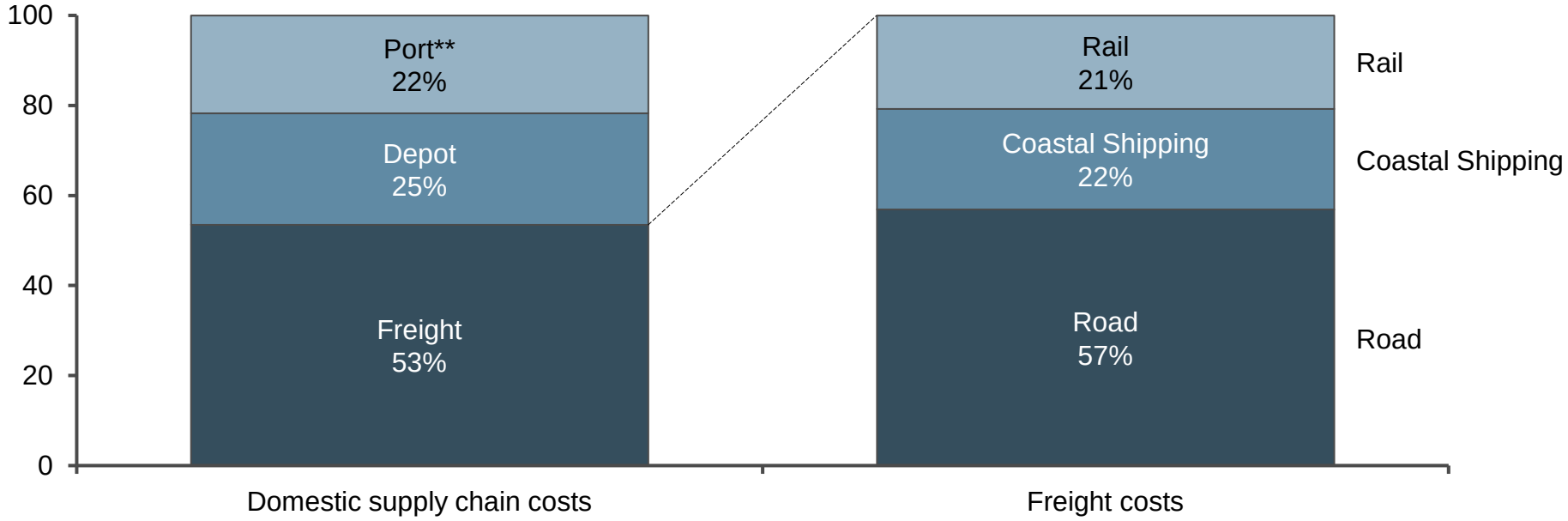
# In the US and France, stronger private control of supply chain infrastructure and more nationally consistent regulation supports efficiency




Source: L.E.K. research and interviews

# Freight accounts for c.55% of cement supply chain costs, with road, coastal shipping and rail accounting for c.60%, c.20% and c.20% each

**Weighted average cement and clinker supply chain costs – Adelaide Brighton, Boral, Cement Australia***
Percent (AUD per tonne)




**$470-660M**

The domestic cement supply chain costs the industry an estimated c.$470-660M per year

Note: * Includes movements of locally produced and imported cement and clinker; ** Excludes trucking, equipment, survey and demurrage
Source: ABS; Adelaide Brighton; Boral; Cement Australia; L.E.K. research and analysis

# Key cement supply chain findings

**The supply chain accounts for a significant proportion of the cost of cement**

**Australia's domestic supply chain accounts for c.25-35% of the price of cement, equivalent to c.$470-660M cost annually** – freight, port costs, and depot costs account for c.55%, c.25%, and c.20% of supply chain costs respectively

**Australia's supply chain costs are similar to comparators**

**Australia compares reasonably well on most elements of the supply chain with the US Northeast and France (e.g. rail and depot charges) but underperforms on road freight** – Australian road freight is more expensive than comparators; coastal shipping and port charges are broadly comparable to overseas rates

**Cement road freight rates are particularly high**

**Road freight compares most unfavourably, costing c.26c/t-km in Australia, c.30% higher than the US Northeast and France** – Australian road freight rates are negatively impacted by factors such as high driver wages, variable heavy vehicle regulation driving sub-optimal vehicle combinations, high vehicle compliance costs, restrictive curfews, urban congestion and delays, particularly in metro areas – long haul road rates are often more reasonable

**Australia's unique short haul coastal shipping routes make for difficult global comparisons**

**Australian shorter haul coastal shipping routes are relatively higher cost (than long haul routes) although these have not been benchmarked,** due to difficultly of making global comparisons. Coastal shipping rates for dedicated pneumatic vessels over 2000km+ sectors are similar to overseas benchmarks and blue water rates over comparable distances

**Depot storage charges are also comparable to overseas**

**Australian depot storage and handling is more expensive than in France but cheaper than the US Northeast, costing c.$11/t on average vs. c.$7/t and c.$13/t respectively** – depot storage is less common overseas however, as delivery direct-to-customer and the greater availability of port terminal storage capacity reduces the need for intermediate storage

**Australian port access is the key challenge, rather than headline costs**

**Australian port costs appear reasonable, c.20-40% less than comparators** – port costs in the US Northeast and France range significantly and can be driven higher by low throughput unloading infrastructure, high taxes and docking charges. However, limited access to dedicated infrastructure drives port congestion and increases demurrage costs which can be material