

Comparing Freight Transport Emissions by Mode

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Overview

- Moving domestic freight by rail or coastal shipping is widely regarded as lower in emissions per tonne-km compared to road freight
- Yet data for New Zealand that would allow us to estimate the reduction in emissions from shifting freight between modes has been limited
- We examine the evidence on emissions by domestic freight modes and recommend assumptions regarding average emissions per tonne-km by mode

Approach

- For each of the three freight modes (coastal shipping, rail, road) we look at evidence from both:
 - New Zealand-specific data
 - Overseas data
- Where the data permits, we break out the data to facilitate comparisons
 - Linehaul vs. urban delivery trucks
 - Diesel vs. electric rail
 - Bulk vs. container vs. tanker ships

Overseas Sources Cited

- United Kingdom *UK Government GHG Conversion Factors for Company Reporting*, 2020 (UK government)
- Netherlands, *STREAM Freight Transport 2016 Handbook* by consulting firm CE Delft under sponsorship of Topsector Logistiek, an industry association
- France – *GHG Information for Transport Services*, 2019 (French government)
- Sweden – benchmark transport data prepared by Network for Transport Measures (NTM), 2020, an industry association

Coastal Shipping: New Zealand-Specific Data

- Only six ships currently devoted to domestic freight service:
 - Bulk ships – Anatoki, Aotearoa Chief, Buffalo
 - Oil product tankers – Kokako, Matuku
 - Container ship – Moana Chief
- We exclude the Cook Strait ferries, as they do not compete with road or rail transport
- International container ship lines also sometimes handle New Zealand domestic freight
- Data on tonne-kms, fuel use, and emissions for coastal shipping very limited

Coastal Shipping: International Data

- Small bulk cargo ships
($<10,000$ tonnes deadweight) – 28-30 g CO₂-e/tonne-km
- Medium oil product tankers
(20,000-60,000 tonnes deadweight)
– 10-16 g CO₂-e/tonne-km
- Small container ships (1000-2000 TEUs*)
– 18-21 g CO₂-e/tonne-km

* TEU = twenty-foot equivalent units = small containers

Rail Freight: New Zealand-Specific Data

Fiscal Year (Ending 30 June)	2015-16	2016-17	2017-18	2018-19	2019-20
	g CO ₂ -e/net tonne-km				
Diesel	31.0	30.5	28.2	28.6	28.7
Electric	5.5	6.4	6.2	6.1	6.9
Average	28.4	28.5	27.0	27.6	28.2

Source: Kiwirail

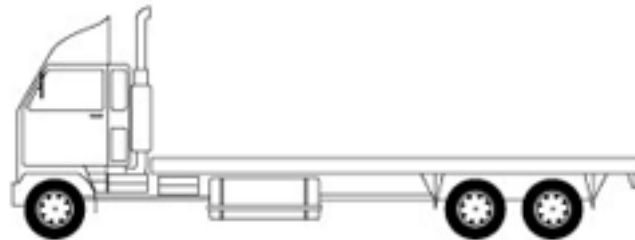
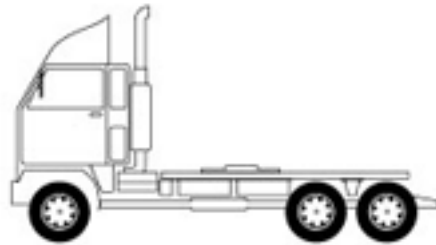
Rail Freight: Overseas Data – Diesel Only

- United Kingdom – 25.6 g CO₂-e/tonne-km
- Netherlands:
 - Medium-length bulk freight train – 18 g CO₂-e/tonne-km
 - Medium-length medium-weight container freight train – 27 CO₂-e/tonne-km
- France – Medium-density freight train – 22.3 g CO₂-e/tonne-km
- Sweden (but global data) – 21 g CO₂-e/tonne-km
- New Zealand (diesel from previous slide) – 28.7-31.0 g CO₂-e/tonne-km

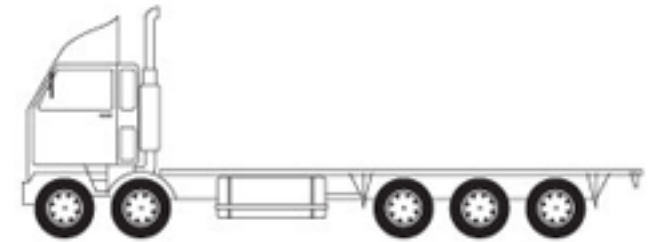
Road Freight: Classifying Heavy Trucks



RUC Type 2



RUC Type 6



RUC Types 14 and 19

[Source: https://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/ruc-rates-and-transaction-fees/#RUC-rates-for-distance-licences-powered](https://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/ruc-rates-and-transaction-fees/#RUC-rates-for-distance-licences-powered)

Road Freight: New Zealand-Specific Data

Survey Year	Urban Delivery (RUC Type 2)		Linehaul (RUC Types 6, 14, 19)	
	g CO2-e/net tonne-km			
	Mean	Median	Mean	Median
2015	378	336	106	104
2016	413	370	108	105
2017	427	384	109	106
2018	432	389	108	105

Sources: EROAD Sample Fuel Use Data, Waka Kotahi/NZTA Weight-in-Motion Data

Road Freight: Overseas Data for Tractor/Trailer Combos Only

- United Kingdom – All articulated > 3.5 tonnes
 - 79.4 g CO₂-e/tonne-km
- Netherlands – 64-134 g CO₂-e/tonne-km
- France – 68-128 g CO₂-e/tonne-km
- Sweden (but EU Data) – heavy (>34 tonnes gross) - 48-55 g CO₂-e/tonne-km
- New Zealand (from previous slide) –
 - 106-109 g CO₂-e/tonne-km

General Observations

- Estimating emissions per tonne-km can be complicated:
 - Type of freight – bulk/containers, high-density/low-density
 - Size of vehicle – especially for trucks and ships
 - Fuel source – especially diesel vs. electric for rail
 - Load factors and repositioning requirements
- New Zealand road and rail emissions per tonne-km tend to be a bit higher than Europe, probably due to
 - New Zealand's more rugged topography; and
 - New Zealand's more lightly-constructed road and rail networks

Recommended Assumptions

- road (average) – 144 g CO₂-e/tonne-km
- road (straight truck/urban delivery) – 400 g CO₂-e/tonne-km
- road (tractor-trailer/linehaul) – 105 g CO₂-e/tonne-km
- rail (diesel) – 29 g CO₂-e/tonne-km
- rail (electric) – 7 g CO₂-e/tonne-km
- rail (average) – 28 g CO₂
- coastal shipping (container freight) – 20 g CO₂-e/tonne-km
- coastal shipping (oil products) – 15 g CO₂-e/tonne-km
- coastal shipping (other bulk) - 29 g CO₂-e/tonne-km.