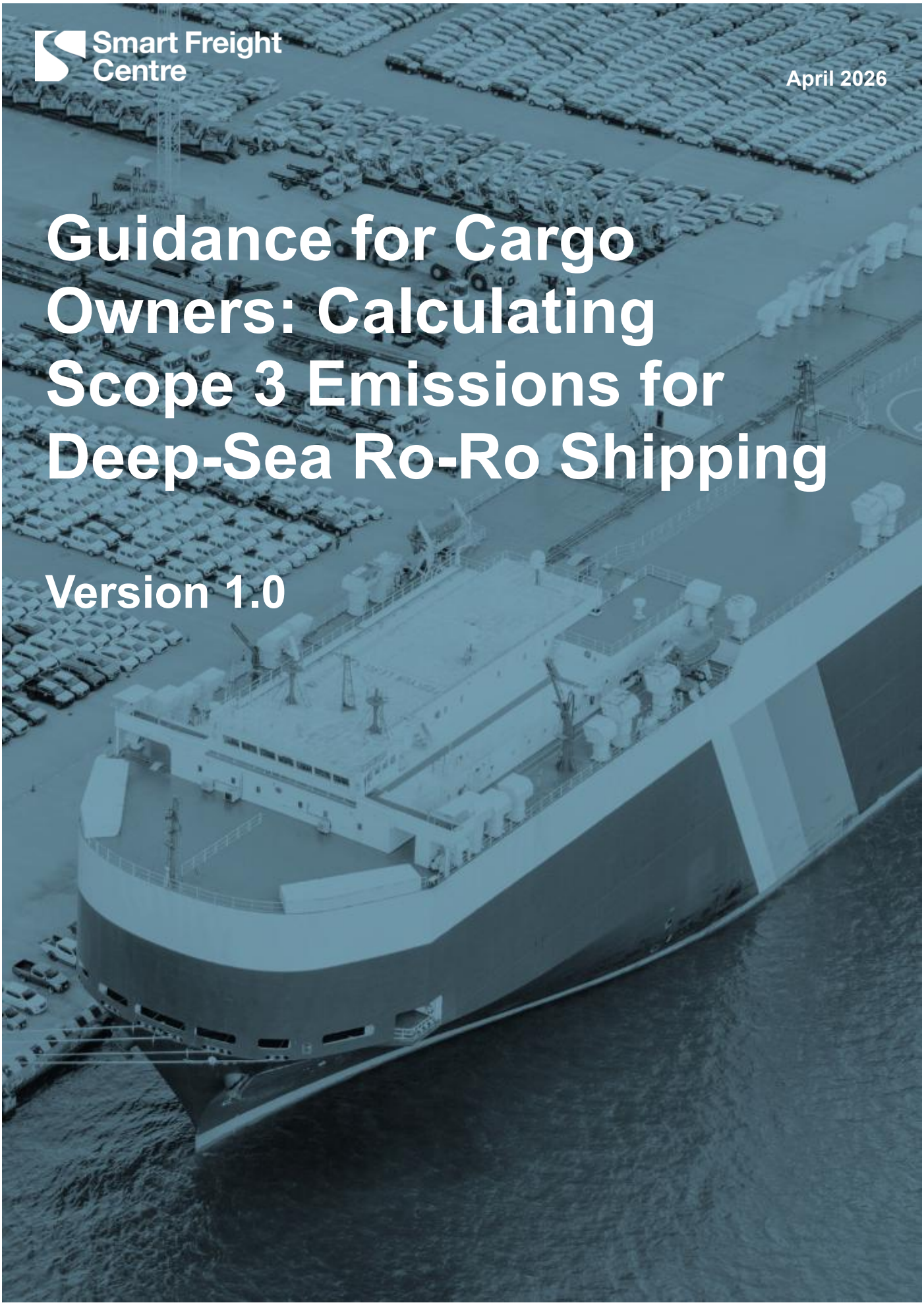
Smart Freight Centre

April 2026

Guidance for Cargo Owners: Calculating Scope 3 Emissions for Deep-Sea Ro-Ro Shipping

Version 1.0



Global Ro-Ro Community

Guidance for Cargo Owners on Calculating Scope 3 Emissions for Deep-Sea Ro-Ro Shipping Using GRC Emission Intensity Factors

April 2026

Suggested citation: Smart Freight Centre. Guidance for Cargo Owners on Calculating Scope 3 Emissions for Deep-Sea Ro-Ro Shipping Using GRC Emission Intensity Factors. April 2026.

Acknowledgements
This report was written by GRC Secretariat of Smart Freight Centre.

Smart Freight Centre (SFC) is a globally active non-profit organization for climate action in the freight sector. Our goal is to mobilize the global logistics ecosystem, in particular our members and partners, in tracking and reducing its greenhouse gas emissions. We accelerate the reduction of logistics emissions to achieve a zero-emission global logistics sector by 2050 or earlier, consistent with 1.5° pathways.

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1 Purpose

This guidance explains how cargo owners (OEMs) can calculate Scope 3 greenhouse-gas (GHG) emissions associated with deep-sea roll-on/roll-off (Ro-Ro) shipping using Global Ro-Ro Community (GRC) emission intensities factors (EIFs).

GRC emission intensity factors represent tradelane-level emission intensities derived from ship-specific verified operational data of participating carriers. These factors enable cargo owners to estimate transport emissions using a consistent and transparent methodology.

The approach aligns with:

- the GLEC Framework
- ISO 14083

Emission intensity factors are expressed in grams of CO_2-equivalent per tonne-kilometre ($gCO_2e/t\text{-}km$).

2 Scope 3 Calculation Using GRC Emission Intensity Factors

OEMs can estimate emissions from Ro-Ro shipments using three inputs:

1. Cargo mass transported (tonnes)
2. Shipment distance (km)
3. GRC emission intensity factor for the relevant tradelane (gCO_2e/t-km)

Calculation formula

GHG Emissions = Cargo Mass × Distance × Emission Intensity

Where:

- Cargo mass = tonnes transported
- Distance = adjusted shipment distance (km)
- Emission intensity = GRC tradelane emission factor (gCO_2e/t-km)

The resulting value represents the GHG emissions associated with transporting the cargo between the origin and destination ports.

Emission intensity factors are expressed in grams of CO_2e, therefore results should be converted to kg CO_2e or tonnes CO_2e when reporting emissions.

Calculations may be performed:

- at the individual shipment level, or
- at an aggregated shipment level, depending on the granularity of logistics data available.

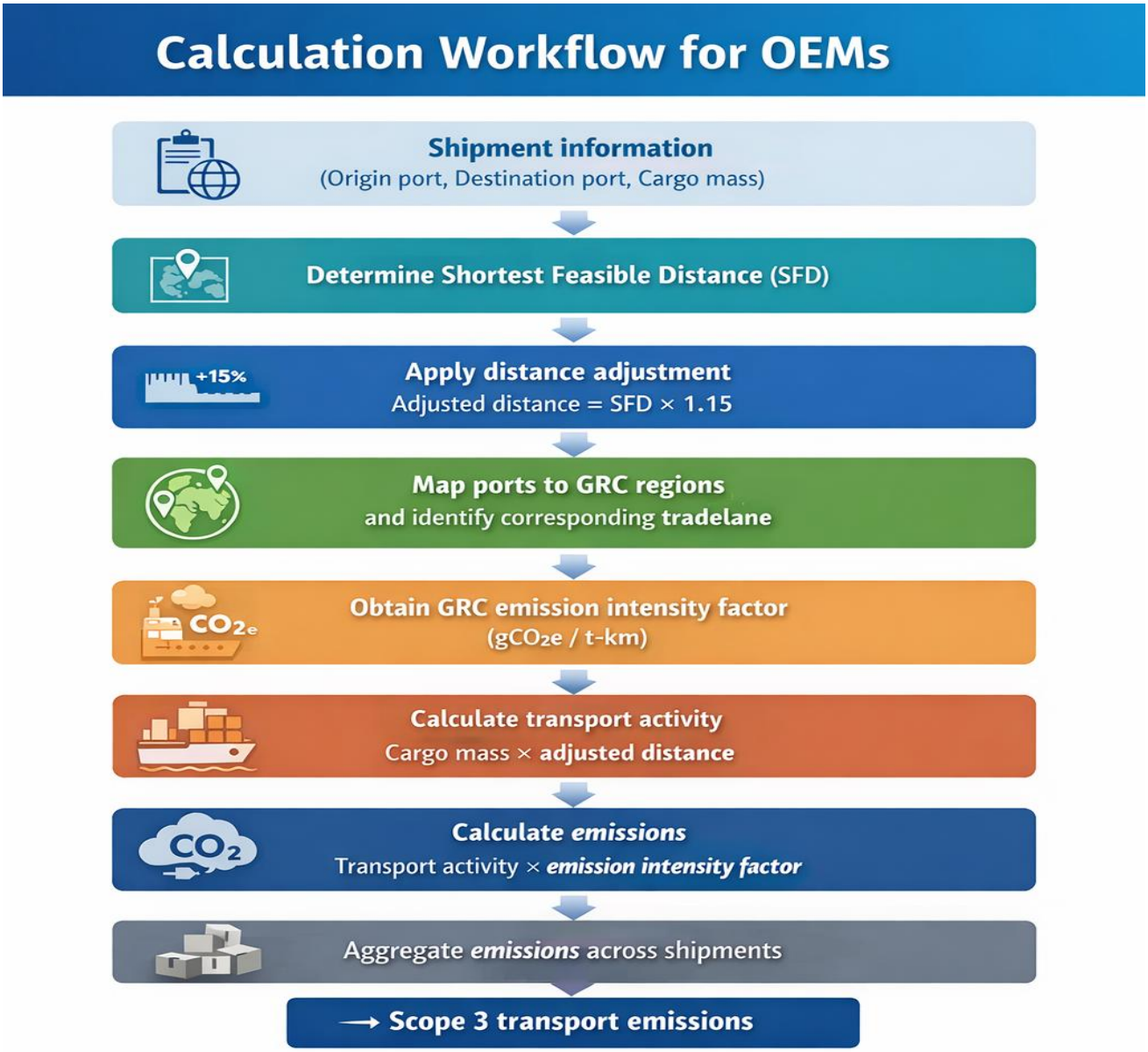
3 Data Required for Calculations

To perform the calculation, OEMs require the following shipment information:

Data element	Description
Port of loading	origin port
Port of discharge	destination port
Cargo mass	weight transported (tonnes)

Cargo mass should represent the actual transported cargo weight.

Where shipments are measured in units (for example vehicles or machinery), OEMs may estimate cargo weight using representative vehicle or product weight assumptions based on product specifications.



4 Determining Shipment Distance

Shipment distance should be determined using the Shortest Feasible Distance (SFD) between the origin and destination ports.

The SFD represents the shortest practical maritime route between two ports, considering navigational constraints such as coastlines, canals, and maritime routing limitations.

Why SFD is used?

GRC emission intensity factors are calculated using actual operational distances sailed by vessels.

Actual voyage distances may vary due to:

- routing decisions
- weather conditions
- intermediate port calls
- operational scheduling

Because cargo owners typically do not have access to the exact route sailed by a vessel, a standardized proxy distance is required for emissions calculations.

The Shortest Feasible Distance (SFD) provides a consistent and transparent approximation of maritime distance.

Distance adjustment

To ensure consistency between the proxy distance used by cargo owners and the operational distances used in emission-intensity calculations, OEMs should apply a 15 percent adjustment factor.

Adjusted Distance = SFD × 1.15

This adjustment accounts for the typical difference between the theoretical shortest route and actual operational routes sailed by vessels.

The SFD may be obtained from:

- the GRC data platform, or
- reputable maritime distance databases or routing tools.

Applying this adjustment ensures that the transport activity calculated by OEMs aligns with the methodology used to derive GRC emission intensity factors.

5 Mapping Shipments to GRC Tradelanes

GRC emission intensity factors are reported at the tradelane level.

A tradelane represents a directional transport flow between two defined geographic regions.

To identify the correct emission intensity factor:

1. Identify the origin port region.
2. Identify the destination port region.
3. Determine the tradelane connecting those two regions.

Emission intensity factors are reported at the region-to-region level rather than individual port pairs. Therefore shipments must first be mapped from ports to their respective regions.

Definitions of regions, ports, and tradelanes are provided in: GRC GHG Emission Intensity Calculation Methods — Annex 2: Trade Regions and Tradelanes.

OEMs should use this document to map ports to regions and identify the appropriate tradelane emission factor.

6 Example Calculation

Shipment details:

Parameter	Value
Port of loading	Nagoya, Japan
Port of discharge	Zeebrugge, Belgium
Cargo mass	2 tonnes

Step 1 — Determine SFD distance

Shortest feasible distance: 19,000 km

Adjusted distance: 19,000 × 1.15 = 21,850 km

Step 2 — Identify tradelane

Using the GRC tradelane definitions, the shipment corresponds to:

Far East / South-East Asia → Europe

Step 3 — Obtain emission intensity factor

Example emission intensity factor:

20 gCO_2e/t-km (from the GRC data platform)

Step 4 — Calculate emissions

Emissions = 2 × 21,850 × 20 = 874,000 gCO_2e = 0.874 tCO_2e

7 Fossil Baseline (VLSFO) Reporting

GRC emission intensity factors provided to cargo owners are reported on a VLSFO (HFO) fossil baseline, expressed in gCO_2e per tonne-kilometre (gCO_2e/t-km).

Under the current methodology, all fuel consumption by vessels is incorporated into the fossil-baseline emission intensity calculation (using volume conversion per energy density to include the volumes of fossil fuel (HFO(VLSFO)) replaced), including:

- conventional fossil fuels
- low-emission fuels used for regulatory compliance
- low-emission fuels used voluntarily

As a result, emission intensity factors represent a fossil-referenced allocation basis for transport emissions across cargo owners.

Implications for OEMs

When calculating Scope 3 emissions, OEMs should:

- use the GRC emission intensity factors as provided
- not assume that benefits from low-emission fuels are separately allocated within the emission intensity factor.

Because low-emission fuels used for regulatory compliance are included within the fossil baseline, any potential emissions benefit from those fuels is not separately reflected in the emission intensity factors used by OEMs.

Consequently:

- Scope 3 emissions calculations are based on a fossil-baseline emission factor
- reported emissions may therefore be higher than if low-emission fuel benefits were allocated separately.

This approach ensures comparability across carriers and tradelanes, regardless of differences in fuel mix.

8 Overview of the GRC Methodology

The GRC methodology calculates emission intensity based on the relationship between:

- total vessel emissions, and
- total transport work performed.

Transport work is measured as: Transport Activity = Cargo Mass × Distance

Emission intensity is calculated as: Emission Intensity = Total GHG emissions / Total transport activity

Carriers calculate emission intensities using vessel-level operational data, including:

- fuel consumption
- cargo transported
- distance sailed
- vessel operations

These data are aggregated into tradelane-level emission intensity factors used by cargo owners.

Ballast voyages

Ro-Ro vessels frequently operate ballast voyages (voyages with minimal cargo).

Under the GRC methodology, voyages carrying 10 percent or less of a vessel's maximum cargo mass are classified as ballast voyages.

Emissions from ballast voyages are incorporated through a Ballast Distribution Factor (BDF) that distributes ballast emissions across laden transport activity.

As a result, the emission intensity factors used by OEMs already include ballast emissions, and no additional adjustment is required.

9 Availability of Emission Intensity Factors

GRC emission intensity factors are available at different levels of aggregation. Access to these factors depends on the level of detail and whether the data is based on actual fuel mix or fossil baseline.

Emission intensity factors based on actual fuel mix are not made available to OEMs and are intended for carrier internal use and performance tracking only. OEMs should use fossil-baseline emission intensity factors for Scope 3 emissions calculations.

At a high level, emission intensity factors are made available as follows:

- **GRC global average**
  - Available for both actual fuel mix and fossil baseline
  - Intended to be publicly available (to be published)
- **GRC average per tradelane**
  - Not publicly available
  - Accessible only to GRC members, including carriers and OEMs (fossil baseline only)
- **Carrier-specific global average**
  - Each carrier can access its own emission intensity values
  - Fossil baseline values may be shared with specific cargo owners at the carrier's discretion
- **Carrier-specific emission intensity per tradelane**
  - Each carrier can access its own tradelane-level data
  - Fossil baseline values may be shared with specific cargo owners at the carrier's discretion

OEMs should obtain emission intensity factors through the GRC data platform or directly from carriers, depending on their level of access. Only **fossil-baseline emission intensity factors** should be used for Scope 3 reporting.

10 Summary of OEM Calculation Steps

1. Identify shipment origin and destination ports.
2. Determine cargo mass transported.
3. Obtain the Shortest Feasible Distance (SFD).
4. Apply the 15 percent distance adjustment.
5. Map ports to regions and identify the corresponding GRC tradelane.
6. Obtain the GRC emission intensity factor for that tradelane.
7. Calculate emissions using the tonne-kilometre formula.
8. Aggregate emissions across shipments for Scope 3 reporting.