

# A Review and Evaluation of Emission Intensity Factors for Road Freight Transport

Martin du Plessis<sup>a</sup> ([martinduplessis@sun.ac.za](mailto:martinduplessis@sun.ac.za)), Joubert van Eeden<sup>a</sup> ([jveeden@sun.ac.za](mailto:jveeden@sun.ac.za)),  
and Leila Goedhals-Gerber<sup>b</sup> ([leila@sun.ac.za](mailto:leila@sun.ac.za))

<sup>a</sup> Department of Industrial Engineering, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

<sup>b</sup> Department of Logistics, Stellenbosch University, South Africa, Private Bag X1, Matieland 7602, South Africa

## Abstract:

Globally, road freight transport is increasingly used due to its convenience, cost, short lead time, and minimal infrastructure investment. However, quantifying the amount of greenhouse gas (GHG) emissions emitted when transporting cargo via road is challenging or ambiguous due to the large amount of emission intensity factors (g CO<sub>2</sub>e/t-km) available for some geographical regions. Other regions in the world such as Africa and Asia, however, have limited or no emission intensity factors available in the literature. Some of the EU and North American frameworks propose road emission factors adjustments as estimates for Africa and Asia.

Establishing the carbon-intensity of shipping goods via road is more important than ever since environmental concerns amongst consumers continue to rise. Further, governments are implementing stricter emission regulations for road freight vehicles, while retailers are ever more interested in sourcing goods that have a smaller carbon footprint.

This is particularly true for diesel road freight transport since the proportion and total volume of goods shipped by this mode has grown considerably in the past decade. Further, the distribution of a product via road transport can potentially contribute significantly towards the overall life cycle emissions of goods if shipped over long distances.

The latter reasons not only necessitate the availability of emission intensity factors to calculate road transport emissions, but also iterates the importance of the accuracy of these emission intensity factors.

This paper, therefore, aims to present a comprehensive summary of existing emission intensity factors for road freight transport across the world. This evaluation of emission intensity factors will not only be limited to the geographical region, but also include aspects such as:

- The commodity groups (refrigerated, dry-bulk, palletised goods and liquids);
- Different configurations of vehicles (rigid trucks, semi's, interlinks, etc.);
- Different vehicle sizes (heavy vehicles, light vehicles, motor cycles, etc.);
- Various loading conditions (percentage load factor) and;
- Proportional empty runnings (percentage empty running).

Ideally, since the logistics of each region differs, emission intensity factors should be specific to and readily available for each geographical region of the world. Further, each regions' emission intensity factor should be differentiated in terms of the listed

criteria to ensure the results of the emission estimation process are true. The purpose of this study is to establish the geographical specific emissions factors available, and also where they are available to compare them to the factors proposed by other frameworks for other regions.

The research method for this paper involves a systematic literature review (SLR). Sources for this literature includes published-peer reviewed literature, governmental reports, industry guidance and frameworks, and other miscellaneous grey literature.

This paper not only aims to present a review and analysis of existing emission intensity factors for road transport vehicles to researchers, industry, and governments, but also identifies areas for future research. It also aims to clarify whether proposing emissions factors across geographical boundaries can be deemed as accurate enough or whether specific research should be done on a smaller geographical level. By comparing emission factors across different geographical regions, commodity groups, vehicle configurations, load factor and empty running, this study contributes to the understanding of the environmental impact of road freight transportation. The findings emphasise the need for continued efforts to establish and develop better guidance to determine road freight transport emissions.