INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
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Agenda item 4

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PREVENTION OF AIR POLLUTION FROM SHIPS

Consideration of ro-ro cargo ship subgroups in the EEDI for new ships

Submitted by Denmark

SUMMARY	
Executive summary:	This document substantiates the split of the original group of ro-ro cargo ships into vehicle carriers, volume carriers and weight carriers. It is proposed that volume carriers should be characterized by a deadweight per lane metre of 2 t/m or above but below 4 t/m, and that weight carriers should be characterized by a deadweight per lane metre of 4 t/m or above but below 8 t/m. Satisfactory baselines are calculated for vehicle carriers and volume carriers, and the Committee is invited to consider how to proceed concerning weight carriers.
Strategic direction:	7.3
High-level action:	7.3.1
Planned output:	7.3.1.1 and 7.3.1.3
Action to be taken:	Paragraph 22
Related documents:	GHG-WG 1/2/1; MEPC 58/4/8; GHG-WG 2/2/5, GHG-WG 2/2/6, GHG-WG 2/2/7; MEPC.1/Circ.681 and MEPC 60/4/7

Introduction

1 This document is submitted in accordance with MSC-MEPC.1/Circ.2, Guidelines on the Organization and Method of Work.

2 MEPC 59 recognized the need to develop an energy efficiency design index for new ships in order to stimulate innovation and technical development of all elements influencing the energy efficiency of a ship from its design phase. The Committee, being mindful that the feasibility and applicability of the EEDI formula to all categories of ships need to be further refined, agreed to circulate the interim Guidelines on the method of calculation of the energy efficiency design index for new ships, as set out in MEPC.1/Circ.681, and invited Member Governments and

observer organizations to use the interim Guidelines for the purpose of test and trials on a voluntary basis and provide the outcome and experiences in applying the interim guidelines to future sessions of the Committee for further improvement of the method of calculation of the EEDI for new ships.

3 The basis for a fair comparison between ships is that an individual ship is only compared to other ships of the same type and size which could have transported the same cargo. Bulk carriers, tankers and containerships of the same size are reasonably similar, and their cargo is fairly similar, so for these segments it is relatively simple to establish a fair index. Ro-ro cargo vessels are more diverse. Some have been optimized for heavy loads, while others have been optimized for lighter loads which, on the other hand takes up a lot of space. A direct comparison between these two segments of ro-ro ships would not be fair, because they are designed differently to carry different cargoes.

4 From this rationale the Committee decided to split the original group of ro-ro cargo ships into three sub-groups: vehicle carriers, volume carriers and weight carriers. The latter two were distinguished by a deadweight per lane metre of 4 t/m. A footnote acknowledged that this value should be further investigated during the period of voluntary use of the EEDI.

Objective

5 The objective of this document is to further substantiate the split of the original group of ro-ro cargo ships into vehicle carriers, volume carriers and weight carriers and to investigate the value of the parameter dividing the latter two groups.

Method

6 The analysis was based on data available in Lloyds Register Fairplay Database. The following parameters were extracted for all ships of the type “ro-ro cargo ship” or “car carrier”:

.1 IMO number;

.2 name of ship;

.3 ship type;

.4 building date;

.5 deadweight;

.6 service speed;

.7 total power of main engines;

.8 ro-ro lanes length; and

.9 length between perpendiculars.

7 Ships were removed from the sample for one or more of the following reasons:

.1 The building date was before 1999;

.2 the ship type was “landing craft”; or

.3 some of the data listed in paragraphs 6.5 to 6.8 were missing.

8 The EEDI was calculated as described in the Interim Guidelines on the method of calculation of the energy efficiency design index for new ships, as set out in MEPC.1/Circ.681, and supplemented by the considerations related to baseline calculations set out in document MEPC 60/4/7.

Vehicle carriers

9 Vehicle carriers were identified as ships of the ship type “car carrier”. In figure 1, the calculated EEDI values versus deadweight are shown together with a best-fit power law curve. Eleven ships were removed from the sample because their EEDI deviated more than 2 standard deviation from the best-fit power law curve. The high-correlation factor confirms that a group of comparable ships has been identified.

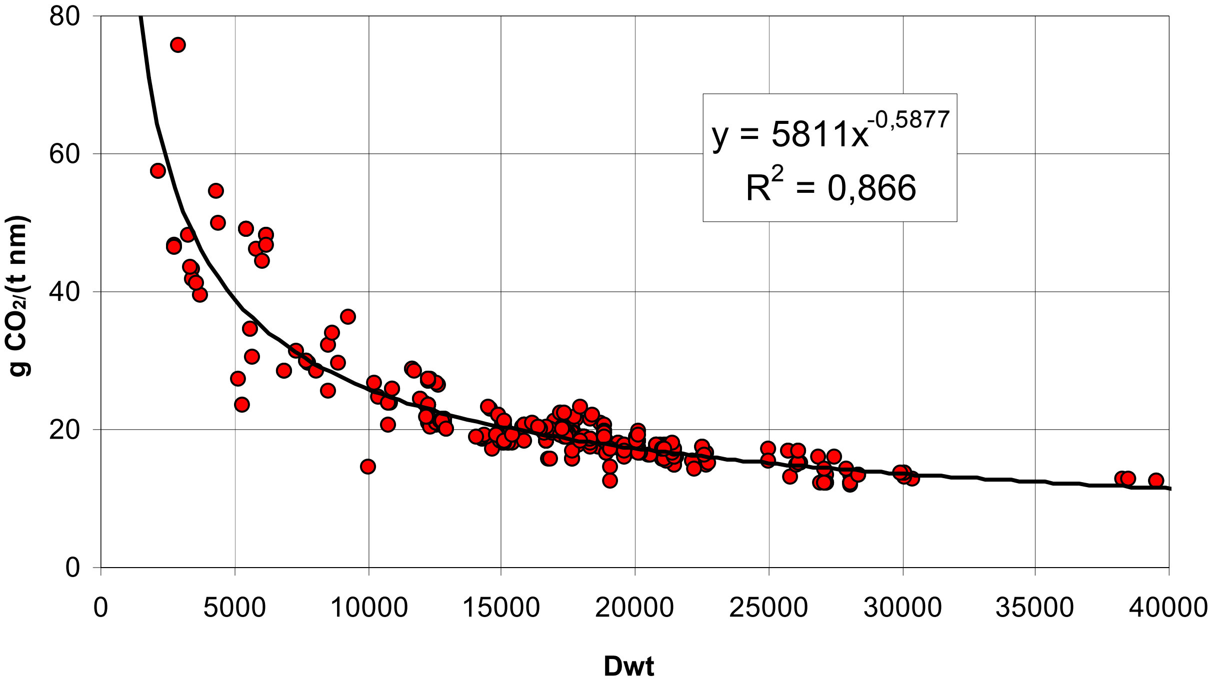

Figure 1: EEDI for vehicle carriers

Separation of volume- and weight carriers

10 Figure 2 shows the service speed versus deadweight per lane metre for volume- and weight carriers. It is obvious that five ships have an excessively high deadweight per lane metre of more than 11 t/m. Pictures or general arrangement drawings of these five ships reveal that a significant part of their cargo capacity is not rolling cargo, but, e.g., containers stowed on the weather deck.

11 Two ships have an excessively low deadweight per lane metre below 2 t/m. General arrangement drawings show that they were purpose built for transportation of Airbus airplane parts from one factory to another, and the low deck height makes transportation of lorries impossible.

12 The vast majority of the ships have a deadweight per lane metre of 2 t/m or above but below 8 t/m. As a consequence of this analysis, ships with a deadweight per lane metre below 2 t/m or a deadweight per lane metre of 8 t/m or above were removed from the sample.

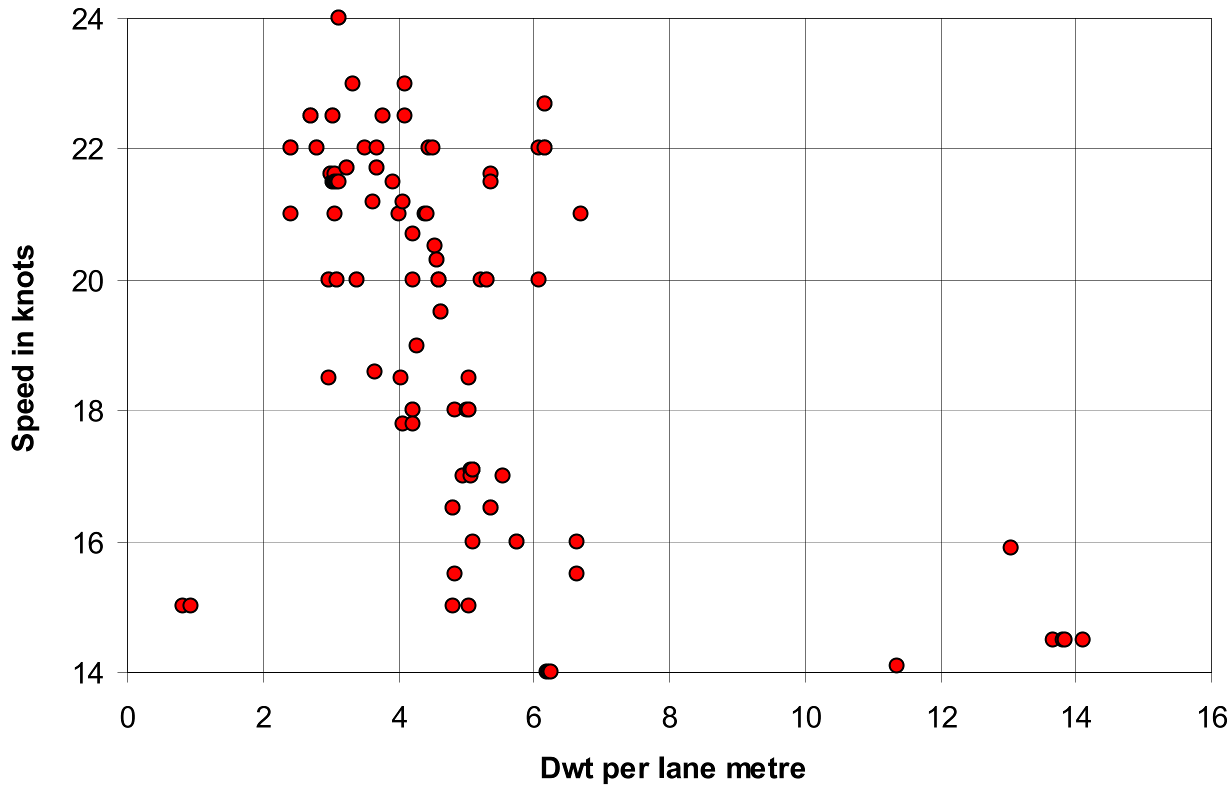

Figure 2: Service speed versus deadweight per lane metre for volume- and weight carriers

13 The remaining volume- and weight carriers are not clearly divided into two distinct groups. However, it appears as if the ships with a deadweight per lane metre below approximately 4.5 t/m seem to have a service speed above approximately 17.5 knots. This confirms the theory that true volume carriers in general are designed and built to be light and fast, while weight carriers have a much wider range of service speeds.

14 Yards, ship owners and consultants involved in the design and building of modern volume carriers can confirm that they typically use a deadweight per lane metre of 4 t/m as a rule of thumb in the initial design process. The deadweight is the sum of the payload and the weight of bunkers, freshwater, stores and other consumables, and the payload for modern volume carriers will typically be 45%-65% of the deadweight. A truck could be 18 m long and weigh 40 tons resulting in a payload per lane metre of 2.2 t/m. If this payload per lane metre constitutes 45%-65% of the deadweight per lane metre, the 4 t/m sounds like a fair assumption.

15 Figures 3 and 4 were produced to further investigate if a value of 4.5 t/m would be more appropriate than 4.0 t/m – i.e. result in a better correlation. Once again ships were removed if their EEDI deviated more than 2 standard deviations from the best-fit power law curve. The red dots are ships with a deadweight per lane metre below 4.0 and the yellow dots are ships with a deadweight per lane metre of 4.0 t/m or above but below 4.5 t/m. The red curve is the best fit through red dots and the black curve is the best fit through all dots.

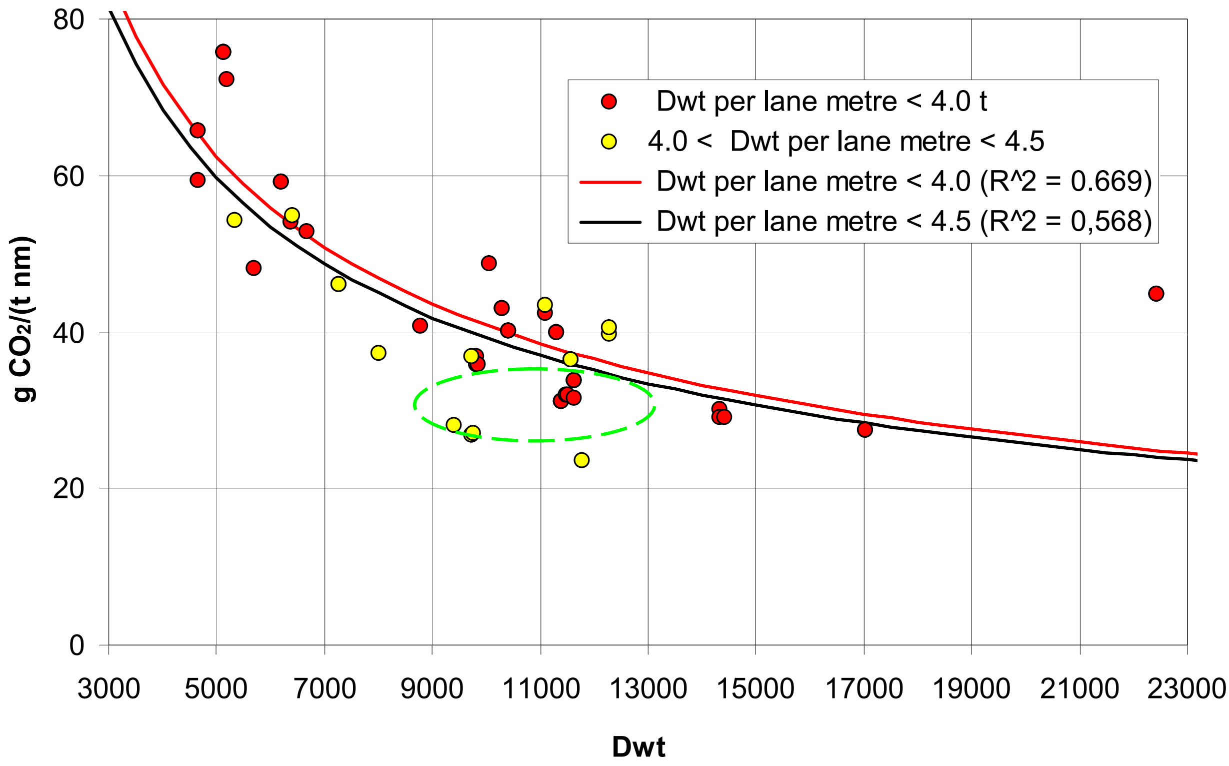

Figure 3: Volume carriers when dividing at 4.0 or 4.5 t/m

16 From this it can be concluded that a better correlation is obtained when dividing at 4.0 t/m. This confirmed the original assumption. Further to this, special attention was given to the ships represented by the yellow dots marked with a green-dotted ellipse because these ships have a deadweight per lane metre in the upper end of the interval between 4.0 and 4.5. These ships were designed to carry double stacks, i.e. trailers with two containers on each. This had of course increased the deadweight per lane metre beyond what is normal for volume carriers and thereby improved the EEDI.

17 Figure 4 is a similar plot for weight carriers confirming that the double stack carriers marked with a green-dotted ellipse more appropriately belong to this group. For weight carriers the correlation is not good in any case. It is evident that this fact is caused by the wide range of service speeds in this group of ships.

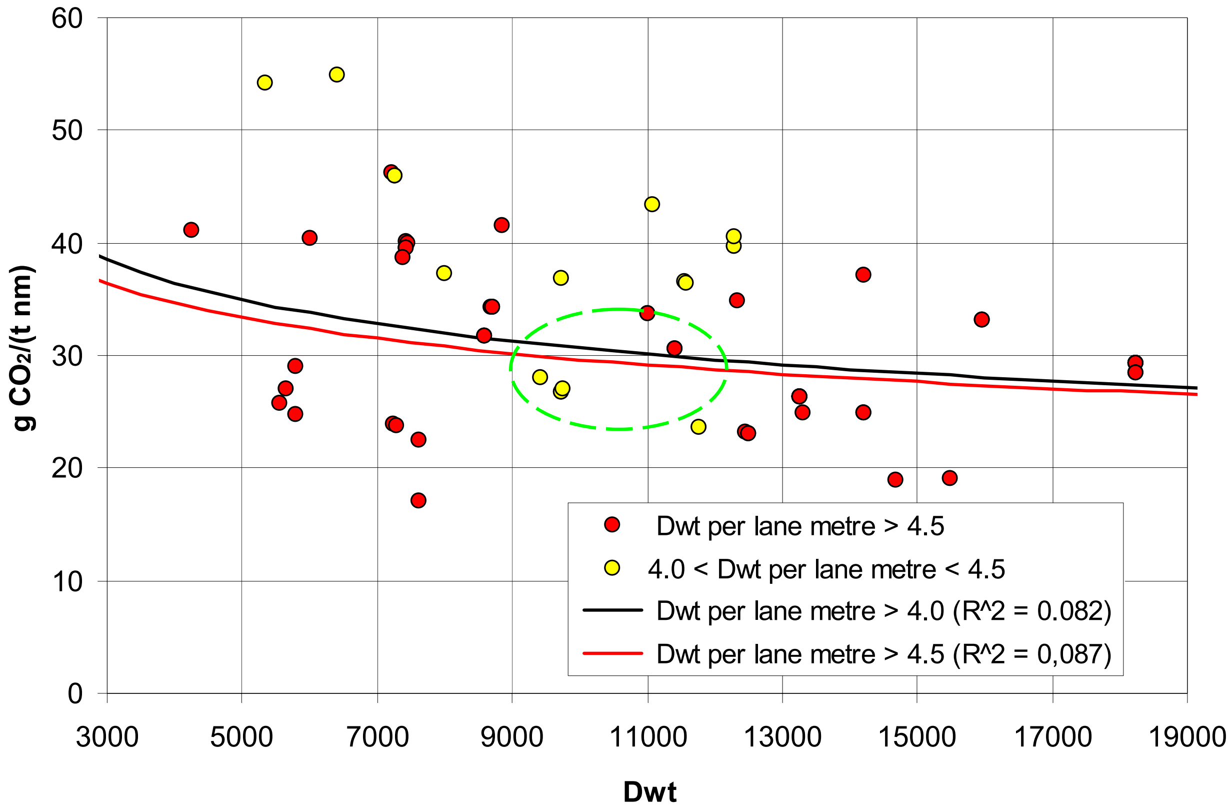

Figure 4: Weight carriers when dividing at 4.0 or 4.5 t/m

Volume carriers

18 In figure 5 the calculated EEDI for volume carriers versus deadweight are shown together with a best-fit power law curve. Ships were removed from the sample if their EEDI deviated more than 2 standard deviation from the best-fit power law curve. The high-correlation factor confirms that a group of comparable ships has been identified.

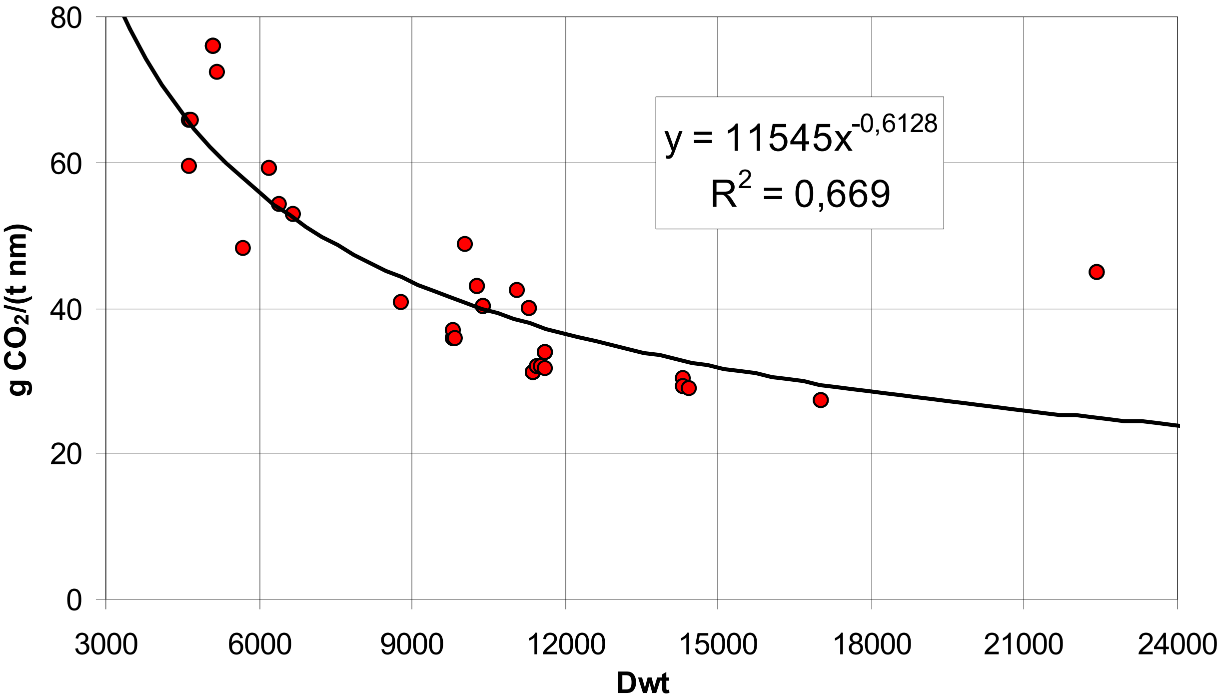

Figure 5: Volume carriers with a deadweight per lane metre of 2 t/m or above but below 4 t/m

Weight carriers

19 Denmark has originally proposed to remove excessively slow ships with a service speed below 15 knots from the sample when calculating baselines for passenger ships, ro-ro passenger ships and ro-ro cargo ships. Figure 5 shows how the correlation factor for weight carriers improves if this cut-off speed is increased. An increase from, e.g., 15 to 17 knots will provide a correlation which is much better.

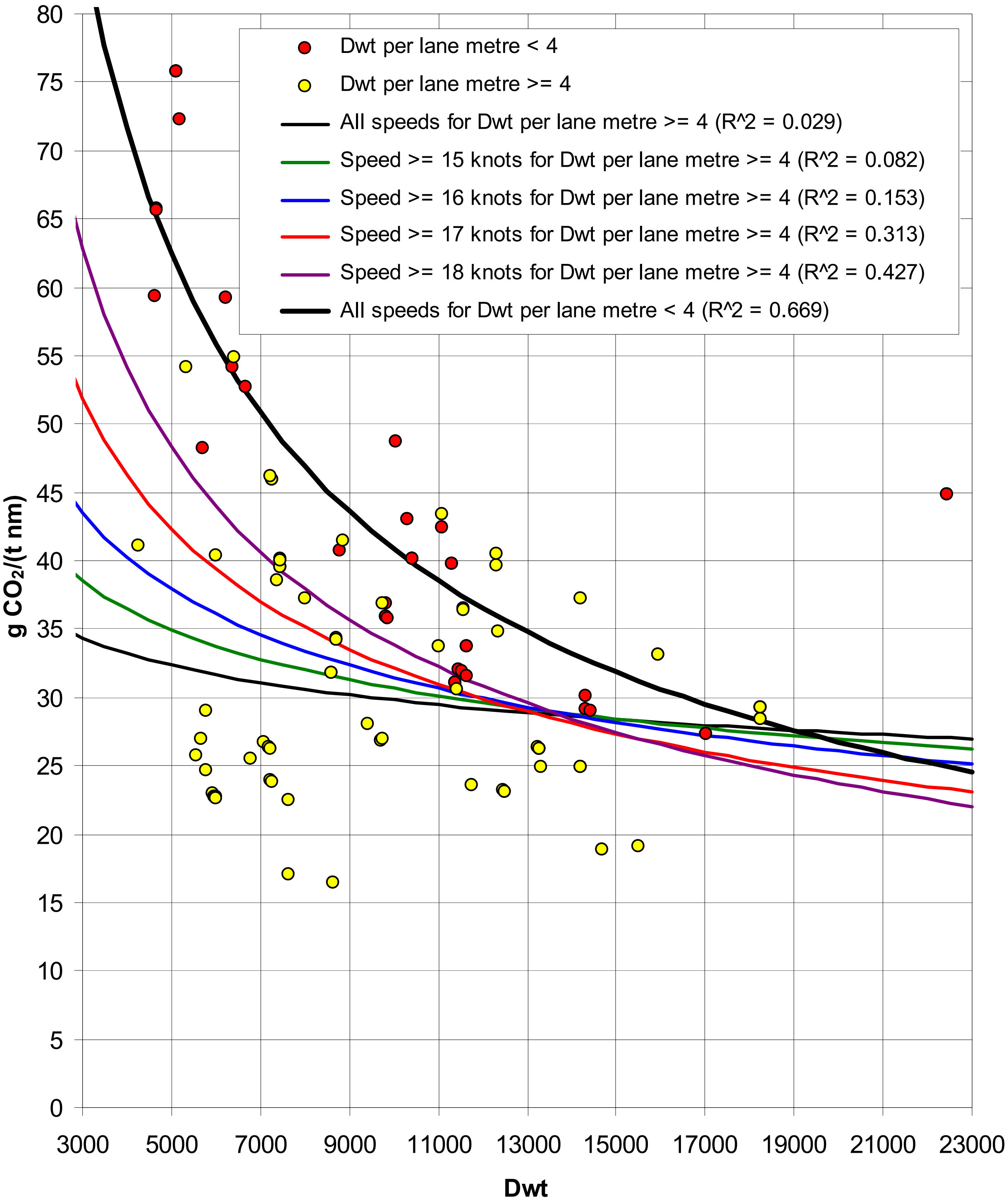

Figure 6: Best-fit power law regression curves for weight carriers depending on cut-off speed

20 The correlation would improve similarly if a cut-off speed was used to exclude the fast ships. The lack of correlation between weight carriers is simply caused by the fact that they have quite different service speeds. Since weight carriers transport similar cargo, it is hard to argue why either the slow ships or the fast ships should not be included in the baseline calculation. The argument for separating vehicle carriers and volume carriers is not that their speeds are different but rather that their cargo is different.

21 This leaves three options: the correlation can be improved by a lower cut-off speed, the correlation can be improved by a higher cut-off speed, or the lack of correlation can be accepted and no cut-off speed applied. The latter option would correspond to the method applied to other types of cargo ships and simply reflect that these ships have been built with quite different efficiencies.

Action requested of the Committee

22 The Committee is invited to:

.1 endorse that ro-ro cargo ships should be divided in three sub-groups: vehicle carriers, volume carriers and weight carriers;

.2 agree that a baseline with a satisfactory correlation can be established for vehicle carriers;

.3 endorse that volume- and weight carriers should be separated by a deadweight per lane metre of 4 t/m;

.4 decide that volume carriers should be characterized by a deadweight per lane metre of 2 t/m or above but below 4 t/m, and that weight carriers should be characterized by a deadweight per lane metre of 4 t/m or above but below 8 t/m;

.5 agree that a baseline with a satisfactory correlation can be established for volume carriers; and

.6 consider how to proceed concerning weight carriers.

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