IEA Experts' Dialogue on Materials Trends in Transport

The potential for material substitution and new vehicles designs in trucks and buses

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Key aims and findings in our study

Study: *"Light weighting as a means of improving Heavy Duty Vehicles' energy efficiency and overall CO_2 emissions"*.

The objective of the work was to provide a comprehensive survey and analysis of the potential contribution of HDV light-weighting to improving future fuel consumption and reducing GHG emissions in the EU.

Weights trends in HDVs

- *Articulated and rigid trucks*
  - Over the past 20 years, the average weight for tractors (of articulated trucks) appears to have increased to a small degree mainly due to the increasing stringency of Euro emission standards, increased safety requirements and increased comfort demand (e.g. through greater use of soundproofing materials).
  - The transition from Euro V to Euro VI has increased weight by a similar extent as in artic tractors so the proportionate impact on payload is usually greater.

Weights trends in HDVs

- *Buses and coaches*
  - According to coach manufacturers, coaches had become around 500-600 kg heavier over the past 20 years. Weight increases due to additional comfort, safety and environmental equipment were in part compensated through lighter body parts.
  - City buses have also increased in weight

Information on materials

Steels

- Conventional mild steel tends to be the dominant material in the manufacture of HDVs and their components

Aluminium

- Aluminium is used for some bodies and chassis on weight-sensitive operations

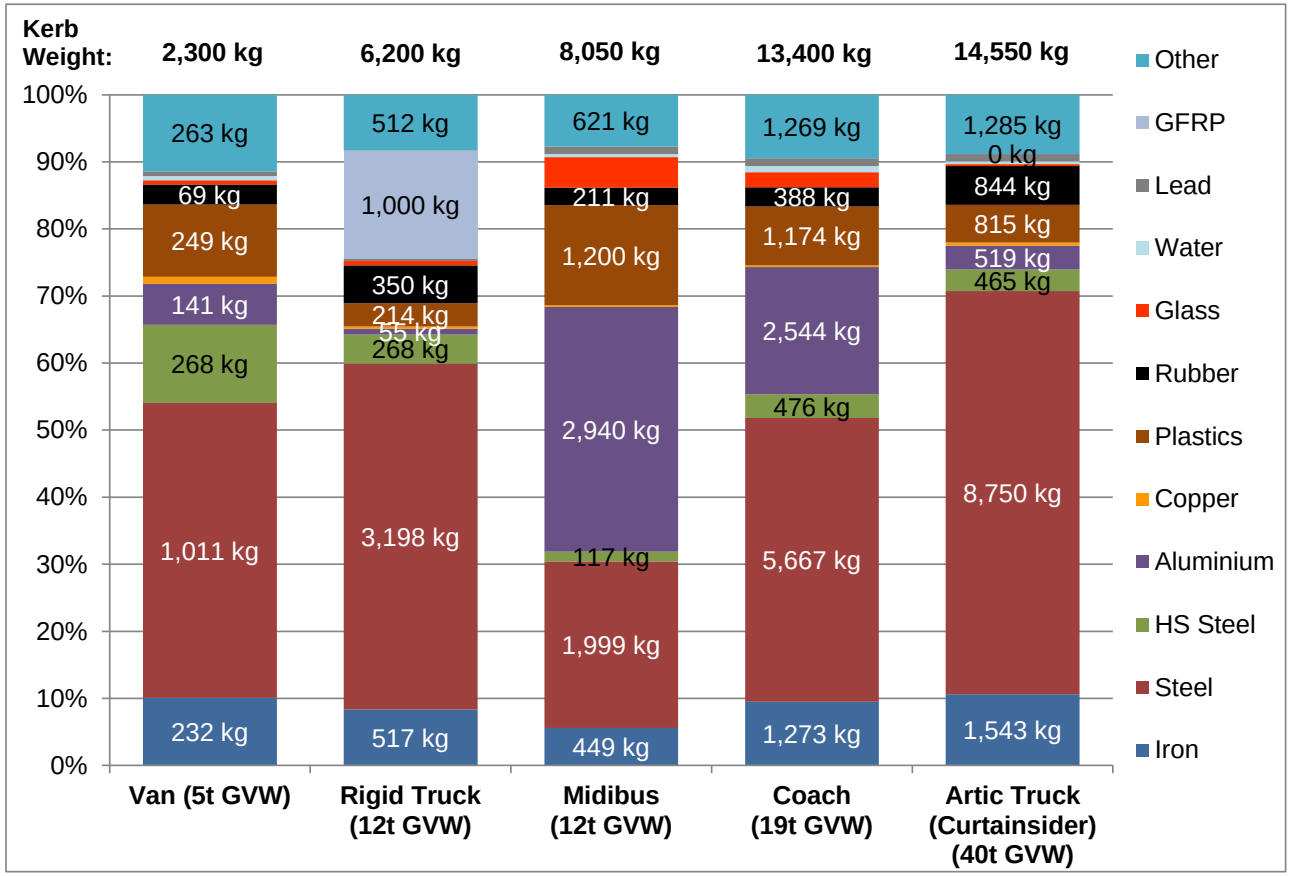
Plastics and fabrics reinforced materials

- There is an emerging trend for non-structural parts on HDVs to be made of plastics (oil sumps, side deflectors, steps, FUP, storage boxes etc)

Breakdown of vehicle composition by material type

Material	Total weight of material (kilograms)				
	Van (5t GVW)	Rigid Truck (12t GVW)	Midibus (12t GVW)	Coach (19t GVW)	Artic Truck (Curtainsider) (40t GVW)
Iron	232	517	449	1,273	1,543
Steel	1,011	3,198	1,999	5,667	8,750
HS Steel	268	268	117	476	465
Aluminium	141	55	2,940	2,544	519
Copper	23	20	20	34	70
Plastics	249	214	1,200	1,174	815
Rubber	69	350	211	388	844
Glass	14	41	367	300	43
Water	15	0	36	120	60
Lead	16	25	90	156	156
GFRP	0	1,000	0	0	0
Other	263	512	621	1,269	1,285
Payload	2,700	5,800	3,950	5,600	25,450
TOTAL	2,300	6,200	8,050	13,400	14,550

Breakdown of vehicle composition by material type



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Impacts of alternative powertrains and future technologies on weight

	Indicative additional weight added to vehicle, kg									
Technology	**Heavy Van (5 t GVW)**		**Rigid Truck (12 t GVW)**		**Midibus (12 t GVW)**		**Coach (19 t GVW)**		**Artic Truck (Box) (40 t GVW)**	
Baseline kerb weight	**2,305 kg**		**6,349 kg**		**7,962 kg**		**13,560 kg**		**15,057 kg**	
Additional weight of technologies	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Stop-start system	**0 kg**	**20 kg**								
Hybrid electric*	**50 kg**	**100 kg**	**100 kg**	**150 kg**	**100 kg**	**150 kg**	**200 kg**	**300 kg**	**200 kg**	**400 kg**
Flywheel hybrid	**150 kg**	**200 kg**	**200 kg**	**300 kg**	**200 kg**	**300 kg**	**200 kg**	**300 kg**	**300 kg**	**400 kg**
Dedicated gas or dual-fuel (gas/diesel) vehicle**	**50 kg**	**150 kg**	**200 kg**	**300 kg**	**1,000 kg**	**1,500 kg**	**500 kg**	**1,000 kg**	**500 kg**	**1,000 kg**
Plug-in hybrid electric vehicle	**150 kg**	**250 kg**								
Fully (battery) electric vehicle***	**250 kg**	**400 kg**			**1,000 kg**	**1,500 kg**				
Euro VI - additional aftertreatment	**40 kg**	**90 kg**	**50 kg**	**100 kg**	**50 kg**	**100 kg**	**100 kg**	**300 kg**	**100 kg**	**200 kg**

Expected trends and drivers for future engineering material prices (1)

Steel:

High volume production processes well established and unlikely to undergo considerable change. Steel material technologies likely to see evolution (Nano steel)

Aluminium:

Recycled aluminium production is likely to be the most significant technological growth area. Evolution of material grades and processes expected

Expected trends and drivers for future engineering material prices (2)

Plastics:

Growth in plastics using natural fibres and new production methods

Carbon fibre:

Rapid development of new manufacturing processes, aimed at reducing the expensive polyacrylonitrile (PAN) element should result in material price reductions over 10-15 years. New manufacture and process developments reducing tact time, enabling higher volume production and improved economies of scale

Where can I find this study?

https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/heavy/docs/hdv_lightweighting_en.pdf

Thank you for your attention!

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