A GUIDE TO THE IMPACT OF WEIGHT ON COMMERCIAL VEHICLES

For a long time we have been helping our customers understand the whole life cost (WLC) of their vehicles. Fuel is a significant proportion of this, and in the case of Commercial Vehicles will vary significantly depending on the load that the van is carrying. To provide some clarity, this document contains the findings of two studies carried out by Arval into the impact of payload (by weight) on fuel consumption and range (in the case of electric vehicles). We hope you find this information useful.

Arval Consulting is our award-winning independent business unit, dedicated to delivering tangible results and adding value for our customers. As specialists in developing business car and van strategies, they regularly provide effective advice and action plans across a range of fleet objectives. These include: Defining and implementing fleet policy, cost reduction, limiting environmental impact, improving health and safety, complying with regulation and boosting driver satisfaction. They use the latest tools and techniques, many of which are unique to our business, to model the impact of different strategies and provide actionable recommendations to meet the specific needs and priorities of our customers.
Study on the impact of weight on vehicle economy

1. THE AIM

Conduct a series of tests over a standardised test course to identify the impact of weight (kg) on vehicle economy (mpg). The standardised course included urban, sub-urban, carriageway and rural driving conditions.

Undulating Test Course

- **49.1 mile** round-trip combining:
  - 25% Urban
  - 20% Sub-Urban
  - 35% Carriageway
  - 20% Rural

Roads: 30 – 70 mph
2 METHOD

A benchmark vehicle was selected from a well-known manufacturer and represents a commonly used model and variant, used by operators across all sectors.

Medium Sized Commercial Vehicle

3 BENCHMARK

The benchmark vehicle was driven around a standardised test course repeatedly with various loads. The vehicle's fuel economy was monitored and recorded without any cargo, then again with 25%, 50% and 75% of the total permissible cargo.

The table below shows the percentage of payload utilised and the weight (kg) of the cargo for each test.

<table>
<thead>
<tr>
<th>Payload %</th>
<th>Payload KG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>0</td>
</tr>
<tr>
<td>Test 2</td>
<td>25</td>
</tr>
<tr>
<td>Test 3</td>
<td>50</td>
</tr>
<tr>
<td>Test 4</td>
<td>75</td>
</tr>
</tbody>
</table>

Consistent Test Conditions

- Same driver
- Vehicles tested at the same time of day
- Adhere to speed limits
- ECO drive style
- Air conditioning off
The graph below shows the impact of increasing payload on fuel economy. As you can see, the impact of weight (kg) on vehicle range (miles) is significant.

The table below shows the actual percentage loss in MPG when compared to the manufacturers published statistic.

<table>
<thead>
<tr>
<th>Payload Used</th>
<th>Cargo Weight (KGs)</th>
<th>Test Route (miles)</th>
<th>Litres</th>
<th>Actual MPG</th>
<th>% Loss in MPG compared to published MPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>N/A</td>
<td>49.1</td>
<td>5.2</td>
<td>35.74</td>
<td>25.39</td>
</tr>
<tr>
<td>25%</td>
<td>270</td>
<td>49.1</td>
<td>5.5</td>
<td>33.79</td>
<td>29.46</td>
</tr>
<tr>
<td>50%</td>
<td>540</td>
<td>49.1</td>
<td>6</td>
<td>30.97</td>
<td>35.34</td>
</tr>
<tr>
<td>75%</td>
<td>809</td>
<td>49.1</td>
<td>6.6</td>
<td>28.16</td>
<td>41.21</td>
</tr>
</tbody>
</table>
SUMMARY

A manufacturer’s published combined MPG is calculated using a standardised internationally recognised test method, however it doesn’t reflect real-world driving conditions. As our test results show, the difference between the published and actual combined MPG is in excess of 25%.

Regardless of the manufacturer’s published fuel economy, the weight of a vehicle’s cargo is shown to have a significant effect on fuel economy. For example, when loaded to 75% of the maximum permissible payload, the vehicle’s fuel economy is reduced by c.16%.

Operators should consider and ensure:

- They understand the weight limits of all vehicles and identify the limits that are applicable to daily operation.
- They understand the weight of a vehicle’s cargo. A good practice is to create an inventory of vehicle stock, or to weigh vehicles at a public weighbridge.
- Drivers are well informed of the load capacity of vehicles and the weight of the cargo. Operators are advised to inform drivers with documented training and should apply decals in, and around, the vehicle displaying the vehicle’s payload, roof height and load length.
- Vehicles are properly equipped and, where possible, utilise third party enhancements such as storage systems. A professional storage system can be a worthwhile investment able to reduce the cost of operation, otherwise known as Whole Life Cost.

Examples include:

A storage system may enable better use of the available space in a vehicle. This could result in operators being able to utilise smaller vehicles that are inherently more cost-effective and have better fuel economy. A small upfront investment of £1,000 could tangibly result in a saving of several thousands over the duration of a vehicle’s contracted life.

Professionally designed storage systems will help operators and operatives organise a vehicle’s cargo both safely and ergonomically. If implemented and monitored correctly, this will reduce the risk of a vehicle being overstocked, which can lead to excessive and unnecessary weight being carried. This will help operators control and reduce fleet fuel economy and budget expenditure more accurately.
Study on the impact of weight on electric commercial vehicles

1 THE AIM

Conduct a series of tests over a standardised test route to identify the impact of weight (kg) on vehicle range (miles).

The standardised course included urban, suburban, dual carriageway, motorway and rural driving conditions.

Undulating Test Course

35.58 mile round-trip combining:
- 16.8% Urban
- 32.5% Sub-Urban
- 21.5% Carriageway
- 29.1% Rural

Roads: 30 – 70mph
2 METHOD

A benchmark electric–powered vehicle was selected from a well-known manufacturer and represents a commonly used model and variant, applicable to operators across a number of business sectors.

Medium Sized Commercial Vehicle

<table>
<thead>
<tr>
<th>Load length (m)</th>
<th>Load height</th>
<th>Range (Published)</th>
<th>Payload (KG)</th>
<th>Drive train</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.04</td>
<td>Low roof</td>
<td>106 miles</td>
<td>703</td>
<td>AC synchronous electric motor</td>
</tr>
</tbody>
</table>

3 BENCHMARK

The benchmark vehicle was driven around a standardised test course repeatedly with various loads. The vehicle’s range was monitored and recorded without any cargo, then again with 25%, 50%, 75% and 100% of the total permissible cargo.

The table below shows the percentage of payload utilised and the weight (kg) of the cargo for each test.

### Consistent Test Conditions

- Same driver
- Vehicles tested at the same time of day
- Adhere to speed limits
- Air conditioning and non-essential electrical items switched off.
The graph below shows the proportion of available range used for each test. As you can see, the impact of weight (kg) on vehicle range (miles) is significant.

The table below shows the actual percentage loss in range when compared to the manufacturer’s published statistics.

<table>
<thead>
<tr>
<th>Controlled conditions</th>
<th>Range</th>
<th>% Loss in range compared to actual range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Published Range (miles)</strong></td>
<td><strong>Published Payload</strong></td>
<td><strong>Payload Used</strong></td>
</tr>
<tr>
<td>104</td>
<td>703</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>
For electric vehicles, the manufacturer published vehicle range is calculated using a standardised internationally recognised NEDC test method, however it doesn’t reflect real world driving conditions. As our test results show, the difference between the published and actual range achieved from a full charge cycle is in excess of 34%.

Regardless of the manufacturer’s published range, the weight of a vehicle’s cargo is shown to have a significant effect on actual range and usability. For example, when loaded to 75% of the maximum permissible payload, the vehicle’s available range reduced by over 70%.

Operators should consider and ensure:

- They understand the weight limits of all vehicles and identify the limits that are applicable to daily operation.
- They strongly consider the application the electric commercial vehicle is to be used for. In terms of driveability, the vehicle is capable of operating on all types of roads and traffic, however, the amount of load carried must be considered.
- They understand the weight of a vehicle’s cargo. A good practice is to create an inventory of a vehicle’s stock, or to weigh vehicles at a public weighbridge.
- For an electrically-powered Light Commercial Vehicle, the vehicle’s use is very important. Using these vehicles laden with between 25% and 75% of maximum payload gives a lesser diminution in range, and so makes the vehicle a viable alternative for cargoes in this weight band.
- Drivers are well informed of the load capacity of vehicles and the weight of the cargo. Operators are advised to inform drivers with documented training and should apply decals in, and around, the vehicle displaying the vehicles payload, roof height and load length.
- Where appropriate, operators should consider investment in driver training to improve vehicle economy and operating costs.
- Vehicles are properly equipped and, where possible, utilise third-party enhancements such as storage systems. A professional storage system can be a worthwhile investment able to reduce the cost of operation, otherwise known as Whole Life Cost.

A storage system may enable better use of the available space in a vehicle. Professionally designed storage systems will help operators and operatives organise a vehicle cargo both safely and ergonomically. If implemented and monitored correctly, this will reduce the risk of a vehicle being over stocked, which can lead to excessive and unnecessary weight being carried. This will help operators control and reduce fleet fuel economy and budget expenditure more accurately.