FreightBestPractice

Truck Specification for Best Operational Efficiency

Guide

THE MOTOR INDUSTRY · SMMT ™

Department for Transport

Foreword

Freight Best Practice is funded by the Department for Transport and managed by Faber Maunsell Ltd to promote operational efficiency within freight operations in England.

Freight Best Practice offers FREE essential information for the freight industry, covering topics such as saving fuel, developing skills, equipment and systems, operational efficiency and performance management.

All FREE materials are available to download from **www.businesslink.gov.uk/freightbestpractice** or can be ordered through the Hotline on **0300 123 1250**. The aim of this guide is to:

- Provide a step-by-step guide to help you assess your vehicle needs accurately
- Identify the main body and trailer options
- Identify the main truck component options
- Help you make the right choices for your business

It also includes a checklist of questions you need to ask yourself at each stage of the process.

"This is an excellent and very detailed guide and should prove a useful aide-mémoire for anyone buying trucks. It should prove particularly valuable in the all-important discussions with truck dealers and as a way of informing people who may have less frequent involvement in the process."

Robin Dickeson, Manager, Commercial Vehicle Affairs, The Society of Motor Manufacturers and Traders Limited

Contents

Introduction

The Importance of Good Vehicle Specification

The capital cost of a vehicle may account for less than 50% of its whole-life cost when fuel, maintenance and other operating expenses are taken into account. Fuel can represent up to 30% of your operational costs. Clearly this is a significant amount and any reduction in fuel costs or improvements in operational efficiency can improve the 'bottom line' of your business.

Spending time in developing an accurate and appropriate vehicle specification will help you do this. Ensuring vehicles are closely matched to the tasks they are expected to perform will improve both fuel and overall operational efficiency. This can lead to cost savings, increased profitability and reduced environmental impact.

On the other hand, inaccurate and inappropriate vehicle specification can result in purchasing a vehicle that is unsuitable for the task it will be required to carry out. Although such vehicles may be slightly cheaper in terms of initial investment, it may become significantly more expensive to operate when fuel consumption and maintenance costs are taken into account in the long term. Poor vehicle specification, in some cases, may even lead to breaches of the law and possible legal action.

Who Should Use this Guide?

Everyone who is responsible for acquiring goods vehicles weighing over 3.5 tonnes gross vehicle weight (GVW). This could be fleet managers, owner drivers and operational managers. It will equip you with the information you need to ensure the most beneficial long term outcome when acquiring commercial vehicles.

How this Guide Will Help?

This publication provides independent and authoritative guidance on vehicle specification. It will show you just how easy it is to produce a fit-for-purpose specification and will take you through the key stages of vehicle specification. Sections 2–4 cover the basics of vehicle specification, while Sections 6–7 contain more detailed information.

How this Guide is Organised

This guide provides a step-by-step review of the key stages involved in the decision making process in specifying a vehicle. Each section includes a checklist of questions.

- Section 2 helps you assess your freight movement requirements and options
- Section 3 provides an overview of the different types of truck available and their basic suitability for particular tasks
- Section 4 focuses more closely on the need to ensure that the truck you acquire is suitable for the specific environments it will operate in
- Section 5 looks at the main components of a truck, such as chassis, suspension and axles, and describes the different options and their uses
- Section 6 looks at additional features, such as aerodynamic design, safety systems and choice of fuel, and discusses the options available
- Section 7 highlights the importance of monitoring a truck's performance after it has entered service to ensure that efficiency gains are maximised

The guide also contains four appendices:

- Appendix 1 contains a table of typical whole life costs for standard commercial vehicles
- Appendix 2 summarises European legislation on vehicle exhaust emission limits
- Appendix 3 explains standard terminology relating to maximum vehicle weights
- Appendix 4 summarises current existing regulations on truck weights and dimensions, and their impact on vehicle specification

Identify Freight Movement Requirements

Vehicle specification is about selecting the right equipment to undertake the work, efficiently and safely.

Purchasing a new vehicle represents a significant financial commitment in terms of both capital and operating costs. The following is a set of basic questions which can help you understand your freight movement requirement:

- What are the characteristics of the load in terms of weight and volume?
- Where does the load need to be delivered and how far away is the destination?
- How frequently are the deliveries required?
- Are there delivery or demand fluctuations?
- How is the product packaged and how easy is it to handle e.g. is additional equipment required for loading and unloading?
- Does the product have any special transport needs e.g. does it need to be temperature controlled, does it consist of hazardous goods, is animal transportation involved?
- What are the driver and crew needs?
- Does anything else have to be carried e.g. tools, special equipment?
- Is there any need for ancillary machinery e.g. blower, pump?
- Are there any other operating constraints e.g. environmental commitments to your Operator's Licence, or customer or consignee requirements for example, low noise, small vehicle?

The answers to these questions will help you understand your business and transport needs better and will help you specify the vehicle appropriate to your needs.

Identify Business Criteria

It is important to understand the criteria your choice of freight option must meet. Although they will be specific to individual cases, such criteria could include:

- Cost-competitiveness
- Consistency with key performance targets e.g. next-day delivery anywhere in the UK
- Ability to ensure installation or assembly of products at the destination: in some instances, this will require specialist skills
- Reduced environmental impact

This list is not exhaustive and you should spend some time identifying the criteria that are important to your business.

Identify Freight Movement Options

You also need to identify the full range of options available for moving your freight. These will include:

- Procuring a dedicated vehicle, either new, second-hand or leased
- Use of a contract haulier
- Use of network services for pallets
- Parcel post

You should cost all the freight movement options against a standard unit e.g. per pallet. Depending on the product, this could be single product or per specified product mix.

Compare and Evaluate Options

Next you need to identify the option best suited to undertaking your transport task. This will involve evaluating the options identified in Section 2.1 and 2.2.

Cost-competitiveness

In most cases, cost will be an important, if not the overriding, factor that influences your decision. It is therefore essential to take the whole-life costs of a purchased vehicle into account. Whole-life costs are a combination of:

- The initial cost of buying the vehicle
- All predicted operating costs, both running and standing costs
- The projected return on disposal

Note: The initial cost minus the projected return on disposal is frequently referred to as depreciation.

An estimate of whole-life costs can be made using headline costs and published costs from manufacturers, trade journals and trade associations. These can then be combined with operational costs for your organisation. When replacing an existing vehicle, it is wise to look at the current costs involved in servicing the demand. Appendix 1 provides details of typical whole life costs for standard commercial vehicles.

With second-hand or previously used vehicles, the purchase price may be appealing but the operating costs may be less attractive. In whole-life terms a used vehicle may be more expensive and less reliable than a new one. The pace of technological improvement in the truck market has resulted in modern vehicles that offer greater economy, increased power, lower fuel consumption, fewer harmful emissions and extended service periods that cut vehicle downtime. If you opt for a second-hand vehicle rather than a new one, it is important to select a vehicle that meets your business needs as exactly as possible and has sufficient economic life left to fulfil the operational demands that will be placed on it.

Rather than allocate a considerable amount of resources to purchasing a vehicle many operators opt for leasing or contract hire. These options can allow for a vehicle to be on dedicated long-term hire to the user. The advantages are that the vehicle can be regularly updated when replacement is due with no additional cost to the user.

From a financial perspective it reduces the risks, as the item is not shown on the balance sheet. This is particularly important to sectors where demand fluctuates.

The major disadvantage of hiring a vehicle, particularly for third party operators, is that it cannot be sold for cash if necessary.

Once your evaluation of each option is complete, you will be in a position to make a well informed decision regarding the right solution to your needs.

Checklist:

Have you:

- Assessed the relevant freight movement requirement?
- Identified all the criteria that your freight movement option must satisfy?
- Identified the different freight movement options that are available?
- Compared options and decided which one best suits your needs?

Operator Licensing

Users of most commercial goods vehicles weighing over 3.5 tonnes must have a goods vehicle operator's licence. This applies even if you use a hired vehicle or use the vehicle for one day only. The licence authorises an operator to use a maximum total number of motor vehicles and trailers and a specific operating centre or centres where the vehicles are kept when not in use.

For further information and advice contact VOSA on **0300 123 9000** or visit the website at: **www.vosa.gov.uk.**

Types of Trucks Available

If you have decided that buying a truck is the best option to meet your requirements, you will then need to produce a detailed vehicle specification. This will ensure that the vehicle you buy closely matches the tasks it will undertake.

The first step towards producing a specification is to develop a clear understanding of the types of vehicle available and their main characteristics. This includes identifying the:

- Basic truck types
- Main benefits and features of truck types
- Body and trailer types

Identify Basic Truck Types

There are three main categories of truck:

Rigid vehicles (Figure 1) comprise a continuous chassis and two or more axles, and include a motorised element and a body.

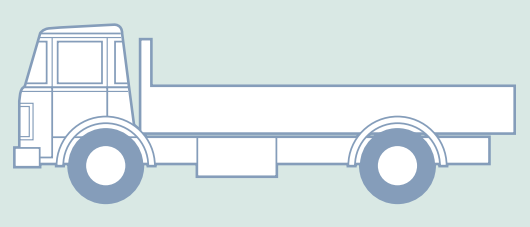


Figure 1 Rigid Vehicle

Articulated vehicles (Figure 2) have two parts: a motorised drawing unit known as a 'tractor unit' and a mounted trailer. The trailer is attached to the drawing unit through a specialised coupling usually known as a fifth wheel coupling.

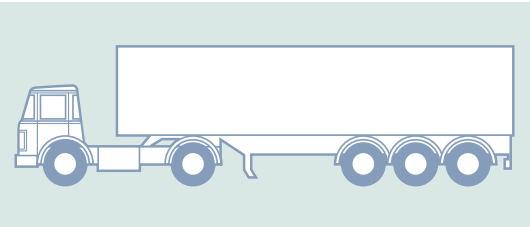


Figure 2 Articulated Truck

Drawbar combinations consist of a rigid vehicle coupled to a totally self-standing trailer via an 'A-frame' drawbar. There are two main types of drawbar trailer: the traditional turntable trailer (Figure 3) and the central-axle bogie trailer (Figure 4). The trailer is towed directly by a rigid vehicle.

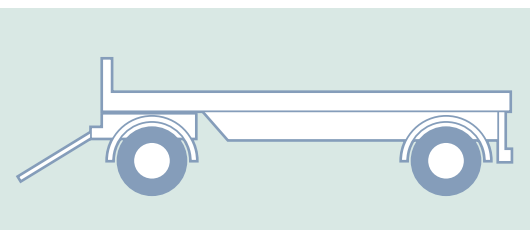


Figure 3 Traditional Turntable Trailer

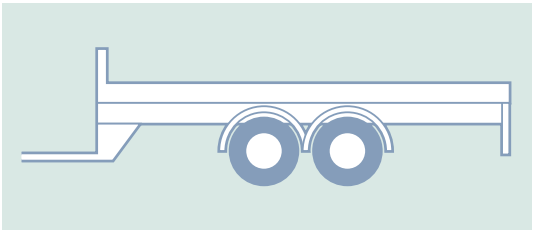


Figure 4 Central-axle Bogie Trailer

Identify Main Benefits and Features of Truck Types

These three categories of vehicle have different characteristics and are suited to different types of operations. The regulations that apply to them generally differ in terms of type of driving licence required and the maximum weight they can legally operate. Appendix 4 has details about legal constraints and requirements.

Rigid Vehicles

- These are the most common type of truck. Of the 426,000 vehicles above 3.5 tonnes in 2003, 309,000 were rigids, (source Department for Transport, Transport Statistics 2003). They are best suited to urban operations where size and manoeuvrability are critical
- Rigid vehicles vary from two axles to four. This depends on the load to be carried and the environment in which operations occur. Lighter loads, such as consumer goods, tend to be carried on two-axle vehicles. Heavier loads, such as aggregates, tend to be carried on four-axle vehicles in order to distribute the load more evenly over the road
- A three-axle rigid usually has one axle at the front and two at the rear. Some vehicles, particularly those operated by breweries, have two axles at the front and one at the rear, these are generally referred to as a 'Chinese Six.' The two front axles will be twin steer i.e. when the vehicle turns both axles move to improve manoeuvrability and reduce tyre wear
- Four-axle vehicles normally have two axles at the rear and twin steer axles at the front

Articulated Vehicles

- Articulated vehicles feature a chassis truck known as a tractor unit, which can be attached to a trailer through a specialised coupling mechanism, called a fifth wheel. This has a groove and lock and is bolted to the chassis. The trailer has a pin fitted near to the front, known as a kingpin. The pin sits in the fifth wheel lock to couple the trailer and can be released by use of a lever. Power and braking to the trailer are provided via wire connections known as 'suzies'. The tractor unit can have a number of axles depending on the load weight
- The trailers used in articulated vehicles have their axles towards the rear and rely on the tractor unit to support the front through the fifth wheel. 'Landing legs' are fitted to the trailers to support the front when not attached to the tractor unit. These are not always designed to be load bearing

Drawbar Combinations

- The traditional turntable drawbar trailer has an axle near each end of the trailer. The front axle is mounted on a sub-frame that steers through a turntable from the A-frame drawbar
- In a centre-axle trailer, which frequently has two axles coupled closely, the axle is situated in the central area of the trailer and is a non-steer axle. The A-frame pulls the trailer in the correct direction. This is often close-coupled with very limited space between the rigid vehicle and the trailer

- Like articulated vehicles, drawbar combinations are best suited to long-distance driving on major trunk routes, rather than urban centres

- Drawbar combinations are currently increasing in popularity due to the flexibility of being able to change trailers and detach if access is an issue. The largest weight combinations are sometimes known as roadtrains.

Identify Body and Trailer Types

Trucks are usually sub-categorised by body or trailer type. The following are the most common:

Flat Beds

A flat bed truck or trailer consists of a chassis fitted with a platform body. Goods are carried on the deck and secured by roping and sheeting which can be inappropriate for certain cargoes i.e. fragile items or goods which contaminate easily. Twist locks can be fitted to each corner of the flat bed to allow the carriage of containers. A special design allows the trailer to be extended in the middle section to allow the carriage of abnormally long loads. These extensions are known as 'trombones'.

Low Loaders

Low loaders are usually built on a semi-trailer designed to carry earth moving equipment and machinery. They are constructed so that the major part of the load platform does not extend over, or between, the wheels and the upper surface is below the top of the tyres. The most common type is the swan-neck trailer. The shape of the swan-neck facilitates the coupling between the tractor and the low bed of the trailer via a right angle joint, as seen from the side of the trailer. The swan-neck is detachable and so allows plant access onto the trailer from the front. Rear access is restricted by the wheel arches.

Curtainsiders

These consist of a roofed frame with a flexible curtain fitted to the sides of the body, and can include a choice of rear section, either barn door or a fixed wall. Curtainsiders are ideal for palletised loads that require protection from the weather. While permitting efficient loading and unloading, as well as nearside and offside access, they provide less load security than rigid-sided vehicles.

Tilts

These are trailers where a metal frame is fitted to a flat bed with a canvas cover known as a 'tilt'. They allow for cargo to be transported covered but with good access for loading and unloading. They are most common on international work.

Box Vehicles and Trailers

Box vehicles comprise a rigid box body, usually with solid sides and solid rear-opening doors. Their size and manoeuvrability make them ideal for urban multi-drop deliveries (see Section 4). A rigid box can also be fitted to trailers as part of an articulated vehicle. Numerous box body design options are available, including solid rear doors, side doors or sliding sidewalls for ease of side access.

Temperature-controlled Bodies

These consist of a rigid box made of insulated material and designed to carry temperature-sensitive (chilled or frozen) products. The bodies can be fitted to rigid vehicles or trailers. Most temperature-controlled vehicles operate a freezer or chiller driven by a separate engine or by the vehicle's main engine and generally include electric standby facilities.

Step-frame Trailers

Built on a box trailer, this design optimises the load space area by lowering the rear chassis with a swan-neck or with small rear axles, thus increasing the volume of the trailer. The upper surface of the major part of the load platform is less than 1m above the ground. They are either used for low weight goods, such as packaging and hanging garments or in the removal sector to carry bulky furniture.

Luton

These are basically box vans with an additional section constructed over the cab used for ancillary equipment and valuables. They are designed for large volume low weight goods and are mainly used for furniture transport and removals.

Double-deck trailers

Double-deck trailers provide two-tier stacking of uniform pallets on a single trailer by means

of a second deck. The second deck can be fixed or moving to give greater flexibility for loading and unloading. This kind of trailer may provide a cost-effective solution for high-volume, low-weight loads. It is important to consider the effect that this type of vehicle will have on infrastructure, for example, their extra height may make them unsuitable where the routes include low bridges, and they may also require specialised loading and unloading equipment. See Appendix 4 on legal constraints on the maximum height of vehicles.

Road Tankers

These vehicles have a permanent tank fitted to a chassis for the transportation of liquids, gases or powders. Road tanker loading/unloading methods include gravity feeds, blowers and vacuuming. Tank bodies are frequently fitted to trailers and rigid vehicles, often multi-axle to maximise weight distribution. Some tank operations include an internal liner to enable the transportation of mixed loads without the need to flush out the tank.

Skeletal Trailers

These consist of a chassis trailer without a purpose-built body. They are designed to carry shipping containers that are usually secured to the chassis via twist locks set at each lower corner of the container.

Tippers

Tippers comprise of an open-top body that can, via a hydraulic ram, tip rearwards to unload when the tailgate is released. Typical loads include earth and stone. As these can be heavy loads, multi axle vehicles are frequently used. Articulated tippers can be used to improve flexibility and have a higher overall weight. See Appendix 4 for legal constraints.

Demountable 'Swap Body' Systems

With this system, the chassis is designed to carry multiple containers. Goods can be loaded independently of the truck at the central warehouse, enabling driver time to be fully utilised driving the vehicle. Often included in drawbar combinations, demountable containers can be arranged in any configuration within legal limits. Managed effectively, significant operational efficiencies can be achieved. For example, a number of fully laden containers can be dropped overnight at a sub-depot by a single vehicle for next day delivery by small urban vehicles. Absence of intermediate goods handling saves time and labour, reduces risk of damage and reduces the need for warehousing at satellite depots. Landing legs are fitted to swap bodies which allow the host vehicle to be driven under the body to couple it to the chassis.

Checklist:

Have you:

- Identified the basic types of truck available?
- Identified the main benefits and features of each type?
- Developed an understanding of body and trailer types and their uses?

Ensuring the Truck is Fit for Purpose

The next step is to build up a more detailed picture of what your vehicle will be used for and to identify which of the vehicle body and trailer designs described in Section 3 provide the best match. This will require a thorough knowledge of the goods to be transported and a clear understanding of delivery destinations, in terms of geographical location and the delivery infrastructure they are equipped with, for example, types of materials handling equipment (MHE) and docking heights, etc.

For example, if the goods to be moved weigh eight tonnes, fit on 14 pallets and require a daily journey of around 300 miles, a vehicle designed for urban high street multi-drop delivery (see 4.2 below) or an articulated vehicle operating at 44 tonnes will not generally be the most appropriate or cost-efficient option. A rigid vehicle between 15 and 17 tonnes GVW, on the other hand, is likely to be the best solution. Remember, a contract haulier consolidating your load with others may be cheaper.

To ensure the vehicle is suitable you will need to:

- Categorise the type of delivery to be undertaken
- Tailor vehicle specification to match delivery type
- Evaluate the impact of other factors on your specification

Categorise Type of Delivery to be Undertaken

Deliveries performed by commercial vehicles can be divided into a number of categories.

The main ones are:

Urban Delivery

Includes destinations in cities, towns and also villages. This is the most common type of delivery, where locations can be characterised by high volumes of traffic, limited parking and the need to unload the vehicle at the kerbside, which can be dangerous to both driver and pedestrians. If your customers are small retailers, most of them will be in this kind of location, for example, on high streets or in shopping precincts.

Urban Multi-drop Delivery

This is where a vehicle carries out more than one delivery in an urban location. They are affected by the same pressures as urban delivery, but to a greater extent due to more activity.

Retail Park Delivery

Some of your customers may be located in retail parks outside town centres. These sites are normally purpose built and generally include better access and facilities (e.g. loading bays) than urban deliveries.

Wholesale or Manufacturing Delivery

Wholesalers' or manufacturers' premises may be located in cities, towns and out-of-town business parks, which creates the needs for a flexible vehicle in order to service all three types of site. They tend to be big deliveries by the very nature that wholesalers and manufacturers tend to buy in bulk. Facilities can vary from a purpose built 24-hour distribution centre equipped with adjustable height loading bays to a small industrial unit in a city centre location which only unloads by hand.

Tailor Vehicle Specification to Match Delivery Type

Once you have identified the type of delivery your vehicle will carry out, you should frame your vehicle specification to take this into account.

Urban Delivery and Urban Multi-drop Delivery

Rigid vehicles with good manoeuvrability would be suitable for this kind of delivery. They can cope better with the traffic and restrictions on parking for unloading deliveries on the high street. When parking, vehicle length will also be a major issue. Moreover, if the vehicle is too big, it may not be able to access locations down narrow streets or where weight restrictions apply.
If the vehicle has rear access only, there may be occasions where there is not enough space behind it for unloading. If the vehicle has side access, this will probably need to be on both sides as unloading directly onto the street can be very dangerous and unloading onto the pavement can be hazardous to pedestrians, especially if the vehicle door opens outwards rather than sliding laterally.

Retail Park Delivery

An articulated vehicle or drawbar combination will be suited to this kind of delivery. In retail parks, most of your customers will have dedicated loading and unloading bays and there will be few size restrictions.

Wholesale or Manufacture Delivery

Articulated vehicles would be better suited to bulk loads such as deliveries to wholesalers or manufacturers. These locations normally include good access to both pick-up and delivery points. If the deliveries are to purpose-built locations, the delivery area will usually be equipped with good facilities e.g. loading bays designed with rear access to loads in mind. Where delivery points have mixed facilities, a combination of rear and side access is recommended. If the products being delivered are suitable, curtainsiders can provide good flexibility. However, where products require temperature controls, rear access may be the only practical choice.

Rural or Off-road Delivery

These may be locations which are fairly isolated with poor access. It may mean a vehicle will have to cope with rugged conditions and at the same time be small enough to handle country lanes. Multiple-drive axles should be considered if available.

Evaluate Impact of Other Factors on Your Specification

A range of additional factors could have an important bearing on the overall design of the vehicle you purchase.

Changes in Product or Packaging

The potential for changes to the product or product packaging during the vehicle's life should be taken into account at the specification stage and may influence the choice of vehicle. It is difficult to predict this, however, close contact with your market and customer may help you do this.

Driver Vision

Most commercial vehicles have blind spots and pedestrians do not always act as expected. Drivers need to be fully aware of what is happening around them at all times. Extra mirrors and rear viewing cameras may be essential, in addition to reversing bleepers, for areas of high risk to pedestrians.

Security

Vehicle security is a particular issue when the driver is delivering unloaded goods and the vehicle is out of the driver's sight for a period of time. The value of the load will be a key factor. Precious metals will normally only be moved in specially designed security vehicles, whereas scrap metal is frequently transported in open-top vehicles as potential theft is less of an issue.

Special Travelling Requirements

For some products, temperature sensitivity may mean the load space needs to be temperature-controlled. Half-carcasses being delivered to butchers will normally travel on hanging rails in the vehicle body, dictating rear access only. Chicken, by contrast, is normally boxed so either rear or side access is suitable. Note: the greater the number of access points, the greater the likelihood of temperature gain. A larger refrigeration unit may be needed to compensate.

Tail Lifts

If the destination has no loading bay, it may be important for your vehicle to be equipped with a tail lift to help loading and unloading of palletised goods, for instance. Manual handling equipment or a forklift truck may also need to be carried with the vehicle. The need for a tail lift could mean that a vehicle has to have rear access. As a general principle, the larger a truck in terms of GVW, the lower the unit cost of transporting its load i.e. pence per mile per tonne of payload moved, providing it is full. However, lower kerbside weight (i.e. the weight of the vehicle in road-going condition, inclusive of water, fuel, oil, spare wheel, spares and tools, without the load) will also generally mean improved fuel economy, resulting in lower payload costs.

However, as Sections 3 and 4 have shown, a wide range of factors will affect the design and ultimately the overall operational efficiency of the vehicle you purchase. It is therefore necessary to base your vehicle specification on a balanced judgement that takes all relevant factors into account.

Checklist:

Have you:

- Categorised the type of delivery that the vehicle will undertake?
- Shaped your vehicle specification to match the type of delivery?
- Evaluated how other factors will affect your vehicle specification?

Table 1 over leaf provides a very simple overview of the suitability of some truck types for particular applications.

Table 1 Overview of Truck Suitability for Particular Applications

	7.5ft flat bed truck	7.5ft curtain sider	7.5ft box vehicle	Multi axle rigid vehicle	Artic vehicle	Drawbar combination	Artic & double deck trailer	Demountable system
Urban (General haulage)	√							
Urban Multi-drop (Pannelised load)		√						
Urban (security need)			√					
Urban (high-density load)				√				
Long-distance trunking					√			
Long-distance trunking (low density cargo)						√		
Long-distance trunking (high density cargo)							√	
Inter-city								√

√ = Suitable Vehicle

Detailed Specification: Core Components

If you have followed the steps outlined in the previous chapters, you should now have developed a good idea of the type of truck that will meet your specific requirements.

Unlike cars and vans, which are usually sold as complete packages, commercial vehicles tend to be customised. Two vehicles may have a similar chassis, but their overall design and load capacity may be completely different, with one designed for long-distance motorway work and the other for low-mileage, off-road duties.

Manufacturers' franchise dealers are equipped with software packages to help their customers produce detailed vehicle specifications. Nevertheless, you will need to make sure the sales person understands your precise requirements, for the range of vehicle components. This means you must have developed a clear idea of the components you need.

The evaluation of your requirements should cover nine key areas:

- Chassis
- Suspension
- Axles
- Tyres/wheels
- Engine
- Transmission
- Fuel tank
- Cab
- Body and trailer

Chassis

Key Points:

- How many axles will the vehicle need?
- How long will the body of the vehicle need to be?
- What ancillary equipment will your truck require?
- Will the chassis provide sufficient torsional stiffness?

Background

The purpose of the chassis is to locate the axles, power unit, running gear and cab to form the structural skeleton for the engine drive train, fuel tanks and batteries. The chassis is the fundamental platform on which the vehicle is designed and essentially has two longitudinal steel channels with a series of cross-members.

Options

The major factors that need considering are:

Number of axles: The number of axles will determine the overall carrying capacity of the vehicle. Generally the heavier the load, the more axles are needed. For a more detailed explanation of the axle considerations see Section 5.3 Axles.

The body: The body length will have an effect on the length of chassis specified. It is important to ensure the body sits on the chassis both in terms of length and fittings. For example, overhang is restricted to 60% of the wheelbase for rigid vehicles. For a more detailed explanation of body considerations see Section 5.9 Body and Trailer.

Ancillary equipment: Certain additional equipment may be required for a vehicle, for example, grabs, cranes, lifting gear or tail lifts. The chassis must be able to accommodate these in terms of space and weight. For a more detailed explanation of this see Section 6.3 Ancillary Equipment.

Specific Issues

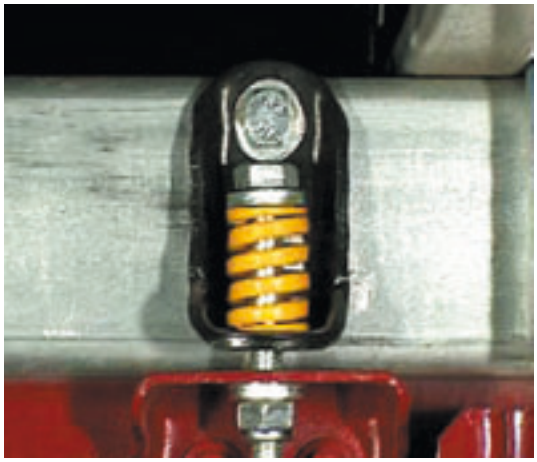
Torsional stiffness: Certain equipment (grabs and lorry loaders cranes) or a requirement to operate the vehicle under severe conditions may require additional torsional stiffness i.e. strength to stop the chassis bending under duress or load beyond that provided by the chassis. This can be achieved by adding further beams to the existing chassis either longitudinally or laterally. To minimise the weight of reinforcement, choosing a chassis with a relatively high torsional stiffness may be advantageous.

Body mountings: Chassis body mountings are important details. Body mountings manage the differential movement between the body, which is generally rigid and the chassis, which flexes with road movement to avoid structural damage to both elements.

If the chassis is unlikely to suffer major flexing i.e. it is to operate only on good road surfaces, a rigid mounting bracket (see Figure 5) may be sufficient. Where the vehicle is to operate in conditions more likely to cause chassis flexing (e.g. off-road) a flexible body mounting (see Figure 6) is recommended. It is important to check that flexible mountings are not over-tightened during maintenance, as this will reduce their flexibility.

Figure 5 Rigid Body Mounting Bracket

Figure 6 Flexible Front Body Mounting



Suspension

Key Points:

- Is smoothness of ride a priority?
- How important are vehicle noise and weight?
- Do you need access to higher authorised maximum weights?
- Is the vehicle going to operate in poor conditions?

Background

A vehicle's suspension system absorbs the impacts caused by travelling over an irregular surface. The choice of suspension system is generally determined by the nature of the vehicle's operation.

Options

There are three main types of suspension:

- Parabolic or taper leaf springs
- Air suspension
- Rubber suspension

Figure 7 Parabolic or Taper Leaf Springs

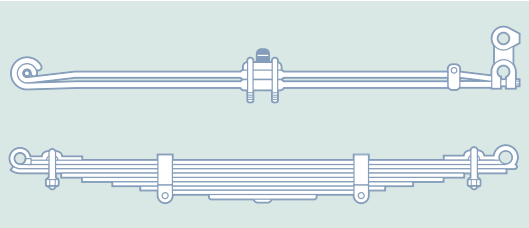
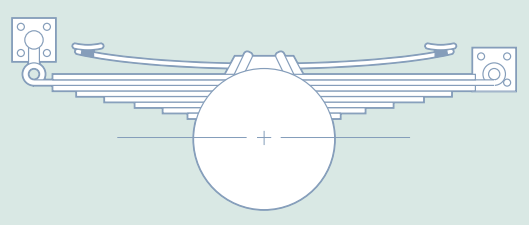
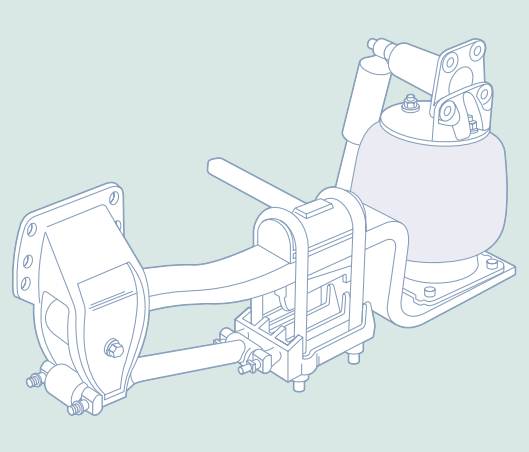


Figure 8 Multi-leaf Spring



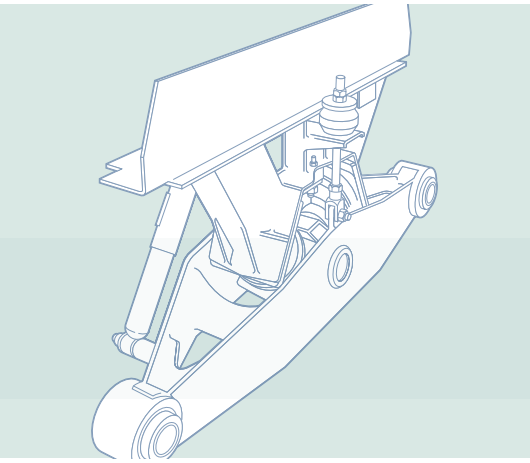
The parabolic or taper leaf spring with dampers and anti-roll bar is the most common form of suspension for trucks. The modern taper leaf spring (Figure 7) normally consists of a single or minimal number of leaf springs. These are replacing the multi-leaf springs (Figure 8) which were prone to friction and damage.

Figure 9 Air Suspension



Air suspension (Figure 9) is a common alternative to the taper leaf springs. Frequently referred to as road friendly suspension (RFS), it has two major benefits: access to the increased maximum authorised weights (see Appendix 4); and smoother ride – characteristics essential for protecting fragile goods e.g. sensitive electrical products. However, air suspension is more costly than taper leaf springs and is slightly heavier, thereby reducing the vehicle's overall payload.

Figure 10 Rubber Suspension



Rubber suspension (Figure 10), like air suspension, provides improved ride characteristics over the taper leaf spring suspension, but it does not have the ability to adjust the ride height like air suspension. Rubber suspension is also heavier than taper leaf spring suspension, again reducing vehicle payload.

Specific Issues

Sensitivity and toughness: Suspension needs to combine sensitivity with toughness. Where potential damage to goods is an issue, for example a load of computers or fresh fruit, most operators will specify air suspension in order to protect the cargo. Rubber suspension is better suited to muckaway (earthmoving/waste disposal) operations where the protection of the product is less important. Rubber suspension is less likely to be damaged by the terrain, whereas an air suspension can burst if it is punctured. The disadvantage is that more of the force of the load is transferred from the vehicle to the road, hence it is less environmentally friendly.

Ride height: Air suspension provides flexibility with respect to road travel heights. The facility to alter travel heights can avoid grounding the trailer when travelling over rough terrain or when travelling onto a ferry. It also enables the truck body to be raised or lowered for loading and unloading, e.g. when docking at warehouses to ensure a flat surface between the bed of the trailer and the dock.
Furthermore, air suspension can lower an articulated unit when hitching up a trailer. This allows the fifth wheel to slide easily to lock onto the kingpin, without having to increase the height of the trailer using landing legs.

Axles

Key Points:

- What are your vehicle's load capacity and power requirements?
- Is your truck likely to run empty or light?
- Do you need to maximise manoeuvrability?

Background

Axles distribute the weight from the truck and its payload onto the road surface. Due to the complex legislation on permitted axle weights, they play a key role in determining the gross weight of the vehicle. Axle weight is defined as the total weight transmitted to the road by all the wheels on one axle.

Vehicles will frequently be referred to as a 6 x 4 or a 6 x 2, for example. This is a simple way of identifying the number of visible (i.e. outer) wheels and the number of driven wheels on the vehicle. In the example of a 6 x 4 the vehicle will have three visible wheels on each side, making a total of six visible wheels running from three axles; if two wheels on either side are on powered axles, this will make a total of four driven wheels.

Options

Four types of axle are found on commercial vehicles:

- Dead axle
- Drive axle
- Lift axle
- Steer axle

Dead axles do not have power or steering capabilities and are used on non-powered trailers and on trucks where there is a need to increase carrying capacity.

Drive axles are powered axles incorporating the final drive, or differential unit, that provides the facility for the driveline to turn through a right angle and power the wheels. The drive axle also incorporates the constant gear reduction mechanism for the transmission system. It is important to have the correct specification to achieve the right power to weight ratio and fuel economy. If you have a choice of drive ratios for the drive axle, you should research the options to ensure the correct match. Where ultra-low gear ratios are required, this is normally achieved by specifying a low final drive ratio. However, to achieve optimum fuel efficiency, engine performance must be matched to the operation (see Section 5.5 on driveline specification for further information).

Lift axles are used during periods of empty, or light, running. Ideally, trucks should run fully loaded all the time but, in reality, a certain amount of empty running is inevitable. For a multi-axle vehicle, the facility to lift and retain a non-driven axle clear of the ground when partially loaded can be economic in terms of both tyre life and fuel use. Lift axles can also transfer weight temporarily to the drive axle for increased traction.

To increase carrying capacity, powered axles are added to multi-axle vehicles. These can either be added in front of (pusher) or behind (tags) the drive axle.

Steer axles are traditionally front axles, both primary and secondary, which are steerable and occasionally driven. Increasingly, rear trailer axles are being given a steer function to improve manoeuvrability.

Specific Issues

Avoiding axle and gross overloads: A crucial factor affecting the choice of axles is the payload and the weight transferred through the axles. If the total axle capacity equals the GVW, the vehicle does not have any load latitude or spare capacity. This means that, when the vehicle is at its maximum weight with a load, the load must be evenly distributed over the axles.

Having a total axle capacity which exceeds the GVW will provide load latitude and help avoid axle overloads (see Appendix 4). Even where vehicles have load latitude, it is essential to maintain proper weight distribution to avoid axle overloads. If in doubt, check load configurations at a public weighbridge or consider investing in axle-weighing equipment. The latter is often built into the chassis of the vehicle and should therefore be specified at the time of buying the vehicle. If the vehicle is to be used off-road it is important to ensure that the equipment installed is robust enough to withstand the extra wear and tear.

Tyres and Wheels

Key Points:

- Is cost an overriding issue?
- How important is length of tyre life?
- Is weight-saving a key consideration?
- What load-carrying ability do you need?
- Are you aiming to maximise fuel efficiency?
- Is the vehicle likely to operate under adverse conditions?

Background

Very few operators specify tyre preference when ordering a new vehicle. However, correct tyre selection is of paramount importance to safety and to operating costs. Tyre selection also affect the tachograph and speed limiter calibration.

A tyre performs a number of functions:

- It supports the vehicle's weight and distributes it over the road surface
- It contributes to the overall ability of the suspension to absorb impacts
- It provides the required level of adhesion between the road and wheel for traction, braking and steering in wet and dry conditions

- It helps provide required performance safely up to the vehicle's top design speed
- It helps the vehicle to run true and provide good straight-line directional stability
- It should offer the minimum rolling resistance to the vehicle's motion and minimise the fuel required to drive the vehicle
- It should be recyclable and relatively easy to dispose of
- It should perform quietly
- It should achieve reasonable economic life, while minimising whole-life costs.

Tyre selection will represent a compromise between these sometimes conflicting needs.

Options

There are two main types of tyres – radial and, the largely historic, cross-ply.

Radial tyres: These are the main type of tyre in use. They have a flexible side wall which permits better road contact and lower rolling resistance leading to better fuel consumption and better cornering and grip, particularly in wet conditions, through reduced side deflection that keeps more of the tread on the road. Today's truck market is dominated by radial tyres, which have around 80% longer life than cross-ply tyres.

Cross-ply tyres: These are sometimes referred to as 'diagonal-ply' and feature a hard sidewall, which has less road contact than a radial tyre.

Other types of tyre include:

Re-grooved tyres: Modern radial tyres are designed to be re-grooved which essentially extends their life and improves road traction. However, for safety reasons, many operators use re-grooved tyres only on rear non-steer axles. The rolling resistance of re-grooved tyres is the same as new radial tyres. Re-grooving radial tyres is recommended by most tyre manufacturers, firstly to re-establish the correct groove width of the tyre as it wears and so give good traction, and secondly to extend tyre life. In some cases, the tyre may be re-grooved more than once, but in all cases must still comply with legal requirements.

Re-moulded or re-treaded tyres: Re-moulds are made from used tyre casings which have hot vulcanised rubber added to form a new tyre tread. Re-treads are strips of tyre tread, which are glued or bonded to the used tyre. The bonded treatment is usually a better and more reliable process. The life expectancy of these tyres is around 20% less than new radial tyres.

Although re-moulded or re-treaded tyres can be fitted to any axle, operators often fit them to rear non-steer axles only. For safety reasons, many will not fit re-grooved, re-treaded or re-moulded tyres to steer axles, although the law does not prohibit this. It is also good practice only to fit tyres with the same characteristics to a single axle.

Super-singles or 'wide tyres': These are defined as having an area of contact with the road at least 300mm in width. They are now commonplace on steer and trailer axles and are gradually being used on drive axles. Super-singles have a number of advantages: less weight than twin tyres – the super-single generally also has lower unsprung weight and generally provides for a smoother ride than twin tyres; lower rolling resistance, leading to better fuel consumption; and a bigger contact area, giving better grip and traction. However, they may not always provide load carrying comparable to twin tyres and a single puncture may mean the truck cannot reach a safety area.

Lower rolling resistance tyres: A tyre's rolling resistance decreases as its tread depth reduces. Manufacturers have been striving to produce lower rolling resistance tyres because of the fuel-saving benefits. Initial trials have shown some positive results, with fuel consumption reduced by around 7-8%. Reductions are most likely to be apparent if the vehicle has multiple axles, if it is engaged in long-distance trunking and if all axles are fitted with these tyres. Some in-use trials have shown tread wear rates inferior to standard tyres, so any potential savings should take into account tyre replacement costs. For more information, see the Freight Best Practice case study 'Save Fuel with Lower Rolling Resistance Tyres'.

Ultra-wide low-profile tyres: Tyres known as 495/45R22.5 are claimed to offer a 17% reduction in rolling resistance, compared to twin tyres on a drive axle. However, service depots may not be able to support vehicles using these tyres.

Alloy wheels: Alloy wheels can be purchased as original equipment costing around £250 each more than a standard steel wheel but typically have a weight saving of 41%-52% compared with the steel equivalent, depending on wheel size. Apart from cosmetic reasons, fitting alloy wheels is recommended only if payload is a critical issue. Alloy wheels are more prone to damage than the harder steel wheels and are not ideal for use on construction sites or off-road activity, where damage can easily occur.

Specific Issues

Tyre maintenance: Modern truck tyres are designed to withstand arduous operating conditions, from stop-start town deliveries to high-speed trunking on motorways and across international road networks. They will also perform efficiently and give economic life over a wide range of terrains and in a variety of weather conditions. To achieve this, it is essential that tyres are carefully inspected and maintained regularly. One of the most common tyre defects is under-inflation. This causes additional fuel use and premature tyre wear, and can jeopardise safety.

Adverse conditions: There are certain substances and situations that can considerably shorten the lives of tyres made from natural or synthetic rubbers. The main substances are mineral oils and greases, brake fluid, concentrated nitric and sulphuric acid and some organic salts. Tyres can also be damaged by roadside kerbs. It is advisable to equip vehicles that regularly visit petrochemical sites with tyres resistant to the type of products found there. For vehicles constantly scuffing kerbs e.g. dustcarts tyres are available with special rubbing bands on both sidewalls. When the wear indicator on the outside band is exposed the tyre can be rotated so that the inner wall becomes the outside face of the tyre.

Spare wheel policy: These days, spare wheels are rarely fitted as they represent an extra cost and dead weight and are vulnerable to theft. Moreover, the safety concerns involved in a driver changing a wheel by the roadside mean it is safer and more efficient to arrange for a tyre company to deal with punctures and tyre problems.

Engine

Key Points

- What weight will the engine need to pull?
- Will your vehicle be used for long distance or local work?
- What road speeds will the truck travel at?
- Will you run ancillary equipment from the main engine?

Background

When selecting the engine, your aim should be to choose one which matches your overall operational power requirements as this will ensure optimum fuel economy.

Important factors to consider when specifying an engine for a particular vehicle are:

- The power to weight ratio should permit the vehicle to operate at maximum torque output for most of its driving pattern (for more information see 'Specific Issues' later in this section)
- Higher power output does not necessarily mean lower fuel consumption
- Fuel consumption benefits should be assessed in whole-life cost terms

Options

Diesel engine: This is the most common type used in commercial vehicles. Unlike the petrol engine, which is a spark compression engine, the diesel engine is essentially a compression ignition engine. The naturally aspirated engine draws air into the cylinder during the induction stroke at ambient temperature and pressurised to a ratio of 14:1 or more. To achieve increased engine power, the pressure is increased through turbo charging and the use of inter-coolers.
Because of the technically advanced nature of modern trucks, engine options exist. The most recent innovation in diesel engines is the introduction of common rail fuel systems. Here, computers control the injection process i.e. electronic engine management, and deliver the fuel under high pressure to individually electronically controlled injection valves. This has resulted in significantly higher-output engines with improved fuel efficiency.

Specific Issues

Power output and torque - clarification of terminology: When specifying an engine, misunderstandings between the terms 'power output' and 'torque' are common.

- Power output is measured as the rate of undertaking work. The common power measurement for commercial vehicles is horsepower. This is based on a horse's ability to move 33,000 pounds 1 foot in 1 minute! The metric equivalent to 1 horsepower is 746 watts.
- Torque is the force put out by the engine at the end of the crankshaft used to drive the vehicle. The torque produced by an engine will vary at different engine speeds. Torque is therefore important to achieving optimum engine efficiency. If optimum torque can be achieved at low engine speed, overall fuel efficiencies will improve considerably compared to an engine running at maximum revolutions

Driveline specification: The driveline is the transfer of power from the engine through the gearbox and drive shaft to the drive axle. The higher gear ratios are used for top speed, but at the cost of power or performance. Matching the engine output in terms of both power output and torque to the gearbox ratios and the drive axle ratio is absolutely essential for optimising fuel consumption.

Studying engine performance curves that show power output, torque and brake-specific fuel consumption plotted against engine speed will tell you much about the suitability of a particular specification for your own operation. In general terms, you should choose higher-power engines and higher final drive ratios for long-distance work. Vehicles that spend most of their time on local work will generally be more economical if they have less power, fewer gear ratios and a lower final drive ratio.

To help operators with their choices on drivelines, gearbox ratios, etc. most manufacturers have computer programs that can compare various engine, gearbox and final drive ratio options. These will forecast the vehicle's theoretical performance, including fuel consumption. You can help ensure that the program arrives at the right answer by supplying as much accurate information as possible about your operation. You can also try to obtain a demonstrator vehicle as close as possible to your specification.

Matching engine power and torque to ancillary equipment's operational needs: When specifying ancillary equipment to be driven from a gearbox-mounted power take-off (PTO), it is important to consider the gear ratio to be used. Modern engines have efficient power and torque curves starting at around 1,000rpm. This provides an ideal position to set the PTO gearing for optimum fuel economy. Lower gearing may produce additional power to drive the ancillary equipment, but at higher fuel consumption.

Second-hand vehicles: A particular point to note is that a used vehicle's exact power rating or final drive ratio may not be obvious. The vehicle could, for example, have a long-distance specification, making it relatively uneconomical for local work. Note: if the vendor cannot produce evidence of the exact specification, it is worth quoting the chassis number to a franchised dealer. This should give access to the manufacturer's original build specification.

Reducing emissions: This is a topic of particular relevance to buyers of second-hand vehicles. The introduction of European exhaust emission standards, known as Euro 1, 2, 3, 4 and 5, has had a considerable impact on the maximum level of harmful pollutants produced from diesel engines. European legislation aims to reduce significantly carbon dioxide (CO_2), hydrocarbon (HC), oxides of nitrogen (NO_x) and particulate emissions from trucks. (See Appendix 2 for more details, including the years of introduction of the various standards.) The fact that these reductions are being achieved alongside improvements in power output and fuel consumption demonstrates the major advances being made in diesel engine technology.

Local air quality and Low Emission Zones (LEZs) are moving up the agenda and also have implications for vehicle emissions. Operators need to develop an understanding of these issues now and consider how the introduction of exclusion zones will affect the choice of engine specification.

Some vehicles fitted with equipment, usually on the exhaust system, that reduces particulate levels can obtain a Reduced Pollution Certificate (RPC) if the vehicle meets certain compliance limits. RPCs, which permit the certified vehicle a lower rate of Vehicle Excise Duty, must be renewed on a yearly basis following an emissions test. It is important to check the engine specification as to whether it qualifies.

Contract hire and operating leases: When acquiring a vehicle through contract hire or an operating lease, you may find that the best vehicle for your operation is, for instance, a low-power tractor unit with a day cab but that the monthly lease payment is lower for a more powerful unit with a sleeper cab. This is mainly a reflection of the desirability of the vehicle in the used market at the end of the lease term. It is important to consider the difference in fuel costs between the two specifications – saving £20 a month on the lease rate may cost £40 a month in fuel costs.

Transmission

Key Points

- Will your vehicle be used for non motorway driving?
- How important is reduced driver fatigue and improved driver concentration?
- Do you need to minimise journey times and maximise fuel efficiency?

Background

A gearbox is needed to disengage the engine from the wheels and to match engine speed, power and torque to a required task enabling the vehicle to pull away or allowing it to accelerate, climb gradients or reverse. In effect, the gearbox acts like a lever. The lower the gear, the greater the leverage and the higher the tractive effort, subject to engine characteristics.

Options

Manual gearboxes: This type of gearbox is common for long distance work where gear changes are infrequent. This is a proven form of technology and is the most popular type in use today, although automated shifts are becoming more popular.

Automatic gearboxes and semi-automatic gearboxes: Automatic gearboxes were developed to reduce the need for constant gear changes. This is done completely through a full automatic or partly through a semi-automatic gearbox. The choice depends upon the extent of gear changes.

They tend to be used in vehicles on frequent stop/start operations, for example, airport vehicles and refuse trucks. This reduces the wear and tear on the driveline and driver fatigue. Automatic boxes help improve driver concentration for emergency service vehicles and provide a smoother engine operation which can improve fuel economy. They are increasingly specified for longer distance work, as the technical developments now offer most drivers improved fuel consumption.

Specific Issues

Cruise control: This is becoming a popular option for commercial vehicles, particularly for motorway/long-distance operations. Cruise control can result in less engine and driveline wear and reduced driver fatigue. It will also help optimise the electronic control system's ability to deliver the appropriate amount of fuel for any given situation, improving fuel efficiency. By setting the cruise control to correspond to the best specific fuel consumption speed of the engine, average fuel consumption can be cut.

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Fuel Tank

Key Points

- Will your vehicle be used for long distance work?
- Is vehicle weight a key issue?
- Will your truck be fitted with ancillary equipment?

Background

The size of the fuel tank can be an important decision when specifying a truck. If the vehicle is designed for long-distance work, the standard fuel tank may not be able to carry enough fuel to complete the journey. If fuel is bunkered on site, this will often cost less than the retail price on forecourts and may be an incentive to fit larger tanks.

Options

Size of tank: The size of the fuel tank required depends upon the type of operation and the amount of fuel required. A long distance vehicle will generally have a larger tank than an urban distribution vehicle, as the range is higher.

Extra capacity: The fitting of an additional tank to a vehicle is popular for international operations as the frequency of fuelling facilities in certain regions is limited. This can either be an extra tank next to the existing one or a tank fitted horizontally on the chassis, known as a belly tank.

Specific Issues

Implications for payloads: Increasing tank holding capacities will reduce a vehicle's overall payload capabilities. This may be critical in terms of the final size and specification of the vehicle. A gallon of diesel weighs 3.86kg, so 100 gallons will add 386kg to the vehicle's kerbside weight.

Ancillary equipment: If the vehicle is fitted with ancillary equipment, such as a freezer/chillier unit that is not driven directly from the engine, this equipment may need a separate fuel tank.

Cab

Key Points

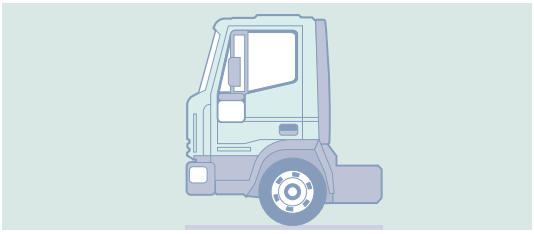
- How many people will the cab need to carry?
- Will long driving hours be the norm?
- Are overnight stops likely?
- Do you need to maximise your truck's residual or re-sale value?

Background

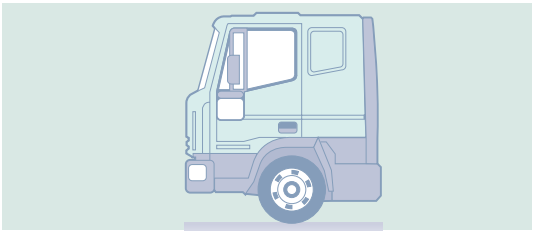
When specifying a truck, the choice of cab may seem fairly straightforward. However, poor choice can reduce the vehicle's re-sale value and can also affect safety and comfort, particularly in view of the range of accessories available in modern cabs.

Options

Day cab: These are used mainly on distribution rigids and tractor units, which do not travel very far from their operating base and need only provide the driver with a workstation to drive the vehicle and comply with breaks.

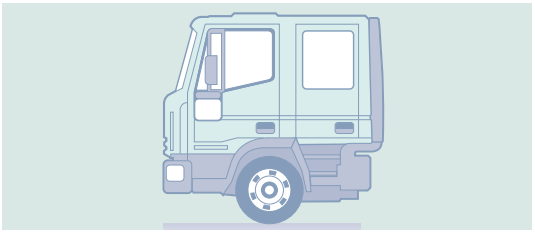


Sleeper cab: Where a driver is on long distance or overnight work the operator has a legal requirement to provide the driver with sleeping facilities. If these are a sleeper cab it must have a full length bunk.



High roof cab: The cab can be extended upwards to increase space available. This is common where two bunks are required. However, it is gaining in popularity with single bunk vehicles as it enhances the rest and storage facilities. As with sleeper cabs they can either be factory specified, or built by coachworks.

Crew cab: Crew cabs are used where the activity demands crew or passenger accommodation, for example, refuse collection lorries and breakdown recovery vehicles.



Specific Issues

Driver comfort and safety: Manufacturers undertake considerable research into designing cabs to provide a comfortable and safe environment. This is important, particularly if the type of operation involves high mileage and long hours in the cab. In these circumstances,

considerations should include the type of seating, lumbar supports etc. As an incentive to the driver, today's cab specifications usually include a full range of audio equipment – again this may be a consideration if the drivers are spending most of their time in the cab.

Body and Trailer

Key Points

- Is vehicle cost or vehicle weight your greater concern?
- Are your loads high-volume, low weight?
- What loading and unloading operations are anticipated?
- Do you envisage any changes to vehicle operations?
- Is load security a key issue?

Background

The body forms a critical element in the overall design specification, ensuring the vehicle is fit for purpose and performs tasks cost-effectively. Limited vehicle types are now offered with standard vehicle manufacturers' pre-built bodies. These bodies reflect operators' general demand requirements, usually represent good value, and the period between order and delivery is usually relatively short. However, the majority of vehicle types are not offered with pre-built bodies. The buyer therefore needs to specify the body and its detailed design. Body manufacturers will help with the design and specification of the body and body materials.

A vehicle with a smaller body is lighter, stronger and less liable to be damaged than a larger one. It creates less aerodynamic drag and therefore fuel consumption will be better. The best body size will normally be the smallest one necessary to do the job, allowing for any possible changes, not the largest one that can be bought for the money.

In the case of high-volume, low-weight loads, double-deck trailers provide extra load space on a single trailer by means of a second deck. The second deck can be fixed or moving to give greater flexibility for loading/unloading.

Options

Materials: Materials for a body are frequently dictated by load characteristics i.e. weight and volume and price. Aluminium, for example, is light, easy to repair but expensive. Glass-reinforced plastic (GRP) is less expensive and less prone to damage, but is much heavier than aluminium. Curtainsiders are usually heavier than aluminium and lighter than GRP, but overall are less secure and more prone to damage. New materials such as high-strength steels, plastics and laminates or composites offer a broader choice allowing bodies to be tailored to an operator's exact requirements, taking durability, weight, flexibility, hygiene etc. into account.

Access: Another key factor when designing a body is the ease of loading and unloading the vehicle. If loading and unloading accounts for 20% of the working day and this can be reduced to 10%, considerable whole-life cost savings can be achieved through increased vehicle utilisation. The need for access to tail lifts, lorry-mounted cranes and other ancillary equipment will also have design implications.

Frequency of loading and unloading: If a vehicle is operating in an urban multi-drop environment, access to the load will be more frequent than with a vehicle undertaking long-haul bulk-drop operation.

Consideration should therefore be given to the following access options, for manual or mechanical loading and unloading:

- A drop-down tailgate on an open truck body mounted on a hinge bracket can provide rear access. Drop-down side panels or boards can also be fitted to an open truck body mounted on a hinge bracket
- Barn doors, usually two rear-opening doors giving access to the full width of the body. Normally, when open, the doors secure to the side of the body. In congested areas with pedestrians, this may cause a potential hazard
- Roller shutter doors, which like barn doors, provide access to nearly all of the body width when open. Although this kind of door sometimes causes limited height access, there is no potential danger to pedestrians in urban areas. However, they are not as secure as barn doors
- Side-loading doors, which are practical for loading and unloading in congested areas and avoid street unloading and other vehicles
- Curtainsiders permit the most flexibility for loading and unloading permitting both nearside and offside access. However, they provide less load security than rigid-sided vehicles

Specific Issues

Safety of loads on vehicles: The Code of Practice 'Safety of Loads on Vehicles' (ISBN 0-11-550666-7), issued by the Department for Transport, is a good source of information. The law is very specific about the safety of loads transported by vehicles and it is essential that the body design is suitable for the type of load being carried.

Consulting body builders: The body plays a crucial role in determining a vehicle's fitness for purpose. It is recommended that body builders be consulted so that their expertise can assist identification of correct materials and provide an understanding of weight implications before final body selection is made.

Type approval: This is a Government approval system to ensure that a vehicle conforms to set standards, covering a variety of issues including safety, noise, pollution, etc. Currently, type approval does not apply to commercial vehicle bodies, which are restricted by weight and dimension regulations (see Appendix 4). However, when specifying a body, it is essential that pre-build checks are undertaken to ensure that the proposed design and fitting do not invalidate any manufacturer's warranties in respect of vehicle chassis and drivelines or cause the vehicle to fall foul of construction and use legislation.

'Safety of Loads on Vehicles is available to download from the DfT's website at **www.dft.gov.uk**

After completing steps 5.1 to 5.9, you will have finished developing the main outline of your truck specification.

As well as ensuring that the vehicle's engineering design meets your objectives, your specification will also need to take into account a range of mandatory legal requirements. These affect key aspects such as vehicle/trailer dimensions and maximum vehicle and axle weights, as well as the type of driving licence required for particular vehicle types. Full information on driver licensing requirements can be found in the DVLA information leaflet, 'D100: What you Need to Know about Driving Licences', available to download from the DVLA website at **www.dvla.gov.uk** or by calling **0300 790 6801.** Appendix 4 provides an overview of the key legal requirements and will allow you to review your vehicle specification against the current regulations.

Checklist

Have you completed a detailed specification for the following core vehicle components:

- Chassis?
- Suspension?
- Axles?
- Tyres and wheels?
- Engine?
- Transmission?
- Fuel tank?
- Cab?
- Body and trailer?

Detailed Specification: Additional Features

As well as the core vehicle components summarised in Section 5, you will need to consider what extra features your vehicle specification should cover. Although some features may be regarded as additional to the basic vehicle, they can nevertheless make a significant contribution to fuel and overall operational efficiency.

The evaluation of your precise component requirements should cover four key areas:

- Aerodynamics
- Active safety systems
- Ancillary equipment
- Fuel

Aerodynamics

Key Points

- Will your vehicle be used mainly for higher-speed work?
- Will the truck have a large frontal area?
- If an existing vehicle, does it already have good aerodynamic design?

Background

The potential for fuel savings through improved aerodynamic body styling, sometimes referred to as an 'air deflector kit', is greatest where operations are most affected by aerodynamic drag i.e. where the vehicle regularly travels at higher speeds and has a large frontal area. In the case of existing vehicles with poor aerodynamic design, there can be improvments to aerodynamic performance through retrofit.

Options

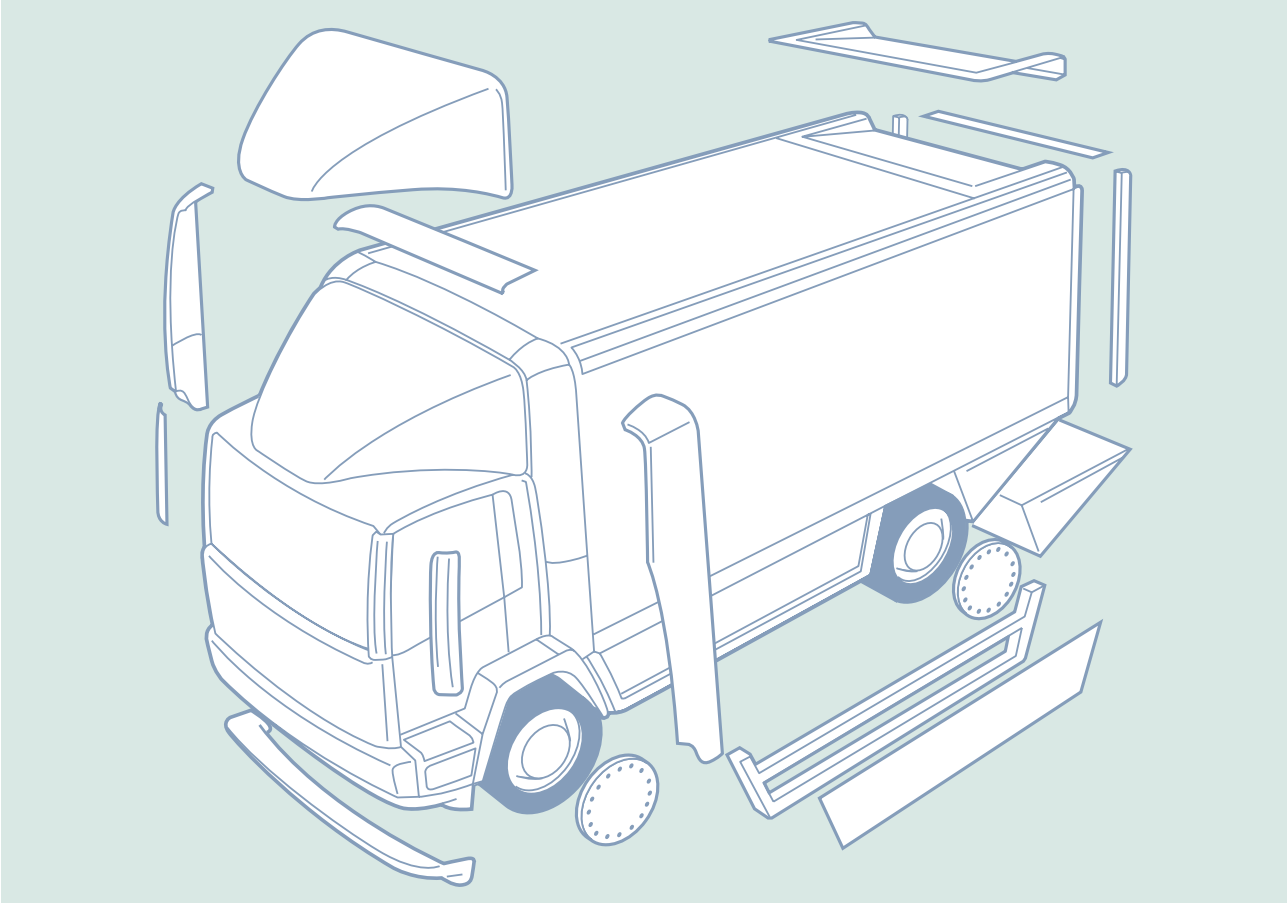
Where to fit: It is important to understand what devices are available and where to fit them. A lot of high-quality independent information is available on aerodynamic body styling for trucks. A summary of the aerodynamic features available can be found in Freight Best Practice publication: 'Streamlined guide to aerodynamic styling'. More detailed technical information can be found in Freight Best Practice publication: 'Truck Aerodynamic Styling'.

For free copies, contact the Freight Best Practice Hotline on **0300 123 1250** or visit the website at **www.businesslink.gov.uk/freightbestpractice**

Specific Issues

Compatibility: Interaction with other pieces of other equipment needs to be considered as, for example, the fitting of tractor side panels may conflict with a fridge engine on a trailer. Potential savings: It is difficult to be specific about how much fuel can be saved by fitting these devices. A lot depends on the vehicle and its operation. However, fitting suitable aerodynamic styling features to a vehicle used on long-distance routes can cut fuel consumption by 6-12%. Generally, figures for fuel savings quoted by manufacturers are based on estimates for vehicles run on tracks or test routes, or on models tested in wind tunnels or other carefully controlled environments. As a result, you are unlikely to realise the same level of savings on the road. It is important to ensure that features are properly adjusted with the current task in mind and that drivers are trained in the correct use and adjustment of the kit.

Figure 11 Aerodynamic Body Styling Options



Active Safety Systems

Key Points

- How can you reduce accident injury and damage levels?
- Will the vehicle need to do a lot of reversing?
- Will the truck be used for urban deliveries?

Background

Active safety systems are designed to reduce the likelihood of road-related accidents. Usually, they harness technological innovations e.g. anti-lock braking and traction control.

Options

Anti-lock braking system (ABS) is an active safety system designed to reduce the risk of a vehicle crash. It works by maintaining grip between the road and a vehicle's tyres under heavy braking conditions, particularly in the wet. Although ABS is mandatory on all commercial vehicles exceeding 3.5 tonnes registered since 1 April 2002, other active safety systems (see below) are not compulsory. Consideration should be given to non-mandatory systems because they offer a safer environment for the driver and, importantly, for other road users.

Systems to be considered include traction control, reversing cameras, reversing sensors to complement bleepers, larger rear-view mirrors and nearside down-facing mirrors to spot pedestrians during urban deliveries. Benefits such as reduced accident damage levels can make the introduction of safety systems like these self-financing.

Specific Issues

Economy v safety: Where there is a legal requirement to fit safety devices the benefits in terms of reduced risk are evident. However, if the item is not mandatory it may seem that specifying certain systems such as reversing alarms is an additional cost. All vehicle operators have a duty of care. In the event of an accident an operator who has a proactive safety policy may be looked upon more favourably than one who only meets the minimum requirement.

Ancillary Equipment

Key Points

- Will additional equipment be needed for loading and unloading?
- Will the load need to be temperature-controlled?
- Is vehicle weight a key concern?
- Is noise an issue?
- Will the availability of rapid and reliable management data improve operations?

Background

Broadly speaking, this covers a host of additional equipment that can be fitted to the vehicle. Three of the main types are:

- Loading and unloading aids
- Equipment to maintain the condition of the cargo e.g. temperature control equipment
- Management information devices e.g. transport telematics

Options

Types of common ancillary equipment: There is a large number of standard and specialist devices, which can be fitted.

For example Standard fitments:

- Tail lifts (column and tuck-away)
- Lorry-mounted cranes, including grabs
- Multi-lifts (skip)

- Hydraulic ramps and winches
- Lorry-mounted forklifts

Specialist operations, including bulk, tankers or load control:

- Blowers and vacuum pumps
- Double-deck column lifts

It is important to consider the nature of the operation to see whether any of these devices are necessary and where this fits into the vehicle specification process.

Maintaining load condition: The most common requirement is for temperature-controlled transportation, usually for foodstuffs but also for some forms of gases and liquids. Temperature-control equipment includes coolers, fridges, gas and compression chambers.

Management information: Technology has made it possible to gather almost any type of information on a truck's operations. This can include how often the rear doors are opened to route taken, fuel consumption through to how many gear changes were made during a period of driving. The devices that record this type of information are known as black boxes or Intelligent Transport Systems (ITS) and store data for downloading onto a computer for analysis. Black boxes can also automatically download data via GSM or GPRS communications. If required, this information can be provided in real-time. If used correctly, this information can significantly improve a vehicle's overall efficiency e.g. through telematics and real-time route planning.

Essentially, good route planning should achieve the maximum deliveries in the minimum distance travelled. This is frequently measured as item delivered per kilometre. Although obvious, operators often ignore the fact that the less distance a vehicle travels, the less fuel it uses and the less wear and tear it will incur. Minimising the distance travelled through careful route planning, therefore, will reduce fuel consumption, environmental impact and operating costs. For more information, see Freight Best Practice publication: 'Computerised routing and scheduling for efficient logistics'.

Transport telematics links modern information technology with the latest developments in telecommunications. Telematics enables improvements in response times to customers or incidents, reductions in fuel consumption through real-time route optimisation, vehicle tracking, satellite navigation e.g. congestion avoidance, and monitoring of driver performance. These systems can be integrated into a company's communication network and vehicle systems to provide accurate, up-to-date fuel consumption figures and other management information. For more details on telematics, see Freight Best Practice publication: 'Telematics'.

Specific Issues

Powering ancillary equipment: As mentioned in Section 5.5, when specifying engine-driven ancillary equipment, it is important to specify power take-off (PTO) ratio. This should be matched to the engine in order to provide the required power at the most fuel-efficient engine speed.

Noise: Noise from ancillary equipment can have a significant impact on the environment. It comes from two sources: driveby noise due to the metallic parts of the equipment striking each other as the truck is driven; and operational noise due to the equipment's use. In urban environments, noise from ancillary equipment can cause nuisance, and the majority of manufacturers offer sound reduction kits. Most ancillary equipment can therefore be silenced. Further information on reducing body noise is available on the DFT website at **www.dft.gov.uk.**

Loss of payload: Ancillary equipment adds to a vehicle's kerbside weight. However, for some types of equipment, a little planning can minimise its effects. For example, by specifying a rear frame lift, which combines the tail lift with the rear frame of the body, it is possible to save a quarter of a tonne, improve the aerodynamic shape of the vehicle's rear and increase the payload capacity. It is therefore important to discuss operating requirements and the potential vehicle design with a reputable body builder who will be able to advise on weight-saving features.

Fuel

Key Points

- Are you aiming to minimise emissions from the vehicle?
- How important are fuel cost and vehicle performance?
- How important are vehicle range and maximum size of payload?

Background

For the efficient fleet operator, fuel represents one of the biggest areas of potential cost savings. Freight Best Practice publication: 'Fuel Management', highlights how cost savings and environmental benefits can be achieved by improving fuel efficiency.

Options

Types of fuel: The choice of fuels for commercial vehicles exceeding 3.5 tonnes is currently rather restrictive. Most vehicles operate on diesel fuels. The constituents of diesel have significantly changed over the last decade, as has the choice of diesels available on the forecourt. A key drawback to using diesel is the emission of particulate matter harmful to the environment. The use of ultra low sulphur diesel is proven to reduce particulate emissions and is therefore less environmentally harmful.

The use of bio-diesel is still in its infancy but, in time, this fuel may prove to be a real alternative to fossil diesel. It can be made from vegetable oil, animal fat or both. Rapeseed oil is commonly used. Currently, a number of UK forecourts offer bio-diesel mixed at 95% fossil diesel and 5% bio-diesel. It is important to check whether your vehicle warranty is still valid if bio-diesel is used. Current information on the status of biofuels can be found on the Department for Transport **website at www.dft.gov.uk.**

Alternatives include:

- Compressed natural gas (CNG), which produces cleaner emissions but currently requires major investment in compression equipment to turn the gas into a liquid before filling the vehicle
- Petrol is not commonly used for vehicles over 3.5 tonnes because it is expensive, has lower fuel economy and does not provide the torque range that the diesel engine equivalent provides
- Liquid petroleum gas (LPG) is an alternative fuel for petrol engines that is cheaper and produces cleaner emissions, but LPG-fuelled engines are not ideally suited to commercial vehicle operational requirements due to the greater volume of fuel required for the same energy output, resulting in a loss in payload

There are currently around half a million gas-powered, i.e. CNG or LPG-powered, vehicles in Europe, mostly in Italy, Germany and France. By contrast, the UK only has around 900. Compared to a diesel engine that complies with Euro 3 i.e. where NOx emissions are cut by 80% – see Appendix 2, particulate matter emissions from engines fuelled with CNG or LPG are reduced by about 95%. Engine noise is also cut by around 5dB(A). In diesel terms, these fuels are already cleaner than the Euro 5 limits which come into force in 2008. CO2 emissions from CNG and LPG are roughly the same as those from diesel. However, the size and weight of CNG and LPG fuel tanks may limit a truck's range and payload.

Currently, fuel choice is still a question of 'horses for courses'. However, as local air quality and LEZ issues grow in importance, alternatives to fossil fuels will need to be given careful consideration. Further information can be found on the EST **website at www.est.org.uk.**

Specific Issues

Fuel saving devices: Fleet managers receive large amounts of sales literature for products offering remarkable fuel savings. These include aftermarket fuel additives, combustion improvers and lubricating oils and additives. However, investing in a product that does not work will be a waste of money. Moreover, the product may even damage your vehicle or invalidate your warranty.

If you are considering investing in a fuel saving device, your evaluation should be a three-step process.

- First, consider whether this is likely to be the most cost-effective way to save fuel in your vehicles. Good operational engineering together with vehicle and driver management are likely to offer better scope for economies
- Then, if you decide a product is worth investigating, establish how it is claiming to work, whether there are any risks associated with using it and how the product has been tested
- Finally, think about how you are going to test the product on your vehicles

For further information, see Freight Best Practice publication: 'Fuel Saving Devices'.

Once you have carried out steps 6.1 to 6.4, you will have completed your draft vehicle specification.

Checklist

Have you decided how the following will impact on your vehicle specification?

- Aerodynamics
- Active safety systems
- Ancillary equipment
- Fuel

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Maximising Efficiency

This guide has helped you acquire a vehicle that is suitable for your business needs.

However, once you have specified and acquired the right vehicle, you need to ensure you maximise its efficiency by continually monitoring its performance. This will help you to identify areas for improvements and reduce costs for operating your vehicle.

Monitoring Key Performance Indicators (KPIs)

KPIs provide a consistent basis for measuring transport efficiency such as vehicle fill, empty running, time utilisation and deviations from schedule. The 'Fleet Performance Management Tool', which consists of an Excelp spreadsheet and an accompanying manual, can help you monitor KPIs. This easy to use spreadsheet and manual will help you measure average miles per gallon, maintenance costs for your vehicles and average cost to deliver a load, to name but a few. By monitoring this information you can understand your business costs and decide where to focus your efforts to maximise profitability.

Monitoring Load Capacity

You need to monitor the load-carrying capacity of your vehicle to ensure that the planned maximum payload does not cause either gross weight or axle overloads. A public weighbridge or axle-weighing equipment can be used for this purpose. Monitoring load capacity will help ensure that your vehicle is operating legally. You also need to include ease of loading and unloading in your evaluation.

Checklist

Have you:

- Planned how to monitor the performance of your vehicle?

Appendix 1 - Typical Whole Life Costs for Standard Commercial Vehicles

	Rigid	% of total cost	Rigid	% of total cost	Rigid	% of total cost	Rigid	% of total cost	Rigid	% of total cost	Artic & semi trailer	% of total cost	Artic & semi trailer	% of total cost	Artic & semi trailer	% of total cost
GVW tonne	7.5		12.0		18.0		26.0		32.0		33.0		38.0		44.0	
Axle configuration	4x2		4x2		4x2		6x2		8x4		4x2		4x2		6x2	
Kerb weight tonne	4.4		5.5		8.0		10.5		12.0		12.5		15.0		16.0	
Payload tonne	3.1		6.5		10.0		15.5		20.0		25.5		29.0		28.0	
Trailer axles											2..0		3.0		3.0	
Annual mileage	40,000		40,000		45,000		50,000		40,000		60,000		70,000		70,000	
Capital cost	£34,498		£38.391		£50,190		£55,873		£72,964		£49,774		£55,337		£63,803	
Trailer cost											£18,328		£20,931		£20,931	
Total cost											£68,102		£76,268		£84,734	
Life (years)	6		6		6		6		7		7		6		6	
Depreciation	£4,887	13.6%	£5.799	14.8%	£6,692	14.9%	£7,450	14.0%	£8,756	14.6%	£7,855	13.0%	£9,307	12.6%	£10,464	13.4%
R & M	£2,731	7.6%	£3,154	8.1%	£3,785	8.5%	£4,542	8.5%	£9,306	15.5%	£6,215	10.3%	£8,475	11.5%	£9.783	12.5%
Fuel	£7,570	21.1%	£8,735	22.3%	£9,827	21.9%	£14,194	26.6%	£14.194	23.7%	£18,925	31.2%	£25,476	34.5%	£27,221	34.8%
Tyres cost	£496	1.4%	£576	1.5%	£621	1.4%	£1,472	2.8%	£2,383	4.0%	£2,286	3.8%	£2,555	3.5%	£2,971	3.8%
Insurance	£1,187	3.3%	£1,372	3.5%	£1,750	3.9%	£2,020	3.8%	£2,213	3.7%	£2,556	4.2%	£3,233	4.4%	£3,233	4.1%
Driver's wages	£18,781	52.4%	£19,336	49.4%	£21,445	47.9%	£22,979	43.1%	£21,879	36.5%	£21,560	35.6%	£23.575	31.9%	£23,352	29.9%
Vehicle excise duty	£165	0.5%	£200	0.5%	£650	1.5%	£650	1.2%	£1,200	2.0%	£1,200	2.0%	£1,200	1.6%	£1,200	1.5%
Total annual cost	£35,817		£39,172		£44,770		£53,307		£59,931		£60,597		£73,821		£78,224	
Cost per mile	£0.895		£0.979		£0.995		£1.066		£1.498		£1.010		£1.055		£1.117	
Cost/mile/tonne payload	£0.289		£0.151		£0.099		£0.069		£0.075		£0.040		£0.036		£0.040	

(Source: FTA – The Manager's Guide to Distribution Costs 2003)

Appendix 2 - Exhaust Emission Limits Specified by European Legislation

For Diesels over 3.5 tonnes GVW

Regulation	Vehicle registered from	CO	HC	NOx	Particulates
ECE Regulation 49	1982	14.00	3.50	18.00	
88/77/EC (Euro 1)	01/10/1990	11.20	2.40	14.00	
91/542/EC (Euro 2)	01/10/19934.50	4.50	1.10	8.00	0.36
99/542/EC (Euro 3)	01/10/19962.10	4.00	1.10	7.00	0.15/0.25
99/96/EC (Euro 4)	01/10/2001	2.10	0.66	5.00	0.10/0.13
99/96/EC (Euro 5)	Oct 2006	1.50	0.46	3.50	0.02
99/96/EC (Euro 6)	Oct 2009	1.50	0.46	2.00	0.02

Limits defined in grams per kWh

Appendix 3 - Maximum Vehicle Weights – Standard Terminology

Gross Vehicle Weight (GVW)

The maximum weight at which a vehicle is permitted to operate, as identified in the Department for Transport Plating Certificate, for vehicles above 3.5 tonnes.

Gross Train Weight (GTW)

The maximum weight at which a vehicle combination is permitted to operate.

Kerbside Weight

The weight of the vehicle in road-going condition, inclusive of water, fuel, oil, spare wheel, spares and tools, without the load and the driver weights.

Unladen Weight (ULW)

The weight of the vehicle inclusive of body and parts normally used in the vehicle operation, but exclusive of the weight of water, fuel, loose tools, equipment and batteries, where these are used to propel the vehicle. (Note: where more than one body is used, the heavier body is counted.)

Appendix 4 - Legal Constraints and Requirements

As well as ensuring that the vehicle's engineering design meets your objectives, your specification will also need to take into account a range of mandatory legal requirements. These affect key aspects such as vehicle/trailer dimensions and maximum vehicle and axle weights, as well as the type of driving licence required for particular vehicle types.

The maximum permissible weights and dimensions of goods vehicles in the UK are set out in the Road Vehicle Construction and Use Regulations 1986 (C&U). Since 1 January 1999, weight limits included in EU Directive 96/53 have been adopted by the UK as part of the Road Vehicle (Authorised Weight) Regulations 1998 (AW). The new AW rules operate in parallel with the C&U regulations and operators may choose to comply with one or other set of regulations. However, they must not combine elements of the two.

This Appendix provides an overview of the key legal requirements that will affect your vehicle specification. It is closely based on the information given in the Freight Transport Association (FTA) Yearbook 2004, which also provides a more detailed layman's explanation of the rules and regulations affecting the weights and dimensions of commercial vehicles.

(See Appendix 3 for standard terminology referring to vehicle weights).

Gross Vehicle Weight Limits

Vehicle type	Number of axels	Weight (kg) - C&U regulations	Weight (kg) - AW regualtions
1. Rigid			
- Where the distance between axles is at least 3m	2	17,000	18,000
- Otherwise	2	16,260	~
	3	25,000 (26,000 with RFS)	25,000 (26,000 with RFS)
	4	30,000 (32,000 with RFS)	30,000 (32,000 with RFS)
2. Drawbar trailers			
- Where the distance between axles is at least 3m	2	18,000	18,000
- Otherwise	2	16,260	~
	3	25,000	24,000
	4	30,490	24,000
3. Articulated			
	3	25,000 (26,000 with RFS)	26,000
	4	32,520 (35,000 with RFS)	36,000 (38,000)*
	5	38,000 (44,000)**	40,000
	6	44,000**	44,000***
4.Road-trains (large drawbar combination)			
	4	32,520 (35,000 with RFS)	36,000#
	5	32,520 (38,000 with RFS)	40,000#
	6	44,000**	44,000***#

Notes:

'RFS' means that road friendly suspension is fitted on the drive axle. As an alternative, each drive axle weight may not exceed 9,500kg (but see ** and *** below). Twin tyres must also be fitted.

* 38,000kg is permitted where the combination consists of a two-axle tractor unit and a two-axle semi-trailer, the weight of the tractor unit does not exceed 18,000kg, the weight of the semi-trailer does not exceed 20,000kg, for which an axle spacing of at least 1.8m is required, and the drive axle is fitted with twin tyres and RFS.

** Operation over 38,000kg is restricted to certain road-rail movements.

*** Operation over 40,000kg requires the axle weight of each drive axle not to exceed 10,500kg, the drive axle(s) to have RFS OR the axle weight not to exceed 8,500kg, the trailer to have RFS and each part of the vehicle combination to have three axles. (Operation over 41,000kg requires, in addition, the use of an engine complying with the Euro 2 standard or better, or a gas engine.)

The distance between the rear axle of the motor vehicle and the front axle of the trailer must not be less than 3m.

Maximum Vehicle Length (C&U regulations) Maximum Vehicle Length (C&U regulations)

Vehicle type	Max. Permited length
Rigid	12m
Articualted	16.5m
Articualted with a low loader semi trailer manufactured on or after 1st April 1991 (excluding step-frame low loaders)	18m
Car transporter semi-trailer	
King-pin to rear	12.5m
King-pin to any point on the front	4.19m
Other semi-trailers	
King-pin to rear	12m~
King-pin to any piont on the front	2.04m~
Composite trailer	14.04m~
Drawbar trailer (excluding length of drawbar) provided: 1) The trailer has four or more 2) The drawing vehicle has a maximum gross wieght over 3,500kg	12m*
Other drawbar trailers (excluding hte length of the drawbar)	7m
Road train - one trailer	18.75m**
Road train - two trailers	25.9m#

Notes:

Vehicles drawing more than one trailer are limited to 9.2m in length.

~ The dimensions include the thickness of any front or rear wall. If there is more than one king-pin position, the measurement is taken from the rearmost position on the semi-trailer, if manufactured before 1 January 1999, and from the foremost position, if manufactured on or after 1 January 1999.

* No set limit for vehicles designed to carry indivisible loads of exceptional length.

** The distance from the foremost part of the loading area behind the cab to the rear of the trailer must not exceed 16.4m and this distance, less the distance between the vehicle and the trailer, must not exceed 15.65m (this is the maximum length of the load-carrying space). The registration of new road-trains with a load space length exceeding 15.65m was precluded under EU Directive 9/53 with effect from 1 June 1998. The use of pre-1 June 1998 road-trains with a load space exceeding 15.65m will be prohibited from 31 December 2006.

Maximum Vehicle Width (C&U regulations)

Vehicle type	Max. Permited width
Motor vehicles	
Locomotives	2.75m
Vehicle constructed to carry goods at reduced temperatures with body side-walls of at least 45mm thickness	2.6m
Any other vehicle	2.55m
Trailer Provided: 1) Every wheel has a pneumatic tyre 2) The drawing vehicle has a maximum gross weight over 3,500kg 3) Every wheel of the towing vehicle has a pneumatic tyre (excluding a locomotive)	2.55m
Trailers constructed to carry goods at reduced temperatures with body side-walls of at least 45mm thickness	2.6m
Other trailer	2.55m

Maximum Vehicle Height

The maximum height of a vehicle operating solely in the UK is unrestricted. However, guidelines recommend that the vehicle does not exceed 4.2m in height in order to avoid problems with the major road network, bridges and overhead power cables. Vehicles operating outside the UK but within the EU are restricted to 4m in height.

To avoid grounding on railway level crossings, a minimum ground clearance of 160mm or 190mm is required, depending on the axle spacing.

Where a vehicle or trailer has an overall travelling height of over 3m (including the height of the vehicle, equipment and load measured from ground level), it is normally required to have a notice in the cab which enables the driver to read easily the travelling height in feet/inches or in feet/inches and in metres (but not in metres only). Where the vehicle is also fitted with high-level equipment (e.g. skip loaders or lorry-mounted cranes), it must also, unless exempt, have a warning device fitted to alert the driver if the equipment moves to a raised position whilst driving. For detailed information, contact your trade association or call VOSA on **0300 123 9000.**

Turning Circles

Generally, articulated vehicles with an overall length over 15.5m first used after 31 May 1998 and all goods vehicles defined as heavy motor cars first used after 31 May 1998 must be able to turn within concentric circles with radii of 12.5m and 5.3m respectively. A concession is allowed for car transporters due to their overhang.

The following vehicles are exempt:

- Any vehicle with an overall length not exceeding 15.5m and first used before the operative date i.e. 31 May 1998
- An articulated vehicle, with a semi-trailer that was manufactured before 1 April 1990 (and which has not been modified to increase its length since then)
- A low loader (defined as a semi-trailer normally used to carry engineering equipment and constructed so that the major part of the load platform does not extend over or between the wheels and the upper surface is below the top of the tyres)
- A vehicle constructed and normally used for exceptionally long indivisible loads
- A step-frame low loader (defined as a semi-trailer – not a low loader – constructed and normally used for engineering equipment and constructed so that the upper surface of the major part of the load platform is less than 1m above the ground)
- A vehicle having four or more axles where the distance between the foremost and rearmost axles exceeds 6.4m

Are there Delivery or Demand Fluctuations?

Vehicles first used from 1 June 1998, which are fitted with a lift axle, must now meet the turning circle requirements both with and without all the wheels in contact with the ground.

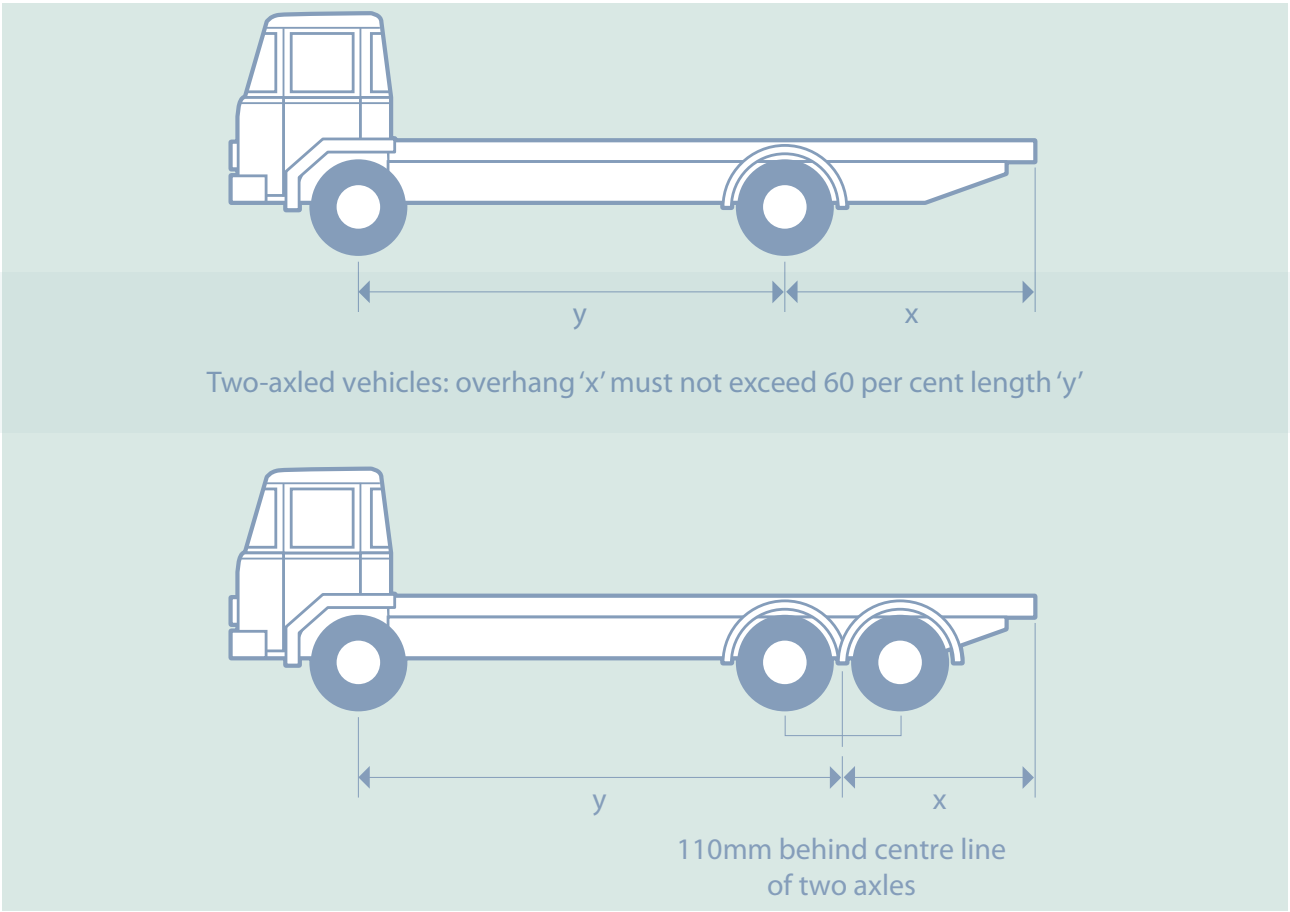
An articulated vehicle is deemed to meet the turning circle requirement if the distance from the king-pin (or front king-pin) to the centre line of the non-steering bogie does not exceed 8.135m for a 2.55m-wide vehicle.

Overhang

The rear overhang of a truck i.e. the extension of the body behind the rear axle(s), is governed by the following ratios as shown in Figure 12:

- Rigid trucks: the overhang must not exceed 60% of the wheelbase
- Multi-axle rigid trucks: the wheelbase is defined as 110mm behind the centre line of the two rear axles

Figure 12 Definition of Wheelbase and Overhang for Multi-axle Rigid Trucks



Lifting Equipment

Lifting equipment is covered by legislation, both in terms of regular inspections of the equipment (LOLER – Lifting Operations and Lifting Equipment Regulations) and user training (PUWER – Provision and Use of Work Equipment Regulations). For further information on these regulations, call the Health and Safety Executive (HSE) Helpline on **0845 3450055.**

Maximum Permitted Axle Weights (C&U and AW regulations)

Axel Type	Maximum C&U permitted Wieght (kg)	Maximum Permitted wieght (kg)
Single axle		
Fitted with a wide tyre width of not less than 300mm or fitted with twin tyres at least 300mm apart	5,090	
Otherwise	4,600	
Twin axle		
Single-tyred wheels	9,200	10,000
Twin-tyred or wide-tyred wheels	10,170*	10,000
As above, where the axle is the sole driving axle of a motor vehicle	10,500*	11,500
Tri-axle		
Axle with more than two wheels in line transversely: Vehicle manufactured before 1 May 1983 – 1 of 2 closely spaced axles or any 1 of 3 adjacent axles	10,170	
Otherwise	11,180	
Vehicle manufactured on or after 1 May 1983	10,170	10,000

Notes:

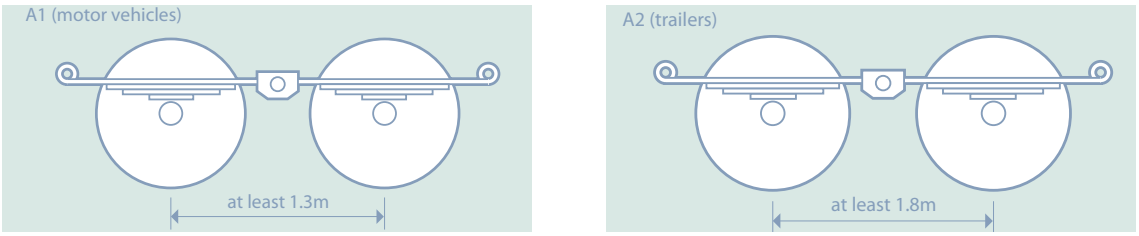
* Twin tyres must have the centres of their area of contact with the road at least 300mm apart. Wide tyres must be at least 300mm wide.

Maximum Axle and Bogie Weights

In law, axle overloads are treated with the same severity as gross weight overloads. If the vehicle is partially loaded, with the bulk of the load just behind the cab, it is likely that the front axle will be overloaded. It is important, even when partially loaded, for the goods to be evenly distributed over the bed of the vehicle. If in doubt, check load configurations at a public weighbridge or consider investing in axle-weighing equipment.

Where a number of axles are closely spaced on a vehicle, this collection of axles is referred to as a bogie. Bogie axle maximum weights are complex and relate to the spacing of a number of close axles, to give a maximum weight over the spread of the close axles, rather than a calculation axle by axle (Figure 13). The regulations apply to vehicles as well as trailers.

Figure 13 Axle Spacing



Maximum Permitted Bogie Weights

Axel Type	Maximum C&U permitted Wieght (kg)	Maximum Permitted wieght (kg)
Driving tandem axle		
	Less than 1m	11,500
	Greater than or equal to 1m but less than 1.3m	16,000
	Greater than or equal to 1.3m	18,000
	Greater than or equal to 1.3m*	19,000
Non-driving tandem axle		
	Less than 1m	11,000
	Greater than or equal to 1m but less than 1.3m	16,000
	Greater than or equal to 1.3m but less than 1.8m	18,000
	Greater than or equal to 1.8m	20,000
Tri-axle		
	Less than or equal to 1m	21,000
	Greater than 1.3m	24,000

* The driving axle must be fitted with twin tyres and road friendly suspension, or each driving axle fitted with twin tyres and no axle with an axle weight exceeding 9,500kg.

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