FreightBestPractice

Department for Transport

Fuel Management Guide

Fuel Management Guide

RHA ROAD HAULAGE ASSOCIATION

FTA FREIGHT TRANSPORT ASSOCIATION

Foreword

This guide is part of a series of FREE publications produced for the Freight Best Practice programme, funded by the Department for Transport.

Formerly known as the TransportEnergy BestPractice programme, Freight Best Practice offers **FREE** and impartial advice to help you improve the efficiency of your operation. Guides, case studies, and software are available on topics such as saving fuel, developing skills, equipment and systems, operational efficiency and performance management.

For a list of available publications, see Appendix 3. For an up-to-date list and to order your FREE publications, visit the website at www.freightbestpractice.org.uk or phone the Hotline on 0845 877 0 877.

The aim of this guide is to:

- Provide information, advice, and suggestions to improve the fuel performance of your goods vehicle fleet
- Provide information about a Fuel Management Programme and how to implement it
- Provide a checklist of key points to consider

References to other Freight Best Practice publications that provide more detailed advice can be found throughout this guide along with suggestions for other sources of information.

Contents

1 Introduction

1.1 What is the purpose of this guide?

With rising fuel bills and the importance of fuel in relation to the profits of an operation, it is important to understand and manage fuel efficiency. This guide is for fleet operators who have a variety of different levels of experience and knowledge about fuel management. It helps you establish a Fuel Management Programme tailored for your operation. It provides detailed information on the processes that need to be undertaken in order to successfully implement such a programme. Ultimately, a Fuel Management Programme has the effect of lowering costs, thus raising profits, whilst also reducing harmful emissions into the environment.

1.2 Structure of the guide

*Each Chapter of this guide has its own colour code for easy reference.

Chapter 2 – Fuel Management

Chapter 2 highlights the main factors that impact fuel efficiency, the financial aspects of a Fuel Management Programme and other related factors to consider once the decision to embark on a Fuel Management Programme has been made.

Chapter 3 – Measuring & Managing Fuel Performance

Chapter 3 illustrates the measuring and managing fuel performance process and gives commentary on how to work through the process.

Chapter 4 – Fuel Types, Purchase and Storage

Chapter 4 covers the different fuel types available and then explores the methods of purchasing and storing fuel.

Chapter 5 – Fuel Efficiency Through Developing Skills

Chapter 5 explores the role and responsibilities of a Fuel Champion and the benefits of training employees.

Chapter 6 – Equipment & Systems

Chapter 6 explores how available equipment & systems can improve fuel efficiency performance. Vehicle specification and preventative vehicle maintenance are also considered.

Appendix 1 – Checklist

A comprehensive checklist to ensure that you have covered all the aspects of a Fuel Management Programme.

Appendix 2 – Conversion Factors

This appendix provides useful conversion factors for analysing data.

Appendix 3 – Freight Best Practice Publications

This lists all the **FREE** guides, case studies, videos and software that are available from Freight Best Practice at the time when this guide was printed.

1.3 How to use this guide

The guide should be used as a reference document to learn about the different elements of a Fuel Management Programme. Therefore, it does not need to be read in one sitting and chapters have been designed so that you can turn to the relevant page when needed. In addition, case studies, examples/figures, signposts and key messages are all used to illustrate the benefits of a Fuel Management Programme and can be found by the following:

Case studies are shown in orange boxes

Examples and figures are shown in yellow

Key messages are highlighted in blue

Signposts to other Freight Best Practice publications are shown in green

2 Fuel Management

2.1 Introduction

This Chapter highlights the main factors that impact on fuel efficiency, the financial aspects of a Fuel Management Programme and other related factors that should be considered once the decision to embark on a Fuel Management Programme has been made.

It is important to realise that there are many factors influencing fuel consumption, and that awareness of these at all levels of an organisation is important if real efficiencies are to be made. The task of managing fuel use needs to be undertaken in a structured way, with a clear monitoring process in place.

The cost of fuel is an ever present concern, meaning that fuel savings continue to be fundamentally important in running a transport operation. In most road transport operations fuel accounts for at least 30% of operating costs, so fuel management is the logical place to start on the road to operational efficiency.

So what is a fuel management programme? A Fuel Management Programme (FMP) is a method to enable you to monitor and manage fuel from the point of entry to the point of use within your operations. A FMP encompasses many aspects but essentially it recognises that *fuel is a precious operational resource*. Fuel is a valuable commodity, so a FMP will enable you to keep track of your stock, fuelling and fuel usage at all times. An effective FMP covers the following four sections which are discussed in detail in this guide:

- Selection
- Purchase
- Storage
- Control

Once an effective FMP is in place, it will ensure effective monitoring and issue of fuel to vehicles and drivers and the in-vehicle use of it.

If an average large goods vehicle in the UK travels 130,000 km (80,000 miles) each year and uses diesel costing £64,000, embarking on a fuel management programme can show savings of at least 5%, meaning an average saving of £3,200 per vehicle per year.

Recently, the price of fuel has risen faster than general inflation. If this continues, the value of fuel savings will increase still further. Remember that the impact of making a five per cent saving in costs is usually magnified in its effect on profit. For example:

- If current total costs = £800,000
- Then if fuel represents 30% of costs = £240,000
- And current profit (at say 5%) = £40,000
- Then **5% saving** in fuel costs = £12,000
- Will **increase profit by 30%** to £52,000

As fuel accounts for at least 30% of operating costs, fuel management is the logical place to start in order to achieve operational efficiency.

Many operators will already have implemented a fuel efficiency programme. Early on, you should assess where you are at and target the level of savings you will be trying to achieve.

2.2 Factors Affecting Fuel Consumption

From the outset it is important to understand the main factors that have a direct effect on fuel consumption. Some of the factors are outside your control but it is helpful to understand their effects. However, other factors can be managed by your own choices and decisions. The following factors can influence fuel consumption:

2.2.1 Employees

The most influential factor on fuel consumption within a business is people. Issues affecting employees concern recruitment, training, motivation and participation in the fuel management programme. As the person driving the vehicle, it makes sense that the driver has the most significant impact on fuel consumption. Therefore, understanding and influencing their daily activities is vital to a successful Fuel Management Programme.

***Chapter 5, 'Fuel Efficiency Through Developing Skills,'** looks at how improved communication and focused training and recruitment can all go towards a more fuel efficient operation.

2.2.2 The Vehicle

Second only to the staff of an organisation, the vehicle has a significant influence on fuel performance in any operation. Therefore, the following must be taken into account:

- Vehicle specification – such as gross vehicle weight, vehicle size, engine specification, engine power and torque, gearbox and final drive ratios
- Age of vehicle -the relationship between mpg and age of vehicle may vary between different makes and models. The 'running-in period' of new vehicles also varies. Some vehicles need more 'running-in' than others before they perform at their best
- Condition of the vehicle – such as engine transmission, axles and tyres
- Operational details – such as the dimensional match between tractor and trailer
- Equipment and products used – such as lubricants, telematics and aerodynamics

***Chapter 6 'Equipment & Systems'** explores the actions that can be taken to benefit fuel consumption in relation to vehicle specification, equipment and systems.

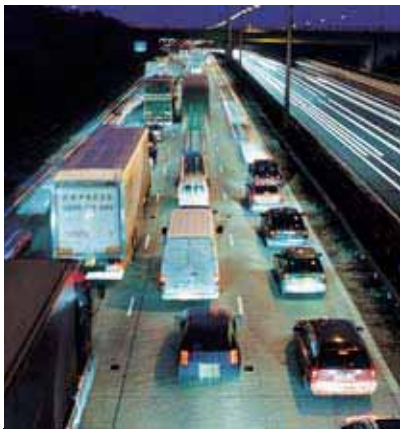
2.2.3 The Load

The load being carried will naturally affect a vehicle's fuel performance. Total weight is the critical factor, and this often changes during the journey as deliveries are made. Also, if the load is on a flat trailer, dropside body or tipper, its dimensions and outline profile will have an effect too. On these types of body, sheeting a load or an empty tipper body can save fuel because it reduces aerodynamic drag. Varying the load on each axle can also impact fuel consumption. In the case of high-volume trailers, there is a trade-off between increased payload capacity and the effect on fuel consumption, which, depending on the circumstances, may make them an attractive proposition.

In addition, strategic load decisions can be used to improve efficiency, for example back-loading. If an

operator is able to organise its deliveries and collections in such a way that it can do a number of back-loads, this can reduce the number of vehicles required, and thus use less fuel in the process. A number of food and non-food retailers have started collecting products from their suppliers after deliveries have been completed. While there is a slight increase in the journey length due to the diversion, overall there is a saving, in that the supplier no longer needs to be paid for the delivery element. The case studies below demonstrate how some operators are achieving operational efficiency as a result of backloading.

***Chapter 6 'Equipment and Systems'** considers vehicle specification in more detail.



2.2.4 Routes and Traffic Conditions

Road type and traffic conditions will also have a significant affect on fuel consumption. Slow and tortuous routes through hilly terrain will drag down the fuel performance of even the best vehicles.

As a rule of thumb, the more times a driver has to change gear, brake or accelerate, the worse the fuel consumption will be. A busy urban environment will also have an impact on fuel consumption because there is a lot of stopping and starting, with the vehicle losing its momentum.

Variations in traffic congestion can also create differing performance results even though the route is the same. This is normally noticeable between day and night operations.

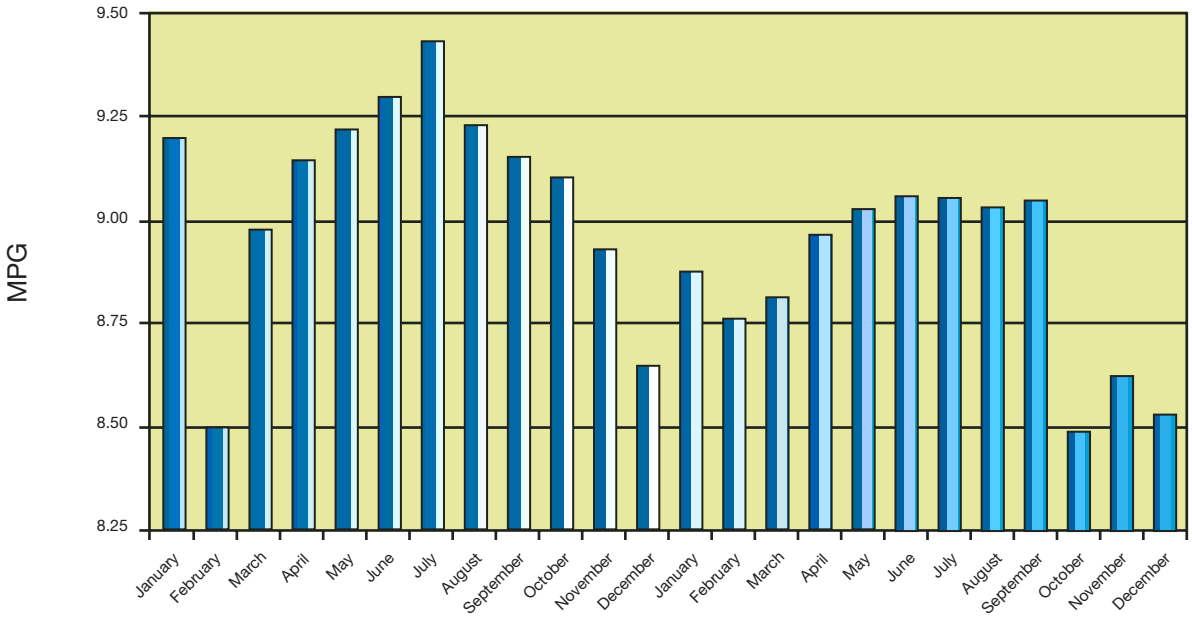
***Chapter 6 Equipment & Systems** considers vehicle telematics and how they can help efficiency through route planning.

2.2.5 Weather and Seasonality

Weather and seasonality are also other factors influencing fuel consumption. These need to be considered when comparing data gathered during different weather conditions. Seasonality affects performance, with the best consumption figures in summer and the worst in winter. Cooler temperatures and the shorter days in winter can result in the greater use of auxiliary equipment and drivers leaving the engine idling to keep their cab warm when parked.

Where there is a change from 'summer grade' diesel fuel to 'winter grade' it can be expected to contribute to a difference in consumption in the order of 3%. This is due to the difference in specific gravity between winter and summer fuels. Performance in the

Fig 2.1 Seasonality in a large fleet (Courtesy of the University of Huddersfield)



winter months can be as much as 10% poorer than in the summer months.

***Chapter 3 'Measuring and Managing Fuel Performance'** considers seasonality and other factors that alter the performance of vehicles when analysing data.

In addition, there are other factors that may affect the fuel consumption of your business. However, these other factors may be specific to your organisation and therefore are not dealt with in this guide. However, if you do identify any other factors do not hesitate to include them within your Fuel Management Programme.

2.3 Understanding Fleet Costs

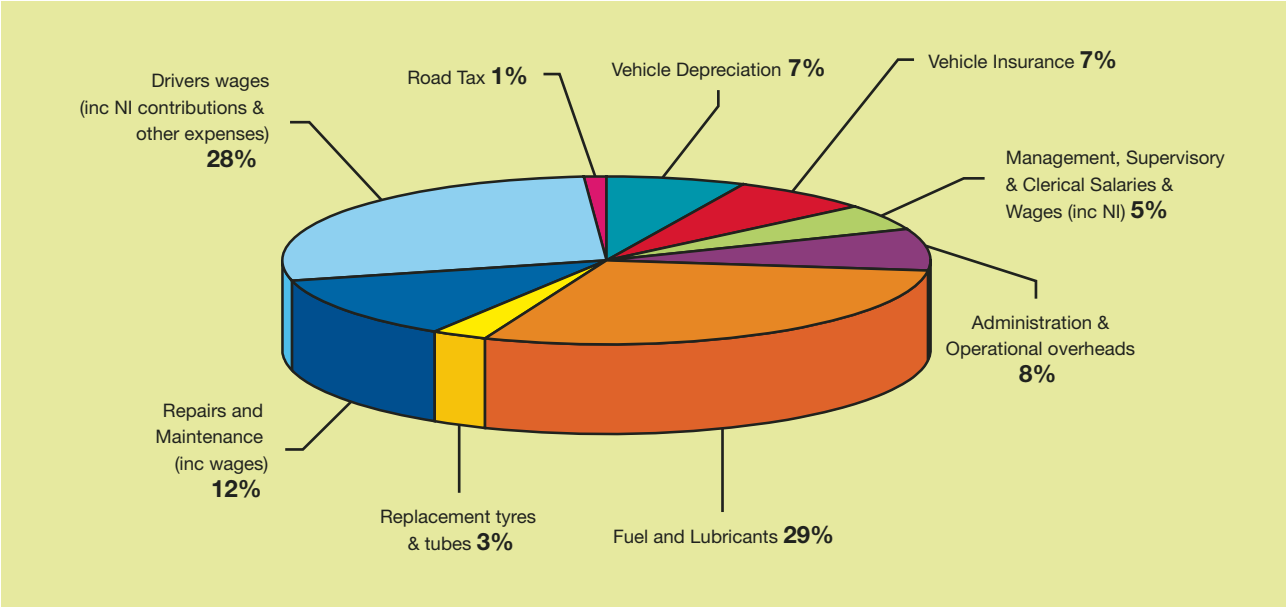
There are a number of financial implications associated with a Fuel Management Programme. The following section provides guidance to help you develop cost justifications and financial targets for your programme. Although there are slight variations because of geographical location and the quantity purchased, transport operators pay similar prices for fuel purchased in the UK. So better fuel management will lead to increased competitiveness within the market and improve your financial performance. Remember that a small improvement in fuel usage can generate a large increase in profitability.

2.3.1 Understanding Your Current Costs

Before you can calculate the potential benefits of a Fuel Management Programme, you must understand your current costs. Trade magazines regularly publish cost tables giving you typical cost breakdowns. Ideally, you should use your own cost figures, but if you are unsure of them, the published ones can be useful examples.

Figure 2.2 below shows the breakdown of the annual operating costs of a typical large fleet with a variety of vehicles.

Fig 2.2 Typical Operational Costs



The diagram is based on the figures contained in the Road Haulage Association (RHA) Goods Vehicle Operating Costs 2006. Although no two operators have identical operating costs, these figures are representative and show how the various elements combine to make up the total.

Table A overleaf shows various elements of operating costs for a 44 tonne articulated vehicle. We have calculated the average price of fuel as 80p per litre (excluding VAT).

Table A: Example of Annual Operational Costs of a 44 Tonne GVW Articulated Vehicle (6x2 Tractor + Tri-Axle Trailer)

Data	**Average Figures**	
Vehicle price (representative)	£70,000	
Average depreciation period (years)	6	
Average miles per annum	69,000	
Average days worked per annum	240	
Average miles per gallon	6.9	
Average tyre life (miles)	65,000	
Costs		
Time-Related Per Annum	**£**	
Wages: 55 hrs per week inc NIC	25,500	
Depreciation	11,670	
Licences (£640, combined transport)	1,200	
Vehicle insurance	6,780	
Goods in transit insurance	450	
Interest on capital (7.5%)	2,625	
Overhead per vehicle	18,900	
Total Time Related Costs	67,125	
Time Cost Per Day	280 + 11 for tri-axle curtainsider trailer	
Mileage-Related		**Trailer**
	ppm	ppm
Fuel	49.6	
Tyres	1.5	2
Repairs and maintenance	7.5	3.3
Total Mileage Costs	58.6	5.3

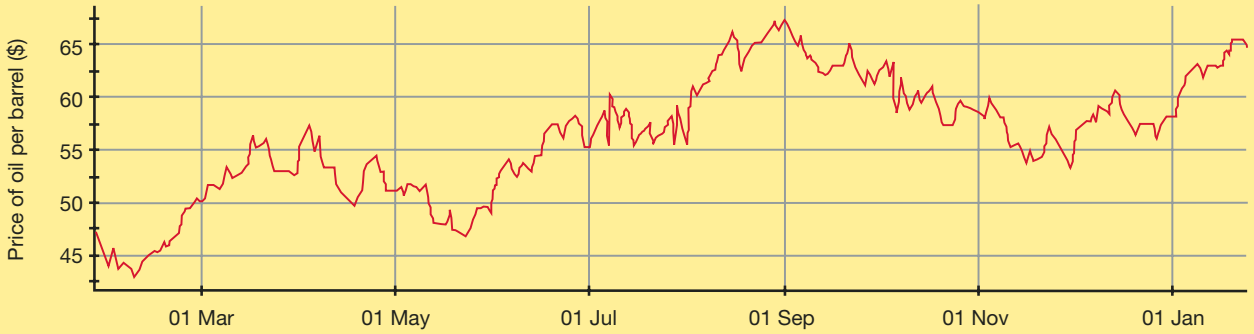
2.3.2 The Effect of Rising Fuel Prices

As fuel plays a fundamental role within a transport or logistics organisation, making up approximately 30% of operational costs, the fluctuation of the price of fuel can have a marked effect on the profits of the company. It is impossible to forecast crude oil prices accurately because there are so many unpredictable factors at work, including political instability, level of world demand, and policy decisions on production volumes by the major oil-producing countries.

This means that an investment in an efficient fuel management programme may pay greater dividends in the future.

Figure 2.3 outlines fluctuations in crude oil prices.

Fig 2.3: Brent Crude Oil



2.4 Implementing a Fuel Management Programme

In addition to financial aspects, when introducing a fuel management programme you will almost certainly be changing some element of the culture of the organisation. One of the main aims must be to develop the drivers so that they drive naturally and automatically in a fuel efficient manner. Therefore, management must provide support and encouragement, making it clear that the organisation encourages safe and fuel-efficient driving as part of the company culture. In turn, management must recognise that fuel costs and usage are manageable and respond by using the same techniques and disciplines as any other management issue.

2.4.1 Commitment

Implementing a fuel management programme may require senior management to make a clear and public decision giving practical fuel management the priority and commitment it requires. Once convinced, the backing for a Fuel Management Programme should ideally come from many parts of the business, including the board. If you are unionised, make sure the trade union is also involved in the programme.

Success is more likely when drivers and those involved feel that the whole organisation is committed to fuel efficiency in everything it does. Therefore, highlight other instances of good practice and its impact elsewhere in the organisation. You should also make fuel efficiency a criterion for selecting company cars. In addition, a driving course for senior management company car drivers sends out a powerful message as well as paying for itself in fuel savings.

2.4.2 Justifying the Investment in a Fuel Management Programme

Achieving fuel savings requires an investment of time, effort and money. Financial expenditure on fuel saving devices or new vehicles is easy to quantify, however hidden costs also exist, which will be more difficult to identify. Such costs include investment in management, clerical and operative time and training. Establishing these costs at the beginning of the project will help you set targets, which will be helpful when monitoring the performance of the programme. A simple approach to evaluating the costs and benefits is the ‘payback’ method as shown in figure 2.4, which looks at the costs and the time taken to generate savings to cover those costs.

This is a very simple method which ignores factors such as inflation, cash flow, interest charges, changes in stock levels etc. Although it lacks detail and precision, it is a quick and easy way of assessing the broad feasibility of the project. Some companies are prepared to accept a longer payback period than others; a two-year period is often quoted as a rule of thumb to decide whether the project is viable.

Figure 2.4: Payback Period Example

A company decided to invest in aerodynamic equipment for one of its articulated vehicles.

The capital cost per vehicle involved was £1,100 and the fuel used by the vehicle cost £50,000 per year. Tests showed an average saving of 3% on fuel through using the aerodynamic equipment.

- **Investment:**
  Aerodynamic Equipment £1,100 including fitting
- **Estimated fuel savings:**
  £1,500 per year (3% of £50,000)
- **Pay back period**
  Approximately 9 Months

In addition to direct financial benefits, driving in a fuel-efficient manner can improve safety and extend the life of the vehicle's driveline, brakes and tyres. This could result in a reduction in the costs of accidents, maintenance, repairs and downtime. Your insurance company may be prepared to discount the insurance premium if it has evidence of a driver-training programme, so it is worth checking with the insurer first to see if it has an agreement with a particular training provider.

It could be sensible to specify a driver training course that specifically combines fuel economy with safe driving. Some operators have even used the improvement in fuel economy as a commercial tool to emphasise the contribution they are making to the environment. Thorough communication between drivers and management is part of a good fuel programme. If handled well, there is a potential spin-off, because it may lead to a better understanding of the operation and an active team atmosphere. Indeed, some organisations have used fuel efficiency as a means of changing the driver culture within their organisation.

If you can provide evidence of a successful driver training programme, your insurance company may discount your insurance premium

2.4.3 Coordination of Green Policies

Most organisations will want to use their social responsibility towards the environment as a commercial tool. Many will have environmental policies in existence already. The Fuel Management Programme can be linked directly to that programme, since one obvious effect of reducing fuel consumption is to reduce the amount of harmful emissions being released into the environment. Government has set up an accreditation system that acknowledges companies' dedication to helping to reduce harmful emissions.

*For more information see the Energy Saving Trust website www.est.org.uk.

2.4.4 Appointing a Fuel Champion

On deciding to embark on a Fuel Management Programme a person should be appointed to be responsible for the project. This person is normally called a 'Fuel Champion'. They ensure that there is always a focal point and that somebody is responsible for tracking the progress of the programme, especially when other business pressures require management's time.

The 'Fuel Champion' is an important part of successfully managing your fuel performance. They must have sufficient authority and responsibility to ensure that the programme is successfully implemented. If you do not wish to appoint a formal 'Fuel Champion', you must ensure that the programme has sufficient impetus to be successful despite the absence of a single focal point.

*See **Chapter 5 'Fuel Efficiency Through Developing Skills'**, for training the Fuel Champion and his/her roles and responsibilities.

Fuel Champion communication is key.

2.4.5 Communicate Progress & Developments

You should talk regularly to drivers and management about their progress and support transport managers in any initiative they take to improve fuel performance. A clear indication that fuel management is important to senior management will help to encourage everyone in the organisation to do their part.

2.4.6 Performance Management

Once you have assessed the financial aspects of a Fuel Management Programme, identified the direct factors on fuel efficiency and made the decision to embark on a Fuel Management Programme, you will then need to measure your performance on fuel efficiency.

***Chapter 3 'Measuring and Managing Fuel Performance'** gives guidance on the factors and key performance indicators that are relevant to a Fuel Management Programme and the procedure of continuous monitoring.

2.5 Summary

It remains to be seen whether the historical trend of fuel costs rising above inflation continues into the future. In times when consumer prices are static or even declining, there may be pressure on transport operators to reduce their rates instead of increasing them to cover any increase in fuel costs. This only serves to make the principle of fuel efficiency even more important.

This Chapter has established the first considerations to take into account when considering a Fuel Management Programme. Therefore, by analysing the factors affecting fuel consumption, finance and the issues discussed when embarking on a Fuel Management Programme, you have taken the first step on the ladder which leads to operational efficiency.

See the **FREE** Freight Best Practice publications:

Fuel Saving Tips

Save It! Road to Fuel Efficiency & Champions of Fuel Video

Fuel Management for Transport Operators
Fuel Saving Devices

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

By analysing the factors that affect fuel consumption and finance, you have taken the first step on the ladder which leads to operational efficiency

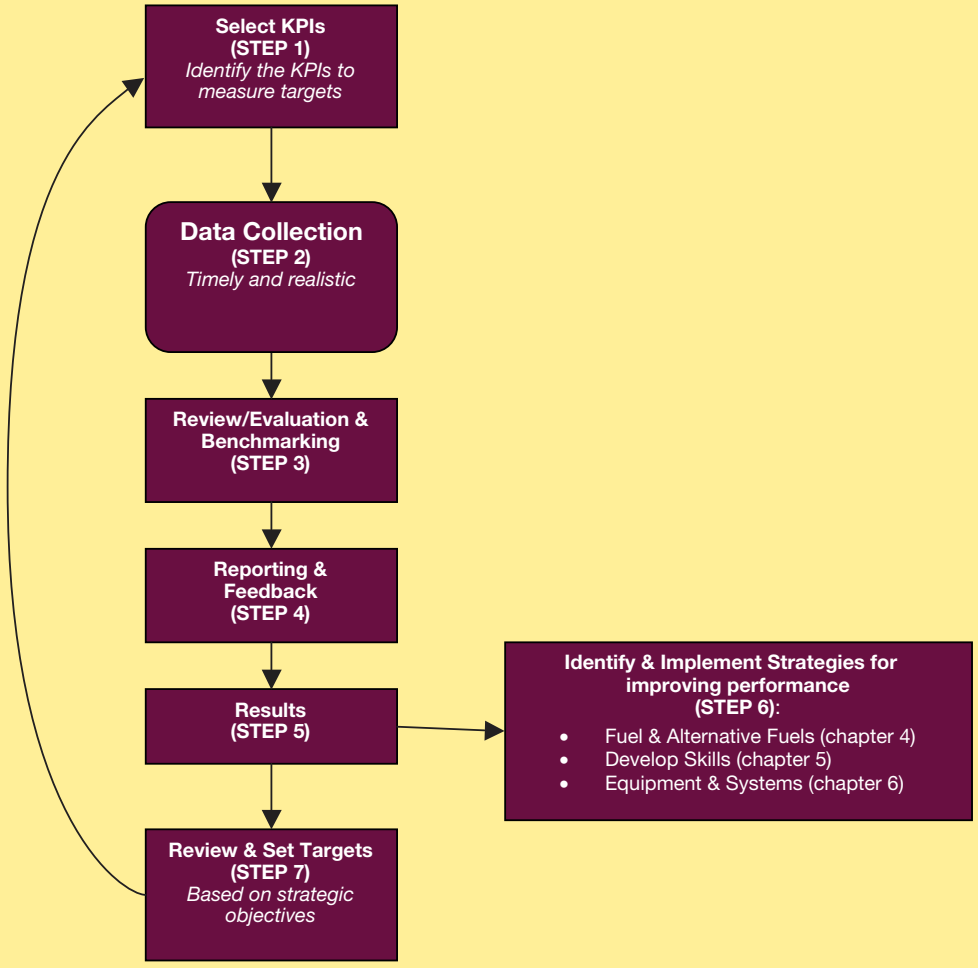
3 Measuring & Managing Fuel Performance

3.1 Introduction

The more you understand about how factors affect your fuel efficiency, the more control you will have over them. This is why it is helpful to create and implement a performance management process in order to identify any problem factors within your operation. Once identified, you can take action against these deficiencies. It is important that you set up this process before introducing new practices and systems into your operation. This will help you target the identified problem areas better instead of wasting valuable resources in areas that are performing well.

A simple set of principles has evolved from different performance measurement systems. Figure 3.1 establishes the relationship between those principles to enable a systematic process of monitoring and

Fig 3.1: The Fuel Performance Measurement & Management Process



targeting. The rest of the chapter gives commentary on each of the individual principles. It is important to realise that this process is a continual progression that enables an operation to improve its efficiency and increase its profits on an ongoing basis.

3.2 (STEP 1) Selecting Fuel Management Key Performance Indicators (KPIs)

The first step in measuring and managing performance is to select the correct KPIs for your operation. KPIs provide a consistent basis for measuring operational efficiency across the fleet by comparing like with like. There are many areas of fuel management which can be subject to KPIs.

KPIs need to be kept simple and easy to measure. In addition, operational staff members need to see real value in monitoring fuel performance levels. If they are immersed in recording too many obscure individual KPIs, they are likely to lose sight of the purpose of the Fuel Management Programme. To be effective KPIs need to be relevant and reliable. They must provide information that is useful for improving the fuel efficiency of the operation. Do not fall into the trap of recording information for the sake of it. It must be useful as a means to assess performance.

The best KPIs are those which are easy to understand and where measurement is straightforward and unaffected by too many outside factors

The easiest KPIs are those where measurement is straightforward and unaffected by too many outside factors. Examples would include bulk tank fuel losses where the figures might be measured each week with a requirement to investigate and resolve any losses over a target figure. More complicated measures would include monitoring vehicle performance. The simplest way is merely to take current performance and demand an improvement.

This takes into consideration only what has actually been achieved rather than what is achievable. Where the routes, loads and factors are consistent, it may be possible to set up standard targets by route, using your best driver to set the target for everyone else. However, this will not take into account seasonal and other outside influences and will need to be interpreted very carefully. A more sophisticated approach is to use 'Energy Intensity' as an indicator. This is defined as:

Fig 3.2: Energy Intensity Indicator

Fuel Consumed
÷
Tonnes Carried x Distance Travelled
=
Energy Intensity*

*This is normally measured as litres per tonne kilometre

Good performance management can focus the attention of management on poor performing areas, and give positive feedback enabling improvements. The Small Fleet Performance Management Tool (SFPMT) is a user friendly spreadsheet that includes 22 KPIs covering five core areas of:

- Costs
- Operational
- Service
- Compliance
- Maintenance

It produces weekly, monthly and annual reports and charts that clearly show what is going on in your business. The results will indicate whether improvements could be made that will reduce your costs and improve efficiency.

See the **FREE** Freight Best Practice publication:

Small Fleet Performance Management Tool

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

A1 Paper Plc and Performance Management

A1 Paper is a leading paper stockist and distributor based in the West Midlands. The company has a turnover of approximately £9 million and employs 50 staff, including 11 drivers. In order to achieve efficiency and improve the fuel performance of their fleet, the Small Fleet Performance Management Tool (SFPMT) is being used to help them monitor how much they spend per vehicle on maintenance, tyres, insurance and perhaps most importantly, fuel.

The SFPMT provided the company with the information to fully understand their operation and costs. Because monitoring showed increasingly high fuel costs, A1 Paper recognised the potential of improving fuel efficiency through training and took the decision to put their drivers through the Safe and Fuel Efficient Driving (SAFED) programme. They have also applied aspects of the Freight Best Practice 'Fuel Management Guide' in their drive to reduce fuel consumption. Drivers are trained and updated on a regular basis to ensure the continuous improvement of their operation.

Average fuel efficiency across A1 Paper's fleet increased by 29.2% between 2004 and 2005, and the company has saved 3,123 gallons (12178 litres) of fuel. This represented a cost saving of £13,444 (based on approximately 95 pence per litre), and equates to a saving of 38 tonnes of CO_2 (based on 2.68kgs of CO_2 per litre).

"Our transport team now operates as professionals. Thanks to the SFPMT we are now seeing rewards in reduced fuel use, greater staff retention and much better overall operational efficiency." John Claffey (Transport Manager, A1 Paper).

Whatever approach you decide to take we recommend that you start with simple KPIs, understand their limitations and in time develop your own measures appropriate to your specific business needs.

The Freight Best Practice programme has undertaken a series of benchmarking projects that measured five KPIs in the pallet network sector, non-food retail sector and food retail sector. The KPIs measured typically included vehicle fill, empty running, time utilisation, deviation from schedule and fuel efficiency. A summary of the results from the projects is presented in Table B. You can find out more about the results from the guides listed below and about the two new KPI surveys in the parcel sector and the construction sector.

The following section explains how you can use your KPIs effectively to collect, review, evaluate, and benchmark your data and then report and feedback on the results of that data. This will enable you to then review and set your targets and consider any strategies that can improve your performance. Each stage of the measuring process is discussed below.

Table B

KPI	Pallet networks	Non-food retail	Food retail
Vehicle fill	73%	51%	53%
Empty running	8%	11%	19%
Productive time utilisation	46%	38%	28%
Deviations from schedule	35%	19%	29%

See the **FREE** Freight Best Practice publications:

Key Performance Indicators for the Pallet Sector

Key Performance Indicators for the Non-Food Retail Distribution

Key Performance Indicators for the Food Supply Chain

Small Fleet Performance Management Tool

Small Fleet Performance Management Tool Helps A1 Paper Improve Efficiency

In-Fleet Trials of Fuel Saving Interventions for Trucks

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

Below are some examples of fuel record collection sheets. Other examples of spreadsheets and reports can be viewed in the review and evaluation section of this chapter.

3.3 (STEP 2) Data Collection

3.3.1 Accurate Data Collection

Collecting accurate data is an essential part of improving fuel efficiency. If the data is collected inaccurately, the whole process will be of limited use. The following steps are recommended:

- Setting up a system for collecting data
- Making sure data is collected accurately
- Cleaning-up data
- Analysing and interpreting the data

In principle, the main options for data collection are:

- Manual data collection
- Electronic data collection – via fuel pumps or telematics
- Fuel cards

In reality, an organisation's data collection systems are normally a mixture of the above options. You should ensure that once the data is collected you input the

Example 1: Fuel Stock Record Sheet

Depot Number: _____ Date: _____

Tank Number: _____ Week: _____

Week Number	Tank Dip (litres)	Deliveries (litres)	Cumulative Meter Reading	Issues (litres from the tank)	Balance (Estimated litres in the tank)	Gain/Loss (litres)	Cumulative Gain/Loss (litres)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1,965	12,000	94,163				
2	11,130		96,977	2,814	11,151	-21	-21
3	9,000		99,099	2,122	9,008	-8	-29
4	6,295		101,786	2,687	6,313	-18	-47
5	4,230	12,000	103,749	1,963	4,332	-102	-149
6	13,830		106,256	2,507	13,723	107	-42
7	10,895		109,172	2,916	10,914	-19	-61
8	9,375		110,684	1,512	9,383	-8	-69
9	7.380		112,643	1,959	7,416	-36	-105
10	4,630			2,764	4,616	14	-91
TOTAL ISSUES	21,244		Cumulative Gain/Loss	-91		% Gain/Loss	-0,4%

Example 2: Manual Pump Issue Sheet

Date: _____ Depot: _____

Date	Time meter	Pump Meter	Start (litres)	Pump Meter End (litres)	Fuel No	Veh Reg No	Tacho (km)	Driver name	No	Signature
16 Feb	6.30	497698.5	497854.8	156.3	23		112.822	M.R.	1	
16 Feb	7.15	497854.8	497916.2	61.4	22		654.761	R.R.	23	
16 Feb	7.20	497916.2	498097.1	180.9	17		157.788	P.B.	11	
16 Feb	7.25	498097.1	498321.8	224.7	5		75.664	P.W	2	
16 Feb	7.45	498321.8	498344.1	22.3	15		372.688	B.T	12	
16 Feb	8.00	498344.1	498441.4	97.3	1		762.990	T.O.	37	
16 Feb	13.45	498441.4	498596.7	155.3	20		31.886	T.D.	5	

Example 3: Manual Vehicle Weekly Fuel Sheet

Vehicle Reg: _____ Month: _____ Year: _____

Fleet No: _____ Speedo reading at last fill up: _____

Please record ALL fuel purchases for this vehicle from whatever source received. This sheet must remain with the same vehicle for the week. Please print details clearly.

Date	Speedo reading	Fuel (litres)	Driver		Signature	Fuel from	Pump reading (end)
16 Feb	372,688	22.3	Thompson	12		Depot	498344.1
16 Feb	372,808	37.5	Arthur	7		Depot	499949.8
17 Feb	373,085	96.0	Arthur	7		Depot	500865.3
18 Feb	373,453	111.2	Arthur	7		Depot	503544.9
19 Feb	373,710	20.0	Arthur	7		Stavid s/s	Off site
19 Feb	373,767	86.0	Arthur	7		Depot	507766.1

Please note:

1. You must fill up completely at the end of each shift.

2. Hand this form to the supervisor at the end of each week with all agency tickets.

3. Collect a new sheet and enter the last mileage immediately.

4. Note any unusual factors affecting your fuel consumption, such as traffic jams, very poor whether, etc.

*Commentary on how to analyse Exception Reports, Detailed Monthly Analysis, Summary of Vehicle Group and Driver League Tables can be found in the section below (Review and Evaluation).

Fig 3.3: The perils of averaging – An example of errors in data processing

By averaging MPG rather than using raw data, Company X thought that its performance was better than it actually was. The following example of averaging the performance of six vehicles over a week demonstrates the problem:

Vehicle 1 travelled 742 miles using 73.2 gallons of fuel, achieving 10.14 mpg

Vehicle 2 travelled 626 miles using 57.6 gallons of fuel, achieving 10.87 mpg

Vehicle 3 travelled 1,746 miles using 222.4 gallons of fuel, achieving 7.85 mpg

Vehicle 4 travelled 1,463 miles using 173.5 gallons of fuel, achieving 8.43 mpg

Vehicle 5 travelled 1,562 miles using 210.0 gallons of fuel, achieving 7.44 mpg

Vehicle 6 travelled 2,050 miles using 265.1 gallons of fuel, achieving 7.73 mpg

Total over the six vehicles over the week = 8,189 miles and 1,001.8 gallons

Simply averaging the individual vehicle weekly MPG figures gives a result of 8.74 mpg (52.46 ÷ 6). However, as each vehicle has run different mileages the true fleet MPG is revealed by totalling all mileage and dividing by all fuel used. This reveals that the actual fleet performance is 8.17 mpg (8,189 ÷ 1,001.8) – a difference of 0.57 mpg or 7%.

relevant data into a spreadsheet or other mechanism for organising it. This will not only ensure you don't lose the data but it will also make the reporting and analysing process easier.

3.3.2 Potential for Data Collection Errors

Errors are likely to occur from time to time either from measuring equipment or operator error, so it is important to take this into consideration when evaluating the results. Often pressures can be the cause of data entry errors. A conscious check on the figures is recommended so that any unusual figures can be checked for reliability. It is also advisable for another person within the operation to periodically monitor the accuracy of the data entry to highlight any errors. Good housekeeping and strong procedures, helped by all involved knowing the importance of doing it right, can go a long way to reducing the problem.

Data errors can be caused by equipment, systems or individuals. For example a common mistake is illustrated in Fig 3.3 above.

3.3.3 Equipment & System Errors

Computers and technology are not always accurate in the data they collect. Other factors can have an effect on the accuracy of the data, but these factors are not taken into account by the equipment. Therefore, you should understand what these factors are and make sure that you take these factors into account when reviewing the data.

Tachographs can illustrate this point. They have to be accurate to within 2% on distance reading when fitted, but a tolerance of up to 4% while in use is permitted. This extra latitude is to allow for the tyre wear that occurs on the drive axle. For example, a typical 295/80R22.5 tyre with 4mm of tread left has a circumference that is 3% smaller than when it was 19mm when bought. So as the tyre wears the tachograph progressively overestimates the distance travelled, giving an optimistic view on fuel consumption. It is easy to spot inaccuracy in this case by running a variety of vehicles on the same route.

Invest in the best data collection system you can justify, taking into account time spent and potential fuel savings

Another routine source of system inaccuracy is the data received from fuel dispensing pumps. The main reason for this is that in-house pumps do not have to conform to the standards that apply to garage forecourt pumps. If you have various in-house pumps this can result in different levels of accuracy, depending on the pump used. Therefore, pump recalibration is recommended at least every year, but ideally every six months.

Inevitably, from time to time equipment breaks down. Therefore, it is a good idea to have a contingency plan to collect data when repairs are taking place. This may be in the form of manually collecting the data or dismissing that period from the fuel reports.

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Computerised Vehicle Routing and Scheduling (CVRS) for Efficient Logistics

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3.3.4 Operator Errors

Operator errors can easily be made through carelessness or time pressure. Common errors include entering incorrect odometer readings into fuel monitoring systems, failure to record off site filling information and poor procedures such as failing to re-fuel at the end of a shift. These errors can be minimised by good housekeeping and strong procedures, by highlighting to everyone involved the importance of doing things correctly.

Fig 3.4: Checklist to minimise errors

Here is a quick checklist to highlight points to consider to avoid fuel data errors:

- Is there an audit trail?
- Is the method of data entry consistent for all people involved?
- Do those people have the authority to take action such as querying the drivers, checking tachograph function etc?
- Who is responsible for accepting fuel deliveries?
- Is the fuel island well managed or is it untidy or congested?
- Does the pump dispense quickly enough?
- Does the fuel froth unacceptably?
- Is the fuel island on level ground?
- Is the island well lit and is it easy to read the pump readings?
- Have all drivers been briefed to fill vehicles to an identical level?
- Have agency drivers been briefed on fuel management procedures?

3.3.5 Cleansing Data

Unfortunately, no matter how carefully raw pump data is collected, it is rarely 100% accurate. Newer systems incorporate various checks to reduce the likelihood of keying errors. Without these, it has been found that up to 20% of transaction records collected automatically from a fuel pump system can be inaccurate.

Errors in odometer readings are usually corrected later by reference to the next reading. On the other hand, errors such as missing or mis-keyed fuel data will not be corrected unless the error is spotted and can be rectified manually.

Apart from using an outside organisation to check the raw data for you, the only real alternative is to check every transaction (the fuel performance based on the

fuel drawn compared with the distance travelled since last fill) and review every result which is outside a norm of, say 25%, from the average performance. You can use a simple spreadsheet to undertake this task.

Provided the fuel recording system is working and set up correctly, the number of litres dispensed and the date/time should be recorded without a problem. Errors creep in when the odometer reading has to be entered manually, or where the incorrect identification has been used for the vehicle or driver.

Newer systems can deal with this by automatic mileage download (such as a radio data link download taking information from the tachograph) and automatic vehicle and driver recognition.

Most systems can be set up to estimate odometer readings and query those that fall outside a predetermined range. This will often detect common errors, such as simply transposing two digits of the odometer reading. If the vehicle's fuel performance is occasionally much better than expected, this may be due to the vehicle fuel tank not being filled completely because the driver knows he is 'only doing a local run tomorrow'.

Only clear procedures and good disciplines will prevent this. The next entry should compensate for this and show a worse than usual figure. However the two together would give a 'usual' result. This is referred to as a 'compensating error'. Sometimes it may be a considerable period of time before the tank is next filled fully and 'compensating errors' eliminated. Exception reports will help to identify those drivers not carrying out the procedures properly and will help the Fuel Champion to take measures to eliminate these problems.

3.4 (STEP 3) Review, Evaluation & Benchmarking

As mentioned in the previous section there should be a continuous process of data collection, so that a detailed picture can be created. In terms of the review period, this can take the form of weekly, monthly and yearly comparisons. It should be noted that comparisons should take into account external circumstances such as weather conditions that may make the fuel consumption increase. In a larger company a comparison between different depots could be made.

Analysing the collected data can be a time consuming process that requires a certain degree of skill. Therefore, the Fuel Champion must be prepared to devote their time to this process. As a result the company will undoubtedly benefit from the analysing process.

The following series of forms can help with the process:

- Exception report
- Detailed monthly analysis
- Summary report for vehicles (by group)
- Driver league table

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Small Fleet Performance Management Tool

Small Fleet Performance Management Tool Helps A1 Paper Improve Efficiency

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3.4.1 The Exception Report

To save the Fuel Champion working through the detailed entries, exception reports can be used to highlight all entries where the consumption is outside an acceptable range. The exception report in this case has been set at 25% variance above or below the target mpg for each vehicle. Each of the exceptions identified should be cross-referenced to the detailed monthly analysis to try and identify the cause of bad performance. Remember to adjust the target to compensate for seasonal variances and where the system allows, for other measurable variables.

If you have sufficient historical data, you can look at the seasonal variation for your own fleet. All these exceptions should be thoroughly investigated to

Example 4: Exception report – Monthly Analysis

Vehicle ID	Plate	Driver ID	Fill Date	Speedo Reading (km)	Distance covered (km)	Fill Qty (ltrs)	Fill Point	Average l/100km	Target mpg	Actual mpg	Actual Variance	Exceptionally Good Performance	Exceptionally Poor Performance
14		05	19/02/05	234911	337	206		61.13	7.96	4.62	-41.96%		X
15		12	16/02/05	372688	46	22.3		48.48	9.10	5.83	-35.9%		X
17		05	23/02/05	64367	88	43		48.86	8.09	5.78	-28.6%		X
20		08	10/02/05	360145	182	50		27.47	8.02	10.28	28.2%	X	
22		10	11/02/05	30532	127	13		10.24	16.24	27.6	70%	X	
22		99	12/02/05	30623	91	20.7		22.75	16.24	12.42	-23.5%		X

*Exceptional performance could be regarded as any performance more or less than 25% of the target.

discover the reasons for the variances. Remember to check first for compensating entries, for example where the first driver did not completely fill the vehicle. The driver would get a good consumption and the next driver who does fill to the top of the tank would be penalised. Where driver league tables are used, these part-fills give incorrect figures. The driver should be told and the results excluded from the table.

Shorter distances often give poorer consumption results as they usually involve more stop/start work and may include a disproportionate amount of 'depot work' which generally gives poor fuel consumption. Example 4 above shows this could be the reason for high variance and poor consumption.

Poor weather, heavy loads, bad traffic, etc are often the reason for a drop in performance. Therefore, where possible you must investigate. If the daily driver sheet allows for these circumstances to be recorded, refer back to them. It is important to look for trends, so keep the monthly reports and see whether there is a pattern, e.g. the same driver in a particular vehicle on a particular job. Remember that poor weather should give poor results for all vehicles in that area on the same day.

3.4.2 Detailed Monthly Analysis

Once a problem entry has been identified, the records for the vehicle should be checked in detail. This is best done at the level of data where you can see every fill-up for each vehicle (transaction data). Example 5 displays the spreadsheet for vehicle detail monthly analysis.

Obviously, if you are capturing the detail manually, you will have this level of detail. Most electronic systems will also give data to this level. You should make sure that you retain historical data to this level.

3.4.3 Summary by Vehicle Group

This is a simple analysis of vehicle monthly performance shown by vehicle grouping. These figures are ranked within group from 'best' to 'worst', relative to each vehicle's individual target.

Example 5: Detailed Vehicle Monthly Analysis

Driver ID	Fill Date	Speedo Reading (km)	Distance covered (km)	Fill Qty (ltrs)	Fill Point	Consumption Performance				Code Notes
						Average l/100km	Target mpg	Actual mpg	Actual Variance	
Vehicle ID: Plate:										
07 Dave	03/02/05	370829	314	94.00		29.94	9.1	9.44	3.7%	
07 Dave	04/02/05	371143	314	100.80		32.10	9.1	8.80	-3.3%	
07 Dave	05/02/05	371457	314	106.00		33.76	9.1	8.37	-8.0%	
07 Dave	06/02/05	371625	168	57.40		34.17	9.1	8.27	-9.1%	
07 Dave	09/02/05	372018	393	126.30		32.14	9.1	8.79	-3.4%	
Summary for 5 Plate:			1503	484.5		32.42	9.1	8.73	-4.02%	

*The conversion rates can be referenced in Appendix 2 of this publication.

Example 6: Summary by vehicle group

Monthly Analysis	Metric Conversion			Consumption Performance			Code
01/02/05 to 29/02/05	Distance (km)	Fill Qty (lts)	Average l/100 km	Target mpg	Actual mpg	Actual Variance	Notes
VEHICLE TYPE: 3.5t							
Summary for: Vehicle 1	718	107.10	14.92	20.98	18.93	-9.8%	
Summary for vehicle type: 3.5t	**718**	**107.10**	**14.92**	**20.98**	**18.93**	**-9.8%**	
VEHICLE TYPE: 7.5t							
Summary for: Vehicle 2	7660	1380.10	18.02	15.19	15.68	3.2%	
Summary for: Vehicle 3	4345	789.00	18.16	15.66	15.57	-0.6%	
Summary for vehicle type: 7.5t	**12005**	**2469.1**	**18.09**	**15.21**	**15.63**	**1.3%**	
VEHICLE TYPE: 18t							
Summary for: Vehicle 4	4357	987.70	22.67	12.1	12.45	2.9%	
Summary for: Vehicle 5	6527	1455.00	22.29	12.75	12.68	-0.5%	
Summary for vehicle type: 18t	**10884**	**2442.70**	**22.44**	**12.48**	**12.59**	**0.9%**	
VEHICLE TYPE: 28t							
Summary for: Vehicle 6	2911	994.00	34.15	8.09	8.27	2.2%	
Summary for: Vehicle 7	5410	2008.50	37.13	7.60	7.61	0.1%	
Summary for: Vehicle 8	4816	1536.00	31.89	9.06	8.86	-2.2%	
Summary for vehicle type: 28t	**13137**	**4538**	**34.39**	**8.39**	**8.25**	**0.03%**	

Action can be taken to:

- Understand why each vehicle has performed well or badly
- Focus on either the driver or vehicle to make improvements
- Swap drivers, vehicles and work done to see the effect on consumption. This will help to establish whether it is the vehicle or the driver that is affecting the result

Example 6 shows a summary by vehicle group type. The data required for the summary by vehicle group are the:

- Type of the vehicle
- Distance covered (miles or km)
- Fuel consumed (litres or gallons) over a pre–specified period

From these it is easy to calculate the average litres used per 100 km and the miles per gallon. Then the actual performance can be compared with the

Example 7: Driver League Table

The Driver League table requires data about the distance covered and the amount of fuel used. This data can be in km or miles for the distance and in litres or gallons for fuel. The period could be a week or a month.

From these it easy to calculate the litres burned for every 100 km or the miles per gallon, during this period of time. Having set target figures for one or both of these measures, the next step is to evaluate the drivers' variation from these targets.

In the following example, the actual mpg are compared against the target, for each driver. The deviation from the target is expressed as a percentage. Notes can also be taken to highlight any possible reasons for these variations.

		Metric Conversion			Consumption Performance			Code
Driver ID	Driver Name	Distance (km)	Fill Qty (lts)	Average l/100 km	Target mpg	Actual mpg	Actual Variance	Notes
03	David Arthur	460	112	24.35	9.06	11.61	28.1%	
11	Philip Bullock	353	120.5	34.14	7.6	8.3	9.2%	
15	Geoff Clarke	6472	1143.6	17.67	15.48	15.98	3.2%	
08	Sakis Pelekanos	7705	2860.2	37.12	8.02	7.61	-5.1%	
14	Zack Sethi	1006	337.4	33.54	9.06	8.43	-7.0%	
02	JonPaul Simpson	718	107.1	14.92	20.98	18.93	-9.8%	

Example 8: Effective Analysis (EA) in action:

First, it has to be determined that it is the vehicle and not the driver that makes the difference. Interchanging drivers, vehicles and routes for short periods of time can achieve this. An example of this, how it was applied, and the savings generated is given below:

A particular fleet includes three 38-tonne units that undertake overnight trunk runs. One of these units is used during the day to take on an additional trunk run. The remaining two units are occasionally used for local delivery work. Analysis of the tachograph charts indicated that the distances for the four trunk routes were:

- Route 1 – overnight trunk of 300 miles
- Route 2 – overnight trunk of 350 miles
- Route 3 – overnight trunk of 410 miles
- Route 4 – daytime trunk of 300 miles

The traffic department assumed that because the units were identical models and were of a similar age they would produce the same fuel consumption. Production of accurate mpg figures revealed that the average mpg for the three vehicles was: Unit 1 – 7.3 mpg; Unit 2 – 7.15 mpg; Unit 3 – 6.5 mpg.

Before applying EA to the fuel costs, Unit 3 was used on routes one and four, Unit 2 on route three and Unit 1 on route two.

The Average Daily Fuel Use

Unit & mpg	Route	Distance – Miles	Fuel Used – Gallons
1 – 7.3	2	350	47.95 (350/7.3)
2 – 7.15	3	410	57.34 (410/7.15)
3 – 6.5	1 & 4	600	92.31 (600/6.5)
Daily Fuel Usage			**197.60**

Source: Transport & Logistics Research Unit: University of Huddersfield

Interchanging drivers, vehicles and routes determined that the fuel consumption figures were more sensitive to the vehicle than the driver or route. By assigning the vehicles with the best fuel consumption to the longer trunk runs, fuel consumption was reduced.

Example of fuel consumption being reduced

Unit & mpg	Route	Distance (Miles)	Fuel Used (Gallons)
1 – 7.28	3 & 4	710	97.53 (710/7.28)
2 – 7.15	2	350	48.95 (350/7.15)
3 – 6.6	1	300	45.45 (300/6.6)
Daily Fuel Usage			**191.93**

Source: Transport & Logistics Research Unit: University of Huddersfield

The daily fuel saving was 5.67 (197.60 – 191.93) gallons. Applying a fuel price of £430.5 gallon, operating five days per week for 50 weeks per year, an annual saving of £6,100 is produced. Route four involved the most hill work and therefore accounted for the slight change in consumption figures when it was reallocated to Unit 1 from Unit 3.

targeted and any variations expressed as a percentage of the actual target. Notes can also be taken, for example about vehicle age, area of operation, average number of drop points, any air flow management equipment, etc.

3.4.4 Driver League Tables

If you decide to introduce driver league tables to your operation, you need to do it carefully. This is because driver league tables are open to the criticism that some variations of performance are outside the drivers' control. For this reason, it may be necessary to develop the tables to allow for known fuel factors that are outside the drivers control, e.g. route, load and the time of day, etc. However, information for driver league tables can be generated by using telematic systems.

Once you are satisfied that these tables give an accurate picture of driver performance, you can highlight bad performers and then consider what action should be taken. However, some driver performance entries can be removed from the league table. For example, a driver who is not a regular driver, and made a return trip without a trailer, thus giving an exceptional result, can be omitted. Also, when a mechanic helps the operation carrying out a local delivery, involving urban driving, or similar circumstances, they can also be removed from the league table.

3.4.5 Good and Bad Performers

By analysing the data you have received, the good and bad performers within the company will be identified over the reporting period. Once these factors have been identified you should then try to identify the underlying cause, for example, is it the driver, the vehicle, the route or the type of work?

Switching vehicles, drivers and work could be considered as a way to help to confirm the diagnosis. If the vehicle is the cause, try to identify any significant variances between the best and worst performing vehicles, such as vehicle type, specification, age and service history. You should then decide if the differences can be eliminated or whether the poor performers have hidden defects that need investigating. When all these avenues have been explored and feasible steps taken, a worthwhile tip is to use the most effective vehicle to carry out the trips that use the most fuel. This process is known as 'Effective Analysis' (See Example 8).

3.4.6 Benchmarking

Benchmarking at its simplest is the process of performance measurement and comparison against other comparable operations or individuals. External benchmarking measures how one organisation is performing compared to other companies in the same or similar market place. Internal benchmarking takes place within a single organisation and offers the opportunity to benchmark different depots, warehouses, shifts and individuals.

Fig 3.5: Benchmarking

Benchmarking involves:

- Regularly comparing aspects of performance with best practitioners.
- Identifying gaps in performance
- Seeking the best approach to bring about improvements in performance to match or exceed best in class.
- Measurement of same aspect over time

The Freight Best Practice programme has undertaken a series of key performance indicator benchmarking surveys in sectors including the pallet network sector, non-food retail distribution, and food supply chain.

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Key Performance Indicators for the Pallet Sector

Key Performance Indicators for the Non-Food Retail Distribution

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The aims of the surveys were to show participating companies how their own relative performance compared with others and to identify real opportunities to maximise transport efficiency.

3.5 (STEP 4) Reporting and Feedback

Once the fuel performance data has been collected and reviewed, it should be reported in an appropriate manner. The amount and content of information included in a report will depend largely on its likely reader. Senior managers will usually want to deal with summarised information giving them an overall knowledge about the key fuel performance figures within the company. At more junior levels within a business a more in depth analysis showing a wider number of KPIs may be necessary. The reporting system must reflect this difference.

Clarity and comparison are important, and graphs tend to tell the story much better than tables in this respect. Reports can be set up in spreadsheet databases to read directly from input pages; thereby speeding up the time spent producing reports. This has the added value of automatically building in previous months' data into the report.

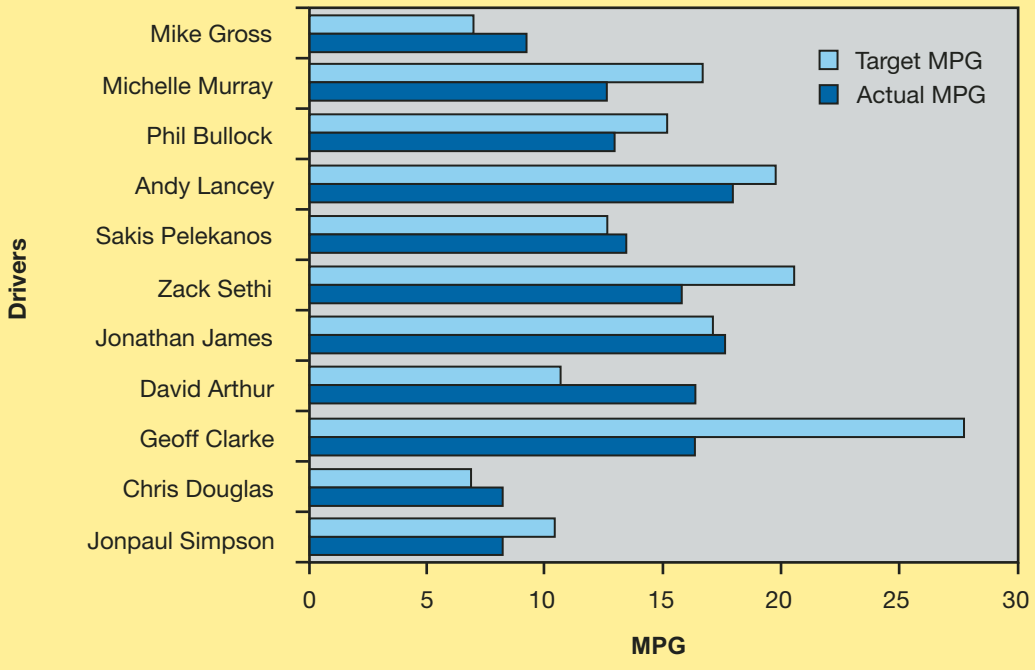
The reports can be designed to show actual figures against targets set for each of the KPIs, and from these reports, automated charts can be produced. Often a chart is able to highlight the problem areas within an operation far more clearly than trawling through tables of data.

It is important to understand what types of reports are available from your chosen system. Output reports should be easy to interpret and can be used to carry out your analysis. Some suppliers offer on-line systems where you can access your vehicle details. It is important to look at all the available options before deciding which one best suits your operation. Standard reports for the performance of people can be grouped using categories.

Many routing and scheduling systems not only store data on vehicle fill, time utilisation, kms travelled etc, but also have a reporting function so that specific fuel

Fig 3.6: Illustrating performance:

One way to show performance of drivers within a depot is to display graphs in the traffic office, so that drivers can view their performance against their peers. Many operators supply a small gift as an incentive for the best performer in a certain period. The gift does not need to be expensive as it simply creates a good competitive environment within the team.



performance measures can be extracted on a regular basis in a report format, with little or no further formatting required. Similarly the warehouse management systems can produce automated reports on efficiency of the operation.

Historical fuel information is also valuable when preparing budgets or making 'same time last year' comparisons. Therefore, it is recommended that fuel information for each vehicle at raw data level is kept throughout its life, in much the same way as its servicing records. (It may also help when selling the vehicle because it is evidence of its fuel performance and your thoroughness.) If it is not feasible to keep that much information, aim for a minimum of a rolling two-year period.

The value of KPIs can only be converted if it changes the behaviour of the people in your business. As a rule, the feedback should be given to people at all levels of the business from strategic to operational levels.

Example 3.7: Calculating Fuel Costs

A company operating a fleet of rigids budgeted for vehicles to perform at 14.5mpg and to travel 10,000 km per 4 week period. Diesel for the vehicles cost 80 pence per litre (excluding VAT).

In fact, on average, the vehicles actually travelled 10,800 km (due to additional work) at 15.25 mpg following a programme of driver training.

The fuel cost of vehicle = miles divided by mpg multiplied by £ per gallon.

	Budget	**Actual Variance**
Distance travelled	10,000 kms	10,800 kms – 800 kms
Multiply by 0.6214 to convert to miles	6,214 miles	6,711 miles – 497 miles
mpg	14.5 mpg	15.25 mpg – 0.75 mpg
Fuel cost	80 p/litre	80 p/litre
Multiply by 4.546 to convert £ to gallon	3.64 per gall	3.64 per gall

Comparing budgeted cost with actual cost:

Budget Cost = 6,214 miles ÷ 14.5 mpg x 3.64 per gall = £1559.93

Actual Cost = 6,711 miles ÷ 15.25 mpg x 3.64 per gall = £1601.84

Extra costs above budget = £41.91 per vehicle per month

Looking only at the costs, it would appear that there has been an increase. However, it is necessary to split out the effect of the increased distance travelled first. One way to do this is to compare budget with actual costs using actual distance travelled in both cases:

Budget cost = 6,711 miles ÷ 14.5 mpg x 3.64 per gall = £1684.69

Actual cost = 6,711 miles ÷ 15.25 mpg x 3.64 per gall = £1601.84

Saving from improved mpg = £82.85 per vehicle per month

(Calculating the effect can be done in several ways. The conversion factors used in this example are taken from the list in appendix 2 – Fuel Measurement and Conversion Factors).

In this example, although total fuel costs have risen by nearly £42 per vehicle per month, the increased mileage travelled would have cost an additional £124.76 (£1,684.69 – £1,559.93), had it not been for the improvement in fuel consumption. As a result of the improved mpg, there has in fact been a saving of £82 per vehicle per month.

If you want to convert the figures from gallons to litres, divide the mpg figure by 4.546 to give you the miles per litre. To work out the costs, divide the mileage by the miles per litre figure and multiply by the fuel cost (in this case 80p per litre).

3.6 (STEP 5) Results

Once you have collected the data and then analysed and reported on that data you will be left with an overall result. In its simplest form you will have succeeded or failed to meet the targets you set yourself. The following section analyses the reasons for this success or failure and also looks at the financial aspects of meeting targets.

3.6.1 Reasons for succeeding or failing to meet targets

It could be that the target has been set too high, and that it actually de-motivates individuals, thus people feel they would never be able to meet the target and therefore negative performance occurs. In this case the target should be reviewed and set at an achievable level.

If targets have been met with ease it may be that targets have been set too low, therefore they should be altered. This is where benchmarking against competitors in the marketplace can provide companies with common fuel efficiency standards.

3.6.2 Financial Results on Fuel Efficiency

Having set out to reduce future costs, it is essential to measure ongoing performance accurately. This will confirm that the investment in the fuel programme is justifiable and that your expectations are succeeding or failing. If targets are not being met you can check the figures, revise the targets or maybe even suspend or increase expenditure on the programme.

The measurement of fuel efficiency should be part of the financial controls of any transport operation. This can be achieved through comparing actual costs with budget or standard costs in the same way that any other expenses are controlled.

Variances between actual and budgeted expenditure can then be investigated and action taken quickly. An example of the ‘actual versus budget’ check is shown on Fig 3.7. This shows how to resolve fuel cost variations that arise through a change in the mileage covered as well as a change in fuel performance.

3.6.3 Rewarding Good Performance

It is also important that within companies, good performance is acknowledged, and the factors that have come together to produce the higher performance level are recognised. Often depot or shift managers may have introduced their own system, which has increased fuel performance, and there could be the opportunity to share this good practice across other depots in the same company. Where targets have not been met, by individual people, depots or by the business as a whole, but other individuals or groups or businesses have achieved better performance, the detailed KPIs can show in which area the performance has fallen below expectations. This information underpins remedial actions.

3.7 (STEP 6) Identify & Implement Strategies to Improve Performance

As stated above, once you have calculated your results you will be able to identify the areas of your operation that need improving in order to create fuel efficiency. The rest of the guide will explore possible mechanisms of improving your performance in a certain areas, for example through the use of aerodynamics to reduce fuel use.

3.8 (STEP 7) Reviewing & Setting Targets

Target setting is fundamental in enabling a continual improvement in fuel performance. Targeting involves:

- Setting goals for the reduction of fuel consumption;
- Introducing specific measures designed to achieve these goals;
- Reviewing progress and feedback; and
- Repeating the process in response to what has happened so far.

Targeting can involve capital expense and/or significant changes to operating practices. It may be best left until a good deal of data has been collected

Setting and reviewing targets is crucial for success.

on the historical performance of the operation, so that the actions chosen are the most appropriate to the particular circumstances. It is for this reason that target setting is not step 1 as you must have set your KPIs, collected data and reviewed it in order to be able to set a realistic and reliable target.

Targets should be challenging enough so that fuel performance can be substantially increased, but also manageable so that employees do not feel de-motivated.

That said, targets don't need to be perfect – the act of setting a target and monitoring your progress towards achieving it is what's really important. Always remember that monitoring and reviewing is an on-going process. If the target was met very easily, you need to go back and look at your benchmarking, and 'raise the bar'. If you fall well short of the target, you should try to understand why this might have occurred and consider adjusting your future target levels.

3.9 The Small Fleet Performance Management Tool

Freight Best Practice has developed a Small Fleet Performance Management Tool (SFPMT) which is a PC Based spreadsheet tool designed to help small to medium sized fleet operators improve their operational efficiency through the management of Key Performance Indicators. The KPIs include costs, operational, service, compliance and maintenance. The tool comprises a CD and accompanying manual.

This tool is an extremely useful mechanism to implement a logical performance measurement and management process.

See the **FREE** Freight Best Practice publications:

Small Fleet Performance Management Tool

Small Fleet Performance Management Tool Helps A1 Paper Improve Efficiency

Available from the Hotline: **0845 877 0 877**

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3.10 Summary

Unless you can accurately measure the resources you use in delivering services, it is very difficult to identify areas that can be improved or assess the impact of any changes you make. For organisations that are unable to measure the performance of fuel management initiatives, it will be extremely difficult to see which areas are in need of attention. Hence, the importance of performance measurement in any commercial operation should not be understated.

A performance measurement system should be balanced, monitoring efficiency and effectiveness and using quantitative and qualitative measures. Hence, it is important to understand the context they will be used in. If you don't measure performance effectively, how can you manage it effectively? This question is vitally important in freight operations as there are so many components to monitor, from fuel consumption and tyre wear through to driver productivity and accident records.

This Chapter has assessed the measuring performance process and analysed the concepts within that process: setting targets, selecting KPIs, data collection, review and evaluation, reporting and feedback, results and benchmarking. Therefore, you should now be able to develop your own performance management process. In addition, Freight Best Practice has a series of publications available to help you monitor your internal operational performance against Key Performance Indicators (KPIs) and to benchmark your own operation against the very best of the competition.

See the **FREE** Freight Best Practice publications:

Key Performance Indicators for the Pallet Sector

Key Performance Indicators for the Non-Food Retail Distribution

Key Performance Indicators for the Food Supply Chain

Small Fleet Performance Management Tool

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If you don't measure it, you can't manage it!

Measuring performance, setting targets and monitoring progress are the cornerstones of successful fuel management.

4 Fuel Types, Purchase & Storage

4.1 Introduction

Once you have established a comprehensive monitoring process for your Fuel Management Programme you can then consider elements of your operation which could have a positive effect on fuel efficiency. The first of these factors is fuel. Essentially, it is this commodity that you are trying to manage and reduce your operation's usage of. Therefore, this Chapter explores the specification and standards of fuel, the factors affecting the purchase, storage and stock control of fuel and the main alternatives to diesel and petrol.

4.2 Fuel Specification

4.2.1 Fuel Standards

Fuel has two main properties:

- The amount of energy it contains, which is highly dependent on the density of the fuel
- The ease with which it combusts, which is normally measured by the cetane index and number

The most important characteristic for fuel consumption is the density of the fuel. This is because the denser the fuel, the more energy it contains. The Auto-Oil Programme (http://europa.eu.int/comm/environment/autooil/index.htm), brought together the oil and automotive industries with the European Commission to develop a proposal for improved fuel specifications and, through the subsequent decision of the European Member States and the European Parliament more stringent fuel specifications, having the aim of contributing to the reduction of harmful greenhouse gases and pollutants, were agreed.

The objective of the Auto-Oil programme was to set engine emission limits and fuel specifications that would contribute, in a cost effective manner, to the attainment of the air quality Directives of the EU and the guidelines of the World Health Organisation (WHO). The European Fuels Directive 98/70/EC, implemented into UK law by the Motor Fuels (Composition and Content) Regulations 1999, cover the technical requirements of diesel and petrol, including their chemical composition. Therefore, when you purchase fuel you should ensure that the following standards are met:

Fig 4.1 Fuel Standards:

Diesel – BS EN 590:2004

95 Octane Unleaded Petrol – BS EN 228:2004

97 Octane Unleaded Petrol – BS 7800:2004

*Standard specifications are from the Department of Trade and Industry http://www.og.dti.gov.uk/downstream/environment/ or www.bsi-global.com

4.2.2 Ultra Low Sulphur Diesel/Petrol

In addition to standard diesel and petrol, Ultra Low Sulphur Diesel/Petrol was defined in the Finance Act 1998. These types of fuel practically became the standard fuel throughout the UK in 1999. This fuel has been estimated to contribute to the reduction in emissions of particulates by 8% and nitrogen oxides by up to 1% in each year between 2001 and 2004. Many fuel companies now produce a form of low

sulphur diesel which is in line with Directive 2003/17. This source of diesel is often known as 'Ultra Low Sulphur Diesel'.

4.2.3 Oil and Lubrication

Selecting suitable engine oils is a difficult, but important task. Instead of just mineral oils, there are now an abundance of synthetic and semi-synthetic oils to choose from, and many claim to save fuel. However, decisions should be based on the official ACEA (Association des Constructeurs Européens d'Automobiles) grade specification of the oil and reference to the vehicle manufacturer's handbook.

To achieve the ACEA grade (prefixed with an E for heavy duty diesel engine oils – E3, E4 etc.) the oil must pass a series of tests and so its performance has been measured. It would be wrong to choose oil simply on its fuel-saving claims, particularly for modern engines that need to satisfy increasingly stringent European exhaust emission regulations (Euro-2, Euro-3 etc.).

The demands on engine oil are therefore becoming much tougher, and the ACEA tests include critical wear tests, ability to handle higher cylinder temperatures and soot dispersal capability. The long-term health of the engine has to take priority when selecting the oil, so following the vehicle or engine manufacturer's recommendations is always a sound strategy.

Fuel saving claims of three to five per cent for a synthetic oil and semi-synthetic oil are commonplace. It is important to establish whether this is entirely derived from the engine oil, or whether the oil in the gearbox and drive axle has also been changed. It has been suggested that a two to three per cent saving is the maximum that can be expected from the engine oil alone. This has to be weighed against the higher cost of the oil. It might be worth using a synthetic or semi- synthetic oil only in the gearbox or drive axle because the costs will be lower – there is less of it and it does not need changing so frequently.

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Fuel Saving Devices

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Or the website: **www.freightbestpractice.org.uk**

One way to offset the cost of expensive engine oil is to make it last longer by extending the drain interval. Some of the most expensive synthetic oils are reportedly able to last up to 200,000 km in a light-duty application. The vehicle or engine manufacturer will advise on varying the drain interval to suit the application, but the fuel consumption of the vehicle is usually a good indicator of the severity of its duty cycle.

If the fuel consumption is better than average for the type of vehicle, the duty cycle is probably light and so it may be possible to extend the drain interval. The best way of establishing the optimum engine oil drain interval is to use oil sample analysis. This is relatively inexpensive and not only determines the oil's life but also detects the various wear metals from the engine and the presence of water and fuel in the oil. It is therefore a far more useful diagnostic tool than simply an oil life indicator.

Analysis may suggest that you can extend the drain interval of your existing mineral-based engine oil. Many oil companies will offer a sample analysis service as part of an oil supply contract. There are also independent laboratories, which will give an objective, unbiased opinion.

When establishing an oil and lubrication strategy for the fleet, try to remain strictly objective about the capital costs. The value of reduced engine wear when the vehicle is seven years old is arguable if the vehicles are replaced after three years. Fuel savings have to be proved, not just claimed. Remember to add the cost of top-up oil and quantify the benefits of reduced downtime and longer oil filter life if the drain periods are extended. Finally, remember the environmental and financial costs of oil and filter disposal. Doubling the drain interval will halve the amount of used oil and number of filters for disposal.

4.3 Purchasing Fuel

As fuel is an essential commodity, you must analyse the different methods of purchasing fuel. This is important as factors such as quality, cost and reliability of supply are affected by the method which you chose. The following section will explore the different methods of purchasing fuel for your operation.

Fuel is an essential commodity that operators should manage effectively. How you purchase and store fuel can make a significant saving in your outgoings.

4.3.1 On-site storage tank purchasing

If you are buying fuel for your on-site storage tank, here a few tips and issues to consider before assessing the methods of purchasing:

- Buying full tanker loads (if you have the capacity) is usually cheaper than buying part loads
- Reducing your credit risk rating in the suppliers' eyes may improve your purchasing power and ability to negotiate more competitive prices
- The ability to accept out of hours deliveries may save money
- Paying fuel invoices promptly may help save some money as most contracts have a 'prompt payment' clause
- Find out which is the nearest terminal to your site and establish which oil companies operate from it. Due to proximity their prices may be cheaper than competitors
- If buying from several suppliers, it is a good idea to demonstrate a degree of loyalty to at least one of them. If for some reason, (i.e. a fuel strike), supply becomes restricted it is comforting to know that you are an important customer. Continuity of supply is ultimately more important than shaving the price
- Audit fuel purchasing procedures from time to time to ensure that the buying process is operating at an efficient level

4.3.2 Fuel Cards

The fuel card providers have recognised that managing fuel is an important and time-consuming job. Therefore, they now provide a range of services that are designed to combine the convenience of cashless refuelling anywhere in the country with an additional function of improved management reporting and control. Many cards can now be used across Europe.

Essentially, fuel card suppliers fall into three categories:

- Retail
- Oil companies
- Bunkering

Retail suppliers supply fuel at the pump price and the cards can be accepted at sites nationwide. This provides the driver with a high level of choice in which service station to use, but means that fuel is purchased at the retail forecourt rate.

Almost all oil companies now operate fuel cards, which are accepted at that company's service station network. This can restrict choice and result in drivers

searching for a particular station, but at least these stations are easily identified.

Bunkering companies are free of ties from oil companies and large customers (for example, buying more than 20,000 litres per month), buy at a commercial market rate. They deposit their fuel into the network system. Smaller users buy from approved dealers and pay only for the fuel used, without using the larger bulk purchase. Fuel purchased this way is made available through a multi-branded network of filling stations and automated refuelling sites.

Different fuel cards have different features and therefore these need to be considered when making the decision to use fuel cards. The following are common features that are offered:

- The location of their network, a good selection of sites on trunk roads, main distribution hubs and destinations
- Anti-fraud measures, such as driver and vehicle recognition, pin numbers, etc
- Reliability of data, vehicle, odometer and driver information
- Price and quality of fuel
- Product restrictions, limiting the card's use to fuel and lubricants, tolls etc (this facility is also becoming increasingly available on the continent)
- The efficiency of dealing with the problem of stolen or lost cards
- Type and quality of reports; is there an early warning system of irregular fuel drawings;
- Ability to rectify errors such as incorrect mileage readings
- Possibility of using the card for home base fuelling
- Speed of reporting

The convenience and management functions of a fuel card do not come free of charge. Costs normally include a card cost per annum, report charges and in the case of bunkering facilities, a handling fee per litre bunkered. If an operator's own on-site fuel storage is connected to the bunkering system, there could also be software and modem charges.

4.3.3 Contract Buying

Contract buying should be considered for those operators that buy a large amount of fuel. As the price of fuel is unstable, a contract can account for this and give you a stable and competitive fuel prices which are normally based on the Platt's index. This is based on the previous week's average pricing. The added benefit of using Platt's prices is that they are published so you do not need to research the price any further. Alternatively, you can negotiate fixed fuel prices for a fixed period.

4.3.4 Buying on Account

Buying on account is the process of setting up an account with your chosen fuel station. This method allows for some negotiation, depending on the amount of fuel you are using. It would be advisable that you research several local filling stations in order to get the best deal.

4.3.5 Buying on the 'spot market'

Buying on the 'spot market' entails researching several suppliers on any given day. This can take some time, but generally you can get very competitive prices. The internet has now made this process quicker but you do not have the reliability of delivery that other methods can offer.

4.3.6 Buying Cooperatives

Buying cooperatives are not a new idea. The main concept behind the idea is that the more fuel is purchased from a supplier, the more bargaining power you will have. However, a single company may not need such a large amount of fuel. Therefore instead, they join allegiance with other companies to purchase a large amount of fuel for several businesses, hence purchasing it for less.

4.4 Fuel Storage

By simply exploring your purchasing options you can make a significant saving in your outgoings. However, it has been suggested that once the asset has been delivered, a lack of management results in this saving being lost. Therefore, the next section will explore the methods of storing fuel once you have purchased it.

4.4.1 Holding your own Bulk Stocks

Deciding whether to hold your own bulk stocks, or alternatively use fuel cards, bunkering facilities or an arrangement with a local service station, is often a complicated decision. The following issues should be considered when making this decision:

- Convenience of home base filling
- Supply availability
- Reliability and quality of supply
- Cost saving in bulk purchase of product
- Cost of equipment
- Managing the storage, including environmental and security issues;
- Control over transactions
- Bunkering and/or credit card suppliers can provide many of the management functions required

If you currently have a bulk tank or wish to purchase one, you must consider the following factors.

Deciding whether to hold your own bulk fuel stocks is often a complicated decision.

4.4.2 Tank Maintenance

The frequency of tank maintenance depends on the amount of usage. Operators using high volumes of fuel might aim to have the tank filters checked and cleaned or replaced every six months, and the tanks de-scaled every 12 months. Smaller users may opt for less frequent maintenance.

Maintenance of the bund that surrounds the tank is also important. It must hold at least 100 per cent of the tank's capacity, and must also be able retain complete integrity. The Environment Agency can provide information on suitable designs and ways to minimise the release of fumes into the atmosphere.

*See their website at www.environment-agency.gov.uk

The pump should be checked, maintained and calibrated regularly. The frequency obviously depends on usage, but generally, it should be at least annually and preferably every six months for heavy users. If you are regularly reconciling bulk stocks you should be able to spot potential problems with pump calibration.

4.4.3 Checking for Water

Monitoring diesel storage tanks for water contamination is crucial. One method is to use water identification paste on the dipstick. This paste is normally available from fuel equipment maintenance companies. A visual check of a sample of fuel can also show this contamination.

A large proportion of tanks have high levels of contamination, with one survey showing that 50% of tanks tested were contaminated with water and 63% with bacteria. The consequences can be serious as water causes poor combustion, clogged filters, corrosion and fuel line freeze-ups. Bacteria cause slime formation, fuel oxidation and corrosion and clog filters and injectors. Bacteria can multiply very quickly in a water/diesel mixture. Therefore, both forms of contamination will have a detrimental effect on your vehicle's performance, fuel efficiency and ultimately your profits.

Checking for water contamination in fuel storage tanks is crucial as this can have detrimental effects on your vehicle's performance, fuel efficiency and ultimately – PROFIT!!

4.4.4 Checking Fuel Samples

If you consistently use the same supplier, you should have a fuel sample checked once a year by a laboratory and then compare these results with the supplier's fuel specification. A copy of these results should be kept on site. The laboratory test will verify such things as density, flash-point and cetane number as well as contaminants. This testing should cost no more than a few hundred pounds and possibly identify misrepresentation by the fuel supplier.

For real confidence that fuel is being measured and dispensed accurately, pumps should be calibrated once or ideally twice a year.

4.5 Stock Control

Once you have purchased and stored your fuel in the most efficient manner, it does not stop there. It is imperative that you then control your fuel stocks. This section analyses the methods of recording fuel stocks and also highlights the common pitfalls that managers tend to fall into.

4.5.1 Stock Records

If you have your own in-house storage it is important that you maintain accurate stock records. Both gains and loss of fuel stocks are possible and action needs to be taken on identifying either of these. Common dangers that need to be identified immediately are leakage, theft, short delivery and inaccurate pump calibrations. Therefore, it is good practice to carry out weekly stock reconciliations, checking actual stock against stock records.

Fig 4.2: Contents of a bulk fuel tank:

Opening Stock (stock when last checked)
+
Quantity of recorded fuel delivered since last checked
-
Quantity of recorded fuel drawn since last check.
=
Contents of a bulk fuel tank

In practice, the theoretical 'closing stock' will rarely match a physical stock measurement precisely. This may be due to several reasons including:

- Inaccurate measurement of stock
- Incorrect record of fuel delivery
- Incorrect record of fuel drawn, due to the pump being wrongly calibrated, manual errors or fuel being misappropriated
- Leakage from the tank or pipe work
- Water contamination from condensation or leakage into the tank

- Contraction/Expansion of fuel depending on the temperature of fuel

4.5.2 Fuel Tank Deliveries

Wherever possible, written procedures should exist for functions such as fuel tanker deliveries. A typical example is shown in the 'Reconciliation Procedure for Fuel Stocks' (see page 49). However, the following are some issues to consider:

- Deliveries of fuel should always be overseen by a responsible person, who must first ensure that the correct tank is being used (not mixing derv with red diesel) and that it has the capacity to accept the delivery
- The responsible person should carry out a dip of their own fuel tank before and after delivery, allowing 10 seconds in position and ensuring the stick does not bounce
- The responsible person should know the site's emergency spillage plan, including the location of spillage containment equipment such as surface water drain covers
- Remember that agitation of the fuel (e.g. following a bulk delivery of fuel) may result in a tank dip showing a higher than true reading
- Where possible, stop vehicles drawing fuel during the delivery and while checking stock levels as this will affect the accuracy of any measurement. This is particularly important when remote computer systems are in operation if misleading apparent stock losses or gains are to be avoided
- Also remember to consider the receiving petroleum spirit regulations which are outside the scope of this guide

4.5.3 Reviewing Stock Control Records

You should maintain cumulative records of stock losses or gains and the percentage of total fuel used. It is difficult to be precise about the level of loss or gain that should trigger an investigation. It is common that if the trend of cumulative losses/gains exceeds 0.5% of the total volume dispensed over a reasonable period (i.e. reconciliations), you should satisfy yourself that these are simply caused by cumulative inaccuracies of the measurement system rather than by anything more serious. If a totally accurate reconciliation is achieved, it is worth investigating fully to ensure that 'imaginative management' has not been at work and that the figures are really that accurate. If the figures are accurate then you are achieving fuel efficiency and therefore saving money.

4.5.4 Off-site Refuelling

A regular cause of distorted fuel consumption figures is the failure to capture accurate data about fuel purchased when off-site. Receipts for off-site refuelling must therefore specify the total number of litres, the monetary value, vehicle identifier, odometer reading and also the driver(s) responsible for refuelling that particular vehicle. It is recommended that you set up a rigorous system to ensure that data is captured accurately, e.g. all invoices and statements balanced back to the entries are put into the vehicle fuel records. Fuel recording systems have made a huge difference in this area as data is easily recorded and processed into an accessible format.

If you notice any poor vehicle performance after vehicles have been re-fuelled off-site, you should test the fuel from that source to check for any abnormalities as there have been instances of fuel being diluted by paraffin. Paraffin is detrimental to a vehicle's performance as it lacks lubrication qualities so friction is increased causing damage to the injection pump. There have also been reported cases of diesel laundering, where the red dye is removed from the lower taxed red diesel and then sold as

normal diesel. These factors ultimately cost your company money in fuel bills and vehicle repairs.

4.5.5 Fuel Recording Systems

Many organisations will have some form of fuel recording system connected to their in-house bulk storage tanks. These systems have varying degrees of sophistication and the choice between them depends on the organisation's desire for accurate data, the size of the fleet, amount of fuel used and the true cost of the alternatives.

Capital cost is a main consideration when deciding on whether a fuel recording system will benefit your company. When purchasing a system it pays to think to the future and perhaps opting for a system that can be upgraded as the company grows. This would save money in the long run as alternatively you would have to buy a whole new system. Invest in the best data collection system that you can justify, taking into account time spent and potential fuel savings. The more precise the system the more money you will save.

The simplest system is to record fuel pump readings manually for each vehicle and then input these readings, along with vehicle kilometres (km), into a spreadsheet in order to work out the mpg.

The next level of system involves attaching a stand-alone Fuel Island Controller (FIC) to the pump. This records the date and time of the transaction, the quantity of fuel delivered and which vehicle and driver is using the pump. However, not all systems record all this data, therefore you need to consider which data you require. The main purpose of the FIC is to restrict the use of the pump to authorised users only, but the data it collects is a good step towards collecting accurate data in order to run an efficient Fuel Management Programme. The information can be either printed on a small 'till roll' type printer, which is attached to the FIC, or it can be downloaded onto a microchip based module, which can be used to transfer the information to an office-based computer.

Operators with more than 20 vehicles fuelling at a single site will undoubtedly need a fuel recording system that allows them to do more than merely safeguard stocks. Two-part systems are now common, with a FIC controlling more than one pump and then a central computer, which runs a PC-based software package. This combination allows for data to be communicated directly to the computer which then creates reports on fuel usage.

Fuel recording system at Premdor

Ryder Plc, a major commercial vehicle, fleet management and supply chain solutions company, provide a dedicated distribution operation for **Premdor**, one of the largest suppliers of joinery products in the world. Ryder decided to introduce the fuel recording system on the Premdor contract in order to receive better information on the fuel efficiency of both his drivers and vehicles. Previously they had taken figures from the drivers, and typed into a spreadsheet.

The MPG figures are measured using the Siemens VDO system. There is a control box, which measures the fuel going into the engine. The advantage of this system is that it can look at how each driver is driving, and measure the performance in terms of MPG. However managers should be aware that there are a range of anomalies possible with fuelling systems, including data entry problems, power supply issues and even possible fraud.

After the system was installed MPG improved by 10% across the fleet. After a while the figure became constant and due to on-going monitoring using KPIs the level has been kept high.

The two-part system also allows a greater flexibility in identifying drivers and vehicles, with driver keys, electronic keys, swipe cards and PIN numbers. It is also becoming common that vehicle identification and mileage data are transmitted from the vehicle via a shortwave radio transmitter which is received by an aerial on the FIC. Systems have now been developed to ensure correct driver, vehicle and odometer readings are captured using driver identification by fingerprint and specially designed nozzles which are capable of identifying the vehicle. These nozzles also transmit the current odometer readings of the vehicle to the FIC.

At the top end of the scale there are multi-site fuel management systems that provide detailed information and reports from fuelling sites situated throughout the country. The information from your own site is often merged with off-site information via fuel cards, creating the total fuel picture for a fleet. A central head office can poll any number of sites to collect fuel data via the internet. There are various reporting options covering all aspects of fuel management. Graphing options and exception reports can highlight key factors from a wealth of data. Used effectively, they can make it much easier to spot the thirstiest vehicles, the most economical drives and the toughest routes which can all be used in driver league tables. Several other patterns also emerge, such as seasonality.

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Vehicle mpg can also be measured through pump based systems, where by a vehicle key or card can be inserted, and the amount of fuel dispensed is automatically entered onto a central system for analysis.

Despite these technological advances, drivers are still extremely important with regard to keeping accurate fuel usage measurements. Many of the fuel recording systems still require the driver to have some input into the data that is recorded. Therefore, you should ensure that the driver understands the system.

Marshalls plc – use of an electronic fuel pump system

Marshalls plc is a manufacturer of hard landscaping products including: paving, paths and driveways, as well as walling and edging products. They have installed fuel tanks at a number of their depots with Triscan monitoring equipment. They have a card system operated by Keyfuels, which links the fuel data for a vehicle regardless of whether it is refuelling at any Marshalls depot or at a Keyfuels site. Keyfuels then issue each depot a weekly report giving fuel figures and MPG for each vehicle.

The system will benefit Marshalls by giving them more control over the operation through the ability to monitor both driver and vehicle MPG from the report information provided.

4.5.6 Fuel Temperature

An important factor is that diesel fuel expands and contracts as its temperature changes. Consequently, the temperature at which it is measured affects the volume and energy contained in a given volume. Fuel delivered at a high temperature and dispensed at low temperatures will show a loss in volume. Although the effect is relatively small, as a change in temperature of 25°C will change the volume by less than 2%, these short falls all add up.

A depot that is situated very close to a refinery may get deliveries at temperatures that are above the average. If you are a large customer you may be able to negotiate a correction factor back to 15°C, which is the standard temperature for fuel specifications.

4.5.7 Reconciliation Procedure for Fuel Stocks

4.5.8 Alternative fuels

The following six factors are leading to a surge of interest in alternative fuels:

Fig 4.3: Reconciliation Procedure for Fuel Stocks

1) Ordering Fuel

- Responsibility of the manager or deputy to ensure fuel stocks are regularly checked in order to maintain an adequate supply at all times
- Supplies should be obtained from a recognised, approved supplier

2) General Points

- Vehicle refuelling should not be permitted during bulk tank reconciliation or weekly bulk tank reconciliations in order to maintain accuracy
- Delivery area MUST be free from hazards
- Fuel bunds MUST be checked weekly and any water/leaking fuel disposed of safely
- Fuel leaks must be reported immediately and repairs implemented
- Any spills must be removed or covered by an absorbent material immediately
- You MUST have a supply of absorbent materials

3) Bulk Delivery of Fuel

- Check the dip/gauge on the receiving bulk fuel tank, noting the quantity contained before any deliveries
- Check dips/meter readings on the vehicle before and after delivery
- Check the dip/gauge on the receiving tank after delivery and agree the quantity delivered to both vehicle dips/meters and tank dips/gauge
- Check quantity on the delivery document, sign it and retain a copy
- Make the delivery point secure
- Ensure tanker leaves the site safely

4) Equipment Calibration

- Fuel tank monitoring equipment should be calibrated on original installation or purchase
- Fuel pumps should be maintained and calibrated on a regular basis

- Ever increasing price of fuel
- Government initiatives
- The effect of fuel on the environment
- Advancing technology in the alternative fuel industry
- Concerns over long term supply of fossil fuels, both in terms of physical stock and security of supply
- Congestion charges

Currently, oil is still the main source of energy for transport throughout the world. However, as fuel reserves decrease we may need to look for other options. Alternative fuels are likely to be more widely used as the demand for oil pushes up prices. Therefore, you can start to contemplate how these methods of power may be incorporated into your operations. The purpose of this section is to highlight the types of alternative fuels that are available in the UK market and the Government's attitude to alternative fuels. The main alternative fuels are:

- Compressed Natural Gas (CNG) and Liquid Natural Gas (LNG)
- Liquid Petroleum Gas (LPG)
- Electricity
- Biofuels

4.5.9 Government Policy

The UK Government has committed itself to reducing the amount of greenhouse gases being released into the atmosphere. Promoting alternative fuels in the transport sector can play a role in helping to meet this objective. There are several schemes available for companies who want to actively use alternative fuels as a method to power their operations, including the Enhanced Capital Allowance Scheme. For more information see the Carbon Trust Website at www.carbontrust.co.uk

4.5.10 Natural Gas – Compressed & Liquid Gas

Natural gas consists of 85-95% methane, which is the simplest hydrocarbon. It is colourless and odourless.

There has been a misconception regarding this fossil fuel, about the risk of explosion. Although explosion is possible (as it is with conventional fuels), the following compensate for this:

- It disperses in the event of a leakage as it is lighter than air
- The diffusion coefficient is high in comparison with conventional fuels and therefore it dilutes rapidly in ambient air
- The auto-ignition temperature is higher than conventional fuels and flammability limits are narrow by comparison with them
- Fitting of pressure relief valves to tanks ensures against increases in tank pressure which causes the main risk of explosion

Compressed natural gas (CNG) and Liquefied natural gas (LNG) have become more attractive in recent years because of advantageous duty rates, capital grants and growing commercial development.

When stored in a compressed form, it is known as Compressed Natural Gas (CNG). Alternatively, when held at a temperature of approximately – 162°C it liquefies and is then known as Liquid Natural Gas (LNG).

The combustion of natural gas reduces carbon dioxide (although not appreciably), nitric oxide and particle emissions but increases the methane output, which can be oxidised by a catalyst. Engine noise is also reduced due to improved combustion characteristics. The technology is now well developed. The Government also introduced a differential to encourage the use of this fuel.

Some technical properties are specific to natural gas, for example, a more complicated tank system is required. Larger heavier tanks are needed for the same range. These vehicles are thus best situated for short trips until sufficient refuelling points are

available. LNG has higher energy content than CNG so needs less storage space, but is held at a lower temperature and pressure than CNG.

There are relatively good supplies of natural gas around the world, certainly more than oil. However, supply can be affected by political events in the same way as oil can.

Manufacturers see CNG as a complement to diesel. However, continued development is needed in order to maximise the potential of this fuel source.

As at 2005, there are approximately 25 sites available for CNG/LNG refuelling in the UK. Larger fleet operations using CNG/LNG usually install a fuel bunker at their depot.

4.5.11 Liquid Petroleum Gas (LPG)

LPG consists of various hydrocarbons. In the UK, LPG is predominantly propane. It is a by-product of oil refining and is also associated with natural gas fields. Compared to diesel, LPG produces significantly lower emissions of nitrous oxides and particulates. Compared to petrol, LPG emissions are lower in all regulated pollutants with approximately a 10% reduction in CO2. LPG is currently popular at the small end of the market, i.e. cars and vans. It is currently available at over 1,100 open access sites.

Indeed, the benefits of using LPG vehicles can be illustrated by York council, who operate LPG engines in 28% of its fleet, Harrogate council, who operate dual LPG and diesel engines in 15% of its fleet and Doncaster council, who operate LPG engines in 105 of its fleet and have also installed its own LPG refuelling facility.

4.5.12 Electricity

Electricity driven vehicles have low noise levels and no emissions at the point of use. However, emissions will be created at the site where the electricity is generated but these will be significantly lower than using diesel. Current battery capacity means the range of these vehicles is limited to between 50 and 100 miles depending on application. These vehicles are therefore best for short, urban deliveries. For example, milk floats have used this technology for many years. However, as technology is developing in this area the battery capacity and speed of these vehicles is advancing.

The main advantage of electric power technology can be best used in hybrid machines, which are becoming increasingly popular. These vehicles have a small petrol or diesel powered engine and a battery. Therefore, the petrol or diesel engine continually regenerates the battery power. Whilst the vehicle is in urban areas it can run off electricity and then it can switch to petrol or diesel when on the highways. This type of machine gives you the benefits of both systems speed and distance capability when needed and an efficient cheap means of power when speed is not necessary.

Hybrid machines have been adopted by several UK councils as a mean of powering public transport. In Liverpool a bus service uses a hybrid system in order to maintain efficiency and help reduce harmful emissions. Transport for London is also running a number of diesel-electric hybrid buses.

4.5.13 Biofuels

Biofuels (liquid fuels) are transport fuels produced from plant material or organic waste oils and fats. Like oil, the organic mass is refined to produce different types of fuel.

Essentially biofuels can be categorised as:

- Biethanol – an alcohol based substitute for petrol produced from sugar beet and wheat
- Biodiesel – a heavy fuel ignited by compression, is a substitute for diesel and is produced from oil seed rape, vegetable waste oils or rendered animal fats. This is typically mixed with diesel and used in normal diesel engines

Biofuel technology is being used to provide a substitute to finite oil and gas reserves. Biofuels can reduce well-to-wheel carbon dioxide emissions, although the precise carbon saving will depend on the amount of energy used to cultivate, harvest, process and transport the fuel. Sales of biofuels currently make up less than 1% of total UK transport fuel sales, but this is set to increase significantly in future years as a result of the Government's Renewable Transport Fuels Obligation which will require all transport fuel suppliers to ensure that 5% of their total fuel sales come from biofuels by 2010.

Biofuels can also have other benefits, including benefits for the rural economy. Out of all the alternative fuels, biodiesel is becoming increasingly popular due to its compatibility with diesel engines. High quality biodiesel can be used in any diesel vehicle at blends of up to 5%, but many vehicle manufacturers will refuse to honour their warranties if biodiesel is used in higher percentage blends. This factor may change in the foreseeable future, as the European Union revises its fuel quality standards. Biodiesel which does not meet appropriate quality standards should not be used under any circumstances.

4.6 Summary

This chapter has established considerations and different methods to take into account when purchasing, storing and keeping control over your fuel stocks. By analysing these considerations you can decide which option best suits your operation in relation to cost and use. Therefore, by becoming efficient in this area your results, within the measuring performance process, will become stronger.

Vehicles that run on alternative fuels may be exempt or at least attract a discount on congestion charges. Contemplating how other fuels can be incorporated into your operation may be a worthwhile investment for the future.

5 Fuel Efficiency Through Developing Skills

5.1 Introduction

In today's economy, continual learning is critical for achieving efficiency. Your employees are your principal business asset and play a vital role in any commercially successful business. Investing in them will enable you to reap rewards that will pay off immediately and in the future. If employees can work in a more efficient and effective manner, there can be substantial savings to be made. Many employers try and gain efficiency through 'work pressure' rather than enhancing employees' skills, which can lead to an unhappy workplace and result in employees leaving the organisation. Indeed, this factor has become increasingly important with the current reported shortage of HGV drivers in the UK.

Essentially, developing skills through focused training and educating an employee about the importance of their role within the business can help to improve the operation's overall fuel efficiency. As technology is becoming more important to achieving efficiency it is important to make sure that your employees can adapt to these technological advances. These skills are explored in **Chapter 6 Equipment & Systems** along side the relevant products.

Employees are your main business asset. Investing in them can reap rewards in the future

This Chapter assesses how you can develop appropriate skills for the Fuel Champion and the driver and gain employee involvement in a Fuel Management Programme.

5.2 The Fuel Champion

As stated in **Chapter 2 Fuel Management**, a responsible person should be appointed as a Fuel Champion. The Fuel Champion plays an important part in successfully managing your fuel performance, and they must have sufficient authority and responsibility to ensure that the Fuel Management Programme is successfully implemented. The Fuel Champion is effectively the 'cog' that makes the Fuel Management Programme wheel turn.

5.2.1 The Fuel Champion's Role and Responsibility

The Fuel Champion will be required to drive the programme and they will need to develop a plan, resource it and ensure it is properly implemented. Even when other business priorities divert senior managers' attention, the 'Fuel Champion' will ensure that the business never loses sight of the programme's objectives. This will inevitably involve balancing conflicting interests, such as operational needs and driver training.

The Fuel Champion is responsible for fuel performance figures being produced, and communicating them to the appropriate people. They need to make sure that any data or information circulated is relevant, correct, accurate and easily understood by people who are not experts in the subject. Depending on the size of the fleet, a fuel champion may be required to spend a significant amount of time on the project if it is to be successful, but for small to medium sized operators, the role of a fuel champion will not be that onerous.

However, the financial benefits which can accrue from a well organised and implemented fuel management

Providing the right feedback to the appropriate people is essential in a good fuel management programme. Ensuring this happens is an important part of the Fuel Champion's role.

programme should make it a very worthwhile use of management time and energy.

It is important that the Fuel Champion must want to make the programme succeed and be committed to making savings. The following outlines the aims, objectives and specifications of a 'Fuel Champion':

- Create the best fuel performance for a transportation fleet
- Understand the factors associated with fuel efficiency, including obtaining accurate fuel data and driver training
- To understand how fuel consumption figures are generated, especially how errors occur in the capture of data, how to correct them and how to minimise their occurrence in future
- To understand the importance of accurate and reliable figures and recognise when they are achieved
- To understand the potential for improvement and ways to achieve that potential
- To understand the method of operation of any on-board fuel monitoring equipment
- To develop the strategies required with management and key staff members and put together an action plan
- To monitor the current situation and progress towards agreed goals
- To investigate and understand the factors which affect fuel consumption such as:
  - driver performance
  - load and route
  - weather
  - vehicle condition
  - traffic

It may be helpful for the senior executive who takes overall responsibility for fuel management to draw up a simple list of responsibilities, knowledge and experience to cover the role of the Fuel Champion.

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Fig 5.1: Example of list of responsibilities, knowledge and experience of a Fuel Champion:

FUEL CHAMPION – Ideal Skills, Knowledge and Experience

Skills	Knowledge	Experience
Understanding and analysing figures • Problem identification • Problem Solving • How to determine and compare performance from data Ability to work with people at all levels, (drivers to management) Good grasp of figures Motivational skills Sharing knowledge and expertise, working in teams, networking Willingness to extend own knowledge	Basic understanding of: • Vehicles and vehicle engineering • Fuel economy issues • Fuel economy software • On-board computers • Company policies • Driver training package • How to drive a vehicle efficiently • The key elements of fuel management	Preferably able to drive the typical vehicle in the fleet and trained in fuel efficient driving techniques If not, to have been trained in a car to experience the process and if possible, to have seen the process in a truck

For the Fuel Champion, communication is key to success.

The Fuel Champion is effectively the 'cog' that makes the Fuel Management Programme wheel turn.

5.2.2 Fuel Champion's Typical Action Plan

The first task for the Fuel Champion must be to draw up an action plan (such as the one below), get it agreed by all, and then ensure it is implemented properly.

Senior management will obviously want to approve the programme and its action plan, and having committed to it, they must then play their part in communicating the programme organisation wide. That means to all levels of management and other departments as well as trade unions and drivers. The objective is to get everyone to buy into the programme so that it is not wrongly interpreted as just another pressure on drivers and other staff.

Fig 5.2: Example of a Fuel Champion's typical action plan:

	Action	By Whom	By When
1	**Communication:**		
	Board presentation and commitment		
	Management briefing		
	Trade Union presentation		
	Driver briefing		
2	**The Fuel Champion:**		
	Responsibilities and authorities		
	Training and development		
3	**Data:**		
	Investigate and review quality		
	Recommend improvements		
	Data collection		
	Driver disciplines		
	Set Up 'monitoring and targeting'		
4	**Develop Plan to improve performance:**		
	Training programme		
	Review maintenance schedules		
	Effectiveness analysis		
	Sustainability		
	Develop programme		
	Decide content and format		
	Decide timescales		
	Programme start-up		
	Decide on recognition or rewards		
	Consider interventions for testing		
5	**Feedback:**		
	Agree reports, frequency and circulation		
	Publish results		
6	**Taking Actions:**		
	Implementing the plan		
	Feedback		
	Re-evaluation		
	Fine tuning		
7	**Evaluations:**		
	Vehicles		
	Interventions		

5.3 Involving Employees in the Fuel Management Programme

If you want a Fuel Management Programme to succeed it is imperative that you involve your employees from the outset. Once you have appointed a Fuel Champion and started the process of managing fuel you must then start a process of communication and consider methods of sustainability to keep fuel efficiency at the forefront of employees' minds.

5.3.1 Communication

If you want to gain the maximum efficiency from your fuel management programme, you must brief the entire team, from the directors to the drivers (top to the bottom). To enable the programme to be successful a sense of involvement and interaction with the programme must be established from the outset.

It is recommended that you publicise the programme in a method that reaches the entire organisation. Various methods such as email, newsletters and team meetings can help you achieve this. The method of briefing and the information that you publicise may differ depending on your business. The following are examples of the facts you may want to include:

Engage drivers and operational staff.

Fig 5.3 Example of a driver's brief. In the following enter your own figures:

Litres of fuel use (diesel) per annum: _____

Multiply by price per litre: _____

Equals, **Annual Fuel Bill:** _____

A 5% saving though a Fuel Management Programme is:

Annual Fuel Saving (£): *Annual Fuel Bill multiplied by 5%*

Environmental benefits as a result of reduced emissions are:

Carbon Dioxide saved in kg per annum = *5% of fuel use (diesel) per annum multiplied by 2.68kg of CO_2 per litre.*

A vehicle that uses 30,000 litres of fuel in a year produces 78 tonnes of carbon dioxide. If you improve your fuel consumption by 5%, you will put 3.9 tonnes less CO_2 into the atmosphere in a year. *(NB: operators should used their own figures)*

The objective is not to try to teach drivers to drive, but more to help drivers to get the best out of each vehicle they drive.

For many years, fuel has been the fastest rising cost, usually going up above the rate of inflation. It is one of the largest costs. If you wish to remain competitive, you must do everything to minimise the amount of fuel you use. *(NB: Operators should change this to match current fuel price trends.)*

This information essentially educates the team of why you, as a business, need to become efficient in terms of fuel use. The bottom line is that if the business is not profitable then the employees' jobs will be at risk, but also in addition, it emphasises the company's active social responsibility in reducing harmful emissions.

Effective communication is an essential component for achieving operational success. Communication is a two way process, so you should recognise and encourage contributions from employees.

5.3.2 Employee Interaction

Once you have communicated the fuel management programme throughout the organisation it is advised that you allow team members to play an active role within the programme. This does not necessarily mean giving team members responsibilities within the programme, simple dialogue between the employees is also important. Remember, it is your staff who will be implementing the fuel management programme and if they do not feel involved then resistance may occur, causing delay and expense.

In addition, drivers, mechanics and office staff may also highlight possible problems from the outset, saving you time and money. Therefore, it is important to establish a communication programme involving management, trade unions (if appropriate), drivers, mechanics and office staff in order to get the programme off to a flying start. This communication programme should explain the importance of fuel efficiency for society and the business, as well as for the development of the employees' skills.

Communication is a two-way process, so as well as providing information and feedback to the team on their performance it is also recommended that you also ask for feedback from them. Therefore, you should recognise and encourage employees' contribution of ideas.

5.3.3 Performance Tables

Like any commercial factor, fuel efficiency should be monitored. One of the ways of accessing useful data on fuel consumption is to gain information from the employees. A recommended method of achieving this is by creating league tables within the business. League tables are a good method of monitoring each driver, mechanic or administration staff. Obviously, the factors that need to be monitored differ depending on the job of the employee. However, league tables should be used sensitively, recognising that different locations and depots have differing geographical constraints and factors, such as heavy terrain routes.

The most popular and easily implemented league tables are concentrated on the drivers of the operation. It is recommended that you publish these tables in respect of fuel consumption figures. Ranking by driver is preferable, however, in some operations this is not reflective of the factors that need to be taken into account, for example where different vehicles are used. Therefore, you can rank by vehicle and/or groups of drivers, or as a last resort, by depot. You should only select the relevant criterion that is applicable to your operation. As stated above, you should use league tables sensitively, recognising for example that some routes are tougher than others, and some vehicles are intrinsically less economical. Ultimately, you may be able to develop a handicapping system, which takes into account the factors affecting fuel economy to make league tables more comparable.

*Further information on driver league tables is provided in **Chapter 3 Measuring and Managing Fuel Performance**

Fig 5.4: Example of a driver league table.

		Metric Conversion			Consumption Performance			Code
Driver ID	Driver Name	Distance (km)	Fill Qty (lts)	Average l/100 km	Target mpg	Actual mpg	Actual Variance	Notes
03	David Arthur	460	112	24.35	9.06	11.61	28.1%	
11	Philip Bullock	353	120.5	34.14	7.6	8.3	9.2%	
15	Geoff Clarke	6472	1143.6	17.67	15.48	15.98	3.2%	
08	Sakis Pelekanos	7705	2860.2	37.12	8.02	7.61	-5.1%	
14	Zack Sethi	1006	337.4	33.54	9.06	8.43	-7.0%	
02	JonPaul Simpson	718	107.1	14.92	20.98	18.93	-9.8%	

Transport office staff members also perform an essential role in any fuel efficient operation, and while not actually being involved in the physical movement and handling of goods, their role nevertheless should be one that is continually monitored. This area is more difficult to assess performance in and the performance of office staff has more often been monitored on a qualitative basis, with the line manager taking a view on the performance of their staff.

5.3.4 Sustainability

To enable sustainability of the programme you need to have a plan for at least 12 months, otherwise there is a danger of the programme wilting. Therefore, it is recommended that you create incentives in order to keep fuel economy at the forefront of the employees' minds. Below are some examples of methods that may achieve this objective.

Competitions

Before considering competitions, you must have reliable and accurate methods of measuring fuel performance. Competitions can then be organised at whichever level you can monitor. Hence, if you can only measure at 'fleet' level, then you can only reward overall fleet improvement. However, if you can monitor individuals you can reward individuals.

Competitions can provide valuable incentives at a relatively low cost and risk. They should be used sparingly to maintain their impact – 2 or 3 a year is more than adequate. The most important factor is that the people whose behaviour you are trying to influence have a real belief that they can win the competition. Merely rewarding the best performer is likely to have a negative impact on those who have no chance of achieving this accolade. Therefore, other options should be considered, for example, the most improved performance or setting a threshold performance level which entitles all those exceeding it to participate in a prize draw.

Prizes should be carefully selected, often activities that the driver may not normally do are popular. Other prizes could include shopping vouchers, vehicle models, driver's coats, etc. Often donations to a charity of the driver's choice are well received.

Bonus Schemes

Introducing a proper bonus scheme related to fuel consumption is a big step. It must be well thought through and take into account issues such as:

- Different drivers doing different work
- Factors which will have an impact on performance including load, tractor/trailer configurations, weather, vehicle maintenance, type of roads, etc
- Impact on pay differentials

Bonus schemes are a specialist area that can involve both significant cost and risk. They can easily become very complex. You may wish to consider seeking specialist advice to tailor any bonus scheme to the particular requirements of the organisation.

Focused Themes

Another good idea to maintaining sustainability of the Fuel Management Programme is to create a 12 month plan of themes, with a different theme for each month. Two or three could be allocated to competitions that run for a month. In other months, the theme would be a key action to improve performance such as 'Staying in the Green', i.e. keeping the engine speed within the green band on the rev counter.

Other themes could include:

- Idling
- Block changing
- Driver disciplines
- Managing roundabouts

Creating Teams

Consider putting employees into teams for competitions. This method is a good way to overcome the problem of individuals doing different jobs. Teams should be evenly drawn from the operation so that they all start with the same average level of performance. This method also has the added advantage of creating a healthy team atmosphere where employees are helping each other to achieve a unified goal – fuel efficiency.

5.4 The Driver

When considering Fuel Management Programmes it is essential that you understand that the driver is a pivotal factor in creating success or failure. Underestimating the driver's role within the programme will undoubtedly result in inefficiency and lost profits. For the vehicle operator, the benefits of a fuel efficient driving style will not just lower fuel bills but it will also lower maintenance and insurance costs.

The purpose of this section is to illustrate a Fuel Management Programme that not only improves the driver's skills but also improves the company's fuel efficiency performance. To develop a culture of fuel efficiency among drivers you must treat them as genuine partners to the Fuel Management Programme, by implementing the communication procedures as outlined previously. Importantly, a good relationship between the organisation and its drivers will help retain existing drivers and also attract a high calibre of potential drivers. Some organisations have embarked on long-term contracts of employment to encourage drivers to stay with them. This can also be in conjunction with Governmental schemes like the Young LGV Driver Training Scheme, which gives the drivers some formal recognition of their skills.

5.4.1 Recruitment

When recruiting new drivers you should ensure that the applicants are assessed to your company standard, which embodies the Fuel Management Programme. Therefore, you should assess not only their driving skills, but also their knowledge about driving economically. This process would normally occur through induction training and a tour of the vehicles that the company operates. Once recruited, drivers should be continually reminded of the importance of fuel-efficient driving through training activities. Drivers need to be aware of how to maximise both the performance of the vehicle and their own skills. Therefore, the driver should be assessed annually in order to maintain the expected levels of fuel efficient driving.

5.4.2 Agency Drivers

Agency drivers now play a significant role in many transport operations. An in depth analysis of agency drivers is out of the scope of this guide. However, if you recruit agency drivers, it is recommended that you have an 'agency driver policy' which provides the criteria on which the driver is recruited. This should include factors such as minimum experience required, the training required, the method of recording agency driver performance and the basic brief that is given to the driver. It is also recommended that you use a fuel efficiency questionnaire as a starting point.

Fig 5.5: Example of a Fuel Efficiency Questionnaire

Example of a Fuel Efficiency Questionnaire

	Please indicate whether the following statements are true or false:	True	False
1	Keeping revs in the green band whenever possible improves fuel consumption		
2	The best way of deciding when to change gear is to listen to the engine noise		
3	Block changing (i.e. missing out gears) will not help your fuel economy		
4	Double de-clutching is good for the engine and fuel consumption		
5	The exhaust brake works best when the revs are low		
6	If the tyres are under-inflated, fuel consumption will be badly affected		
7	Carrying out pre-start checks is unnecessary and will not help fuel consumption		
8	The way the driver drives is not important in getting the best fuel consumption out of a vehicle		
9	Reducing fuel consumption helps to reduce pollution and therefore improve the environment		
10	If you know that the vehicle will be stationary for more than 2-3 minutes, you should switch the engine off to save fuel		
11	Driving at a steady 50 mph uses significantly less fuel than driving at 56 mph		
12	It is not possible to drive fuel-efficiently and defensively (or safely) at the same time		
13	The professional driver takes pride in driving safely, courteously and fuel efficiently		
14	Although the principles are the same, you need to know the characteristics of the engine in each vehicle to get the best out of it		
15	You should always let the engine warm up fully before you start moving		

Answers:
1) True; 2) False; 3) False; 4) False; 5) False; 6) True; 7) False; 8) False; 9) True; 10) True; 11) True; 12) False; 13) True; 14) True; 15) False

You can also use this questionnaire on your own drivers to identify areas of concern.

5.4.3 Training & Development

It is imperative, as part of a Fuel Management Programme, that you have some kind of formal training for the drivers. If you do not then you should introduce a standard mandatory training plan. Whether you have your own trainers or you contract this job out, you should make sure that the programme for drivers includes efficient and economical driving.

A new European Directive on Driver Training, expected to be implemented by 2009, will establish a certain threshold of on going training that is required for HGV drivers, for example drivers will need a Certificate of Professional Competence. Therefore, steps that are taken now will inevitably make this Directive less onerous in 2009. Once again, the fuel efficiency questionnaire can illustrate who will need specialised training from the outset. In addition,

performance monitoring will also highlight those who urgently need the training.

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5.4.4 The Safe and Fuel Efficient Driving (SAFED) Scheme

The Safe and Fuel Efficient Driving (SAFED) scheme for trucks was developed by a steering group of industry experts and introduced in May 2003. It has been developed specifically to enable both vehicle operators and training providers to implement driver training and development for existing HGV drivers within the road freight industry. Driver training consists of a full day training course, which includes practical assessments and theory papers, based around two central themes which are:

- Accident prevention and reduction
- Fuel efficient driving.

It is also important to remind drivers that it is not only driving that needs to be economical. Their efforts must extend to other activities such as taking care to refuel vehicles, reducing spillages, locking the fuel caps, ensuring the vehicle is free of defects and recording vehicle and mileage data accurately when dispensing fuel and completing records. In total, SAFED training for 6,375 drivers has resulted in the industry saving approximately £10,500,000 in fuel.

In January 2006, the SAFED for Vans scheme was launched following a successful pilot project that found significant financial and environmental gains could be made in van fleets. Benefits for a typical driver doing 20,000 miles a year could include:

- Savings of up to £500 of diesel per vehicle
- Over 1/4 tonne reduction in carbon emissions
- Reduction of fuel consumption by around 10% per vehicle
- 59% fewer gear changes
- Fewer accidents, lower insurance premiums, lower running costs and higher resale value of vehicles

At the time of the Fuel Management Guide going to print, the Department for Transport was offering free SAFED for Vans training to 200 instructors and 3,500 drivers across England. The optional one day course involves a mix of classroom and on-the-road tuition and teaches the use of driving techniques such as better use of gears.

Full details of SAFED can be found by visiting the SAFED website at www.safed.org.uk.

SAFED training for 6,375 drivers resulted in the industry saving £10,500,000 in fuel. That's a £1640 saving of fuel per driver!

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The Safe and Fuel Efficient Driving Standard

Companies and Drivers Benefit From SAFED: A selection of Case Studies

SAFED for Vans- A Guide to Safe And Fuel Efficient Driving for Vans

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Exel and the SAFED programme

Exel is a global leader in supply chain management, with some 109,000 employees in more than 120 countries.

Arthur McLennand is Exel's Head of Transport for a large contract at Daventry. He stated "We seized the opportunity to complete the SAFED training because we realised how well it would complement our in-house driver training. We see enhanced safe-driving techniques, like those taught in the SAFED scheme, as a major benefit. They make drivers more aware of what is going on around them and encourage them to have more sympathy for their vehicle and its controls. Our before-and-after fuel consumption records also show that the training resulted in fuel savings of up to 5% from the 45 drivers based at Daventry."

Paul Lanny has more than a quarter of a century's experience as a professional truck driver. He emphasised, "you become complacent. Everybody who has driven for years slips into their own little ways. You would be silly to ignore the information you get from the SAFED course. My gearshift count, for example, was cut by about 50% and my driving style now is more relaxed, so I am not so tired at the end of the day. When a driver is less tired, he is bound to be more aware of what's going on around him."

5.4.5 Training the Trainer

If you decide that driver training is to be carried out in-house then you need to consider what aspects should be addressed. Operators must also be aware that current legislation requires paid in-house trainers for van drivers (Category B) to be ADI registered. Further information on ADI can be seen on the Driving Standards Agency website on www.dsa.gov.uk.

However, an operator will need to train their trainer, taking into account any training that they have had already. The following factors need to be covered:

- Basic training and coaching skills
- Driving the vehicle economically
- Selecting the drivers for training and coachig
- Organising and implementing the training

Organising and implementing the training is an area which needs careful planning. Often operational priorities will conflict with training priorities. However, you must make time for training. Careful and considerate planning will help to create a scheduled time table that enables your operation and training to run smoothly.

5.4.6 Driver Disciplines & Vehicle Checklists

Within the driver's job description a driver should already carry out safety checks at the beginning of their shift or when they swap vehicles or trailers. A conscientious driver will also do a quick walk-round check at the end of a rest break to check the security of the load and to see there are no leaks of fuel, air, oil or water. These may only show up when the vehicle has been standing while it is hot. Therefore, drivers should be supplied with a check list to complete during their shift. When the driver has completed the daily check then the form should be signed by the driver and at the end of their shift these should be filed with the vehicle records.

There are also other checks that the driver should carry out from time to time during their shift but not while driving (unless safe to do so). These should include:

- Brakes binding
- Colour of exhaust
- Engine temperatures and oil pressures

In this way any problems with the vehicles will be highlighted at an early stage.

Fig 5.6 Example check list for drivers

It is critical for companies to maintain the roadworthiness of their vehicles, hence it is important for drivers to complete a daily walk round check of their vehicle equipment before use.

The following checks can be undertaken before leaving the site at the start of shift and if appropriate checks can be made again before booking off from your shift:

1. Are the tyres in good condition, including wheel fixings?
2. Are the wheels correctly aligned, and at the correct pressure?
3. Is the fuel system free from leaks?
4. Is the fuel system adjusted to the manufacturer's recommendations?
5. Are the exhaust emissions visually normal? (Black smoke indicates excess fuel).
6. Are the oil and coolant levels correct?
7. Is the oil of the minimum viscosity possible within the manufacturer's recommendations?
8. Are the air cleaners serviceable (i.e. not blocked)?
9. Is there any evidence of air leaks?
10. Is there any evidence of the brakes binding?
11. Is there any evidence of clutch slip?

Any damage apparent to your vehicle at the start of shift or damaged caused during the shift must be reported as soon it is apparent/caused.

5.4.7 Performance Monitoring

Nowadays, performance monitoring has become a lot easier due to the introduction of telematics and other technological advances (see Chapter 6). These systems do come at a price but undoubtedly create accurate and efficient methods of recording driver data. This has a knock on effect on fuel efficiency and therefore profits. The most common device is on board computers which can be fitted for a variety of purposes, including:

- Training
- Modifying driver behaviour
- Monitoring individual driver performance
- Communications
- Location tracking
- Vehicle monitoring
- Setting optimum targets
- Assisting in evaluating fuel-saving interventions

Most operators now have on-board computers, but if you decide you need a new system then you should fit a small number of vehicles with the device in order to assess the benefits of that system. The types of systems an operation will need will vary depending on your business needs.

However, if you don't have any telematics systems then you can encourage your drivers to monitor their own performance by providing a system to calculate their own performance. Normally, drivers are expected to fill up their vehicles at the end of each shift. Driver worksheets can provide the formulae to calculate fuel economy:

Fig 4.2: Contents of a bulk fuel tank:

MILES PER GALLON =

2.825 x KILOMETRES / LITRES

OR

4.546 X MILES / LITRES

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Thorntons Plc's use of Driver Performance Management

Thorntons is a major UK manufacturer and retailer of premium confectionery. They introduced a Fuel Management Programme in 1995 as part of the company's commitment to reduce distribution costs and improve operational efficiency.

"One of the key tools used to achieve this reduction in operating costs has been our Fuel Management Programme. It is a great example of drivers, operations staff and management working together to improve our operational efficiency and reduce our operating costs." Greg Garside, Head of distribution.

The average mpg of the core fleet (17 tonne rigids, 32 tonne articulated and 38 tonne articulated) has improved from 9.29 mpg in 2000/01 to 9.90 mpg in 2002/03 – a fuel efficiency improvement of just over 6.5%. In addition to this, Thorntons has indicated that the number of accidents for which its drivers are liable has also fallen.

In recent years, Thorntons invested further in computerised fuel monitoring equipment and feel the investment was worthwhile given the ongoing fuel savings. Regular meetings between drivers and managers, combined with a range of key driver performance indicators linked to financial bonuses has helped them meet performance targets and has provided a basis for successful fuel management.

5.5 Summary

Overall, employees of a transport or logistics company can play an essential role in helping fuel efficiency within an organisation. It is these employees that carry out the day-to-day operations of the company and therefore they will implement the Fuel Management Programme. If you can train your staff to become efficient within their role, the company will benefit as a whole. The employees will become more skilled and therefore gain job satisfaction and the company will become more efficient. Once again, these actions will have an immediate effect on the results of a company within the measuring performance process.

Therefore, this Chapter has outlined the various ways in which to train the Fuel Champion and the driver, as well as how to involve your staff in a Fuel Management Programme.

6 Equipment and Systems

6.1 Introduction

If you have decided that you wish to embark on a Fuel Management Programme and you have installed a performance management procedure, you should then research the results they attain. These results will highlight areas where fuel efficiency is underperforming and therefore the manager can look to improve those areas in order to increase the overall fuel efficiency of the operation. Equipment and systems can play an important role in improving fuel efficiency. This Chapter explores the functions of relevant equipment and systems for a Fuel Management Programme, including; fuel recording systems, vehicle specification and telematics. In addition, maintenance workshops are also explored to illustrate how equipment and systems should be maintained.

6.2 Fuel Recording Systems

These systems are considered in their context in **Chapter 4**. Fuel recording systems have varying degrees of sophistication depending on the requirements of your operation. The cost of the systems will increase depending on the accuracy of the data, the size of your fleet and the amount of fuel used. Essentially, most recording systems operate from a Fuel Island Controller (FIC) which records the date and time of the transaction, quantity of fuel delivered, the vehicle and the driver using the pump. The information can then either be printed out or downloaded onto a computer. The more sophisticated systems can collect data from refuelling sites across the country and then process the data into manageable reports.

6.3 Specifying the Vehicle

Spending time in developing an accurate and appropriate vehicle specification will help you ensure that your vehicles are closely matched to the tasks they are expected to perform and will improve both fuel and overall operational efficiency.

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. For example, in two years a typical tractor unit will use diesel that costs much the same as the vehicle’s purchase price. What is more, the value of a fuel-efficient specification will increase if diesel fuel becomes more expensive. This can lead to cost savings, increased profitability and reduced environmental impact.

Attention must also be given to the load carrying part of the vehicle, whether it is a trailer or the body on a rigid vehicle. It will generate considerable aerodynamic drag and so will be a major influence on fuel economy. It will also have an impact on a vehicle’s overall productivity and ease of operation.

Choosing the size and type of vehicle that is right for the job is one of the first steps on the path towards optimum fuel management.

6.3.1 Selecting the Right Vehicles

Vehicle specification is about selecting the right equipment to undertake the work efficiently and safely. The following are some basic points which could help you to understand your business and transport needs better, enabling you to select the correct vehicle and specification:

- Is there a good dealer nearby?
- Is there an adequate dealer network covering the routes that your vehicles will travel?
- Is the vehicle available in a configuration, wheelbase length and with an engine power output option to suit your needs?
- What are the driver and crew needs?
- Do you need a sleeper cab and is the cab the right size?
- How heavy is the vehicle when it is unladen?
- Is maintenance going to be competitively priced and convenient, maintained by the dealer, in-house or by another contractor?
- What are the service intervals?
- Does the manufacturer allow extended oil drain intervals dependent on the type of operation and the type of oil used?
- Is the engine fully electronically managed, and able to allow fuel consumption and engine data to be captured and downloaded?
- What fuel tank capacities can be fitted?
- Are fuel tanks fitted on the 'right side' for your fuel islands, and if you are running refrigerated trailers, are they all compatible?

Selecting the right vehicles will improve both fuel and overall operational efficiency

6.3.2 Vehicle Costs

Cost is an important, if not the overriding factor that influences your decision. Although it is easy to focus on capital cost when choosing vehicles, this should not be the only factor taken into account. 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

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.

It is beyond the scope of this guide to explore whole life costing in detail. If necessary, take advice from an accountant to make sure that the full cost implications are considered. This will allow the use of sophisticated techniques such as discounted cash flow if necessary. The use of discounted cash flows is particularly important when evaluating the worth of residual values, and especially in deciding whether it is worth investing in additional options to enhance the second-hand value of the truck.

6.3.3 Assessing the Core Vehicle Specification

Before selecting vehicles and body types, you need to build a picture of what your vehicle will be used for. 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 and docking heights.

The first step towards producing a specification is to develop a clear understanding of the types of vehicle available and their main characteristics. The Freight Best Practice guide "Truck Specification for Best Operational Efficiency" discusses vehicle selection in greater detail. The guide will help you:

- Identify the basic types of trucks available
- Identify the main benefits and features of each type
- Develop an understanding of body and trailer types and their uses

Unlike cars and vans which are usually sold as complete packages, commercial vehicles tend to be supplied according to bespoke requirements. 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.

See the **FREE** Freight Best Practice publication:

Truck Specification for Best Operational Efficiency

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

Manufacturers' franchise dealers are equipped with software packages to help their customers produce detailed vehicle specifications. But you must develop a clear idea of the components you need so that your precise requirements and range of vehicle components can be clearly understood by dealers. The evaluation of your requirements should cover areas such as axles and tyres, body and trailer, chassis, driveline specification/engine, fuel tank, transmission, and assessing a demonstrator vehicle.

Axles and Tyres

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.

To increase carrying capacity, additional axles are added and operators should 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 affects the tachograph and speed limiter calibration.

There are two main types of tyres, radial and cross-ply. Radial tyres have a flexible side wall which permits better road contact and lower rolling resistance. This leads to better fuel consumption and better cornering and grip, particularly in wet conditions. Cross-ply tyres feature a hard sidewall, which has less road contact than a radial tyre. Other types of tyre include re-grooved tyres and re-treaded tyres.

The more tyres a vehicle has in contact with the road, the greater the rolling resistance and the higher the fuel consumption. This is particularly true when the

axles are not tracking parallel to the direction of travel and when tyres are under-inflated.

Self-steering axles at the rear of trailer bogies and at the back of three-axle vehicles have become popular in recent years to reduce tyre scrub when the vehicle manoeuvres regularly in confined spaces.

They may pay for themselves in better manoeuvrability, longer tyre life and marginally better fuel consumption. Lifting axles that lift the wheels clear of the road, when the vehicle is running empty or lightly laden, serve the same purpose.

Tyre manufacturers have been striving to reduce the rolling resistance of tyres in order to promote their fuel-saving benefits. A tyre's rolling resistance decreases naturally as its tread depth reduces, but to produce a new tyre with low rolling resistance without reducing the tread depth is much more difficult.

The validity of claims for tyres advertised as 'energy efficient' needs to be carefully considered. The savings are most likely to be apparent if the vehicle has multiple axles (such as a five or six-axle artic), it is engaged on long distance trunking and all axles are fitted with the low-rolling resistance tyres.

In other circumstances, improvements in fuel consumption may not be so significant, and in any event, there may be deterioration in other aspects of tyre performance. Tyre compounds and designs are a delicate balancing act between such factors as rolling resistance, wear rate, grip, abrasion resistance, noise, casing life, cost and weight. Accentuating one of these features can impact on others.

See the **FREE** Freight Best Practice publication:

Saving Fuel With Lower Rolling Resistance Tyres

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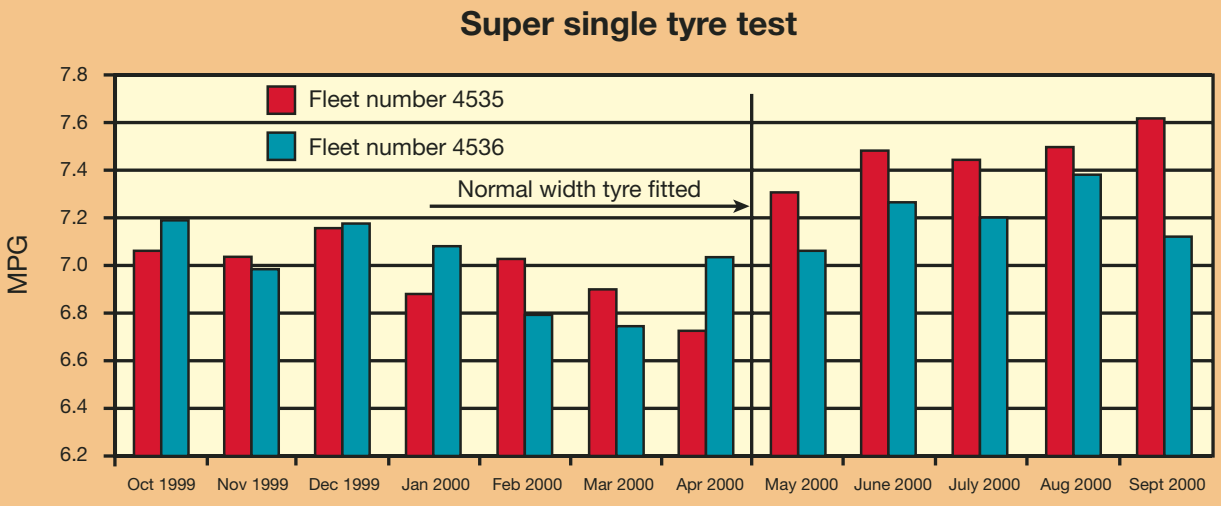
BOC Gases Tyre Testing

BOC Gases noticed that two new vehicles were struggling to meet their fuel consumption targets. They discovered that they were fitted with wide single tyres on the steer axle. By reverting to standard width tyres, fuel consumption was improved by an average of 0.51 mpg or 3.6%. Both vehicles have now increased their route targets, and are providing an annual fuel saving of £1.900 per year. The bar chart shows the immediate improvement in fuel consumption after the standard width tyres were fitted



Body and Trailer

The body forms a critical element in the overall design specification, ensuring the vehicle is fit for purpose and performs tasks cost-effectively. When deciding on the body, consideration should be given to access options for manual or mechanical loading and unloading.

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 and unloading. Using double-deck trailers can reduce the number of journeys required, so while there are obvious operational benefits regarding a reduction of vehicles and drivers required, there is also the substantial reduction in miles run, reducing fuel costs.

Using double-deck trailers can reduce the number of journeys required, so while there are obvious operational benefits regarding a reduction of vehicles and drivers required, there is also the substantial reduction in miles run, reducing fuel costs.

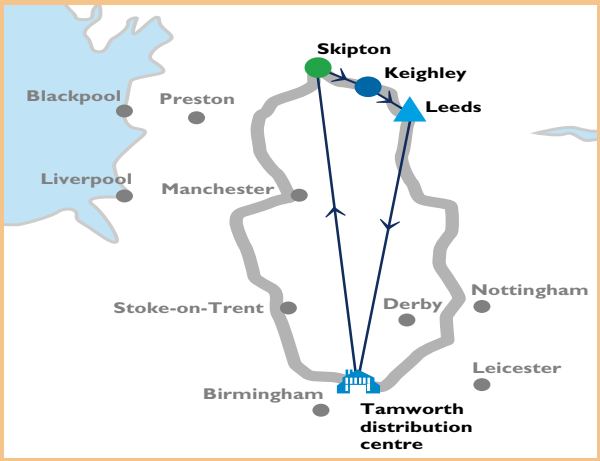
Focus DIY's use of Double-Deck Trailers

The following maps illustrate how Focus DIY benefited from using double deck trailers.

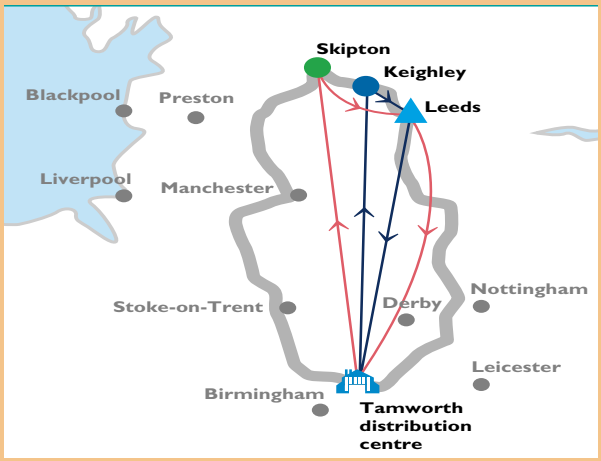
MAP 1 – A double deck trailer delivery of 41 Roller Cage Equivalents (RCE) to Skipton and then 44 RCE to Keighley, before picking up a back-load of 66 RCE from Leeds.

Map 2 – The comparison with two single deck trailers delivering the same volume. The first, delivering 41 RCE to Skipton and picking up a back-load of 45 RCE from Leeds. and an identical vehicle delivering 44 RCE to Keighley and picking up a back -load of 21 RCE at Leeds

Double deck delivery



Single deck delivery



Using the double-deck trailer compared to two single deck trailers gave the following benefits:

- Mileage reduced by 257 miles (413 km), saving £378 in operating costs (based on an operational coat of £1.17 per mile)
- Fuel costs reduced by £108 (based on fuel price of £0.70 per litre) and lower CO_2 emissions.
- Halving working time as only one driver is required to deliver the same load
- Improved average utilisation (only one vehicle required)

Double deck trailers provide extra load space for high volume, low weight loads and so can help improve fleet efficiency

Trucks are usually sub-categorised by body or trailer type. The most common include flat beds, curtain-siders, low loaders, tilts, box bodies, temperature controlled bodies, tippers, road tankers, skeletal trailers, step-frame trailers, Luton, double deck trailers, and demountable 'swap body' systems..

See the **FREE** Freight Best Practice publication:

Focus on Double Decks

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Demountable bodies offer another innovative approach to improving operational efficiency through vehicle specification. Demountable bodies enable drivers and vehicles to be used more intensively, due to quicker turnaround times at the depot. Essentially vehicles and drivers don't have to wait around to re-load.

This is most effective where a driver has multiple trips during the day. They also provide a good option for trunking operations where several boxes can be sent to another depot and then taken individually on local deliveries the next day, in a "hub and spoke" operation. The case study on Premdor demonstrates the use and benefits of demountable bodies.

Premdor's Use of Demountable Bodies

Premdor, one of the largest suppliers of joinery products in the world, operate a central warehouse at Barnsley. They have 4 other sites at Swindon, Heddingham, Middlesbrough and Bridgwater, which manufacture some of the products and act as outbases.

During the night 38t drawbar units take two demountable boxes with manufactured products from the outbase depots to the Barnsley depot, where preloaded bodies with customer deliveries are then trunked back down to the outbases. The next morning the trailer body is picked up by an 18t chassis which makes deliveries, while the 26t prime-mover also makes the delivery with its demountable body.

The Benefits: Premdor are able to reduce trunking mileage by half, while still being able to use smaller vehicles for delivery into their customers which include a number of builders merchants and construction sites, where site constraints prohibit the use of articulated vehicles.

See the **FREE** Freight Best Practice publication:

Making the Swap to Demountables

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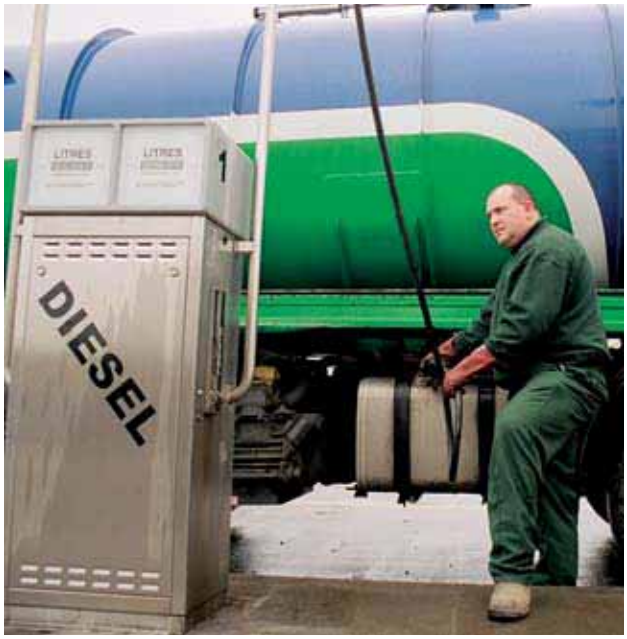
Fig 6.1 Examples of type of trucks suitable for different applications

	7.5t Flat bed truck	7.5t Curtain sider	7.5t Box vehicle	Multi-axle rigid vehicle	Artic vehicle	Drawbar combination	Artic & Double Deck trailer	Demountable system
Urban (General Haulage)	✓							
Urban multi-drop (palletised load)		✓						
Urban (security need)			✓					
Urban (high-density cargo)				✓				
Long distance trunking					✓			
Long distance trunking (Low density cargo)						✓		
Long distance trunking (high density cargo)							✓	
✓ = Suitable Vehicle								✓

Chassis

The purpose of the chassis is to locate the axles, power unit, running gear and cab and 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. The major factors that need to be considered are number of axles, the body, ancillary equipment (for example grabs, cranes, tail lifts, etc). Specific issues such as torsional stiffness and body mountings are also important.



Driveline Specification/Engine

Matching the engine output (in terms of both power and torque) to the gearbox ratios and the drive axle ratio is absolutely essential for optimising fuel consumption. Equally, the overall specification has to be suited to your operation, so that the engine is working in its most fuel efficient speed range for as much time as possible. The following are important factors to consider when specifying an engine for a particular vehicle:

- The power to weight ratio should permit the vehicle to operate at maximum torque output for most of its driving pattern
- Higher power output does not necessarily mean lower fuel consumption
- Fuel consumption benefits should be assessed in whole-life cost terms

Matching the engine power 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, torque and brake specific fuel consumption plotted against engine speed will tell the fleet engineer much about the suitability of a particular specification to their own operation.

In general terms, you should choose high power engines and higher final drive ratios for long distance work. Vehicles that will spend most of their time on local work will generally be more economical with less power than that needed for longer distances, fewer gear ratios and a lower final drive ratio.

To help operators with choices about drivelines, gearbox ratios etc, most manufacturers have computer programs that can compare the various

BOC: Engine/Driveline Specification Case Study

BOC had been collecting and analysing data downloaded from the Cummins Road Relay onboard management system. They found that these data held the key to identifying the reasons why some drivers were far more efficient than others.

For example, a driver holding top gear for 87% of the distance and using cruise control for 89% of the journey would use 21% less fuel than a driver who was in top gear 71% and in cruise control for 25% of the same route and driving the same vehicle. This is illustrates in the table below (1).

Table (2) illustrates the fuel consumption benefits through the reduction of over-revving the engine.

BOC concluded that the best driving practice for fuel efficiency is to keep the Cummins engines' rpm below the 1,700 'sweetspot' limit. Above the sweetspot, which was at the top of the green band, 'was like turning up the fuel tap', he said. The sweetspot is the optimal (minimum) Specific Fuel Consumption for a given power and speed.

Table (1) Fuel efficiency improvement of 21.4% through maximising use of top gear and cruise control

Fleet No	Miles	Gallons	Mpg	% distance in top gear	% distance using cruise control
4505	9560	1201	7.96	71	25
4505	9996	1035	9.66	87	89
Difference			1.7 (21%)	16	64

Source: Huddersfield University

Table (2) Fuel efficiencies through the reduction of over-revving

Fleet No	Engine Revs	Miles	Gallons	Mpg
4547	Allowed to go above 1700 rpm	12687	1515	8.4
4547	Kept below 1700 rpm	12942	1484	8.7
Difference				0.3 (3.5%)

Source: BOC

options of engine, gearbox and final drive ratio. The program 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. Then try to obtain a demonstrator vehicle that is as close as possible to this specification.

When buying a used vehicle, its exact power rating or final drive ratio may not be apparent and it is possible to make an expensive mistake. For example, it could have a long-distance specification (high power and a high final drive ratio), making it relatively uneconomical for local work. If the seller cannot produce evidence of the exact specification, it is worth quoting the chassis number to the franchised dealer. This should give access to the manufacturer's original build specification.

For long distance work, vehicles should have high power engines and higher final drive ratios. Local work would be more economical with less power, fewer gears and lower final drive ratios

For those acquiring vehicles through contract hire or operating lease, the best vehicle for the task in hand may be for instance, a low-power tractive unit with a day cab, and yet 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.

Fuel Tank

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.

Transmission

A transmission is needed to disengage the engine from the wheels and to match engine speed, power and torque to a required task, e.g. 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. Manual, automatic/semi-automatic gearboxes and cruise control are various options available.

Assessing a Demonstrator Vehicle

The driver should be shown how to get the best out of the vehicle during the short time it is with you. If there were a large difference between the computer-predicted fuel consumption and the actual figure achieved, it would be a good idea to re-run the computer forecast using the demonstrator's actual specification to see if the difference in specification could be the reason for the variation. Remember to check issues such as tachograph recording accuracy.

If all the other operational data is correct, it is reasonable to assume that the computer model is inaccurate for your operation and so the actual results achieved must be your guide. It may be necessary to make an allowance for external factors such as the weather conditions during the demonstration period.

6.3.4 Assessing the Additional Vehicle Specification

Some features such as aerodynamics, active safety systems, ancillary equipment, and fuel are regarded as additional components for basic vehicles. These can make a significant contribution to fuel and overall operational efficiency as discussed below.

Specific types of equipment may be needed depending on the type of operation. For example, the temperature-controlled distribution sector is undoubtedly at the more specialist end of commercial road transport and, as such, the equipment needs to be of the highest standard. Hence refrigerated transport equipment should be considered by operators; as such equipment over time can result in greater operational efficiencies, which can ultimately save money.

See the **FREE** Freight Best Practice publication:

Buyers Guide To Refrigerated Transport Equipment

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Aerodynamics

The potential for fuel savings through improved aerodynamic body styling 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 significant scope to improve aerodynamic performance through retrofit. The following is an image of aerodynamic body styling options available.

Aerodynamic aids are not necessarily add-on extras. For example, it is advisable to specify bodies with rounded edges, with a radius of about 200 mm. This will improve fuel consumption and also help stability in crosswinds. The extra cost of this detail is spending money wisely rather than spending additional money.

Fitting an air deflector on the cab roof will minimise the drag of a high body but the air deflector has to be paid for in the first place. Equally, cab-side deflectors help streamline a body that is wider than the cab, but it is worth checking that the body really does need to be that wide – many people opt for a full-width body without question.

Not all money spent on aerodynamics is necessarily a good investment. Aerodynamics become more important as speed rises, so a vehicle that spends its

life making urban deliveries close to base may never repay the cost of an add-on aerodynamic package. If you have an operation that largely involves urban transport, it may be worthwhile to run some trials to check the costs and benefits achieved with your operation.

Conversely, the most suitable candidate for attention to its aerodynamics is a light vehicle with a large body, spending a lot of time on the motorway and trunk roads, which permit relatively high speeds to be maintained. Because of its low weight but large dimensions, wind resistance will feature prominently in the total forces that need to be overcome to keep the vehicle moving.

Curtain-sided bodies are inherently slightly less aerodynamically "clean" than smooth-sided box vans because the curtains are less rigid and the air flow is broken up by the curtain buckles and the pelmet. To mitigate these effects, the curtains should be tightly tensioned. Some organisations have stated that buckleless curtain-siders have improved their fuel performance.

An important aspect is minimising the coupling gap between the tractive unit and the trailer, restricting the amount of air resistance encountered by the trailer's front bulkhead. Many of the air management kits fitted to tractive units have side pieces that are designed to partially fill the gap.

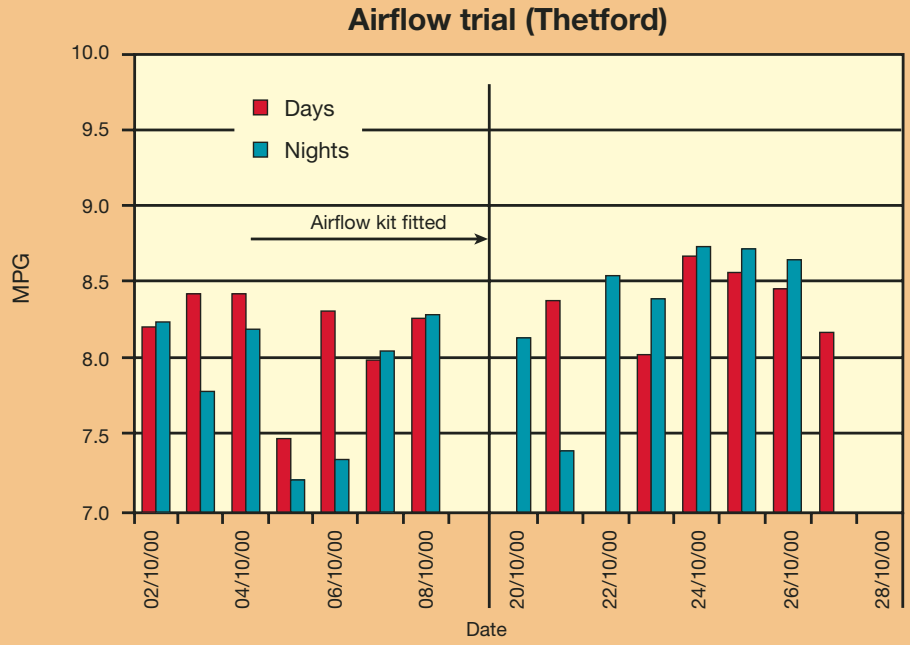
When setting the position of the tractive unit's fifth wheel to determine the coupling gap, there are several considerations to bear in mind.

BOC – Aerodynamics case study

An AB Air Flow Deflector kit was fitted to an ERF equipped with a sleeper cab which ran day and night on long distance, motorway trunking runs. The vehicle was driven by the same four drivers and based at BOC's Thetford branch.

The bar chart illustrates not only a 4% improvement in fuel consumption of an already efficient 41 tonne vehicle, but also how the benefits are usually greater when the vehicle is running at night. This is because of the longer period that the vehicle can run at the maximum regulated speed of 56 mph.

All the data from the trial were carefully monitored by the Logistics Research Unit at Huddersfield University and indicate a 4% improvement in fuel consumption and a financial payback of 5 months.



- There must be adequate swing clearance for the trailer when the vehicle is articulated, including an allowance for vertical articulation such as on ramps when the top of the trailer is closer to the back of the cab;
- There must be room for the driver to be able to reach the air-lines and electrical connectors in order to connect and disconnect them;
- The tractor unit may have to pull a variety of trailers with different kingpin settings, so the fifth wheel must either cater for the deepest kingpin position or be adjustable;
- The fifth-wheel position will determine the weight distribution on the tractive unit – moving it further forward to minimise the cab gap will increase the loading on the steer axle and reduce the load (and traction) on the drive axle;
- The overall length of the outfit must always conform to the legal maximum; and
- There are legal limits on maximum axle weights.

Vehicles that travel at high speeds and have a large frontal area will use less fuel if fitted with aerodynamic body styling equipment.

Similar issues apply to the position of the body on a rigid vehicle. Mounting it as close as possible to the back of the cab is preferable for good aerodynamics, but the issues of weight distribution and clearance for cab tilting need to be thought through.

Savings produced through the use of aerodynamic styling kits or aids can be quite substantial, though these savings are highly sensitive to road speed – the higher the speed, the greater the saving. Where vehicles spend a great deal of their operational distance at low speeds the aerodynamic aids may not have a significant effect.

Transport operators must remember that the savings are highly sensitive to road speed and large goods vehicles that travel a high proportion of their distance at speeds below 40 mph will see much less improvement in fuel consumption.

See the **FREE** Freight Best Practice publications:

Truck Aerodynamic Styling Guide

The Streamlined Guide to Truck Aerodynamic Styling

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Or the website: **www.freightbestpractice.org.uk**

6.4 The Maintenance Workshop

When considering a Fuel Management Programme it is essential that you understand the overall importance of vehicle maintenance. The proper function of this task will undoubtedly create better fuel efficiency within the organisation. For the vehicle operator, the benefits of a comprehensive maintenance policy will not only save money on future maintenance, but will also save fuel bill costs. The programme should not only include in-house mechanics or independent mechanics, but also the transport office staff and drivers.

When applying for an Operator's Licence you are required to create a maintenance policy, therefore you should already have one in place. In addition, vehicle manufacturers will also make recommendations for maintenance schedules, which if not completed will affect the warranty. It is beyond the scope of this guide to give full guidance on maintenance policies; however, the purpose of this section is to illustrate some key factors that need to be considered when preparing a maintenance policy.

6.4.1 Maintenance Priorities

Particular care should be taken by an operator to ensure that maintenance is carried out at regular intervals. However, repairs should be based on cost and fuel performance, particularly if maintenance is contracted out. Whether maintenance is carried out by in-house workshops or contracted out, you may wish to consider hiring an independent maintenance specialist to run spot checks on the maintenance records of the organisation. There are external organisations that will carry out annual independent

inspections on the fleet, usually 6 months after the MOT. They will also check your service records for service intervals, corresponding records, service history and the two year tachograph records. Subsequently, a report is generated from this inspection which will help you to modify your maintenance policy. Remember your Operator Licence depends on these actions being taken. Another major concern for an operation with a maintenance workshop is safety conditions. External Health and Safety consultants can provide an objective and impartial assessment.

6.4.2 Record Keeping

Accurate record keeping is fundamental to a fuel efficient operation. Transport Managers should keep a record of any servicing or repairs carried out on each vehicle. If you keep these records in order the regulatory requirements can be easily met. There are several computer programmes that monitor the maintenance history of a vehicle. These products will enable your operation to comply with legislation as well as creating fuel efficient vehicles.

In addition, a record of fuel consumption should also be kept in order to help spot trends or changes in vehicle performance. If a dealer or an external workshop carries out maintenance for you, it is worth including a fuel consumption record with the vehicle when it goes for service. Failing that, the person responsible for fuel recording should check the figures and then pass on the information. If these records are kept accurately, then the Transport Manager should be able to reconcile the vehicle maintenance records with the fuel consumption history, enabling them to see if there are any substantial changes after vehicle servicing.

Driver inefficiencies can also be highlighted by properly maintained records, for example, early replacement of brake linings or pads indicating poor forward planning whilst driving.

6.4.3 Maintenance Factors Affecting Fuel Efficiency

There are a number of mechanical factors that can have a huge impact on fuel efficiency. Below are a few examples that can be added to your check list and the reasons why it is important to check these components.

Brakes

An important check on any vehicle is the brakes as this can affect the safety and the fuel efficiency of a vehicle. You should always be aware when brakes are binding when driving. A slight binding can cause a

Fig 6.2 An example of maintenance record sheet from Freight Best Practice's Small Fleet Performance Management Tool:

Click Here for Menu Sheet	Monthly Report (Compliance)						12 Periods
Select the period you want to see by clicking the appropriate box	Period Number						
	1	2	3	4	5	6	
	7	8	9	10	11	12	13

Period	1	Date	30/1/02

Top

	No of Inspections		Defects					Vehicle		Drivers Hours / Records	Traffic accidents		Accidents / incidences	
Reg'n Number	Due	Overdue / Failed	Number	Rectified in 24 hrs	Rectified in 7 days	Rectified in more than 7 days	MOT Failures / Prohibitions	No of Overloads	Traffic Infringements	No. of Infringements	Blame worthy	Non-blame worthy	RIDDOR	Recordable
AY52 UOL	2		3	3				1		1		1		1
Total	2		3	3				1		1		1		1

reduction in fuel efficiency as there is a resistance to vehicle motion that results in more fuel being used.

When stopping for a break the driver should check the rims for over heating, check the ABS is working and that the green light is visible on the trailer.

Turbochargers

Most modern diesel engines are turbocharged and if the turbocharger is not working correctly there will be deterioration in power. This in turn will result in the engine using more fuel for a given level of performance. The turbocharger's shaft can be spinning at up to 120,000 revs per minute and depends on a constant oil supply to keep it lubricated. Switching an engine off immediately after a run will stop the oil supply, even though the turbocharger's shaft is still spinning, as it takes a while to slow down. It is therefore good practice to let an engine idle for a minute or two after stopping. The vehicle's handbook should give the manufacturer's exact recommendation for such a procedure.

Smoke Monitoring

Drivers should be encouraged to check for the presence of exhaust smoke from their vehicles, noting the colour of the smoke. If they notice any smoke this should be reported immediately to the maintenance staff. Persistent smoke of any colour normally indicates that fuel is being wasted because the engine is not running at its optimum.

Black smoke is usually caused by unburned carbon in the exhaust. Although the specification of the fuel has a great deal to do with this, so does the engine's injection and combustion set-up. Over-fuelling will also produce black smoke, so incorrect injection pump calibration or worn injectors are common causes. In addition, a dirty air filter will have a similar effect.

White smoke is a mixture of unburned fuel droplets combined with water. It is typical when a diesel engine starts from cold and the temperature is still too low for evaporation and complete combustion. It should disappear when the engine is warmed up.

Blue smoke signals suggest that there is oil getting into the combustion chambers. This could be due to piston ring, valve or worn engine problems.

To address these problems before they occur, you may want to consider periodic engine tests. These would include a compression test, injection pump calibration and injector checks. To assess the cost of performing these checks it would be a good idea to run the checks on a small sample of vehicles to see if those vehicles consistently perform better than the rest of the fleet.

These problems underline the importance of the maintenance department having access to the vehicle fuel performance records as the fuel consumption figures may illustrate minor problems before any serious damage is done.

Fuel Injection Systems

As a vehicle gets older, and its engine starts to wear, you can expect wear of the fuel injection system. Recalibration by a specialist may improve fuel performance by up to 5% and may identify more serious faults.

Tyre Checks

Maintaining the correct tyre pressures is known to be the best way of maximising the life of a tyre. Establishing the optimum pressure – knowing the maximum regular axle loading – and then maintaining that pressure will also help the vehicle's fuel consumption. Tests have found that 20% under-inflation will cause a 10 per cent increase in rolling resistance, leading to 2% deterioration in fuel consumption on average.

Fig 6.3 Tips for tyre checks:

- Tyre pressures should be checked with the tyres at ambient temperature
- A visual inspection is an essential part of a driver's daily checks
- Missing valve caps should be replaced immediately
- In an ideal world, tyre pressures would be checked once a week with a calibrated gauge. In reality, it is more likely to be once a month, but it should never be less frequent than that
- It is important that trailer tyre pressures should be checked as well as tractor units

On-board air pressure monitoring systems are available and keep a constant check on tyre pressures. They have wheel-mounted pressure sensors that use a radio transmitter to send a signal to a display unit on the dashboard. This will alert the driver if the pressure falls below a predetermined level.

Axle Alignment

Poorly aligned axles or incorrect toe-in/out on steer axles are normally associated with accelerated or uneven tyre wear, but as mentioned earlier, anything that hastens tyre wear is also likely to be harming the fuel consumption. If your workshop does not have its own equipment for checking axle alignment, specialist companies exist which can do the job for you. Drivers should be required to look out for, and report, signs of the vehicle crabbing.

6.4.4 Vehicle Maintenance Check lists

Daily driver checks are the first alert to any problems with the vehicle and would normally be carried out by the driver, prior to commencing their journey. However these daily checks may be done by maintenance personnel, but in some situations and types of operation, the maintenance personnel may get involved on a daily basis.

The following gives an indication of factors that need considering when carrying out maintenance checks.

Even though you may delegate the maintenance and safety inspection of your vehicle to a third party, you cannot delegate responsibility for ensuring that the vehicles are safe and roadworthy or avoid the consequences if they are not. (FTA, 2006)

Fig 6.4 Maintenance Checklist considerations:

Regular vehicle service inspections should be carried out on the following;

- Inspect Fuel, oil and exhaust leaks ☐
- Examine Oil and Fuel lines for chafing and kinks ☐
- Inspect lubricant level of Steering gear housing ☐
- Tighten Steering gear housing bolts ☐
- Inspect the fluid level of the clutch and/or brake master cylinder ☐
- Inspect the level of engine oil ☐
- Tighten electrical connections and mounting bolts of the starter, generator and alternator ☐
- Inspect generator commutator and brushes ☐
- Test and adjust the alternator, generator and regulator with a voltmeter ☐
- Battery – remove cables, clean terminals, reinstall cables and coat with petroleum jelly ☐
- Battery – Test cells specific gravity with hydrometer ☐
- Battery – Examine level of each cell and add distilled water if required ☐
- Radiator – Inspect coolant level and add water or antifreeze solution if required ☐
- Radiator Coolant – Inspect for signs of oil or combustion leakage ☐
- Cooling System – Pressure test ☐
- Clean air filter ☐
- Adjust and tighten the mounting on the air compressor ☐

Ongoing related maintenance checks:

- Stock levels of spare parts and location of service centres ☐
- Plan training in advance, so operatives certified prior to schemes going live ☐
- Continuation of training for operatives ☐
- Training of workshop staff in advance ☐
- Provision of training and manuals by manufacturer of all equipment for operatives and workshop mechanics. ☐

6.5 Vehicle Telematics

There are vast amounts of technology that exists to help to create an efficient operation. Many of these technological advances have a direct affect on fuel consumption. Therefore, this section gives an overview of the systems that could be used in conjunction with your Fuel Management Programme.

However, the best technology in the world cannot be a substitute for effective employees, as **Chapter 5** illustrated. The main benefit of telematics is that they help to effectively and efficiently manage your resources with the main aim of saving fuel. However, you must ensure that your employees are capable of using the systems, by giving them affective training. The following systems will be discussed below: Traffic

Information systems; Journey Planning Tools; Computerised Vehicle and Routing Scheduling systems; Satellite Navigation systems and Vehicle Diagnostics systems.

Investing in the right IT systems can enable you to do more for less and could improve any type of operation whether large or small

See the **FREE** Freight Best Practice publication:

Telematics Guide

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

6.5.1 Traffic Information Systems

Traffic Information Systems are networked systems that provide detailed live and up to date travel/traffic information. These services can plan routes in real time, provide advice based on predictive, historical, live and incident traffic information. In addition to information provided by television and radio, there are also free systems available over the internet, notably the Highways Agency. There are also several traffic information providers that charge an annual fee in return for information. These providers will provide the information directly to the driver via GPS based mobile communication devices. The main benefit of these systems is that you can help avoid or at least minimise potential disruptions of traffic congestion. Therefore, this has a direct affect on the amount of fuel that is used.

6.5.2 Journey Planning Tools

A journey planner is a piece of software containing a digital road network, with roads defined by a range of categories and speeds. It has the ability to calculate the best route between any two given locations and also devises a route that includes any number of call points. The principal purpose is to calculate time, distance and cost for individual journeys. Journey planners can help you find an efficient route in terms of fuel consumption. They are very similar to CVRS systems but the cost is considerably cheaper. Many of these systems are free via the internet.

6.5.3 Computerised Vehicle Routing Scheduling Systems

A computerised vehicle scheduling system (CVRS) combines customer location data, such as postcodes, with delivery or collection data such as product type, weight and quantity to create the most efficient schedule for a fleet of vehicles and drivers to get the required delivery done. The benefits of a vehicle scheduling system include substantial reductions in planning time over traditional manual planning, reduced fuel usage and the requirement for fewer vehicles and drivers. They also have the ability to take into account situations where two incompatible products should not be loaded on the same vehicle. Therefore, journey numbers are reduced as fewer errors occur. This has a direct effect on the amount of fuel consumption of an operation.

See the **FREE** Freight Best Practice publications:

Computerised Vehicle Routing and Scheduling (CVRS) for Efficient Logistics

Concise Guide to Computerised Vehicle Routing and Scheduling (CVRS)

Available from the Hotline: **0845 877 0 877**

Or the website: **www.freightbestpractice.org.uk**

6.5.4 Satellite Navigation Systems

Satellite Navigation (Sat Nav) systems use-in cab GPS devices and display screens to replace the need for a road atlas. Sat Nav systems enable drivers to plan their route and receive guidance on how to get there once they set off. Systems include detailed maps and are expandable to include additional city and street maps. Devices calculate travel times when a journey is planned and update these whilst en-route to the final destination. Sat Nav eliminates the need for drivers to obtain detailed directions to their next destination and gives them the freedom to concentrate on the road while the system

automatically guides the way. This enables them to drive in a fuel efficient manner and therefore save fuel.

Sat Nav systems can also reduce planning time and lost running as well as decreasing overall travel times. Some systems can also advise drivers of traffic delays and assists re-routing decisions. This can help decrease fuel consumption and increase vehicle utilisation. However, drivers can not rely entirely on such systems as they do not identify low bridges, length and width restrictions at the moment.

Freight Best Practice carried out an in-fleet research study in December 2005 on wayfinding using satellite navigation in the freight industry. The satellite navigation trial showed that the less familiar a driver is with the delivery address, the greater the contribution that a navigation system could make to operational efficiency. Similarly, the more locations a mobile worker has to visit each day, the greater the potential savings. To be successful, satellite navigation-enabled systems for road freight operations must be carefully selected, installed and managed. The sector is generally not technology oriented but will adopt solutions that deliver value and reduce costs. It is expected that freight specific wayfinding equipment will become readily available at affordable cost in the future and the use of satellite navigation will become more widespread across many sectors of the industry, as a result.

6.5.5 Vehicle Diagnostics

As the commercial vehicle market is becoming increasingly advanced, so is the Engine Control Unit (ECU), which is situated within the vehicles. Due to the increased complexity of these systems it is becoming important to use and understand diagnostics. There are several different methods of accessing the ECU, including static computers and mobile hand held devices. However, all these devices essentially turn your PC into a powerful automotive diagnostic tool for finding faults in the vast number of sensors, actuators and electronic circuits found in today's commercial vehicles.

The cost of sending vehicles back to the manufacturer for a fault to be diagnosed is considerable. These systems enable you to monitor the vehicle's status in detail which inevitably reduces the need for major maintenance works as faults are identified prior to serious damage. This has a knock on affect on fuel consumption – faulty vehicles will normally use more fuel. However, these devices may not necessarily read or fully interpret all fault codes held within the ECU.

6.5.6 Driver Information Systems

Systems that collect vehicle and driver information are often referred to as 'black box' technology. This simply means that a computer system is connected to one or more electrical inputs from around a cab or chassis, e.g. tachographs, rev counters, CAN bus (Controller Area Network) or fuel meters. A black box

Bathstore.com's use of IT Systems

Bathstore.com is a retailer of bathrooms and accessories and has an extensive home delivery operation. They are the largest bathroom specialist in the UK, and part of the Wolseley group.

Recently the company introduced the datatrack system, which incorporates vehicle tracking, satellite navigation for routing and proof of deliveries (PODs). The satellite navigation system in the cab, gives the driver directions to the next drop. The driver can manually override the system and is able to edit the drop sequence in the PDA. The navigation system responds accordingly with the revised route. Prior to the new technology, the driver was given a sheet with his orders on. It was then up to the driver to put them into the best order, and go out and do the deliveries.

Benefits

Roger Davies explained some of the benefits of the technology to the Bathstore operation: *"The sat-nav system offers **efficient routing** and **increased fuel savings**, also drivers do not require geographic knowledge of routes, providing extra flexibility for operation".*

can provide information on a range of variables, including fuel consumption, idling, over-revving and speeding. This information can then be linked to specific drivers. Information from a black box can be transmitted in a number of ways. Older technology requires a PC to be plugged into the vehicle; however, most systems can now transfer data either through driver ID cards or through wireless communication links used for vehicle tracking.

Driver and vehicle information can provide general information about fuel consumption trends, compare fuel use between drivers and monitor occurrences of idling, over-revving, speeding and harsh braking. They can also evaluate the impact of fuel saving initiatives. This information will ultimately help you reduce mpg which can also have associated benefits such as reduced maintenance costs, increased road safety and lower insurance costs.

Buy products fit for purpose and don't over-specify.

6.5.7 Ensuring that Employees can use telematics

Depending on the telematics that your operation uses, you should identify any employees that cannot use the systems and subsequently give them adequate training. This will give you the maximum benefits from telematics. If you are buying a new system then training should also be given before the operation uses that technology. Equipment training should be an essential criterion when choosing a supplier of telematics.

6.6 Summary

Specifying the right vehicle and the right IT system at the outset to make sure it is fit for its intended purpose is one of the secrets to long term operational efficiency and reduced operating costs over the life of the vehicle.

Equipment and Systems can play an integral part in improving an operation's fuel efficiency. However, it is critical you only buy the products that will benefit your operation. Therefore, when considering products, ask yourself 'what functions do I require from this product?' If integrated properly into the Fuel Management Programme, systems and equipment can improve profits and enable data to be collected in a quick and accurate manner. Therefore, you can easily identify problem areas and then rectify those problems.

This Chapter has assessed which equipment and systems may help your operation; including fuel recording systems, vehicle specifications and telematics. It also identifies the importance of the maintenance workshop. Once you have identified where savings can be made, by using the performance management process, you will then be able to decide which product could benefit the fuel efficiency of your operation.

Appendix 1 – Fuel Management Checklist

Below is a simple checklist that enables you to determine the progress you are making whilst embarking on a Fuel Management Programme. Once you have carried out the task simply indicate this on the checklist. (Note – It is advised that you use a sticker or coloured pin so that you can start the progress again and again to enable a continuous improvement in fuel efficiency). If the action is not applicable to your organisation then indicate this in the achieved box (i.e. N/A).

Chapter	Task	Achieved
2 Fuel Management	Understood the importance of a Fuel Management Programme	
	Understood the factors affecting fuel consumption	
	Understood your current costs	
	Understood how to implement a Fuel Management Programme	
	Shown and demonstrated commitment to the Fuel Management Programme	
	Researched Government accreditation schemes for reducing harmful emissions	
	Appointed a Fuel Champion	
3 Measuring & Managing Performance	Understood the purpose of Performance Management	
	Understood the selection of fuel management KPI's	
	Understood how the process of performance management works	
	Read Performance Management Guide	
	Read and/or Start using the Small Fleet Performance Management Tool	
	Understood the importance of collecting accurate data	
	Considered different ways of collecting data	
	Set up a system of collecting data	
	Understood the potential for data errors and identified areas of your company which is applicable	
	Collected data accurately	
	Cleansed data	
	Inputted data into a performance management tool	
	Review and evaluate information from data collection	
	Understood how to analyse the data	
	Set up a timetable for reviewing and analysing data	
	Understood the types of reports that are applicable to your operation	
	Created clear and concise reports on the analysed data	
	Benchmark within your organisation. For example, compare operations or drivers within your business.	
	Understand the importance of reporting and obtaining feedback	
	Created a mechanism to give constructive feedback to the appropriate personnel	
	Reviewed targets and set appropriate new ones	
	Identified and implemented strategies to improve performance	
	Understood the importance of continuous review and target setting	
	Read various Freight Best Practice guides on performance management	

Chapter	Task	Achieved
4 Fuel Types, Purchase & Storage	Understood fuel specification	
	Understood the benefits of oil and lubricants	
	Understood fuel purchasing options	
	Understood the factors affecting your decision to purchase fuel	
	Researched potential suppliers of fuel	
	Understood fuel storage issues	
	Decided whether to hold your own bulk stocks	
	Set up a system for tank maintenance	
	Checked tank for water contamination	
	Checked the pump	
	Checked fuel samples	
	Understood the importance of stock control	
	Set up a system of maintaining accurate stock records on a weekly basis	
	Created a written procedure for stock deliveries	
	Reviewed stock control records	
	Researched fuel recording systems	
	Set up fuel reconciliation process	
	Identified any dangers	
	Researched Alternative Fuels	
5 Fuel Efficiency Through Developing Skills	Understood the importance of developing employees skills	
	Understood the role and responsibility of a fuel champion	
	Appointed a Fuel Champion	
	Created a Fuel Champion Action Plan	
	Understood the importance of communicating effectively with all employees	
	Set up a feedback forum for your employees	
	Set up performance tables	
	Researched methods of maintaining sustainability	
	Created sustainability	
	Understand the importance of driver training and development	
	Researched Governmental schemes to train your drivers	
	Incorporated fuel efficiency into the recruitment process	
	Created an agency driver policy which incorporates fuel efficiency	
	Distributed the Fuel Efficiency Questionnaire	
	Identified taining needs for other employees	
	Researched different methods of training	
	Created driver checklists	

Chapter	Task	Achieved
6 Equipment and Systems	Understood the role that equipment and systems can play in fuel efficiency	
	Specifying the right vehicle for your operation	
	Understood Vehicle costs (Whole Life Costs)	
	Understood vehicle specification issues	
	Read the Truck Specification for Best Operational Efficiency Guide	
	Read the Truck Aerodynamic Styling Guide	
	Read the Streamlined Guide to Truck Aerodynamic Styling	
	Understood the importance of vehicle maintenance	
	Understood the importance of vehicle maintenance records	
	Created a maintenance checklist	
	Understood the importance of IT systems	
	Read the IT Systems Guide, Telematics Guide, and the Computerised Vehicle Routing & Scheduling (CVRS) Guide	
	Understood training needs for employees relating to use of IT systems	

Appendix 2 – Conversion Factors

Introduction

Fuel performance is usually measured in miles per gallon or litres per 100 kilometres, although kilometres per litre and miles per litre are also used.

Virtually all fuel-dispensing pumps measure in litres. Some electronic management systems can measure fuel used in US gallons. These are smaller than UK (or imperial) gallons. The exact conversion factor is included in the tables below.

Vehicles fitted with tachographs (generally those above 3.5 tonnes gvw) measure distance in kilometres, but buses, vans and cars are normally measured in miles.

SOME BENCH MARK VALUES

Miles/Gallon	Litres/100km
10 mpg	28.25 litres/100km
9 mpg	31.4 litres/100km
8 mpg	35.3 litres/100km

Kilometres/litre	Miles/litre
3.54 km/litre	2.20 miles/litre
3.19 km/litre	1.98 miles/litre
2.83 km/litre	1.76 miles/litre

Miles per hour	Km per hour
30 mph	48 kph
40 mph	64 kph
50 mph	80 kph
56 mph	90 kph
60 mph	97 kph

Km per hour	Miles per hour
50 kph	31 mph
70kph	44 mph
90 kph	56 mph
100 kph	62 mph
110 kph	68 mph

To convert:	To:	Multiply by:
Miles	Kilometres	1.609344
Kilometres	Miles	0.621371
Litres	Gallons	0.21997
Gallons	Litres	4.54609
US Gallons	Imperial Gallons	0.83268
Imperial Gallons	US gallons	1.20094
Horsepower (bhp)	Kilowatts	0.746
Kilowatts	Horsepower	1.341
Imperial tons	Metric tonnes	1.016
Metric tonnes	Imperial tons	0.984

To convert from mpg to litres/100 kms and vice versa, use the following calculators:

$$\text{mpg} = \frac{282.5}{\text{Litres/100km}}$$

$$\text{Litres/100km} = \frac{282.5}{\text{mpg}}$$

If greater accuracy is required, replace 282.5 in the above calculators by;
282.4859

Drivers can use the following formulae to calculate their own mpg:

Fuel in:	Speedo in	mpg is given by
Litres	Kilometres	2.825 multiplied by kilometres divided by litres
Litres	Miles	4.546 multiplied by miles divided by litres
Gallons	Kilometres	0.621 multiplied by kilometres divided by gallons

Appendix 3 – Freight Best Practice Publications

Saving Fuel

Fuel Management Guide – New and Updated
The new and updated guide gives step-by-step explanations of the key elements of fuel management and how to implement an effective programme and measure performance. Key reference document for fleet managers with different levels of experience and knowledge.

***Pocket Guide* Fuel Saving Tips**
Top tips from fellow professionals, aimed in particular at small fleet operators and owner drivers.

Save It Video!
Two 25 minute programmes for truck operators and drivers.

The Road to Fuel Efficiency
Practical tips and advice on efficient driving, vehicle maintenance and specification.

Champions of Fuel
The role of fuel champions, fuel monitoring, safe and economical driving techniques.

Fuel Saving Devices
Practical impartial tips to help operators objectively assess the fuel saving claims made for the numerous products on the market.

***Case Study* Fuel Management for Transport Operators**
Describes significant fuel savings achieved by Thorntons plc through the use of in-cab data logging equipment.

***Case Study* BOC Ltd Fuel Champion Saves Equivalent of 50 Trailer Loads of Carbon Dioxide a year**
How BOC have reduced their fleet energy and exhaust emissions through driver training, fitting aerodynamic kits and optimising bulk storage.

Developing Skills

The Safe and Fuel Efficient Driving (SAFED) Scheme
This guide outlines the elements of the Safe and Fuel Efficient Driving (SAFED) Scheme and explains the content of the one-day SAFED training course.

***Case Study* Companies and Drivers Benefit from SAFED: A Selection of Case Studies**
This selection of case studies describes the benefits experienced by 15 companies and their drivers who have taken part in the SAFED scheme. It provides direction on ways to sustain the benefits achieved under SAFED in the long term.

Pocket Guide
Safe Driving Tips
Written especially for lorry drivers this pocket sized guide provides essential safety hints and tips on all aspects of the job.

***Case Study* Proactive Driver Performance Management**
Shows how Thornton's implemented a highly effective driver incentive scheme combining in-cab driver monitoring, service delivery levels and accident rates.

SAFED for Vans: A Guide to Safe and Fuel Efficient Driving for vans
This guide outlines the elements of Safe and Fuel Efficient Driving (SAFED) for vans.

Equipment & Systems

Truck Specification for Best Operational Efficiency
A step-by-step guide to the process of correctly specifying an efficient and 'fit for purpose vehicle'.

Telematics Guide
Provides information on the basic ingredients of telematics systems, highlights how to use this technology, the information obtained from it and how to select the right system for you.

Computerised Vehicle Routing and Scheduling for Efficient Logistics
New and updated guide describing the different types of systems available with hints and tips on how to choose and implement a CVRS system.

Concise Guide to Computerised Vehicle Routing and Scheduling
This guide shows the latest routing and scheduling software developments.

Truck Aerodynamic Styling
Practical information on aerodynamically effective trucks and appropriate add-on features.

Streamlined Guide to Truck Aerodynamic Styling
An introduction to aerodynamic styling.

***Case Study* Focus on Double Decks**
An outline demonstration of the efficiency benefits gained by Focus DIY in trialling double deck trailer operations.

***Case Study* Save Fuel with Lower Rolling Resistance Tyres**
Explains how different companies have performed in-use trials and track tests to evaluate the benefits of energy efficient tyres.

***Case Study* Testing Time for Trucks**
Outline results of four technical evaluations – energy efficient tyres, effects of air conditioning, open windows and sheeting tipper bodies.

Buyers' Guide to Refrigerated Transport Equipment
Explores the different systems available and the suitability for particular operations.

***Case Study* Making the Swap to Demountables**
Describes different body systems and the benefits from using demountables.

Information Technology (IT) Systems for Freight Transport Operations
Overview of the relevant systems within the industry, covering their individual uses, likely benefits, issues to consider and associated costs.

Operational Efficiency

Make Back-loading Work for You
A guide showing how to find and choose profitable backloads

Working Together to Improve Operational Efficiency of RDCs
Best practice examples in action, showing how RDC operators and their partners can improve efficiency, meet cuystomer service obligations and minimise environmental impact.

Case Study Wheel Alignment
Featuring Kidds Transport and SRL Distribution, it shows how much can be saved by implementing a regular wheel alignment programme including increased fuel savings and extended tyre life.

Case Study Expert Advice Helps Cut Fleet Costs
Savings achieved by Denholm Industrial Services Ltd as a result of the measures implemented as part of the site specific action plan developed with help from an advisor from the Fuel Economy Advisors (FEA) scheme.

Case Study Jaguar Sprints Forward
Jaguar cars reduce their stockholding, waiting time and other cost savings by using a new logistics system.

Case Study Heathrow Airport Retail Consolidation Centre
Explains how consolidated deliveries to Heathrow Airport reduce lorry congestion and improve air quality.

Case Study Consolidate and Save
The benefits of groupage operations using the Tankshare scheme as a case study example.

Case Study Home Delivery: Meeting the Needs of Customers and the Environment
Describes a trial performend in Nottingham by Royal Mail Group plc that offers an innovative, environmentally friendly solution to address the problem of failed deliveries.

Case Study Profit Through Partnership
How joining forces to form a haulage consortium allows small and medium businesses to pool their resources and strengths in order to win and manage larger and more lucrative logistics contracts.

Case Study Reducing the Environmental Impact of Distribution: Transco National Logistics
How Transco reduced costs, mileage and CO_2 emissions with alternative fuels, stepframe trailers and improved vehicle routing.

Performance Management

Fleet Performance Management Tool
This new and updated PC based spreadsheet tool is essential for fleet operators to help manage the most important aspects of running a fleet – costs, vehicle utilisation, service levels, legal compliances and maintenance.

Measuring Performance for Freight Transport Operations
This guide explains the process of measuring performance effectively, including advice on how data is best collected and used to measure performance on a continuing basis.

Introduction to Job Costing for Freight Operators
How to understand the true cost of your operation down to individual vehicles in the fleet. Cost it right and stay in business!

In Fleet Trials of Fuel Saving Interventions for Trucks
For managers investigating the use of fuel saving interventions or setting up their own in-fleet trials. This guide shows how to establish the potential performance of fuel saving devices in your fleet.

Key Performance Indicators for the Next Day Parcel Delivery Sector
Measuring of KPIs and analysis of benchmarking in this sector.

Key Performance Indicators for Non-Food Distribution
Measurement of KPIs and analysis of benchmarking in this sector.

Key Performance Indicators for the Food Supply Chain
Measurement of KPIs and analysis of benchmarking in this sector.

Key Performance Indicators for the Pallet Sector
A benchmarking guide to help pallet network operators understand their fleet needs and identify real opportunities to maximise transport efficiency.

Case Study Small Fleet Performance Management Tool Helps A1 Paper Improve Efficiency
Shows how, in conjunction with the Fuel Management Guide and SAFED driver development, A1 Paper has made use of the tool's monitoring capabilities.

Public Sector

Efficient Public Sector Fleet Operations
Baseline information on understanding, designing, and running public sector fleets. Case studies show performance measurement and benchmarking best practice.

Freight Quality Partnership Guide
This Guide, which is aimed at those involved in setting up and running Freight Quality Partnerships, provides step-by-step guidance on how to set up and run an effective Freight Quality Partnership.

Freight Quality Partnerships Case Studies
Case study examples of existing Freight Quality Partnerships, it illustrates the process of establishing an FQP and highlights some of the solutions that different FQPs are looking at.

Freight Best Practice

The Freight Best Practice programme offers a range of **FREE** publications to help you improve the efficiency of your operation. Guides, case studies, software and seminars are available on topics such as saving fuel, developing skills, equipment and systems, operational efficiency, performance management.

A selection is outlined below.

Contact us now for further information

website: www.freightbestpractice.org.uk
Hotline: 0845 877 0 877
Email: info@freightbestpractice.org.uk

Saving Fuel

Fuel Saving Tips

This handy pocket book is ideal for drivers and managers looking for simple ways to reduce fuel consumption.

Operational Efficiency

Make Back-loading Work for You

A guide showing how to find and choose profitable backloads.

Developing Skills

Safe Driving Tips

Written especially for commercial drivers, this pocket sized guide provides essential safety hints and tips on all aspects of the job.

Performance Management

Small Fleet Performance Management Tool

PC based spreadsheet tool designed to help small to medium sized fleet operators improve their operational efficiency through the management of Key Performance Indicators. The KPIs include costs, operational, service, compliance and maintenance. Comprises a CD and accompanying manual.

Equipment & Systems

Truck Specification for Best Operational Efficiency

A step-by-step guide to the process of correctly specifying an efficient and ‘fit for purpose vehicle’.

Public Sector

Efficient Public Sector Fleet Operations

Baseline information on understanding, designing,and running public sector fleets. Case studies show performance measurement.

More publications are available; check appendix 3 of this guide or look at our website for an up-to-date list.

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