

Road haulage companies are interested in making their fleet more fuel efficient.

Yorky Trucks Limited
Yorky House
Yorkshire YO7 9IE

Dear Department of Transport,

Please can you advise how our freight distribution company can save money by making our trucks aerodynamic.

Our fleet is made up of 10 rigid trucks, 6 articulated lorries and 7 draw-bar trucks.

Last year, each rigid truck travelled approximately 90,000 miles, each articulated lorry travelled approximately 100,000 miles and each draw-bar truck approximately 80,000 miles.

We have estimated our fuel efficiency to be 10mpg for the rigid trucks and 7mpg for all other trucks.

Please provide a summary of money saving options available and advise where we can make the biggest savings.

We are also interested in knowing how long it will take to payback the initial investment of modifying the cabs based on the current cost of fuel.

Yours sincerely,

Yorky Trucks Limited

You need to work out how much is saved by each **modification**.

There will be a **different calculation** for each **type of truck**.

Agree an **order** for the savings calculations. *Is there more than one possible order that will work?*

Use a **calculator** to find the **savings**.

- Work out the total **cost of running the truck** for a year without the modification.
- Convert the amount to a **price per gallon**.
- Work out the total **cost of running the truck** for a year with the modification.
- Work out the **amount saved** in a year.
- Work out how many **gallons of fuel** the truck uses in a year without the modification.
- Find the **cost of a litre of fuel**.

	Cost	Estimated fuel saving %		
		Rigid	Articulated	Draw-bar
Cab Roof Deflector Minimises the air flowing between cab and container.	£300	2.4	2.4	1.2
Cab Roof Fairing Ensures a smooth airflow between the front roof of the cab and container.	£400	4.8	3.7	2.3
Cab Collar and Roof Fairing Roof fairing provides a smooth airflow over the container and the collar reduces the effect of crosswinds.	£650	6.5	*****	3.2
Cab Side-edge Turning Vanes Reduce drag if they cover sharp edges and also help to reduce the build-up of dirt.	£100	0.5	0.3	0.3
Air Dam Reduce drag by diverting air around the sides and roof of the truck.	£250	0.7	0.3	0.3
Cab Side-edge Fairings Block the flow through the gap between tractor and trailer, thereby reducing the effect of crosswind on vehicle drag.	£350	*****	0.6	*****

Enter all your **savings** in the *Calculating costings* spreadsheet.

Use the **spreadsheet** to calculate the **fastest payback time**.

Write a **letter** to Yorky Trucks setting out your recommendations.

Can you help?

Put the calculations in order.

Is there more than one correct way to do this?

Work out the total **cost of running the truck** for a year **without** the modification.



Convert the amount to a **price per gallon**.

Work out the total **cost of running the truck** for a year **with** the modification.









Work out the **amount saved** in one year per truck.

Work out how many **gallons of fuel** the truck uses in a year **without** the modification.



Find the **cost of a litre of fuel**.

getting there

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getting there

Getting there: More miles for your money

Description

With high fuel costs, many freight and logistics companies are looking at ways to reduce running costs. Fuel efficiency is also environmentally desirable. Based on information and guides provided by the Department of Transport, this topic introduces the cost benefits of improving the aerodynamics of the cab section of the truck.

Resources

Calculators, access to a spreadsheet.

Activity 1: Fuel efficiency

Activity 2: How much can you save?

Trucks come in all shapes and sizes, but the majority can be categorised into three different types.



A rigid truck usually has a cab and a large container box.



An articulated truck is made up of two parts. The front part, called a tractor, pulls the trailer.



A draw-bar truck is usually a rigid truck that is connected to a trailer by a bar.

Various modifications can be made to each of the truck types. **Fuel efficiency**, a calculator activity, explores the fuel efficiency effects of one of these modifications on the three types of truck. It provides an introduction to the topic and requires pupils to grapple with the concepts of miles per gallon and percentage increase and with converting litres to gallons. It uses the idea of distance travelled as a concrete model for fuel efficiency. It may be worth mentioning that the figures provided are estimates as the actual distance travelled is likely to depend on a variety of factors including the steepness of the roads, the weather conditions and the speed travelled.

How much can you save? is a more advanced activity and is likely to extend over two periods. The initial problem is a highly complex one and the activity as presented breaks this down into smaller steps. The activity works best with pupils in groups of three, each working with one of the types of truck. Each group needs a copy of the **How much can you save?** cut up sheet or a set of the cards already laminated so that they can discuss how to arrange the calculation processes to achieve the desired result. They then work out the savings for each modification, using the **How much can you save?** information sheet and sharing out the work. A whole class discussion at this point will confirm the results.

Getting there: More miles for your money

The second part of the activity involves using the **How much can you save?** spreadsheet. The group enters all of their savings calculations and then uses the spreadsheet to work out the payback time for each modification. They discuss how to choose the fastest payback and the best long term investment and they record this on their spreadsheet. An alternative approach is to use the calculator or a spreadsheet throughout the whole of this activity. Using their final results and analysis, the pupils compose a letter to Yorky Trucks Limited setting out their recommendations for improving the fleet. Alternatively, the groups can each be encouraged to prepare a PowerPoint presentation of their recommendations for the rest of the class.

The mathematics

These activities involve using calculators and spreadsheets to work on conversions and percentages in the context of a complex multi-step problem. Considerable mathematical thinking is involved in breaking down the problem into simpler steps, keeping track of the constituent parts and analysing the final results.



More miles for your money : How much can you save?

Rigid	Cost per truck (£)	Saving per truck	Years to recover cost	Fastest Payback	Best long term investment
Cab roof deflector	300				
Cab roof fairing	400				
Cab collar and roof fairing	650				
Cab side edge turning vanes	100				
Air dam	250				
Cab side -edge fairing	350				

Artic	Cost per truck (£)	Saving per truck	Years to recover cost	Fastest Payback	Best long term investment
Cab roof deflector	300				
Cab roof fairing	400				
Cab collar and roof fairing	650				
Cab side edge turning vanes	100				
Air dam	250				
Cab side -edge fairing	350				

Draw bar	Cost per truck (£)	Saving per truck	Years to recover cost	Fastest Payback	Best long term investment
Cab roof deflector	300				
Cab roof fairing	400				
Cab collar and roof fairing	650				
Cab side edge turning vanes	100				
Air dam	250				
Cab side -edge fairing	350				