WHITE PAPER

10 TIPS for better Driving behavior

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Who should read this paper?

CEOS | CFOS | COOS | FLEET MANAGERS | FINANCE EXECUTIVES |PROFESSIONAL DRIVERS AND DRIVERS IN GENERAL

What kind of impact does driving behavior have on your fleet's costs? Why does better-driving behavior contribute to climate protection and pollution reduction? Delyan Kostov and David Rodrigues answer these questions and present easy-to-implement methods that will significantly impact your fleet's costs and productivity.

Introduction

Vehicles are part of every contemporary business. In fact, a large part of some companies operation costs are directly related to them. Depending on the type of business, vehicles can be involved in the main company activity – transportation of passengers and/or loads, or they can be engaged in attendant company activities – service, distribution, trading, and other activities.

The **10 tips for better driving behavior** we present here represent a change in driving habits and the adopted way of exploiting vehicles. They also significantly impact fuel economy and CO2 emissions to the atmosphere.

Tip #1

Choose the right vehicles

Review the organization of your fleet's activity – make changes to optimize it if necessary. Good organization is achieved by planning and allocating the work to **minimize the number of vehicles and downtime while maximizing the work time of each vehicle**.

The vehicles you choose for your fleet must comply with the type of work they will be used for (not vice versa): the number of passengers, size, and weight of the load. Do not choose vehicles that are too big or too small. Large cars can transport many passengers and a large quantity of freight, but if their capacity (freight volume) is not 100% used, this reduces their effectiveness.

When it comes to small vehicles, their capacity is smaller, leading to the need to use more vehicles or more trips, leading to more costs on fuel and workforce for performing the same work.

Other important factors you must pay attention to are:

The terrain where your vehicles will travel – flat, hilly, with steep slopes. Considering the type of terrain, you will be able to make the right choice of engine – engine type, capacity, power; gearbox – automatic or manual; differential gear – with a larger or smaller ratio. Do not choose high power engines for vehicles that will travel mostly on flat terrain or in cities, and vice versa – engines of low power for vehicles that will travel on a terrain of prevailing slopes.

When in doubt you should consult your vehicle distributor for the right choice of engine, gearbox, auxiliary brakes such as retarder, and differential gear.

The fuel you will use – petrol, diesel or an alternative one. Research your region on the possibilities of using alternative fuels – legal framework, fuel distribution, and service centers for the specific equipment.

After doing the research, make comparative cost calculations on the acquisition and exploitation of vehicles using conventional and alternative fuels.

In most of the cases results are in favor of alternative fuels.

In the past few years, most vehicle manufacturers started manufacturing vehicles with alternative fuels – mainly propane-butane and methane.

You may consult your vehicle distributors for varieties of fuel types they offer. Even if your vehicle distributor does not provide options with alternative fuel, there is a wide range of equipment manufacturers on the market. If you choose alternative energy, you may have to make a higher initial investment for vehicles and equipment, but your fuel costs will be lower. And on the other hand, alternative fuels do not pollute the environment as much, which reduces the ecological footprint of your fleet.

Current systems used in the automotive industry – new technologies and systems for improving the fuel efficiency of the vehicles are being researched and developed, such as engine Start/Stop, regenerative braking systems, etc. Usually, these systems are offered as extras, but you can often negotiate with your vehicle distributor. Make the needed calculations and see if they pay off in a reasonable time.

Other types of new technologies are hybrid and fully electric vehicles. The difference between both technologies is that Hybrid Engines use an electric motor to support the main engine. In contrast, the latter uses only an electric motor without petrol or diesel assistance. Electric motors use batteries that store the needed electricity. Every battery has a limited life cycle due to the number of recharges, which could be their main downside. However, with the advances in the investigation, they are getting smaller and with an improved lifetime. Therefore, they are starting to be a solution that you should consider.

You can ask your vehicle supplier if they offer such vehicles and supply you with the exact details: battery life, single-charge range, charging options, etc. After some analysis, you can evaluate if this technology suits your fleet requirements.

Tip #2

Keep your vehicles in good shape

Maintain your vehicles in perfect technical condition, observing the manufacturer's recommendations for the periodicity of service appointments.

If there is a problem with the vehicle, immediately take the necessary actions to rectify it because delaying the correction of a problem may lead to more severe issues and threaten the life and health of employees, passengers, and other users of the roads.

The main systems that impact fuel consumption and emissions are the fuel, exhaust, and brake systems. Each of them has to be kept in perfect technical condition in order to ensure minimal fuel costs.

Also, keep air intake filters in good condition. Keeping them clean will help run the engine at its maximum efficiency. **This is particularly important for vehicles traveling in dusty areas.**

Tip #3

Pay attention to the tires and fuel you use

There are various products with different parameters and prices on the market. Some of the recent tire developments and fuels can significantly impact energy efficiency.

Tires are responsible for up to 15% of fuel consumption. They use up energy[1]. This is mainly due to the rolling resistance, one of the leading forces a vehicle must overcome to carry on moving. Vehicle tire manufacturers offer tires of low rolling resistance, which lead to lower fuel consumption and longer tire life. According to tests conducted by Michelin[2], tires with low rolling resistance can save up to 80 liters of fuel during their lifetime.

This means that the investment made for energy-efficient tires will pay for itself by lowering fuel consumption, extending the tires' lifetime, and also reducing CO2 emissions.

Tire pressure is also quite important. Every vehicle manufacturer issues recommendations on the proper air pressure of their tires. **Observe these recommendations and regularly check the air pressure in tires, especially during weather changes – warm-cold or vice versa.** The ambient temperature influences how air expands, increasing the air pressure in tires. Improper air pressure in tires leads to premature wear and tear due to deformation. This also leads to increased fuel consumption due to increased rolling resistance. More important is that driving with under-inflated tires is dangerous because it may lead to flats. This may threaten the life or health of the driver, passenger, and other users of the roads, not to mention cargo.

All fuel distributors offer standard fuel variations in different chemically-enhanced versions – **chemically enhanced fuels**. Optimizing fuel consumption also requires proper energy use, and improvements are due to adding supplements to the fuel.

Those supplements help maintain the fuel systems cleared out of bacteria, improve the lubrication of all the components on the fuel injection system, and with the increased octane/cetane number of the fuel, the combustion becomes more efficient and with reduced emissions.

You can experiment with the engine's operation and fuel consumption with several fuel types**. From the results, you will be able to select your fuel distributor and the type of fuel that is most suitable for you**. According to the European Petroleum Industry Association (EUROPIA – www.europia.com), chemically-enhanced fuel may lead to a fuel economy increase of 2 to 4%.

You also have to pay attention to refueling and plan the refueling so that the fuel you have in your tank is enough for the mileage you will travel during the day, or if you have a long trip, just divide refueling into two or more times. Note that a full fuel tank also means a heavier vehicle.

[1] Source: https://en.wikipedia.org/wiki/Low-rolling_resistance_tires#Comparison_with_conventional_tires
[2] According to Michelin and the Energy Saver line of products (http://www.michelin.co.uk/tyres/michelin-energy-saver).

Tip #4

Respect aerodynamics

The resistance between air and the vehicle is also one of the main factors impacting fuel consumption. To optimize aerodynamics, all modern vehicles are manufactured and tested in aerodynamic wind tunnels. Design elements subsequently added to vehicles influence the vehicle's aerodynamics in two ways – positively and negatively.

Elements that reduce air turbulence and minimize cab resistance – side skirts, encapsulation of the entire floor of the vehicle, side panels decreasing vortices at the wheels (for trucks and trailers), tail panels, etc., have a positive influence on fuel consumption.

Figure 1 - Aerodynamics study of a truck and trailer.

However, do not resort to developing, mounting, and setting aerodynamic elements of vehicles on your own because if this is not conducted professionally, it may have a negative effect.

Elements that increase air resistance of vehicles – luggage carriers, decorative elements at the front or the sides of the vehicle, etc., all negatively influence fuel consumption.

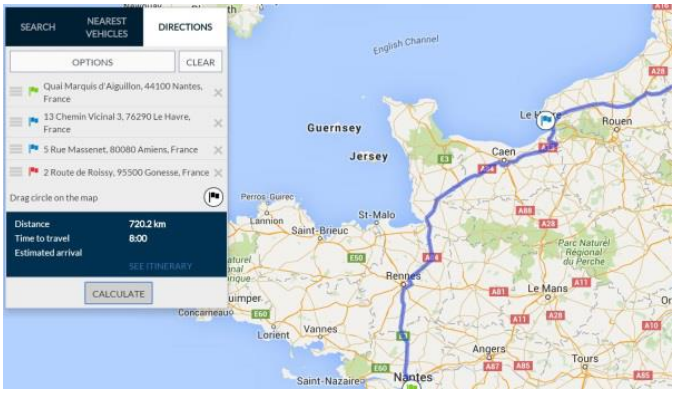
To improve the aerodynamics of your vehicle, you should remove all that is not used and increases air resistance. You may also add fenders, side panels, or spoilers to reduce air resistance.

Improved aerodynamics of vehicles may reduce fuel consumption by 3 to 17%, according to different equipment manufacturers[3].

Tip #5

Plan and optimize trips

When you plan daily trips, try to optimize travel time and the number of passengers or freight transport.



Use traffic information and your own knowledge of typical traffic patterns. Then, **as far as possible, execute trips when there is not much traffic**. This will help you save time and fuel because vehicles will not need to wait in traffic jams or traffic lights.

Plan trips in advance to have enough time for additional activities such as refueling, waiting, loading and unloading, etc. **This will allow drivers to drive at lower speeds and in a calmer manner, which will lead to lower fuel consumption and depreciation of the chances for mistakes or incidents**.

You may also try to allocate your freight so that your vehicles will be full up to 80-100% of their capacity, and there will be no vehicles traveling empty or half-empty. Vehicles that travel empty consume less fuel, of course, but they do not bring any income, and meanwhile, they have the exact exploitation cost, which means that they have lower efficiency in the end.

Take into consideration the legal driving times for each activity to complete successfully all the tasks planned.

Tip #6

Use engine, gears, brake, and accelerator effectively

Every internal combustion engine is characterized by two leading indicators – maximum torque (Nm) and maximum power (hp).

The manufacturer provides data on the changes in torque and power at different engine speeds and their maximum values for each engine. Here is an example of the features of an engine – Scania, 540hp, Euro 6, 13 liters.

[3] For instance, Cartwright is a manufacturer of equipment to optimize heavy vehicles' aerodynamics. Due to the test results, they have made many tests in collaboration with TNT and now have energy efficiency certificates issued to some of their products.

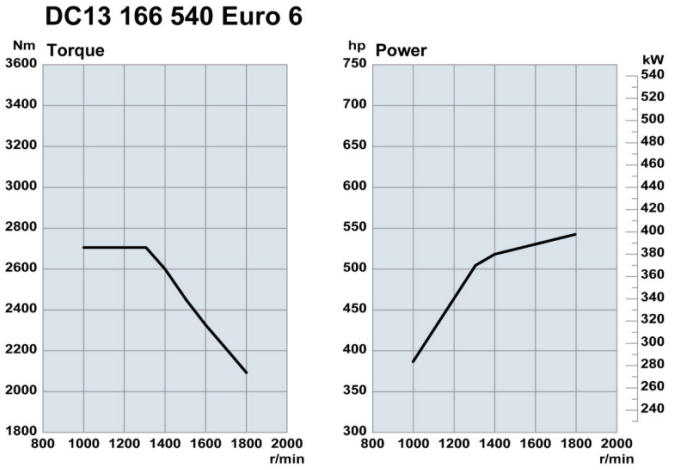


Figure 2 - Source: www.scania.com

The maximum torque for this engine occurs between 1,000 and 1,300 revs, whereas the full power occurs between 1,400 and 1,800 revs. **The engine is most effective in the interval in which the torque is at its maximum value** – the power coming from the crankshaft to the transmission is highest.

Always observe this vehicle data and **try to drive your vehicle in the revs interval that is most efficient**. This way, you will reduce fuel consumption and avoid operation at high revs, which will extend the engine's life.

The combination power-torque is affected directly by the driver's actions. That is why you need to be highly focused on the vehicle and the road condition to efficiently deal with the accelerator and brake pedals.

In most modern vehicles, the fuel flow is controlled electronically by the accelerator pedal, which means that even small changes in the pressure of the pedal count in transmitting fuel to the engine. That is why the driver should handle the pedal carefully and gradually. Abrupt or excessive fuel flow may take the engine out of its normal operating mode, which causes larger gas detonations, higher vibrations, and operation at too high or too low revs. This causes disturbances in engine lubrication, higher fuel temperature, and higher exhaust temperature, which shortens the engine's life and increases the risks of damaging or ruining elements in different systems. And in the end, all of these lead to higher fuel consumption and higher maintenance costs.

Using the accelerator properly, you may use the engine as a brake, using its friction and resistance for smooth deceleration. For this purpose, remove your foot from the accelerator, staying at the gear you are driving at. The vehicle will continue to move under the influence of kinetic energy, but the speed will decrease. In this situation, the vehicle is traveling without consuming fuel because the accelerator pedal is not pressed, and forced idle mode is activated – the fuel supply to the engine is stopped.

Try to use the brake pedal only when necessary to stop, or a contingency has occurred on the road. You may use the engine, gears, or auxiliary brakes for deceleration in all other cases you.

Also, note that inadequate handling of the accelerator and brake pedals may lead to discomfort for the passengers or damage to the freight you are transporting. It may also create dangerous situations on the roads, threatening other participants in the traffic.

Tip #7

Anticipation - try to look as far as possible

When driving, try to focus and observe what is ahead and around you. This way, you will avoid dangerous situations and last-second reactions.

Watching as far as possible, you may predict approaching situations and so be able to take measures in advance, bringing the vehicle to an optimal regime for passing through these situations. Here are some of the most common cases happening on the road and the ways of optimizing fuel consumption when passing through them:

- **There is a traffic light in front of you** – the signal is red; you may start lowering the speed by decelerating, then by reducing the gears, aiming to reach the traffic light when it already has the green sign and to pass without having to stop. Every vehicle consumes fuel mostly at setting off. Try to eliminate the situations in which you stop, and after that, set off;
- **You will have to climb a slope** – accelerate to the maximum possible speed (without over-revving, breaking the law, or creating a hazard) before reaching the beginning of the slope. This way, you will be able to climb the slope or at least a part of it at a higher speed, but at higher gear and lower revs of the engine;
- **You are climbing up a slope** – choose the proper gear, carefully handle the gas and try to maintain maximum speed at low rpm. Before reaching the top, when you feel the vehicle starts to accelerate, take off the gas. In this way, the vehicle will climb the top without consuming fuel.

The main goals you should aim at when passing through different situations on the road are: maintaining a constant speed, minimizing stops and set-offs, avoiding abrupt throttling followed by pressing the brakes for abrupt stopping and vice versa, use to the fullest the kinetic energy of the vehicle, as well as the friction and resistance of the engine for stopping.

Tip #8

Small things also count

Things you have possibly not thought of also negatively influence the vehicle's fuel consumption. Most of them, not to a large extent, but in combination with the rest, may increase the fuel consumption of your vehicle. Try to reduce using them or change your driving style if necessary.

Here are some:

- **Turn off the engine when not moving** – when idling longer than 1 minute, turn off the engine. Not only will it not consume fuel, but the engine also will not be subjected to work in an abnormal environment – during traveling, the oncoming air surrounds the engine and cools it. When idling, this does not happen, and the working temperature increases. This is extremely important, especially for diesel engines!
- **Restrict the use of air-conditioning** – use it only on long trips when you want to achieve the temperature you set it. Maintaining the air-conditioner operating requires around 5 hp from the engine's power;
- All additional electrical consumables require more work from the vehicles' charging system and, therefore, higher fuel consumption. **Turn them off** unless they are necessary;
- Open windows increase air resistance; **avoid circulating with open windows** at high speeds;
- Opt for **a slower speed in traffic jams**, which minimizes the times you have to accelerate and decelerate. This will save fuel and make your journey safer.

Tip #9

Invest in training sessions for your drivers

Efficiently managing the company costs is one of the keys to success. Investing money in Legal Driving Times and Driving-related training sessions is often discarded. However, these types of training pay themselves over time. Reducing fuel-related costs will be the fastest way to reduce your overall costs. Check also Tip#10 to see how Frotcom's Driver coaching module can help training your drivers "on the job".

On the other hand, reducing the driving times problems with authorities will help you focus on what is really important – improving your operations.

Vehicle technologies are constantly changing. Therefore, learning in a controlled environment how to efficiently use the available systems in your vehicles for optimizing and helping driving - cruise control, speed limiter, and others, will avoid difficult situations later on when you may need these tools.

These systems are developed to optimize vehicle operation and help drivers. Cruise control is a system that allows drivers to switch to automatic mode for maintaining the desired speed, which also means the automatic control of the engine and gearing (in automatic gearboxes).

Automatic control of the engine and gears reduces fuel consumption because the fuel supplied to the engine is optimized. This happens at the most appropriate gear (again in automatic gearboxes).

Systems that complement the brake system (mainly for heavy vehicles – engine brake, exhaust brake, or retarder) are developed to slow down cars, prevent dangerous situations, and control speed. Use them whenever possible instead of the brake pedal. This way, the operation of the brake system is reduced, and therefore, the replacement of consumables will decrease.

Get acquainted with the equipment available in the vehicle – safety equipment, SOS kit, spare tires, and tools. If something is missing, you should replace it immediately to avoid unpleasant situations on the road if you need it. Do not overload the driving compartment, just place the legally required or necessary things. Remove everything else because additional weight increases fuel consumption.

Tip #10

Analyze your Fleet Management System data and engage your drivers

Frotcom collects various CANBus data, including accelerator pedal position, brake pedal position, gear, auxiliary brakes, and engine torque, among others.

You can use these indicators to create **Driver coaching sessions** and analyze all the driver's driving behavior details.

Here are some advantages of using this powerful training and coaching module:

Know in detail how vehicles are being driven
Never before you had so much information in real-time about the exact way each vehicle is being driven.

Identify easily where driving can be improved
You will be able to identify exactly what may be incorrect in the driving style. Not purely based on statistics, but on second by second observation.

Show your drivers what needs to be improved
You will be able to show them the "video" of exactly what happened. The exact moment and place.

Help inexperienced drivers from a distance
Do you have unexperienced drivers? You will be able to spot immediately the less experienced ones and coach them on a daily or weekly basis.

Know what happened in case of an accident
You will be able to revisit the situation by checking on a very detailed basis (approximately once a second) the driving maneuvers at the time of the accident.

Reduce costs and increase productivity
By increasing the driving performance of your drivers in a consistent manner, you will be able to reduce your fleet's fuel and maintenance costs, at the same time improving productivity.

Train drivers on the job with a fraction of the cost
Frotcom's Driver coaching is a great tool for training your drivers, and keep improving without having to train them on premise. You can coach them all without the need for expensive and unproductive training courses. Think about what this means in terms of costs and productivity.

Engaging with the drivers is not an easy task, but it becomes easier when analyzing accurate data from a real trip.

Sharing and discussing this data with your drivers will help them to know where they are not doing things so well.

Engaging with the drivers about driving behavior analysis will create good competition between them. They will want to be on the top of the leaderboard of the lower fuel consumption of the company!

For case studies on improved driving behavior, visit Frotcom's Knowledge Center at www.frotcom.com, or contact us.

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