The effect of tyre pressure on vehicle performance

by

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Bsc (Honours) Mechanical Engineering

A thesis submitted to the Department of Mechanical Engineering

Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirements for the degree of

Master of Science in Mechanical Engineering

College of Engineering

SEPTEMBER, 2011

DECLARATION

I hereby declare that this submission is my work towards the Msc Mechanical Engineering degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text.

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ABSTRACT

In the world today, due to the high cost of running a vehicle, there has been many research to see ways of minimizing this cost. Some of these cost come from the tyre of the vehicle, amount of fuel needed to run the vehicle smoothly, buying spare parts of vehicles and ensuring safety of the vehicle. This thesis seeks to find the effect that tyre pressures of vehicles have on the fuel consumption and the various ways of reducing this effect if there are any.

First of all, a survey of vehicles on KNUST campus was done to ascertain how tyre pressures of these vehicles deviate from the recommended tyre pressures. Then the survey was extended to other four places namely, Kumasi Polytechnic campus, Asafo, Roman Hill and Kejetia. The survey showed that most of the vehicles tyre pressures deviate from the recommended tyre pressure. Out of 660 vehicles surveyed in these five areas in the Kumasi Metropolis, 96.52% had their tyre pressures deviated from the recommended tyre pressures. That means only 3.48% of these vehicles had their measured tyre pressures conforming to the recommended tyre pressures.

From this result obtained, a case study was carried out to find out whether these deviations in the tyre pressure of the vehicles have effect on the fuel consumed by the vehicles. Five Nissan shuttle buses in KNUST campus with Vehicles 1, 2, 3, 4 and 5 were studied. A three month case study was carried out starting from September 2009 to November 2009. Values were taken each day at an interval of three hours, that is, 8:00, 11:00, 14:00 and 17:00. In each reading, values were taken for distance travelled, fuel consumed and tyre pressure for all the tyres of the vehicles.

From the case study, it was observed that, there is direct effect of the vehicles tyre pressure on the fuel consumed. It was seen that when vehicles tyre pressure deviate from the recommended tyre pressure, there is additional fuel consumed by the vehicle. Using Vehicle 1 as an example, with ten percent tyre pressure deviation above the recommended tyre pressure, an additional fuel of 2.72 litres will be incurred for Kumasi/Accra return trip (540km). Similarly, 10.87 litres and 24.46 litres of an additional fuel will be incurred for twenty percent and thirty percent tyre pressure deviation below the recommended tyre pressure for Kumasi/Accra return trip. These will result in additional money spent by the drivers.

In all it was seen from the research that any deviation in tyre pressure of vehicles result in an additional fuel consumed by the vehicles. Also, most vehicles in the Kumasi Metropolis have their tyre pressures deviating from the recommended tyre pressures.

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ABBREVIATIONS

KNUST – Kwame Nkrumah University of Science and Technology

JAF – Japan automobile federation

TREAD – transport recall enhancement, accountability and documentation

TPMS – tyre pressure monitoring system

GHG – greenhouse gas

FR – front right tyre

FL – front left tyre

RR – rear right tyre

RL – rear left tyre

MTP – measured tyre pressure

MRTP – manufacturer's recommended tyre pressure

AMTP — average measured tyre pressure

ARTP — average recommended tyre pressure

AMRTP — average manufacturer's recommended tyre pressure

DOT — department of transportation

F — fuel consumption

N/mm^2 – Newton per millimetre square

p — tyre pressure

ACKNOWLEDGMENT

First of all, my biggest thanks go to Jehovah God for his mercies and help throughout my schooling. I thank my parents, Mr and Mrs Alhassan, and my siblings, Sampson, Samuel, Esther, Michael, Grace, Elizabeth, Rebecca and Japheth for their support and advice through my education. Big thanks to all my friends for their encouragement and support especially Stella Adjeiwaa-Sefa. Moreover, I thank my room mates, Kennedy, Nettey, Nathaniel, Amponsah, Osei and Jethro for their care, help and support. I also thank my supervisor, Dr Prince Yaw Andoh for his direction, support and help throughout my project work. And last but not the least, to Dr Fiagbe for his enormous support and directions.

DEDICATION

I dedicate this thesis to my parents Mr and Mrs Alhassan and Sampson Alhassan.

CHAPTER ONE – INTRODUCTION

This chapter discusses the background information, the problem statement, the objective of the research, the significance of research and the scope of research.

1.1 Background

As an automobile travels, the surface of the tyre and the road come into contact and must be continually peeled apart. In addition, each surface (both the tyre and the road) is deformed slightly so that in effect, the wheel is rolling uphill. These effects combine to produce a rolling resistance. A ratio of 1:5.3, or more than a two percent is found for the effect on fuel economy for every ten percent change in rolling resistance for highway driving and a ratio of 1:9.6, or about a one percent fuel economy change for every ten percent change in rolling resistance for urban driving [Calwell et al., 2003]. Consistent with these findings, the German Umweltbundesamt reports a thirty percent reduction in a tyre's rolling resistance can reduce a vehicle's fuel consumption from two percent to six percent, depending on driving conditions and other factors [Friedrich, 2002].

According to the Rubber Manufacturer's Association, when a tyre is under inflated by one pound per square inch (psi), the tyre's rolling resistance is increased by approximately 1.1% and that a five to eight percent deterioration in rolling resistance performance, which equates to a roughly one percent reduction in fuel efficiency [Calwell et al., 2003]. This is similar to the review study done by Schuring and Futamura that found for each ten percent reduction in the rolling resistance coefficient the fuel efficiency increased by (1.2–2.5)% for city and (0.9–2.1)% percent for highway

driving [Schuring and Futamura, 1990]. This is because inflation pressure determines tyre stiffness, which has a significant influence on the contact area of the tyre and pressure distribution over the contact surface. Thus, as pressure in the vehicles tyres is reduced, the rolling resistance increases over the road because the surface contact area and virtual hill height is increased. When the rolling resistance is increased, it takes more energy (fuel) to get the automobile to go the same distance. The relationship between tyre pressure, rolling resistance and fuel economy is complex and dynamic and is dependent on several other factors, including vehicle type and load, road and environmental conditions.

Overall, rolling resistance makes up a relatively small percentage of the losses in a typical vehicle; it accounts for about four percent of a vehicle's energy expenditure at low speeds and about seven percent at highway speeds [Stein, 2006]. However, these modest losses are substantial when in the context of the entire US, where automobile travel accounts for the largest source of energy use and GHG emissions, with petroleum combustion causing 2438 Tg (106 tons) CO_2 or forty three percent of the emissions in 2004. Globally the situation is similar, where in 1990 the transportation sector was responsible for some twenty five percent of the world's energy use, and twenty two percent of the global CO_2 emissions. [Stein, 2006]

Tyres are specified by the vehicle manufacturer with a recommended inflation pressure, which permits safe operation within the specified load rating and vehicle loading. Most tyres are stamped with a maximum pressure rating. For passenger vehicles and light

trucks, the tyres should be inflated to what the vehicle manufacturer recommends, which is usually located on a decal just inside the driver's door, or in the vehicle owners handbook. Tyres are not expected to be inflated to the pressure on the sidewall; this is the maximum pressure, rather than the recommended pressure.

Regardless of its size, every tyre's load capacity, durability, traction and handling is dependent on using the recommended inflation pressure for the application. Since both too little and too much inflation pressure sacrifices some of the tyres' performance, maintaining the "right" inflation pressure is very important.

According to Hillier [1991] 'underinflation' or overloading leads to rapid wear on each side of the tread and internal damage to the casing, whereas 'overinflation' wears the centre of tread.

The major causes of over-inflation are an inaccurate tyre pressure gauge, hot tyres or incorrect reading by the operator. [Read and Reid, 2000]

If tyre pressure is too high, the tyre contact patch is reduced, which decreases rolling resistance. However, ride comfort is reduced, but traction is not always reduced, stopping distance is not always increased. Also, going above max sidewall pressure rarely results in the centre of the tyre wearing more than the shoulder.

If tyre pressure is too low, the tyre contact patch is increased, increasing rolling resistance, tyre flexing and friction between the road and tyre. This "underinflation" can lead to tyre overheating, premature tread wear, and tread separation in severe cases.

It is important that vehicle tyres are of the correct pressure for maximum economy (tyre wear and fuel consumption) and safety. That is the tyre should have the correct amount of tread in contact with the road for optimum grip and traction and also, the air in the tyre that supports the vehicle.

It is important for vehicle users to note that when vehicle tyres are inflated to their correct pressures, the safety of the occupant is guaranteed, the fuel economy of the car is also enhanced as well as the comfortability is achieved. [Reimpell and Stoll, 1996]

1.2 Problem Statement

In recent years, the increasing demand for the safety of an automobile has promoted research and development of the technology of active safety. One of the important factors determining vehicle dynamics including safety is tyre air pressure. A reduction in tyre pressure from the proper level will cause deteriorations in the driving stability, fuel consumption, tyre life, and possible bursts of the tyres.

A survey on the tyre pressure conducted in the parking lot of a company shows that cars with low-pressure (under 140 kPa) tyres occupy about four percent, and sixty four percent of these cars have four tyres with substantially equal pressures which is due to the natural leakage [Ohashi et al., 1997]. According to the statistics of Japan Automobile Federation (JAF), tyre problems on highways are the greatest number of cases in which the JAF is asked to rescue. This situation is caused by the difficulty for ordinary drivers to sense the reductions in the air pressures or because of the lack of interest in maintaining proper tyre air pressure.

Similar results are found elsewhere in the world. For example, a recent study in Saudi Arabia found the pressure in twenty one percent of the inspected tyres was twenty five percent or more below the vehicle manufacturer's recommended inflation settings [Ratrout, 2005]. Tyres typically lose about one pound per square inch (psi) of air pressure per month during normal driving conditions, and can lose considerably more during the change in ambient temperature (1 psi per 10 °F drop). Under-inflated tyres decrease fuel economy, shorten tread life, have less lateral traction and longer stopping distances and prone to stress damage, which are more vulnerable to flat tyres and thus resulted in rollovers.

The problem is how far vehicles deviate from the recommended tyre pressure and the relationship between the tyre pressure and fuel consumption.

1.3 Research Objective

The main objective of this thesis is to develop a model for the effect of tyre pressure on fuel consumption in vehicles and come out with some suggestions and recommendations on how to reduce these effects.

The specific objectives of this thesis are to:

1) Find the extent of deviation of tyre pressures of vehicles from the vehicles manufacturers' recommendation.
2) Develop a model for the effect of tyre pressure on fuel consumption for vehicles.
3) Validate the model.
4) Find the effect of tyre pressure on the Ghanaian economy.

1.4 Justification (Significant Of Research)

Tyre pressures of vehicles have direct effect on the fuel consumption. From research, when tyre pressures of vehicles fall below the recommended tyre pressure more fuel are consumed. This means that when vehicles have their tyre pressures below the recommended drivers will spend more money on fuel. The government has to import more crude oil and that means more money has to be channelled into road transportation sector of the economy. If that happens, other sectors of the country will not be developed.

When vehicles have the pressures in their tyres deviating from the recommended tyre pressure it can also leads to accidents. When the tyre pressure is below the recommended tyre pressure it can leads to stress build up on the tyres which will lead to tyre burst and that can cause accident. When accidents occur it may lead to loss of life and in effect manpower of the country will be lost. This can cause low productivity in the country due to manpower lost. Even if no human life is lost, it may lead to loss of property and injury to the motorist.

1.5 Scope of Research

The scope of the study will involve a literature review conducted to find out about various types of tyres on the Ghanaian market. Also, measurements of some vehicles tyre pressures will be taken to see how they deviate from the recommended manufacturers' tyre pressure and to have an overview of how drivers monitor their tyre pressures of their

vehicles. The research will involve surveying five vehicles from KNUST shuttles to see their various tyre pressures in corresponding to the fuel consumed. Then a model will be developed to represent all the five vehicles.

1.6 Structure of the Report

Chapter One of the studies consist mainly of the general introduction to study, its objectives, problem statement and research questions, scope and methodology. The subject under discussion set out the procedure to guide the conduct of the research.

Chapter Two which provides the framework for data analysis deals with a review of the relevant literature on the subject matter. Review of the research, which will be based on both theoretical and empirical evidence, which are relevant to the study. It explores the nature and extent of the literature on the subject and thus serves as foundation for the rest of the study. There was a critical assessment of tyre pressures and their impact on fuel consumption. The problems associated with it and its successes.

Chapter Three presents at how the research was conducted and the sampling technique used to analyse the data. Chapter Four presents at the quantitative analysis of the results. This includes data analysis and presentation that were collected during the primary survey. Finally, Chapter Five, conclusion of findings and make recommendations that will help to ensure fuel economy are discussed.

CHAPTER TWO – LITERATURE REVIEW

This chapter discusses the various classifications of tyres, factors affecting vehicle performance, effects of tyre pressure on vehicle performance and fuel efficiency.

2.1 Introduction to Tyres

Tyres, are ring-shaped parts, either pneumatic or solid (including rubber, metals and plastic composites), that fit around rims to protect them and enhance their function.

Tyre is a covering mounted on the rim of a wheel that serves as a cushion and surface for traction. Tyres are used on road vehicles, tractors, aircraft and spacecraft landing gear, factory and warehouse machinery, and on a variety of other vehicles, including shopping carts and baby carriages. Tyres are made of chemically treated rubber and fabric. Those for indoor use are generally solid rubber with a smooth surface, while those used outdoors are pneumatic, or hollow and filled with pressurized air, and have a traction pattern cut into the surface.

Pneumatic tyres are used on different types of vehicles, such as bicycles, motorcycles, cars, trucks, earthmovers, and aircraft. Tyres enable better vehicle performance by providing traction, braking, steering, and load support. Tyres form a flexible cushion between the vehicle and the road, which smooths out shock and makes for a comfortable ride.

Figure2.1: Pneumatic automobile tyre

2.2 Parts and Classification of Tyres

The main parts of the pneumatic tyre are the tread, the body, and the beads. The tread is a thick pad of rubber into which grooves are cut to form cleats or ridges. The tread provides traction to move and stop a vehicle and to prevent skidding and sliding while a vehicle is in motion.

The body gives the tyre its strength and form. It consists of layers of fabric permeated with rubber. The fabric in most passenger-vehicle tyre bodies is polyester. Each fabric layer is called a ply, and the strength of a tyre is sometimes described by the number of plies in its body. Most automobile tyres have two plies. The beads of a tyre are the two bands that hold the tyre to its wheel. They are located along the tyre's inner edges and are made up of strands of wire surrounded by rubber and covered with fabric.

Tyres are classified into several standard types, based on the type of vehicle they serve and how they were constructed. Since the manufacturing process, raw materials, and equipment vary according to the tyre type, it is common for tyre factories to specialize in

one or more tyre types. In most markets, factories that manufacture passenger and light truck radial tyres are separate and distinct from those that make aircraft or off-the-road (OTR) tyres. The types of tyres include high performance tyres are designed for use at higher speeds, and more often, a more "sporty" driving style. They feature a softer rubber compound for improved traction, especially on high speed cornering. The trade off of this softer rubber is shorter tread life.

Mud and Snow tyre is a classification for specific winter tyres designed to provide improved performance under low temperature conditions, compared to all-season tyres. The tread compound is usually softer than that used in tyres for summer conditions, thus providing better grip on ice and snow, but wears more quickly at higher temperatures. Studded tyres are used in the upper tier classes of ice racing [Markus and Frank 2008] and rallying.

Mud tyres are specialty tyres with large, chunky tread patterns designed to bite into muddy surfaces. The large, open design also allows mud to clear quickly from between the lugs.

All season truck tyres usually have no business going off-road, as their composition and tread designs are not built to handle beatings from off-road conditions. They do, however, provide long-lasting tread that excels on wet or dry paved roads and offers tremendous longevity. [Han, 2007]

All-terrain tyres are typically used on SUVs and light trucks. These tyres often have stiffer sidewalls for greater resistance against puncture when traveling off-road. The

tread pattern offers wider spacing than all-season tyres to remove mud from the tread. [Han, 2007]

Heavy duty tyres are also referred to as Truck/Bus tyres. These are the tyre sizes used on vehicles such as commercial freight trucks, dump trucks, and passenger buses.

The off-the-road (OTR) tyre classification includes tyres for construction vehicles such as wheel loaders, backhoes, graders, trenchers, and the like; as well as large mining trucks.

The agricultural tyre includes tyres used on farm vehicles, typically tractors and specialty vehicles like harvesters. High flotation tyres are used in swampy environments and feature large footprints at low inflation pressures.

Racing tyres are highly specialized according to vehicle and race track conditions. This classification includes tyres for top-fuel dragsters, drift racers, extreme off-road racing, oval-track racers, jet-powered trucks, and monster trucks - as well as the large-market race tyres for Formula One, NASCAR, rallying, MotoGP and the like.

The Industrial tyre is a bit of a catch-all category and includes pneumatic and non-pneumatic tyres for specialty in industrial and construction equipment such as skid loaders and fork lift trucks.

Aircraft tyres are designed to withstand extremely heavy loads for short durations. The number of tyres required for aircraft increases with the weight of the plane. Aircraft tyre tread patterns are designed to facilitate stability in high crosswind conditions, to channel water away to prevent hydroplaning, and for braking effect. Aircraft tyres generally

operate at high pressures, up to 200 psi (13.8 bar) for airliners, and even higher for business jets. Tests of airline aircraft tyres have shown that they are able to sustain pressures of maximum 800 psi (55.2 bar) before bursting.

There are many different types of motorcycle tyres which include: Sport Touring, Sport Street and track or slick.

Bias tyre (or cross ply) construction utilizes body ply cords that extend diagonally from bead to bead, usually at angles in the range of 30 to 40 degrees, with successive plies laid at opposing angles forming a crisscross pattern to which the tread is applied. The design allows the entire tyre body to flex easily, providing the main advantage of this construction, a smooth ride on rough surfaces. This cushioning characteristic also causes the major disadvantages of a bias tyre: increased rolling resistance and less control and traction at higher speeds.

A belted bias tyre starts with two or more bias-plies to which stabilizer belts are bonded directly beneath the tread. This construction provides smoother ride that is similar to the bias tyre, while lessening rolling resistance because the belts increase tread stiffness.

Radial tyre construction utilizes body ply cords extending from the beads and across the tread so that the cords are laid at approximately right angles to the centerline of the tread, and parallel to each other, as well as stiff stabilizer belts directly beneath the tread. The advantages of this construction include longer tread life, better steering control, and lower rolling resistance. Disadvantages of the radial tyre include a harder ride at low speeds on

rough roads and in the context of off-roading, decreased "self-cleaning" ability and lower grip ability at low speeds.

Many tyres used in industrial and commercial applications are non-pneumatic, and are manufactured from solid rubber and plastic compounds via molding operations. Solid tyres include those used for lawn mowers, skateboards, golf carts, scooters, and many types of light industrial vehicles, carts, and trailers. One of the most common applications for solid tyres is for material handling equipment (forklifts).

2.3 Importance of Tyres

Tyres are part of the backbone of a car, truck, piece of construction equipment or bicycle. Tyres add traction, braking, steering and load support to vehicles while also absorbing shock and creating a smooth and comfortable ride. They are o-shaped parts that can be pneumatic or solid and fit around the wheels of the vehicle to protect the wheels and add to their effect. A solid tyre consists of rubber, metals and plastic parts. [Williams, 2008]

Vehicle tyres can affect not only the way car are handled, but also can affect the overall performance and fuel economy of a vehicle. One of the most important things to do is a regular schedule to check air pressure in tyres. Incorrect air pressure in tyre causes the tyre failure. Tyre failure while driving can lead to crush and possibly injure the driver and the passengers. [Gibson, 2006]

2.4 Factors Affecting the Performance of a Vehicle

Aerodynamics is one of the leading factors in vehicle performance. Car racing has focused on this aspect early in the 1960's, when the first invented wings were installed on formula cars. In time, the development of aerodynamic devices grew stronger, often borrowing ideas and solutions form the flight industry. By improving aerodynamics, engineers saw faster lap times and more driver control over the car, both at high and low speeds. The final element that contributes to improved handling and grip is the downforce - using the underbody of the vehicle to facilitate airflow and "stick" the car to the tarmac. [Johnson, 2005]

When the hood of the vehicle is pop open, some parts are greasy, others are filled with fluids and some parts are just too hot to touch after a long run. These are the intricacies of the engine adapted by the vehicle which makes the vehicle run with good performance. However, the basis of their performance is not solely accredited to the number of cylinders the vehicle has or the type of arrangement your engine parts have adapted. There is more to the ones running under the hood. This gives the power that the car needs in every change to the gear. The kind of engine that is inside the car helps the vehicle to use gasoline efficiently and effectively. There are other things that one needs to consider. It is simply because the road is not straight and even. [Michaels, 2008]

One of the factors that should be looked at is suspension. Suspension allows the car to ride smoothly even when the road is bumpy. Without it, it will lose the ability to achieve stability in steering or even loose control with car. The purpose of putting them on the vehicle is revolved on two purposes: i) to distribute weight equally as the car accelerates

(on different surface levels of the road) and ii) to absorb the energy from the road without causing undue disturbance to the body of the car. [Michaels, 2008]

Another factor that affects vehicle performance is tyre pressure. Simply put, failure to maintain right tyre pressure on a consistent basis may result in faster tyre wear, tyre failures and loss of control, thus resulting in possible serious injuries or even property damages. More importantly, having the correct tyre pressures mean that the vehicle will be in better control, lesser chances of experiencing tyre blowouts or punctures and therefore preserving precious life. [Yeo, 2006]

2.5 Effects of Tyre Pressure on Vehicle Performance

Tyres are specified by the vehicle manufacturer with a recommended inflation pressure, which permits safe operation within the specified load rating and vehicle loading. Most tyres are stamped with a maximum pressure rating (for USA only). For passenger vehicles and light trucks, the tyres should be inflated to what the vehicle manufacturer recommends, which is usually located on a decal just inside the driver's door, or in the vehicle owners handbook. Tyres should not be inflated to the pressure on the sidewall; this is the maximum pressure, rather than the recommended pressure.

If tyre pressure is too high, the tyre contact patch is reduced, which decreases rolling resistance. However, ride comfort is reduced, but traction is not always reduced, stopping distance is not always increased. [FEA, 2009] Also, going above max sidewall pressure rarely results in the center of the tyre wearing more than the shoulder. If tyre pressure is

too low, the tyre contact patch is increased, increasing rolling resistance, tyre flexing and friction between the road and tyre. This "underinflation" can lead to tyre overheating, premature tread wear, and tread separation in severe cases. Braking distance does not statistically change as tyre pressure increased, suggesting that a larger contact patch from underinflation may not be a significant contributor for the conditions explored in these specific tests.

From the above information it is seen that the inflation pressure or tyre pressure of a vehicle affects rolling resistance, tyre heating, tread wear, tread separation and fuel consumption.

2.5.1 Rolling Resistance

Rolling resistance is the resistance to rolling caused by deformation of the tyre in contact with the road surface. As the tyre rolls, tread enters the contact area and is deformed to conform to the roadway. The energy required to make the deformation depends on the inflation pressure, rotating speed, and numerous physical properties of the tyre structure, such as spring force and stiffness. Tyre makers seek lower rolling resistance tyre constructions in order to improve fuel economy in cars and especially trucks, where rolling resistance accounts for a high amount of fuel consumption.

The pneumatic tyre also has the more important effect of vastly reducing rolling resistance compared to a solid tyre. Because the internal air pressure acts in all directions, a pneumatic tyre is able to "absorb" bumps in the road as it rolls over them without

experiencing a reaction force opposite to the direction of travel, as is the case with a solid (or foam-filled) tyre. Overall, rolling resistance makes up a relatively small percentage of the losses in a typical vehicle; it accounts for about 4% of a vehicle's energy expenditure at low speeds and about 7% at highway speeds [Stein, 2006].

2.5.2 Tread Wear

Friction between the tyre and the road surface causes the tread rubber to wear away over time. Government legal standards prescribe the minimum allowable tread depth for safe operation. There are several types of abnormal tread wear. Poor wheel alignment can cause excessive wear of the innermost or outermost rims. Gravel roads, rocky terrain, and other rough terrain will cause accelerated wear. Over inflation above the sidewall max can cause excessive wear to the center of the tread. However, inflating up to the sidewall limit will not cause excessive wear in the center of the tread. Modern tyres have steel belts built in to prevent this. Under inflation causes excessive wear to the outer ribs. Quite often the placard pressure is too low and most tyres are underinflated as a result. Unbalanced wheels can cause uneven tyre wear, as the rotation may not be perfectly circular. Tyre manufacturers and car companies have mutually established standards for tread wear testing that include measurement parameters for tread loss profile, lug count, and heel-toe wear. Also can be known as tyre wear.

Tyre wear rates reported in the literature range between 0.006 and 0.09 g km^{-1} per tyre [Rogge et al., 1993]. An estimate from Great Britain showed the

total tyre wear to be 140 g per meter per year [Environment Agency News, 1999]. The actual wear rate is, however, dependent on a range of factors such as driving style, weather, and tyre and road characteristics [EEA, 2003]. The wear rate has been shown to be several times higher during urban driving than during motorway driving, due to increased acceleration, braking, and cornering in cities [Stalnaker et al., 1996]. Thus, a significant part of the worn tread rubber may be emitted in cities, even though city driving only accounts for a small part of the tyre mileage. The following annual figures on the emissions of tyre wear particles to the environment have been reported for different countries; Great Britain 57×10^6 kg [Environment Agency News, 1999], Germany 60×10^6 kg [Baumann and Ismeier, 1998], Italy 50×10^6 kg [Milani et al., 2004], Sweden 10×10^6 kg [KemI, 2003], Denmark 7.3×10^6 kg [Fauser et al., 2002], and USA 500×10^6 kg [Councell et al., 2004]. Most of the abraded rubber is released in the form of relatively large particles that will deposit on the road or close to the road, [Fauser, 1999]. Tyre wear particles have complex shapes and morphologies and are rich in porosity [Milani et al., 2004]. Rubber from skid marks from twelve different tyres was analysed by pyrolysis gas chromatography mass spectrometry, and tyres were found not to be homogenous. Several peaks that were found in tyre samples were not found in skid mark samples, indicating that these compounds were either lost during the skid process or not left behind [Sarkissian, 2007].

2.5.3 Tread Separation

Tyre blowouts and tread separation are a very hot safety issue in the Kingdom of Saudi Arabia. Accidents resulting from tyre failure on rural roads are intensively covered by the local media. Recent statistics compiled by the Special Forces for road security in the kingdom revealed that 624 traffic accidents resulted from tyre failure in the year 2001. This represents 13% of the total traffic accidents attended to by these forces. Taking into consideration the length of roads under the jurisdiction of the special forces for road security (mainly rural roads), the total number of tyre-related accidents can be transformed into a rate of 1 accident per 11 km of rural road in that year.[Ratrout, 2005]

The only study on tyre failure and tread separation in the Kingdom of Saudi Arabia was done by the Saudi ARAMCO Company. It ran from 1981 to 1985 and covered mainly the company's vehicles. The study found that 60% of the surveyed vehicles had their tyre pressure 20% below the recommended pressure and that about 2% of the tyres used by the company had failed because of tread separation. The report concluded that tyre under-inflation was one of the major contributors to tyre failure. [Ratrout, 2005]

The National Center for Statistics and Analysis of the USA (NCSA) in USA studied the data collected by the National Accident Sampling System-Crashworthiness Data System (NASS-CDS) between 1995 and 1998 and estimated that “23,464 tow-away crashes, or 0.5% of all crashes, are caused by blowouts or flat tyres each year”.[Ratrout, 2005] Many studies and reputable tyre manufacturers indicate that under-inflation in tyres is a major contributor to tyre failure. When tyres are under-inflated, their sidewalls flex more, and

consequently the temperature inside them increases up to a point that the tyre cannot withstand and failure occurs.[Ratrout, 2005]

2.5.4 Tyre Pressure and Fuel Efficiency

According to the Rubber Manufacturer's Association, when a tyre is under inflated by 1 Ib, the tyre's rolling resistance is increased by approximately 1% and that a 5–8% deterioration in rolling resistance performance, which equates to a roughly 1% reduction in fuel efficiency [Calwell et al., 2003]. This is similar to the review study done by Schuring and Futamura [1990] that found for each 10% reduction in the rolling resistance coefficient the fuel efficiency increased by 1.2–2.5% for city and 0.9–2.1% for highway driving. This is because inflation pressure determines tyre stiffness, which has a significant influence on the contact area of the tyre and pressure distribution over the contact surface. Thus, as pressure in the vehicle's tyres is reduced, the rolling resistance increases over the road because the surface contact area and virtual hill height is increased. When the rolling resistance is increased, it takes more energy (fuel) to get the automobile to go the same distance. [Schuring and Futamura, 1990]

According to this research, there is a direct effect of tyre pressure on fuel consumption. Any decrease in tyre pressure means extra fuel consumed by the vehicles.

2.6 Tyre Pressure Monitoring System

Tyre pressure monitoring systems (TPMS) are electronic systems that monitor the tyre pressures on individual wheels on a vehicle, and alert the driver when the pressure goes below a warning limit. There are several types of designs to monitor tyre pressure. Some actually measure the air pressure, and some make indirect measurements, such as gauging when the relative size of the tyre changes due to lower air pressure. These systems are becoming mandatory in countries such as the United States.

For example, to address challenges and safety concerns created by America's increased use of sports utility vehicles (SUVs), the National Highway Traffic Safety Administration created, and the US 106th Congress passed, the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act (2000). The TREAD Act requires automobile companies to report defects in motor vehicles, tyres, or equipment and requires faulty equipment to be replaced or repaired at no cost to the consumer. The TREAD Act will also reduce energy use because it demands that manufactures install a tyre pressure monitoring system (TPMS) in future automobiles. The deployment of TPMS, which consists of a tire pressure sensor in each tyre, a logic circuit, and a warning system for the driver, will reduce fuel use by assuring America's fleet is driving on properly inflated tyres. It has already been established that the average driver does not understand, monitor or correct vehicle tyre pressure [McKenzie-Mohr et al., 1999; Jones, 2001].

2.7 Conclusion from the literature review

From the review carried out, significant research works draw some correlation between the tyre pressure and the fuel consumption such that when tyre pressure increases, the fuel consumption also decreases until it reaches the recommended tyre pressure and then when tyre pressure increases, fuel consumption decreases. Both underinflation and overinflation of the vehicle tyres affects the fuel consumption. However, none of the researches was able to provide define model that relates tyre pressure to fuel consumption. This thesis seeks to verify if those research works carried out elsewhere in the world also holds in Ghana and develop a model to relate the effect of tyre pressure on fuel consumption.

CHAPTER THREE - RESEARCH METHODOLOGY

This chapter looks at how the research was conducted and the sampling technique used to analyse the data.

3.1 Research design

A survey of vehicles was conducted in Kumasi metropolis. The survey was based on field data on vehicles from KNUST campus, Kumasi Polytechnic campus, Asafo, Roman Hill and Kejetia.

A case study approach was adopted for this kind of research. Research constraints as well as the depth of the study were taken into consideration in adopting the case study approach. The study was based on field data on vehicles from the KNUST shuttle point. This is because it is not possible to cover all the vehicles on campus. This is partly due to logistic and resource constraint.

3.2 Measurement of tyre pressure

A survey was conducted to ascertain how far vehicles plying their trade on roads in Kumasi have tyre pressure deviated from the manufacturers recommended tyre pressure. Three (3) public transport stations in Kumasi metropolis were taken into consideration namely Asafo, Roman Hill and Kejetia and two public institutions namely KNUST and Kumasi Polytechnic.

Initially, the survey was conducted in the transport department of KNUST. All the tyre pressures for each vehicle were measured using tyre pressure gauge and compared to the manufacturers recommended tyre pressure. The result is shown in Table 3.1.

Table 3.1: Measured tyre pressure of vehicles at Transport department of KNUST

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)(MTP)				MANUFACTURERS RECCOMENDED TYRE PRESSURE (N/mm^2)(MRTP)			
	FR	FL	RR	RL	FR	FL	RR	RL
1	0.1792	0.1655	0.1655	0.2068	0.2068	0.2068	0.2206	0.2206
2	0.2620	0.2620	0.1655	0.1517	0.2551	0.2551	0.2965	0.2965
3	0.2758	0.2758	0.3378	0.3378	0.3516	0.3516	0.4482	0.4482
4	0.1310	0.1310	0.1517	0.2068	0.2137	0.2137	0.2620	0.2620
5	0.2344	0.2344	0.2068	0.2344	0.2068	0.2068	0.2620	0.2620
6	0.2689	0.2758	0.2068	0.2689	0.2068	0.2068	0.2689	0.2689
7	0.2068	0.1931	0.3447	0.1655	0.3103	0.3103	0.4137	0.4137
8	0.2000	0.1931	0.1517	0.1793	0.2137	0.2137	0.2206	0.2206
9	0.1034	0.3172	0.2206	0.2068	0.2068	0.2068	0.2206	0.2206
10	0.2551	0.0827	0.2137	0.2758	0.3103	0.3103	0.4137	0.4137

From Table 3.1, the average tyre pressures in each vehicle for both measured and recommended were computed. The difference between the average measured tyre pressure and average recommended tyre pressure were then computed to establish the

percentage deviation of the tyre pressure. The results are tabulated and presented in Table 3.2.

Table 3.2 Percentage deviation of vehicles at Transport department of KNUST

VEHICLE	AVERAGE MEASURED TYRE PRESSURE (N/mm^2)(AMTP)	AVERAGE RECOMMENDED TYRE PRESSURE (N/mm^2) (ARTP/AMRTP)	DEVIATION =AMTP - AMRTP	PERCENTAGE DEVIATION (%) ((AMTP-AMRTP) /AMRTP)*100
1	0.1793	0.2137	-0.0344	-16
2	0.2103	0.2758	-0.0655	-24
3	0.3068	0.3999	-0.0931	-23
4	0.1551	0.2293	-0.0742	-32
5	0.2275	0.2258	0.00173	0.8
6	0.2551	0.2430	0.0121	5
7	0.2275	0.3620	-0.1345	-37
8	0.1810	0.2172	-0.0362	-17
9	0.2120	0.2137	-0.00173	-0.8
10	0.2068	0.3620	-0.1552	-43

This was repeated for the remaining ten (10) units in the University. The tables of results are presented at appendix A. The results were grouped into ranges, that is (0.01 – 10)%, (10.01 – 20)%, (20.01 – 30)%, and so on. The results obtained are tabulated and presented in Table 3.3.

Table 3.3: Deviation of tyre pressures at KNUST campus

DEVIATION	NUMBER OF VEHICLES
ABOVE +30%	2
+(20.01 – 30)%	1
+(10.01 – 20)%	4
+(0.01 – 10)%	11
Recommended	2
-(0.01 – 10)%	9
-(10.01 – 20)%	30
-(20.01 – 30)%	29
BELOW -30%	12
TOTAL	100

From Table 3.3, it could be inferred that 98% of the vehicles deviated from the recommended tyre pressure. Only 2% conform to the recommended tyre pressure.

Hence, the survey was extended to Kumasi Polytechnic campus, and three other public transport stations in the Kumasi Metropolis, which are, Asafo, Roman Hill, and Kejetia to verify whether they have the same trend as obtained KNUST campus. 60 vehicles were surveyed in Kumasi Polytechnic, 150 in Asafo, 100 in Roman Hill and 250 in Kejetia.

The same procedure was used for them and the results obtained are presented in Table 3.4 whilst the raw data presented in Appendix A.

Table 3.4: Deviation of tyre pressures of the various vehicles at various vehicle stations

DEVIATION	K-POLY CAMPUS	ASAFO	ROMAN HILL	KEJETIA
ABOVE +30%	0	0	0	0
+(20.01 – 30)%	0	0	1	0
+(10.01 – 20)%	3	5	3	2
+(0.01 – 10)%	2	15	12	25
Recommended	0	8	3	10
-(0.01 – 10)%	5	32	23	71
-(10.01 – 20)%	23	58	27	72
-(20.01 – 30)%	21	27	28	59
BELOW -30%	6	5	3	11
TOTAL	60	150	100	250

Inferring from the Table 3.4 and Table 3.3, only 3.48% (23) out of the 660 vehicles measured had the recommended tyre pressure, indicating that 96.52% of the vehicles deviated from the recommended tyre pressure. This means that majority of the vehicles surveyed deviated from the recommended tyre pressure and this means that most of the vehicles in the Kumasi Metropolis do not use the recommended tyre pressure.

The deviation in tyre pressure from the three public stations and the two public institutions therefore necessitated a research into tyre pressure in the Kumasi Metropolis. This is to help in formulating policy recommendations to help avert any negative impact that it can have on motorist and the economy of the country as a whole.

Hence, a case study was carried out on KNUST campus on some of the vehicles to ascertain the effect of tyre pressure of vehicles on the fuel consumption.

3.3 Measurement of tyre pressure and fuel consumption of KNUST shuttle buses

The effects of tyre pressure on vehicle performance cannot be overlooked since research has shown that it has effect on tyre wear, fuel consumption, and rolling resistance. It is assumed that when the tyre pressure is below or above the recommended tyre pressure, more fuel may be consumed. This means that more fuel will be needed for the same amount of distance to be covered.

Tyre wear can cause tyre blowout, causes discomfort in driving and makes it unsafe to drive the vehicle. Tyre wear also affects the fuel used since it may lead to more fuel consumption. Tyre blowout can also cause accidents. When the rolling resistance is

decreased or increased, it can cause tyre wear and also make it unsafe to handle the vehicle. Rolling resistance can also leads to more fuel consumption.

Hence a case study was conducted on KNUST campus to establish a relation between the tyre pressure and the fuel consumption. The experiment seeks to find out the effect of tyre pressure on the fuel consumed by vehicles. The experiment was carried out for three (3) months period using five of the shuttle buses. In each day tyre pressures, odometer reading, and the fuel reading were recorded for each vehicle. Records were taken at intervals of three (3) hours. The results for vehicle with vehicle 1 readings for the first two days were tabulated and presented in Table 3.5.

Table 3.5: Reading taken for the first two days for vehicle 1

Day	Time	Odometer Reading (km)	Fuel Reading (litres)	Tyre Pressure (N/mm^2)			
				Right Front	Left Front	Right Rear	Left Rear
1	8:00	39947	39.75	0.2758	0.2758	0.3447	0.3241
	11:00	39991	32.18	0.2758	0.2758	0.3447	0.3241
	14:00	40025	28.39	0.2758	0.2758	0.3447	0.3241
	17:00	40055	24.61	0.2758	0.2758	0.3447	0.3241
2	8:00	40080	75.71	0.2758	0.2758	0.3378	0.3172
	11:00	40111	71.92	0.2758	0.2758	0.3378	0.3172
	14:00	40141	68.14	0.2758	0.2758	0.3378	0.3172
	17:00	40206	60.57	0.2758	0.2758	0.3378	0.3172

From Table 3.5 above, average pressure was found and the fuel flow, that is, the fuel was divided by the distance covered were found and presented in Table 3.6.

Table 3.6 Average tyre pressures and the corresponding fuel consumptions for Vehicle 1

Average Pressure (N/mm^2)	Fuel Consumption (litres/km)
0.3051	0.1721
0.3051	0.1114
0.3051	0.1261
0.3017	0.3030
0.3017	0.1221
0.3017	0.1261
0.3017	0.1164

Readings were taken for three months and the results were tabulated and presented in appendix B. From Table 3.6 and appendix B, the pressures were arranged from 0.3017 N/mm^2 upwards with intervals of 5.5. With the same pressure, different fuel consumptions were attained. For instance, at the pressure of 0.3051 N/mm^2, the recorded fuel consumptions were, 0.1721, 0.1114, and 0.1261litres/km. Average fuel consumption was used to represent the corresponding tyre pressure; thus for 0.3051 N/mm^2, an average of 0.1365±0.0258 litres/km was obtained.

This was done for the other four vehicles namely Vehicle 2, Vehicle 3, Vehicle 4 and Vehicle 5 and the results are presented Appendix B.

3.4 Model suitability for the data

In the most general sense, a model is anything used in any way to represent something else. Some models are physical objects, for instance, a toy model which may be assembled, and may even be made to work like the object it represents.

Models are typically used when it is either impossible or impractical to create experimental conditions in which scientists can directly measure outcomes. Direct measurement of outcomes under controlled conditions will always be more accurate than modelled estimates of outcomes. When predicting outcomes, models use assumptions, while measurements do not. However, it is important to note that in analyzing the data collected from measurements, assumptions are made albeit different to those made through the use of a model. As the number of assumptions in a model increases, the accuracy and relevance of the model will likely diminish.

Modelling is an essential and inseparable part of all scientific activity, and many scientific disciplines have their own ideas about specific types of modelling. There is little general theory about scientific modelling, offered by the philosophy of science, systems theory, and new fields like knowledge visualization.

All models are in simulacra, that is, simplified reflections of reality, but despite their inherent falsity, they are nevertheless extremely useful. Building and disputing models is fundamental to the scientific enterprise. Complete and true representation may be impossible (see non-representational theory), but scientific debate often concerns which is the better model for a given task, such as the most accurate climate model for seasonal forecasting.

A model is evaluated first and foremost by its consistency to empirical data; any model inconsistent with reproducible observations must be modified or rejected. However, a fit to empirical data alone is not sufficient for a model to be accepted as valid. Other factors important in evaluating a model include: Ability to explain past observations, ability to predict future observations, cost of use, especially in combination with other models, refutability, enabling estimation of the degree of confidence in the model, simplicity, or even aesthetic appeal. People may attempt to quantify the evaluation of a model using a utility function.

All models can be classified under these three 1) static-dynamic 2) deterministic-probabilistic 3) iconic-analog-symbolic

This research will concentrate on mathematical models using statistical method of modelling. A statistical method of model is a formalization of relationships between variables in the form of mathematical equations. A statistical model describes how one or more random variables are related to one or more random variables. The model is statistical as the variables are not deterministically but stochastically related. In mathematical terms, a statistical model is frequently thought of as a pair (Y,P) where Y is the set of possible observations and P the set of possible probability distributions on Y. It is assumed that there is a distinct element of P which generates the observed data. Statistical inference enables us to make statements about which element(s) of this set are likely to be the true one.

According to the number of the endogenous variables and the number of equations, statistical models can be classified as complete models (the number of equations equals to the number of endogenous variables) and incomplete models. Some other statistical models are the general linear model (restricted to continuous dependent variables), the generalized linear model (for example, logistic regression), the multilevel model, and the structural equation model.

For this research least squares method of estimation for regression will be used to estimate the model. Least squares method is the simplest and thus very common estimator. It is conceptually simple and computationally straightforward. Least squares estimates are commonly used to analyze both experimental and observational data. Other methods are there but cannot give good result for the collected data.

CHAPTER FOUR – DISCUSSION OF RESULTS

Having reviewed the necessary literature on tyre pressure and its effects, there is the need to ascertain and validate some of the information presented in the literature across the world. This chapter looks at the quantitative analysis of the study. This includes data analysis and presentation of the data that were collected during the primary survey.

4.1 Deviation from recommended tyre pressure

A field survey was conducted on the KNUST campus to find out whether the various vehicles sampled, that is, one hundred (100), for the study had the recommended tyre pressure for smooth running of the vehicles. Tyre pressure gauge was used to measure the tyre pressures of the vehicles. For each vehicle all the tyres were measured. Figure 4.1 shows how measured tyre pressure of vehicles on KNUST campus deviate from the manufacturers recommended tyre pressure.

It could be inferred that almost all one hundred (100) vehicles studied deviated from the recommended tyre pressure. Only two (2) out of the 100 vehicles studied, representing two (2) percent, conformed to the manufacturer's recommended tyre pressure. The remaining ninety eight (98) vehicles, representing ninety eight (98) percent, deviated from the recommended tyre pressure.

Figure 4.1: A graph showing how measured tyre pressures of vehicles on KNUST campus deviate from the manufacturers recommended tyre pressure

With respect to the above phenomenon, eighty (80) percent of the deviating vehicles, being the vast majority, fell short of the recommended tyre pressure. Proportionally, eight (8) vehicles representing eight (8) percent were noted to have their tyre pressure being (0 – 9.99) % less than the recommended standard. Thirty (30) vehicles representing thirty (30) percent had their tyre pressures being (10 – 19.99) % less than the recommended tyre pressure, whilst the tyre pressure of twenty nine (29) vehicles also deviated by (20 – 29.99)% less than the ideal pressure. The remaining twelve (12) vehicles had their

measured tyre pressure more than thirty (30) percent below the recommended tyre pressure.

On the flip side however, the remaining eighteen (18) percent of the vehicles rather exceeded the manufacturer's recommended tyre pressure. In other words, eleven (11) vehicles had their tyre pressure being (0 – 9.99) % more than the recommended pressure. Four (4) vehicles also had their tyre pressure being (10 – 19.99) % more than the recommended standard, whilst one (1) vehicle deviated by thirty (20 – 29.99) % more than the ideal tyre pressure. The remaining two (2) vehicles had their measured tyre pressure more than thirty (30) percent above the recommended tyre pressure.

With this result in view four other stations in the Kumasi Metropolis which are Kumasi Polytechnic campus, Asafo Market station, Roman Hill station and Kejetia station were studied to see how far they have deviated from the manufacturers recommended tyre pressure. Hence the results obtained for the four other stations are presented in Figure 4.2.

From Figure 4.2, it could be seen that at Kumasi Polytechnic campus all the vehicles deviated from the recommended tyre pressure. 92% of the vehicles had their measured tyre pressures below the recommended tyre pressure whilst 8% had their measured tyre pressure above the recommended tyre pressure.

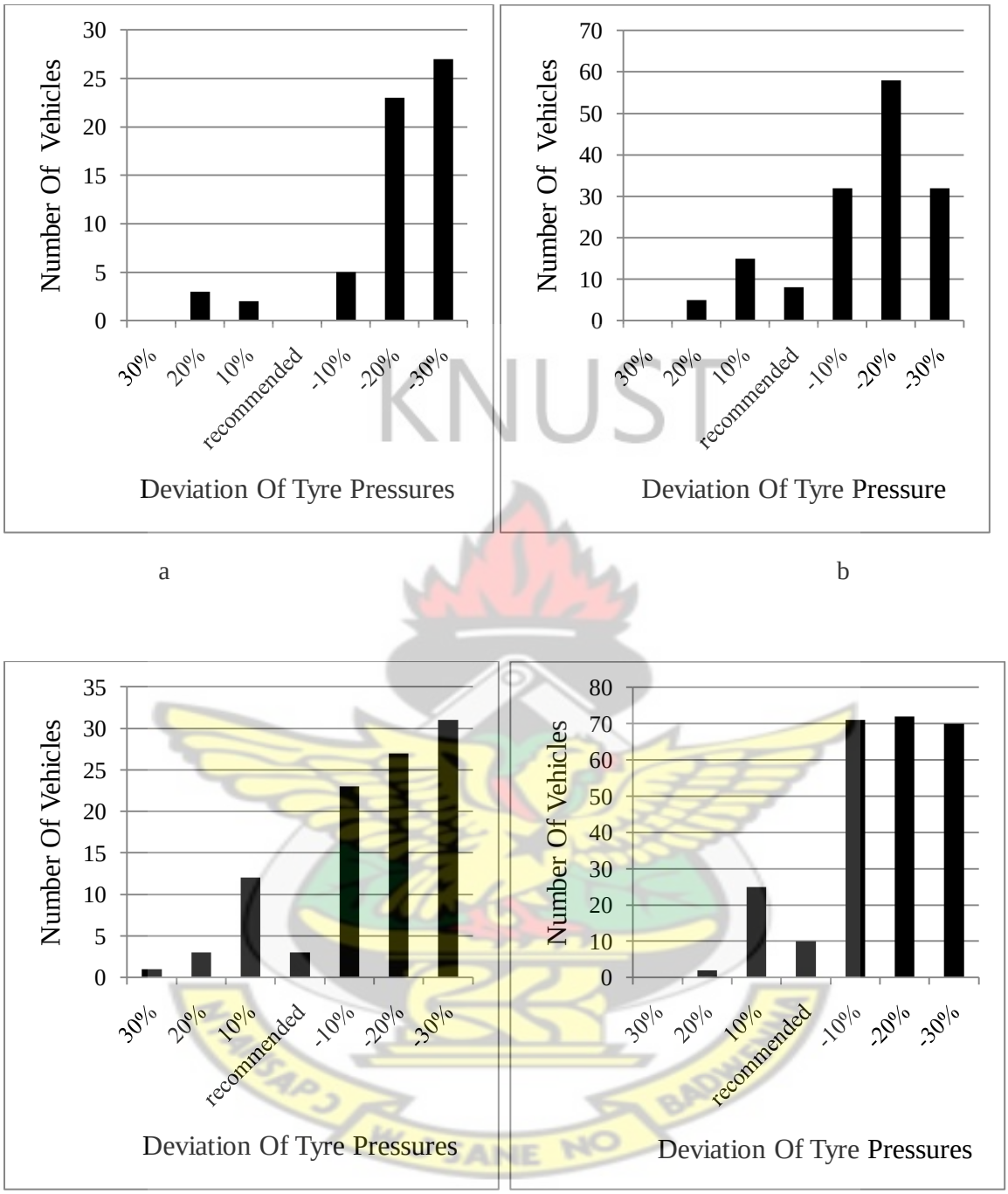

Figure 4.2: A graph showing how tyre pressures of vehicles in Kumasi Polytechnic, Asafo, Roman Hill and Kejetia respectively deviate from the manufacturers recommended tyre pressure

For Asafo, 5% of the vehicles had their measured tyre pressure being the same as the recommended tyre pressure. The rest, which is 95%, of the vehicles had their measured tyre pressure deviate from the recommended tyre pressure. Similar results were recorded at Roman Hill and Kejetia. In Roman Hill, 3% of the vehicles had their measured tyre pressure being the same as the recommended tyre pressure and the rest of the vehicles had their measured tyre pressure deviate from the recommended tyre pressure.

Combining all the five study areas, as shown in Figure 4.3, out of the total of six hundred and sixty (660) vehicles survey in the Kumasi Metropolis, only twenty three (23) out of the 660 vehicles representing three (3) percent, conformed to the manufacturer's recommended tyre pressure. The remaining six hundred and thirty seven (637) vehicles, representing ninety seven (97) percent, deviated from the recommended tyre pressure.

With respect to the phenomenon below, eighty three (83) percent of the deviating vehicles, being the vast majority, fell short of the recommended tyre pressure. Proportionally, one hundred and forty (140) vehicles representing twenty one (21) percent were noted to have their tyre pressure being ten (10) percent less than the ideal or recommended standard. Two hundred and ten (210) vehicles representing thirty two (32) percent had their tyre pressures being twenty (20) percent less than the recommended tyre pressure, whilst the tyre pressure of one hundred and sixty four (164) vehicles also deviated by thirty (30) percent less than the ideal pressure. The remaining thirty seven (37) vehicles had their measured tyre pressure more than thirty (30) percent below the recommended tyre pressure.

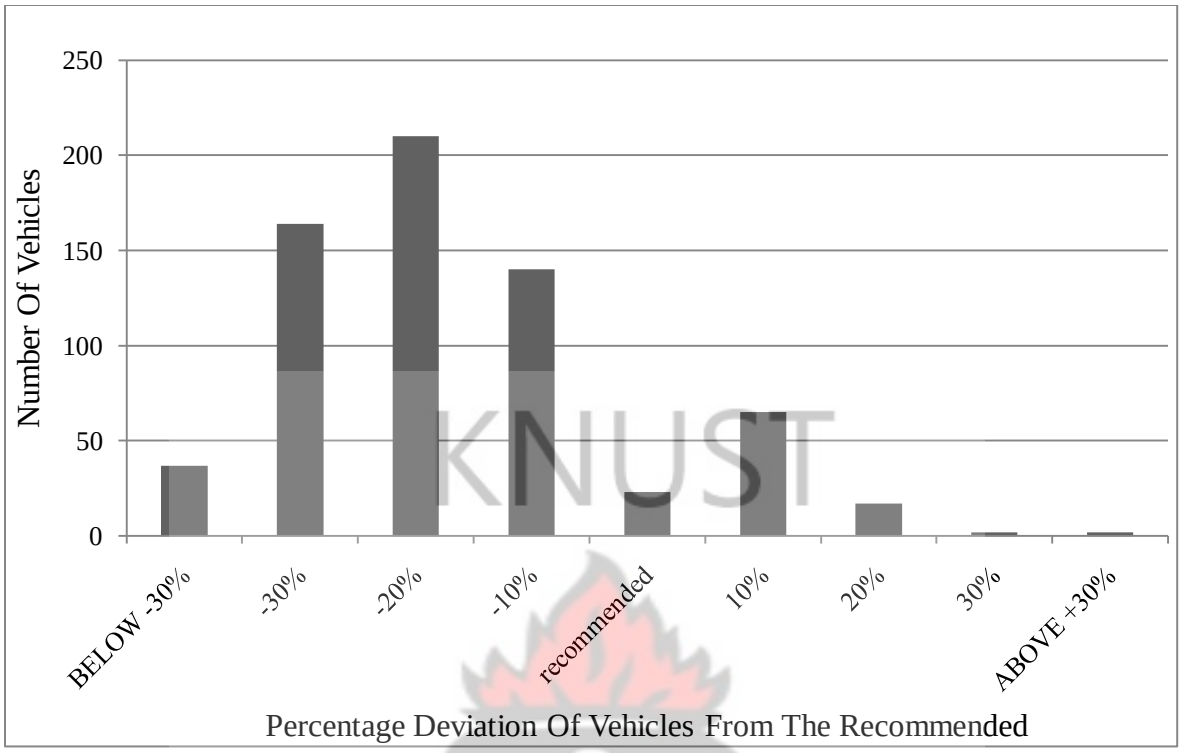

Figure 4.3: A graph showing how tyre pressures of vehicles in Kumasi deviate from the manufacturers recommended tyre pressure

On the other side however, the remaining fourteen (14) percent of deviating vehicles rather exceeded the manufacturer's recommended tyre pressure. In other words, sixty five (65) vehicles had their tyre pressure being ten (10) percent more than the ideal or recommended pressure. Seventeen (17) vehicles also had their tyre pressure being twenty (20) percent more than the recommended standard, whilst two (2) vehicles deviated by thirty (30) percent more than the ideal tyre pressure. The remaining two (2) vehicles had their measured tyre pressure more than thirty (30) percent above the recommended tyre pressure.

Having carried out an extensive study on the tyre pressure of about six hundred and sixty (660) vehicles in the Kumasi metropolis it is very alarming to note that only three (3) percent of the vehicles conformed to the manufactures required tyre pressure. This leaves much to be desired necessitating a study on its effect on vehicle performance.

Emanates from the fact that more energy is now required to move the vehicle and maintain the designated speed it requires. This means more fuel will be required and will therefore increase the cost of fuel since consumption of fuel is very high. Drivers will have to spend much more on fuel expenditure in order to keep their vehicles running smoothly. Therefore, this will reduces the revenue that commercial drivers would have earned from their operations. Some of these costs are also transferred to the general public who patronize these commercial vehicles leading to hikes in the prices of fares, goods and services.

The significant increase in the fuel consumption will be discussed in the next section of this chapter when the performances of five vehicles on KNUST campus are studied. With the increase in fuel consumption, there is a need to get more crude oil in the country. This therefore means government will have to commit more resources to the importation of crude oil in the country. The little hard earned foreign exchange will have to be used in the importation of this commodity. Resources that could be channeled to other vital sectors of the economy come to a standstill hindering the smooth running of the economy. This will therefore affects the developmental agenda of government as well.

From the environmental point of view, as more fuel is burnt it emits more carbon monoxides into the atmosphere causing environmental problems. It is therefore clear that

under-inflated tyres do indeed contribute to pollution and its related diseases. With the environmental hazards more resources will therefore have to be invested into health care in order to minimize its effect

Drivers normally experience a lot of discomfort and inconveniences when the vehicle is underinflated. When a tyre is underinflated, most of the vehicle's weight is concentrated on the tread which is located just under the sidewalls of the tyre, rather than being spread out evenly across the full width of the tyre. This means that as the tyre rolls, the sidewall gets continually flexed (squished, if you will) and heats up. This affects both performance and safety.

Rolling resistance which is caused by deformation of the tyre in contact with the road surface is another problem that may be brought about as a result of the deviations in the tyre pressures of the vehicles studied. The type of roads that these vehicles ply may also contribute to the increases in the rolling resistance of the tyre to the road inferring that more energy must be applied in order to move the vehicles. This has contributed to the decline and rise of the fuel flow despite increases in the tyre pressure.

Low tyre pressure, excess vehicle weight and high temperatures can cause additional flexing and stress on the sidewalls and can lead to tyre failure. In addition, tyres with low pressure wear more quickly, degrade the vehicle's handling, lower the vehicle's load-carrying ability and increase fuel consumption. In a worst-case scenario, under inflated tyres can lead to a catastrophic blowout or tread separation.

It can be concluded that tyre wear and rolling resistance affect fuel consumption. With the increase in fuel consumption and its effect on socio-economic development there is

therefore the need to look at the issue at stake more critically. The facts suggest that a largely unseen and potentially dangerous problem exists for drivers.

4.2 Development of a model

4.2.1 Modeling using least squares method

The scatter diagrams for the various collected data were plotted as shown in Figures 4.4, 4.5, 4.6, 4.7 and 4.8. From the scatter diagrams, it could be inferred that the corellation between the fuel consumption and the tyre pressures are in the form of a polynomial function of a second degree. Hence a model can be developed using the least squares method of modeling.

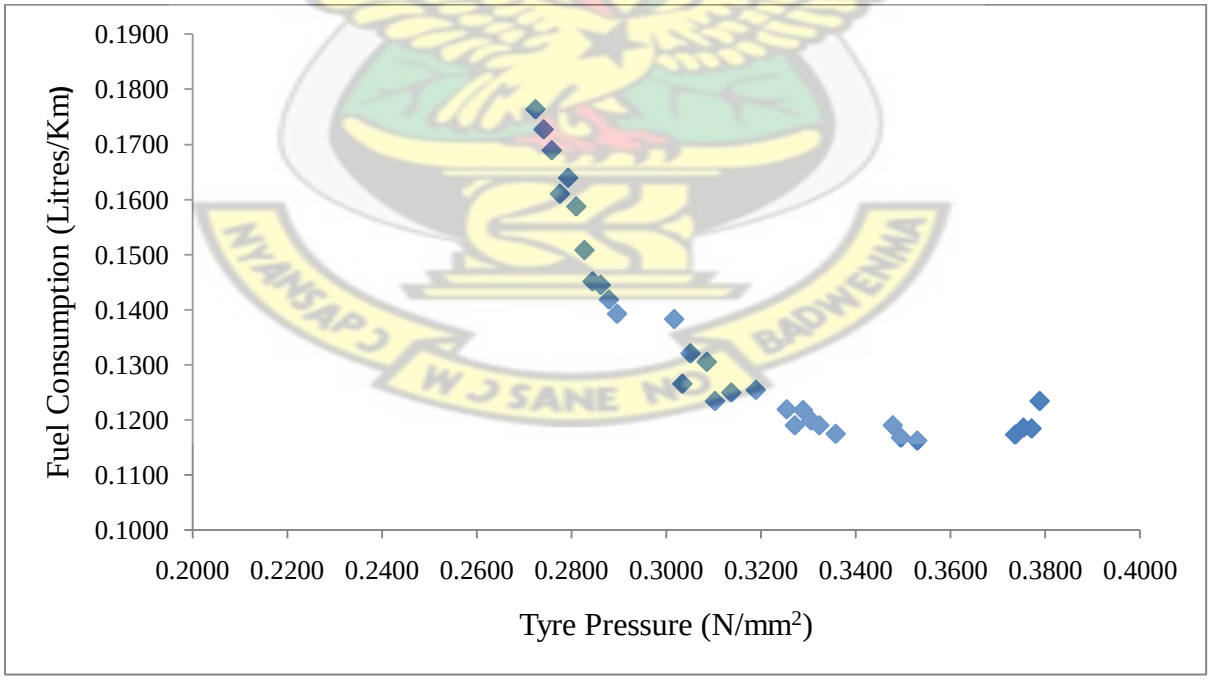

Figure 4.4: A scatter diagram for Vehicle 1 showing fuel consumption verses tyre pressure

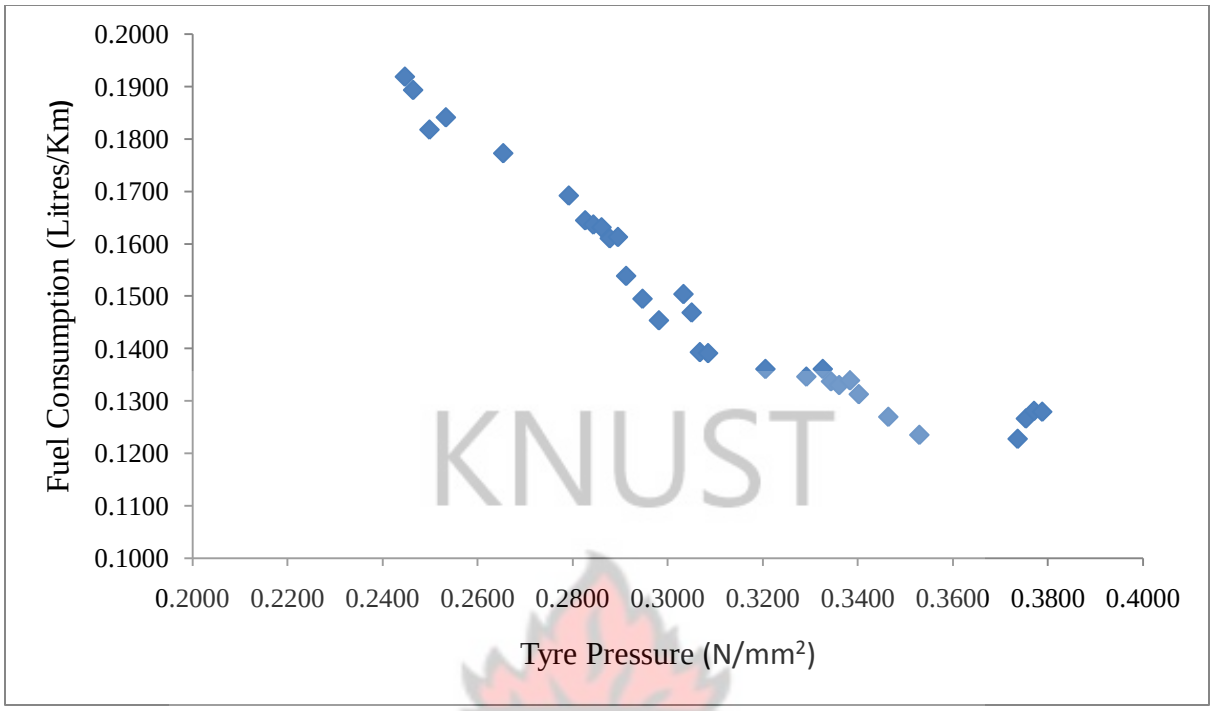

Figure 4.5: A scatter diagram for vehicle 2 showing fuel consumption against tyre pressure

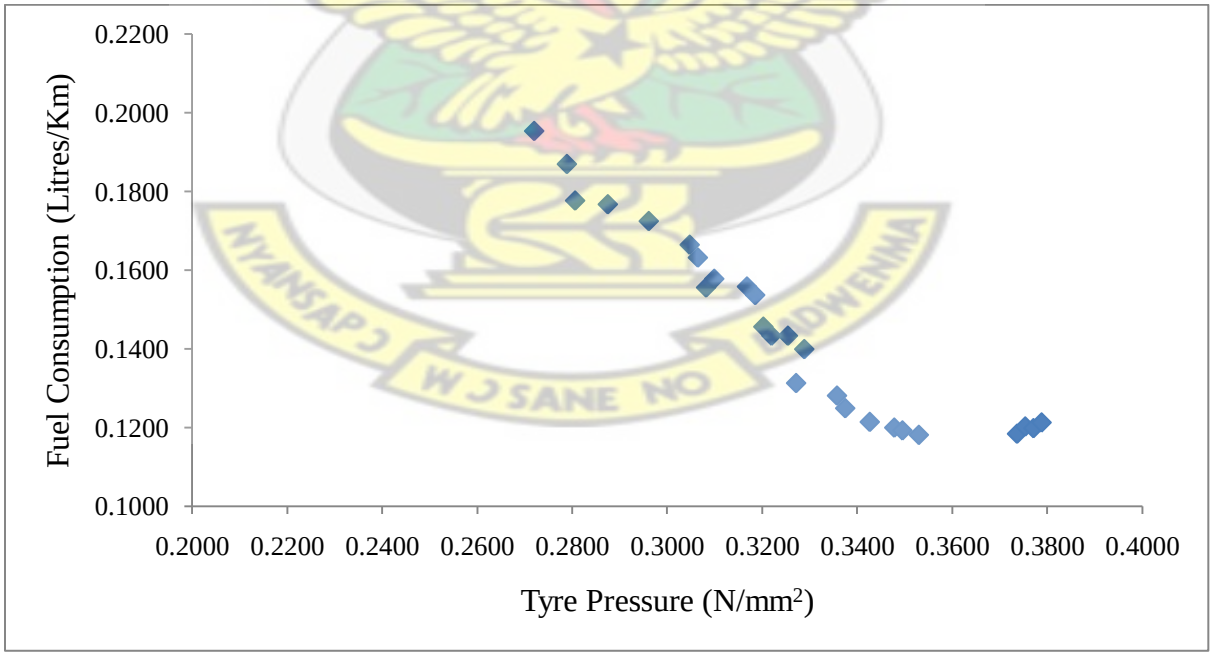

Figure 4.6: A scatter diagram for vehicle 3 showing fuel consumption against tyre pressure

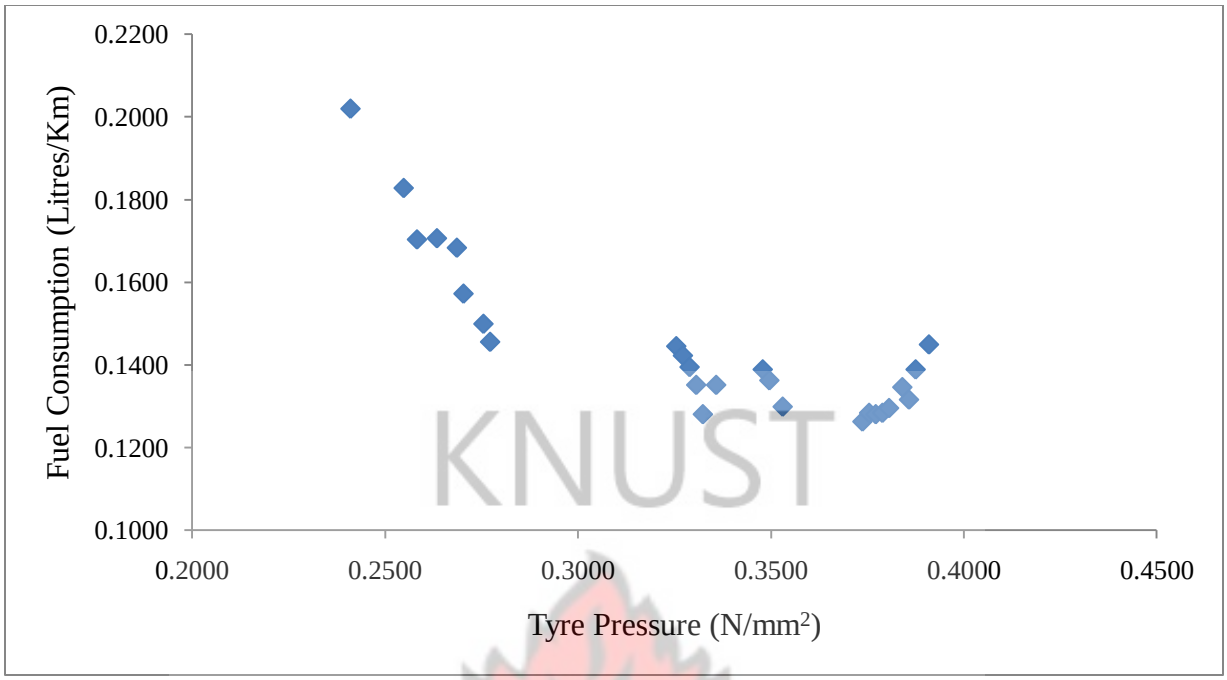

Figure 4.7: A scatter diagram for vehicle 4 showing fuel consumption against tyre pressure

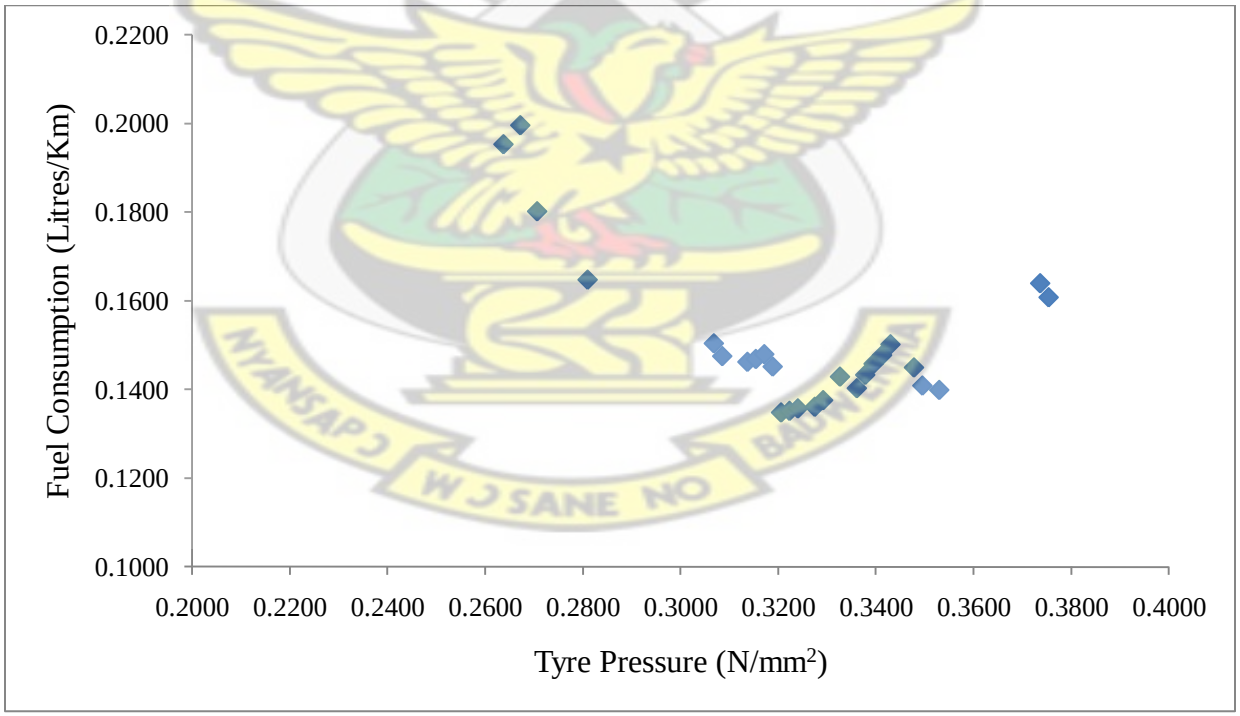

Figure 4.8: A scatter diagram for vehicle 5 showing fuel consumption against tyre pressure

The least squares method of regression and correlation was used to develop the models for the five vehicles. In the least squares method, the equation for the model is given by $F = B_0 + B_1p + B_2p^2 + e$, where F represent the fuel consumption, p represent tyre pressure, B_0, B_1, and B_2 are constants for the polynomial which must be derived from the data obtained, and e represent the error in the data. This equation can be written into three equations as

$$\sum_{i=1}^{n} F_i = B_0 n + B_1 \sum_{i=1}^{n} p_i + B_2 \sum_{i=1}^{n} p_i^2 \quad \ldots\ldots\ldots\ldots (1)$$

$$\sum_{i=1}^{n} p_i F_i = B_0 \sum_{i=1}^{n} p_i + B_1 \sum_{i=1}^{n} p_i^2 + B_2 \sum_{i=1}^{n} p_i^3 \quad \ldots.. (2)$$

$$\sum_{i=1}^{n} p_i^2 F_i = B_0 \sum_{i=1}^{n} p_i^2 + B_1 \sum_{i=1}^{n} p_i^3 + B_2 \sum_{i=1}^{n} p_i^4 \quad \ldots.. (3)$$

Putting the various values for the different vehicles into these equations and solving for various constants, B_0, B_1, and B_2 give the equation for each vehicle. For instance, for vehicle 1, the tyre pressure values were tabulated and the summations found as shown in Table 4.1.

Table 4.1: Substituted values and their summation for Vehicle 1 for solving the equation

TYRE PRESSURE (N/mm^2) (p)	FUEL CONSUMPTION (litres/km) (F)	p^2	p^3	p^4	pf	p^2f
0.2723	0.1764	0.0742	0.0202	0.0055	0.0480	0.0131
0.2741	0.1727	0.0751	0.0206	0.0056	0.0473	0.0130
0.2758	0.1689	0.0761	0.0210	0.0058	0.0466	0.0128
0.2775	0.1610	0.0770	0.0214	0.0059	0.0447	0.0124
0.2792	0.1639	0.0780	0.0218	0.0061	0.0458	0.0128
0.2810	0.1587	0.0789	0.0222	0.0062	0.0446	0.0125
0.2827	0.1508	0.0799	0.0226	0.0064	0.0426	0.0121
0.2844	0.1451	0.0809	0.0230	0.0065	0.0413	0.0117
0.2861	0.1445	0.0819	0.0234	0.0067	0.0413	0.0118
0.2879	0.1418	0.0829	0.0239	0.0069	0.0408	0.0118
0.2896	0.1393	0.0839	0.0243	0.0070	0.0403	0.0117
0.3017	0.1383	0.0910	0.0274	0.0083	0.0417	0.0126
0.3034	0.1266	0.0920	0.0279	0.0085	0.0384	0.0116
0.3051	0.1321	0.0931	0.0284	0.0087	0.0403	0.0123
0.3085	0.1305	0.0952	0.0294	0.0091	0.0403	0.0124
0.3103	0.1235	0.0963	0.0299	0.0093	0.0383	0.0119
0.3137	0.1250	0.0984	0.0309	0.0097	0.0392	0.0123
0.3189	0.1255	0.1017	0.0324	0.0103	0.0400	0.0128
0.3254	0.1220	0.1059	0.0345	0.0112	0.0397	0.0129
0.3271	0.1190	0.1070	0.0350	0.0115	0.0389	0.0127
0.3289	0.1218	0.1081	0.0356	0.0117	0.0401	0.0132
0.3306	0.1199	0.1093	0.0361	0.0119	0.0396	0.0131
0.3323	0.1190	0.1104	0.0367	0.0122	0.0396	0.0131
0.3358	0.1175	0.1127	0.0378	0.0127	0.0395	0.0132
0.3478	0.1190	0.1210	0.0421	0.0146	0.0414	0.0144
0.3495	0.1168	0.1222	0.0427	0.0149	0.0408	0.0143
0.3530	0.1163	0.1246	0.0440	0.0155	0.0410	0.0145
0.3737	0.1174	0.1396	0.0522	0.0195	0.0439	0.0164
0.3754	0.1186	0.1409	0.0529	0.0199	0.0445	0.0167
0.3771	0.1185	0.1422	0.0536	0.0202	0.0447	0.0169
0.3788	0.1235	0.1435	0.0544	0.0206	0.0468	0.0177
Summation = 9.7875	4.1741	3.1239	1.0081	0.3289	1.3021	0.4107

Substituting these values in to the equations gives

$4.1741=31B_0+9.7875B_1+3.1239B_2$ ……. (1)

$1.3021=9.7875B_0+3.1239B_1+1.0081B_2$ …….. (2)

$0.4107=3.1239B_0+1.0081B_1+0.3289B_2$ …….. (3)

Solving these equations simultaneously give $B_0 = 3.6285$, $B_1 = -21.4049$ and $B_2 = 32.3927$. Substituting into the main equation gives $F = 3.6285 - 21.4049p + 32.3927p^2$ as the equation for Vehicle 1. This procedure was repeated four the other four vehicles and the results are shown in Appendix C and the equations obtained are tabulated and presented in Table 4.2.

Table 4.2: Various vehicles' equations for the five vehicles

VEHICLE	VEHICLES' EQUATIONS
1	$F = 3.6285 - 21.4049p + 32.3927p^2$
2	$F = 0.6272 - 2.5941p + 3.3428p^2$
3	$F = 0.5568 - 1.7946p + 1.618p^2$
4	$F = 1.4454 - 7.9701p + 11.7484p^2$
5	$F = 0.6402 - 2.7463p + 3.7853p^2$

With these equations obtained, the various model graphs were drawn as shown in Figures 4.9, 4.10, 4.11, 4.12 and 4.13.

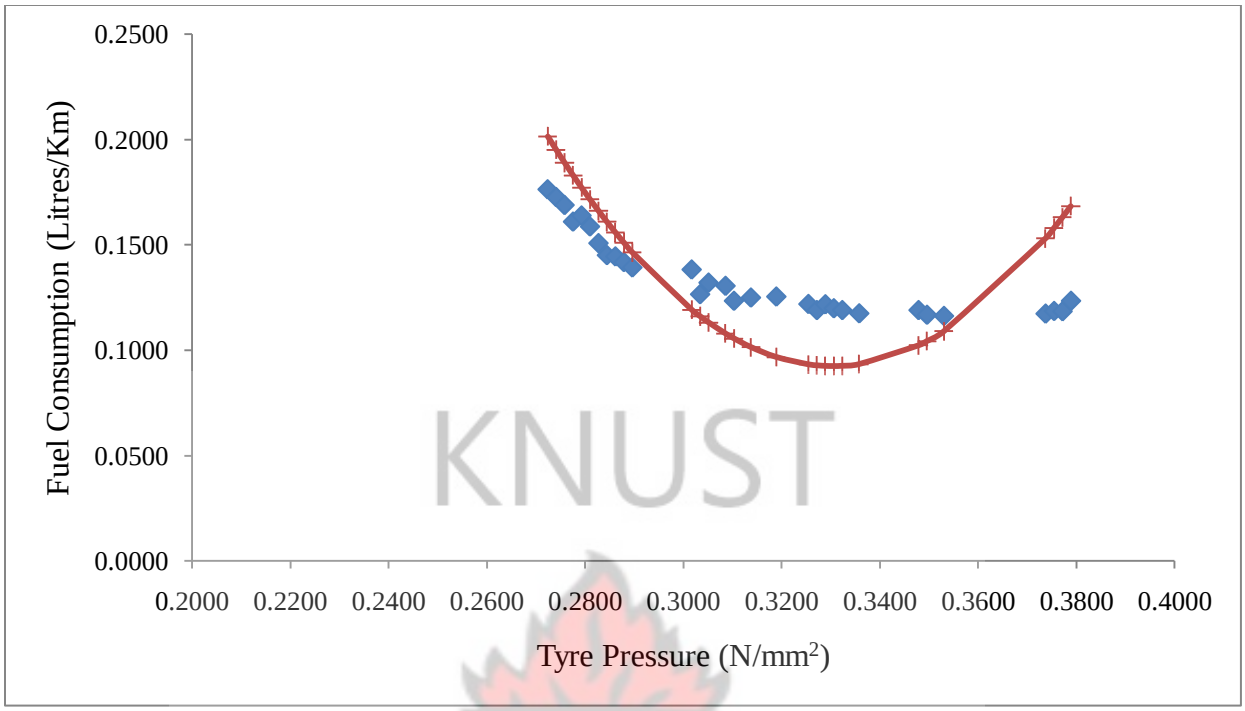

Figure 4.9: Model values of Vehicle 1 compared to the measured values

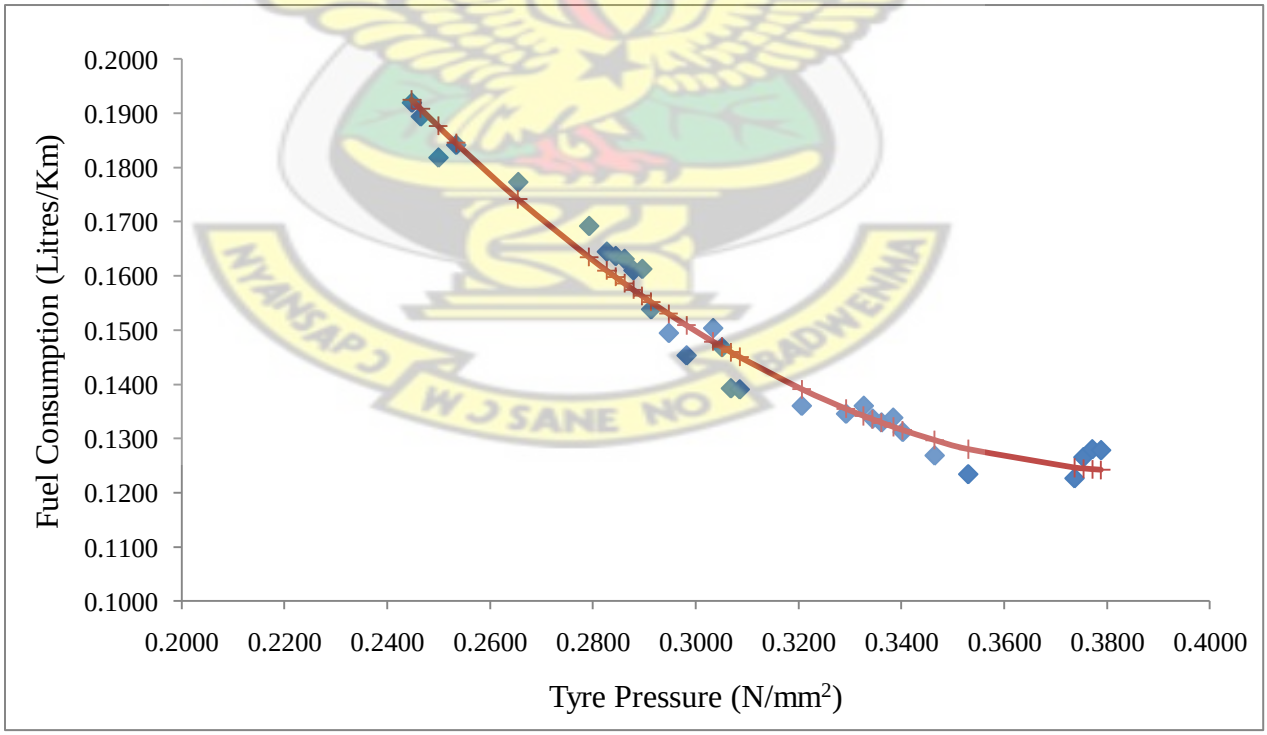

Figure 4.10: Model values of Vehicle 2 compared to the measured values

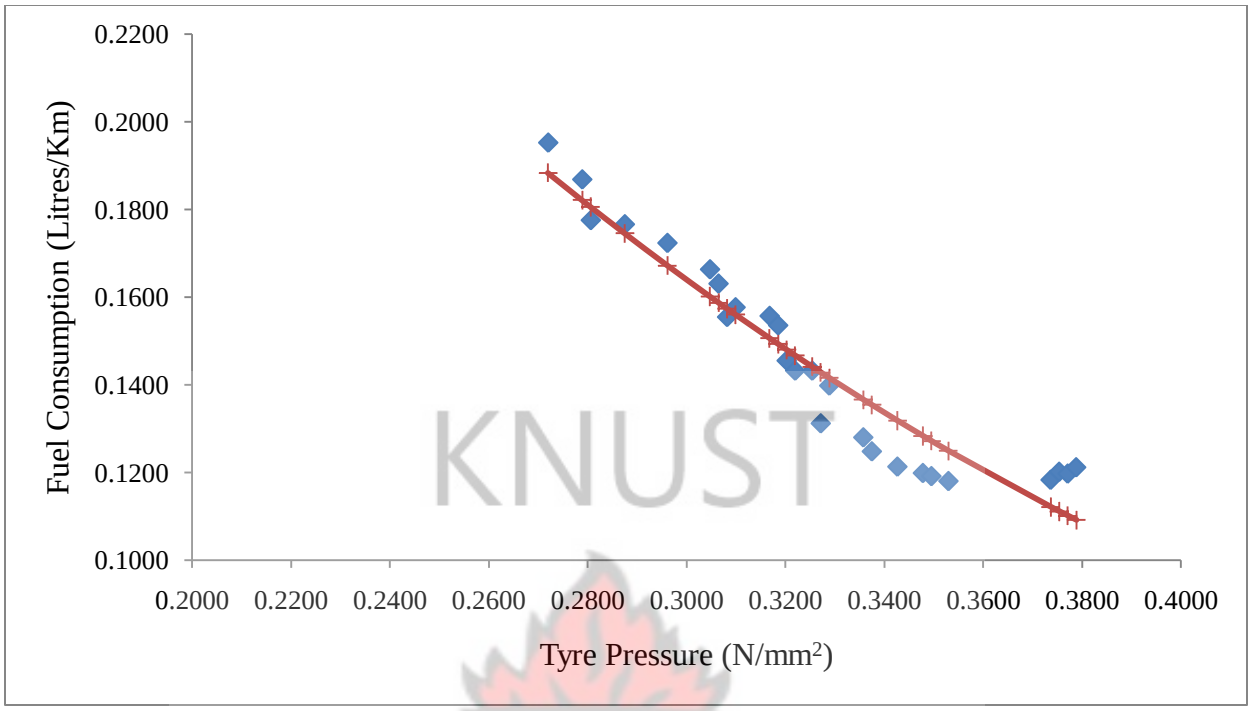

Figure 4.11: Model values of Vehicle 3 compared to the measured values

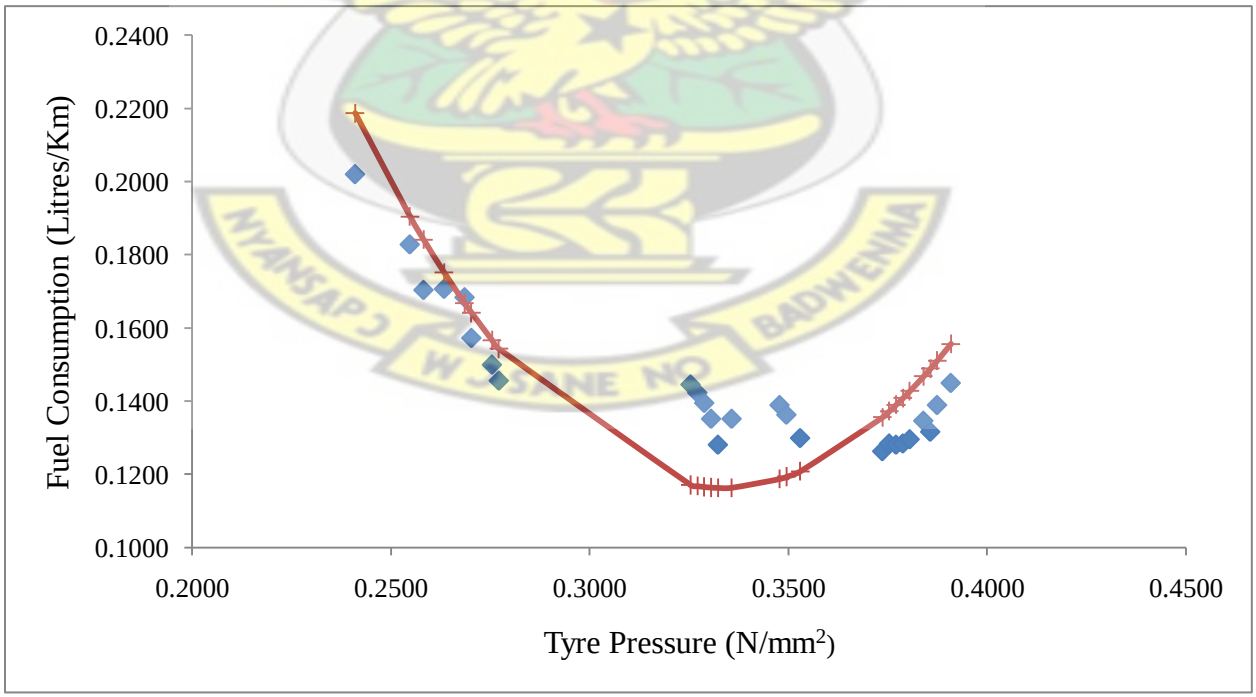

Figure 4.12: Model values of Vehicle 4 compared to the measured values

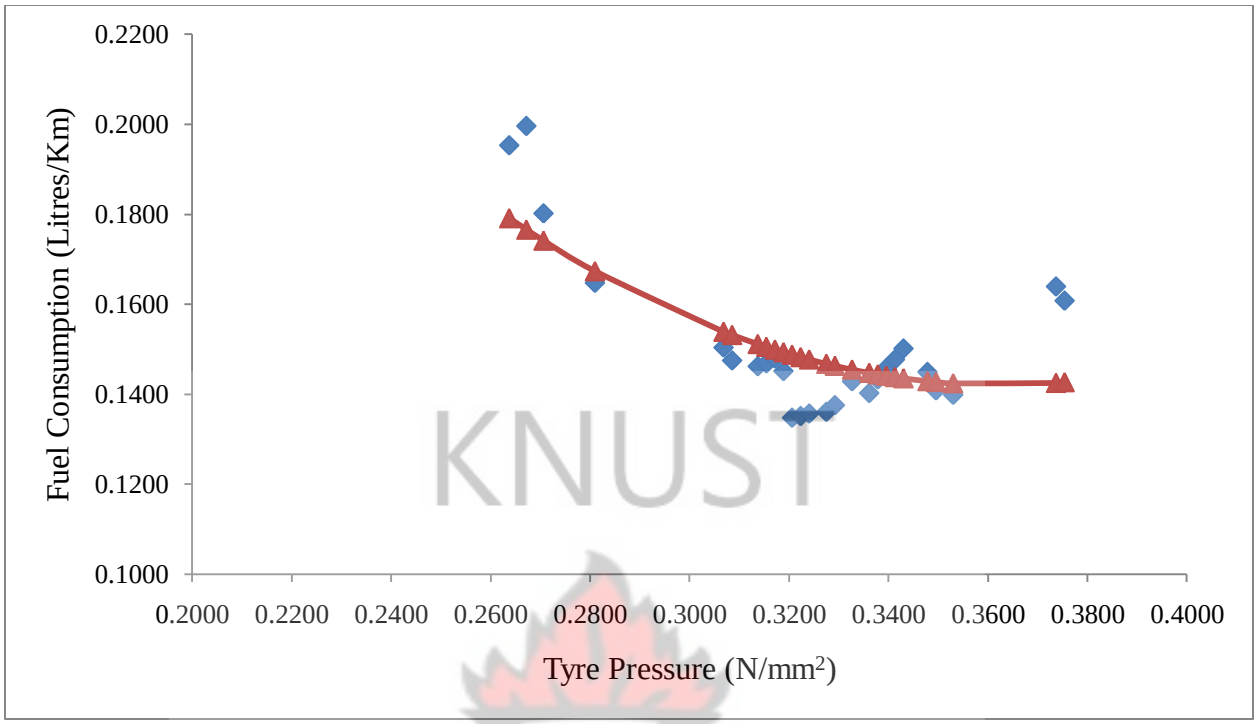

Figure 4.13: Model values of Vehicle 5 compared to the measured values

4.2.2 Verification of the model

To verify the model, two steps were carried out. First of all, the R^2 values were found for all the five vehicles using the least squares method for correlation. R^2 values represent the correlation, that is, how closely the variables are associated, were found using this equation

$$R^2 = \frac{(B_1 \sum_i (p_i - \bar{p})(F_i - \bar{F}) + B_2 \sum_i (p_i^2 - \bar{p}^2)(F_i - \bar{F}))}{\sum_i (F_i - \bar{F})^2}$$

For instance using Vehicle 1, the various values were substituted and their summations found as shown in Table 4.3.

Table 4.3: Substituted values and their summation for Vehicle 1 for solving R^2

TYRE PRESSURE (N/mm^2)(F)	FUEL CONSUMPTION (litres/km) (p)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.2723	0.1764	0.0742	-0.0434	-0.0266	0.0417	-0.00181	-0.00111	0.0017
0.2741	0.1727	0.0751	-0.0417	-0.0257	0.0381	-0.00159	-0.00098	0.0014
0.2758	0.1689	0.0761	-0.0399	-0.0247	0.0343	-0.00137	-0.00085	0.0012
0.2775	0.1610	0.0770	-0.0382	-0.0238	0.0264	-0.00101	-0.00063	0.0007
0.2792	0.1639	0.0780	-0.0365	-0.0228	0.0293	-0.00107	-0.00067	0.0009
0.2810	0.1587	0.0789	-0.0348	-0.0218	0.0241	-0.00084	-0.00053	0.0006
0.2827	0.1508	0.0799	-0.0330	-0.0209	0.0162	-0.00053	-0.00034	0.0003
0.2844	0.1451	0.0809	-0.0313	-0.0199	0.0105	-0.00033	-0.00021	0.0001
0.2861	0.1445	0.0819	-0.0296	-0.0189	0.0099	-0.00029	-0.00019	0.0001
0.2879	0.1418	0.0829	-0.0279	-0.0179	0.0072	-0.0002	-0.00013	0.0001
0.2896	0.1393	0.0839	-0.0261	-0.0169	0.0046	-0.00012	-7.8E-05	0.0000
0.3017	0.1383	0.0910	-0.0141	-0.0098	0.0037	-5.2E-05	-3.6E-05	0.0000
0.3034	0.1266	0.0920	-0.0124	-0.0087	-0.0081	9.97E-05	7.05E-05	0.0001
0.3051	0.1321	0.0931	-0.0106	-0.0077	-0.0025	2.71E-05	1.96E-05	0.0000
0.3085	0.1305	0.0952	-0.0072	-0.0056	-0.0041	2.95E-05	2.29E-05	0.0000
0.3103	0.1235	0.0963	-0.0055	-0.0045	-0.0112	6.12E-05	5.05E-05	0.0001
0.3137	0.1250	0.0984	-0.0020	-0.0024	-0.0096	1.94E-05	2.27E-05	0.0001
0.3189	0.1255	0.1017	0.0032	0.0009	-0.0092	-2.9E-05	-8.4E-06	0.0001
0.3254	0.1220	0.1059	0.0097	0.0051	-0.0127	-0.00012	-6.5E-05	0.0002
0.3271	0.1190	0.1070	0.0114	0.0062	-0.0156	-0.00018	-9.7E-05	0.0002
0.3289	0.1218	0.1081	0.0131	0.0074	-0.0128	-0.00017	-9.5E-05	0.0002
0.3306	0.1199	0.1093	0.0149	0.0085	-0.0147	-0.00022	-0.00013	0.0002
0.3323	0.1190	0.1104	0.0166	0.0097	-0.0156	-0.00026	-0.00015	0.0002
0.3358	0.1175	0.1127	0.0200	0.0120	-0.0171	-0.00034	-0.0002	0.0003
0.3478	0.1190	0.1210	0.0321	0.0202	-0.0156	-0.0005	-0.00032	0.0002
0.3495	0.1168	0.1222	0.0338	0.0214	-0.0178	-0.0006	-0.00038	0.0003
0.3530	0.1163	0.1246	0.0373	0.0238	-0.0184	-0.00068	-0.00044	0.0003
0.3737	0.1174	0.1396	0.0579	0.0389	-0.0173	-0.001	-0.00067	0.0003
0.3754	0.1186	0.1409	0.0597	0.0402	-0.0160	-0.00096	-0.00064	0.0003
0.3771	0.1185	0.1422	0.0614	0.0414	-0.0162	-0.00099	-0.00067	0.0003
0.3788	0.1235	0.1435	0.0631	0.0427	-0.0112	-0.00071	-0.00048	0.0001
SUMMATION = 9.7875	4.1741	3.1239	0.0000	0.0000	0.0000	-0.01573	-0.00989	0.0106
AVERAGE = 0.3157	0.1346	0.1008						

The values found were substituted into the equation and the R^2 value was found to be 1.54. This was repeated the other four vehicles and the results obtained are tabulated and presented in Appendix C and Table 4.4.

Table 4.4: The various correlations or R^2 values for the five vehicles

VEHICLE	VEHICLES' EQUATIONS	R^2	$/1 - R^2/$
1	$F = 3.6285 - 21.4049p + 32.3927p^2$	1.54	0.54
2	$F = 0.6272 - 2.5941p + 3.3428p^2$	0.93	0.07
3	$F = 0.5568 - 1.7946p + 1.618p^2$	0.90	0.10
4	$F = 1.4454 - 7.9701p + 11.7484p^2$	1.39	0.39
5	$F = 0.6402 - 2.7463p + 3.7853p^2$	0.53	0.47

Secondly, the model fuel consumption values were compared with measured fuel consumption to find out the deviation as shown in Figures 4.9, 4.10, 4.11, 4.12 and 4.13.

Comparing the R^2 values and the model values of the five vehicles, it could be seen that, the equation for vehicle 2 is the best and can be used as the model. This vehicle has R^2 value of 0.93 and the fuel consumption model values deviate by ±4 which is within experimental error. So, the equation $F = 0.6272 - 2.5941p + 3.3428p^2$ with $R^2 = 0.93$ can be accepted as the model for now.

This model was tested using the data for the other four vehicles and the results obtained for the R^2 values are presented in Table 4.5.

Table 4.5: Comparing the R^2 values when using the vehicles own equation and when using the model

	Using vehicles own equation		Using the model	
VEHICLE	R^2	$/1 - R^2/$	R^2	$/1 - R^2/$
1	1.54	0.54	0.73	0.27
2	0.93	0.07	0.93	0.07
3	0.90	0.10	0.46	0.54
4	1.39	0.39	1.12	0.12
5	0.53	0.47	0.64	0.36

From Table 4.5, it could be inferred that using the model gives better R^2 than using the vehicles own equation. Which means that the model gives better fuel consumption values compared with using the vehicles own equation. Only Vehicle 3 has better R^2 value when using it own equation than using the model but the rest shows the opposite. This means that, the model can be used for all the five vehicles and by extension all vehicles if possible.

But from the general equation using least squares method, there is an error value e which has to be found when error values exceed ±5. Using the general model equation for the other four vehicles it could be seen that the error values exceed that value and so the error value e of the equation has to be found for the four vehicles and the least value taken. Using 95% confidence, the equation gives

$F = 0.6272 - 2.5941p + 3.3428p^2 \pm 1.96\sigma_e$, where $\sigma_e$represent standard deviation of the error values. σ_e is given by $\sigma_e = \sqrt{\frac{\sum(e-\bar{e})^2}{N}}$ where N is the number of values taken.

For instance, using Vehicle 1, the various values were substituted and their summations found as shown in Table 4.6.

Table 4.6: Substituted values and their summation for Vehicle 1 for solving the error

TYRE PRESSURE (N/mm^2)	MEASURED FUEL CONSUMPTION(F)	USING VEHICLE'S OWN EQUATION (F)	USING MODEL (F)	ERROR (e)	e^2
0.2723	0.1764	0.2016	0.1687	0.0077	0.0000595
0.2741	0.1727	0.1952	0.1673	0.0054	0.0000290
0.2758	0.1689	0.1890	0.1660	0.0029	0.0000084
0.2775	0.1610	0.1830	0.1647	-0.0037	0.0000138
0.2792	0.1639	0.1772	0.1635	0.0005	0.0000002
0.2810	0.1587	0.1716	0.1622	-0.0035	0.0000123
0.2827	0.1508	0.1662	0.1610	-0.0102	0.0001036
0.2844	0.1451	0.1609	0.1598	-0.0147	0.0002152
0.2861	0.1445	0.1559	0.1586	-0.0141	0.0001993
0.2879	0.1418	0.1511	0.1575	-0.0156	0.0002438
0.2896	0.1393	0.1464	0.1563	-0.0170	0.0002904
0.3017	0.1383	0.1192	0.1489	-0.0105	0.0001113
0.3034	0.1266	0.1161	0.1479	-0.0213	0.0004535
0.3051	0.1321	0.1132	0.1469	-0.0148	0.0002194
0.3085	0.1305	0.1079	0.1450	-0.0145	0.0002100
0.3103	0.1235	0.1056	0.1441	-0.0207	0.0004277
0.3137	0.1250	0.1015	0.1424	-0.0174	0.0003022
0.3189	0.1255	0.0967	0.1399	-0.0144	0.0002083
0.3254	0.1220	0.0932	0.1370	-0.0151	0.0002273
0.3271	0.1190	0.0928	0.1363	-0.0173	0.0002983
0.3289	0.1218	0.0925	0.1356	-0.0138	0.0001910
0.3306	0.1199	0.0924	0.1350	-0.0151	0.0002265
0.3323	0.1190	0.0926	0.1343	-0.0153	0.0002327
0.3358	0.1175	0.0934	0.1331	-0.0155	0.0002418
0.3478	0.1190	0.1023	0.1293	-0.0103	0.0001057
0.3495	0.1168	0.1043	0.1289	-0.0121	0.0001453
0.3530	0.1163	0.1090	0.1280	-0.0117	0.0001380
0.3737	0.1174	0.1531	0.1246	-0.0072	0.0000525
0.3754	0.1186	0.1580	0.1245	-0.0058	0.0000341
0.3771	0.1185	0.1632	0.1243	-0.0058	0.0000341
0.3788	0.1235	0.1685	0.1242	-0.0008	0.0000006
SUMMATION = 9.7875	4.1741				0.0050357

These summations were substituted into the equation and error found was ±0.025. This was repeated for the other four vehicles and the results are tabulated and presented in Appendix C and Table 4.7.

Table 4.7: Error values for the other four vehicles when using the model

VEHICLE	ERROR VALUES
1	±0.025
3	±0.025
4	±0.018
5	±0.0295

Taken the least gives the final general equation of $F = 3.3428p^2 - 2.5941p + 0.6272 \pm 0.018$. Since ±0.018 is the least it can be used, because using the largest error value will mean that the error for the other vehicles will be increased.

The model is also verified using the data for vehicle 2 and the results are presented in Table 4.8. it could be inferred from the table that the model can be used since the percentage error is within experimental error of ± 5%.

Table 4.8: Verification of the model using the data for vehicle 2

Pressure (N/mm^2)	Measured Fuel consumption(litre/km) (mfc)	Predicted fuel consumption (litre/km) (pfc)	Error (mfc-pfc)	% error
0.2448	0.1919	0.1925	-0.00059	-0.31
0.2465	0.1894	0.1909	-0.00149	-0.78
0.2499	0.1818	0.1877	-0.00585	-3.12
0.2534	0.1842	0.1845	-0.00036	-0.19
0.2655	0.1773	0.1741	0.00316	1.82
0.2792	0.1692	0.1635	0.00573	3.50
0.2827	0.1645	0.1610	0.00346	2.15
0.2844	0.1637	0.1598	0.00386	2.41
0.2861	0.1631	0.1586	0.00451	2.84
0.2879	0.1610	0.1575	0.00357	2.27
0.2896	0.1613	0.1563	0.00497	3.18
0.2913	0.1539	0.1552	-0.00135	-0.87
0.2948	0.1495	0.1530	-0.00353	-2.30
0.2982	0.1454	0.1509	-0.00554	-3.67
0.3034	0.1504	0.1479	0.00250	1.69
0.3051	0.1468	0.1469	-0.00007	-0.05
0.3068	0.1393	0.1460	-0.00669	-4.58
0.3085	0.1391	0.1450	-0.00596	-4.11
0.3206	0.1361	0.1391	-0.00306	-2.20
0.3292	0.1346	0.1355	-0.00089	-0.66
0.3327	0.1361	0.1342	0.00189	1.41
0.3344	0.1337	0.1335	0.00015	0.12
0.3361	0.1330	0.1329	0.00005	0.04
0.3384	0.1339	0.1322	0.00171	1.30
0.3403	0.1312	0.1316	-0.00032	-0.24
0.3465	0.1269	0.1297	-0.00280	-2.16
0.3530	0.1235	0.1280	-0.00457	-3.57
0.3737	0.1227	0.1246	-0.00192	-1.54
0.3754	0.1266	0.1245	0.00212	1.71
0.3771	0.1280	0.1243	0.00372	2.99
0.3788	0.1279	0.1242	0.00367	2.95

4.2.3 Using the model to predict fuel consumptions

From the experiment, it could be seen that the relationship between the fuel consumption and the tyre pressures of various vehicles is in the form of $F = B_2p^2 - B_1p + B_0 \pm e$, where B_0, B_1, B_2 and e depends on other factors of the vehicle such as the age of the vehicle, the conditions under which the measurements were taken and so on. This equation although cannot be used to represent all other vehicles but can be used to predict fuel consumptions for vehicles when their tyre pressures are known.

Taking vehicle 1 as an example, the predicted fuel consumptions using the model for various tyre pressures were calculated and compared with the measured fuel consumption and the results are tabulated as shown in Table 4.9.

From Table 4.9, it could be inferred that some of the measured fuel consumptions fall within the predicted fuel consumption and the rest which does not fall within the predicted fuel consumption deviate by ±7% which is within experimental error.

Similar results are shown by the other three vehicles and the results are shown in Appendix D.

Table 4.9: Predicted fuel flow compared with the measured fuel consumption for vehicle 1

Pressure (N/mm^2)	Measured Fuel consumption(litre/km) (mfc)	Predicted Fuel consumption (pfc)	Error (mfc-pfc)	% error
0.2723	0.1764	0.1687	0.00771	4.57
0.2741	0.1727	0.1673	0.00538	3.22
0.2758	0.1689	0.1660	0.00289	1.74
0.2775	0.1610	0.1648	-0.00372	-2.26
0.2792	0.1639	0.1635	0.00046	0.28
0.2810	0.1587	0.1622	-0.00351	-2.16
0.2827	0.1508	0.1430	0.00782	5.47
0.2844	0.1451	0.1418	0.00333	2.35
0.2861	0.1445	0.1406	0.00388	2.76
0.2879	0.1418	0.1395	0.00239	1.71
0.2896	0.1393	0.1383	0.00096	0.69
0.3017	0.1383	0.1309	0.00745	5.69
0.3034	0.1266	0.1299	-0.00329	-2.54
0.3051	0.1321	0.1289	0.00319	2.47
0.3085	0.1306	0.1270	0.00351	2.76
0.3103	0.1235	0.1261	-0.00268	-2.12
0.3137	0.1250	0.1244	0.00062	0.50
0.3189	0.1255	0.1219	0.00357	2.93
0.3254	0.1220	0.1190	0.00292	2.46
0.3271	0.1191	0.1183	0.00073	0.62
0.3289	0.1218	0.1176	0.00418	3.55
0.3306	0.1199	0.1170	0.00295	2.52
0.3323	0.1191	0.1163	0.00274	2.36
0.3358	0.1175	0.1151	0.00245	2.13
0.3478	0.1191	0.1113	0.00772	6.93
0.3495	0.1168	0.1109	0.00595	5.36
0.3530	0.1163	0.1100	0.00625	5.68
0.3737	0.1174	0.1246	-0.00724	-5.81
0.3754	0.1186	0.1245	-0.00584	-4.69
0.3771	0.1185	0.1243	-0.00584	-4.70
0.3788	0.1235	0.1242	-0.00075	-0.61

4.3 Effect on the Ghanaian economy

From the model established, that is, $F = 0.6272 - 2.5941p + 3.3428p^2 \pm 0.018$, it could be seen that, as the tyre pressures of the vehicles increase, less fuel are consumed to cover the same distance until the pressure reaches the recommended tyre pressure, which is the maximum tyre pressure and then more fuel are consumed with any increase in the tyre pressure. This means that when the vehicles do not use the recommended tyre pressure there will be some extra fuel consumed by the vehicles, which will amount to extra cost for the drivers.

With this model established, then the additional fuel consumed for various deviations can then be found. This additional fuels used were found for Kumasi/Accra return trip (540 km). The results were tabulated and presented in Table 4.8.

Table 4.10: Additional fuel consumed for Kumasi/Accra return trip using the model

Percentage deviation (%)	Pressure deviation (N/mm^2)	additional fuel (litres)
+20	0.4656	10.87
+10	0.4268	2.72
recommended	0.388	0.00
-10	0.3492	2.72
-20	0.3104	10.87
-30	0.2716	24.46

From the survey of the 660 vehicles, as shown in Table 3.1, 98% of these vehicles had their measured tyre pressure deviate from the recommended tyre pressure. Therefore, assuming that, 100,000 vehicles plying their trade on Kumasi/Accra road, there will be 21,212 vehicles for ten percent deviation below the recommended tyre pressure.

Similarly, there will be 31,818 vehicles for twenty percent deviation below the recommended tyre pressure. There will be 30,455 vehicles for thirty percent deviation below the recommended tyre pressure. Also, there will be 9,848 vehicles for ten percent deviation above the recommended tyre pressure.

For 100,000 vehicles plying their trade on the Kumasi/Accra road, using the model for Kumasi/Accra return trip, then for various deviations, their corresponding additional fuel incurred is shown in Table 4.10.

Table 4.11: Additional fuel incurred for 100,000 vehicles for Kumasi/Accra return trip for a day.

Percentage deviation (%)	Pressure deviation (N/mm^2)	Additional fuel (litres/day)
+10	0.4268	26743.83
Recommended	0.388	0
-10	0.3492	57682.11
-20	0.3104	345976.4
-30	0.2716	745016.7

From Table 4.9, for +10%, -10%, -20% and -30% deviations additional fuel of 1,175,419.04 litres will be incurred, this will amount to GHC 1,386,994.47. This correspond to 93,333 vehicles out of 100,000 vehicles, that is, 93.333% deviation of the vehicles. The rest of the deviations are for above +30%, +30%, +20% and below -30% which makes up for 4.67% deviation. From this it could be seen that more fuel are consumed when vehicles do not use the recommended tyre pressure. This will be that

more fuel has to be imported into the country by the government. According to one research on Ghana's daily oil importation as shown in Table 4.10, it could be seen that 45,380bbl/day of fuel is imported.

Table 4.12: Ghana's daily oil importation

Year	Oil - imports	Rank	Percent Change	Date of Information
2008	45,520	84		2005
2009	45,520	86	0.00 %	2005
2010	45,380	91	-0.31 %	2007

*This entry is the total oil imported in barrels per day (bbl/day), including both crude oil and oil products.

* CIA World Factbook - Unless otherwise noted, information in this page is accurate as of November 3, 2010

45,380 barrels per day is equal to 5,247,157.598 litres of fuel, which means that using the information in Table 4.11 will give 22.4% of the national fuel imported. This means that, additional 22.4% increase in fuel has to be imported for 100,000 vehicles when their tyre pressures are deviating as shown in Table 3.1.

It is therefore clear from the ensuring discussion that using the recommended tyre pressures are always desirable and safe. Besides saving fuel and money and minimizing emissions, properly inflated tyres are safer and less likely to fail at high speeds. Under-inflated tyres make gives longer stopping distances and will skid longer on wet surfaces. Properly inflated tyres also wear more evenly and will last longer accordingly. Tyres play a crucial role in the safety of a vehicle. As the only part of the car that physically touches the ground, tyres are one of the key factors affecting a vehicle's handling and overall safety. Proper tyre inflation and maintenance can extend tyre life, increase fuel efficiency and improve vehicle safety.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

Chapter five, as the last chapter, seeks to conclude the entire research. It is therefore based on a summary of the major findings, after which appropriate recommendations would be made to ensure an efficient utilization of vehicular fuel.

5.1 Conclusion

It could be inferred that 83.49% of the vehicles studied had their measured tyre pressure below the manufacturers recommended tyre pressure. However, only 13.03% of the vehicles have their measure tyre pressure above the recommended tyre pressure. In all, 96.52% of the surveyed vehicles deviated from the recommended tyre pressure.

The model obtained is $F = 0.6272 - 2.5941p + 3.3428p^2 \pm 0.018$ which can also be used to predict the amount of fuel consumed.

The model was validated with it own data which showed a deviation of ±5% which is within experimental error.

Using the recommended tyre pressures reduces the fuel consumption by 17.60% thus reducing cost. It also minimized emissions thereby making movement safe and desirable.

5.2 Recommendation

The above conclusion translates into the recommendations below;

Every car owner or driver must keenly ensure that their vehicles tyre pressure always conform to the manufacturer's recommended tyre pressure. There should be a massive public education or awareness about this need. This need, according to the research, is against the backdrop that when tyre pressure falls below the recommended tyre pressure, the decrease in the pressure invariably leads to an increase in fuel consumption. Also underscoring this need is the fact that most drivers or car owners fail to regularly check the level of their tyre pressure.

When tyres are underinflated or overinflated more fuel is consumed than using the recommended tyre pressure for vehicle. The correct tyre pressures for the vehicle should be maintained, and take steps to ensure the consistency and integrity of tyres pressures and lastly, tyre pressures should be checked regularly to make sure that they are at the correct pressure levels to improve fuel efficiency, better and safer handling and increase the longevity of tyres lives which translate into money saved.

Hence, if drivers constantly check their tyre pressure and ensure conformity to the manufacturer's recommended tyre pressure, fuel consumption would invariably decrease as the tyre pressure increases or approaches the recommended tyre pressure.

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APPENDIX A

Table A1a: Measured tyre pressure of vehicles in KNUST campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE(MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (AVERAGE MTP- AVERAGE MRTP) (N/mm^2)	% DEVIATION
	FRONT RIGHT	FRONT LEFT	REAR RIGHT	REAR LEFT		FRONT RIGHT	FRONT LEFT	REAR RIGHT	REAR LEFT			
1	0.1793	0.1655	0.1655	0.2069	0.1793	0.2069	0.2069	0.2206	0.2206	0.2137	-0.0345	-16.00
2	0.2620	0.2620	0.1655	0.1517	0.2103	0.2551	0.2551	0.2965	0.2965	0.2758	-0.0655	-24.00
3	0.2758	0.2758	0.3379	0.3379	0.3068	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0931	-23.00
4	0.1448	0.1517	0.1517	0.2069	0.1638	0.2137	0.2137	0.2620	0.2620	0.2379	-0.0741	-32.00
5	0.2206	0.2206	0.2069	0.2275	0.2189	0.2069	0.2069	0.2275	0.2275	0.2172	0.0017	0.80
6	0.2689	0.2758	0.2069	0.2689	0.2551	0.2069	0.2069	0.2689	0.2896	0.2430	0.0121	5.00
7	0.2069	0.1931	0.3448	0.1655	0.2275	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1345	-37.00
8	0.2000	0.1931	0.1517	0.1793	0.1810	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0362	-17.00
9	0.1034	0.3172	0.2206	0.2069	0.2120	0.2069	0.2069	0.2206	0.2206	0.2137	-0.0017	-0.80
10	0.2551	0.0827	0.2137	0.2758	0.2069	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1551	-43.00
11	0.0965	0.1862	0.2689	0.2069	0.1896	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1724	-48.00
12	0.2206	0.2069	0.2069	0.2137	0.2120	0.2275	0.2275	0.2689	0.2689	0.2482	-0.0362	-15.00
13	0.2758	0.2620	0.1793	0.2344	0.2379	0.2206	0.2206	0.2206	0.2206	0.2206	0.0172	8.00
14	0.2069	0.2896	0.2758	0.2758	0.2620	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1000	-28.00
15	0.2965	0.2965	0.0965	0.2965	0.2465	0.1793	0.1793	0.2000	0.2000	0.1896	0.0569	0.30
16	0.2069	0.1862	0.1655	0.1655	0.1810	0.2069	0.2069	0.2689	0.2689	0.2379	-0.0569	-23.00
17	0.2344	0.2413	0.1586	0.2069	0.2103	0.2206	0.2206	0.2206	0.2206	0.2206	-0.0103	-5.00
18	0.1724	0.1655	0.2000	0.2206	0.1896	0.2137	0.2137	0.2344	0.2344	0.2241	-0.0345	-16.00
19	0.2206	0.1517	0.1310	0.1310	0.1586	0.2137	0.2137	0.2344	0.2344	0.2241	-0.0655	-29.00

Table A1b: Measured tyre pressure of vehicles in KNUST campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE(MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (AVERAGE MTP-AVERAGE MRTP) (N/mm^2)	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
20	0.2827	0.2758	0.2758	0.2758	0.2775	0.2413	0.2413	0.2827	0.2827	0.2620	0.0155	6.00
21	0.1379	0.2896	0.2137	0.2137	0.2137	0.1931	0.1931	0.2344	0.2344	0.2137	0.0000	0.00
22	0.2000	0.2137	0.2689	0.2689	0.2379	0.2069	0.2069	0.2689	0.2689	0.2379	0.0000	0.00
23	0.2896	0.2620	0.3034	0.3034	0.2896	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0724	-20.00
24	0.1655	0.2000	0.2620	0.2069	0.2086	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0086	-4.00
25	0.1655	0.1655	0.1241	0.1586	0.1534	0.2069	0.2069	0.2482	0.2482	0.2275	-0.0741	-34.00
26	0.2482	0.2689	0.2413	0.2758	0.2586	0.2069	0.2069	0.2482	0.2482	0.2275	0.0310	14.00
27	0.3241	0.2965	0.2413	0.4206	0.3206	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0414	-11.00
28	0.2689	0.1379	0.1793	0.3310	0.2293	0.1931	0.1931	0.2344	0.2344	0.2137	0.0155	7.00
29	0.1931	0.2069	0.2000	0.2000	0.2000	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0414	-18.00
30	0.1379	0.1379	0.1793	0.1241	0.1448	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0586	-29.00
31	0.3585	0.3723	0.3310	0.2896	0.3379	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0621	-16.00
32	0.2069	0.2069	0.2069	0.1931	0.2034	0.2069	0.2069	0.2482	0.2482	0.2275	-0.0241	-11.00
33	0.2206	0.2344	0.2069	0.2275	0.2224	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0190	-8.00
34	0.2413	0.2413	0.2896	0.2620	0.2586	0.2758	0.2758	0.3792	0.3792	0.3275	-0.0690	-27.00
35	0.2827	0.2758	0.3172	0.2551	0.2827	0.2206	0.2206	0.2620	0.2620	0.2413	0.0414	18.00
36	0.1724	0.1862	0.0896	0.1931	0.1603	0.2137	0.2137	0.2344	0.2344	0.2241	-0.0638	-28.00
37	0.2069	0.1448	0.1448	0.1379	0.1586	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0827	-36.00
38	0.2344	0.2069	0.1793	0.1931	0.2034	0.2413	0.2413	0.2551	0.2551	0.2482	-0.0448	-18.00
39	0.2206	0.2344	0.2965	0.2689	0.2551	0.2758	0.2758	0.4482	0.4482	0.3620	-0.1069	-30.00
40	0.1517	0.2758	0.3379	0.1448	0.2275	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1345	-37.00
41	0.1586	0.2069	0.1517	0.1517	0.1672	0.1931	0.1931	0.2275	0.2275	0.2103	-0.0431	-21.00
42	0.0690	0.1931	0.2206	0.2069	0.1724	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0310	-15.00
43	0.2344	0.2275	0.1517	0.0965	0.1775	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0259	-13.00

Table A1c: Measured tyre pressure of vehicles in KNUST campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE(MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (AVERAGE MTP-AVERAGE MRTP) (N/mm^2)	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
44	0.1862	0.1931	0.1517	0.1517	0.1707	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0465	-21.00
45	0.2758	0.2758	0.0758	0.3172	0.2362	0.1931	0.1931	0.2137	0.2137	0.2034	0.0328	16.00
46	0.3034	0.3034	0.3723	0.2896	0.3172	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0448	-12.00
47	0.2689	0.2137	0.1586	0.1655	0.2017	0.2551	0.2551	0.3103	0.3103	0.2827	-0.0810	-29.00
48	0.2551	0.2344	0.2000	0.2206	0.2275	0.2620	0.2620	0.2827	0.2827	0.2724	-0.0448	-16.00
49	0.2000	0.2344	0.2413	0.2344	0.2275	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0138	-6.00
50	0.1448	0.1724	0.2206	0.2482	0.1965	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0448	-19.00
51	0.3379	0.3310	0.2689	0.1310	0.2672	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0948	-26.00
52	0.2000	0.2137	0.2137	0.2206	0.2120	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0293	-13.00
53	0.2758	0.2758	0.2758	0.2758	0.2758	0.2413	0.2413	0.2758	0.2758	0.2586	0.0172	4.00
54	0.2620	0.3034	0.1931	0.1034	0.2155	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0259	-11.00
55	0.2069	0.2206	0.2069	0.1931	0.2069	0.2206	0.2206	0.2275	0.2620	0.2327	-0.0259	-11.00
56	0.3654	0.3654	0.3585	0.2896	0.3448	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0552	-14.00
57	0.1931	0.1793	0.1655	0.1724	0.1775	0.2069	0.2069	0.2689	0.2689	0.2379	-0.0603	-25.00
58	0.1379	0.3448	0.2689	0.2551	0.2517	0.3516	0.3516	0.4482	0.4482	0.3999	-0.1482	-37.00
59	0.3103	0.3448	0.3034	0.2965	0.3137	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0862	-22.00
60	0.3448	0.3930	0.2896	0.2000	0.3068	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0931	-23.00
61	0.1034	0.3172	0.2206	0.2069	0.2120	0.2069	0.2069	0.2206	0.2206	0.2137	-0.0017	-0.01
62	0.2551	0.0827	0.2137	0.2758	0.2069	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1551	-0.43
63	0.0965	0.1862	0.2689	0.2069	0.1896	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1724	-0.48
64	0.2206	0.2206	0.2206	0.2275	0.2275	0.2413	0.2413	0.2689	0.2689	0.2603	-0.0396	-0.15
65	0.2758	0.2620	0.1793	0.2344	0.2379	0.2206	0.2206	0.2206	0.2206	0.2206	0.0172	0.08
66	0.2069	0.2896	0.2758	0.2758	0.2620	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1000	-0.28
67	0.3034	0.2965	0.0965	0.2965	0.2430	0.1793	0.1793	0.2000	0.2000	0.1844	0.0586	0.32

Table A1d: Measured tyre pressure of vehicles in KNUST campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE(MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (AVERAGE MTP- AVERAGE MRTP) (N/mm^2)	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
68	0.2206	0.2344	0.1862	0.1586	0.1896	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0431	-0.19
69	0.1931	0.1241	0.1586	0.1862	0.1638	0.2069	0.2069	0.2413	0.2413	0.2189	-0.0552	-0.25
70	0.1586	0.1379	0.2344	0.1793	0.1741	0.2482	0.2482	0.2758	0.2758	0.2655	-0.0914	-0.34
71	0.2896	0.2344	0.1862	0.2069	0.2206	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0121	-0.05
72	0.1310	0.1241	0.1241	0.1379	0.1293	0.1793	0.1793	0.2000	0.2000	0.1844	-0.0552	-0.30
73	0.2827	0.3516	0.2827	0.2827	0.2999	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0621	-0.17
74	0.3103	0.3103	0.3654	0.3103	0.3241	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0379	-0.10
75	0.2000	0.2344	0.2413	0.2344	0.2189	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0138	-0.06
76	0.1448	0.1724	0.2206	0.2482	0.1879	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0448	-0.19
77	0.3379	0.3310	0.2689	0.1310	0.2672	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0948	-0.26
78	0.2000	0.2137	0.2000	0.2069	0.2034	0.2069	0.2069	0.2620	0.2620	0.2327	-0.0293	-0.13
79	0.2758	0.2758	0.2758	0.2758	0.2758	0.2551	0.2551	0.2758	0.2758	0.2655	0.0103	0.04
80	0.2620	0.3034	0.1931	0.1034	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-0.11
81	0.2069	0.2206	0.2069	0.2275	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-0.11
82	0.3654	0.3654	0.3585	0.2896	0.3448	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0552	-0.14
83	0.2137	0.1793	0.1724	0.1724	0.1827	0.2206	0.2206	0.2689	0.2689	0.2430	-0.0603	-0.25
84	0.2758	0.3448	0.2689	0.3516	0.3103	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0896	-0.22
85	0.3103	0.3448	0.3034	0.2965	0.3137	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0862	-0.22
86	0.3448	0.3930	0.2896	0.2000	0.3068	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0931	-0.23
87	0.2344	0.2344	0.2413	0.2344	0.2275	0.2069	0.2069	0.2620	0.2620	0.2258	0.0017	0.01
88	0.2689	0.2551	0.2069	0.2689	0.2551	0.2069	0.2069	0.2689	0.2689	0.2430	0.0121	0.05
89	0.2069	0.1931	0.3448	0.1655	0.2275	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1345	-0.37
90	0.2000	0.1931	0.1517	0.1793	0.1810	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0362	-0.17

Table A1e: Measured tyre pressure of vehicles in KNUST campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE(MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (AVERAGE MTP- AVERAGE MRTP) (N/mm^2)	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
91	0.1034	0.3172	0.2206	0.2069	0.2120	0.2069	0.2069	0.2206	0.2206	0.2137	-0.0017	-0.01
92	0.2551	0.2758	0.2620	0.2896	0.2706	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0914	-0.25
93	0.2758	0.2620	0.2689	0.2551	0.2655	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0965	-0.27
94	0.2206	0.2206	0.2206	0.2275	0.2206	0.2413	0.2413	0.2758	0.2758	0.2603	-0.0396	-0.15
95	0.2758	0.2620	0.1793	0.2344	0.2379	0.2206	0.2206	0.2206	0.2206	0.2206	0.0172	0.08
96	0.2069	0.2896	0.2758	0.2758	0.2620	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1000	-0.28
97	0.3034	0.2965	0.0965	0.2965	0.2430	0.1793	0.1793	0.2000	0.2000	0.1844	0.0586	0.32
98	0.2069	0.2069	0.1655	0.1724	0.1862	0.2206	0.2206	0.2689	0.2689	0.2430	-0.0569	-0.23
99	0.2827	0.2758	0.3172	0.2551	0.2741	0.2206	0.2206	0.2620	0.2620	0.2327	0.0414	0.18
100	0.1724	0.1862	0.0896	0.1931	0.1603	0.2137	0.2137	0.2344	0.2344	0.2241	-0.0638	-0.28

Table A2a: Measured tyre pressure of vehicles in Kumasi Polytechnic campus compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP)(N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP)(N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (MTP-MRTP) a(N/mm^2)	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
1	0.2206	0.2344	0.1862	0.1517	0.1982	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0431	-17.86
2	0.1931	0.1241	0.1586	0.1862	0.1655	0.2069	0.2069	0.2413	0.2482	0.2258	-0.0603	-26.72
3	0.1586	0.1517	0.2344	0.1655	0.1775	0.2482	0.2482	0.2758	0.2758	0.2620	-0.0845	-32.24
4	0.2896	0.2344	0.1862	0.2069	0.2293	0.2206	0.2206	0.2620	0.2620	0.2413	-0.0121	-5.00
5	0.1103	0.1103	0.1103	0.1172	0.1120	0.1793	0.1793	0.2000	0.2000	0.1896	-0.0776	-40.91
6	0.2827	0.3516	0.2827	0.2827	0.2999	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0621	-17.14
7	0.3103	0.3103	0.3654	0.3103	0.3241	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0379	-10.48
8	0.2206	0.2344	0.2275	0.2275	0.2275	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0190	-8.15
9	0.2413	0.2344	0.2896	0.2482	0.2534	0.2413	0.2206	0.4482	0.4482	0.3396	-0.0931	-27.41
10	0.2827	0.2758	0.3172	0.2551	0.2827	0.2206	0.2206	0.2620	0.2620	0.2327	0.0414	17.78
11	0.1724	0.1862	0.0896	0.1931	0.1603	0.2137	0.2137	0.2344	0.2344	0.2241	-0.0638	-28.46
12	0.2069	0.1379	0.1448	0.1448	0.1500	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0827	-35.56
13	0.2344	0.2069	0.1793	0.1931	0.2000	0.2413	0.2413	0.2551	0.2551	0.2448	-0.0448	-18.31
14	0.2206	0.2344	0.2965	0.2689	0.2551	0.2758	0.2758	0.4482	0.4482	0.3620	-0.1069	-29.52
15	0.1517	0.2758	0.3379	0.1448	0.2275	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1345	-37.14
16	0.1586	0.1793	0.1517	0.1379	0.1638	0.1931	0.1931	0.2069	0.2069	0.2069	-0.0431	-20.83
17	0.0690	0.1931	0.2206	0.2069	0.1724	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0310	-15.25
18	0.2344	0.2275	0.1517	0.0965	0.1775	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0259	-12.71
19	0.1862	0.1931	0.1517	0.1517	0.1707	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0465	-21.43
20	0.2758	0.2758	0.0758	0.3172	0.2362	0.1931	0.1931	0.2137	0.2137	0.2034	0.0328	16.10
21	0.3034	0.3034	0.3723	0.2896	0.3172	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0448	-12.38
22	0.2689	0.2137	0.2069	0.1931	0.2206	0.2069	0.2551	0.3310	0.3310	0.2810	-0.0603	-21.47

Table A2b: Measured tyre pressure of vehicles in Kumasi Polytechnic campus compared to the recommended tyre pressure

	MEASURED TYRE PRESSURE (MTP)(N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP)(N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	
VEHICLE	FR	FL	RR	RL		FR	FL	RR	RL			% DEVIATION
23	0.2551	0.2344	0.2000	0.2206	0.2275	0.2620	0.2620	0.2827	0.2827	0.2724	-0.0448	-16.46
24	0.2000	0.2344	0.2413	0.2344	0.2189	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0138	-5.93
25	0.1655	0.1517	0.2206	0.2482	0.1879	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0448	-19.26
26	0.3379	0.3310	0.2689	0.1310	0.2672	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0948	-26.19
27	0.2000	0.2137	0.2137	0.2206	0.2034	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0293	-12.59
28	0.2758	0.2758	0.2758	0.2758	0.2758	0.2551	0.2551	0.2758	0.2758	0.2655	0.0103	3.90
29	0.2620	0.2689	0.1931	0.1379	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-11.11
30	0.2069	0.2206	0.2069	0.2275	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-11.11
31	0.3654	0.3654	0.3585	0.2896	0.3448	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0552	-13.79
32	0.1931	0.1793	0.1655	0.1724	0.1827	0.2069	0.2069	0.2689	0.2689	0.2430	-0.0603	-24.82
33	0.1724	0.1586	0.1448	0.1586	0.1500	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0827	-35.56
34	0.2344	0.2069	0.1793	0.1931	0.2000	0.2413	0.2413	0.2551	0.2551	0.2448	-0.0448	-18.31
35	0.2206	0.2344	0.2965	0.2689	0.2551	0.2758	0.2758	0.4482	0.4482	0.3620	-0.1069	-29.52
36	0.1517	0.2758	0.3379	0.1448	0.2275	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1345	-37.14
37	0.1586	0.2069	0.1517	0.1379	0.1638	0.1931	0.1931	0.2206	0.2206	0.2069	-0.0431	-20.83
38	0.1034	0.1586	0.2206	0.2069	0.1724	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0310	-15.25
39	0.1724	0.2275	0.1517	0.1448	0.1775	0.1931	0.1931	0.2137	0.2137	0.2034	-0.0259	-12.71
40	0.1862	0.1931	0.1517	0.1517	0.1707	0.2137	0.2137	0.2206	0.2206	0.2172	-0.0465	-21.43
41	0.2758	0.2689	0.1379	0.2620	0.2362	0.1931	0.1931	0.2137	0.2137	0.2034	0.0328	16.10
42	0.3034	0.3034	0.3723	0.2896	0.3172	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0448	-12.38
43	0.2689	0.2137	0.1586	0.1586	0.2000	0.2069	0.2551	0.3310	0.3310	0.2810	-0.0810	-28.83
44	0.2551	0.2344	0.2000	0.2206	0.2275	0.2620	0.2620	0.2827	0.2827	0.2724	-0.0448	-16.46
45	0.2000	0.2344	0.2413	0.2344	0.2189	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0138	-5.93
46	0.1517	0.1655	0.2206	0.2482	0.1879	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0448	-19.26

Table A2c: Measured tyre pressure of vehicles in Kumasi Polytechnic campus compared to the recommended tyre pressure

	MEASURED TYRE PRESSURE (MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	
VEHICLE	FR	FL	RR	RL		FR	FL	RR	RL			% DEVIATION
47	0.3379	0.3310	0.2689	0.1310	0.2672	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0948	-26.19
48	0.2000	0.2137	0.2137	0.2206	0.2034	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0293	-12.59
49	0.2758	0.2758	0.2758	0.2758	0.2758	0.2551	0.2551	0.2758	0.2758	0.2655	0.0103	3.90
50	0.2620	0.2344	0.1931	0.1724	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-11.11
51	0.2069	0.2206	0.2069	0.2275	0.2069	0.2206	0.2206	0.2620	0.2620	0.2327	-0.0259	-11.11
52	0.3654	0.3654	0.3585	0.2896	0.3448	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0552	-13.79
53	0.1931	0.1793	0.1655	0.1724	0.1827	0.2069	0.2069	0.2689	0.2689	0.2430	-0.0603	-24.82
54	0.1379	0.3448	0.2689	0.2551	0.2517	0.3516	0.3516	0.4482	0.4482	0.3999	-0.1482	-37.07
55	0.3103	0.3448	0.3034	0.2965	0.3137	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0862	-21.55
56	0.3448	0.3930	0.2896	0.2000	0.3068	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0931	-23.28
57	0.1793	0.1655	0.1655	0.2069	0.1793	0.2069	0.2069	0.2206	0.2206	0.2137	-0.0345	-16.13
58	0.2620	0.2620	0.1655	0.1517	0.2103	0.2551	0.2551	0.2965	0.2965	0.2758	-0.0655	-23.75
59	0.2758	0.2758	0.3379	0.3379	0.3068	0.3516	0.3516	0.4482	0.4482	0.3999	-0.0931	-23.28
60	0.1310	0.1310	0.1862	0.2069	0.1551	0.2137	0.2137	0.2620	0.2620	0.2293	-0.0741	-32.33

Table A3a: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION (MTP-MRTP)*100
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
1	0.3379	0.324065	0.4068	0.4137			0.3706	0.3516	0.3516	0.4482	0.4482			0.3999	-7.33
2	0.3172	0.337855	0.3930	0.4206			0.3672	0.3516	0.3516	0.4482	0.4482			0.3999	-8.19
3	0.6068	0.59297	0.7653	0.7585	0.7516	0.7585	0.7056	0.6206	0.6206	0.7585	0.7585	0.7585	0.7585	0.7125	-0.97
4	0.6343	0.64813	0.7653	0.7240	0.7585	0.7378	0.7113	0.6206	0.6206	0.7585	0.7585	0.7585	0.7585	0.7125	-0.16
5	0.6137	0.60676	0.6895	0.6964	0.7653	0.7653	0.6895	0.6206	0.6206	0.7585	0.7585	0.7585	0.7585	0.7125	-3.23
6	0.6068	0.613655	0.7653	0.7860	0.7447	0.7516	0.7113	0.6206	0.6206	0.7585	0.7585	0.7585	0.7585	0.7125	-0.16
7	0.3172	0.30338	0.4551	0.3723	0.4482	0.3792	0.3792	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	0.00
8	0.3103	0.28959	0.4068	0.4206	0.3999	0.4275	0.3758	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-0.91
9	0.2758	0.268905	0.3999	0.4068	0.4206	0.4137	0.3643	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-3.94
10	0.3516	0.379225	0.4551	0.4482	0.4344	0.4413	0.4183	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	10.30
11	0.3448	0.351645	0.3930	0.3999			0.3723	0.3103	0.3103	0.3585	0.3585			0.3344	11.34
12	0.3172	0.33096	0.3379	0.3172			0.3258	0.3103	0.3103	0.3585	0.3585			0.3344	-2.58
13	0.3448	0.35854	0.4482	0.4482			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
14	0.3448	0.351645	0.4551	0.3999			0.3878	0.3516	0.3516	0.4482	0.4482			0.3999	-3.02
15	0.3792	0.31717	0.4137	0.4413			0.3878	0.3516	0.3516	0.4482	0.4482			0.3999	-3.02
16	0.3654	0.35854	0.4551	0.4206			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
17	0.3034	0.31717	0.3792	0.3723			0.3430	0.3516	0.3516	0.4482	0.4482			0.3999	-14.22
18	0.3516	0.38612	0.3448	0.3448			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
19	0.2896	0.2758	0.3448	0.3516			0.3154	0.3516	0.3516	0.4482	0.4482			0.3999	-21.12
20	0.3103	0.34475	0.3723	0.3792			0.3516	0.3516	0.3516	0.4482	0.4482			0.3999	-12.07
21	0.2827	0.2758	0.3516	0.3448			0.3137	0.3516	0.3516	0.4482	0.4482			0.3999	-21.55
22	0.3585	0.37233	0.4620	0.4689			0.4154	0.3516	0.3516	0.4482	0.4482			0.3999	3.88

Table A3b: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
23	0.2896	0.282695	0.4275	0.4344			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
24	0.3792	0.379225	0.5033	0.5171			0.4447	0.3516	0.3516	0.4482	0.4482			0.3999	11.21
25	0.3516	0.38612	0.4482	0.4482			0.4085	0.3516	0.3516	0.4482	0.4482			0.3999	2.16
26	0.2758	0.2758	0.3585	0.3654			0.3189	0.3516	0.3516	0.4482	0.4482			0.3999	-20.26
27	0.3654	0.38612	0.4344	0.4413			0.4068	0.3516	0.3516	0.4482	0.4482			0.3999	1.72
28	0.3585	0.365435	0.4482	0.4344			0.4016	0.3516	0.3516	0.4482	0.4482			0.3999	0.43
29	0.2827	0.28959	0.3448	0.3516			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-20.69
30	0.3448	0.351645	0.3723	0.3654			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
31	0.3103	0.31717	0.3723	0.3792			0.3448	0.3516	0.3516	0.4482	0.4482			0.3999	-13.79
32	0.3448	0.34475	0.3723	0.3723			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
33	0.3103	0.33096	0.3999	0.3930			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
34	0.3034	0.33096	0.3930	0.3999			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
35	0.3172	0.324065	0.3654	0.3516			0.3396	0.3448	0.3448	0.4137	0.4137			0.3792	-10.45
36	0.3103	0.30338	0.3654	0.3792			0.3396	0.3448	0.3448	0.4137	0.4137			0.3792	-10.45
37	0.3516	0.379225	0.3999	0.4068			0.3844	0.3448	0.3448	0.4137	0.4137			0.3792	1.36
38	0.3034	0.310275	0.3723	0.3585			0.3361	0.3516	0.3516	0.4482	0.4482			0.3999	-15.95
39	0.2758	0.282695	0.3585	0.3585			0.3189	0.3516	0.3516	0.4482	0.4482			0.3999	-20.26
40	0.2827	0.282695	0.3792	0.3792			0.3310	0.3516	0.3516	0.4482	0.4482			0.3999	-17.24
41	0.3241	0.324065	0.3654	0.3585			0.3430	0.3516	0.3516	0.4137	0.4137			0.3827	-10.36
42	0.2758	0.282695	0.4068	0.4068			0.3430	0.3516	0.3516	0.4137	0.4137			0.3827	-10.36
43	0.3585	0.379225	0.4068	0.4137			0.3896	0.3516	0.3516	0.4137	0.4137			0.3827	1.80
44	0.3172	0.31717	0.3654	0.3723			0.3430	0.3516	0.3516	0.4137	0.4137			0.3827	-10.36
45	0.3172	0.31717	0.3723	0.3654			0.3430	0.3516	0.3516	0.4137	0.4137			0.3827	-10.36
46	0.3241	0.310275	0.3999	0.3999			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34

Table A3c: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
47	0.3310	0.30338	0.3792	0.3585			0.3430	0.3516	0.3516	0.4482	0.4482			0.3999	-14.22
48	0.3379	0.351645	0.3516	0.3654			0.3516	0.3516	0.3516	0.4482	0.4482			0.3999	-12.07
49	0.2758	0.37233	0.3930	0.3861			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
50	0.3310	0.324065	0.3861	0.3930			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
51	0.3172	0.324065	0.3999	0.3861			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
52	0.3241	0.351645	0.3723	0.3792			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
53	0.1724	0.17927	0.2000	0.2069			0.1896	0.2069	0.2069	0.2206	0.2206			0.2137	-11.29
54	0.1379	0.172375	0.2206	0.2137			0.1862	0.2069	0.2069	0.2206	0.2206			0.2137	-12.90
55	0.1517	0.158585	0.2137	0.2344			0.1896	0.2069	0.2069	0.2206	0.2206			0.2137	-11.29
56	0.2069	0.227535	0.2069	0.2137			0.2137	0.2069	0.2069	0.2206	0.2206			0.2137	0.00
57	0.1931	0.199955	0.2275	0.2206			0.2103	0.2069	0.2069	0.2206	0.2206			0.2137	-1.61
58	0.2620	0.186165	0.1724	0.2069			0.2069	0.2069	0.2069	0.2206	0.2206			0.2137	-3.23
59	0.3241	0.33096	0.3792	0.3861			0.3551	0.3516	0.3516	0.4482	0.4482			0.3999	-11.21
60	0.3310	0.310275	0.3930	0.3861			0.3551	0.3516	0.3516	0.4482	0.4482			0.3999	-11.21
61	0.3241	0.296485	0.3792	0.3861			0.3465	0.3516	0.3516	0.4482	0.4482			0.3999	-13.36
62	0.3379	0.393015	0.4413	0.3861			0.3896	0.3516	0.3516	0.4482	0.4482			0.3999	-2.59
63	0.3379	0.34475	0.4275	0.4137			0.3809	0.3516	0.3516	0.4482	0.4482			0.3999	-4.74
64	0.3310	0.33096	0.3792	0.3861			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
65	0.3999	0.35854	0.4137	0.3723			0.3861	0.3516	0.3516	0.4482	0.4482			0.3999	-3.45
66	0.3241	0.31717	0.4068	0.3448			0.3482	0.3516	0.3516	0.4482	0.4482			0.3999	-12.93
67	0.3585	0.351645	0.4689	0.4137			0.3982	0.3516	0.3516	0.4482	0.4482			0.3999	-0.43
68	0.3448	0.35854	0.4551	0.4413			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
69	0.3654	0.38612	0.4482	0.4344			0.4085	0.3516	0.3516	0.4482	0.4482			0.3999	2.16
70	0.3516	0.30338	0.4620	0.4551			0.3930	0.3516	0.3516	0.4482	0.4482			0.3999	-1.72

Table A3d: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
71	0.3103	0.31717	0.4068	0.3999			0.3585	0.3516	0.3516	0.4482	0.4482			0.3999	-10.34
72	0.3654	0.28959	0.4551	0.3103			0.3551	0.3516	0.3516	0.4482	0.4482			0.3999	-11.21
73	0.3448	0.35854	0.3654	0.3585			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
74	0.3448	0.35854	0.4551	0.4689			0.4068	0.3516	0.3516	0.4482	0.4482			0.3999	1.72
75	0.3654	0.379225	0.4344	0.4206			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
76	0.3792	0.33096	0.5171	0.5378			0.4413	0.3516	0.3516	0.4482	0.4482			0.3999	10.34
77	0.3448	0.337855	0.4551	0.4551			0.3982	0.3516	0.3516	0.4482	0.4482			0.3999	-0.43
78	0.3585	0.35854	0.4482	0.4275			0.3982	0.3516	0.3516	0.4482	0.4482			0.3999	-0.43
79	0.3654	0.35854	0.4344	0.4275			0.3965	0.3516	0.3516	0.4482	0.4482			0.3999	-0.86
80	0.3999	0.38612	0.4137	0.4068			0.4016	0.3516	0.3516	0.4482	0.4482			0.3999	0.43
81	0.3241	0.379225	0.4551	0.4827			0.4103	0.3516	0.3516	0.4482	0.4482			0.3999	2.59
82	0.3379	0.282695	0.4068	0.3654			0.3482	0.3516	0.3516	0.4482	0.4482			0.3999	-12.93
83	0.3723	0.4137	0.4413	0.4137			0.4103	0.3516	0.3516	0.4482	0.4482			0.3999	2.59
84	0.0276	0.39991	0.4068	0.4344			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-20.69
85	0.2896	0.282695	0.3585	0.3585			0.3223	0.3516	0.3516	0.4482	0.4482			0.3999	-19.40
86	0.3516	0.33096	0.4344	0.4413			0.3896	0.3516	0.3516	0.4482	0.4482			0.3999	-2.59
87	0.3448	0.34475	0.4413	0.4551			0.3965	0.3516	0.3516	0.4482	0.4482			0.3999	-0.86
88	0.3723	0.35854	0.4413	0.4275			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
89	0.3654	0.365435	0.4137	0.3999			0.3861	0.3516	0.3516	0.4482	0.4482			0.3999	-3.45
90	0.3379	0.324065	0.4758	0.5033			0.4103	0.3516	0.3516	0.4482	0.4482			0.3999	2.59
91	0.2758	0.31717	0.4689	0.5102			0.3930	0.3516	0.3516	0.4482	0.4482			0.3999	-1.72
92	0.3379	0.28959	0.4758	0.4964			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
93	0.3654	0.365435	0.4413	0.4206			0.3982	0.3516	0.3516	0.4482	0.4482			0.3999	-0.43
94	0.3379	0.310275	0.4275	0.4551			0.3827	0.3516	0.3516	0.4482	0.4482			0.3999	-4.31

Table A3e: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
95	0.2827	0.37233	0.4827	0.4758			0.4034	0.3516	0.3516	0.4482	0.4482			0.3999	0.86
96	0.2965	0.38612	0.4068	0.4413			0.3827	0.3516	0.3516	0.4482	0.4482			0.3999	-4.31
97	0.3172	0.296485	0.3585	0.2896			0.3154	0.2758	0.2758	0.3448	0.3448			0.3103	1.67
98	0.2965	0.268905	0.2965	0.3034			0.2913	0.2758	0.2758	0.3448	0.3448			0.3103	-6.11
99	0.3034	0.227535	0.3516	0.3654			0.3120	0.2758	0.2758	0.3448	0.3448			0.3103	0.56
100	0.3034	0.28959	0.3654	0.3585			0.3292	0.3103	0.3103	0.3585	0.3585			0.3344	-1.55
101	0.2413	0.255115	0.2689	0.2620			0.2568	0.3103	0.3103	0.3585	0.3585			0.3344	-23.20
102	0.2206	0.241325	0.2758	0.2689			0.2517	0.3103	0.3103	0.3585	0.3585			0.3344	-24.74
103	0.2275	0.213745	0.2620	0.2551			0.2396	0.3103	0.3103	0.3585	0.3585			0.3344	-28.35
104	0.2137	0.227535	0.2482	0.2620			0.2379	0.3103	0.3103	0.3585	0.3585			0.3344	-28.87
105	0.2275	0.24822	0.2965	0.2896			0.2655	0.2758	0.2758	0.3585	0.3585			0.3172	-16.30
106	0.2206	0.23443	0.2620	0.2758			0.2482	0.3103	0.3103	0.3792	0.3792			0.3448	-28.00
107	0.2620	0.255115	0.2758	0.2827			0.2689	0.3103	0.3103	0.3585	0.3585			0.3344	-19.59
108	0.2482	0.241325	0.2620	0.2689			0.2551	0.2758	0.2758	0.3448	0.3448			0.3103	-17.78
109	0.2344	0.22064	0.2620	0.2620			0.2448	0.3103	0.3103	0.3792	0.3792			0.3448	-29.00
110	0.2275	0.241325	0.2758	0.2827			0.2568	0.3103	0.3103	0.3585	0.3585			0.3344	-23.20
111	0.1931	0.19306	0.2137	0.1793			0.1948	0.1931	0.1931	0.2137	0.2137			0.2034	-4.24
112	0.3034	0.30338	0.3723	0.2896			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-12.38
113	0.2689	0.213745	0.2069	0.1931			0.2206	0.2069	0.2551	0.3310	0.3310			0.2810	-21.47
114	0.2551	0.23443	0.2000	0.2206			0.2275	0.2620	0.2620	0.2827	0.2827			0.2724	-16.46
115	0.1655	0.172375	0.1586	0.1655			0.1655	0.2206	0.2206	0.2620	0.2620			0.2413	-31.43
116	0.1448	0.1379	0.2206	0.2482			0.1879	0.2206	0.2206	0.2620	0.2620			0.2413	-22.14
117	0.3379	0.33096	0.2689	0.1310			0.2672	0.3103	0.3103	0.4137	0.4137			0.3620	-26.19
118	0.2000	0.213745	0.1931	0.2069			0.2034	0.2206	0.2206	0.2620	0.2620			0.2413	-15.71

Table A3f: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
119	0.2344	0.241325	0.2758	0.2758			0.2568	0.2482	0.2482	0.2758	0.2758			0.2620	-1.97
120	0.2620	0.30338	0.1931	0.0690			0.2069	0.2206	0.2206	0.2620	0.2620			0.2413	-14.29
121	0.2069	0.22064	0.2069	0.1931			0.2069	0.2206	0.2206	0.2620	0.2620			0.2413	-14.29
122	0.3654	0.365435	0.3585	0.2896			0.3448	0.3516	0.3516	0.4482	0.4482			0.3999	-13.79
123	0.2137	0.17927	0.1655	0.1724			0.1827	0.2206	0.2206	0.2689	0.2689			0.2448	-25.35
124	0.2069	0.12411	0.1310	0.1379			0.1500	0.2206	0.2206	0.2620	0.2620			0.2413	-37.86
125	0.2344	0.20685	0.1793	0.1793			0.2000	0.2413	0.2413	0.2482	0.2482			0.2448	-18.31
126	0.2206	0.15169	0.1310	0.1310			0.1586	0.2137	0.2137	0.2344	0.2344			0.2241	-29.23
127	0.2137	0.227535	0.2344	0.2413			0.2293	0.2413	0.2413	0.2827	0.2827			0.2620	-12.50
128	0.1379	0.19306	0.2137	0.2137			0.1896	0.1931	0.1931	0.2344	0.2344			0.2137	-11.29
129	0.2000	0.19306	0.2275	0.2344			0.2137	0.2069	0.2069	0.2689	0.2689			0.2379	-10.14
130	0.2896	0.26201	0.3034	0.3034			0.2896	0.3103	0.3103	0.4137	0.4137			0.3620	-20.00
131	0.1655	0.199955	0.1931	0.2069			0.1913	0.2137	0.2137	0.2206	0.2206			0.2172	-11.90
132	0.1655	0.16548	0.1241	0.1586			0.1534	0.2069	0.2069	0.2482	0.2482			0.2275	-32.58
133	0.2482	0.268905	0.2413	0.2758			0.2586	0.2069	0.2069	0.2482	0.2482			0.2275	13.64
134	0.3241	0.296485	0.2413	0.4206			0.3206	0.3103	0.3103	0.4137	0.4137			0.3620	-11.43
135	0.2000	0.1379	0.1793	0.1931			0.1775	0.1931	0.1931	0.2344	0.2344			0.2137	-16.94
136	0.1931	0.20685	0.2000	0.2000			0.2000	0.2206	0.2206	0.2620	0.2620			0.2413	-17.14
137	0.1379	0.1379	0.1793	0.1241			0.1448	0.1931	0.1931	0.2137	0.2137			0.2034	-28.81
138	0.3585	0.37233	0.3310	0.2896			0.3379	0.3516	0.3516	0.4482	0.4482			0.3999	-15.52
139	0.2069	0.20685	0.2069	0.1931			0.2034	0.2069	0.2069	0.2482	0.2482			0.2275	-10.61
140	0.1517	0.16548	0.1724	0.1793			0.1672	0.2206	0.2206	0.2620	0.2620			0.2413	-30.71
141	0.2896	0.282695	0.3516	0.3516			0.3189	0.3516	0.3516	0.4482	0.4482			0.3999	-20.26
142	0.2827	0.282695	0.3448	0.3448			0.3137	0.3516	0.3516	0.4482	0.4482			0.3999	-21.55

Table A3g: Measured tyre pressure of vehicles in Asafo station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
143	0.2758	0.2758	0.3654	0.3516			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-20.69
144	0.3516	0.351645	0.3654	0.3585			0.3568	0.3516	0.3516	0.4482	0.4482			0.3999	-10.78
145	0.2758	0.2758	0.2965	0.2965			0.2861	0.3516	0.3516	0.4482	0.4482			0.3999	-28.45
146	0.2827	0.28959	0.3448	0.3516			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-20.69
147	0.2413	0.26201	0.3654	0.3585	0.3792	0.3723	0.3298	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-20.72
148	0.2965	0.30338	0.3448	0.3448	0.3516	0.3516	0.3321	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-20.17
149	0.2275	0.22064	0.3103	0.3172	0.3310	0.3379	0.2907	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-30.11
150	0.2827	0.2758	0.3448	0.3516	0.3654	0.3654	0.3310	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-20.44

Table A4a: Measured tyre pressure of vehicles in Roman Hill station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION (MTP-MRTP)/MTP	% deviation
	FR	FL	RR	RL		FR	FL	RR	RL			
1	0.2965	0.2689	0.3516	0.3516	0.3172	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0172	-5.15
2	0.3172	0.3034	0.3723	0.3516	0.3361	0.3103	0.3103	0.3585	0.3585	0.3344	0.0017	0.52
3	0.2689	0.2758	0.3448	0.3379	0.3068	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0276	-8.25
4	0.2413	0.2344	0.3172	0.3034	0.2741	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0534	-16.32
5	0.2344	0.2689	0.3103	0.3310	0.2861	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0414	-12.63
6	0.2206	0.2275	0.2896	0.2896	0.2568	0.2758	0.2758	0.3448	0.3448	0.3103	-0.0534	-17.22
7	0.2069	0.2137	0.2689	0.2689	0.2396	0.3103	0.3103	0.4137	0.4137	0.3620	-0.1224	-33.81
8	0.2827	0.3172	0.3585	0.3585	0.3292	0.3103	0.3103	0.3448	0.3448	0.3275	0.0017	0.53
9	0.2275	0.2344	0.3172	0.3034	0.2706	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0914	-25.24
10	0.3034	0.3172	0.3723	0.3585	0.3379	0.3103	0.3103	0.3585	0.3585	0.3344	0.0034	1.03
11	0.3103	0.3172	0.3585	0.3516	0.3344	0.3103	0.3103	0.3585	0.3585	0.3344	0.0000	0.00
12	0.2344	0.2482	0.2965	0.3034	0.2706	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0638	-19.07
13	0.2413	0.2275	0.2827	0.2965	0.2620	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0724	-21.65
14	0.2827	0.2896	0.3310	0.3310	0.3086	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0259	-7.73
15	0.3103	0.3172	0.3516	0.3448	0.3310	0.3103	0.3103	0.3516	0.3516	0.3310	0.0000	0.00
16	0.2551	0.2689	0.3448	0.3516	0.3051	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0569	-15.71
17	0.2206	0.2137	0.3172	0.3103	0.2655	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0965	-26.67
18	0.2275	0.2275	0.3103	0.2896	0.2637	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0983	-27.14
19	0.2896	0.2965	0.3241	0.3379	0.3120	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0224	-6.70
20	0.2413	0.2620	0.2758	0.2896	0.2672	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0672	-20.10
21	0.3310	0.3448	0.3792	0.3792	0.3585	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0034	-0.95

Table A4b: Measured tyre pressure of vehicles in Roman Hill station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (MRTP) (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	% deviation
	FR	FL	RR	RL		FR	FL	RR	RL			
22	0.2000	0.2137	0.2206	0.2206	0.2137	0.2069	0.2069	0.2206	0.2206	0.2137	0.0000	0.00
23	0.2275	0.2344	0.2413	0.2482	0.2379	0.2069	0.2069	0.2206	0.2206	0.2137	0.0241	11.29
24	0.2413	0.2482	0.2689	0.2758	0.2586	0.2069	0.2069	0.2206	0.2206	0.2137	0.0448	20.97
25	0.2965	0.2689	0.3241	0.3379	0.3068	0.2758	0.2758	0.3103	0.3103	0.2930	0.0138	4.71
26	0.2965	0.3034	0.4344	0.4275	0.3654	0.3103	0.3103	0.4137	0.4137	0.3620	0.0034	0.95
27	0.3379	0.3172	0.4068	0.4413	0.3758	0.3103	0.3103	0.4137	0.4137	0.3620	0.0138	3.81
28	0.3516	0.3654	0.4275	0.4482	0.3982	0.3103	0.3103	0.4137	0.4137	0.3620	0.0362	10.00
29	0.3310	0.2965	0.3379	0.3654	0.3327	0.3103	0.3103	0.3516	0.3516	0.3310	0.0017	0.52
30	0.3379	0.3034	0.4413	0.4068	0.3723	0.3103	0.3103	0.4137	0.4137	0.3620	0.0103	2.86
31	0.2965	0.3034	0.3999	0.4068	0.3516	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0103	-2.86
32	0.2896	0.3379	0.3999	0.4413	0.3672	0.3103	0.3103	0.4137	0.4137	0.3620	0.0052	1.43
33	0.3516	0.3585	0.4413	0.4482	0.3999	0.3103	0.3103	0.4137	0.4137	0.3620	0.0379	10.48
34	0.3516	0.3654	0.4413	0.4413	0.3999	0.3103	0.3103	0.4137	0.4137	0.3620	0.0379	10.48
35	0.1931	0.2275	0.2275	0.2137	0.2155	0.2069	0.2069	0.2206	0.2206	0.2137	0.0017	0.81
36	0.2206	0.1931	0.2344	0.2206	0.2172	0.2069	0.2069	0.2206	0.2206	0.2137	0.0034	1.61
37	0.2965	0.3103	0.3930	0.4068	0.3516	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0103	-2.86
38	0.2896	0.3310	0.3999	0.3930	0.3534	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0086	-2.38
39	0.2689	0.2620	0.3448	0.3379	0.3034	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0586	-16.19
40	0.2620	0.2758	0.3999	0.3861	0.3310	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0310	-8.57
41	0.3034	0.2896	0.4206	0.4068	0.3551	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0069	-1.90
42	0.2896	0.2965	0.3999	0.3930	0.3448	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0172	-4.76
43	0.2758	0.2413	0.3448	0.3103	0.2930	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0690	-19.05
44	0.2827	0.2758	0.3861	0.3930	0.3344	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0276	-7.62
45	0.3310	0.3034	0.3861	0.4137	0.3585	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0034	-0.95

Table A4c: Measured tyre pressure of vehicles in Roman Hill station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (MTP) (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	% deviation
	FR	FL	RR	RL		FR	FL	RR	RL			
46	0.2965	0.2965	0.3654	0.3654	0.3310	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0310	-8.57
47	0.3448	0.2758	0.3861	0.4206	0.3568	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0052	-1.43
48	0.2551	0.2482	0.3310	0.3172	0.2879	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0741	-20.48
49	0.2413	0.2482	0.3379	0.3241	0.2879	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0741	-20.48
50	0.3103	0.2965	0.3448	0.3379	0.3223	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0396	-10.95
51	0.2896	0.2896	0.3516	0.3448	0.3189	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0431	-11.90
52	0.3103	0.2758	0.3448	0.3585	0.3223	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0396	-10.95
53	0.2896	0.2069	0.2758	0.2965	0.2672	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0948	-26.19
54	0.3310	0.2965	0.3792	0.3654	0.3430	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0190	-5.24
55	0.2758	0.2482	0.3516	0.3654	0.3103	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0517	-14.29
56	0.2551	0.2344	0.2827	0.2896	0.2655	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0965	-26.67
57	0.2206	0.3172	0.2413	0.2344	0.2534	0.3103	0.3103	0.3516	0.3516	0.3310	-0.0776	-23.44
58	0.3172	0.3034	0.3448	0.3379	0.3258	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0362	-10.00
59	0.2965	0.2827	0.3448	0.3516	0.3189	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0155	-4.64
60	0.3034	0.2620	0.3723	0.4137	0.3379	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0241	-6.67
61	0.2413	0.3172	0.2758	0.2689	0.2758	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0862	-23.81
62	0.2827	0.2896	0.2965	0.3103	0.2948	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0672	-18.57
63	0.2896	0.3034	0.3448	0.3516	0.3223	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0396	-10.95
64	0.2965	0.3034	0.3448	0.3516	0.3241	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0379	-10.48
65	0.2827	0.2896	0.3516	0.3448	0.3172	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0448	-12.38
66	0.2758	0.2827	0.3448	0.3516	0.3137	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0483	-13.33
67	0.3034	0.3034	0.3448	0.3448	0.3241	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0379	-10.48
68	0.2344	0.2275	0.2965	0.3034	0.2655	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0965	-26.67
69	0.2689	0.2758	0.3585	0.3654	0.3172	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0448	-12.38

Table A4d: Measured tyre pressure of vehicles in Roman Hill station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	% deviation
	FR	FL	RR	RL		FR	FL	RR	RL			
70	0.2827	0.3241	0.3172	0.3103	0.3086	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0534	-14.76
71	0.2413	0.2206	0.3034	0.3103	0.2689	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0931	-25.71
72	0.2620	0.2620	0.2620	0.2551	0.2603	0.3103	0.3103	0.3516	0.3516	0.3310	-0.0707	-21.35
73	0.2482	0.2413	0.2689	0.2620	0.2551	0.3103	0.3103	0.3516	0.3516	0.3310	-0.0758	-22.92
74	0.2965	0.2896	0.3310	0.3241	0.3103	0.3103	0.3103	0.3516	0.3516	0.3310	-0.0207	-6.25
75	0.2896	0.2965	0.3379	0.3172	0.3103	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0241	-7.22
76	0.2758	0.2827	0.3172	0.3172	0.2982	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0362	-10.82
77	0.2620	0.2620	0.2758	0.2689	0.2672	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0672	-20.10
78	0.2413	0.2482	0.2827	0.2827	0.2637	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0707	-21.13
79	0.2275	0.2206	0.2758	0.2827	0.2517	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0758	-23.16
80	0.2758	0.2689	0.2758	0.2896	0.2775	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0500	-15.26
81	0.2620	0.2551	0.2827	0.2896	0.2724	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0552	-16.84
82	0.2275	0.2344	0.2413	0.2413	0.2362	0.3103	0.3103	0.3448	0.3448	0.3275	-0.0914	-27.89
83	0.2482	0.2482	0.2689	0.2827	0.2620	0.2758	0.2758	0.3585	0.3585	0.3172	-0.0552	-17.39
84	0.2551	0.2413	0.2689	0.2758	0.2603	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0741	-22.16
85	0.2275	0.2413	0.2758	0.2758	0.2551	0.2758	0.2758	0.3585	0.3585	0.3172	-0.0621	-19.57
86	0.2758	0.2689	0.2620	0.2551	0.2655	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0690	-20.62
87	0.2896	0.2896	0.3241	0.3034	0.3017	0.3448	0.3448	0.4137	0.4137	0.3792	-0.0776	-20.45
88	0.3103	0.2827	0.2965	0.3034	0.2982	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0638	-17.62
89	0.2689	0.2827	0.3448	0.3103	0.3017	0.3448	0.3448	0.4137	0.4137	0.3792	-0.0776	-20.45
90	0.2620	0.2413	0.3172	0.3241	0.2861	0.3103	0.3103	0.4137	0.4137	0.3620	-0.0758	-20.95
91	0.2413	0.2551	0.2689	0.2620	0.2568	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0776	-23.20
92	0.2206	0.2413	0.2758	0.2689	0.2517	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0827	-24.74
93	0.2275	0.2137	0.2620	0.2551	0.2396	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0948	-28.35

Table A4e: Measured tyre pressure of vehicles in Roman Hill station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)				AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)				AVERAGE (N/mm^2)	DEVIATION	% DEVIATION
	FR	FL	RR	RL		FR	FL	RR	RL			
94	0.2137	0.2275	0.2482	0.2620	0.2379	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0965	-28.87
95	0.2275	0.2482	0.2965	0.2896	0.2655	0.2758	0.2758	0.3585	0.3585	0.3172	-0.0517	-16.30
96	0.2206	0.2344	0.2620	0.2758	0.2482	0.3103	0.3103	0.3792	0.3792	0.3448	-0.0965	-28.00
97	0.2620	0.2551	0.2758	0.2827	0.2689	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0655	-19.59
98	0.2482	0.2413	0.2620	0.2689	0.2551	0.2758	0.2758	0.3448	0.3448	0.3103	-0.0552	-17.78
99	0.2344	0.2206	0.2620	0.2620	0.2448	0.3103	0.3103	0.3792	0.3792	0.3448	-0.1000	-29.00
100	0.2275	0.2413	0.2758	0.2827	0.2568	0.3103	0.3103	0.3585	0.3585	0.3344	-0.0776	-23.20

Table A5a: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
1	0.2758	0.2827	0.3516	0.3585			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-14.13
2	0.2896	0.2965	0.3654	0.3792			0.3327	0.3103	0.3103	0.4137	0.4137			0.3620	-8.81
3	0.2689	0.2620	0.3379	0.3448			0.3034	0.3103	0.3103	0.4137	0.4137			0.3620	-19.32
4	0.2551	0.2689	0.3448	0.3585			0.3068	0.3103	0.3103	0.4137	0.4137			0.3620	-17.98
5	0.2482	0.2827	0.3516	0.3792			0.3154	0.3103	0.3103	0.4137	0.4137			0.3620	-14.75
6	0.2827	0.2758	0.3654	0.3654			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
7	0.2758	0.3034	0.3654	0.3723			0.3292	0.3103	0.3103	0.4137	0.4137			0.3620	-9.95
8	0.2413	0.2758	0.3861	0.3792			0.3206	0.3103	0.3103	0.4137	0.4137			0.3620	-12.90
9	0.2689	0.2827	0.4068	0.3999			0.3396	0.3516	0.3516	0.4482	0.4482			0.3999	-17.77
10	0.2620	0.2896	0.3516	0.3654			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-26.09
11	0.2896	0.2827	0.3999	0.3930			0.3413	0.3516	0.3516	0.4482	0.4482			0.3999	-17.17
12	0.2827	0.3034	0.3585	0.3723			0.3292	0.3516	0.3516	0.4482	0.4482			0.3999	-21.47
13	0.2896	0.2827	0.3448	0.3516			0.3172	0.3516	0.3516	0.4482	0.4482			0.3999	-26.09
14	0.2413	0.2551	0.3516	0.3585			0.3017	0.3516	0.3516	0.4482	0.4482			0.3999	-32.57
15	0.1931	0.1862	0.2344	0.2137			0.2069	0.2069	0.2069	0.2206	0.2206			0.2137	-3.33
16	0.1724	0.1793	0.1724	0.1793			0.1758	0.2069	0.2069	0.2206	0.2206			0.2137	-21.57
17	0.1931	0.2206	0.2275	0.2344			0.2189	0.2069	0.2069	0.2206	0.2206			0.2137	2.36
18	0.1586	0.1724	0.1931	0.1862			0.1775	0.2069	0.2069	0.2206	0.2206			0.2137	-20.39
19	0.1517	0.1448	0.1793	0.1724			0.1620	0.2069	0.2069	0.2206	0.2206			0.2137	-31.91
20	0.1379	0.1586	0.2000	0.2069			0.1758	0.2069	0.2069	0.2206	0.2206			0.2137	-21.57
21	0.1793	0.2137	0.2069	0.2206			0.2051	0.2069	0.2069	0.2206	0.2206			0.2137	-4.20
22	0.3241	0.3241	0.3999	0.3930	0.3999	0.3999	0.3735	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-11.38

Table A5b: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
23	0.3448	0.3310	0.4137	0.4137	0.4068	0.4137	0.3873	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-7.42
24	0.3241	0.3241	0.3999	0.4068	0.4137	0.4206	0.3815	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-9.04
25	0.3310	0.3448	0.4206	0.4275	0.4275	0.4344	0.3976	0.3516	0.3516	0.4482	0.4482	0.4482	0.4482	0.4160	-4.62
26	0.3103	0.2965	0.3448	0.3379			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
27	0.2896	0.2896	0.3516	0.3448			0.3189	0.3103	0.3103	0.4137	0.4137			0.3620	-13.51
28	0.3103	0.2758	0.3448	0.3585			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
29	0.2896	0.2069	0.2758	0.2965			0.2672	0.3103	0.3103	0.4137	0.4137			0.3620	-35.48
30	0.3310	0.2965	0.3792	0.3654			0.3430	0.3103	0.3103	0.4137	0.4137			0.3620	-5.53
31	0.2758	0.2482	0.3516	0.3654			0.3103	0.3103	0.3103	0.4137	0.4137			0.3620	-16.67
32	0.2551	0.2344	0.2827	0.2896			0.2655	0.3103	0.3103	0.4137	0.4137			0.3620	-36.36
33	0.2206	0.3172	0.2413	0.2344			0.2534	0.3103	0.3103	0.3516	0.3516			0.3310	-30.61
34	0.3172	0.3034	0.3448	0.3379			0.3258	0.3103	0.3103	0.4137	0.4137			0.3620	-11.11
35	0.2965	0.2827	0.3448	0.3516			0.3189	0.3103	0.3103	0.3585	0.3585			0.3344	-4.86
36	0.3034	0.2620	0.3723	0.4137			0.3379	0.3103	0.3103	0.4137	0.4137			0.3620	-7.14
37	0.2413	0.3172	0.2758	0.2689			0.2758	0.3103	0.3103	0.4137	0.4137			0.3620	-31.25
38	0.2827	0.2896	0.2965	0.3103			0.2948	0.3103	0.3103	0.4137	0.4137			0.3620	-22.81
39	0.2896	0.3034	0.3448	0.3516			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
40	0.2965	0.3034	0.3448	0.3516			0.3241	0.3103	0.3103	0.4137	0.4137			0.3620	-11.70
41	0.2827	0.2896	0.3516	0.3448			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-14.13
42	0.2758	0.2827	0.3448	0.3516			0.3137	0.3103	0.3103	0.4137	0.4137			0.3620	-15.38
43	0.3034	0.3034	0.3448	0.3448			0.3241	0.3103	0.3103	0.4137	0.4137			0.3620	-11.70
44	0.2344	0.2275	0.2965	0.3034			0.2655	0.3103	0.3103	0.4137	0.4137			0.3620	-36.36
45	0.2689	0.2758	0.3585	0.3654			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-14.13
46	0.2827	0.3241	0.3172	0.3103			0.3086	0.3103	0.3103	0.4137	0.4137			0.3620	-17.32

Table A5c: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
47	0.2413	0.2206	0.3034	0.3103			0.2689	0.3103	0.3103	0.4137	0.4137			0.3620	-34.62
48	0.2620	0.2620	0.2620	0.2551			0.2603	0.3103	0.3103	0.3516	0.3516			0.3310	-27.15
49	0.3172	0.3241	0.4137	0.4068			0.3654	0.3103	0.3103	0.4137	0.4137			0.3620	0.94
50	0.3172	0.3034	0.4068	0.4206			0.3620	0.3103	0.3103	0.4137	0.4137			0.3620	0.00
51	0.2827	0.2758	0.3723	0.3861			0.3292	0.3103	0.3103	0.4137	0.4137			0.3620	-9.95
52	0.2896	0.3034	0.3654	0.4068			0.3413	0.3103	0.3103	0.4137	0.4137			0.3620	-6.06
53	0.2689	0.2689	0.3792	0.3861			0.3258	0.3103	0.3103	0.4137	0.4137			0.3620	-11.11
54	0.3103	0.3034	0.3999	0.4068			0.3551	0.3103	0.3103	0.4137	0.4137			0.3620	-1.94
55	0.2896	0.2965	0.3930	0.3999			0.3448	0.3103	0.3103	0.4137	0.4137			0.3620	-5.00
56	0.2620	0.2827	0.3654	0.3723			0.3206	0.3103	0.3103	0.4137	0.4137			0.3620	-12.90
57	0.2827	0.2896	0.3516	0.3516			0.3189	0.3103	0.3103	0.4137	0.4137			0.3620	-13.51
58	0.2758	0.2896	0.3999	0.3861			0.3379	0.3103	0.3103	0.4137	0.4137			0.3620	-7.14
59	0.3172	0.3310	0.3379	0.3172			0.3258	0.3103	0.3103	0.3585	0.3585			0.3344	-2.65
60	0.3448	0.3585	0.4482	0.4482			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
61	0.3448	0.3516	0.4551	0.4689			0.4051	0.3516	0.3516	0.4482	0.4482			0.3999	1.28
62	0.3792	0.3172	0.4137	0.4413			0.3878	0.3516	0.3516	0.4482	0.4482			0.3999	-3.11
63	0.3654	0.3585	0.4551	0.4206			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
64	0.3723	0.3861	0.4482	0.4551			0.4154	0.3516	0.3516	0.4482	0.4482			0.3999	3.73
65	0.3379	0.3861	0.3792	0.4068			0.3775	0.3516	0.3516	0.4482	0.4482			0.3999	-5.94
66	0.3930	0.2965	0.4206	0.4275			0.3844	0.3516	0.3516	0.4482	0.4482			0.3999	-4.04
67	0.3103	0.3448	0.3723	0.3792			0.3516	0.3516	0.3516	0.4482	0.4482			0.3999	-13.73
68	0.3516	0.3379	0.4413	0.4344			0.3913	0.3516	0.3516	0.4482	0.4482			0.3999	-2.20
69	0.3585	0.3723	0.4620	0.4689			0.4154	0.3516	0.3516	0.4482	0.4482			0.3999	3.73
70	0.3792	0.3792	0.4758	0.4620			0.4240	0.3516	0.3516	0.4482	0.4482			0.3999	5.69

Table A5d: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
71	0.3792	0.3792	0.5033	0.5171			0.4447	0.3516	0.3516	0.4482	0.4482			0.3999	10.08
72	0.3516	0.3861	0.4482	0.4482			0.4085	0.3516	0.3516	0.4482	0.4482			0.3999	2.11
73	0.3654	0.3585	0.3930	0.3999			0.3792	0.3516	0.3516	0.4482	0.4482			0.3999	-5.45
74	0.3654	0.3861	0.4344	0.4413			0.4068	0.3516	0.3516	0.4482	0.4482			0.3999	1.69
75	0.3516	0.3654	0.4482	0.4344			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
76	0.3585	0.3516	0.4482	0.4413			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
77	0.3448	0.3516	0.4551	0.4482			0.3999	0.3516	0.3516	0.4482	0.4482			0.3999	0.00
78	0.3792	0.3723	0.4482	0.4551			0.4137	0.3516	0.3516	0.4482	0.4482			0.3999	3.33
79	0.3792	0.3516	0.3999	0.3861			0.3792	0.3516	0.3516	0.4482	0.4482			0.3999	-5.45
80	0.3172	0.3310	0.3999	0.3930			0.3603	0.3516	0.3516	0.4482	0.4482			0.3999	-11.00
81	0.2413	0.2827	0.3723	0.3585			0.3137	0.3103	0.3103	0.4137	0.4137			0.3620	-15.38
82	0.2689	0.3172	0.3792	0.3861			0.3379	0.3103	0.3103	0.4137	0.4137			0.3620	-7.14
83	0.2896	0.3034	0.3448	0.3516			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
84	0.2758	0.2758	0.2758	0.2758			0.2758	0.2551	0.2551	0.2758	0.2758			0.2655	3.75
85	0.2620	0.3034	0.1931	0.1034			0.2155	0.2206	0.2206	0.2620	0.2620			0.2413	-12.00
86	0.2069	0.2206	0.2069	0.2275			0.2155	0.2206	0.2206	0.2620	0.2620			0.2413	-12.00
87	0.3654	0.3654	0.3585	0.2896			0.3448	0.3516	0.3516	0.4482	0.4482			0.3999	-16.00
88	0.2137	0.1793	0.1724	0.1724			0.1844	0.2206	0.2206	0.2689	0.2689			0.2448	-32.71
89	0.2758	0.3448	0.2689	0.3516			0.3103	0.3516	0.3516	0.4482	0.4482			0.3999	-28.89
90	0.3103	0.3448	0.3034	0.2965			0.3137	0.3516	0.3516	0.4482	0.4482			0.3999	-27.47
91	0.3448	0.3930	0.2896	0.2000			0.3068	0.3516	0.3516	0.4482	0.4482			0.3999	-30.34
92	0.2344	0.2344	0.2413	0.2344			0.2362	0.2069	0.2069	0.2620	0.2620			0.2344	0.73
93	0.2689	0.2551	0.2069	0.2689			0.2499	0.2069	0.2069	0.2689	0.2689			0.2379	4.83
94	0.2344	0.2413	0.3448	0.3172			0.2844	0.3103	0.3103	0.4137	0.4137			0.3620	-27.27

Table A5e: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
95	0.2000	0.1931	0.1517	0.1793			0.1810	0.2137	0.2137	0.2206	0.2206			0.2172	-20.00
96	0.1034	0.3172	0.2206	0.2069			0.2120	0.2069	0.2069	0.2206	0.2206			0.2137	-0.81
97	0.2551	0.2758	0.2620	0.2896			0.2706	0.3103	0.3103	0.4137	0.4137			0.3620	-33.76
98	0.2758	0.2827	0.2896	0.2758			0.2810	0.3103	0.3103	0.4137	0.4137			0.3620	-28.83
99	0.2206	0.2206	0.2206	0.2275			0.2224	0.2413	0.2413	0.2758	0.2758			0.2586	-16.28
100	0.2758	0.2620	0.1793	0.2344			0.2379	0.2206	0.2206	0.2206	0.2206			0.2206	7.25
101	0.2620	0.2896	0.3241	0.3103			0.2965	0.3103	0.3103	0.4137	0.4137			0.3620	-22.09
102	0.2206	0.2137	0.2069	0.2620			0.2258	0.1793	0.1793	0.2000	0.2000			0.1896	16.03
103	0.2069	0.2069	0.1793	0.1862			0.1948	0.2206	0.2206	0.2689	0.2689			0.2448	-25.66
104	0.2758	0.2689	0.2758	0.2896			0.2775	0.3103	0.3103	0.3448	0.3448			0.3275	-18.01
105	0.2620	0.2551	0.2827	0.2896			0.2724	0.3103	0.3103	0.3448	0.3448			0.3275	-20.25
106	0.2413	0.2344	0.2827	0.2758			0.2586	0.3103	0.3103	0.3448	0.3448			0.3275	-26.67
107	0.2482	0.2482	0.2689	0.2827			0.2620	0.2758	0.2758	0.3585	0.3585			0.3172	-21.05
108	0.2551	0.2413	0.2689	0.2758			0.2603	0.3103	0.3103	0.3585	0.3585			0.3344	-28.48
109	0.2275	0.2413	0.2758	0.2758			0.2551	0.2758	0.2758	0.3585	0.3585			0.3172	-24.32
110	0.2758	0.2689	0.2620	0.2551			0.2655	0.3103	0.3103	0.3585	0.3585			0.3344	-25.97
111	0.2896	0.2896	0.3241	0.3034			0.3017	0.3448	0.3448	0.4137	0.4137			0.3792	-25.71
112	0.3103	0.2827	0.2965	0.3034			0.2982	0.3103	0.3103	0.4137	0.4137			0.3620	-21.39
113	0.2689	0.2827	0.3448	0.3103			0.3017	0.3448	0.3448	0.4137	0.4137			0.3792	-25.71
114	0.2620	0.2413	0.3172	0.3241			0.2861	0.3103	0.3103	0.4137	0.4137			0.3620	-26.51
115	0.2413	0.2551	0.2689	0.2827			0.2620	0.3103	0.3103	0.3585	0.3585			0.3344	-27.63
116	0.2206	0.2413	0.2896	0.2965			0.2620	0.3103	0.3103	0.3585	0.3585			0.3344	-27.63
117	0.2689	0.2620	0.3516	0.3448			0.3068	0.3103	0.3103	0.3585	0.3585			0.3344	-8.99
118	0.2482	0.2551	0.3172	0.3034			0.2810	0.3103	0.3103	0.3585	0.3585			0.3344	-19.02

Table A5f: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
119	0.2275	0.2482	0.2965	0.2896			0.2655	0.2758	0.2758	0.3585	0.3585			0.3172	-19.48
120	0.2620	0.2620	0.3241	0.3310			0.2948	0.3103	0.3103	0.3792	0.3792			0.3448	-16.96
121	0.2620	0.2551	0.2758	0.2827			0.2689	0.3103	0.3103	0.3585	0.3585			0.3344	-24.36
122	0.2482	0.2413	0.2620	0.2689			0.2551	0.2758	0.2758	0.3448	0.3448			0.3103	-21.62
123	0.2758	0.2689	0.3310	0.3448			0.3051	0.3103	0.3103	0.3792	0.3792			0.3448	-12.99
124	0.2275	0.2413	0.2896	0.2827			0.2603	0.3103	0.3103	0.3585	0.3585			0.3344	-28.48
125	0.2620	0.2689	0.2896	0.3103			0.2827	0.3103	0.3103	0.4137	0.4137			0.3620	-28.05
126	0.2758	0.2827	0.3448	0.3516			0.3137	0.3103	0.3103	0.4137	0.4137			0.3620	-15.38
127	0.2689	0.2551	0.3310	0.3241			0.2948	0.3103	0.3103	0.4137	0.4137			0.3620	-22.81
128	0.2413	0.2482	0.3448	0.3379			0.2930	0.3103	0.3103	0.4137	0.4137			0.3620	-23.53
129	0.2620	0.2620	0.3310	0.3516			0.3017	0.3103	0.3103	0.4137	0.4137			0.3620	-20.00
130	0.2827	0.2758	0.3654	0.3723			0.3241	0.3103	0.3103	0.4137	0.4137			0.3620	-11.70
131	0.2413	0.2413	0.3241	0.3310			0.2844	0.3103	0.3103	0.4137	0.4137			0.3620	-27.27
132	0.2896	0.2896	0.3930	0.3999			0.3430	0.3103	0.3103	0.4137	0.4137			0.3620	-5.53
133	0.2758	0.2689	0.3310	0.3241			0.2999	0.3103	0.3103	0.4137	0.4137			0.3620	-20.69
134	0.2758	0.2827	0.3723	0.3585			0.3223	0.3103	0.3103	0.4137	0.4137			0.3620	-12.30
135	0.2551	0.2827	0.3379	0.3379			0.3034	0.3103	0.3103	0.4137	0.4137			0.3620	-19.32
136	0.2758	0.2758	0.3585	0.3448			0.3137	0.3103	0.3103	0.4137	0.4137			0.3620	-15.38
137	0.2827	0.2689	0.3792	0.3861			0.3292	0.3103	0.3103	0.4137	0.4137			0.3620	-9.95
138	0.2620	0.2689	0.3930	0.3999			0.3310	0.3103	0.3103	0.4137	0.4137			0.3620	-9.38
139	0.2965	0.2689	0.3516	0.3516			0.3172	0.3103	0.3103	0.3585	0.3585			0.3344	-5.43
140	0.3172	0.3034	0.3723	0.3516			0.3361	0.3103	0.3103	0.3585	0.3585			0.3344	0.51
141	0.2689	0.2758	0.3448	0.3379			0.3068	0.3103	0.3103	0.3585	0.3585			0.3344	-8.99
142	0.2413	0.2344	0.3172	0.3034			0.2741	0.3103	0.3103	0.3448	0.3448			0.3275	-19.50

Table A5g: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
143	0.2344	0.2689	0.3103	0.3310			0.2861	0.3103	0.3103	0.3448	0.3448			0.3275	-14.46
144	0.2206	0.2275	0.2896	0.2896			0.2568	0.2758	0.2758	0.3448	0.3448			0.3103	-20.81
145	0.2413	0.2482	0.3172	0.3103			0.2792	0.3103	0.3103	0.4137	0.4137			0.3620	-29.63
146	0.2827	0.3172	0.3585	0.3585			0.3292	0.3103	0.3103	0.3448	0.3448			0.3275	0.52
147	0.2551	0.2551	0.3172	0.3034			0.2827	0.3103	0.3103	0.4137	0.4137			0.3620	-28.05
148	0.3034	0.3172	0.3723	0.3585			0.3379	0.3103	0.3103	0.3585	0.3585			0.3344	1.02
149	0.3103	0.3172	0.3585	0.3516			0.3344	0.3103	0.3103	0.3585	0.3585			0.3344	0.00
150	0.2344	0.2482	0.2965	0.3034			0.2706	0.3103	0.3103	0.3585	0.3585			0.3344	-23.57
151	0.2413	0.2275	0.2827	0.2965			0.2620	0.3103	0.3103	0.3585	0.3585			0.3344	-27.63
152	0.2827	0.2896	0.3310	0.3310			0.3086	0.3103	0.3103	0.3585	0.3585			0.3344	-8.38
153	0.3103	0.3172	0.3516	0.3448			0.3310	0.3103	0.3103	0.3516	0.3516			0.3310	0.00
154	0.2551	0.2689	0.3448	0.3516			0.3051	0.3103	0.3103	0.4137	0.4137			0.3620	-18.64
155	0.2344	0.2413	0.3172	0.3379			0.2827	0.3103	0.3103	0.4137	0.4137			0.3620	-28.05
156	0.2896	0.2827	0.3792	0.3723			0.3310	0.3103	0.3103	0.4137	0.4137			0.3620	-9.38
157	0.2896	0.2965	0.3241	0.3379			0.3120	0.3103	0.3103	0.3585	0.3585			0.3344	-7.18
158	0.2413	0.2620	0.2758	0.2896			0.2672	0.3103	0.3103	0.3585	0.3585			0.3344	-25.16
159	0.3310	0.3448	0.3792	0.3792			0.3585	0.3103	0.3103	0.4137	0.4137			0.3620	-0.96
160	0.2000	0.2137	0.2206	0.2206			0.2137	0.2069	0.2069	0.2206	0.2206			0.2137	0.00
161	0.2275	0.2275	0.2413	0.2482			0.2362	0.2069	0.2069	0.2206	0.2206			0.2137	9.49
162	0.2344	0.2206	0.2413	0.2344			0.2327	0.2069	0.2069	0.2206	0.2206			0.2137	8.15
163	0.2965	0.2689	0.3241	0.3379			0.3068	0.2758	0.2758	0.3103	0.3103			0.2930	4.49
164	0.2965	0.3034	0.4344	0.4275			0.3654	0.3103	0.3103	0.4137	0.4137			0.3620	0.94
165	0.3379	0.3172	0.4068	0.4413			0.3758	0.3103	0.3103	0.4137	0.4137			0.3620	3.67
166	0.3516	0.3654	0.4275	0.4482			0.3982	0.3103	0.3103	0.4137	0.4137			0.3620	9.09

Table A5h: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
167	0.3310	0.2965	0.3379	0.3654			0.3327	0.3103	0.3103	0.3516	0.3516			0.3310	0.52
168	0.3379	0.3034	0.4413	0.4068			0.3723	0.3103	0.3103	0.4137	0.4137			0.3620	2.78
169	0.2965	0.3034	0.3999	0.4068			0.3516	0.3103	0.3103	0.4137	0.4137			0.3620	-2.94
170	0.2896	0.3379	0.3999	0.4413			0.3672	0.3103	0.3103	0.4137	0.4137			0.3620	1.41
171	0.3034	0.3103	0.4137	0.4206			0.3620	0.3103	0.3103	0.4137	0.4137			0.3620	0.00
172	0.3034	0.3172	0.3999	0.4068			0.3568	0.3103	0.3103	0.4137	0.4137			0.3620	-1.45
173	0.1931	0.2069	0.2069	0.2137			0.2051	0.2069	0.2069	0.2206	0.2206			0.2137	-4.20
174	0.2206	0.1931	0.2069	0.2206			0.2103	0.2069	0.2069	0.2206	0.2206			0.2137	-1.64
175	0.2965	0.3103	0.3930	0.4068			0.3516	0.3103	0.3103	0.4137	0.4137			0.3620	-2.94
176	0.2896	0.3310	0.3999	0.3930			0.3534	0.3103	0.3103	0.4137	0.4137			0.3620	-2.44
177	0.2689	0.2620	0.3448	0.3379			0.3034	0.3103	0.3103	0.4137	0.4137			0.3620	-19.32
178	0.2620	0.2758	0.3792	0.3861			0.3258	0.3103	0.3103	0.4137	0.4137			0.3620	-11.11
179	0.2896	0.3034	0.3516	0.3379			0.3206	0.3103	0.3103	0.4137	0.4137			0.3620	-12.90
180	0.2689	0.2758	0.3585	0.3654			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-14.13
181	0.2413	0.2551	0.2689	0.2758			0.2603	0.3103	0.3103	0.3585	0.3585			0.3344	-28.48
182	0.2275	0.2413	0.2758	0.2896			0.2586	0.3103	0.3103	0.3585	0.3585			0.3344	-29.33
183	0.2275	0.2551	0.2827	0.3034			0.2672	0.3103	0.3103	0.3585	0.3585			0.3344	-25.16
184	0.2482	0.2620	0.3034	0.3103			0.2810	0.3103	0.3103	0.3585	0.3585			0.3344	-19.02
185	0.2275	0.2482	0.2965	0.2896			0.2655	0.2758	0.2758	0.3585	0.3585			0.3172	-19.48
186	0.2344	0.2344	0.3448	0.3516			0.2913	0.3103	0.3103	0.3792	0.3792			0.3448	-18.34
187	0.2620	0.2551	0.2758	0.2827			0.2689	0.3103	0.3103	0.3585	0.3585			0.3344	-24.36
188	0.2482	0.2413	0.2620	0.2689			0.2551	0.2758	0.2758	0.3448	0.3448			0.3103	-21.62
189	0.2344	0.2206	0.3103	0.3103			0.2689	0.3103	0.3103	0.3792	0.3792			0.3448	-28.21
190	0.2620	0.2689	0.2758	0.2827			0.2724	0.3103	0.3103	0.3585	0.3585			0.3344	-22.78

Table A5i: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
191	0.3448	0.3585	0.4275	0.4344			0.3913	0.3516	0.3516	0.4482	0.4482			0.3999	-2.20
192	0.3516	0.3448	0.4482	0.4413			0.3965	0.3516	0.3516	0.4482	0.4482			0.3999	-0.87
193	0.3516	0.3034	0.4620	0.4482			0.3913	0.3516	0.3516	0.4482	0.4482			0.3999	-2.20
194	0.3103	0.3172	0.3930	0.4206			0.3603	0.3516	0.3516	0.4482	0.4482			0.3999	-11.00
195	0.3654	0.2896	0.4551	0.4206			0.3827	0.3516	0.3516	0.4482	0.4482			0.3999	-4.50
196	0.3379	0.3585	0.4068	0.4206			0.3809	0.3516	0.3516	0.4482	0.4482			0.3999	-4.98
197	0.3448	0.3585	0.4551	0.4206			0.3947	0.3516	0.3516	0.4482	0.4482			0.3999	-1.31
198	0.3654	0.3585	0.4344	0.4206			0.3947	0.3516	0.3516	0.4482	0.4482			0.3999	-1.31
199	0.3516	0.3448	0.4413	0.4344			0.3930	0.3516	0.3516	0.4482	0.4482			0.3999	-1.75
200	0.3585	0.3585	0.4206	0.4275			0.3913	0.3516	0.3516	0.4482	0.4482			0.3999	-2.20
201	0.3448	0.3585	0.4482	0.4206			0.3930	0.3516	0.3516	0.4482	0.4482			0.3999	-1.75
202	0.3654	0.3585	0.4344	0.4206			0.3947	0.3516	0.3516	0.4482	0.4482			0.3999	-1.31
203	0.3585	0.3654	0.4137	0.4206			0.3896	0.3516	0.3516	0.4482	0.4482			0.3999	-2.65
204	0.3241	0.3792	0.4275	0.4206			0.3878	0.3516	0.3516	0.4482	0.4482			0.3999	-3.11
205	0.3241	0.3310	0.3930	0.3999			0.3620	0.3516	0.3516	0.4482	0.4482			0.3999	-10.48
206	0.3448	0.3516	0.4413	0.4206			0.3896	0.3516	0.3516	0.4482	0.4482			0.3999	-2.65
207	0.1793	0.1724	0.2137	0.2206			0.1965	0.1931	0.1931	0.2137	0.2137			0.2034	-3.51
208	0.3034	0.3034	0.3723	0.2896			0.3172	0.3103	0.3103	0.4137	0.4137			0.3620	-14.13
209	0.2689	0.2137	0.2069	0.1931			0.2206	0.2069	0.2551	0.3310	0.3310			0.2810	-27.34
210	0.2551	0.2344	0.2000	0.2206			0.2275	0.2620	0.2620	0.2827	0.2827			0.2724	-19.70
211	0.1655	0.2344	0.2413	0.2344			0.2189	0.2206	0.2206	0.2620	0.2620			0.2413	-10.24
212	0.1448	0.1724	0.2206	0.2482			0.1965	0.2206	0.2206	0.2620	0.2620			0.2413	-22.81
213	0.2758	0.2896	0.3172	0.2896			0.2930	0.3103	0.3103	0.4137	0.4137			0.3620	-23.53
214	0.2000	0.2137	0.2206	0.2137			0.2120	0.2206	0.2206	0.2620	0.2620			0.2413	-13.82

Table A5j: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURERS RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
215	0.2413	0.2413	0.2758	0.2758			0.2586	0.2482	0.2482	0.2758	0.2758			0.2620	-1.33
216	0.2620	0.3034	0.1931	0.0690			0.2069	0.2206	0.2206	0.2620	0.2620			0.2413	-16.67
217	0.2069	0.2206	0.2069	0.1931			0.2069	0.2206	0.2206	0.2620	0.2620			0.2413	-16.67
218	0.3654	0.3654	0.3585	0.2896			0.3448	0.3516	0.3516	0.4482	0.4482			0.3999	-16.00
219	0.2137	0.1793	0.1655	0.1862			0.1862	0.2069	0.2069	0.2689	0.2689			0.2379	-27.78
220	0.2069	0.1931	0.1724	0.2069			0.1948	0.2206	0.2206	0.2620	0.2620			0.2413	-23.89
221	0.2344	0.2069	0.1793	0.1793			0.2000	0.2413	0.2413	0.2413	0.2551			0.2448	-22.41
222	0.2206	0.1517	0.1586	0.1724			0.1758	0.2137	0.2137	0.2344	0.2344			0.2241	-27.45
223	0.2413	0.2620	0.2689	0.2689			0.2603	0.2413	0.2413	0.2827	0.2827			0.2620	-0.66
224	0.1379	0.2758	0.2137	0.2137			0.2103	0.1931	0.1931	0.2344	0.2344			0.2137	-1.64
225	0.2000	0.2069	0.2689	0.2689			0.2362	0.2069	0.2069	0.2689	0.2689			0.2379	-0.73
226	0.2896	0.2620	0.3034	0.3034			0.2896	0.3103	0.3103	0.4137	0.4137			0.3620	-25.00
227	0.1655	0.2000	0.2620	0.2069			0.2086	0.2137	0.2137	0.2206	0.2206			0.2172	-4.13
228	0.1655	0.1655	0.1931	0.2000			0.1810	0.2069	0.2069	0.2482	0.2482			0.2275	-25.71
229	0.2137	0.2275	0.2275	0.2344			0.2258	0.2069	0.2069	0.2482	0.2482			0.2275	-0.76
230	0.3241	0.2965	0.2413	0.4206			0.3206	0.3103	0.3103	0.4137	0.4137			0.3620	-12.90
231	0.1862	0.1931	0.2206	0.2275			0.2069	0.1931	0.1931	0.2344	0.2344			0.2137	-3.33
232	0.1931	0.2069	0.2000	0.2000			0.2000	0.2206	0.2206	0.2620	0.2620			0.2413	-20.69
233	0.1379	0.1379	0.1793	0.1931			0.1620	0.1931	0.1931	0.2137	0.2137			0.2034	-25.53
234	0.3585	0.3723	0.3310	0.2896			0.3379	0.3516	0.3516	0.4482	0.4482			0.3999	-18.37
235	0.2069	0.2069	0.2069	0.1931			0.2034	0.2069	0.2069	0.2482	0.2482			0.2275	-11.86
236	0.2206	0.2137	0.2069	0.2275			0.2172	0.2206	0.2206	0.2620	0.2620			0.2413	-11.11
237	0.2758	0.3172	0.4689	0.4413			0.3758	0.3516	0.3516	0.4482	0.4482			0.3999	-6.42
238	0.3379	0.3448	0.4344	0.4482			0.3913	0.3516	0.3516	0.4482	0.4482			0.3999	-2.20

Table A5k: Measured tyre pressure of vehicles in Kejetia station compared to the recommended tyre pressure

VEHICLE	MEASURED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	MANUFACTURER'S RECOMMENDED TYRE PRESSURE (N/mm^2)						AVERAGE (N/mm^2)	% DEVIATION
	FR	FL	RR	RL	RR	RL		FR	FL	RR	RL	RR	RL		
239	0.3585	0.3516	0.4413	0.4413			0.3982	0.3516	0.3516	0.4482	0.4482			0.3999	-0.43
240	0.3448	0.3103	0.4482	0.4344			0.3844	0.3516	0.3516	0.4482	0.4482			0.3999	-4.04
241	0.3448	0.3723	0.4413	0.4275			0.3965	0.3516	0.3516	0.4482	0.4482			0.3999	-0.87
242	0.3516	0.3861	0.4068	0.3999			0.3861	0.3516	0.3516	0.4482	0.4482			0.3999	-3.57
243	0.2689	0.2758	0.3448	0.3379	0.4482	0.3792	0.3425	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-10.74
244	0.2896	0.3034	0.4068	0.4137	0.3999	0.4482	0.3769	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-0.61
245	0.2758	0.2689	0.3999	0.4068	0.4206	0.4137	0.3643	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-4.10
246	0.2896	0.2965	0.4068	0.3930	0.4344	0.4413	0.3769	0.3103	0.3103	0.4137	0.4137	0.4137	0.4137	0.3792	-0.61
247	0.2620	0.3034	0.1931	0.0690			0.2069	0.2206	0.2206	0.2275	0.2620			0.2327	-12.50
248	0.2069	0.2206	0.2069	0.1931			0.2069	0.2206	0.2206	0.2275	0.2620			0.2327	-12.50
249	0.3654	0.3654	0.3585	0.2896			0.3448	0.3516	0.3516	0.4482	0.4482			0.3999	-16.00
250	0.2137	0.1793	0.2206	0.2137			0.2069	0.2069	0.2069	0.2689	0.2896			0.2430	-17.50

APPENDIX B

Table B1a: Measured values for Vehicle 1

Day	Time	Speedometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	39947	0	39.75	0.00	0.2758	0.2758	0.3448	0.3241	0.3051	
	12:00	39991	44	32.18	7.57	0.2758	0.2758	0.3448	0.3241	0.3051	0.1721
	15:00	40025	34	28.39	3.79	0.2758	0.2758	0.3448	0.3241	0.3051	0.1113
1	18:00	40055	30	24.61	3.79	0.2758	0.2758	0.3448	0.3241	0.3051	0.1262
	09:00	40080	25	75.71	7.57	0.2758	0.2758	0.3379	0.3172	0.3017	0.3028
	12:00	40111	31	71.92	3.79	0.2758	0.2758	0.3379	0.3172	0.3017	0.1221
	15:00	40141	30	68.14	3.79	0.2758	0.2758	0.3379	0.3172	0.3017	0.1262
2	18:00	40206	65	60.57	7.57	0.2758	0.2758	0.3379	0.3172	0.3017	0.1165
	09:00	40225	19	58.67	1.89	0.2896	0.2896	0.3585	0.3379	0.3189	0.0996
	12:00	40267	42	53.00	5.68	0.2896	0.2896	0.3585	0.3379	0.3189	0.1352
	15:00	40308	41	47.32	5.68	0.2896	0.2896	0.3585	0.3379	0.3189	0.1385
3	18:00	40349	41	41.64	5.68	0.2896	0.2896	0.3585	0.3379	0.3189	0.1385
	09:00	40422	73	30.28	11.36	0.2896	0.2758	0.3379	0.3379	0.3103	0.1556
	12:00	40454	32	24.61	5.68	0.2896	0.2896	0.3448	0.3310	0.3137	0.1774
	15:00	40486	32	18.93	5.68	0.2896	0.2896	0.3448	0.3310	0.3137	0.1774
4	18:00	40497	11	17.03	1.89	0.2896	0.2896	0.3448	0.3310	0.3137	0.1721

Table B1b: Measured values for Vehicle 1

Day	Time	Speedometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
5	18:00										
	09:00										
	12:00										
	15:00										
6	18:00										
	09:00										
	12:00										
	15:00										
7	18:00										
	09:00	40959	0	79.49	0.00	0.2758	0.2758	0.3448	0.3172	0.3034	
	12:00	40999	40	73.82	5.68	0.2758	0.2758	0.3448	0.3172	0.3034	0.1420
	15:00	41016	17	70.03	3.79	0.2758	0.2758	0.3448	0.3172	0.3034	0.2227
8	18:00	41045	29	66.24	3.79	0.2827	0.2827	0.3448	0.3241	0.3086	0.1305
	09:00										
	12:00										
	15:00										
9	18:00										

Table B1c: Measured values for Vehicle 1

Day	Time	Speedometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
10	18:00										
	09:00	44145	0	79.49	0.00	0.2551	0.2551	0.3172	0.3034	0.2827	
	12:00	44171	26	71.92	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.2912
	15:00	44203	32	64.35	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.2366
11	18:00	44256	53	56.78	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.1428
	09:00	44289	33	53.00	3.79	0.2551	0.2551	0.3172	0.3034	0.2827	0.1147
	12:00	44324	35	45.42	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.2163
	15:00	44359	35	37.85	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.2163
12	18:00	44432	73	30.28	7.57	0.2551	0.2551	0.3172	0.3034	0.2827	0.1037
	09:00	44471	39	26.50	3.79	0.2551	0.2689	0.3172	0.3034	0.2861	0.0971
	12:00	44498	27	22.71	3.79	0.2551	0.2689	0.3172	0.3034	0.2861	0.1402
	15:00	44519	21	15.14	7.57	0.2551	0.2689	0.3172	0.3034	0.2861	0.3605
13	18:00	44548	29	11.36	3.79	0.2620	0.2689	0.3241	0.3034	0.2896	0.1305
	09:00	44571	23	79.49	3.79	0.2620	0.2620	0.3241	0.3034	0.2879	0.1646
	12:00	44593	22	75.71	3.79	0.2620	0.2620	0.3241	0.3034	0.2879	0.1721
	15:00	44609	16	71.92	3.79	0.2620	0.2620	0.3241	0.3034	0.2879	0.2366
14	18:00	44638	29	68.14	3.79	0.2620	0.2620	0.3241	0.3034	0.2879	0.1305

Table B1d: Measured values for Vehicle 1

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	44800	162	37.85	30.28	0.2551	0.2551	0.3172	0.3034	0.2827	0.1869
	12:00	44846	46	32.18	5.68	0.2551	0.2551	0.3172	0.3034	0.2827	0.1234
	15:00	44887	41	26.50	5.68	0.2551	0.2551	0.3172	0.3034	0.2827	0.1385
15	18:00	44903	16	22.71	3.79	0.2551	0.2551	0.3172	0.3034	0.2827	0.2366
	09:00	44954	51	13.25	9.46	0.2551	0.2551	0.3172	0.2965	0.2810	0.1856
	12:00	44967	13	9.46	3.79	0.2551	0.2551	0.3172	0.2896	0.2792	0.2912
	15:00	44967	0	9.46	0.00	0.2551	0.2551	0.3172	0.2896	0.2792	
16	18:00	44985	18	79.49	3.79	0.2551	0.2551	0.3172	0.2896	0.2792	0.2103
	09:00	45051	66	70.03	9.46	0.2551	0.2551	0.3103	0.2896	0.2775	0.1434
	12:00	45100	49	62.46	7.57	0.2551	0.2551	0.3103	0.2896	0.2775	0.1545
	15:00	45146	46	54.89	7.57	0.2551	0.2551	0.3103	0.2896	0.2775	0.1646
17	18:00	45174	28	45.42	9.46	0.2551	0.2551	0.3103	0.2896	0.2775	0.3380
	09:00	45204	30	39.75	5.68	0.2620	0.2551	0.3172	0.3034	0.2844	0.1893
	12:00	45244	40	34.07	5.68	0.2689	0.2620	0.3172	0.3103	0.2896	0.1420
	15:00	45261	17	30.28	3.79	0.2620	0.2551	0.3103	0.3034	0.2827	0.2227
18	18:00	45298	37	22.71	7.57	0.2620	0.2551	0.3103	0.3034	0.2827	0.2046
	09:00	45319	21	18.93	3.79	0.2620	0.2551	0.3103	0.3034	0.2827	0.1803
	12:00	45348	29	13.25	5.68	0.2620	0.2551	0.3103	0.3103	0.2844	0.1958
	15:00	45377	29	7.57	5.68	0.2620	0.2551	0.3103	0.3103	0.2844	0.1958
19	18:00	45398	21	5.68	1.89	0.2620	0.2551	0.3103	0.3103	0.2844	0.0901

Table B1e: Measured values for Vehicle 1

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	47124	0	41.64	0.00	0.2551	0.2620	0.3103	0.3034	0.2827	
	15:00	47139	15	39.75	1.89	0.2620	0.2620	0.3103	0.3034	0.2844	0.1262
20	18:00	47156	17	35.96	3.79	0.2551	0.2620	0.3103	0.3034	0.2827	0.2227
	09:00	47186	30	30.28	5.68	0.2482	0.2551	0.3034	0.2965	0.2758	0.1893
	12:00	47210	24	26.50	3.79	0.2551	0.2551	0.3103	0.3034	0.2810	0.1577
	15:00	47221	11	24.61	1.89	0.2620	0.2620	0.3103	0.3103	0.2861	0.1721
21	18:00	47236	15	22.71	3.79	0.2551	0.2551	0.3103	0.3034	0.2810	0.2524
	09:00	47266	30	17.03	5.68	0.2551	0.2482	0.3034	0.2965	0.2758	0.1893
	12:00	47290	24	13.25	3.79	0.2551	0.2551	0.3103	0.3034	0.2810	0.1577
	15:00	47304	14	11.36	1.89	0.2620	0.2620	0.3172	0.3172	0.2896	0.1352
22	18:00	47326	22	79.49	3.79	0.2551	0.2551	0.3103	0.3034	0.2810	0.1721
	09:00										
	12:00										
	15:00										
23	18:00										
	09:00										
	12:00										
	15:00										
24	18:00										

Table B1f: Measured values for Vehicle 1

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	Fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
25	18:00										
	09:00										
	12:00	48031	0	24.61	0.00	0.2482	0.2620	0.3034	0.2896	0.2758	
	15:00	48045	14	22.71	1.89	0.2551	0.2620	0.3034	0.2896	0.2775	0.1352
26	18:00	48070	25	18.93	3.79	0.2482	0.2620	0.3034	0.2896	0.2758	0.1514
	09:00	48077	7	17.03	1.89	0.2413	0.2620	0.3034	0.2896	0.2741	0.2704
	12:00	48084	7	15.14	1.89	0.2413	0.2551	0.3034	0.2896	0.2724	0.2704
	15:00										
27	18:00										
	09:00										
	12:00										
	15:00										
28	18:00										
	09:00										
	12:00										
	15:00										
29	18:00										

Table B2a: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)					
						Right Front	Left Front	Right Rear	Left Rear	Average (N/mm^2)	fuel Consumption (litres/km)
	09:00	47060	0	26.50	0.00	0.2896	0.2758	0.1931	0.3034	0.2655	
	12:00	47101	41	17.03	9.46	0.2896	0.2758	0.1931	0.3034	0.2655	0.2308
	15:00	47126	25	11.36	5.68	0.2896	0.2758	0.1931	0.3034	0.2655	0.2271
1	18:00	47165	39	3.79	7.57	0.2896	0.2758	0.1931	0.3034	0.2655	0.1941
	09:00	47225	60	75.71	11.36	0.2896	0.2758	0.1931	0.3034	0.2655	0.1893
	12:00	47255	30	70.03	5.68	0.2896	0.2758	0.1931	0.3034	0.2655	0.1893
	15:00	47284	29	64.35	5.68	0.2896	0.2758	0.1931	0.3034	0.2655	0.1958
2	18:00	47324	40	56.78	7.57	0.2896	0.2758	0.1931	0.3034	0.2655	0.1893
	09:00										
	12:00										
	15:00										
3	18:00										
	09:00	47380	56	47.32	9.46	0.2896	0.2758	0.1931	0.3034	0.2655	0.1690
	12:00	47417	37	41.64	5.68	0.3034	0.2965	0.2000	0.3172	0.2792	0.1535
	15:00	47433	16	37.85	3.79	0.3034	0.2965	0.2000	0.3172	0.2792	0.2366
4	18:00	47471	38	32.18	5.68	0.3034	0.2965	0.2000	0.3172	0.2792	0.1494

Table B2b: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
5	18:00										
	09:00										
	12:00										
	15:00										
6	18:00										
	09:00										
	12:00										
	15:00										
7	18:00										
	09:00	48535	0	18.93	0.00	0.2827	0.2758	0.3310	0.3034	0.2982	
	12:00	48573	38	81.39	5.68	0.3034	0.2758	0.3310	0.3034	0.3034	0.1494
	15:00	48598	25	75.71	3.79	0.3034	0.2758	0.3310	0.3034	0.3034	0.1514
8	18:00	48644	46	68.14	7.57	0.2827	0.2758	0.3310	0.3034	0.2982	0.1646
	09:00										
	12:00										
	15:00										
9	18:00										

Table B2c: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	52800	0	1.89	0.00	0.2758	0.3448	0.3172	0.2896	0.3068	
	15:00										
10	18:00										
	09:00										
	12:00										
	15:00										
11	18:00										
	09:00	52889	0	83.28	0.00	0.2758	0.3448	0.3172	0.2896	0.3068	
	12:00	52909	20	79.49	3.79	0.2758	0.3448	0.3172	0.2896	0.3068	0.1893
	15:00	52960	51	71.92	7.57	0.2758	0.3448	0.3241	0.2896	0.3086	0.1484
12	18:00	52998	38	68.14	3.79	0.2758	0.3448	0.3241	0.2896	0.3086	0.0996
	09:00	53064	66	56.78	11.36	0.2758	0.3448	0.3103	0.2896	0.3051	0.1721
	12:00	53123	59	49.21	7.57	0.2758	0.3172	0.2896	0.2827	0.2913	0.1283
	15:00	53158	35	45.42	3.79	0.2758	0.3172	0.2896	0.2827	0.2913	0.1082
13	18:00	53197	39	37.85	7.57	0.2758	0.3172	0.2896	0.2827	0.2913	0.1941
	09:00	53225	28	34.07	3.79	0.2827	0.3310	0.2896	0.2758	0.2948	0.1352
	12:00	53259	34	28.39	5.68	0.2827	0.3310	0.2896	0.2758	0.2948	0.1670
	15:00	53289	30	22.71	5.68	0.2827	0.3241	0.2827	0.2758	0.2913	0.1893
14	18:00	53308	19	83.28	3.79	0.2827	0.3241	0.2827	0.2758	0.2913	0.1992

Table B2d: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	53379	71	64.35	15.14	0.1655	0.3172	0.2689	0.2620	0.2534	0.2133
	12:00	53404	25	58.67	5.68	0.1655	0.3172	0.2689	0.2620	0.2534	0.2271
	15:00	53475	71	43.53	15.14	0.1655	0.3172	0.2689	0.2620	0.2534	0.2133
15	18:00	53529	54	34.07	9.46	0.1655	0.3172	0.2689	0.2620	0.2534	0.1753
	09:00	53601	72	22.71	11.36	0.1586	0.3172	0.2689	0.2551	0.2499	0.1577
	12:00	53654	53	11.36	11.36	0.1586	0.3172	0.2689	0.2551	0.2499	0.2143
	15:00	53681	27	5.68	5.68	0.1586	0.3172	0.2620	0.2482	0.2465	0.2103
16	18:00	53703	22	1.89	3.79	0.1586	0.3172	0.2620	0.2482	0.2465	0.1721
	09:00	53733	30	79.49	5.68	0.1586	0.3172	0.2620	0.2413	0.2448	0.1893
	12:00	53779	46	71.92	7.57	0.1586	0.3172	0.2620	0.2413	0.2448	0.1646
	15:00	53813	34	66.24	5.68	0.1586	0.3172	0.2620	0.2413	0.2448	0.1670
17	18:00	53859	46	56.78	9.46	0.1586	0.3172	0.2620	0.2413	0.2448	0.2057
	09:00										
	12:00	53968	109	41.64	15.14	0.4137	0.3034	0.2896	0.2758	0.3206	0.1389
	15:00	53999	31	35.96	5.68	0.4137	0.3034	0.2896	0.2758	0.3206	0.1832
18	18:00	54027	28	32.18	3.79	0.4137	0.3034	0.2896	0.2758	0.3206	0.1352
	09:00	54067	40	26.50	5.68	0.4137	0.3034	0.2896	0.2758	0.3206	0.1420
	12:00	54099	32	20.82	5.68	0.4137	0.3034	0.2896	0.2758	0.3206	0.1774
	15:00	54126	27	17.03	3.79	0.4137	0.3034	0.2896	0.2758	0.3206	0.1402
19	18:00	54166	40	9.46	7.57	0.4137	0.3034	0.2896	0.2758	0.3206	0.1893

Table B2e: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	55802	0	45.42	0.00	0.2827	0.3310	0.2758	0.2620	0.2879	
	15:00	55833	31	39.75	5.68	0.2827	0.3310	0.2827	0.2620	0.2896	0.1832
20	18:00	55851	18	35.96	3.79	0.2758	0.3310	0.2758	0.2551	0.2844	0.2103
	09:00	55883	32	32.18	3.79	0.2758	0.3379	0.2827	0.2620	0.2896	0.1183
	12:00	55916	33	28.39	3.79	0.2896	0.3310	0.2758	0.2620	0.2896	0.1147
	15:00	55929	13	26.50	1.89	0.2896	0.3310	0.2758	0.2551	0.2879	0.1456
21	18:00	55947	18	22.71	3.79	0.2827	0.3310	0.2758	0.2620	0.2879	0.2103
	09:00	55964	17	18.93	3.79	0.2758	0.3241	0.2758	0.2551	0.2827	0.2227
	12:00	55985	21	79.49	3.79	0.2758	0.3310	0.2758	0.2620	0.2861	0.1803
	15:00										
22	18:00										
	09:00										
	12:00										
	15:00										
23	18:00										
	09:00										
	12:00										
	15:00										
24	18:00										

Table B2f: Measured values for Vehicle 2

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	56295	0	41.64	0.00	0.3034	0.3861	0.2620	0.2344	0.2965	
	12:00										
	15:00										
25	18:00										
	09:00	56911	0	18.93	0.00	0.3034	0.3861	0.3310	0.3034	0.3310	
	12:00	56923	12	17.03	1.89	0.3172	0.3861	0.3379	0.3034	0.3361	0.1577
	15:00	56933	10	15.14	1.89	0.3034	0.3861	0.3379	0.3034	0.3327	0.1893
26	18:00	56942	19	11.36	3.79	0.3103	0.3792	0.3379	0.3034	0.3327	0.1992
	09:00	56955	13	9.46	1.89	0.3241	0.3861	0.3379	0.3034	0.3379	0.1456
	12:00	56983	28	60.57	3.79	0.3172	0.3861	0.3379	0.3034	0.3361	0.1352
	15:00	56999	16	56.78	3.79	0.3103	0.3792	0.3310	0.2965	0.3292	0.2366
27	18:00	57021	22	53.00	3.79	0.3172	0.3861	0.3379	0.3034	0.3361	0.1721
	09:00	57055	34	49.21	3.79	0.3241	0.3999	0.3448	0.3172	0.3465	0.1113
	12:00	57074	19	45.42	3.79	0.3172	0.3861	0.3379	0.3034	0.3361	0.1992
	15:00	57084	10	43.53	1.89	0.3172	0.3861	0.3379	0.3034	0.3361	0.1893
28	18:00	57121	37	37.85	5.68	0.3310	0.3861	0.3379	0.3034	0.3396	0.1535
	09:00	57151	30	34.07	3.79	0.3172	0.3861	0.3379	0.3034	0.3361	0.1262
	12:00	57191	40	26.50	7.57	0.3172	0.3861	0.3379	0.3034	0.3361	0.1893
	15:00	57234	43	18.93	7.57	0.3034	0.3792	0.3448	0.3103	0.3344	0.1761
29	18:00	57246	12	17.03	1.89	0.3034	0.3792	0.3516	0.3103	0.3361	0.1577

Table B3a: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)					
						Right Front	Left Front	Right Rear	Left Rear	Average (N/mm^2)	fuel Consumption (litres/km)
	09:00	42322	0	34.07	0.00	0.3310	0.3310	0.3241	0.3310	0.3120	
	12:00	42361	39	26.50	7.57	0.3310	0.3310	0.3241	0.3310	0.3120	0.1941
	15:00	42399	38	20.82	5.68	0.3310	0.3310	0.3241	0.3310	0.3120	0.1494
1	18:00	42419	20	15.14	5.68	0.3310	0.3310	0.3241	0.3310	0.3120	0.2839
	09:00	42469	50	7.57	7.57	0.3310	0.3310	0.3241	0.3310	0.3120	0.1514
	12:00	42509	40	1.89	5.68	0.3310	0.3310	0.3241	0.3310	0.3120	0.1420
	15:00	42548	39	75.71	7.57	0.3310	0.3310	0.3241	0.3310	0.3120	0.1941
2	18:00	42576	28	68.14	7.57	0.3310	0.3310	0.3241	0.3310	0.3120	0.2704
	09:00	42611	35	62.46	5.68	0.3310	0.3310	0.3241	0.3310	0.3120	0.1622
	12:00										
	15:00										
3	18:00										
	09:00	42637	26	58.67	3.79	0.3310	0.3379	0.3379	0.3379	0.3206	0.1456
	12:00	42676	39	54.89	3.79	0.3448	0.3448	0.3448	0.3448	0.3275	0.0971
	15:00	42698	22	49.21	5.68	0.3448	0.3448	0.3448	0.3448	0.3275	0.2581
4	18:00	42731	33	43.53	5.68	0.3448	0.3448	0.3448	0.3448	0.3275	0.1721

Table B3b: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
5	18:00										
	09:00										
	12:00										
	15:00										
6	18:00										
	09:00										
	12:00										
	15:00										
7	18:00										
	09:00	43302	0	83.28	0.00	0.3379	0.3379	0.3310	0.3379	0.3189	
	12:00	43354	52	73.82	9.46	0.3379	0.3379	0.3310	0.3379	0.3189	0.1820
	15:00	43374	20	70.03	3.79	0.3379	0.3379	0.3310	0.3379	0.3189	0.1893
8	18:00	43394	20	66.24	3.79	0.3379	0.3379	0.3310	0.3379	0.3189	0.1893
	09:00										
	12:00										
	15:00										
9	18:00										

Table B3c: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	46202	0	34.07	0.00	0.4413	0.3999	0.3310	0.3999	0.3585	
	15:00	46232	30	30.28	3.79	0.4413	0.3999	0.3310	0.3999	0.3585	0.1262
10	18:00	46275	43	22.71	7.57	0.4413	0.3999	0.3310	0.3999	0.3585	0.1761
	09:00	46291	16	81.39	3.79	0.3792	0.3310	0.3930	0.3310	0.3361	0.2366
	12:00	46340	49	73.82	7.57	0.3861	0.3241	0.3241	0.3241	0.3206	0.1545
	15:00	46367	27	70.03	3.79	0.3861	0.3241	0.3241	0.3241	0.3206	0.1402
11	18:00	46395	28	66.24	3.79	0.3861	0.3241	0.3241	0.3241	0.3206	0.1352
	09:00	46431	36	62.46	3.79	0.3861	0.3241	0.3241	0.3241	0.3206	0.1052
	12:00	46463	32	56.78	5.68	0.3861	0.3241	0.3241	0.3241	0.3206	0.1774
	15:00	46494	31	49.21	7.57	0.3861	0.3241	0.3241	0.3241	0.3206	0.2442
12	18:00	46528	34	37.85	11.36	0.3861	0.3241	0.3241	0.3241	0.3206	0.3340
	09:00	46573	45	32.18	5.68	0.3861	0.3241	0.3241	0.3241	0.3206	0.1262
	12:00	46601	28	28.39	3.79	0.3585	0.4137	0.4137	0.4137	0.3827	0.1352
	15:00	46639	38	20.82	7.57	0.2896	0.4137	0.4137	0.4137	0.3654	0.1992
13	18:00	46660	21	17.03	3.79	0.2896	0.4137	0.4137	0.4137	0.3654	0.1803
	09:00	46678	18	15.14	1.89	0.3448	0.4068	0.4137	0.4068	0.3775	0.1052
	12:00	46692	14	79.49	3.79	0.3379	0.4068	0.4137	0.4068	0.3758	0.2704
	15:00	46713	21	75.71	3.79	0.3379	0.4068	0.4137	0.4068	0.3758	0.1803
14	18:00	46744	31	71.92	3.79	0.3379	0.4068	0.4137	0.4068	0.3758	0.1221

Table B3d: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	47593	0	79.49	0.00	0.3448	0.3861	0.3999	0.3861	0.3689	
	12:00	47629	36	75.71	3.79	0.3448	0.3861	0.3999	0.3861	0.3689	0.1052
	15:00	47674	45	68.14	7.57	0.3448	0.3861	0.3999	0.3861	0.3689	0.1682
15	18:00	47701	27	60.57	7.57	0.3448	0.3861	0.3999	0.3861	0.3689	0.2804
	09:00	47753	52	53.00	7.57	0.3379	0.3861	0.3930	0.3861	0.3654	0.1456
	12:00	47798	45	45.42	7.57	0.3379	0.3861	0.3861	0.3861	0.3620	0.1682
	15:00	47821	23	37.85	7.57	0.3379	0.3861	0.3861	0.3861	0.3620	0.3292
16	18:00	47866	45	28.39	9.46	0.3379	0.3861	0.3861	0.3861	0.3620	0.2103
	09:00	47901	35	18.93	9.46	0.3310	0.3861	0.3792	0.3861	0.3568	0.2704
	12:00	47925	24	79.49	3.79	0.3310	0.3861	0.3792	0.3861	0.3568	0.1577
	15:00	47964	39	73.82	5.68	0.3310	0.3861	0.3792	0.3861	0.3568	0.1456
17	18:00	47980	16	70.03	3.79	0.3310	0.3861	0.3792	0.3861	0.3568	0.2366
	09:00										
	12:00	48039	59	62.46	7.57	0.3516	0.3861	0.3930	0.3861	0.3689	0.1283
	15:00	48073	34	56.78	5.68	0.3516	0.3861	0.3930	0.3861	0.3689	0.1670
18	18:00	48107	34	49.21	7.57	0.3516	0.3861	0.3930	0.3861	0.3689	0.2227
	09:00	48135	28	41.64	7.57	0.3516	0.3861	0.3930	0.3861	0.3689	0.2704
	12:00	48174	39	34.07	7.57	0.3516	0.3861	0.3930	0.3861	0.3689	0.1941
	15:00	48208	34	26.50	7.57	0.3516	0.3861	0.3930	0.3861	0.3689	0.2227
19	18:00	48249	41	22.71	3.79	0.3516	0.3861	0.3930	0.3861	0.3689	0.0923

Table B3e: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	49905	0	45.42	0.00	0.3379	0.3654	0.3930	0.3654	0.3585	
	15:00	49928	23	41.64	3.79	0.3379	0.3654	0.3930	0.3654	0.3585	0.1646
20	18:00	49940	12	39.75	1.89	0.3379	0.3654	0.3930	0.3654	0.3585	0.1577
	09:00	49960	20	35.96	3.79	0.3379	0.3654	0.3861	0.3654	0.3568	0.1893
	12:00	49985	25	32.18	3.79	0.3448	0.3723	0.3861	0.3723	0.3603	0.1514
	15:00	50001	16	30.28	1.89	0.3448	0.3723	0.3861	0.3723	0.3603	0.1183
21	18:00	50024	23	28.39	1.89	0.3585	0.3723	0.3861	0.3723	0.3654	0.0823
	09:00	50042	22	26.50	1.89	0.3585	0.3723	0.3930	0.3723	0.3672	0.0860
	12:00	50068	26	22.71	3.79	0.3448	0.3723	0.3861	0.3723	0.3603	0.1456
	15:00	50090	22	79.49	3.79	0.3448	0.3723	0.3861	0.3723	0.3568	0.1721
22	18:00	50111	21	75.71	3.79	0.3448	0.3723	0.3861	0.3723	0.3603	0.1803
	09:00										
	12:00										
	15:00										
23	18:00										
	09:00										
	12:00										
	15:00										
24	18:00										

Table B3f: Measured values for Vehicle 3

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
25	18:00										
	09:00										
	12:00	50810	0	26.50	0.00	0.3448	0.3585	0.3585	0.3585	0.3482	
	15:00	50821	11	24.61	1.89	0.3379	0.3654	0.3585	0.3654	0.3499	0.1721
26	18:00	50841	20	20.82	3.79	0.3448	0.3585	0.3585	0.3585	0.3482	0.1893
	09:00	50863	22	17.03	3.79	0.3379	0.3585	0.3516	0.3585	0.3448	0.1721
	12:00	50905	42	9.46	7.57	0.3448	0.3585	0.3585	0.3585	0.3482	0.1803
	15:00	50932	27	60.57	3.79	0.3379	0.3585	0.3585	0.3585	0.3465	0.1402
27	18:00	50955	23	56.78	3.79	0.3448	0.3585	0.3585	0.3585	0.3499	0.1646
	09:00	50987	32	53.00	3.79	0.3448	0.3585	0.3585	0.3585	0.3482	0.1183
	12:00	51007	20	49.21	3.79	0.3448	0.3585	0.3585	0.3585	0.3482	0.1893
	15:00										
28	18:00										
	09:00										
	12:00										
	15:00										
29	18:00										

Table B4a: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)					
						Right Front	Left Front	Right Rear	Left Rear	Average (N/mm^2)	fuel Consumption (litres/km)
	09:00	47550	0	37.85	0.00	0.3034	0.3310	0.3723	0.3861	0.3482	
	12:00	47599	49	30.28	7.57	0.3034	0.3310	0.3723	0.3861	0.3482	0.1545
	15:00	47627	28	26.50	3.79	0.3034	0.3310	0.3723	0.3861	0.3482	0.1352
1	18:00	47678	51	18.93	7.57	0.3034	0.3310	0.3723	0.3861	0.3482	0.1484
	09:00	47697	19	15.14	3.79	0.2965	0.3310	0.3723	0.3792	0.3448	0.1992
	12:00	47762	65	3.79	11.36	0.2965	0.3310	0.3723	0.3792	0.3448	0.1747
	15:00										
2	18:00										
	09:00										
	12:00										
	15:00										
3	18:00										
	09:00										
	12:00	48384	622	41.64	83.28	0.3103	0.3448	0.3861	0.3999	0.3603	0.1339
	15:00	48417	33	35.96	5.68	0.3103	0.3448	0.3861	0.3999	0.3603	0.1721
4	18:00	48450	33	30.28	5.68	0.3103	0.3448	0.3861	0.3999	0.3603	0.1721

Table B4b: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
5	18:00										
	09:00										
	12:00										
	15:00										
6	18:00										
	09:00										
	12:00										
	15:00										
7	18:00										
	09:00	49045	0	83.28	0.00	0.3034	0.3310	0.3034	0.3861	0.3310	
	12:00	49098	53	71.92	11.36	0.3034	0.3310	0.3034	0.3861	0.3310	0.2143
	15:00	49115	17	68.14	3.79	0.3034	0.3310	0.3034	0.3861	0.3310	0.2227
8	18:00	49132	17	64.35	3.79	0.3034	0.3310	0.3034	0.3861	0.3310	0.2227
	09:00										
	12:00										
	15:00										
9	18:00										

Table B4b: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
10	18:00										
	09:00	52579	0	83.28	0.00	0.3516	0.3310	0.3448	0.3585	0.3465	
	12:00	52634	55	75.71	7.57	0.3723	0.3448	0.3723	0.3792	0.3672	0.1377
	15:00	52669	35	71.92	3.79	0.3723	0.3448	0.3723	0.3792	0.3672	0.1082
11	18:00	52705	36	68.14	3.79	0.3723	0.3448	0.3723	0.3792	0.3672	0.1052
	09:00	52737	32	64.35	3.79	0.3723	0.3448	0.3654	0.3792	0.3654	0.1183
	12:00	52774	37	60.57	3.79	0.3723	0.3448	0.3654	0.3792	0.3654	0.1023
	15:00	52811	37	53.00	7.57	0.3723	0.3448	0.3654	0.3792	0.3654	0.2046
12	18:00	52842	31	45.42	7.57	0.3723	0.3448	0.3654	0.3792	0.3654	0.2442
	09:00	52871	29	41.64	3.79	0.3448	0.3448	0.3448	0.3792	0.3534	0.1305
	12:00	52925	54	32.18	9.46	0.3723	0.3448	0.3723	0.3448	0.3585	0.1753
	15:00	52941	16	28.39	3.79	0.3723	0.3448	0.3723	0.3448	0.3585	0.2366
13	18:00	52978	37	20.82	7.57	0.3723	0.3448	0.3723	0.3448	0.3585	0.2046
	09:00	52994	16	83.28	1.89	0.4689	0.5240	0.4620	0.4689	0.4809	0.1183
	112:00	53021	27	77.60	5.68	0.4689	0.5240	0.4620	0.4689	0.4809	0.2103
	15:00	53056	35	71.92	5.68	0.4620	0.5171	0.4620	0.4689	0.4775	0.1622
14	18:00	53089	33	66.24	5.68	0.4620	0.5171	0.4551	0.4689	0.4758	0.1721

Table B4d: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	53130	41	58.67	7.57	0.4551	0.5033	0.4551	0.4689	0.4706	0.1847
	12:00	53184	54	51.10	7.57	0.4551	0.4964	0.4551	0.4689	0.4689	0.1402
	15:00	53226	42	45.42	5.68	0.4482	0.4964	0.4551	0.4689	0.4671	0.1352
15	18:00	53242	16	41.64	3.79	0.4482	0.4964	0.4551	0.4689	0.4671	0.2366
	09:00	53287	45	34.07	7.57	0.4482	0.4964	0.4551	0.4620	0.4654	0.1682
	12:00	53321	34	28.39	5.68	0.4482	0.4964	0.4551	0.4620	0.4654	0.1670
	15:00	53366	45	22.71	5.68	0.4482	0.4964	0.4551	0.4620	0.4654	0.1262
16	18:00	53391	25	15.14	7.57	0.4482	0.4964	0.4551	0.4620	0.4654	0.3028
	09:00	53416	25	9.46	5.68	0.4413	0.4964	0.4551	0.4620	0.4637	0.2271
	12:00	53443	27	79.49	3.79	0.4413	0.4964	0.4551	0.4620	0.4637	0.1402
	15:00	53487	44	71.92	7.57	0.4413	0.4964	0.4551	0.4620	0.4637	0.1721
17	18:00	53511	24	68.14	3.79	0.4413	0.4964	0.4551	0.4620	0.4637	0.1577
	09:00	53543	32	62.46	5.68	0.4482	0.5033	0.4620	0.4620	0.4689	0.1774
	12:00	53590	47	54.89	7.57	0.4620	0.5102	0.4620	0.4689	0.4758	0.1611
	15:00	53621	31	47.32	7.57	0.4620	0.5102	0.4620	0.4689	0.4758	0.2442
18	18:00	53659	38	41.64	5.68	0.4620	0.5102	0.4620	0.4689	0.4758	0.1494
	09:00	53688	29	34.07	7.57	0.4551	0.5171	0.4551	0.4689	0.4740	0.2611
	12:00	53720	32	26.50	7.57	0.4620	0.5171	0.4620	0.4689	0.4775	0.2366
	15:00	53759	39	18.93	7.57	0.4620	0.5102	0.4620	0.4689	0.4758	0.1941
19	18:00	53791	32	13.25	5.68	0.4620	0.5102	0.4620	0.4689	0.4758	0.1774

Table B4e: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	55703	0	49.21							
	12:00	55725	22	45.42	3.79	0.4068	0.4275	0.4551	0.4620	0.4378	0.1721
	15:00	55739	14	41.64	3.79	0.4137	0.4413	0.4551	0.4620	0.4430	0.2704
20	18:00	55757	18	37.85	3.79	0.4068	0.4275	0.4551	0.4620	0.4378	0.2103
	09:00										
	12:00										
	15:00										
21	18:00										
	09:00	56093	0	37.85	0.00	0.4068	0.4275	0.4551	0.4620	0.4378	
	12:00	56134	41	79.49	3.79	0.4068	0.4275	0.4551	0.4620	0.4378	0.0923
	15:00	56146	12	77.60	1.89	0.3999	0.4344	0.4620	0.4620	0.4396	0.1577
22	18:00	56174	28	73.82	3.79	0.4068	0.4275	0.4551	0.4620	0.4378	0.1352
	09:00										
	12:00										
	15:00										
23	18:00										
	09:00										
	12:00										
	15:00										
24	18:00										

Table B4f: Measured values for Vehicle 4

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
25	18:00										
	09:00										
	12:00	57334	0	22.71	0.00	0.3792	0.4068	0.4413	0.4413	0.4171	
	15:00	57345	11	20.82	1.89	0.3792	0.4068	0.4413	0.4413	0.4171	0.1721
26	18:00	57359	14	18.93	1.89	0.3861	0.4137	0.4413	0.4413	0.4206	0.1352
	09:00	57370	11	17.03	1.89	0.3861	0.4137	0.4482	0.4413	0.4223	0.1721
	12:00	57398	28	13.25	3.79	0.3861	0.4068	0.4413	0.4413	0.4189	0.1352
	15:00	57413	15	60.57	1.89	0.3861	0.4068	0.4413	0.4413	0.4189	0.1262
27	18:00	57432	19	56.78	3.79	0.3792	0.3930	0.4482	0.4482	0.4171	0.1992
	09:00	57472	40	51.10	5.68	0.3861	0.4068	0.4413	0.4413	0.4189	0.1420
	12:00	57486	14	49.21	1.89	0.3930	0.4137	0.4482	0.4482	0.4258	0.1352
	15:00	57509	23	45.42	3.79	0.3861	0.4068	0.4413	0.4413	0.4189	0.1646
28	18:00	57532	23	41.64	3.79	0.3792	0.4068	0.4413	0.4413	0.4171	0.1646
	09:00	57565	33	37.85	3.79	0.3792	0.4068	0.4413	0.4344	0.4154	0.1147
	12:00	57593	28	34.07	3.79	0.3861	0.4068	0.4413	0.4413	0.4189	0.1352
	15:00										
29	18:00										

Table B5a: Measured values for Vehicle 5

Day	Time	Speed-ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)					
						Right Front	Left Front	Right Rear	Left Rear	Average (N/mm^2)	fuel Consumption (litres/km)
	09:00	52022	0	35.96	0.0000	0.2344	0.2344	0.2896	0.3103	0.2672	
	12:00	52057	35	30.28	0.5678	0.2344	0.2344	0.2896	0.3103	0.2672	0.1622
	15:00	52091	34	26.50	0.3785	0.2344	0.2344	0.2896	0.3103	0.2672	0.1113
1	18:00	52102	11	24.61	0.1893	0.2344	0.2344	0.2896	0.3103	0.2672	0.1721
	09:00	52137	35	18.93	0.5678	0.2344	0.2344	0.2896	0.3103	0.2672	0.1622
	12:00	52165	28	15.14	0.3785	0.2344	0.2344	0.2896	0.3103	0.2672	0.1352
	15:00	52192	27	11.36	0.3785	0.2344	0.2344	0.2896	0.3103	0.2672	0.1402
2	18:00	52248	56	3.79	0.7571	0.2344	0.2344	0.2896	0.3103	0.2672	0.1352
	09:00	52290	42	68.14	0.7571	0.2344	0.2413	0.2965	0.3103	0.2706	0.1803
	12:00	52341	51	60.57	0.7571	0.2413	0.2551	0.3034	0.3241	0.2810	0.1484
	15:00	52385	44	51.10	0.9464	0.2413	0.2551	0.3034	0.3241	0.2810	0.2151
3	18:00	52426	41	45.42	0.5678	0.2413	0.2551	0.3034	0.3241	0.2810	0.1385
	09:00	52469	43	37.85	0.7571	0.2413	0.2551	0.3034	0.3241	0.2810	0.1761
	12:00	52504	35	30.28	0.7571	0.2551	0.2413	0.3034	0.3241	0.2810	0.2163
	15:00	52527	23	28.39	0.1893	0.2551	0.2413	0.3034	0.3241	0.2810	0.0823
4	18:00	52559	32	24.61	0.3785	0.2551	0.2413	0.3034	0.3241	0.2810	0.1183

Table B5b: Measured values for Vehicle 5

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
5	18:00										
	09:00										
	12:00										
	15:00										
6	18:00										
	09:00										
	12:00										
	15:00										
7	18:00										
	09:00	53113	0	79.49	0.0000	0.2206	0.2344	0.2896	0.3103	0.2637	
	12:00	53156	43	71.92	0.7571	0.2206	0.2344	0.2896	0.3103	0.2637	0.1761
	15:00	53168	12	70.03	0.1893	0.2206	0.2344	0.2896	0.3103	0.2637	0.1577
8	18:00	53180	12	68.14	0.1893	0.2206	0.2344	0.2896	0.3103	0.2637	0.1577
	09:00										
	12:00										
	15:00										
9	18:00										

Table B5c: Measured values for Vehicle 5

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
10	18:00										
	09:00	56416	0	79.49	0.0000	0.3448	0.2689	0.3172	0.3172	0.3120	
	12:00	56465	49	71.92	0.7571	0.2896	0.2827	0.3310	0.3310	0.3086	0.1545
	15:00	56501	36	64.35	0.7571	0.2896	0.2827	0.3310	0.3310	0.3086	0.2103
11	18:00	56536	35	56.78	0.7571	0.2896	0.2827	0.3310	0.3310	0.3086	0.2163
	09:00	56580	44	49.21	0.7571	0.2896	0.2827	0.3310	0.3241	0.3068	0.1721
	12:00	56602	22	47.32	0.1893	0.2896	0.2827	0.3310	0.3241	0.3068	0.0860
	15:00	56623	21	45.42	0.1893	0.2896	0.2827	0.3310	0.3241	0.3068	0.0901
12	18:00	56676	53	41.64	0.3785	0.2896	0.2827	0.3310	0.3241	0.3068	0.0714
	09:00	56708	32	34.07	0.7571	0.2896	0.2827	0.3310	0.3241	0.3068	0.2366
	12:00	56745	37	26.50	0.7571	0.3448	0.3448	0.4137	0.4137	0.3792	0.2046
	15:00	56790	45	18.93	0.7571	0.3448	0.3448	0.4137	0.4137	0.3792	0.1682
13	18:00	56821	31	11.36	0.7571	0.3448	0.3448	0.4137	0.4137	0.3792	0.2442
	09:00	56849	28	79.49	0.3785	0.3379	0.3448	0.4068	0.4068	0.3741	0.1352
	12:00	56871	22	75.71	0.3785	0.3379	0.3448	0.4068	0.4068	0.3741	0.1721
	15:00	56889	18	71.92	0.3785	0.3379	0.3448	0.4068	0.4068	0.3741	0.2103
14	18:00	56911	22	68.14	0.3785	0.3379	0.3448	0.4068	0.4068	0.3741	0.1721

Table B5d: Measured values for Vehicle 5

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00	57880	0	43.53	0.0000	0.3310	0.3448	0.4068	0.3999	0.3706	
	12:00	57934	54	37.85	0.5678	0.3310	0.3448	0.4068	0.3999	0.3706	0.1052
	15:00	57960	26	30.28	0.7571	0.3310	0.3448	0.4068	0.3999	0.3706	0.2912
15	18:00	57981	21	28.39	0.1893	0.3310	0.3448	0.4068	0.3999	0.3706	0.0901
	09:00	58002	21	26.50	0.1893	0.3241	0.3379	0.4068	0.3999	0.3672	0.0901
	12:00	58053	51	18.93	0.7571	0.3241	0.3379	0.4068	0.3999	0.3672	0.1484
	15:00	58066	13	17.03	0.1893	0.3241	0.3379	0.4068	0.3999	0.3672	0.1456
16	18:00	58066	0	17.03	0.0000	0.3241	0.3379	0.4068	0.3999	0.3672	
	09:00	58099	33	7.57	0.9464	0.3172	0.3379	0.3999	0.3999	0.3637	0.2868
	12:00	58120	21	79.49	0.3785	0.3172	0.3379	0.3999	0.3999	0.3637	0.1803
	15:00	58158	38	75.71	0.3785	0.3172	0.3379	0.3999	0.3999	0.3637	0.0996
17	18:00	58199	41	68.14	0.7571	0.3172	0.3379	0.3999	0.3999	0.3637	0.1847
	09:00										
	12:00										
	15:00	58298	99	47.32	2.0820	0.3723	0.3654	0.4137	0.4068	0.3896	0.2103
18	18:00	58327	29	43.53	0.3785	0.3723	0.3654	0.4137	0.4068	0.3896	0.1305
	09:00	58405	78	35.96	0.7571	0.3723	0.3654	0.4137	0.4068	0.3896	0.0971
	12:00	58449	44	28.39	0.7571	0.3723	0.3654	0.4137	0.4068	0.3896	0.1721
	15:00	58478	29	24.61	0.3785	0.3723	0.3654	0.4137	0.4068	0.3896	0.1305
19	18:00	58509	31	15.14	0.9464	0.3723	0.3654	0.4137	0.4068	0.3896	0.3053

Table B5e: Measured values for Vehicle 5

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00	59810	0	35.96	0.0000	0.3654	0.3585	0.4068	0.3999	0.3827	
	15:00	59837	27	32.18	0.3785	0.3654	0.3585	0.4068	0.3999	0.3827	0.1402
20	18:00	59863	26	28.39	0.3785	0.3654	0.3585	0.4068	0.3999	0.3827	0.1456
	09:00	59892	29	24.61	0.3785	0.3723	0.3654	0.4206	0.4137	0.3930	0.1305
	12:00	59918	26	20.82	0.3785	0.3723	0.3654	0.4137	0.4068	0.3896	0.1456
	15:00	59929	11	18.93	0.1893	0.3654	0.3654	0.4137	0.4068	0.3878	0.1721
21	18:00	59940	11	17.03	0.1893	0.3723	0.3654	0.4137	0.4068	0.3896	0.1721
	09:00	59960	20	15.14	0.1893	0.3792	0.3654	0.4137	0.4068	0.3913	0.0946
	12:00	59984	24	79.49	0.3785	0.3723	0.3654	0.4137	0.3999	0.3878	0.1577
	15:00	60011	27	79.49	0.3785	0.3654	0.3723	0.4068	0.3999	0.3861	0.1402
22	18:00	60035	24	75.71	0.3785	0.3723	0.3654	0.4137	0.4068	0.3896	0.1577
	09:00										
	12:00										
	15:00										
23	18:00										
	09:00										
	12:00										
	15:00										
24	18:00										

Table B5f: Measured values for Vehicle 5

Day	Time	Speed ometer Reading (km)	Difference (km)	Fuel Reading (litres)	Difference (litres)	Tyre Pressure (N/mm^2)				Average (N/mm^2)	fuel Consumption (litres/km)
						Right Front	Left Front	Right Rear	Left Rear		
	09:00										
	12:00										
	15:00										
25	18:00										
	09:00										
	12:00	60804	0	26.50	0.0000	0.3516	0.3448	0.3930	0.3861	0.3689	
	15:00	60819	15	22.71	0.3785	0.3448	0.3448	0.3861	0.3792	0.3637	0.2524
26	18:00	60839	20	18.93	0.3785	0.3516	0.3448	0.3930	0.3792	0.3672	0.1893
	09:00	60861	22	15.14	0.3785	0.3516	0.3448	0.3861	0.3792	0.3654	0.1721
	12:00	60898	37	9.46	0.5678	0.3516	0.3516	0.3930	0.3861	0.3706	0.1535
	15:00	60922	24	51.10	0.3785	0.3516	0.3448	0.3930	0.3861	0.3689	0.1577
27	18:00	60946	24	47.32	0.3785	0.3516	0.3448	0.3930	0.3861	0.3689	0.1577
	09:00	60973	27	43.53	0.3785	0.3516	0.3516	0.3930	0.3861	0.3706	0.1402
	12:00	61004	31	39.75	0.3785	0.3654	0.3585	0.3999	0.3861	0.3775	0.1221
	15:00	61032	28	35.96	0.3785	0.3516	0.3516	0.3999	0.3861	0.3723	0.1352
28	18:00	61066	34	30.28	0.5678	0.3516	0.3448	0.3930	0.3861	0.3689	0.1670
	09:00	61089	23	26.50	0.3785	0.3516	0.3448	0.3930	0.3861	0.3689	0.1646
	12:00	61117	28	22.71	0.3785	0.3585	0.3448	0.3999	0.3930	0.3741	0.1352
	15:00										
29	18:00										

Table B6a: Tyre pressure values and their corresponding fuel consumption for the five vehicles

VEHICLE 1		VEHICLE 2		VEHICLE 3		VEHICLE 4		VEHICLE 5	
TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)
0.2723	0.1764	0.2448	0.1919	0.2720	0.1953	0.2410	0.2020	0.2637	0.1953
0.2741	0.1727	0.2465	0.1894	0.2789	0.1869	0.2547	0.1828	0.2672	0.1996
0.2758	0.1689	0.2499	0.1818	0.2806	0.1776	0.2582	0.1704	0.2706	0.1802
0.2775	0.1610	0.2534	0.1842	0.2875	0.1767	0.2634	0.1706	0.2810	0.1647
0.2792	0.1639	0.2655	0.1773	0.2961	0.1724	0.2685	0.1684	0.3068	0.1504
0.2810	0.1587	0.2792	0.1692	0.3047	0.1664	0.2703	0.1572	0.3085	0.1475
0.2827	0.1508	0.2827	0.1645	0.3065	0.1631	0.2754	0.1499	0.3137	0.1462
0.2844	0.1451	0.2844	0.1637	0.3082	0.1555	0.2772	0.1456	0.3154	0.1468
0.2861	0.1445	0.2861	0.1631	0.3099	0.1577	0.3254	0.1445	0.3172	0.1479
0.2879	0.1418	0.2879	0.1610	0.3168	0.1558	0.3271	0.1422	0.3189	0.1451
0.2896	0.1393	0.2896	0.1613	0.3185	0.1536	0.3289	0.1395	0.3206	0.1348
0.3017	0.1383	0.2913	0.1538	0.3203	0.1456	0.3306	0.1351	0.3223	0.1351
0.3034	0.1266	0.2948	0.1495	0.3220	0.1433	0.3323	0.1280	0.3240	0.1357
0.3051	0.1321	0.2982	0.1453	0.3254	0.1433	0.3358	0.1351	0.3275	0.1361
0.3085	0.1305	0.3034	0.1504	0.3272	0.1312	0.3478	0.1389	0.3292	0.1376

Table B6b: Tyre pressure values and their corresponding fuel consumption for the five vehicles

VEHICLE 1		VEHICLE 2		VEHICLE 3		VEHICLE 4		VEHICLE 5	
TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)	TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (litres/km)
0.3103	0.1235	0.3051	0.1468	0.3289	0.1399	0.3495	0.1362	0.3327	0.1429
0.3137	0.1250	0.3068	0.1393	0.3358	0.1280	0.3530	0.1299	0.3361	0.1403
0.3189	0.1255	0.3085	0.1391	0.3375	0.1248	0.3737	0.1263	0.3378	0.1433
0.3254	0.1220	0.3206	0.1361	0.3427	0.1214	0.3754	0.1284	0.3396	0.1458
0.3271	0.1190	0.3292	0.1346	0.3478	0.1199	0.3771	0.1280	0.3413	0.1477
0.3289	0.1218	0.3327	0.1361	0.3495	0.1192	0.3788	0.1284	0.3430	0.1502
0.3306	0.1199	0.3344	0.1337	0.3530	0.1181	0.3806	0.1295	0.3478	0.1449
0.3323	0.1190	0.3361	0.1330	0.3737	0.1183	0.3840	0.1346	0.3495	0.1408
0.3358	0.1175	0.3384	0.1339	0.3754	0.1202	0.3857	0.1316	0.3530	0.1399
0.3478	0.1190	0.3403	0.1312	0.3771	0.1198	0.3875	0.1389	0.3737	0.1639
0.3495	0.1168	0.3465	0.1269	0.3788	0.1212	0.3909	0.1449	0.3754	0.1608
0.3530	0.1163	0.3530	0.1235						
0.3737	0.1174	0.3737	0.1227						
0.3754	0.1186	0.3754	0.1266						
0.3771	0.1185	0.3771	0.1280						
0.3788	0.1235	0.3788	0.1279						

APPENDIX C

USING LEAST SQUARES MODELLING METHOD TO FIND THE MODEL

Table C1: Substituted values and their summation for Vehicle 2

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	p^3	p^4	pf	p^2f
0.2448	0.1919	0.0599	0.0147	0.0036	0.0470	0.0115
0.2465	0.1894	0.0608	0.0150	0.0037	0.0467	0.0115
0.2499	0.1818	0.0625	0.0156	0.0039	0.0454	0.0114
0.2534	0.1842	0.0642	0.0163	0.0041	0.0467	0.0118
0.2655	0.1773	0.0705	0.0187	0.0050	0.0471	0.0125
0.2792	0.1692	0.0780	0.0218	0.0061	0.0472	0.0132
0.2827	0.1645	0.0799	0.0226	0.0064	0.0465	0.0131
0.2844	0.1637	0.0809	0.0230	0.0065	0.0465	0.0132
0.2861	0.1631	0.0819	0.0234	0.0067	0.0467	0.0134
0.2879	0.1610	0.0829	0.0239	0.0069	0.0464	0.0133
0.2896	0.1613	0.0839	0.0243	0.0070	0.0467	0.0135
0.2913	0.1538	0.0849	0.0247	0.0072	0.0448	0.0131
0.2948	0.1495	0.0869	0.0256	0.0075	0.0441	0.0130
0.2982	0.1453	0.0889	0.0265	0.0079	0.0433	0.0129
0.3034	0.1504	0.0920	0.0279	0.0085	0.0456	0.0138
0.3051	0.1468	0.0931	0.0284	0.0087	0.0448	0.0137
0.3068	0.1393	0.0941	0.0289	0.0089	0.0427	0.0131
0.3085	0.1391	0.0952	0.0294	0.0091	0.0429	0.0132
0.3206	0.1361	0.1028	0.0330	0.0106	0.0436	0.0140
0.3292	0.1346	0.1084	0.0357	0.0117	0.0443	0.0146
0.3327	0.1361	0.1107	0.0368	0.0122	0.0453	0.0151
0.3344	0.1337	0.1118	0.0374	0.0125	0.0447	0.0149
0.3361	0.1330	0.1130	0.0380	0.0128	0.0447	0.0150
0.3384	0.1339	0.1145	0.0388	0.0131	0.0453	0.0153
0.3403	0.1312	0.1158	0.0394	0.0134	0.0447	0.0152
0.3465	0.1269	0.1200	0.0416	0.0144	0.0440	0.0152
0.3530	0.1235	0.1246	0.0440	0.0155	0.0436	0.0154
0.3737	0.1227	0.1396	0.0522	0.0195	0.0458	0.0171
0.3754	0.1266	0.1409	0.0529	0.0199	0.0475	0.0178
0.3771	0.1280	0.1422	0.0536	0.0202	0.0483	0.0182
0.3788	0.1279	0.1435	0.0544	0.0206	0.0484	0.0184
Summation = 9.6141	4.6257	3.0281	0.9682	0.3141	1.4113	0.4376

$4.6257=31B_0+9.6141B_1+3.0281B_2$ …….. (1)

$1.4113=9.6141B_0+3.0281B_1+0.9682B_2$ …….. (2)

$0.4376=3.0281B_0+0.9682B_1+0.3141B_2$ …….. (3)

Solving these equations simultaneously give $B_0 = 0.6272$, $B_1 = -2.5941$ and $B_2 = 3.3428$ and substituting into the equation gives the equation of the vehicle as $F = 0.6272 – 2.5941p + 3.3428p^2$.

Table C2: Substituted values and their summation for Vehicle 3

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	p^3	p^4	pf	p^2f
0.2720	0.1953	0.0740	0.0201	0.0055	0.0531	0.0144
0.2789	0.1869	0.0778	0.0217	0.0060	0.0521	0.0145
0.2806	0.1776	0.0787	0.0221	0.0062	0.0498	0.0140
0.2875	0.1767	0.0827	0.0238	0.0068	0.0508	0.0146
0.2961	0.1724	0.0877	0.0260	0.0077	0.0511	0.0151
0.3047	0.1664	0.0929	0.0283	0.0086	0.0507	0.0155
0.3065	0.1631	0.0939	0.0288	0.0088	0.0500	0.0153
0.3082	0.1555	0.0950	0.0293	0.0090	0.0479	0.0148
0.3099	0.1577	0.0960	0.0298	0.0092	0.0489	0.0151
0.3168	0.1558	0.1004	0.0318	0.0101	0.0493	0.0156
0.3185	0.1536	0.1015	0.0323	0.0103	0.0489	0.0156
0.3203	0.1456	0.1026	0.0328	0.0105	0.0466	0.0149
0.3220	0.1433	0.1037	0.0334	0.0107	0.0461	0.0149
0.3254	0.1433	0.1059	0.0345	0.0112	0.0466	0.0152
0.3272	0.1312	0.1070	0.0350	0.0115	0.0429	0.0140
0.3289	0.1399	0.1082	0.0356	0.0117	0.0460	0.0151
0.3358	0.1280	0.1127	0.0379	0.0127	0.0430	0.0144
0.3375	0.1248	0.1139	0.0384	0.0130	0.0421	0.0142
0.3427	0.1214	0.1174	0.0402	0.0138	0.0416	0.0142
0.3478	0.1199	0.1210	0.0421	0.0146	0.0417	0.0145
0.3495	0.1192	0.1222	0.0427	0.0149	0.0417	0.0146
0.3530	0.1181	0.1246	0.0440	0.0155	0.0417	0.0147
0.3737	0.1183	0.1396	0.0522	0.0195	0.0442	0.0165
0.3754	0.1202	0.1409	0.0529	0.0199	0.0451	0.0169
0.3771	0.1198	0.1422	0.0536	0.0202	0.0452	0.0170
0.3788	0.1212	0.1435	0.0544	0.0206	0.0459	0.0174
Summation = 8.4747	3.7752	2.7859	0.9235	0.3087	1.2132	0.3933

$3.7752=27B_0+8.4747B_1+2.7859B_2$ ……. (1)

$1.2132=8.4747B_0+2.7859B_1+0.9235B_2$ …….. (2)

$0.3933=2.7859B_0+0.9235B_1+0.3087B_2$ …….. (3)

Solving these equations simultaneously give $B_0 = 0.5568$, $B_1 = -1.7946$ and $B_2 = 1.618$ and substituting into the equation gives the equation of the vehicle as $F = 0.5568 – 1.7946p + 1.618p^2$.

Table C3: Substituted values and their summation for Vehicle 4

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	p^3	p^4	pf	p^2f
0.2410	0.2020	0.0581	0.0140	0.0034	0.0487	0.0117
0.2547	0.1828	0.0649	0.0165	0.0042	0.0466	0.0119
0.2582	0.1704	0.0667	0.0172	0.0044	0.0440	0.0114
0.2634	0.1706	0.0694	0.0183	0.0048	0.0449	0.0118
0.2685	0.1684	0.0721	0.0194	0.0052	0.0452	0.0121
0.2703	0.1572	0.0730	0.0197	0.0053	0.0425	0.0115
0.2754	0.1499	0.0759	0.0209	0.0058	0.0413	0.0114
0.2772	0.1456	0.0768	0.0213	0.0059	0.0403	0.0112
0.3254	0.1445	0.1059	0.0345	0.0112	0.0470	0.0153
0.3271	0.1422	0.1070	0.0350	0.0115	0.0465	0.0152
0.3289	0.1395	0.1081	0.0356	0.0117	0.0459	0.0151
0.3306	0.1351	0.1093	0.0361	0.0119	0.0447	0.0148
0.3323	0.1280	0.1104	0.0367	0.0122	0.0425	0.0141
0.3358	0.1351	0.1127	0.0378	0.0127	0.0454	0.0152
0.3478	0.1389	0.1210	0.0421	0.0146	0.0483	0.0168
0.3495	0.1362	0.1222	0.0427	0.0149	0.0476	0.0166
0.3530	0.1299	0.1246	0.0440	0.0155	0.0458	0.0162
0.3737	0.1263	0.1396	0.0522	0.0195	0.0472	0.0176
0.3754	0.1284	0.1409	0.0529	0.0199	0.0482	0.0181
0.3771	0.1280	0.1422	0.0536	0.0202	0.0483	0.0182
0.3788	0.1284	0.1435	0.0544	0.0206	0.0486	0.0184
0.3806	0.1295	0.1448	0.0551	0.0210	0.0493	0.0188
0.3840	0.1346	0.1475	0.0566	0.0217	0.0517	0.0198
0.3857	0.1316	0.1488	0.0574	0.0221	0.0508	0.0196
0.3875	0.1389	0.1501	0.0582	0.0225	0.0538	0.0209
0.3909	0.1449	0.1528	0.0597	0.0234	0.0567	0.0221
SUMMATION: 8.5727	3.7670	2.8884	0.9919	0.3462	1.2218	0.4059

$3.7670=27B_0+8.5727B_1+2.8884B_2$ …… (1)

$1.2218=8.5727B_0+2.8884B_1+0.9919B_2$ …….. (2)

$0.4059=2.8884B_0+0.9919B_1+0.3462B_2$ …….. (3)

Solving these equations simultaneously give $B_0 = 0.1.4454$, $B_1 = -7.9701$ and $B_2 = 11.748$ and substituting into the equation gives the equation of the vehicle as $F = 0.6272 – 2.5941p + 3.3428p^2$.

Table C4: Substituted values and their summation for Vehicle 5

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	p^3	p^4	pf	p^2f
0.2637	0.1953	0.0695	0.0183	0.0048	0.0515	0.0136
0.2672	0.1996	0.0714	0.0191	0.0051	0.0533	0.0142
0.2706	0.1802	0.0732	0.0198	0.0054	0.0488	0.0132
0.2810	0.1647	0.0789	0.0222	0.0062	0.0463	0.0130
0.3068	0.1504	0.0941	0.0289	0.0089	0.0461	0.0142
0.3085	0.1475	0.0952	0.0294	0.0091	0.0455	0.0140
0.3137	0.1462	0.0984	0.0309	0.0097	0.0459	0.0144
0.3154	0.1468	0.0995	0.0314	0.0099	0.0463	0.0146
0.3172	0.1479	0.1006	0.0319	0.0101	0.0469	0.0149
0.3189	0.1451	0.1017	0.0324	0.0103	0.0463	0.0148
0.3206	0.1348	0.1028	0.0329	0.0106	0.0432	0.0139
0.3223	0.1351	0.1039	0.0335	0.0108	0.0436	0.0140
0.3240	0.1357	0.1050	0.0340	0.0110	0.0440	0.0142
0.3275	0.1361	0.1072	0.0351	0.0115	0.0446	0.0146
0.3292	0.1376	0.1084	0.0357	0.0117	0.0453	0.0149
0.3327	0.1429	0.1107	0.0368	0.0122	0.0475	0.0158
0.3361	0.1403	0.1130	0.0380	0.0128	0.0471	0.0158
0.3378	0.1433	0.1141	0.0386	0.0130	0.0484	0.0164
0.3396	0.1458	0.1153	0.0391	0.0133	0.0495	0.0168
0.3413	0.1477	0.1165	0.0397	0.0136	0.0504	0.0172
0.3430	0.1502	0.1176	0.0404	0.0138	0.0515	0.0177
0.3478	0.1449	0.1210	0.0421	0.0146	0.0504	0.0175
0.3495	0.1408	0.1222	0.0427	0.0149	0.0492	0.0172
0.3530	0.1399	0.1246	0.0440	0.0155	0.0494	0.0174
0.3737	0.1639	0.1396	0.0522	0.0195	0.0613	0.0229
0.3754	0.1608	0.1409	0.0529	0.0199	0.0604	0.0227
SUMMATION = 8.4165	3.9234	2.7454	0.9019	0.2983	1.2626	0.4099

$3.9234=27B_0+8.4165B_1+2.7454B_2$ …….. (1)

$1.2626=8.4165B_0+2.7454B_1+0.9019B_2$ …… (2)

$0.4099=2.7454B_0+0.9019B_1+0.2983B_2$ …… (3)

Solving these equations simultaneously give $B_0 = 0.6402$, $B_1 = -2.7463$ and $B_2 = 3.7853$ and substituting into the equation gives the equation of the vehicle as $F = 0.6402 – 2.7463p + 3.7853p^2$.

FINDING THE R^2 VALUES FOR THE FIVE VEHICLES

Table C5a: Substituted values and their summation for Vehicle 2

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.2448	0.1919	0.0599	-0.0654	-0.0378	0.0427	-0.00279	-0.00161	0.00183
0.2465	0.1894	0.0608	-0.0636	-0.0369	0.0402	-0.00256	-0.00148	0.00161
0.2499	0.1818	0.0625	-0.0602	-0.0352	0.0326	-0.00196	-0.00115	0.00106
0.2534	0.1842	0.0642	-0.0568	-0.0335	0.0349	-0.00198	-0.00117	0.00122
0.2655	0.1773	0.0705	-0.0447	-0.0272	0.0281	-0.00126	-0.00076	0.00079
0.2792	0.1692	0.0780	-0.0309	-0.0197	0.0200	-0.00062	-0.00039	0.00040
0.2827	0.1645	0.0799	-0.0274	-0.0178	0.0153	-0.00042	-0.00027	0.00023
0.2844	0.1637	0.0809	-0.0257	-0.0168	0.0145	-0.00037	-0.00024	0.00021
0.2861	0.1631	0.0819	-0.0240	-0.0158	0.0139	-0.00033	-0.00022	0.00019
0.2879	0.1610	0.0829	-0.0223	-0.0148	0.0118	-0.00026	-0.00018	0.00014
0.2896	0.1613	0.0839	-0.0206	-0.0138	0.0121	-0.00025	-0.00017	0.00015
0.2913	0.1538	0.0849	-0.0188	-0.0128	0.0046	-8.7E-05	-5.9E-05	0.00002
0.2948	0.1495	0.0869	-0.0154	-0.0108	0.0003	-4E-06	-2.8E-06	0.00000
0.2982	0.1453	0.0889	-0.0119	-0.0088	-0.0039	4.61E-05	3.39E-05	0.00001
0.3034	0.1504	0.0920	-0.0068	-0.0056	0.0012	-7.8E-06	-6.6E-06	0.00000
0.3051	0.1468	0.0931	-0.0050	-0.0046	-0.0024	1.2E-05	1.09E-05	0.00001
0.3068	0.1393	0.0941	-0.0033	-0.0035	-0.0099	3.29E-05	3.52E-05	0.00010
0.3085	0.1391	0.0952	-0.0016	-0.0025	-0.0101	1.61E-05	2.52E-05	0.00010
0.3206	0.1361	0.1028	0.0105	0.0051	-0.0132	-0.00014	-6.7E-05	0.00017
0.3292	0.1346	0.1084	0.0191	0.0107	-0.0146	-0.00028	-0.00016	0.00021
0.3327	0.1361	0.1107	0.0225	0.0130	-0.0132	-0.0003	-0.00017	0.00017
0.3344	0.1337	0.1118	0.0243	0.0141	-0.0155	-0.00038	-0.00022	0.00024
0.3361	0.1330	0.1130	0.0260	0.0153	-0.0162	-0.00042	-0.00025	0.00026

Table C5b: Substituted values and their summation for Vehicle 2

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.3384	0.1339	0.1145	0.0283	0.0168	-0.0153	-0.00043	-0.00026	0.00024
0.3403	0.1312	0.1158	0.0301	0.0181	-0.0180	-0.00054	-0.00033	0.00032
0.3465	0.1269	0.1200	0.0363	0.0224	-0.0223	-0.00081	-0.0005	0.00050
0.3530	0.1235	0.1246	0.0429	0.0269	-0.0258	-0.0011	-0.00069	0.00066
0.3737	0.1227	0.1396	0.0635	0.0419	-0.0265	-0.00168	-0.00111	0.00070
0.3754	0.1266	0.1409	0.0653	0.0432	-0.0226	-0.00148	-0.00098	0.00051
0.3771	0.1280	0.1422	0.0670	0.0445	-0.0212	-0.00142	-0.00094	0.00045
0.3788	0.1279	0.1435	0.0687	0.0458	-0.0213	-0.00147	-0.00098	0.00046
SUMMATION = 9.6141	4.6257	3.0281	0.0000			-0.01208	-0.00769	0.00607
AVERAGE = 0.3101	0.1492	0.0977						

Substituting these values into the equation gives $R^2 = 0.93$.

Table C6: Substituted values and their summation for Vehicle 3

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.2720	0.1953	0.0740	-0.0540	-0.0332	0.0501	-0.0027	-0.00166	0.00251
0.2789	0.1869	0.0778	-0.0471	-0.0294	0.0417	-0.00196	-0.00123	0.00174
0.2806	0.1776	0.0787	-0.0453	-0.0284	0.0324	-0.00147	-0.00092	0.00105
0.2875	0.1767	0.0827	-0.0384	-0.0245	0.0315	-0.00121	-0.00077	0.00099
0.2961	0.1724	0.0877	-0.0298	-0.0195	0.0272	-0.00081	-0.00053	0.00074
0.3047	0.1664	0.0929	-0.0212	-0.0143	0.0212	-0.00045	-0.0003	0.00045
0.3065	0.1631	0.0939	-0.0195	-0.0132	0.0179	-0.00035	-0.00024	0.00032
0.3082	0.1555	0.0950	-0.0178	-0.0122	0.0103	-0.00018	-0.00013	0.00011
0.3099	0.1577	0.0960	-0.0160	-0.0111	0.0125	-0.0002	-0.00014	0.00016
0.3168	0.1558	0.1004	-0.0091	-0.0068	0.0106	-9.7E-05	-7.2E-05	0.00011
0.3185	0.1536	0.1015	-0.0074	-0.0057	0.0084	-6.2E-05	-4.8E-05	0.00007
0.3203	0.1456	0.1026	-0.0057	-0.0046	0.0004	-2.1E-06	-1.7E-06	0.00000
0.3220	0.1433	0.1037	-0.0040	-0.0035	-0.0019	7.69E-06	6.73E-06	0.00000
0.3254	0.1433	0.1059	-0.0005	-0.0013	-0.0019	1.02E-06	2.42E-06	0.00000
0.3272	0.1312	0.1070	0.0012	-0.0001	-0.0140	-1.7E-05	1.7E-06	0.00020
0.3289	0.1399	0.1082	0.0029	0.0010	-0.0053	-1.6E-05	-5.4E-06	0.00003
0.3358	0.1280	0.1127	0.0098	0.0056	-0.0172	-0.00017	-9.6E-05	0.00029
0.3375	0.1248	0.1139	0.0115	0.0068	-0.0204	-0.00023	-0.00014	0.00041
0.3427	0.1214	0.1174	0.0167	0.0103	-0.0238	-0.0004	-0.00024	0.00057
0.3478	0.1199	0.1210	0.0219	0.0138	-0.0253	-0.00055	-0.00035	0.00064
0.3495	0.1192	0.1222	0.0236	0.0150	-0.0260	-0.00061	-0.00039	0.00068
0.3530	0.1181	0.1246	0.0270	0.0175	-0.0271	-0.00073	-0.00047	0.00074
0.3737	0.1183	0.1396	0.0477	0.0325	-0.0269	-0.00128	-0.00087	0.00072
0.3754	0.1202	0.1409	0.0495	0.0338	-0.0250	-0.00124	-0.00084	0.00063
0.3771	0.1198	0.1422	0.0512	0.0351	-0.0254	-0.0013	-0.00089	0.00065
0.3788	0.1212	0.1435	0.0529	0.0364	-0.0240	-0.00127	-0.00087	0.00058
SUMMATION = 8.4747	3.7752	2.7859	0.0000	0.0000	0.0000	-0.00916	-0.00609	0.00735
AVERAGE = 0.3259	0.1452	0.1071						

Table C7: Substituted values and their summation for Vehicle 4

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.2410	0.2020	0.0581	-0.0888	-0.0530	0.0571	-0.00507	-0.00303	0.00326
0.2547	0.1828	0.0649	-0.0750	-0.0462	0.0379	-0.00284	-0.00175	0.00144
0.2582	0.1704	0.0667	-0.0715	-0.0444	0.0255	-0.00182	-0.00113	0.00065
0.2634	0.1706	0.0694	-0.0664	-0.0417	0.0258	-0.00171	-0.00108	0.00066
0.2685	0.1684	0.0721	-0.0612	-0.0390	0.0235	-0.00144	-0.00091	0.00055
0.2703	0.1572	0.0730	-0.0595	-0.0381	0.0123	-0.00073	-0.00047	0.00015
0.2754	0.1499	0.0759	-0.0543	-0.0352	0.0050	-0.00027	-0.00018	0.00003
0.2772	0.1456	0.0768	-0.0526	-0.0343	0.0007	-0.00004	-0.00002	0.00000
0.3254	0.1445	0.1059	-0.0043	-0.0052	-0.0004	0.00000	0.00000	0.00000
0.3271	0.1422	0.1070	-0.0026	-0.0041	-0.0026	0.00001	0.00001	0.00001
0.3289	0.1395	0.1081	-0.0009	-0.0029	-0.0054	0.00000	0.00002	0.00003
0.3306	0.1351	0.1093	0.0009	-0.0018	-0.0097	-0.00001	0.00002	0.00010
0.3323	0.1280	0.1104	0.0026	-0.0007	-0.0168	-0.00004	0.00001	0.00028
0.3358	0.1351	0.1127	0.0060	0.0016	-0.0097	-0.00006	-0.00002	0.00010
0.3478	0.1389	0.1210	0.0181	0.0099	-0.0060	-0.00011	-0.00006	0.00004
0.3495	0.1362	0.1222	0.0198	0.0111	-0.0086	-0.00017	-0.00010	0.00007
0.3530	0.1299	0.1246	0.0233	0.0135	-0.0150	-0.00035	-0.00020	0.00023
0.3737	0.1263	0.1396	0.0440	0.0285	-0.0186	-0.00082	-0.00053	0.00035
0.3754	0.1284	0.1409	0.0457	0.0298	-0.0165	-0.00075	-0.00049	0.00027
0.3771	0.1280	0.1422	0.0474	0.0311	-0.0168	-0.00080	-0.00052	0.00028
0.3788	0.1284	0.1435	0.0491	0.0324	-0.0165	-0.00081	-0.00054	0.00027
0.3806	0.1295	0.1448	0.0509	0.0337	-0.0154	-0.00078	-0.00052	0.00024
0.3840	0.1346	0.1475	0.0543	0.0364	-0.0103	-0.00056	-0.00037	0.00011
0.3857	0.1316	0.1488	0.0560	0.0377	-0.0133	-0.00075	-0.00050	0.00018
0.3875	0.1389	0.1501	0.0577	0.0390	-0.0060	-0.00035	-0.00023	0.00004
0.3909	0.1449	0.1528	0.0612	0.0417	0.0000	0.00000	0.00000	0.00000
SUMMATION = 8.5727	3.7670	2.8884	0.0000	0.0000	0.0000	-0.02026	-0.01260	0.00932
AVERAGE = 0.3297	0.1449	0.1111						

Table C8: Substituted values and their summation for Vehicle 5

TYRE PRESSURE (N/mm^2)	FUEL CONSUMPTION (LITRES/KM)	p^2	$p-\bar{p}$	$p^2-\overline{p^2}$	$F-\bar{F}$	$(p-\bar{p})(F-\bar{F})$	$(p^2-\overline{p^2})(F-\bar{F})$	$(F-\bar{F})^2$
0.2637	0.1953	0.0695	-0.0600	-0.0361	0.0444	-0.00266	-0.0016	0.00197
0.2672	0.1996	0.0714	-0.0565	-0.0342	0.0487	-0.00275	-0.00167	0.00237
0.2706	0.1802	0.0732	-0.0531	-0.0324	0.0293	-0.00155	-0.00095	0.00086
0.2810	0.1647	0.0789	-0.0427	-0.0267	0.0138	-0.00059	-0.00037	0.00019
0.3068	0.1504	0.0941	-0.0169	-0.0115	-0.0005	8.85E-06	6.01E-06	0.00000
0.3085	0.1475	0.0952	-0.0152	-0.0104	-0.0034	5.17E-05	3.54E-05	0.00001
0.3137	0.1462	0.0984	-0.0100	-0.0072	-0.0047	4.7E-05	3.38E-05	0.00002
0.3154	0.1468	0.0995	-0.0083	-0.0061	-0.0041	3.36E-05	2.48E-05	0.00002
0.3172	0.1479	0.1006	-0.0066	-0.0050	-0.0030	1.95E-05	1.49E-05	0.00001
0.3189	0.1451	0.1017	-0.0048	-0.0039	-0.0058	2.78E-05	2.26E-05	0.00003
0.3206	0.1348	0.1028	-0.0031	-0.0028	-0.0161	5.02E-05	4.55E-05	0.00026
0.3223	0.1351	0.1039	-0.0014	-0.0017	-0.0158	2.18E-05	2.7E-05	0.00025
0.3240	0.1357	0.1050	0.0003	-0.0006	-0.0152	-5.2E-06	9.1E-06	0.00023
0.3275	0.1361	0.1072	0.0038	0.0016	-0.0148	-5.6E-05	-2.4E-05	0.00022
0.3292	0.1376	0.1084	0.0055	0.0028	-0.0133	-7.4E-05	-3.7E-05	0.00018
0.3327	0.1429	0.1107	0.0090	0.0051	-0.0080	-7.2E-05	-4.1E-05	0.00006
0.3361	0.1403	0.1130	0.0124	0.0074	-0.0106	-0.00013	-7.8E-05	0.00011
0.3378	0.1433	0.1141	0.0141	0.0085	-0.0076	-0.00011	-6.5E-05	0.00006
0.3396	0.1458	0.1153	0.0159	0.0097	-0.0051	-8.1E-05	-5E-05	0.00003
0.3413	0.1477	0.1165	0.0176	0.0109	-0.0032	-5.6E-05	-3.5E-05	0.00001
0.3430	0.1502	0.1176	0.0193	0.0120	-0.0007	-1.4E-05	-9E-06	0.00000
0.3478	0.1449	0.1210	0.0241	0.0154	-0.0060	-0.00014	-9.2E-05	0.00004
0.3495	0.1408	0.1222	0.0258	0.0166	-0.0101	-0.00026	-0.00017	0.00010
0.3530	0.1399	0.1246	0.0293	0.0190	-0.0110	-0.00032	-0.00021	0.00012
0.3737	0.1639	0.1396	0.0500	0.0340	0.0130	0.000651	0.000444	0.00017
0.3754	0.1608	0.1409	0.0517	0.0353	0.0099	0.00051	0.000349	0.00010
SUMMATION = 8.4165	3.9234	2.7454			0.0000	-0.00747	-0.00438	0.00742
AVERAGE = 0.3237	0.1509	0.1056						

Substituting these values into the equation gives $R^2 = 0.53$.

FINDING THE ERROR (e)

Table C9: Substituted values and their summation for Vehicle 3

TYRE PRESSURE (N/mm^2)	MEASURED FUEL CONSUMPTION(F) (litres/km)	USING VEHICLE'S OWN EQUATION (F)	USING MODEL (F)	ERROR (e)	e^2
0.2720	0.1953	0.1884	0.1689	0.0264	0.000696
0.2789	0.1869	0.1822	0.1637	0.0232	0.000537
0.2806	0.1776	0.1806	0.1625	0.0151	0.000229
0.2875	0.1767	0.1746	0.1577	0.0190	0.00036
0.2961	0.1724	0.1673	0.1522	0.0203	0.00041
0.3047	0.1664	0.1602	0.1471	0.0193	0.000372
0.3065	0.1631	0.1588	0.1462	0.0170	0.000288
0.3082	0.1555	0.1574	0.1452	0.0103	0.000106
0.3099	0.1577	0.1560	0.1443	0.0134	0.00018
0.3168	0.1558	0.1507	0.1409	0.0149	0.000222
0.3185	0.1536	0.1493	0.1401	0.0135	0.000183
0.3203	0.1456	0.1480	0.1393	0.0063	3.95E-05
0.3220	0.1433	0.1467	0.1385	0.0048	2.26E-05
0.3254	0.1433	0.1441	0.1370	0.0062	3.9E-05
0.3272	0.1312	0.1429	0.1363	-0.0051	2.58E-05
0.3289	0.1399	0.1416	0.1356	0.0042	1.8E-05
0.3358	0.1280	0.1366	0.1331	-0.0050	2.51E-05
0.3375	0.1248	0.1354	0.1325	-0.0076	5.8E-05
0.3427	0.1214	0.1318	0.1308	-0.0094	8.92E-05
0.3478	0.1199	0.1283	0.1293	-0.0094	8.88E-05
0.3495	0.1192	0.1272	0.1289	-0.0097	9.38E-05
0.3530	0.1181	0.1249	0.1280	-0.0100	9.93E-05
0.3737	0.1183	0.1121	0.1246	-0.0063	3.93E-05
0.3754	0.1202	0.1111	0.1245	-0.0043	1.82E-05
0.3771	0.1198	0.1101	0.1243	-0.0046	2.08E-05
0.3788	0.1212	0.1091	0.1242	-0.0030	8.98E-06
SUMMATION = 8.4747	3.7752				0.00427

Substituting these values into the equation gives $e = \pm 0.025$.

Table C10: Substituted values and their summation for Vehicle 4

TYRE PRESSURE (N/mm^2)	MEASURED FUEL CONSUMPTION(F) (litres/km)	USING VEHICLE'S OWN EQUATION (F)	USING MODEL (F)	ERROR (e)	e^2
0.2410	0.2020	0.2071	0.1962	0.0058	0.0000336
0.2547	0.1828	0.1775	0.1833	-0.0005	0.0000002
0.2582	0.1704	0.1708	0.1803	-0.0099	0.0000982
0.2634	0.1706	0.1612	0.1759	-0.0052	0.0000273
0.2685	0.1684	0.1523	0.1717	-0.0033	0.0000109
0.2703	0.1572	0.1495	0.1703	-0.0131	0.0001704
0.2754	0.1499	0.1415	0.1663	-0.0164	0.0002683
0.2772	0.1456	0.1389	0.1650	-0.0195	0.0003784
0.3254	0.1445	0.0959	0.1370	0.0075	0.0000560
0.3271	0.1422	0.0954	0.1363	0.0059	0.0000352
0.3289	0.1395	0.0949	0.1356	0.0038	0.0000148
0.3306	0.1351	0.0945	0.1350	0.0002	0.0000000
0.3323	0.1280	0.0942	0.1343	-0.0063	0.0000392
0.3358	0.1351	0.0938	0.1331	0.0021	0.0000043
0.3478	0.1389	0.0945	0.1293	0.0096	0.0000914
0.3495	0.1362	0.0949	0.1289	0.0074	0.0000542
0.3530	0.1299	0.0959	0.1280	0.0018	0.0000034
0.3737	0.1263	0.1076	0.1246	0.0016	0.0000027
0.3754	0.1284	0.1091	0.1245	0.0039	0.0000153
0.3771	0.1280	0.1106	0.1243	0.0037	0.0000138
0.3788	0.1284	0.1121	0.1242	0.0042	0.0000173
0.3806	0.1295	0.1138	0.1241	0.0054	0.0000294
0.3840	0.1346	0.1173	0.1240	0.0106	0.0001125
0.3857	0.1316	0.1191	0.1239	0.0076	0.0000583
0.3875	0.1389	0.1210	0.1239	0.0150	0.0002238
0.3909	0.1449	0.1251	0.1240	0.0210	0.0004398
SUMMATION = 8.5727	3.7670				0.0021987

Substituting these values into the equation gives e = ±0.018.

Table C11: Substituted values and their summation for Vehicle 5

PRESSURE (N/mm^2)	MEASURED FUEL CONSUMPTION(F) (litres/km)	USING VEHICLE'S OWN EQUATION (F)	USING MODEL (F)	ERROR (e)	e^2
0.2637	0.1953	0.1792	0.1756	0.0197	0.00039
0.2672	0.1996	0.1767	0.1727	0.0269	0.000721
0.2706	0.1802	0.1742	0.1700	0.0102	0.000104
0.2810	0.1647	0.1674	0.1622	0.0025	6.29E-06
0.3068	0.1504	0.1539	0.1460	0.0044	1.95E-05
0.3085	0.1475	0.1532	0.1450	0.0025	6.01E-06
0.3137	0.1462	0.1512	0.1424	0.0038	1.45E-05
0.3154	0.1468	0.1506	0.1415	0.0053	2.81E-05
0.3172	0.1479	0.1500	0.1407	0.0072	5.21E-05
0.3189	0.1451	0.1494	0.1399	0.0052	2.73E-05
0.3206	0.1348	0.1488	0.1391	-0.0044	1.89E-05
0.3223	0.1351	0.1483	0.1384	-0.0032	1.04E-05
0.3240	0.1357	0.1478	0.1376	-0.0019	3.7E-06
0.3275	0.1361	0.1468	0.1362	-0.0001	1.39E-08
0.3292	0.1376	0.1463	0.1355	0.0021	4.26E-06
0.3327	0.1429	0.1455	0.1342	0.0087	7.55E-05
0.3361	0.1403	0.1448	0.1329	0.0073	5.36E-05
0.3378	0.1433	0.1444	0.1323	0.0109	0.000119
0.3396	0.1458	0.1441	0.1318	0.0140	0.000196
0.3413	0.1477	0.1438	0.1312	0.0165	0.000272
0.3430	0.1502	0.1436	0.1307	0.0194	0.000378
0.3478	0.1449	0.1429	0.1293	0.0156	0.000243
0.3495	0.1408	0.1427	0.1289	0.0120	0.000143
0.3530	0.1399	0.1424	0.1280	0.0118	0.00014
0.3737	0.1639	0.1425	0.1246	0.0393	0.001546
0.3754	0.1608	0.1427	0.1245	0.0363	0.001319
					SUMMATION = 0.005891

Substituting these values into the equation gives e = ±0.0295.

APPENDIX D

Appendix D1: Predicted fuel consumption compared with the measured fuel consumption for Vehicle 3

Pressure (N/mm^2)	Measured Fuel consumption (litres/km) (mfc)	Predicted fuel consumption(pfc)	Error (mfc-pfc)	% error
0.2720	0.1953	0.1869	0.00839	4.49
0.2789	0.1869	0.1817	0.00518	2.85
0.2806	0.1776	0.1805	-0.00287	-1.59
0.2875	0.1767	0.1757	0.00098	0.56
0.2961	0.1724	0.1702	0.00226	1.33
0.3047	0.1664	0.1651	0.00128	0.78
0.3065	0.1631	0.1642	-0.00103	-0.63
0.3082	0.1555	0.1632	-0.00771	-4.72
0.3099	0.1577	0.1623	-0.00459	-2.83
0.3168	0.1558	0.1589	-0.00312	-1.96
0.3185	0.1536	0.1581	-0.00446	-2.82
0.3203	0.1456	0.1393	0.00628	4.51
0.3220	0.1433	0.1385	0.00476	3.44
0.3254	0.1433	0.1370	0.00624	4.56
0.3272	0.1312	0.1363	-0.00508	-3.72
0.3289	0.1399	0.1356	0.00424	3.13
0.3358	0.1280	0.1331	-0.00501	-3.77
0.3375	0.1248	0.1325	-0.00762	-5.75
0.3427	0.1214	0.1128	0.00856	7.58
0.3478	0.1199	0.1113	0.00858	7.70
0.3495	0.1192	0.1109	0.00831	7.50
0.3530	0.1181	0.1100	0.00804	7.30
0.3737	0.1183	0.1246	-0.00627	-5.03
0.3754	0.1202	0.1245	-0.00427	-3.43
0.3771	0.1198	0.1243	-0.00456	-3.67
0.3788	0.1212	0.1242	-0.00300	-2.41

Appendix D2: Predicted fuel consumption compared with the measured fuel consumption for Vehicle 4

Pressure (N/mm^2)	Measured Fuel consumption (litres/km) (mfc)	Predicted fuel consumption(pfc)	Error (mfc-pfc)	% error
0.2410	0.2020	0.1962	0.00580	2.95
0.2547	0.1828	0.1833	-0.00049	-0.27
0.2582	0.1704	0.1623	0.00809	4.99
0.2634	0.1706	0.1759	-0.00522	-2.97
0.2685	0.1684	0.1717	-0.00330	-1.92
0.2703	0.1572	0.1523	0.00495	3.25
0.2754	0.1499	0.1483	0.00162	1.09
0.2772	0.1456	0.1470	-0.00145	-0.99
0.3254	0.1445	0.1370	0.00748	5.46
0.3271	0.1422	0.1363	0.00593	4.35
0.3289	0.1395	0.1356	0.00385	2.84
0.3306	0.1351	0.1350	0.00018	0.13
0.3323	0.1280	0.1343	-0.00626	-4.66
0.3358	0.1351	0.1331	0.00208	1.56
0.3478	0.1389	0.1473	-0.00844	-5.73
0.3495	0.1362	0.1289	0.00736	5.71
0.3530	0.1299	0.1280	0.00184	1.44
0.3737	0.1263	0.1246	0.00165	1.32
0.3754	0.1284	0.1245	0.00391	3.14
0.3771	0.1280	0.1243	0.00372	2.99
0.3788	0.1284	0.1242	0.00416	3.35
0.3806	0.1295	0.1241	0.00542	4.37
0.3840	0.1346	0.1420	-0.00739	-5.21
0.3857	0.1316	0.1239	0.00763	6.16
0.3875	0.1389	0.1419	-0.00304	-2.14
0.3909	0.1449	0.1420	0.00297	2.09

Appendix D3: Predicted fuel consumption compared with the measured fuel consumption for Vehicle 5

Pressure (N/mm^2)	Measured Fuel consumption(litres/km) (mfc)	Predicted fuel consumption(pfc)	Error (mfc-pfc)	% error
0.2637	0.1953	0.1936	0.001743	0.89
0.2672	0.1996	0.1907	0.008858	4.44
0.2706	0.1802	0.1880	-0.00782	-4.34
0.2810	0.1647	0.1622	0.002507	1.52
0.3068	0.1504	0.1460	0.004411	2.93
0.3085	0.1475	0.1450	0.002452	1.66
0.3137	0.1462	0.1424	0.003811	2.61
0.3154	0.1468	0.1415	0.005299	3.61
0.3172	0.1479	0.1407	0.007215	4.88
0.3189	0.1451	0.1399	0.005229	3.60
0.3206	0.1348	0.1391	-0.00435	-3.23
0.3223	0.1351	0.1384	-0.00322	-2.38
0.3240	0.1357	0.1376	-0.00192	-1.42
0.3275	0.1361	0.1362	-0.00012	-0.09
0.3292	0.1376	0.1355	0.002065	1.50
0.3327	0.1429	0.1342	0.008687	6.08
0.3361	0.1403	0.1329	0.00732	5.22
0.3378	0.1433	0.1503	-0.00708	-4.94
0.3396	0.1458	0.1498	-0.00401	-2.75
0.3413	0.1477	0.1492	-0.00152	-1.03
0.3430	0.1502	0.1487	0.001449	0.97
0.3478	0.1449	0.1473	-0.0024	-1.66
0.3495	0.1408	0.1469	-0.00603	-4.28
0.3530	0.1399	0.1460	-0.00617	-4.41
0.3737	0.1639	0.1606	0.003319	2.02
0.3754	0.1608	0.1605	0.000312	0.19