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[1.] Teodor VASIU, [2.] Adina BUDIUL BERGHIAN, [3.] Diana STOICA

STATISTICAL ANALYSIS OF OPERATION OF MOTOR FREIGHT

[1-3.] Faculty of Engineering Hunedoara, ROMANIA

Abstract: The paper presents the mathematical regularities research of fuel consumption, the mass of cargo carried and the distance travelled by vehicles transporting goods. Principles to address the issues are valid for all vehicles on the road. This paper is presented an example for Iveco-Stralis.
Keywords: fuel consumption, mass of cargo, distance travelled

1. INTRODUCTION

The choice of application of mathematical statistics to the cargo transport vehicles was due to the importance of these entities in the carriage of goods by consumer and industrial materials for the construction of motorways. This issue is observed in the relatively large number of units purchased by different economic agents, which implies a strict record of their operation (fuel consumption, goods transported tonnage, defects, stationing in service, etc.).

In the present work it is only studying the connection between fuel economy and distance respectively volume transported mass, can make technical appraisals of the effectiveness of economic exploitation-these machines. Other qualitative elements in time (reliability, maintainability, availability) are no less important, but will be studied in a future paper.

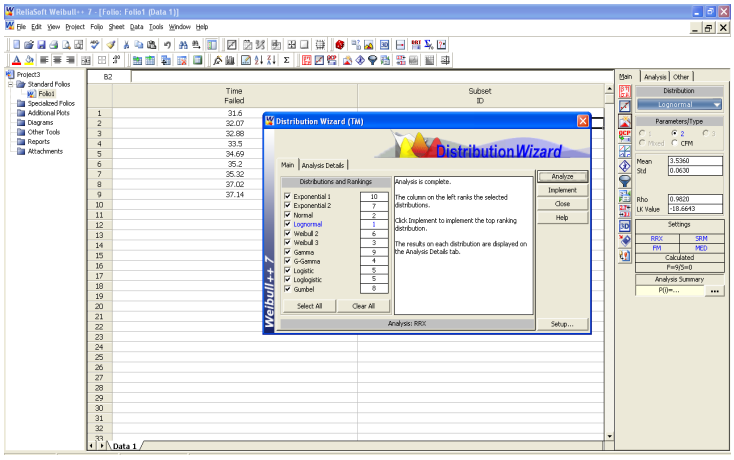

Figure 1. Determination of distribution laws for fuel

2. REGISTRATION AND EXPERIMENTAL DATA FOR A CAR IVECO STRALIS

To achieve its purpose were made records of distance traveled [km], the average consumption of diesel fuel [l] and the amount of freight transported [t] for a cargo vehicle type Iveco Stralis for six months. Data collected were processed using Weibull ++ 7's software, and the results are shown below.

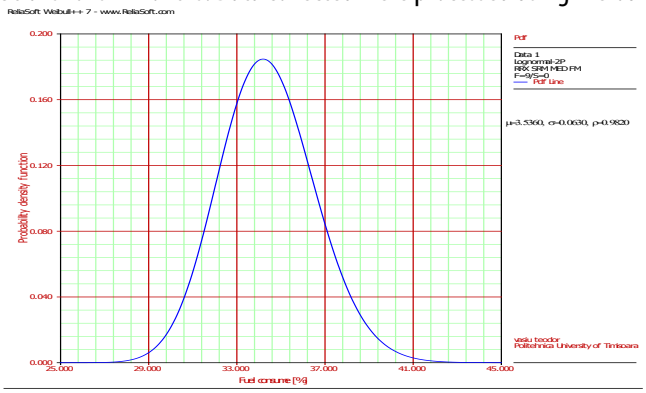

Figure 2. Probability density fuel

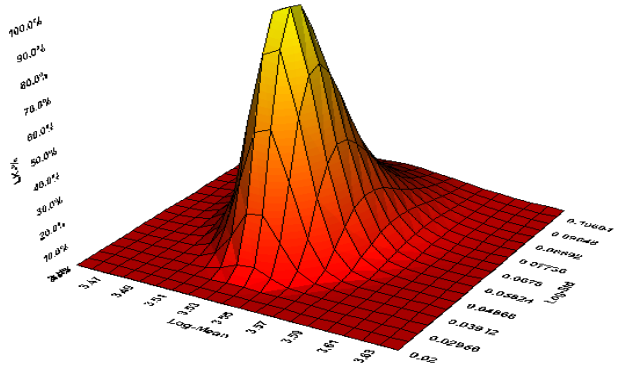

Figure 3. Fuel Likelihood Function

Since fuel consumption is directly related to distance and traffic load mass was considered useful to establish how effectively influence the two parameters studied vehicle diesel consumption. Data on distance relationship - consumption and mass transport - consumption are shown graphically in figures below.

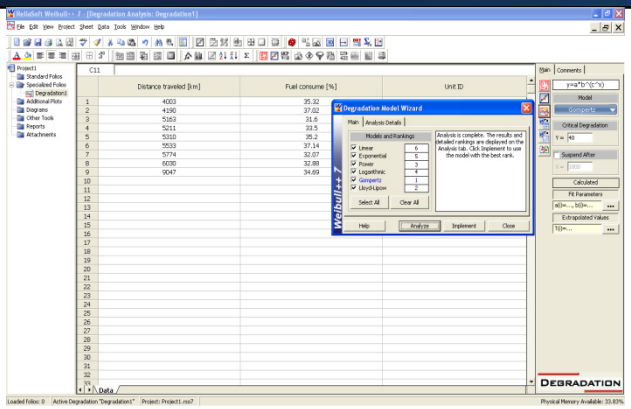

Figure 4. Determination of mathematical link fuel consumption depending on the distance traveled

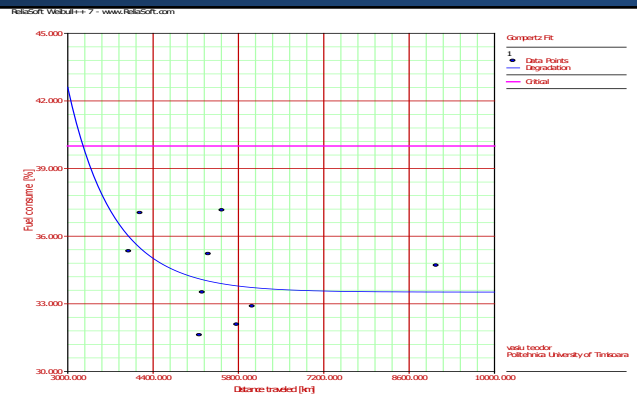

Figure 5. Fuel consumption depending on the distance traveled

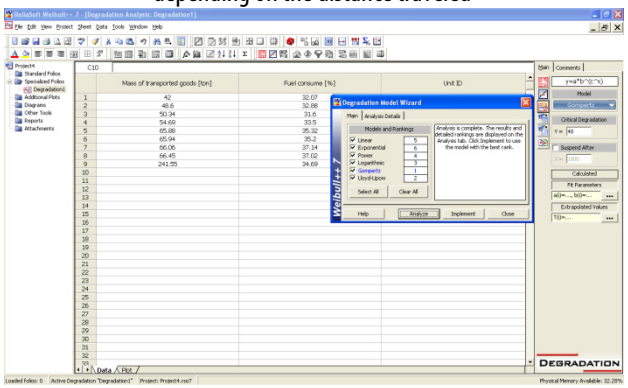

Figure 6. Determination mathematical relationship diesel consumption depending on load weight

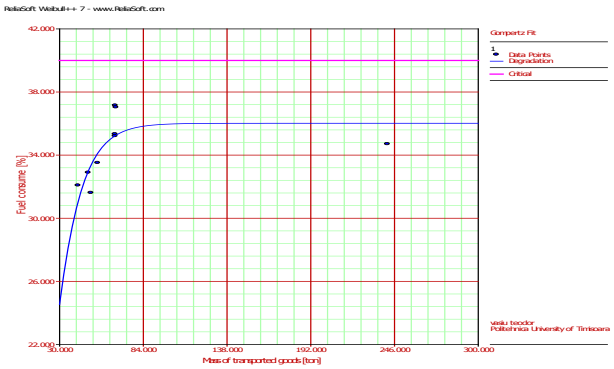

Figure 7. Fuel consumption depending on load weight

A practical application of experimental data consists in determining the mathematical relationship between fuel consumption according to the mass transported (x) and distance (y). This was done with statistical program and the result is shown in Figure 8.

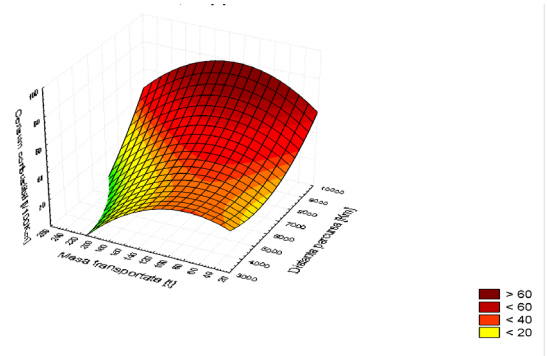

Figure 8. Fuel consumption according to the mass transported (x) and distance (y)

3. CONCLUSIONS

It appears that the fuel consumption figures for the law-abiding log-normal distribution with a correlation coefficient $\rho = 0.982$. Law parameters are: $a = 3.536$ and $\sigma = 0.063$. With probability density fuel can determine, which is most likely consumption data in the certain operating conditions (tonnage transported, driver etc.). High values indicate the probability of normal operating conditions of the machine. Experimental data with the same software Weibull ++ 7 shows that consumer law dependence mathematics - distance is Gompertz (Figure 4), with parameters $a = 33.51763876$, $b = 9988.702063$ and $c = 0.9987850003$. Gompertz function chart (Figure 4) shows that a relatively small distance (in the same city) consumption is highest and decreases, reaching an average of approx. 34% on long distance trips. It is therefore recommended that the roads in the same city or town nearest the transport of goods to be made with other types of vehicles.

Regarding the influence of the traffic load on fuel consumption is expected to grow latter as the car is full. Link consumption - mass is transported all Gompertz type (Figure 6) with parameters $a = 36.01738407$, $b = 1.52$ and $c = 0.9234672215\text{-}02$. It is found that (Figure 7) at a race exceeds 84 tons cargo mass consumption remains relatively constant.

The relationship in Figure 8, knowing a priori the mass to be transported (in tonnes) and distance that is moving (in Km) one can determine specific diesel consumption (in liters / 100 km).

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