Determination of Reliability for Dacia Solenza 1,9D

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Abstract. This paper analyses running and failure of Dacia Solenza 1,9D. The study comprises plotting the Pareto diagram in accordance with the data collected by observation of the vehicle running/failure and determination of its reliability using the Weibull++8 specialized software of the company ReliaSoft, conclusions being presented in graphic form within this study.

1. Introduction
In the system of economic efficiency, which points all aspects and components of the production activity, products quality and its continuous improvement have a significant place.

Reliability is one of the prominent elements of product quality and according to SR-EN-ISO 8402-1991 represents: Ability of a product to accomplish a specified function in fixed conditions and for a certain period of time [1], [2], [5].

From a certain point of view, quality can be considered as a "static" feature to satisfy some requirements at a certain moment, while reliability is "dynamic", as manifestation in time of the quality.

2. Pareto diagram
The analysis of the data collected from the observation of the functioning/drawback of the Dacia Solenza 1,9D car allows the construction of so called Pareto diagram (Figure 1). This is a method of analysis of fault distribution and of evaluation allowing in the same time the identification of fault categories upon which one must operate with priority, in case of faults with unknown causes.

3. Determination of reliability for Dacia Solenza 1,9D
Information on reliability for Dacia Solenza 1,9 have been obtained observing the running of a lot of vehicles of the same generation and fabrication, on a period of a six months. This control programme comprises data on the number of kilometers from which intervene changes in status or behavior of the vehicle, moment of down time, moment of re-starting up after removal of failure causes.

After processing the obtained data from the exploration of the car Dacia Solenza with the specialized soft Weibull ++ 9.0.9, the following results present graphically in Figures 2-8 were obtained.
Figure 1. The Pareto chart for the car Dacia Solenza 1,9D

Figure 2. Interface for determining the Weibull placement parameters
Figure 3. Processing the results with the help of the Weibull ++ 9.0.9 software

The certification of the fact that the real reliability of the studied vehicle respects the Weibull placement law can be seen in Figure 4, in which the Alain Plait diagram is presented where the double-logarithmic coordinates show the time independence of the cumulated relative frequency [3].

The calculated values of the parameters of Weibull’s law are, with the correlation coefficient \( \rho = 0.987777 \): \( \beta = 2.11702 \), \( \eta = 59658.607 \) and \( \gamma = 3625.00 \) [4], [5]. In this way, the mathematical expression of the law of the reliability’s placement of Dacia Solenza, 1,9D is:

\[
R(t) = e^{\left( \frac{-(t-\gamma)^\beta}{\eta} \right)} = e^{\left( \frac{t-3625}{59658.607} \right)^{2.11702}}
\]  

(1)
Figure 4. Alain Plait diagram
Figure 5. Reliability graphic according to km
Figure 6. Non-reliability graphic according to km
Figure 7. The failure rate graphic according to km
4. Conclusions
From Figure 1 it is found out that by reducing or eliminating the first four categories of faults, stabilizer bar sleeves 25,3968; pre-heated spark plugs 12,6984; bilelet direction 12,6984; transmission and drive shaft 7,9365, the number of accidental stops is reduced with approximately 65%.

From Figure 5 one can observe that the reliability has an accentuated decrease from the moment the car starts. This means that the mechanical problems emphasized through Pareto diagram (Figure 1) occur very fast. The major milestone that contribute to the appearance of the flaws must be analysed with big responsibility in what concerns both the quality of the material and the processing, and their fitting.

Not respecting these observations makes the reliability of the car to drop below 0,2 after only 80.000Km, and the failure rate has a rapid growth in this distance (Figure 7); this means that the car’s warranty period, when free maintenance operations are made, has bigger costs for the producer. Also, low reliability imposes a higher maintenance which duration brings frustrations to the owner of the car.

References
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Figure 8. Graphic representation of the Likelihood function