Transilvania University of Brasov
FACULTY OF MECHANICAL ENGINEERING

COMAT 2020 & eMECH 2020

Brasov, ROMANIA, 29-31 October 2020

TENSILE STRENGTH STUDY ON SAFETY SYSTEMS

Toderita Ana[1], Sorin Vlase
[1] Transilvania Univeristy of Brașov, Romania, Brasov,ana.tode@yahoo.com, svlase@unitbv.ro

Abstract: *In today's world people are more pretentious with the vehicles they choose, from the safety systems point of view. Although the user of the vehicle knows he has to check the oil level, tire pressure and do yearly inspections most users do not know to check their seatbelts for defects that could appear over time or from wrong manipulation. This paper has the purpose to identify these defects and analyse which are the potential ones that could put in danger the passengers safety. The most common defects found were scratches cuts and burns found on the webbing of the seatbelts . Results from tensile test were compared to the new state results.*
Keywords: *safety systems, tensile strength, safety systems*

1.SAFETY SYSTEMS -GENERAL DESCRIPTION

Passenger safety holds a very important place in the automobile industry. Producers are aware of this and with each new vehicle model the safety systems are more complex and efficient in protecting the passengers and pedestrians. While airbags have saved thousands of lives they also have the potential of injuring someone if the seatbelts is not properly fastened. Children under 12 years must sit in the back in an adequate retaining system .
The safety belt, an important part in passive safety in vehicles is in continuous improvement. The pretensioning device in seatbelt withdraws the webbing immediately in case of impact, some producers offer inflatable safety belts for backseat passengers ,and in case of an impact will distribute the forces on a much wider area, very important for the more fragile passengers such as children and elderly people.

2. MANIPULATION OF SAFETY BELTS

For the paper to be applicable in real life we searched for the most common defects found in vehicles on seatbelts. We decided to exclude defects such as stains which are the most common due to the fact that most people eat in their vehicle but this will not affect the performance in case of an accident.
We identified three types of defects and decided to test them from strength point of view:

- burnt webbing – this can appear in a vehicle where the passengers are smokers and a fallen cigarette or ash can produce a disruption in the structure of the webbing;

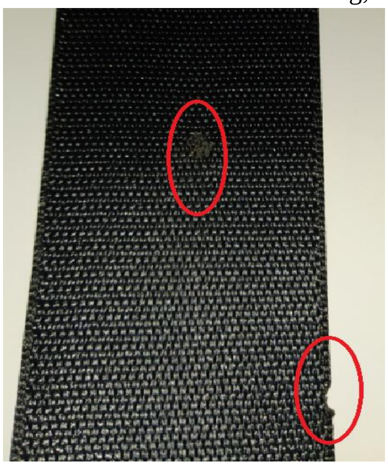


Figure 1: Burnt webbing

- cut webbing-this type of failure appears from wrong handling of a sharp objects such as opening a package with a cutter and accidentally snipping the webbing;

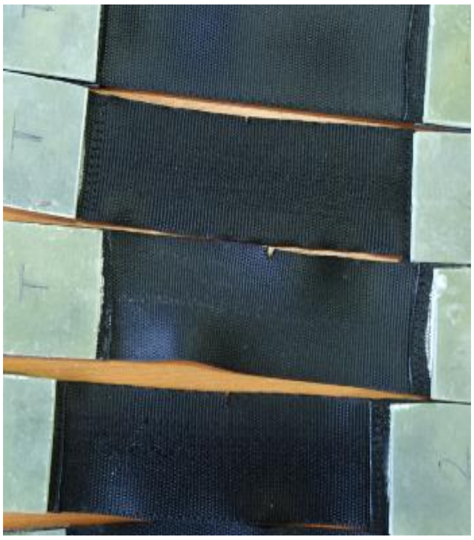


Figure 2: Cuts on webbing

- scratches on webbing-this defects appears from inappropiate transportation of animal companions in the vehicle such as cats and dogs without a cage and permitting access to the webbing , they can chew or scratch it which can lead to also breaking the webbing and not being able to use it anymore.

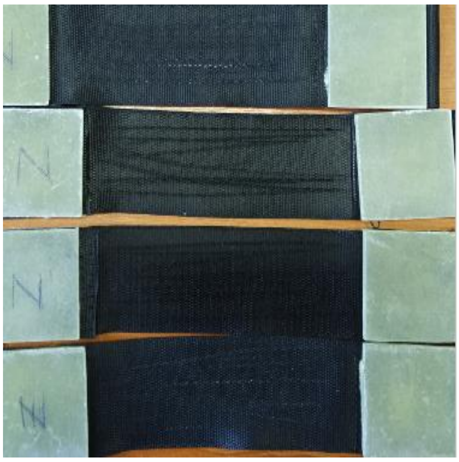
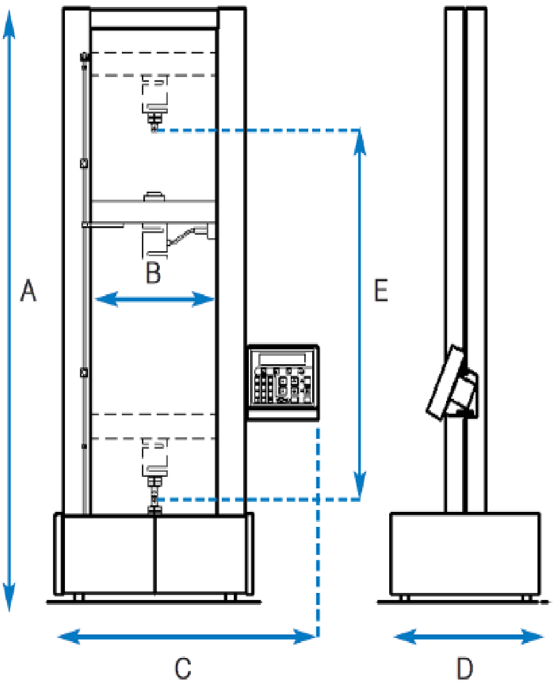


Figure 3: scratches on webbing

3. PREPARING THE SAMPLES AND TESTING METHOD

Because the webbing of the seatbelt is smooth to not produce any discomfort to the passengers, we realized that the prepared samples would slip out from the grabber of the tensile machine. Each sample had to have its ends treated with a special resin to make it more rigid for the grabbers to have adherence. It was chosen to test 6 samples per type of failure.
The advanced testing equipment LS100Plus incorporated a wide research of functions, it is ideal for complex testing and basic testing up to 100kN.
Characteristics:

- easy to configure, operate and maintain;
- high precision load measuring;
- constant load;
- storage up to 600 test results;
- resolution extension <0,03 microns
- 10 settings for testing;



	mm
(Standard machine height)	1567
(Extended machine height)	1857
	404
	868
	596
(Standard machine travel)	824
(Extended machine travel)	1012

Figure 4: LS100Plus schematic representation

4. RESULTS AND INTERPRETATION

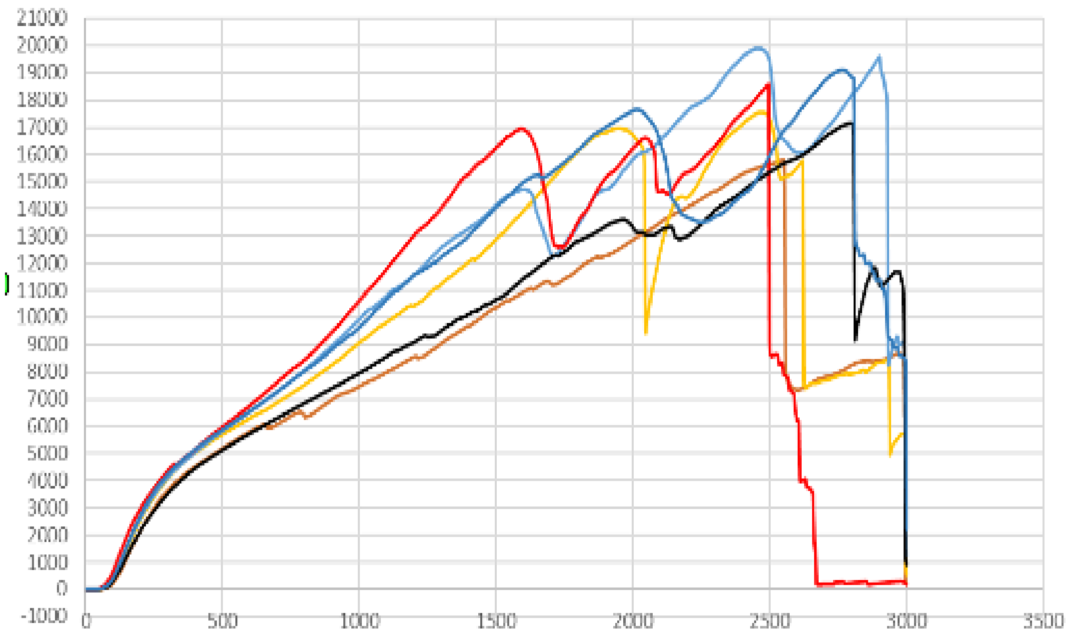


Figure 5: Multiload tensile strength new state

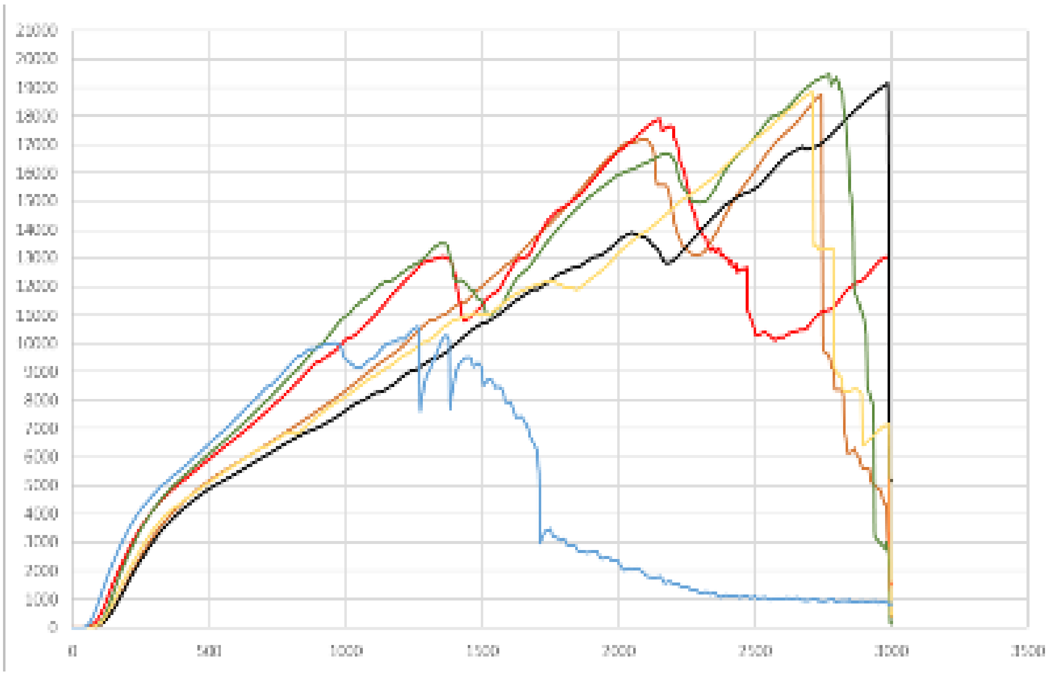


Figure 6: Multiload tensile stregth burnt webbing

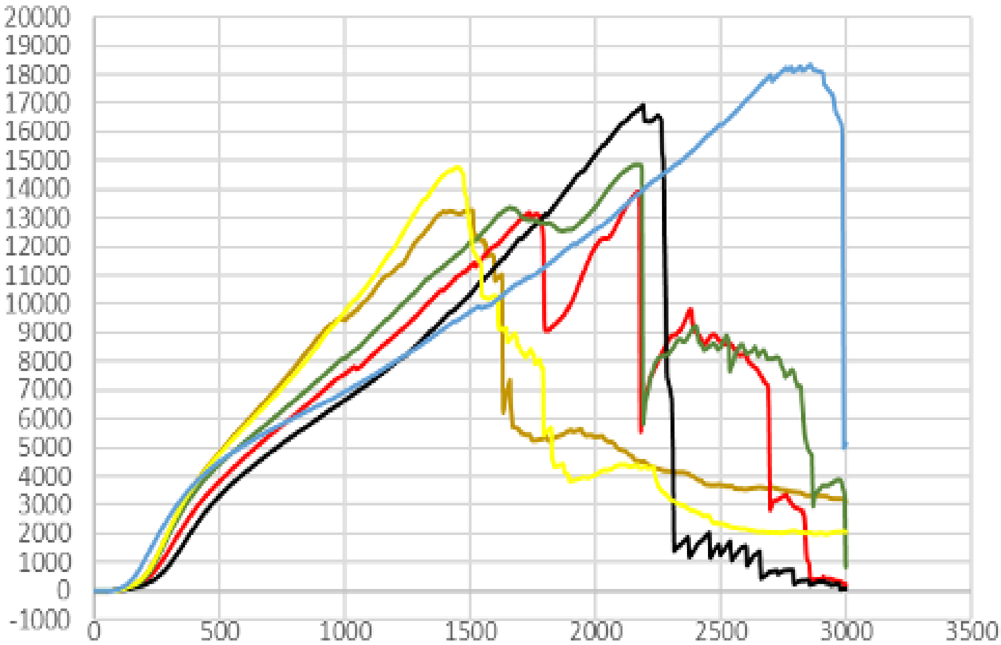


Figure 7: Multiload tensile stregth cut webbing

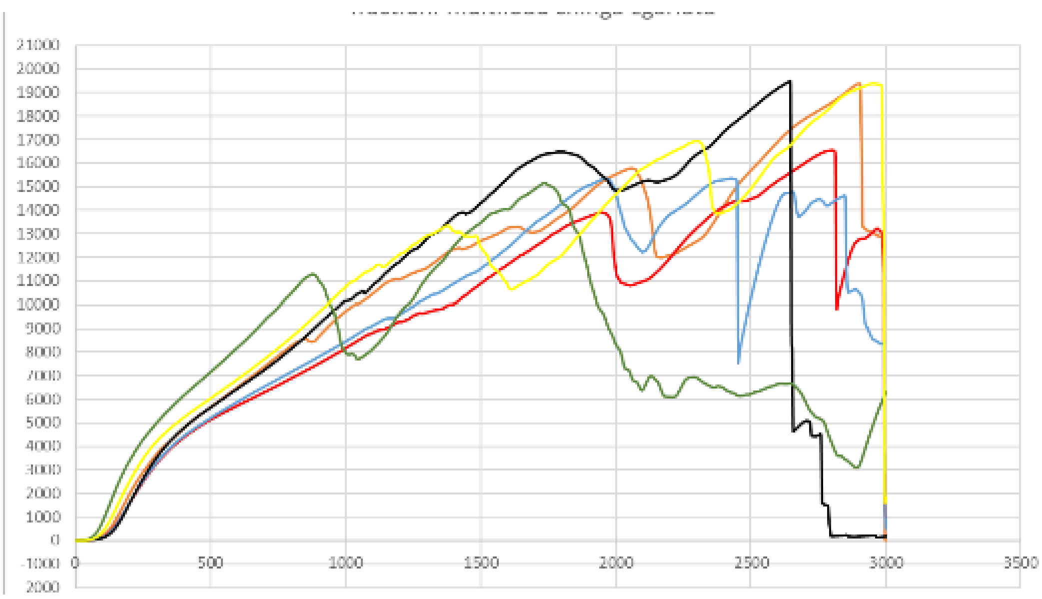


Figure 8: Multiload tensile strength scratched webbing

Based on the values obtained we can observe small deviations from the new state tests for the samples with burns/scratches, a 3.2% and 2.5% decrease in performance values.
Considerable deviations were found on samples with cut webbing, a 14.8% decrease in performance.

Table 1: Results

Case type	Tensile strength medium value (kN)	Stress at max.load	Performance with respect to new state samples
Webbing new state	18	255.44	n/a
Burnt webbing	17.43	247.4	-3.20%
Cut webbing	15.34	217.67	-14.80%
Scratched webbing	17.55	249	-2.50%

5. CONCLUSIONS

We can conclude that from three types of failures tested only one has presents danger in case of a collision. It must be taken into consideration that the samples were tested with different types of grippers than those used in the automotive industry. Samples from new state, burnt webbing and scratches failed in the resin treated area compared to the webbing samples with cuts that failed in the area with the defects. At a speed of 30km/h which is 10m/s, multiplying by the average weight of the occupant which is 75kg leads to a 750 kg impact force on a 30km/h speed.

15kN which is the european acceptance limit for tensile strength in safety belts means 1529 kg of force which is an impact at 60 km/h for an occupant of 75 kg