Analysis of the Mid Day Temperature of the Sun Expose Side of the Car Bodywork Protective Coating in Relation with the Contact Destructions with Marine Bird Droppings on the Black Sea Coast

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Abstract. In the paper we take in considerations the mid-day temperatures that a body car can get in summer, depending of color and type and try to settle its relation with the car bodywork protective coating's destruction in contact with marine bird droppings on the Romanian Black Sea Coast zone, highlighting possible causes of the loss of the aesthetic qualities protection of the car-body-frame film layer.

Keywords: car frame, external temperature, automotive body coating, bird

1 Introduction

This research is the subject of a Court case in which the owner request replacement of his new vehicle during warranty period, because of changing of its premium range car aesthetics outer coating body-frame. Technical expertise had to determine how the body car exterior temperature influence over the accelerated destruction reaction caused by the external factors – in case - those which appear in contact with the droppings of seabirds in the Black Sea Coast of marine area. Finally, we found a similarity of the destruction with the recognized pattern that appears catalyzed by the external mid 2015 summer days temperature, already noticed by the specialists, for this type of the external impact factors over the black protective coating film of the car frame in study.

Fig. 1. Bird droppings - a nightmare of manufacturers and owners of the modern cars

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2 Experimental car frame exterior surface measurements

The multiple analysis carried out on the state of the black body coverage (with multiple layers which include color pigment layer - and final transparent protective layer) (Figure 2, 3) shows that in the area of interest investigated in the aesthetic destruction signaled *B zone (rear left panel) made by the destruction reaction with marine bird droppings on the Black Sea Coast - in case, were a lot of other complementary acceleration factors that influenced the damage. For example, was made a strong polishing action with a rotary device (Figure 3). Taking a set of measurements *in the area of interest* with properly equipments (*fig. 2*) it was obvious that the paint had thinner coatings layers due from the shape of the body in the destruction area.

a. Ultimate Speed ULSP2A1 b.Broad care GM200 c Limit 5100

c polarised light device d.2016 metrologised & quality control meter gauges Elcometer 456

Fig. 2. Technical aspects of obtaining experimental measurements of coating thickness used during car coating film thickness distribution mesurements on the framepanel „rear wing" - zone B

Also, after a statistical and mathematical experimental data processing we can see in the deep of the coat structure that there were two types of mechanical stress over the coating framework that interested: on the "up/back part of the left rear panel" we find a depression beneath the bird etching that shows us that during the summer day when the clear coat was expanded the bird droppings that's dried quickly, became the toughest element of stability of the center of the destruction zone. The colored pigment layer, that expanded not so rapidly as the clear coat, was forced, during the rapid

cooling of the car-panel during the night to crack its substrates and to form a specifically “spider net pattern” under the clear coat (fig.2).

a. B Area *b. paintwork coating damages lok like the "spider-net" type template*

Fig. 3. Photos of the claimed aesthetic damaged area B of the *left rear wing* body

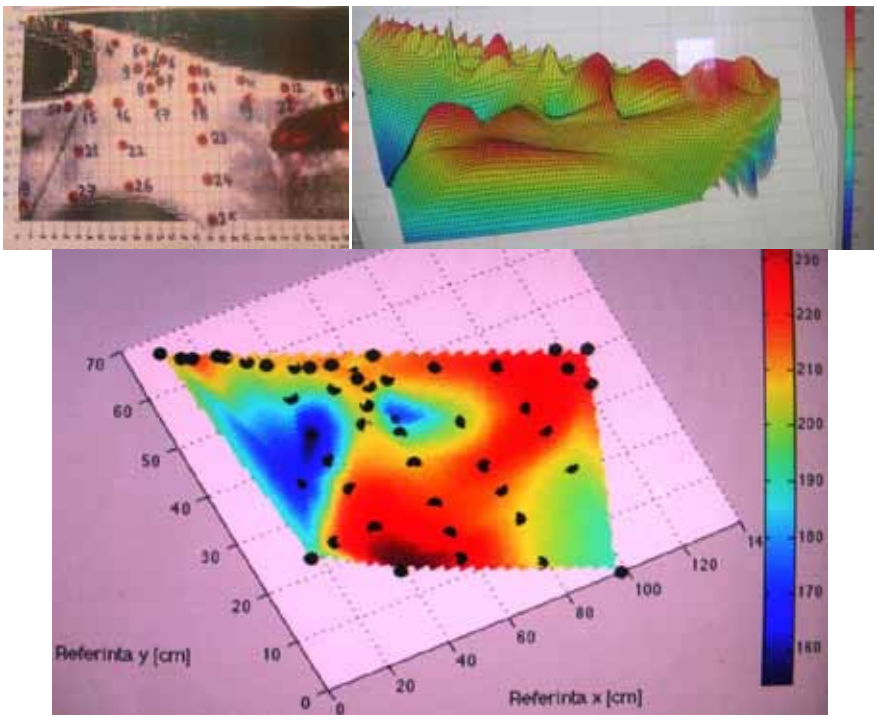


Fig. 4. Determination of the real and virtual car body coat thickness surface

So, in the destruction area we gathered information about the lower thickness (within the limits stated by the manufacturer) of the coat (probably part because of technology coverage on the painting manufacturer's plant, either possible, in our opinion, due to the emergence unauthorized effort applied on the protective surface by strong polishing -hoping uniform the final transparent coating film surface at the site - (fig. 2 - obvious circular destructions show in polarized light), and also of the existing "spider net template or a pattern" deformation under the clear coat (figure 3).

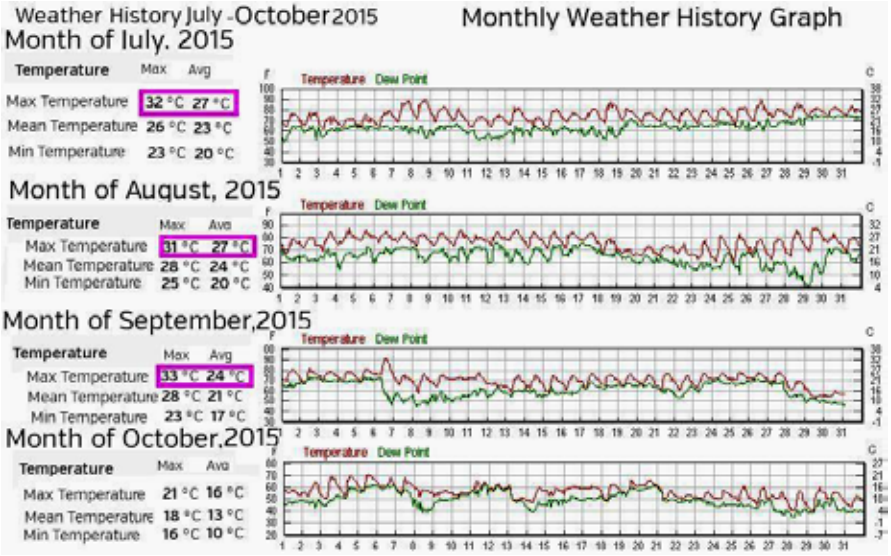
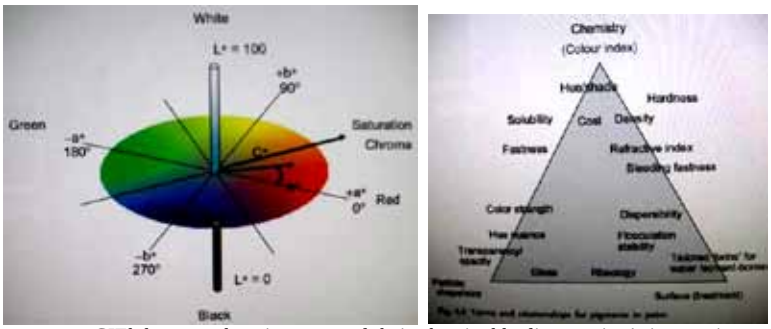
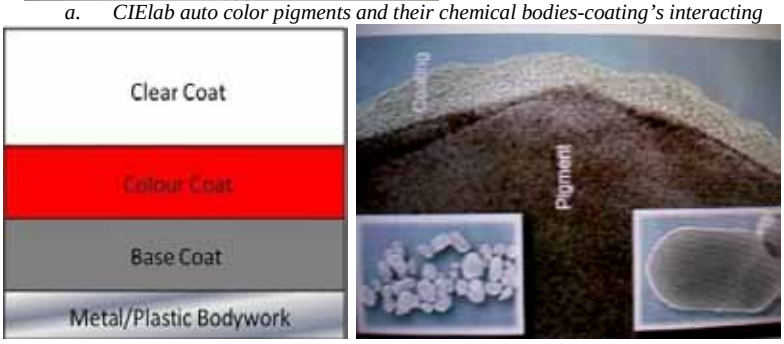


Fig. 5. Caloric radiation intensity analysis depending on the evolution of atmospheric temperature in Black Sea Coast Area from July to September 2015

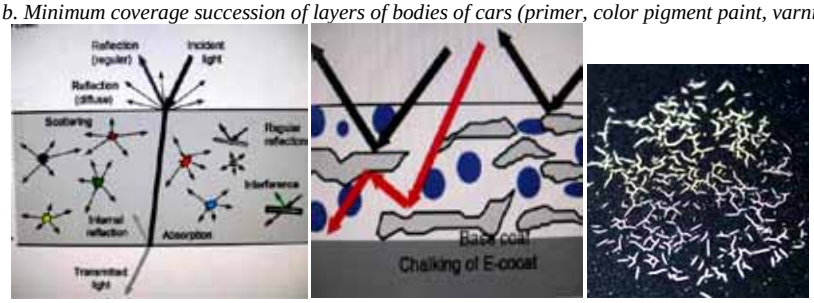
Summarizing the observations, emerge the following assumptions validated by the experimental measurements: 1.The damage appeared likely in the summer time season of 2015, when there were above normal maximum elevated temperatures during the day on the Constanta Black Sea Coast (33-35 degrees C), and when the black color body exposed to direct sunlight reached very high temperature values (60-80 degrees C) due to strong caloric radiation absorbing [6]. Given that on the Black Sea Coast there are many species of marine birds that usually random defecates we started also the search in this direction, linking it with the related observations of specialists in marine biology that shows that marine bird droppings (which varies depending on the species, diet, season) are a cocktail composed of salts rich in nitrogen (8-16%), ammonia, ammonium oxalate, urate, uric phosphate, uric acid and phosphoric potassium (2-3%) / ammonium biological materials, including bacteria and enzymes and that the oil contained in the excrement of seabirds make their adhesion to automotive paint to be big and have the effect of catalyzing attack reactions on cover frame body coating films, we tried to concentrate the specific search on the temperature activator.



a. CIElab auto color pigments and their chemical bodies-coating's interacting



b. Minimum coverage succession of layers of bodies of cars (primer, color pigment paint, varnish)



c. optical phenomena of color coating's perception

c.1. -with normal arrangement of coating c.2,3 distorsion arrangement -. damaged coating layers by external factors such as bird droppings

Fig. 6. Technical and theoretical aspects on „in-time" experimental behavior simulation of body-car-coating (Source: [5])

Fig. 7. Monitoring the temperature of a car bodyshell in a summer day with ambient temperature of 25-27^{o}C with infrared thermometer Broadcare GM 320

On that way it is known that bird droppings in contact with the car body coatings proved harmful varnish and paints damages, fading and even in depth degradation of the bodywork coverage (figure 2, figure 5), amplified by: magnifying to time reaction, 2.grain excrement and water content (as the grain deposit is bigger it becomes more rigid during the day and during the night on the cooled the body, if it is not removed, it becomes solid so the inflated transparent film of varnish and paint around shrinks around it taking the form of a cone or a "spider webs" as it is considered in the literature: "typical damage attack pattern to the car body coating with bird droppings" 3 temperature of the car frame during the impact (leading to the activation of components in the coating layer dilated and attack deeper and more corrosive the varnish layer stretched on smaller inflated thickness, and dry faster and intense deposit solid.

We want to see experimentally if, as it says, the dark black non metalized colors of car bodies are most exposed (black amassing maximum heat radiation) and high temperatures during hot summer days amplifies the destruction process (see Figure 5); First we study the weather history of summer 2015 temperatures which reveals medium day temperatures of 25oC-27oC (as it shown in figure.4) assuming that high temperature variation on hot summer days versus night, with daytime maximum temperatures exceeding 30 degrees C and 16-23 degrees C during night time, cause dilation and extent of the clear coat and the paint during the day, and in the event of a deposit which rapidly solidifies contraction of different paint around the varnish and with specific destructions of the paintwork with color pigment. If the reaction persists then cause irreversible damage to the protective layer of varnish and repainting it is necessary on the entirely body part.

The results revealed that black panels of the body frame heat up to 74 - 75 degrees C (on the side of the sun) compare with white color that assumes 25-27 degrees C or light metalized grey that assumes 35-39 degrees C. If we compared the exposed part of the body to the sun with the non direct exposed we find differences of 22 to 23 Celsius degrees –for case in study see also Figure 5, case e; for a light metalized brown car body. Different types of spark metallic inclusions in the coat offers different reflection to the sun rays (fig.5) that is why the experiments reveal that black metalized body frames reach with 10-14 Celsius degrees lower temperatures than normal black -see figure.5 case f. To understand why the reflection in the color and clear coat is so much important for the aesthetics of the car we present from bibliography [5] same short optical facts.

3 Conclusions

Studied bird droppings in contact with the car body coatings have been proven harmful for varnish and paints, causing fading and even degradation in depth the film coverage of the bodywork (Figure 2 versus Figure 5) effects amplified also by the temperature of the body frame and the strong differences day/night during summer 2015 nights.

We can say that in the respect of our search exist the possibility of finding a corresponding „pattern of destruction" type-like „image of spider webs" contraction of the

color paint film under the protective transparent car-frame coating just as it was in the complaining of the owner of the premium car, in case.

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