Focussed on: Fracture and Structural Integrity related Issues

Field Load Acquisition and variable amplitude fatigue testing on maxi-scooter motorcycles

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ABSTRACT. Aim of the present work was the instrumentation of a maxi scooter for the field collection of service loads acting on the scooter main components such as frame, fork, handlebar, rear frame and suspension. Service loads were collected on an instrumented Yamaha Tmax scooter equipped with 22 channels during a set of field tests that were representing a predefined road mix, covering a mileage of 270 km. Field load histories were used to develop an accelerated test procedure for the accelerated bench fatigue testing of a new model prototype whose mission was set to 50000 km. The acceleration procedure allowed a time reduction from 1600 hrs to 122 hrs bench equivalent testing. Both the benchmark scooter Tmax and a maxi-scooter prototype under development underwent the bench variable amplitude fatigue testing. The results of the fatigue tests on the prototype allowed to identify some critical bolted connections and to reduce some stress concentration features causing the appearance of small cracks that were found also after during 50000 km of driving tests.

KEYWORDS. Motorcycle; Field data collection; Accelerated variable amplitude fatigue; Cracked components.

INTRODUCTION

The development of a new motorcycle model is a long and complex process that involves several fields of knowledge ranging from the styling, the design of frame-suspensions-engine components, the virtual assessment of components, the prototyping, the bench testing and the final driving tests: in that process, manufacturers can rely on their former experience and on the support of component manufacturers, depending on their industrial size and historic production.

Usually, experiences from a small vehicle are useful but not enough to develop a more powerful vehicle: on the other side, also strong experiences in the automotive or motorcycle market may not be enough to enter in a new market as, for instance, the maxi-scooter market that is nowadays bridging between the small city scooter vehicles and the road motorcycle family.

Over the last decades, a lot of investigation was carried out by manufacturers and researchers in order to establish a proper set of methodologies supporting the development of motorcycles, nowadays usually implemented in the industry. The first set of information needed by engineers regarded the loads acting on the components of scooter or motorcycles: this was approached by the application of sensors to the component of the vehicle [1-4] or in some cases by the