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Strain in BMX frame through different tests

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The structural role of the bicycle frame is to transfer the mechanical energy produced by the cyclist at the rear wheel. In bicycle cross (BMX) high loads are applied on the frame, from the pilot, the field and the ground reaction. In BMX, the empirical design and the important power applied on the pedals can lead to the rupture of some tubes. The aim of this study is to equipped a BMX frame with strain gages and to measure the strain of the bicycle frame through tests representative of different actual race conditions: 1) A bar system was designed to simulate the forces applied to the pedals by the pilot in static condition; 2) a pilot applied a maximal isometric force on the pedal with help of handlebars (*e.g.*, Competition start); and 3) a pilot performed one pedaling bout at a cadence of 200 rotations per minute and at power of 550 Watts. During the last two conditions, the tests were realized on an ergo-trainer with two 3D pedals and a SRM.

The results obtained through experimentations highlight the strain imbalance in the frame. The conditions as function of time confirm the results obtained in static condition: the seat tube, the down tube and the chain stay have to be strengthened in the area near the bracket. The muscular power output is an important parameter of performance in BMX and the deformation of the frame is proportional to the power developed.

To develop a bicycle frame optimized for performance, it is necessary to develop tests that represent the cyclist-frame interaction in actual conditions. This protocol can be useful in order to compare BMX frames and to find the determinant factors to enhance the transfer of mechanical energy from the pedal to the drive train.

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