

Abstract

Title: Mechanics and consequences of the head load impact.

Objectives: The objective of the main part of the diploma thesis is the analysis of the data obtained during crash-test experiments, using a tram and a Hybrid III test dummy. The aim of the analysis is to describe the effect of mechanical load on the human head during collisions at different tram velocities, the position of the dummy and the types of front bodies of tram sets.

Method: The work has the character of experimental research based on the results of a crash test and confirmation or refutation of hypotheses. Four types of tram sets used in Prague (T3, KT8D5, T14, T15) and a Hybrid III crash test dummy were used for the research. Based on the selected criteria, a contact impact of the tram into the dummy was performed and individual components of the acceleration vector were recorded. Obtained data were processed in Microsoft Office Excel 2007 and magnitude of the acceleration vector was calculated. Head impact criterion (HIC) and Abbreviated injury scale (AIS) were used for assessment of the impact and probability of severe head injury. The experiment took place on the tram track in the central workshops of DPP, in cooperation with UK FTVS, VUKV a.s., ŠKODA Transportation, Advance Engineering and. No need for the approval of the ethics committee.

Results: Calculated HIC values suggest low probability of serious injuries characterized by the AIS scale. Given the criteria, a head injury will not qualify for a higher grade than $AIS \geq 2$, which is not considered as life-threatening. High-speed camera records revealed that in every case of frontal impact there was a contact of the head with the tram. Data also suggest more severe injuries in case of the front impact than in case of the sagittal impact. However, crash tests did not show a life-threatening collision. Performed tests did not confirm any significant correlation between severity of injuries and shape/construction of the front body of the tram.

Keywords: head injury, impact mechanism, injury criteria, injury qualification, causes of tram accidents, pedestrian-tram collision, Head Impact Criterion, Abbreviated Injury Scale