Vehicles

Modeling the Effects of Boots on Leg Injury Mitigation in Under-Body Blast (UBB) Events

A finite element model (FEM) of the human lower leg was developed by US Army Aeromedical Research Laboratory (USAARL) from Computed Tomography (CT) data, and it was used to simulate the response of the lower extremities to representative UBB exposures. The model was validated against available experimental data using postmortem human subjects. Simulations were run for both booted and unbooted conditions to assess the efficacy of boots to mitigate forces being transmitted through the floor into the lower leg, and to help quantify the associated risk of injuries to the Service Member. Simulations performed at varying levels of impact, mass, and velocity showed reductions of 34-40 percent in peak forces transmitted to the tibia. A validated FEM can be used to assess Service Member response to potentially harmful events, such as blast and ballistic loading. The lower leg model being described here has been used to evaluate the protective effects of boots, and can also help design and assess the performance of future improvements to personal protective equipment (PPE) and other protective technologies (Figure 1). This can include both Service Member-borne and vehicle-borne systems.

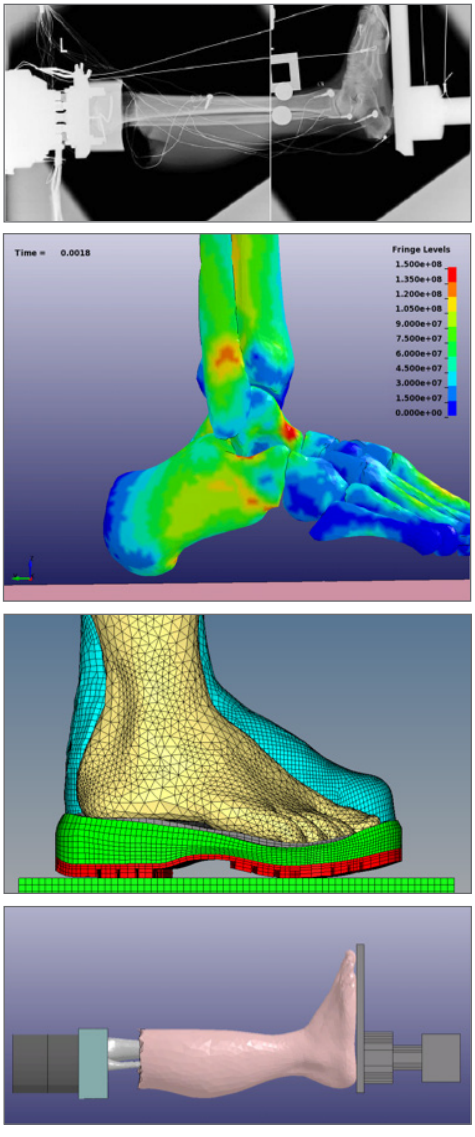

FIGURE 7-10: The figures above represent experiments and numerical analysis to study how blast forces are transferred to the lower leg of a Soldier seated in a vehicle subject to blast loading. The numerical analysis enables an understanding of how stresses are transmitted through the skeletal structure, and how they can be mitigated with protective equipment.