This work is focused on the numerical simulation of experimentally tested single lap joints, based on cohesive zone modeling techniques. Seven cases have been considered for analysis. The models were built in a 3-dimensional finite element space. The adherents were modeled with continuum elements whereas the entire adhesive layer has been modeled with cohesive elements. A mixed-mode cohesive model, which is an ideal candidate for describing the loading and fracture response of a relatively thin ductile adhesive layer, has been used as the constitutive relation of the cohesive elements. The traction increase part of the cohesive laws is given by an exponential function, which describes the elastoplastic adhesive response, and the traction decrease part is given by a linear function, which describes damage initiation and propagation. By using this model, it was achieved to calculate the developed peel, in-plane and out-of-plane shear stresses over the adhesive area. Thus, the global measured response of all cases was justified by examining the stress fields and their variation through the loading history. © 2012 Elsevier Ltd. All rights reserved.