Finite element limit analysis of slabs including limitations on shear forces

The load carrying capacity of existing concrete slab bridges is often limited by the shear capacity and the redistribution of shear forces when subjected to concentrated loads. In the recent years, finite element limit analysis has shown to be an efficient method to determine the ultimate capacity of concrete slabs. The existing plate elements within this method applied to concrete slabs cannot handle limitations on moment and shear forces. In this paper, a lower bound linear element for limit analysis of concrete slabs is presented. The element can model shear forces and include limitations on the shear forces. Yield conditions for moment, shear and interaction are considered. It is shown that the element performs well compared to the linear Kirchhoff element, which cannot handle shear limitations. Finally, a model of an existing shear critical bridge is compared with a full-scale field test.