Composite beam has higher rigidity and strength than steel beam in the case of positive bending, and is considered to be the steel beam otherwise. Because of this, a composite beam in double curvature becomes complicated, since it consists of two portions of different length, stiffness, and strength. This paper proposes a practical analysis method that can clarify such a double curvature composite behavior in detail. The method is used to clarify elasto-plastic behavior of the composite beam by referring to various nonlinear effects from its elements such as steel beam, concrete slab, and stud connector. Furthermore, mechanical considerations and parametric studies on the strain of the lower flange of the beam end suggest a useful examination method for the design of composite beams.