Self-Consistent Beam Equilibrium and Halo-Free Beam Transport, Y.K. BATYGIN, RIKEN - Intense nonuniform particle beam exhibits strong emittance growth and halo formation in linear focusing channel due to a mismatch between the beam profile and the focusing field. This phenomenon limits beam brightness and results in particle losses. The problem is connected with irreversible distortion of phase space volume of the beam in conventional focusing structures due to filamentation in phase space. Emittance growth is accompanied with halo formation in real space which finally results in inevitable particle losses. New approach for solving a self-consistent problem for a matched nonuniform beam in two-dimensional geometry is discussed. Resulting solution is applied to the problem of beam transport, while avoiding emittance growth and halo formation by the use of nonlinear beam-line elements. It is demonstrated that self-field of space-charge dominated beam compensates for the applied focusing field, which allows for the determination of the beam particle distribution based on knowledge of the external field profile. This in turn allows for choosing parameters for the beam in such a way, that a matched beam profile is established which results in suppressed beam emittance growth. Reduced emittance growth and suppression of halo formation are demonstrated via analytical derivations and utilizing particle-in-cell simulation for a beam with a realistic beam distribution.