What is the critical height of leading edge roughness for aerodynamics?

In this paper the critical leading edge roughness height is analyzed in two cases: 1) leading edge roughness influencing the lift-drag ratio and 2) leading edge roughness influencing the maximum lift. The analysis was based on wind tunnel measurements on the airfoils NACA0015, Risoe-B1-18 and Risoe-C2-18 and at three different Reynolds numbers with two different leading edge roughness tape heights. Firstly, an analysis of the momentum thickness as function of Reynolds number was carried out based on the boundary layer theory by Thwaites. Secondly, the wind tunnel measurements combined with panel code predictions of the boundary layer momentum thickness created the basis for determining the impact of roughness on the aerodynamic performance. The critical heights were related to the Reynolds numbers and thereby the size of the wind turbines.