Wave Breaking in Undular Bores.

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An undular bore is a laminar flow which transitions between two different flow depths. In rivers, bores are generally due to tidal forcing. Bores can also be studied in the laboratory, and a number of studies have been aimed at understanding the main features of bores. In particular, Favre conducted a dedicated series of experiments with the aim of classifying different types of bores (Ondes de Translation, Dunod, Paris, 1935).

In the relatively simple situation of a wavetank, one may without loss of generality assume that the upstream flow depth is the undisturbed depth, and define the bore strength to be the incident wave amplitude divided by the undisturbed depth.

It was found by Favre that there are three main bore types. If the bore strength is below 0.28, the flow is laminar and oscillations of the free surface start to develop. Since in this case, none of the waves are breaking, this case is termed the purely undular bore. If the bore strength exceeds 0.28, then the leading wave behind the transition front starts to break. If the bore strength exceeds 0.75, a fully turbulent bore appears. The main purpose of this lecture is to explore whether the ratio 0.28 can be found using some fairly simple wave models such as Boussinesq systems.