Flow Resistance Introduction

SPEAKER Bob Holmes: In this particular lesson, we're going to cover a number of key points and introduce some new issues and new equations that you haven't seen to this point. In the introduction of this lesson, I want to kind of go over a few of those points. We're going to talk specifically about the friction slope and the energy grade line and exactly what that is and discuss the differences between it and the bed slope and what kinds of flows that they would be equivalent. We're also going to go over the bed shear or the tractive forces, what it's also known by, and that's an equation that people use in a number of different applications including sediment transport. But we use it--you've seen a little bit of that in Lesson 5 when we went over the velocity profiles, but that's the shear stress of the bed, tau zero, Greek letter tau again, is equal to the unit weight of water, gamma, times the hydraulic radius, R, which is a new concept we're going to introduce today, times the friction slope, which is abbreviated S sub-f.

Now, the hydraulic radius, as I've mentioned, is going to be the cross-sectional area divided by the wetted perimeter. And the wetted perimeter, we'll show you in the next section of this lesson. Now, for uniform flow, we're also going to note that the bed slope is equal to the friction slope. In addition in this lecture, we're going to introduce a couple of equations that are uniformly used, the one equation that's particularly used in the United States which is the Manning equation which predicts the velocity from the characteristics of the channel or the channel roughness and the slope or the energy grade line. There's also an equation we'll use, which is not as predominantly here in the United States as it is in Europe, and that's the Chezy equation.

Now, we're going to talk about energy loss and accounting for that energy loss. And that's what the purpose for these friction equations or these resistance equations are. We used those in a number of applications, in step backwater modeling and to do indirect determinations of discharge. Real fluids, again, as we've mentioned throughout this--the earlier parts of this course, we've mentioned that real fluids have resistance to movement, which resulted to energy loss as the water moves along the channel. Accounting for this energy loss is one of the most difficult processes in hydraulic computations, and quite frankly you spend most of your time trying to assess that in your work.

That will end our introduction here. You should now go on to the next section.