Similitude Introduction

SPEAKER Bob Holmes: Okay, in this lesson, we're going to talk about similitude and dimensional analysis. This is always a somewhat difficult topic for students to set through, understand and sometimes even question why we even offer this in the class. But it's crucial because we have a broad spectrum of students that attend this course. For example, in some cases, students later on in their career will have to do physical modeling where they will actually take a prototype situation, say a dam on a particular lake or a particular river or something like that. There might be something they wanna find out about it. Maybe they wanna look at how the flow of velocity's downstream of the tail race behave, or they might want to examine the sediment transport aspects of how sediment builds up behind the dam or a number of different things. Well, it's very expensive to do things, a kind of trial and error in the field and our mathematical models sometimes are not sufficient and detailed enough to be able to answer some of the questions we want to answer. So we basically build physical models. These are scaled models of the actual system out there in the prototype. So I'm gonna talk about similitude which is how we would set up a model, because you need to look at more things than just the physical scale of the model and so we'll talk about that.

In addition, we have a lot of dimensionless numbers in hydraulics and fluid mechanics that help us look at various issues. For example, we talk about later on in this class and Lecture 5, we'll get into the difference between laminar and turbulent flow and because we have different velocity profiles for those. We will give you a number called the Reynolds number that will allow you to compute a number that would tell you, "Okay, is this flow laminar or is it turbulent?" So this lecture will get into how that's actually derived and computed and what that equation looks like. In some cases, we will need to be doing experiments. Let's say that you were wanting to look at the drag on a bridge pier if you were trying to design that bridge pier to stand up out there under the flow conditions that you might encounter or ice loading or whatever it would be. You would--you possibly might want to do some experiments in the flume and you'd want to know exactly what kind of parameters that you need to collect. So the lectures on dimensional analysis will kind of

look at those kinds of things dimensionally analyzing what we need to look at in order to understand the problem and kind of know ahead of time a priority. What parameters we need to collect? What are important? What can we maybe not do as good a job in on the experiment? Because it's not as important to understanding the problem as other aspects that are very important to the problem. So anyway, that is kind of an introduction to this Lesson 3. At this point, we'll--I encourage you to go on to Section B which we will discuss similitude.