Cowan's Method

SPEAKER Charles Berenbrock: One of the approaches for estimating resistance is the Cowan's method. The Cowan's method is a systematic analysis of the factors affecting Manning's n. The equation is shown here. "n" is equal to the quantity of n_0 plus n_1 plus n_2 plus n_3 plus n_4 times m_5. This is a seven-step procedure. The first thing we ought to do is look at n_0. "n_0" represents the roughness of the types of base material. In other words, what is the base material on the bottom and on the sides of your channel? Is it rock? Is your channel compose of, let's say, cobbles? If it did then n_0 would be 0.36.

Let's go on to n_1. It represents the surface irregularities in your channel of question. If your surface irregularities are smooth, you would have--n_1 would be zero. Let's say if it was moderate surface irregularities, you would assign it a value of 0.010. And you can see under what conditions you would sign that value. "n_2" represents the variations in cross section size and shape from one cross section to another, so in other words, the upper cross section and the lower cross section or maybe even lower cross sections. If you had gradual changes you would apply a zero to n_2. If you had occasional section changes like your cross section size and shape change occasionally from one to the other, you'd assign it a value of 0.005. If you have frequent changes though, it can range from 0.010 to 0.015. You'd assign that to n_2.

"n_3" represents the channel obstructions. In other words, how much woody debris or log jams you have in there, maybe debris deposit, large boulders, stumps and roots and maybe other things that can have channel obstructions. If you have no channel obstructions, you'd assign n_3 as zero. If minor obstruction, let's say, a log or two in your channel, you might assign it a value ranging between 0.010 and 0.015. And you can see through the rest of that list for appreciable and severe channel obstructions what values you would sign there. You can have as much as 0.060 to that value.

Let's go to n_4. "n_4" represents the vegetation. In other words, the limbs, stems, foliage and also remember that this value can change throughout the growing season. If you have low vegetation, in other words not much vegetation in your section, you can assign it a value ranging anywhere from 0.005 to 0.010. And you can see through the rest of that list all the other ones in there too, for example, like high can range from 0.025 to 0.050.

"m_5" represents the degree of meandering. In other words, it's the ratio of the length of meandering to the length of your stream. If you have minor--say, your ratio is less than 1.2, you'd assign it the value of 1 for m_5. If you have appreciable ratio, in other words, your ratio ranges from 1.2 to 1.5, you'd assign m_5 as 1.15. If you have severe meandering, in other words your ratio of L_m divided by L_s is greater than 1.5, you'd assign it a value of 1.3 to m_5.

Now what you do in the next section is you add n_0 the n_1, n_2, n_3 and n_4 together then you multiply it by m_5.

In summary of Cowan method, n_0 represents the roughness of your base material, of your stream and sides. "n_1" represents the degree of surface irregularities. "n_2" represents the variation of cross section from one section to another cross section in the region under consideration. "n_3" represents channel obstructions like woody debris and n_4 represents vegetations like stems, leaves and foliage, and remember that can change throughout the year and especially during the growing season. And then also m_5 represents the degree of meandering and the reach under consideration.

Now we'll go through a simple example here. Let's say we have a channel it's a earthen channel. It's probably composed of fine sand. You give it a value of 0.020 [n_0]. Let's say you have minor irregularities in the reach so we'll assign it n_1 has a value of 0.005. Let's say we have occasional section changes in that reach. We'd also assign n_2 as 0.005. Let's say there's some minor obstructions like woody debris in there. It could be caused from a beaver even. We'll assign it a value of 0.015. Let's say we have moderate vegetation in our channel n_4, we'll assign it a value of 0.018. Now what we do is we add all the values together, our subtotal is 0.063. Let's say we had a minor meandering or no meandering at all in this reach under consideration, we'll assign m_5 a value of 1. We multiply 1 times 0.063 and our result "n" is 0.063.

I hope this is a pretty good method. I've used it quite a few times and it works really well but it even works better if you can get a colleague to do it also. Compare your notes, discuss it where you have differences or even discuss it where you have similarities and see if you guys can get the same result.