3.1.2 Lane's Relationship

In 1955, E. W. Lane expressed the relationships between the driving and resisting forces for channel change in the following simple proportionality. The expression is also illustrated on **Figure 3.1.1**.

$$Q_S \, D_{50} \, \alpha \, S \, Q_W$$

Where: Q_S = Rate of sediment flow; D_{50} = Median size of mobile particles; S = Slope of the channel bed; Q_W = Rate of water flow [1]

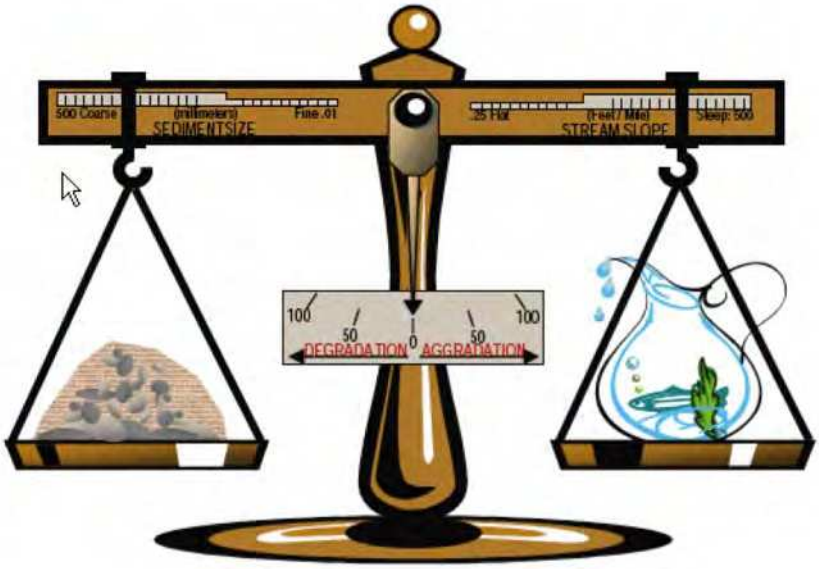

Figure 3.1.1. Lanes Balance - Sediment Load X Sediment Size ∝ Sediment Slope X Water Discharge

Here the D50 stands as proxy for boundary strength and S for channel slope. From this relationship, it is clear that a change in any of these parameters will, once a threshold is exceeded, induce a change in one or more of the others. The familiar increase in flow discharge Qw associated with urban development illustrates this point well. The response to this increase is some combination of the following: a decrease in channel bed slope (incision), an increase in sediment load (increased erosion) and an increase in the median size of mobile particles. When considering all four parameters, these responses often occur in sequence as described below:

> *Initial change:* $Q_W \Uparrow$*; followed by the response:* $Q_S \Uparrow$. With an increase in water flow, the bed slope often remains relatively unchanged at first, so to maintain the proportionality, Qs increases. The increase in sediment load is generated

[1] Adapted from Lane, E.W., The Importance of Fluvial Geomorphology in Hydraulic Engineering, J. Hydraulic Engineering, 1955.