

Univ. of Tokyo, C. E. Member, Prof. T. Maruyasu Ph. D.

Univ. of Tokyo, C. E. Member, Prof. Y. Takahashi Ph. D.

Univ. of Tokyo. O. D. G. T. Rees M. Sc.

Introduction.

In this project the movements of bed-sediment along Azusa River in Nagano Prefecture were studied by systematic measurements of the geological composition of the bed-sediment throughout the main drainage system. The direct results of such a study give the Proportions of bed-sediment contributed by each tributary to each main confluence, and, under favourable conditions, the movements throughout the system by proportion. If data of the actual debris movements at one or more points on the system is available, this may be correlated with the above results to give the actual movements throughout the system if this data is in a suitable form. The bed-sediment was identified on three size ranges as follows: 15.90 mm. to 9.52 mm.; 9.52 mm. to 4.60 mm.; and 4.60 mm. to 2.50 mm. In this paper, only that part of the river between Mt. Yakedake and Nagawado Dam site is discussed.

Results.

A short summary of the main results is given here.

- 1) Accuracy of bed-sediment sampling. The results show a standard deviation of less than 2.5% amongst samples from the same river reach using samples of approximately 2250 particles. This was for a reach having a wide flood plain; the standard deviation dropped to less than 1.8% in the case of a narrow flood plain. It is estimated that the accuracy of identification was of the order of $\pm 1\%$ and the remaining fluctuations represent an actual random variation from place to place in the bed-sediment composition at any one place in the river.
- 2) Proportions of bed-sediment contributed by tributaries to confluences. These results are the direct results of this study programme, and are based on field work and sample identification by the same team, so that the work was done to a consistent accuracy. The accuracy in the values found for the Proportions of bed-sediment from each tributary to a confluence depends in large part on the relative compositions of each tributary in addition to any errors or difficulties in identification of the geological composition. The relative differences in composition should differ by at least 15%. It is unfortunate that conditions on Azusa River are not the most favourable in this respect.
- 3) Bed-sediment movements throughout the system. Due to the geological conditions and lack of data of rates of aggradation on Azusa River, estimates had to be introduced at this stage of the study. Although Debris Yield data is available for accumulations behind several debris control dams, this gives the yield upstream of the dam, and bears no direct relationship to the yield below the dam, i.e. how much is passing the dam under present conditions. Thus, this data cannot be correlated directly with the results of such a study unless sampling has also been carried out before the dams were constructed.

However, the debris yield is known at a debris control dam at the downstream end of the river system, which thus gives the yield from the river system considered at that point. If this value is used in the analysis, and aggradation and degradation in the rivers are ignored, the values for the debris movements resulting indicate the origins of the material passing the downstream point. The actual movements at any other point will be higher than those so given, as some of the material passing such a point on the system will be deposited in the system before reaching the downstream point (in the case of aggradation). The differences between the actual movements and those shown for this condition become greater the farther ones goes from the downstream point. It is estimated that the Debris-delivery Ratio under present conditions in the main channel of the Azusa River here is of the order of 10% only. If some such estimation is taken, or if this is known from past bed level surveys, actual movements can be calculated.

4) Practical Results for Nagawado Dam-site. Due to geological conditions, the debris yield data available, the changing regime conditions due to recently constructed debris control dams, and the fact that the results of this study are for one year only, only provisional estimates can be given for the likely yields at the heads of the reservoir that will be formed behind Nagawado Dam. The yields will also change as new debris control dams fill up and gradually pass more and more debris. These provisional estimates are given on Fig. 1, and are based on the average yield measured at Inakoki Debris Control Dam, which is situated a short distance downstream of the new dam, and on estimates of the aggradation in the main stream of Azusa River, as no data is available for this.

