

Estimation of Sediment Supply to the Downstream of Direct Control Section According to Grain Size Groups

SUWA Yoshio, Head, FUKUSHIMA Masaki (Dr. Eng.), Senior Researcher, NISHIMURA Yusuke, Researcher, EJIRI Yuzaburo, Guest Research Engineer
River Division, River Department

Key words: total sediment management, sediment balance, grain size group

1. Procedure to estimate / calculate sediment supply by grain size group

Based on the sediment balance ¹⁾ prepared with focus on changes in cross-sectional area, we are working for calculation of sediment supply to the downstream of the direct control section. The purpose of calculation is comparison across water systems and grasp of the factors that affect sediment supply. Sediment supply to the downstream of the direct control section according to grain size group was calculated by subtracting the dam sedimentation from the sediment yield and adding the supply from the channel comprised of material of the relevant grain size group or subtracting sedimentation on the channel.

- (1) Sediment yield was calculated with the specific sediment yield estimation equation ²⁾ according to the geological classification in the basin. The average elevation and relief degree, which are the parameters of the source of yield were calculated with 1km mesh elevation for each 10 km square area.
- (2) Dam sedimentation was calculated with actual sedimentation when total capacity of reservoir is over 1 million m³, or on the relationship between total capacity of reservoir in the same river system and actual sedimentation when the capacity is under 1 million m³.
- (3) For the percentage according to grain size groups (gravel, sand, silt, clay) of sediment yield and dam sedimentation, we used the average of gravel size component percentages for 27 dams across the country.
- (4) For sediment supply from the channel or sedimentation on the channel, we calculated by subtracting gravel extraction and channel excavation from changes in channel volume only for the direct control sections.
- (5) For sediment yield, the area two times the standard deviation estimated from the variation of specific sediment yield was indicated as calculation range, and the calculation area was also indicated for the sediment supply to the downstream in the direct control section.

2. Example of calculation result 1: Ishikari River (Fig. 1)

The river bed of the Ishikari River in the downstream is mainly comprised of sand and there is no supply of gravel to the river mouth. For sand, silt, and clay, decrease due to dam sedimentation is comparatively small, about 30 percent of the estimated supply from the basin. At present, effect of dam sedimentation on the sediment supply to the river mouth is considered small

since sand is supplied from the river channel in excess of dam sedimentation.

3. Example of calculation result 2: Tenryu River (Fig. 2)

In the Tenryu River, in accordance with the decrease in sediment supply from the river to the river mouth, the river mouth terrace and sand bar set back and sediment is flowing into the river mouth from the nearby coast, and pier construction is proceeding to control sediment inflow into the river mouth along the coast on the right side of the river mouth. In the Tenryu River, gravel and sand deposited in the dam in an amount more than 85 % of sediment yield, respectively, and silt and clay, more than 70 %, respectively. Thus, dam sedimentation is greatly contributing to decrease in sediment supply to the river mouth. Therefore, the effect of the sediment replenishment from the river to the river mouth by the dam realignment project is expected for the Tenryu River.

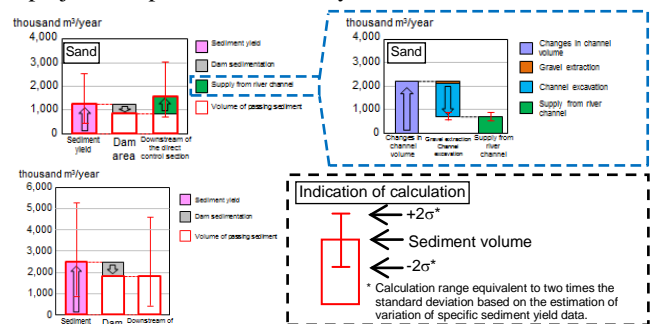


Figure 1: Sediment supply to the downstream of the direct control section (Ishikari River)

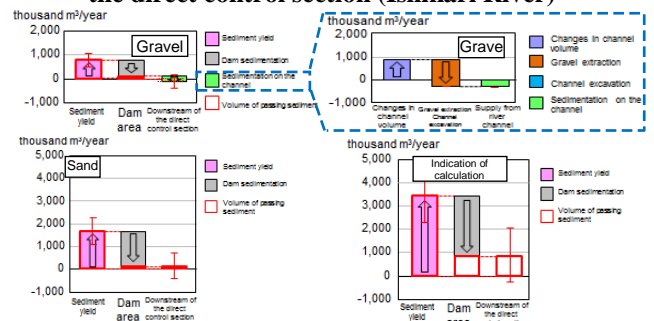


Figure 2: Sediment supply to the downstream of the direct control section (Tenryu River)

[Reference] 1) Masuya et al. (2015) "Annual Average Rate of Changes in the Channel Capacity in Class A Rivers across the Country", Collection of Papers on River Engineering, vol. 21, pp. 241-246
2) Guide to Dam Sedimentation Estimation (draft), MLIT, River Bureau, River Environment Division, April 2015