

The bed shear stress in local scour area in “clear-water” and “live-bed” conditions

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ABSTRACT

Local scouring process is an effect of river bed dynamic equilibrium loss (destabilization of the channel reach), arisen as a result of previous hydraulic parameters change, which took a significant role in water flow conditions and sediment transport regime formation. Those changes could be invoked both by natural (such as ice blockages or by wood rubble deposition) and by anthropogenic factors, connected with developing the channel by water structures, for example in the region of bridge pillars, or lengthwise structures, such as weirs or dams.

Water structure could interrupt the continuity of debris transport or this continuity could be also preserved, what took place when the debris movement is conducted through the structure (i.e. through the bridge pillars, gabions or the natural structure formation, such as stones or rocks, that could be used as a weir). First case is called “clear-water” conditions, because flowing water downstream the structure is almost devoid of sediment, meanwhile water flow containing the sediment load is named “live-bed” conditions (Fig. 1).

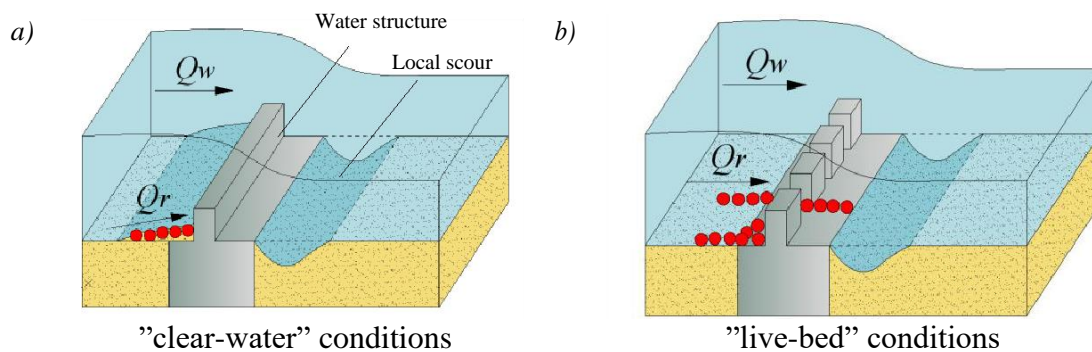


Fig. 1. Sediment transport in “clear-water” (a) and “live-bed” (b) conditions, where Q_w – water discharge, Q_r – sediment transport intensity

Numerous approaches in sediment mobility studies highlighted the key meaning of channel roughness, which results from bed material granulation, but also from various bed forms presence, caused by continuous sediment transport. Those forms are strictly connected with intensity of particles transport and they eventuate from bed shear stress. Studies comprise local scour geometric dimensions research in various development of the laboratory flume in various hydraulic properties, both in “clear-water” and “live-bed” conditions of sediment movement. The influence of bed shear stress downstream the model on scour hole dimensions of water structure is investigated, as one of the key factors, that impacts on sediment transport intensity. hole dimensions of water structure is investigated, as one of the key factors, that impacts on sediment transport intensity.