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An approach to dimension the vegetative crib walls

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The wooden log crib wall system was developed from the Krainer, the retaining crib walls that have been used in the eastern Alps for many years. At that time, crib (Krainer) walls were built in either the usual way (making cribs, with soil and dead plant material) or in the form of boxes (bin walls) filled with boulders or gravel. Now people have started to insert the live plants between crib layers. The crib retaining structures made of wooden/bamboo logs with live plants inside are called vegetative crib walls which are now becoming popular due to their advantages over conventional civil engineering walls.

Conventionally, wooden crib walls were dimensioned based on past experiences. At present, there are several guidelines and design standards for machine finished wooden crib walls, but only few guidelines for the design and construction of vegetative log crib walls are available which are generally not sufficient for an economic engineering design of such walls. In this paper, a typical bamboo crib retaining wall is analysed in different aspects to optimise the design. The external and internal stability analyses are carried out with varying slope angle and width to height ratio of the crib wall.

As other gravity retaining walls, bamboo/wooden vegetative crib walls shall be designed to withstand lateral earth and water pressures, the effects of surcharge loads, the self-weight of the wall and in special cases, earthquake loads in accordance with the general principles specified in design standards for gravity retaining walls. For the external stability analysis, the crib wall is taken as gravity retaining walls considering the composite body as a whole (Monolithic theory). For internal stability analysis the

silo theory is applied. In the internal stability analysis, the strength of crib elements, fill material and vegetative cuttings should be examined. However, in the present analysis, for simplification, the calculation is made without considering the vegetations. Altogether six limit modes of failure are taken into account in the stability analysis. The overturning, sliding, bearing and deformation failures are considered for external stability analysis whereas shear and slip failures of soil and crib elements are considered in internal stability analysis and the safety factors for each mode of failures are determined.

In addition to the overall stability and safety factors calculations, the durability and serviceability requirements as well as the optimal geometry of a vegetative crib wall for an easy growth of vegetations are also considered in the analysis. The results of the analysis are presented in charts and tables and the general design criteria for designing a vegetative log crib walls are summarized in this paper.