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河谷岸坡变形破坏的一种特殊模式——论尼泊尔色迪河桥桥址区岸坡岩体拉裂变形的成因机制

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摘要 尼泊尔色迪河桥于1995年开始修建，1998年9月竣工。1995年6月洪水期间，加德满都岸岸坡出现3条裂缝。1999年8月，该岸最外侧裂缝张开度开始加大，到目前为止，该裂缝最大宽度已超过4 m，对大桥的安全已造成了一定的威胁。通过现场考察和结合最新的勘探资料，提出了色迪河桥岸坡变形破坏的主要成因机理：在该桥址岸坡特殊的气象水文条件、独特的河谷地貌形态以及独特的岸坡地质结构这3种因素的有机组合下，河谷底部岩层在水流强烈侧蚀作用下被冲刷掏空，上部相对坚硬岩体在重力作用下产生“悬臂梁”式的拉裂倾倒变形，裂缝自上而下发展贯通后整体下座。上述变形破坏模式是一种非常特殊的河谷岸坡变形破坏模式，在国内外都很少见。

关键词 岩石力学；色迪河桥；岸坡；变形破坏模式；成因机理；倾倒；易冲蚀层；拉裂—倾倒—座落

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SPECIAL DEFORMATION AND FAILURE MODE OF RIVER BANK SLOPE —— STUDIES ON MECHANISM OF DEFORMATION AND FAILURE OF BANK ROCK SLOPE AT SETI BRIDGE SITE，NEPAL

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Abstract

Seti bridge，located in Pokhara city，Nepal，is one of the key bridges in main national highway network，connecting Kathmandu with Plkhara，and plays an important role in Pokhara city traffic. Its construction started in 1995 and was completed in September 1998. During floods in June 1995，three cracks appeared at left bank. Till now，the largest crack width is about 4 m，threatening the safety of the bridge. In

March 2001，a group of seven Chinese scholars investigated the deformation and failure of bank rock slope. Investigation results show that the main deformation mechanisms of the Seti bridge river bank rocks are the combination actions of its peculiar conditions：special meteorological-hydrographic condition (intensive rainfall)，valley topographical features (deep-cutting and narrow valley) and special geological structures (banks consisting of bonded gravel with “easy-scouring” rock stratum underneath，as proved by new investigation results，2002)，and the erosion of the bottom rock strata to form a reentrant by strong water flow. The deformation and failure mechanisms of bank rock slope at Seti bridge site are very special，named as a fracturing-toppling-falling pattern. Under intense scouring actions，easy-scouring strata at the bottom of valley are hollowed out by rushing water. Tensile cracks will then develop in the relatively rigid rock mass overlaid，and induces toppling failure like cantilever due to gravity. The rock mass among the tensile cracks starts to fall. This pattern of deformation and failure can explain reasonably failure phenomena that appeared in deformation process of bank slope. At present，the inside crack at Kathmandu bank is 17 meters away from Seti Bridge，and the tensile cracks have the possibility to develope，and the crack are threatening the safety of Seti Bridge. Therefore，it is necessary to reinforce both of bank slopes with appropriate measures at bridge site.

Key words rock mechanics；Seti Bridge；bank slope；deformation and failure mode；cause of formation and mechanism；toppling；“easy-scouring”rock stratum；fracturing-toppling-falling pattern

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