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## Turbulent Flow Structure around a Horizontal Circular Cylinder Placed on a Rough Bed

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Pipelines that traverse a river are often buried beneath the river bed. However, the pipeline may be exposed due to scoured riverbed during floods. The exposed pipeline vibrates in a frequency band depending upon the flow velocity, size, and shape of the pipe. These vibrations are detrimental to the pipeline safety and stability due to their cyclic nature. In fact, these vibrations are induced by the turbulence around the cylinder which is a function of the flow velocity apart from the diameter of the cylinder and the bed roughness. The main objective of this paper is to investigate the structure of turbulent flow in the recirculation, reattachment and recovery regions behind a horizontal circular cylinder placed on the rough bed. In this direction, different experiments were conducted in a wide flume for various flow Reynolds numbers and cylinder Reynolds numbers. The Acoustic Doppler Velocimetry (ADV) was used for measuring the instantaneous point velocities. The raw velocity data were properly processed before the analysis. The approach flow was found to be a canonical near wall turbulent flow. In the immediate downstream of the cylinder, flow is characterized by recirculation, boundary layer reattachment and recovery. The reattachment length was determined using the established forward fraction method and reattachment length is independent of the flow Reynolds number. In addition, enhanced turbulence intensities, Reynolds shear stress, and turbulent kinetic energy were observed in the separated shear layer and they rapidly decreased in the recovery region. The present investigation will boost the understanding of hydraulics of flow around the horizontal bed-mounted cylindrical objects in rough bed natural streams under different flow conditions.

**Keywords:** Wall mounted horizontal cylinder; Boundary layer; Separated and reattached turbulent flows; Wall Wake flows; ADV; Open channel flow.