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Cluster Detection and Development using Terrestrial Laser Scanning

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Gravel-bed rivers exhibit many micro-scale sedimentological forms and structures including particle clusters, transverse ribs and stone nets and these are important in influencing sediment transport and flow resistance. Very little is known about the grain-scale nature of gravelly beds, the mechanics of surface structuring and the conditions under which structures develop and persist. This is due to the difficulties in recognising bed structures that have dimensions in the same order of magnitude as their constituent particles and spatial patchiness. In addition the subjective nature of sampling leads to operational bias. Surface roughness has been objectively measured using a random field of spatial elevation data where the previous success of this approach has been tempered by the lack of high-resolution topographic data covering all roughness scales. However, improved data-point resolution below the grain scale in gravel bed rivers is now achievable using terrestrial laser scanning technology. The aim of this project is to test a new method determining the distribution and dynamics of micro-scale sedimentological bedforms utilising laser scan survey data through the classified post-processing of the statistical properties of particle arrangement and organisation. A Riegl LMS Z210 field laser scanner was employed to collect random field data of river bed evolution after two geomorphologically effective flows. The 180 m reach of Kingsdale Beck, North Yorkshire was fixed to a local grid system using theodolite control points. Local standard deviation of the elevation data were computed using an optimised moving window across the reach. The resultant surface of standard deviations were interrogated to determine the values corresponding to observed pebble

clusters and these statistics were used to compute a surface displaying all elements within the river channel. The results indicate cluster elements developed and changed with each flow, where density and spacing metrics supports previous flume based research suggesting that they are important in regulating flow resistance.