PREFACE

Varanasi or Kashi (25˚ 20 ' N and 83˚ 7 ' E) is located in the middle Ganges valley in the Eastern Uttar Pradesh in North India on the banks of Ganga River. The city averages between 15 m and 21 m above the river bed. It is the oldest city situated on the concave bank of the holy river Ganga, which is known as lifeline of India and a blessed religious deity. Ganga river water is the principal source of water for many localities in Varanasi district of Uttar Pradesh. River discharge was monitored at 14 different cross-sections (M-1-M-14), and water level profiling was done at all the cross-sections over the same time period using Acoustic Doppler Current Profiler (ADCP). The Varanasi bend of River Ganga has been divided into the 14 separate cross-sections for measurement, named as M-14 to M-1 respectively from upstream of flow to downstream of flow. Further with the help of ADCP, complete profiling of each cross-section had been completed. Recorded ADCP data have been extracted by using the supporting software of ADCP i.e. Win River-II, for analysis purpose. Excel sheets for each cross-section (from M-1 toM-14) of distance from bank, velocity and depth was prepared for calibration of regression based model. Simultaneous measurements of discharge has been done with current meters and an ADCP in the Ganga River and comparisons of the discharge measured by the both methods have been done over 14 different cross-sections of the stream length. The discharges calculated from the average of the two methods are 1305 m^3/s for the current meter measurement and 1270 m^3/s for the ADCP. The data were collected on a profiling frame, which was moved

continuously over the height of the intake. After application of data reprocessing methods to the ADCP data, the overall agreement between the two methods was within 1.67%.

A regression model was developed to estimate the discharge of the river with certain limitations by using the complete data set of all cross-sections. Three cross-sections from both ends of the bend and two cross-sections from center location have been selected for model development. Selected cross-sections give a complete picture of the Varanasi bend of River Ganga. For calibration of the regression model complete 55 data (63.95 % of total) and remaining 31 data (36.05 % of total) are used for the validation of the model. As the complete 86 data of the whole bend of Varanasi for River Ganga were measured out of which the 55 data used for the calibration of the model, remaining 31 data used for the validation of the model given in the. A multiple linear regression model was developed by using the measured discharge; depth and velocity through ADCP of Varanasi bend of river Ganga. The regression model shows a high correlation between the discharge, depth and velocity parameters with the R^2 value of 0.8624, from the validation set of 31 data's, 9 data's of discharge were of range of 100m^3/s out of which 6 data's gives more error. As well as the average velocity lies in the range of 0.101m/s to 0.279m/s in validation set which gives the more error in validation of model. The proposed model is validated for the average velocity greater than 0.279 m/s up to 0.899m/s. The developed model also shows variation when the depth of flow is less than 5m, so this model is suitable for the depth above 5m up to the maximum of 19.98m at the Varanasi bend of River Ganga.

The equation of rating curve of River Ganga at Varanasi bend has been developed by using 90 days (November to March, 2014) data of Rajghat cross-section. The best value of the constants for the rating curve equation of given range of stage of river has been obtained by the least square error method. Grain size analysis of the sediment at each cross-section of the Varanasi bend of river Ganga has been done

to get the understanding of the effect of the sediment size on erosion, sedimentation and river sinuosity. The three sand samples were collected from each cross-section, one is from left bank, one from middle and the third is from right bank of the river from each cross-section. All 42 samples were analyzed by automatic sieve shaker analyzer having sieve size of 45µm, 75µm, 150µm, 250 µm, 500 µm, 1000 µm and 2000 µm.