An Estimation of Head Loss Coefficients at Surcharged Combine Junction Manhole with Square Shape

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The energy loss at manholes, often exceeding friction loss of pipe under surcharged flow, is considered as one of the major causes of inundation in urban area. Therefore, it is necessary to analyze the head loss at manholes, especially in surcharged flow. Hydraulic experimental apparatus with square manhole was installed for this study. In the experiments, two inflows(Q_1 , Q_2) were varied from 0 to 4 l/sec and 15 combinations were tested in total. The flow ratio Q_2/Q_3 were varied from 0 to 1 for a total flow $Q_3(Q_3 = Q_1 + Q_2)$ of 2, 3, and 4 l/sec, respectively. The computation fluid dynamic(CFD) model(Fluent 6.3) was also used to obtain the head loss coefficients at surcharged combine junction manhole. The variation of head losses were strongly influenced by the lateral inflow because the head loss coefficient increases as the flow ratio Q_2/Q_3 increases. There was no significant difference of head loss as discharge change. The relation equation between K and Q₂/Q₃ was suggested in this paper. Also, the CFD model(Fluent 6.3) was carefully assessed by comparing simulated results with the experimental ones. Good agreement was obtained between head loss coefficient of the computation model and one of the laboratory experiments, Therefore, the CFD model(Fluent 6.3) might be as a tool to simulate the water depth, energy losses, and velocity distribution at surcharged combine junction manhole with square shape.

Keywords: Head loss coefficient, surcharged flow, combine junction manhole.



Fig 1. Head loss coefficient at junction manhole



References

- [1] Chanwit, S. and Ian, G., 10th National convention on civil engineering, Thailand, 2 (2005)
- [2] Zhao, C.H., Zhu, D.Z., and Rajarattnam, N., J. hydraulic engineering, ASCE. V.132(12) (2006)