## References

Abad, J.D., García, M.H., and Meander: A toolbox for re-meandering of channelized streams, *Computers and Geosciences* 32, pp.92–101, 2006.

Abreu, V., Sullivan, M., Pirmez, C., and Mohrig, D.: Lateral accretion packages (LAPs): an important reservoir element in deep water sinuous channels, *Marine and Petroleum Geology* 20 (6–8), pp.631–648, 2003.

Ahilan, R.V. and Sleath, J.F.A.: Sediment Transport in Oscillatory Flow over Flat Bed, *Journal of Hydraulic Research*, 113(3), pp.308–322, 1987.

Alabi, P.D.: Time development of local scour at bridge pier fitted with a collar (*Doctoral dissertation*). University of Saskatchewan, Saskatoon, Canada, 2006.

Ali, K.H.M, and Karim, O.: Simulation of Flow around Piers, *J. Hydraulic. Research*, IAHR, 40(2), pp.161-174, 2002.

Ansari, S.A. and Qadar, A.: Ultimate depth of Scour around bridge piers, *Proc. A.S.C.E. National Hydraulics Conference*, Buffalo, New York, U.S.A., pp.51-55, 1994.

Asano, T.: Two-phase Flow Model on Oscillatory Sheet-flow, *Proc. 22nd Conf. Coastal Engrg.* ASCE, pp.2372–2384, 1990.

Bakker, W.T.: Sand Concentration in an Oscillatory Flow, *Proc. 14th Conf. Coastal Eng.* ASCE, Copenhagen, pp.1129–1148, 1974.

Beheshti A. A. and Ataie-Ashtiani B.: Experimental Study of Three-Dimensional Flow Field around a Complex Bridge Pier, *Journal of Hydraulic Research*, 136(2), pp.143–154, 2010.

Bhuiyan F., Hey R.D. and Wormleaton P.R.: Hydraulic Evaluation of W-Weir for River Restoration, *Journal of Hydraulic Research*, 133(6), pp.596–609, 2007.

Breusers, H.N.C., Nicollet, G., and Shien, H.W.: Local Scour around Cylindrical Piers, *Journal of Hydraulic Research* ASCE, 15(3), pp211-252, 1977.

Chiew, Y.M.: Scour protection at bridge piers. *Journal of Hydraulic Engineering*, ASCE, 118(9): 1260-1269, 1992.

Chow, V.T.: Open Channel Hydraulics, McGraw-Hill Book Company, NY, 1959.

Coleman, S. E., and Melville, B. W.: CASE Study: New Zealand Bridge Scour Experiences, *Journal of Hydraulic Engineering*, pp.535-546, July 2001.

Dargahi B.: Controlling mechanism of local scouring. *Journal of Hydraulic Engineering*, 116(10), pp.1197–1215, 1990.

Dargahi B.: Experimental Study and 3D Numerical Simulations for a Free-Overflow Spillway, *Journal of Hydraulic Engineering*, 132,(9), pp.899–907, 2006.

Dargahi, B.: Controlling Mechanism of Local Scouring, *Journal of Hydraulic Research* ASCE, 116(10), pp.1197-1214, 1990.

Dargahi, B.: The Turbulent Flow Field around a Circular Cylinder, *Experiments in Fluids*, 8, pp.1-12, 1982.

Mueller, S. David. and Chad, R. Wagner: Analysis of Pier Scour Predictions and Real-Time Field Measurements, *Proceedings of ICSF-1 First International Conference on Scour of Foundations*, 2002.

Deng Lu and Cai, C. S.: Bridge Scour: Prediction, Modeling, Monitoring and Counter measures—Review." *Practice Periodical on Structural Design and Construction*, 15(2), pp.125–134, 2010.

Dey, S., and Raikar, R.V.: Clear-water scour at piers in sand beds with an armour layer of gravels, *Journal of Hydraulic Engineering*, ASCE, 133(6), pp.703-711, 2007.

Dey, S., Bose, S.K., and Sastry, G.L.N.: Clear Water Scour at Circular Piers A Model, *Journal of Hydraulic Engineering*, 121(12), pp.869-876, 1995.

Elliot, C.M. (Ed.): River Meandering, *Proceedings of the Conference Rivers'83*, New Orleans, Louisiana. American Society of Civil Engineers, New York, 1984.

Ettema, R.: *Scour at Bridge Piers*, University of Auckland, School of Engineering, Auckland, New Zealand, Rep. No. 216, 1980.

Fang, H., He, G. and Wang, L.: Influence of Vertical Resolution and Non equilibrium Model on Three-Dimensional Calculations of Flow and Sediment Transport, *Journal of Hydraulic Research*, 136(2), pp.122–128, 2010.

Fluent Inc.: FLUENT 6.0 User' Guide, 2001.

Fotherby, L. Me Jones, J.S.: The influence of exposed footings on pier scour depths. *Proceeding of Hydraulics Conference*, ASCE, New York: 922-927, 1993.

Foti S. and Sabia D.: Influence of Foundation Scour on the Dynamic Response of an Existing Bridge, *Journal of Bridge Engineering*, 16(2), pp.295–304, 2011.

Frank M. White: Fluid Mechanics, 4th ed., McGraw-Hill, New York, 1999.

Froehlich, D. C.: Analysis of onsite measurements of scour at piers, *Proceedings of the ASCE National Hydraulic Research Conference*, Colorado Springs Co. 1991.

Froehlich, D.C.: Local Scour at Bridge Abutments, *Proc.*, *ASCE*, *National Hydraulics Conference*, *Colorado Spring*, Colorado, U.S.A., pp.13-18, 1989.

Gao, D., G.L. and Nordin, C.F.: Pier scour equations used in the people's Republic of China – Review and Summary, *Proc. A.S.C.E. National Hydraulics Conference*, San Francisco, CA, U.S.A., pp.1031-1036, 1993.

Gautier, E., Brunstein, D., Vauchel, P., Roulet, M., Fuertes, O., Guyot, J.L., Darozzes, J., and Bourrel, L.: Temporal relations between meander deformation, water discharge and sediment fluxes in the floodplain of the Rio Beni (Bolivian Amazonia), *Earth Surface Processes and Landforms* 32 (2), pp.230–248, 2007.

Graf, W.H, and Istiarto, I: Flow Pattern in the Scour Hole around a Cylinder. *Journal of Hydraulic Research*, 40(1), pp.13-20, 2001.

Güneralp, İ., and Rhoads, B.L.: Spatial autoregressive structure of meander evolution revisited, *Geomorphology* 120 (3–4), pp. 91–106, 2010.

Gurnell, A., and Petts, G.E. (Eds.): *Changing River Channels*. Wiley, Chichester, pp. 87–116, 2006.

Gurnell, A.M., Bertoldi, W., and Corenblit, D.: Changing river channels: the roles of hydrological processes, plants and pioneer fluvial landforms in humid temperate, mixed load, gravel bed rivers. *Earth-Science Reviews* 111 (1–2), pp.129–141, 2012.

Gurnell, A.M., and Downward, S.R., Jones, R.: Channel planform change on the River Dee meanders, 1876–1992. Regulated Rivers, *Research and Management 9*, pp.187–204, 1994.

Hagatun, K. and Eidsvik, K.J.: Oscillatory Turbulent Boundary Layers with Suspended Sediments, *Journal of Geophysical Research*, 91(C11), pp.13045–13055, 1986.

Henriquez, A., Tyler, K.J., and Hurst, A.: Characterization of fluvial sedimentology for reservoir simulation modeling, *SPE Formation Evaluation* 5 (3), pp.211–216, 1990.

Heritage, G.L., Large, A.R.G., Moon, B.P., and Jewitt, G.,: *Channel hydraulics and geomorphic effects of an extreme flood event on the Sabie River*, South Africa. Catena 58, pp.151–181, 2004.

Hooke, J.M., and Kain, R.J.P.: Historical Change in the Physical Environment, *A Guide to Sources and Techniques*. Butterworths, London, 1982.

Hooke, J.M.: Cutoffs galore! Occurrence and causes of multiple cutoffs on a meandering river, *Geomorphology* 61 (3–4), pp.225–238, 2004.

Hosny M. M.: Experimental Study of Local Scour around Circular Bridge Piers in Cohesive Soils, *Ph.D. Dissertation, Civil Engineering Department*, Colorado State University, Fort Collins, Colorado, USA, 1995.

Howard, A.D.: How to make a meandering river, *Proceedings of the National Academy of Sciences of the United States of America* 106 (41), pp.17245–17246, 2009.

Howard, A.D.: Modelling channel migration and floodplain sedimentation in meandering streams. In: Carling, P.A., Petts, G.E. (Eds.), Lowland Floodplain River, *Geomorphic Perspectives*. John Wiley, New York, pp.1–41, 1992.

Hudson, P.F., Kesel, R.H.: Channel migration and meander-bend curvature in the lower Mississippi River prior to major human modification. *Geology* 28 (6), pp.531–534, 2000.

Ikeda, S., Parker, G., and Sawai, K.: Bend theory of river meanders, *1. Linear development, Journal of Fluid Mechanics* 112, pp.363–377, 1981.

IMolinas, A. and Chih Ted fVang, C.: Generalize water surface profile computations, *Journal of Hydraulic Engineering*, I(11)3)), March 1985.

Jansen, P., Van Bendegom, L., Van Den Berg, J., de Vries, M., and Zanen, A.: Principles of River Engineering, *The Non-Tidal Alluvial River*. Pitman, London, 1984.

Jeong E. and Girimaji S.S.: Partially Averaged Navier–Stokes (PANS) Method for Turbulence Simulations—Flow Past a Square Cylinder, *Journal of Fluids Engineering*, 132, pp.203-214, 2010.

Jones, J.S.: Comparison of Prediction Equations for Bridge Pier and Abutment Scour, *Trans*. Res. Rec. 1950, Transportation Research Board, Washington, 1984.

Kayaturk, S.Y., Kokpinar, M.A. and Gogus, M.: Effect of collar on temporal development of scour around bridge abutments. *2nd International Conference on scour and erosion, IAHR, Singapore*, 14-17 November, pp.7, 2004.

Keshavarzi, A., Melville, B., and James Ball, J.: Three-dimensional analysis of coherent turbulent flow structure around a single circular bridge pier, *Environmental Fluid Mechanics*, 2014.

Kirkil G., Constantinescu S.G. and Ettema R.: Coherent Structures in the Flow Field around a Circular Cylinder with Scour Hole, *Journal of hydraulic engineering*, 134(5), pp.572–587, 2008.

Knight, D.W., Omran M. and Tang X.: Modeling Depth-Averaged Velocity and Boundary Shear in Trapezoidal Channels with Secondary Flows. *Journal of hydraulic engineering ASCE*, 133(1), pp.39–47, 2007.

Kondolf, G.M., Piegay, H., and Landon, N.: Channel response to increased and decreased bedload supply from land use change: contrasts between two catchments, *Geomorphology* 45, pp.35–51, 2002.

Kondolf, G.M.: River restoration and meanders, *Ecology and Society* 11 (2), pp.42, 2006.

Kumar, V., Ranga Raju, K.G., and Vittal, N.: Reduction of local scour around bridge piers using slots and collars, *Journal of Hydraulic Engineering*, *ASCE*, 125(12), pp.1302-1305, 1999.

Laursen, E.M.: An Analysis of Relief Bridge Scour, *Journal of Hydraulics Division, ASCE*, 89(3), pp.93-118, 1963.

Leopold, L.B., Wolman, M.G.: River meanders, *Geological Society of America Bulletin*, 1960

Leys, K.F., Werritty, A.: River channel planform change, *software for historical analysis, Geomorphology* 29, pp.107–120, 1999.

Masjedi, A., Bejestan, M.S., and Esfandi, A.: Reduction of local scour at a bridge pier using collar in a 180 degree flume bend, *Journal of Applied Sciences*, 10, pp.124-131, 2010.

Melville, B. W., and Coleman, S. E.: Bridge scour, *Water Resources Publications, LLC*, Colorado, U.S.A. 2002.

Melville, B.W. and Raudkivi, A.J.: Flow characteristics in Local Scour at Bridge Piers, *Journal of Hydraulic Research ASCE*, 15, pp.373-380, 1996.

Melville, B.W. and Sutherland, A.J.: Design Method for Local Scour at Bridge Piers, *Journal of Hydraulic Engineering, ASCE*, 114(10), pp.1210-1226, 1988.

Melville, B.W.: *Local Scour at Bridge Sites*, University of Auckland, School of Engineering, Auckland, New Zealand, 117, 1975.

Mousavi, S. F., and Daneshfaraz R.: Evaluating Various Factors in Calculation of Scour Depth around Bridge Piers Using HEC-RAS Software, CSU2001 and Froehlich Equations." *Journal of Civil Engineering and Urbanism*, 3(6), pp398-402, 2013.

Mueller, D. and Chad R. Wagner.: Analysis of Pier Scour Predictions and Real-Time Field Measurements, *Proceedings of ICSF-1 First International Conference on Scour of Foundations*, Texas A&M University, College Station, Texas, USA, 2002.

Nadaoka, K. and Yagi, H.: Single-phase Fluid Modeling of Sheet-flow Tohe Development of Numerical Mobile Bed, *Preceding in 22th International Conference on Coastal Engineering ASCE*, pp.2346–2359, 1990.

Nanson, G.C., and Beach, H.F.: Forest succession and sedimentation on ameandering-river floodplain, Northeast British Columbia, Canada, *Journal of Biogeography* 4(3), pp.229–251, 1977.

Nanson, R.A.: Flow fields in tightly curving meander bends of low width-depth ratio, *Earth Surface Processes and Landforms* 35 (2), 119–135, 2010.

Neil, C.R.: Guide to Bridge Hydraulics, *Road and Transportation Assoc. of Canada, University of Toronto Press*, Toronto, Canada, pp.191, 1973.

Nicoll, T.J., and Hickin, E.J.: Planform geometry and channel migration of confined meandering rivers on the Canadian prairies, *Geomorphology* 116 (1–2), pp.37–47, 2010.

Olsen, N.R.B., and Melaaen, M.C.: Three-dimensional calculation of scour around cylinders, *Journal of Hydraulic Engineering*, 119(9), pp.1048-1054, 1993.

Pappenberger, F., Beven, K., Horritt, M., and Blazkova, S.: Uncertainty in the calibration of effective roughness parameters in HEC-RAS using inundation and downstream level observations, *ELSEVIER Journal of Hydrology 302*, pp.46–69, 2005.

Patra, K.C. and Kishanjit Kumar Khatua, K.K.: Energy loss in two stage meandering and straight compound channels, *Published in conference of hydro-2005*, Turmur, Karnataka, India, December 2005.

Patra, K.C., and Kar, S.K.: Flow interaction of Meandering River with Flood plains, *Journal of hydraulic engineering ASCE*, 126(8), pp.593-603, 2000.

Pu, J. H., and Lim, S. Y.: Efficient numerical computation and experimental study of temporally long equilibrium scour development around abutment, *Environ Fluid Mech*14, pp.69–86, 2014.

Richardson, J.E. and Pancheng, V.G.: Three dimensional Simulation of Scour Inducing Flow at Bridge Piers, *Journal of hydraulic engineering ASCE*, 124(5), 1998.

Seminara, G., Zolezzi, G., Tubino, M., and Zardi, D.: Downstream and upstream influence in river meandering, Part 2, Planimetric development, *Journal of Fluid Mechanics* 438, pp.213–230, 2006.

Shen, H.W., Schneider, V.R. and Karaki, S.: Local scour around bridge piers, *Proceedings ASCE*, *Journal of Hydraulics Division*, 95(6), pp.1919-1940, 1969.

Shen, H.W., Schneider, V.R. and Karaki, S.S.: Mechanics of Local Scour, *Colorado State University, Civil Engineering Dept., Fort Collins, Colorado*, Pub. No. CER66-HWS22, 1966.

Shields, F.D., Simon, A., and Steffen, L. J.: Reservoir effects on downstream river channel migration. *Environmental Conservation* 27, pp.54–66, 2000.

- Shiono K. and Knight, D.W.: Mathematical Models of Flow in two or Multistage Straight Channels, *Proc. Int. Conf. on River Flood Hyd.*, (Ed. W.R.White), J. Wiley & Sons, Wallingford, Paper G1, pp.229-238, September 1990.
- Shiono K., and Knight, D. W.: Two dimensional analytical solution of compound channel, *Proc.*, *3rd Int. Symp. on refined flow modelling and turbulence measurements*, Universal Academy Press, pp.591-599, 1989.
- Shiono, K., Al-Romaih, J. S. and Knight D. W.: Stage-discharge assessment in compound meandering channels, *Journal of hydraulic engineering ASCE*, pp.305, April 2004.
- Shiono, K., and Knight, D. W.: Turbulent Open Channel Flows with Variable Depth Across the Channel, *Journal of Fluid Mechanics*, Cambridge, U.K., 222, pp.617-646, 1991.
- Simarro G., Fael M. S. and Cardoso A. H.: Estimating Equilibrium Scour Depth at Cylindrical Piers in Experimental Studies, *Journal of Hydraulic Engineering*, 137(9), pp.1089–1093, 2011.
- Singh, C.P., Setia, B., and Verma, D.V.S.: Collar-sleeve combination as a scour protection device around a circular pier. *29th Congress on Hydraulics of River, Water Works and Machinery*. Chinese Hydraulic Engineering Society, Beijing, China, pp. 202-209,16-21 September 2001.
- Singh, S. M. and Maiti, P. R.: Local scouring around a circular pier in open channel, *International journal of Emerging Technology and Advanced Engineering*, 2(5), pp.454-458, 2012.
- Singh, S. M.: Analysis of flow field around cylindrical structure, *6th International Conference on Advance Computing and Communication Technologies*, Asia Pacific Institute of Information Technology, Panipat, Haryana, India organized by IEEE, 3 November 2012.
- Singh, S. M.: Analysis of vortex around bluff body, *Indian Journal of Applied Research*, 3 (6), pp.223-226, 2013.
- Singh, Sabita Madhvi and Maiti, P. R.: Flow Characteristics around a circular bluff body, *International Conference on Emerging Trends in Engineering and Technology*, College of Engineering, Teerthankar Mahaveer University, Moradabad, 6-7 April, 2012.
- Sturm T.W.: Scour around Bankline and Setback Abutments in Compound Channels, *Journal of Hydraulic Engineering*, 132(1), pp.21–32, 2006.
- Sumer, B.M., Roulund, A., Fredsoe, J., and Michelsen, J.: 3-D Numerical Modelling of Flow and Scour around a Pile, *First International Conference on Scour of Foundations, ICSF-1, College Station, Texas*, 17-20 Nov, 2, pp.795-809, 2002.
- Swanson, D.C.: The importance of fluvial processes and related reservoir deposits, *JPT Journal of Petroleum Technology*, pp.368–377, 1993.

Tabarestani M. K., and Zarrati A.R.: Effect of collar on time development and extent of scour hole around cylindrical bridge piers, *IJE Transactions C*, 25(1), pp.11-16, 2004.

Tokyay N.D. and Altan-Sakarya A.B.: Local energy losses at positive and negative steps in subcritical open channel flows, *Water SA*, 37(2), pp. 237-244, 2011.

Totapally, H.G.S., Aziz, N.M., Kulne, R.A. and Alonso, C.V.: Temporal Variation of Local Scour at Abutments under Steady Flow Conditions and Stepped Hydrographs, *Proceedings of the 1999 International Water Resources Engineering Conference, August, Session BS-05*, Water Resources Publications, LLC, Highlands Ranch, CO, 1999.

Tseng, M., Yen, C.L., and Song, C.C.S.: Computation of three-dimensional flow around square and circular piers, *International Journal for Numerical Methods in Fluids*, 34, pp.207-227, 2000.

U. P. State Bridge Corporation, Varanasi, India

Valiani, A. and Caleffi, V.: Analytical findings for power law cross-sections: Uniform flow depth, *Advances in Water Resources*, 32, pp.1404–1412, 2009.

Valiani, A. and Caleffi, V.: Depth–energy and depth–force relationships in open channel flows: Analytical findings, *Advances in Water Resources*, 31, pp.447–454, 2008.

Van Rijn, L.C.: Sediment Pick-Up Function, *Journal of Hydraulic Engineering*, 110(10), pp.1494-1502, 1984.

Vatankhah, A. R. and Valiani, A.: Analytical inversion of specific energy–depth relationship in channels with parabolic cross-sections. *Hydrological Sciences Journal*, *56*(5), pp.834–840, 2011.

Vittal, N., Kothyari, U.C. and Haghighat, M.: Clear-water scour around bridge pier group. Journal of Hydraulic Engineering, ASCE, 120(11): 1309-1318, 1994.

Walsh, Kenneth.: Gambit, Fluent and Matlab for Fluid-Structure Interaction, *Master Thesis, Dept. of Civil and Environmental Engineering*, FSU-FAMU College of Engineering, 2002.

Wang, S.S.Y. and Jia, Y.: Computational Simulations of Local Scour at Bridge Crossings – Capabilities and Limitations, *Proceedings of the 1999 International Water Resources Engineering Conference, August, Session BS-06*, Water Resources Publications, LLC, Highlands Ranch, CO, 1999.

William Miller, Jr.: Model for the Time Rate of Local Sediment Sour at cylindrical Structure, *Ph.D. Dissertation*, University of Florida, 2003.

Xun, Z., Wanjin, H. and Zhiqiang, L.: Experimental Investigation of Energy Loss in Straight and Bowed Cascades with Aft-loaded Profiles, *Heat Transfer—Asian Research*, 34(2), pp.108–119, 2005.

Yanmaz, A.M., and Altinbilek, H.D.: Study of Time-Dependent Local Scour around Bridge Piers, *Journal of Hydraulic Engineering*, 117(10), pp.1247-1268, 1991.

Zarrati, A.M., Nazariha, M., and Mashahir, M.B.: Reduction of local scour in the vicinity of bridge pier groups using collars and riprap, *Journal of Hydraulic Engineering*, *ASCE*, 132(2), pp.154-162, 2006.

Zhi-wen, Z., and Zhen-qing, L.: CFD prediction of local scour hole around bridge piers, *Journal of Central South University of Technology*, *19*, pp.273–281, 2012