

Subject: Mechanics of Sediment Transportation and Channel Changes

Course number : DMP 382E

Instructor : Prof. Shinji EGASHIRA

Term / Time : Fall through Winter

1 Course Description

Sediment transportation takes place in various forms such as bed-load, suspended load, debris flow etc. and its spatial imbalance causes river bed degradation and aggradation, side bank erosion, sand bar formation and channel shifting. Although these channel changes will be suitable for ecological systems, if they are within an allowable level. However, if these are over some critical level, flood and sediment disasters will happen. This course provides methods for evaluating sediment transportation and associated channel changes with attention focused on basic principles of sediment mechanics. In addition, methods of sediment management are discussed for disaster mitigation as well as for a suitable drainage condition.

2 Course Outline (Course Topics)

Week

- 1 : Introduction (1)
 - Characteristics of sediment
- 2 : Introduction (2)
 - Sediment transportation and corresponding channel changes
 - Methods to evaluate channel changes
- 3 : Mechanics of sediment transportation (1)
 - Parameters associated with sediment transportation
- 4 : Mechanics of sediment transportation (2)
 - Critical condition for initiating bed load
- 5 : Mechanics of sediment transportation (3)
 - Bed load formulas
- 6 : Mechanics of sediment transportation (4)
 - Bed load formulas
- 7 : Mechanics of sediment transportation (5)
 - Extension of bed load formula to non-uniform sediment
- 8 : Mechanics of sediment transportation (6)
 - Suspended load
- 9 : Mechanics of debris flow (1)
 - Constitutive equations
 - Debris flow characteristics over erodible beds
- 10 : Mechanics of debris flow (2)
 - A bed load formula derived from constitutive equations

- 1 1 : Bed forms and flow resistance (1)
 - Geometric characteristics of bed forms
 - Formative domain of bed forms
- 1 2 : Bed forms and flow resistance (2)
 - Flow resistance
- 1 3 : Prediction of channel changes (1)
 - Governing equations employed in steep areas
 - Topographic change in steep areas
- 1 4 : Prediction of channel changes (2)
 - Governing equations employed in alluvial reaches
 - Topographic change in alluvial reaches
- 1 5 : Method to predict sediment transport process in drainage basins
 - Sediment management in drainage basin

3 Grading

50 points for reports and short quizzes

50 points for the examination at the end of semester

Notice: Either a report or a short quiz is assigned every two weeks, regarding questions illustrated at the end of each chapter in Lecture Note.

4 Textbooks

4-1 Required

- Egashira, S. (2009): Mechanics of Sediment Transportation and River Changes, Lecture Note

4-2 Others

- Sturm, T. W. (2001): Open Channel hydraulics, McGraw-Hill.
- Graf, W. H. (1997): Fluvial Hydraulics, Wiley.
- Julien Pierre: River Mechanics, Cambridge University Press
(Website: <http://www.cambridge.org/us/catalogue/catalogue.asp?isbn=9780521529709>)
(<http://www.amazon.co.jp/River-Mechanics-Pierre-Y-julien/dp/0521529700>)
- Albert Gyr and Klaus Hoyer: Sediment Transport, A Geophysical Phenomenon, Springer Netherlands
(<http://www.springerlink.com/content/q0x656/>)
- Ashida K., Egashira S. and Nakagawa H. (2008), River Morphodynamics for the 21st Century, Kyoto University Press (in Japanese)