WODCON XXI

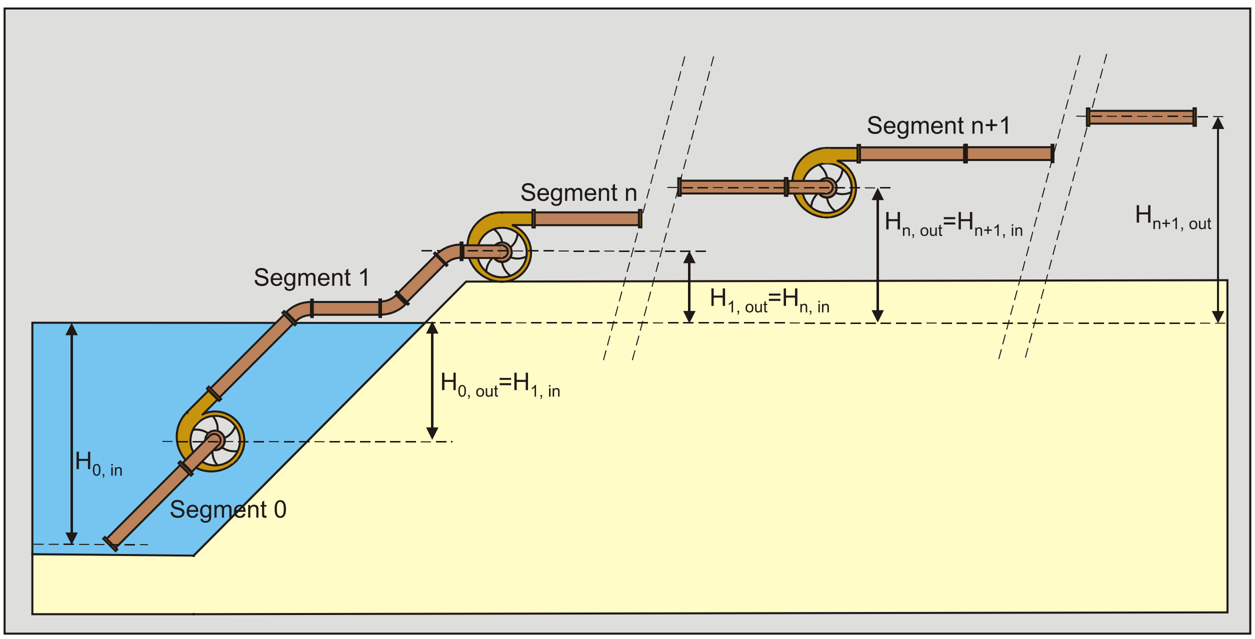
WORLD DREDGING CONGRESS & EXHIBITION

INNOVATIONS IN DREDGING

JUNE 13-17, 2016

Continuing Education Short Course on Slurry Transport

Monday June 13th 2016 from 8.00-12.00 AM



By

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Preface.

In August 2012 I was approached by a dredging company with the question which head loss model to use for a project with a cutter dredge and a discharge length of 35 km. This raised the following questions:

- What did the company want to know?
- How many booster stations to use?
- What should be the locations of the booster stations?
- What were the real issues?
- What should be the total pump pressure to avoid plugging the line?
- Where to locate the booster stations to avoid cavitation at the entrance of each pump?
- How does this depend on the particle size distribution?

These questions triggered a study in to the existing head loss models. With the knowledge that the main Dutch and Belgium dredging contractors use the Durand & Condolios (1952) and Fuhrboter (1961) models in a modified form, while companies in the USA and Canada often use the Wilson (1992) model in a modified form or the SRC model, the study started with a comparison of these models. Other models that were investigated were the Newitt et al. (1955) model, the Doron & Barnea (1987) model, the Matousek (1997) model and others. Also later models like the 4 component Sellgren & Wilson (2012) model and the 2LM and 3LM models of Wilson (1979-2014) and Matousek (1997-2014) were investigated.

Usually the models perform well in the neighborhood of the parameters used during the experiments, especially the pipe diameter (small) and the particle diameter, but for real life conditions (large pipe diameters) the models deviate and it's not clear which model matches these conditions. Another issue is that most models are derived for transport (delivered) volumetric concentrations as input and not the spatial volumetric concentrations. The research into the existing models did not give a satisfactory result to the above questions.

Reason to develop a new model from scratch, the Delft Head Loss & Limit Deposit Velocity Framework. This DHLLDV Framework is based on the spatial volumetric concentration in the pipe and uniform sands or gravels and consists of a framework containing a set of sub-models.

1. The fixed or stationary bed model.
2. The sliding bed model.
3. The heterogeneous transport model.
4. The homogeneous transport model.
5. The sliding flow model.
6. The limit deposit velocity model.
7. The holdup or slip factor model.
8. The concentration distribution model.
9. The bed height model.

The holdup model transforms constant spatial volumetric concentration curves into constant transport (delivered) volumetric concentration curves. The curves for graded sands or gravels are constructed by proportional summation of the curves of the different fractions after correcting the liquid properties for the fines content.

Contents of the course:

08:00:08:20 Existing models (empirical, physical, 2LM & 3LM).

08:20-08:40 Flow regime identification.

08:40-08:50 Stationary Bed regime.

08:50-09:00 Sliding Bed regime.

09:00-09:20 Heterogeneous regime.

09:20-09:30 Homogeneous regime.

09:30-09:40 Sliding Flow regime.

09:40-09:55 The Limit Deposit Velocity.

09:55-10:15 Coffee break.

10:15-10:25 The slip velocity or holdup function.

10:25-10:40 The concentration distribution in the pipe.

10:40-10:55 The transition heterogeneous-homogeneous transport.

10:55-11:05 The bed height.

11:05-11:15 Graded sands and gravels.

11:15-11:25 Flow regime diagrams

11:25-11:40 Inclined pipes. (15 minutes)

11:40-12:00 Using DHLLDV.

A summary of the DHLLDV Framework will be published in the WEDA Journal of Dredging Engineering before the conference.

All participants will receive a copy of the book:

Slurry Transport: Fundamentals, A Historical Overview & The Delft Head Loss & Limit Deposit Velocity Framework by Sape A Miedema and Edited by Robert C. Ramsdell.

A preview of the book is included here.

Sape A. Miedema