Experimentation of Solid Waste Blockage in Drainage System: Effect of Waste Material and Flow Velocity

presented by

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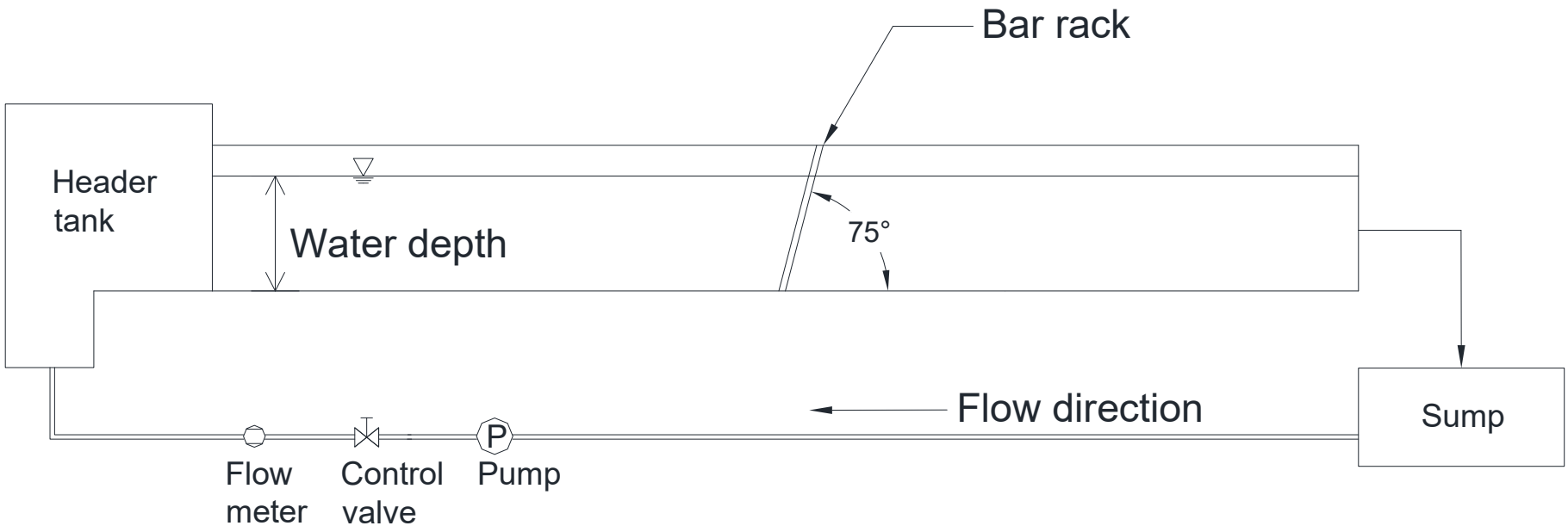
Experimentation of Solid Waste Blockage in Drainage System

- Laboratory scale
- Determine energy loss coefficient of different solid waste



General layout of the experiment

Experiment Setup

- The experiments carry out in a laboratory and use a rectangular-section flume with dimension of 0.24 m width, 0.4 m depth and 10 m length.

Upstream

downstream

Rectangular-section flume

Experiment Setup

- Trash rack made from steel with 6 mm. thickness and gap dimension of 35 mm. is attached in the flume. The horizontal angle between trash rack and flume is 75 degree (same configuration at the field).

Trash rack

Attached in the flume

Trash rack

Experiment Setup

- Vertical velocity was measured by current meter. Water depth was measured by depth meter. flow rate and level was maintained at 9 l/s. and 16.5 cm. respectively.

Current Meter

Measuring velocity and water depth

Velocity and water depth measurement

Experiment Setup

- Solid waste was used in the experimental consist of
  - wood (timber)
  - Foam
  - plastic bottle.

Sample	Timber	Foam box	Foam plate	Plastic bottle
Picture				
Dimension (cm)	7.5 x 7.5 x 3.5	17.5 x 12.3 x 6.5	14.3 x 20.6 x 1.5	7 dia. x 23 (for 1 unit)
Density (g/cm^3)	0.9	0.003	0.009	0.04

Experiment Setup

- Determine the reduction of drainage capacity by analyse the energy loss across bar rack.

$$\frac{v_{up}^2}{2g} + H_{up} = \frac{v_{down}^2}{2g} + H_{down} + H_{loss}$$

- Energy loss coefficient for modeling in SWMM was obtained by.

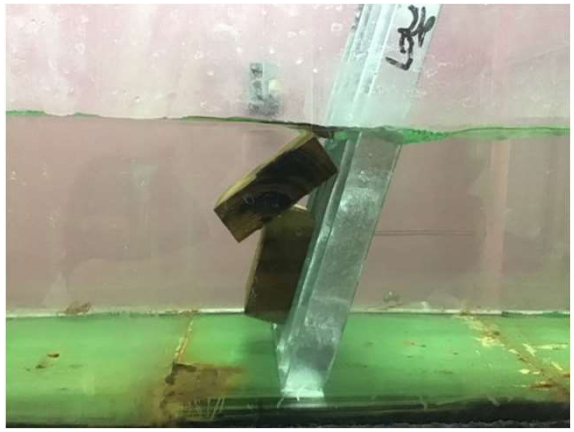
$$H_{loss} = k \frac{v^2}{2g}$$

Result

Result

- Timber

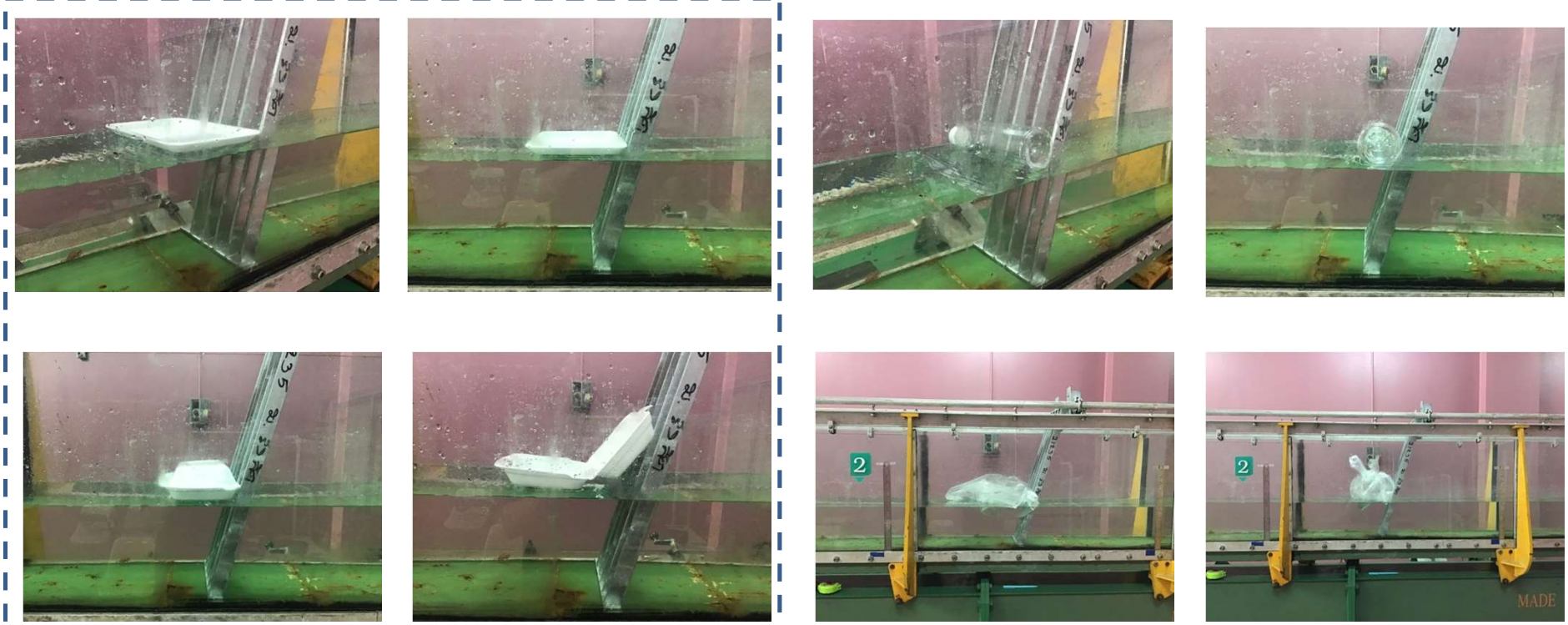
  Timber flow and stuck firmly at the bar rack beneath the water surface. Pattern of blockage is non-uniform.



Effect of timber

Result

- Foam and Plastic
  Effect of blockage depends on their position and shape when it stuck. If it floated, the effect was less that submerged significantly.



Effect of foam and plastic (floating)

Result

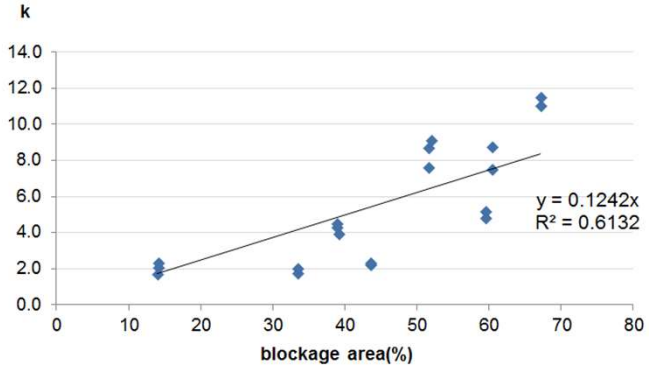
- Foam and Plastic
  Effect of blockage depends on their position and shape when it stuck. If it floated, the effect was less that submerged significantly.

Effect of foam and plastic (submerged)

Result

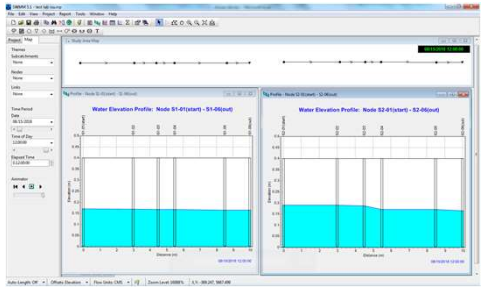
- **Relationship between blockage area and head loss coefficient**

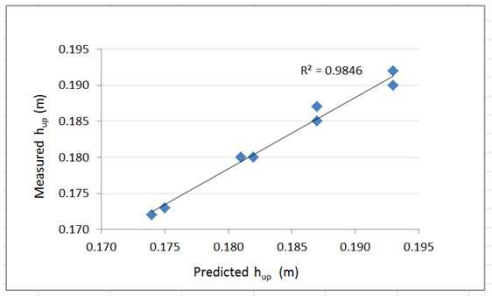
  Pattern of water flow and blockage depends on the shape of waste stuck in front of the bar rack.



- **Model with the laboratory experiment**

  Data from laboratory experiment were used in SWMM in order to compare water depth at the upstream (h_{up}) at different blockage condition .





Acknowledgement

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THANK YOU

for your attention