Jun 22nd, 11:25 AM - 11:40 AM

Session D1: Experimental Study on Flow Patterns in Vertical Slot Fishways

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Experimental study on flow patterns in vertical slot fishways

Dipl.-Ing. Verena Höger

A cooperation between the Institute for Water and River Basin Management of KIT and the Federal Waterways Engineering and Research Institute
Introduction
Introduction

- flow pattern 1 (FP1) und flow pattern 2 (FP2)

(Tarrade 2008)

(Tarrade 2008)
Material and methods - Experimental setup

- Physical model at Theodor-Rehbock-Laboratory of the IWG (KIT)
- 9.5 m x 0.79 m flume
- Variable slope
- 6 pools (variable geometry)

Investigated geometric parameters:

- B/L-ratio (0.6 to 0.8)
- angle of slot α (24° to 56°)
- distance from the guide wall to the slot a (3.8 and 7.1 cm)
- slope of the fishway S (2.8% to 5%)
Material and methods - Methodology

- long time exposure of water surface
- exposure time: 4.9 s
- Tracer particles: white rubber sponge ball (15 mm diameter)
- pool: black bottom, white edging

- water depths
- ultrasonic distance sensor
- mesh: ~10 x 10 cm

- Acoustic Doppler Velocimeter (ADV)
- 300 s measuring time per measuring point
- mesh: ~5 x 5 x 5 cm
Results - Long time exposure

B/L = 0.75
α = 24°
a_{LW} = 0.38 cm

FP1
FP2
Transition

B/L = 0.75
α = 56°
a_{LW} = 0.38 cm
<table>
<thead>
<tr>
<th>α = 24°</th>
<th>B/L = 0.8</th>
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<tbody>
<tr>
<td>a = 0.71</td>
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<tr>
<td>α = 39°</td>
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<td>α = 56°</td>
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<td><img src="image25.png" alt="Image" /></td>
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FP1; Transition; FP2
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<th>S = 5%</th>
<th>B/L = 0.8</th>
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| \( \alpha = 24^\circ \)  \\
| \( a = 0.71 \)  \\
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| \( \alpha = 56^\circ \)  \\
| \( a = 0.71 \)  \\
| \( \alpha = 56^\circ \)  \\
| \( a = 0.38 \)  |

FP1; Transition; FP2
Results - Velocities

S = 2.8%, B/L = 0.8, \( \alpha = 24^\circ \)

S = 2.8%, B/L = 0.8, \( \alpha = 56^\circ \)
Results - Maximum velocities

\[ \Delta h = 0.105 \text{ cm} \]

\[ v_{\text{max}} = \sqrt{2g\Delta h} = 1.44 \text{ m/s} \]
Results - TKE

S = 2.8%, B/L = 0.8, α = 24°, FP1

S = 2.8%, B/L = 0.8, α = 56°, FP2

Wang et al. 2010
Conclusions and Outlook

- flow patterns can vary for identical slope and B/L
- more geometrical parameters influence the flow patterns
- angle of slot $\alpha$ is an important parameter
- $v_{\text{max}}$ at FP1 is $\sim 15\%$ larger than at FP2
- maximum velocities are allocated about whole depth
- at FP2: $v_{\text{max}}$ is $\sim \sqrt{2g\Delta h}$
- more, selected variants will be studied by ADV measurements
Thank you for your attention.