HYDRAULICS OF DIKE BREACHING

L. Schmocker and Willi H. Hager

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Versuchsanstalt für Wasserbau,
Hydrologie und Glaziologie

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1 Introduction

Dike erosion is a significant process due to:

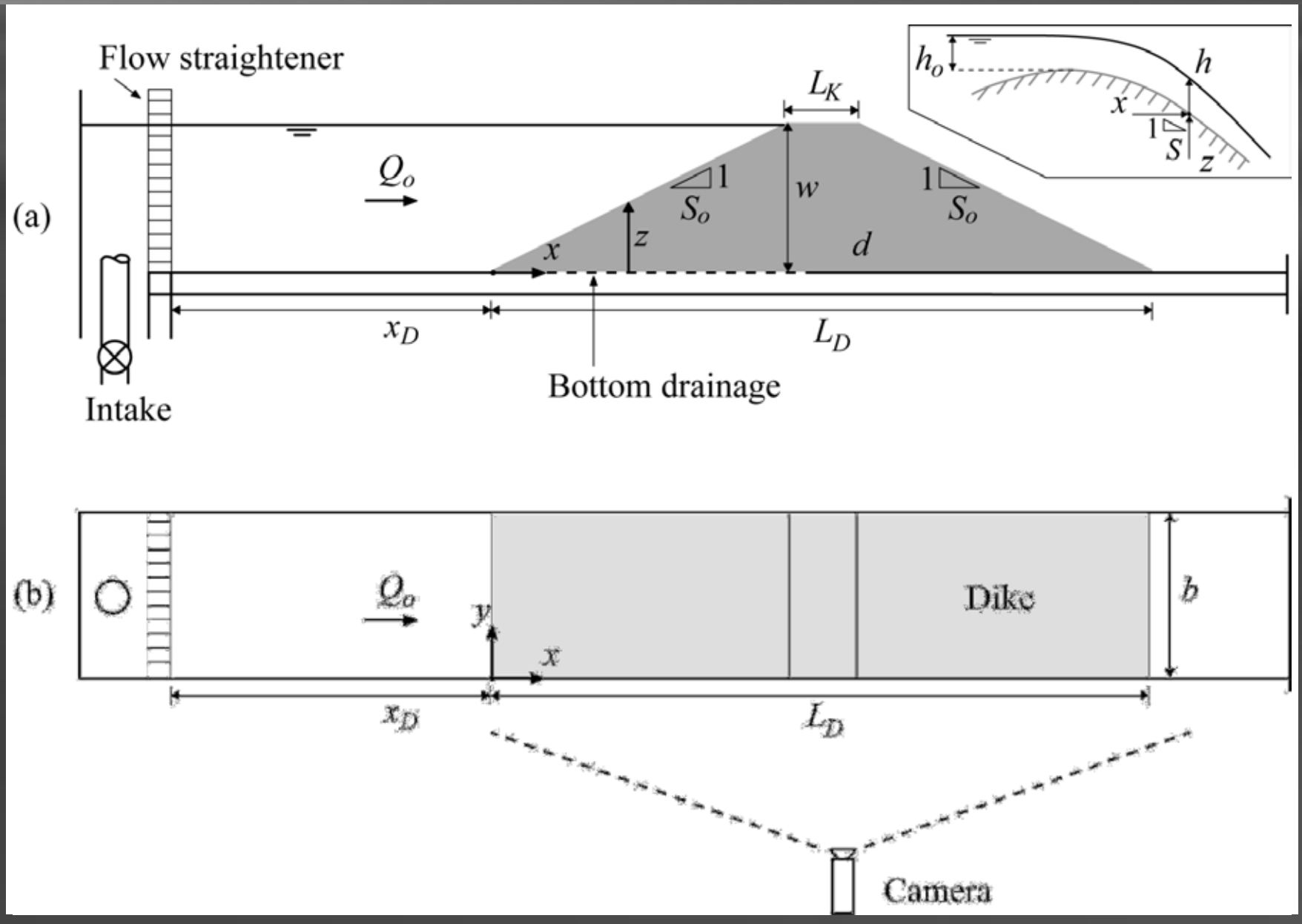
- Relevance for flooding prediction
- Stability assessment of existing dikes
- Analysis of erosion process in time and location
- Definition of generalized sediment transport equation
- Beauty of hydraulic features

2 Hydraulic Model

Simple model dike:

- Trapezoidal
- Homogenous, non-cohesive sand or gravel
- No surface protection or core
- Plane erosion process
- Steady inflow discharge

2 Hydraulic Model

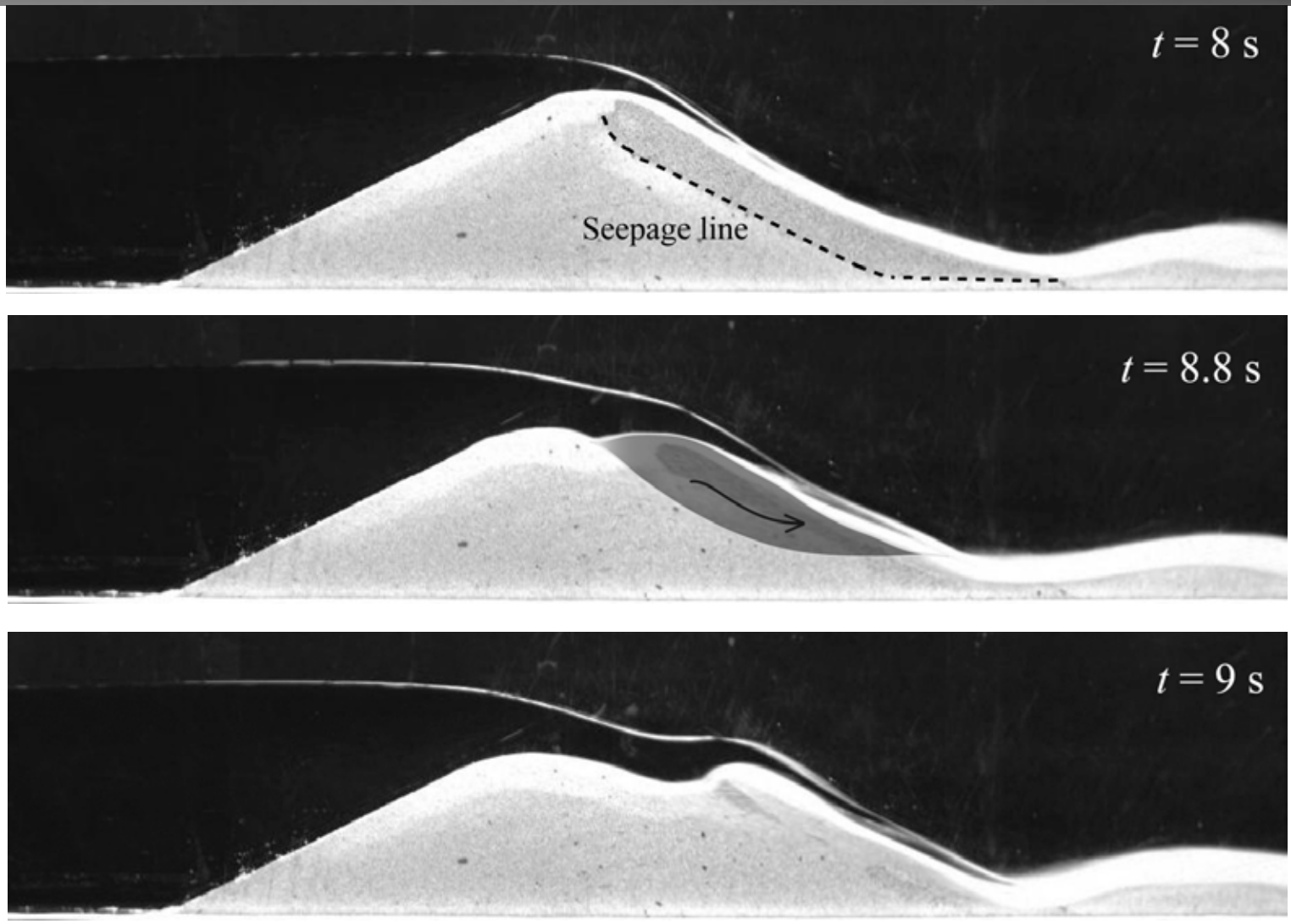


2 Hydraulic Model

Investigated Parameters:

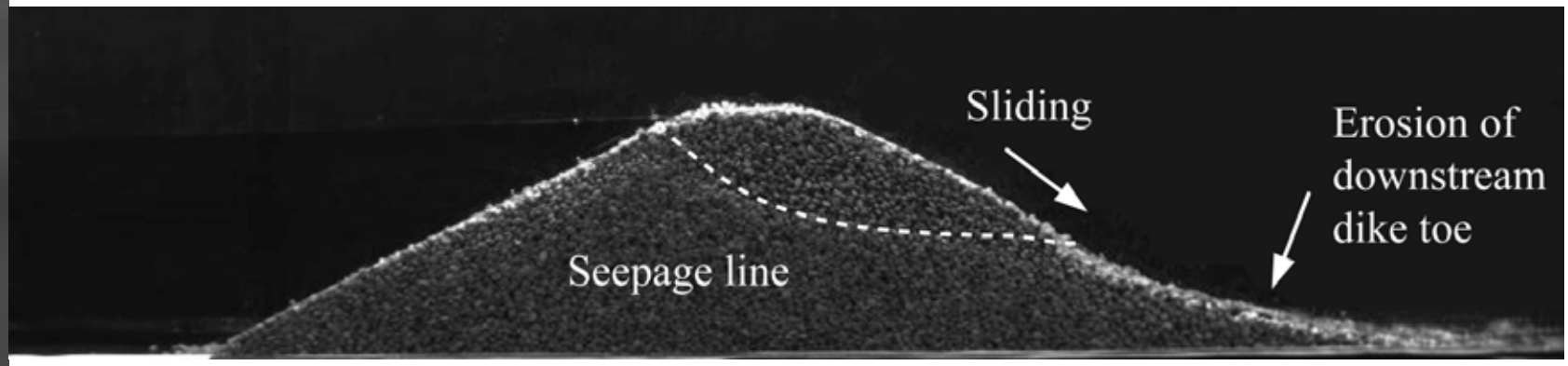
- Q_o = 1 to 64 l/s
- w = 0.10, 0.20, 0.40 m
- b = 0.10, 0.20, 0.40 m
- L_K = 0.05, 0.10, 0.20 m
- d = 1.0, 1.5, 2.0, 4.0, 8.0 mm

3 Effect of Seepage

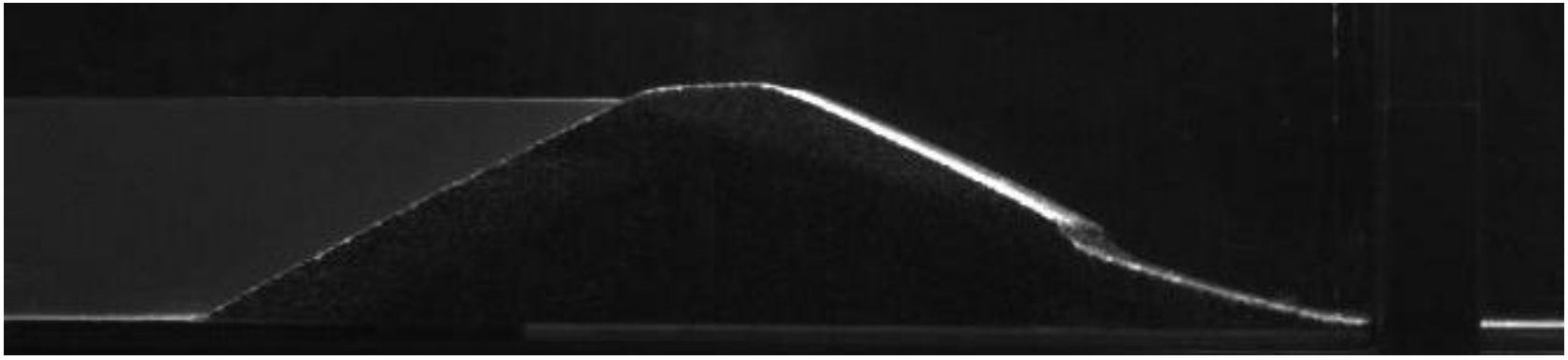


Sliding of downstream dike slope due to combined erosion *and* seepage

3 Effect of Seepage

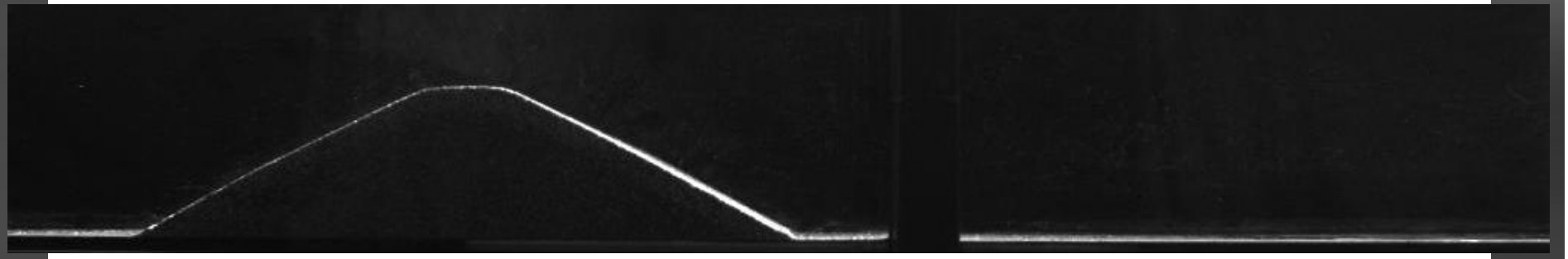


Erosion of downstream dike toe due to seepage (d = 8.00 mm)



Erosion of downstream dike toe due to seepage (long reservoir filling time)

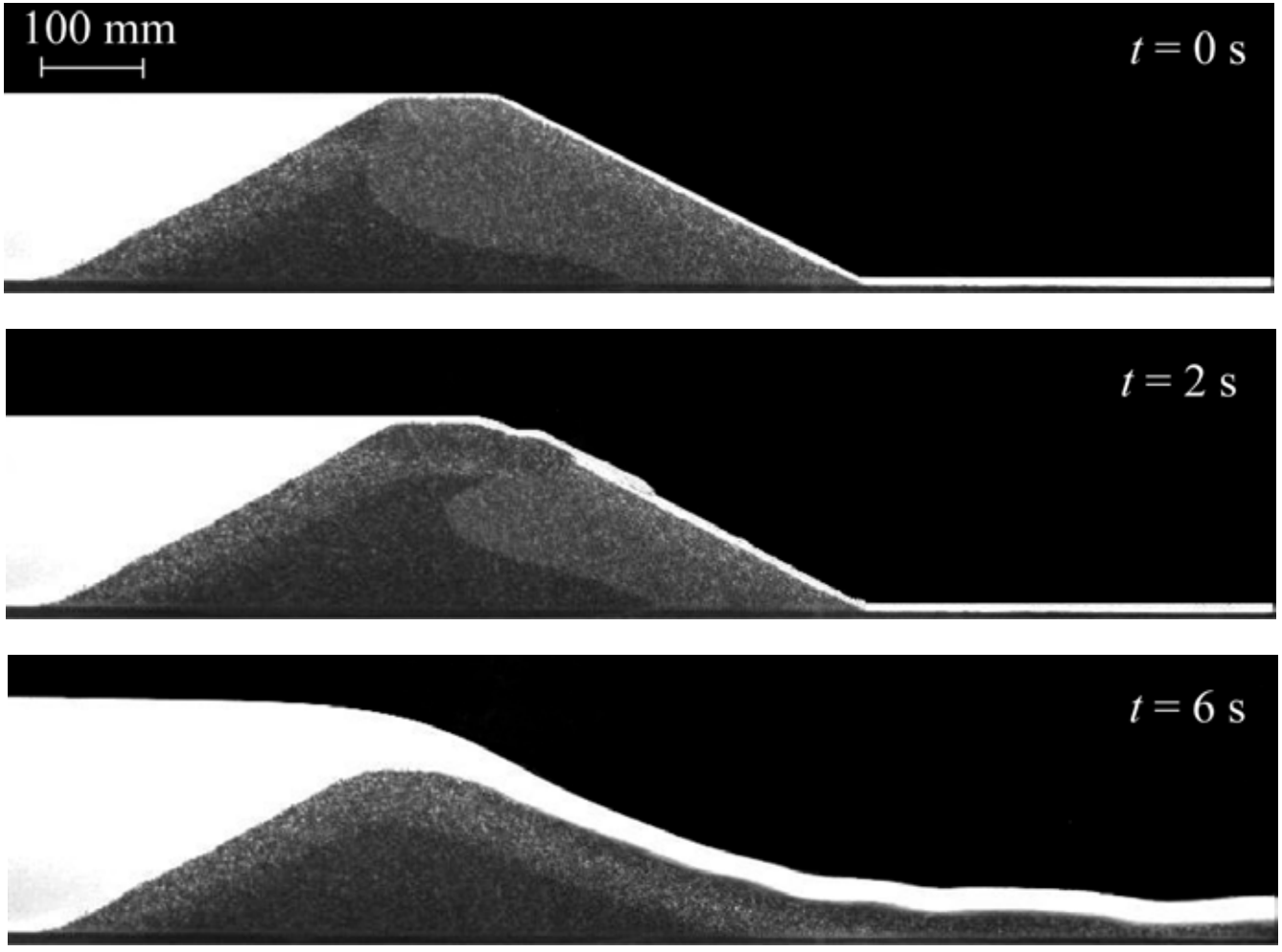
4 Erosion Process



Temporal progress of dike erosion for

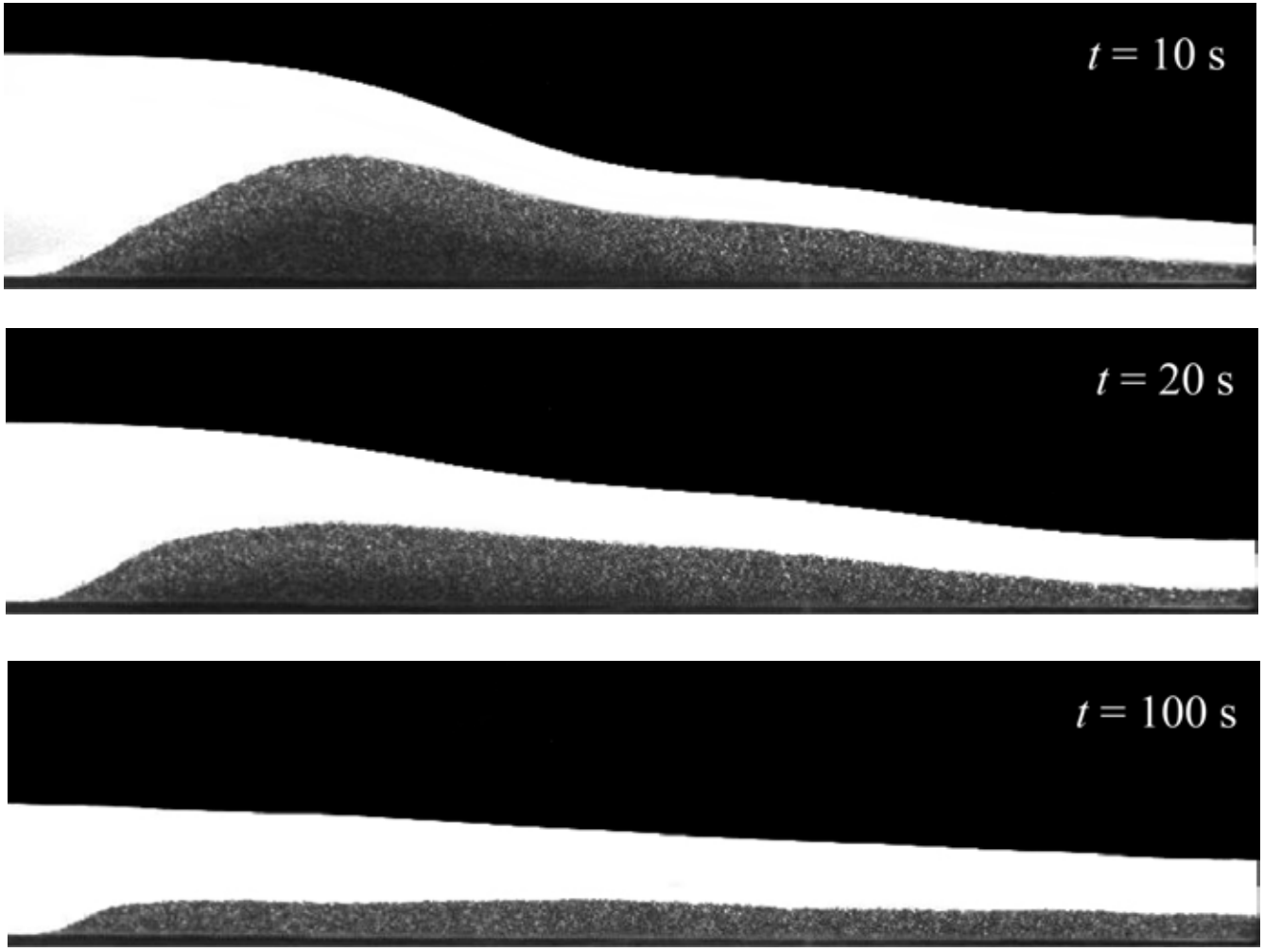
Q_o = 10 l/s, w = 0.20 m, b = 0.20 m, d = 2.0 mm

4 Erosion Process



Q = 11.3 l/s, w = 0.20 m, b = 0.20 m, L_K = 0.10 m, d = 2.00 mm

4 Erosion Process



Q = 11.3 l/s, w = 0.20 m, b = 0.20 m, L_K = 0.10 m, d = 2.00 mm

5 Scale Effects

3 Scale Families

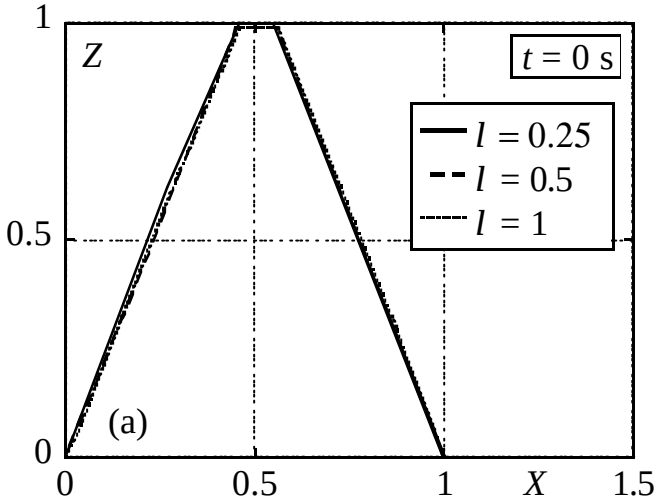
	1	2	3
$?_1$ = 1:	w = 0.40 m b = 0.40 m L_K = 0.20 m d = 4.00 mm Q_o = 64 l/s	Q_o = 32 l/s	d = 8.00 mm

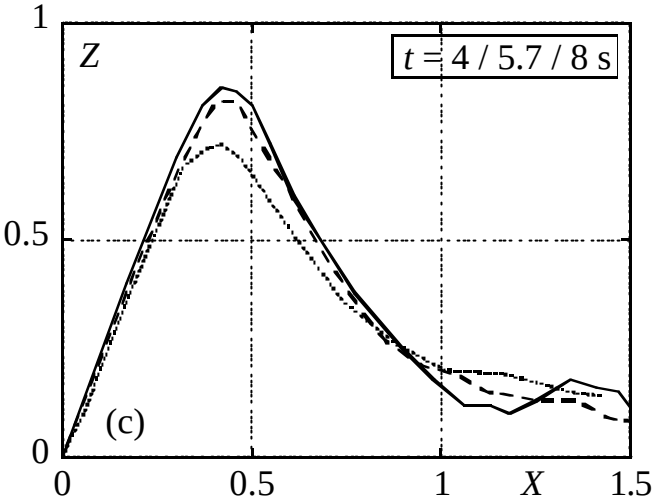
$?_2$ = 0.5 and $?_3$ = 0.25

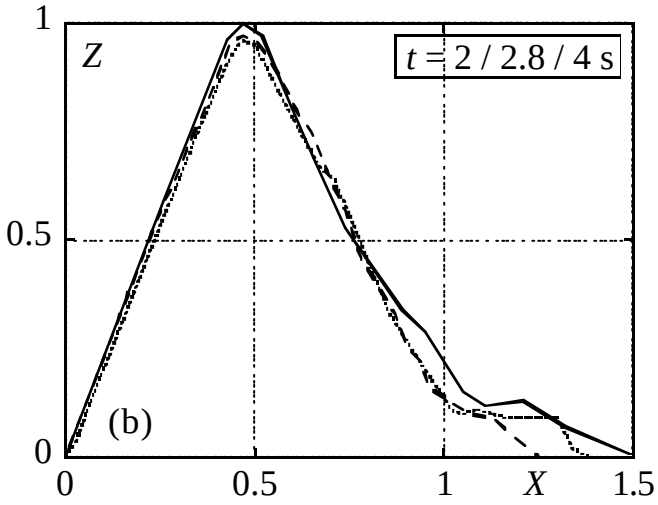
Comparison of temporal dike surface profiles $Z(X)$ based on Froude similitude ($Z = z/w$, $X = x/L_D$)

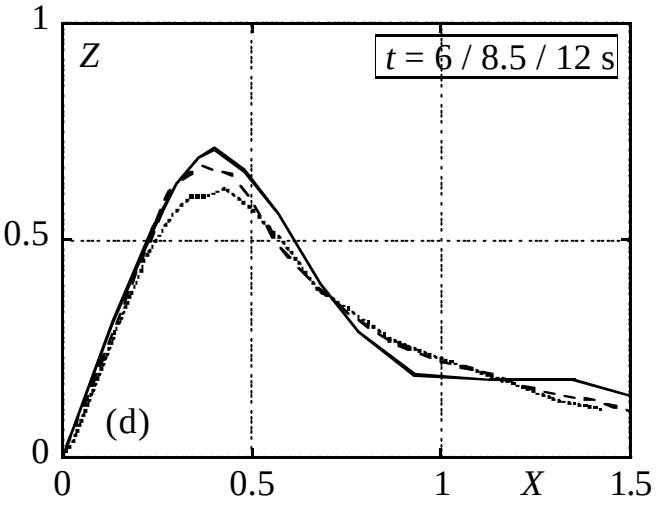
5 Scale Effects

Dike surface profiles $Z(X)$ at various times t



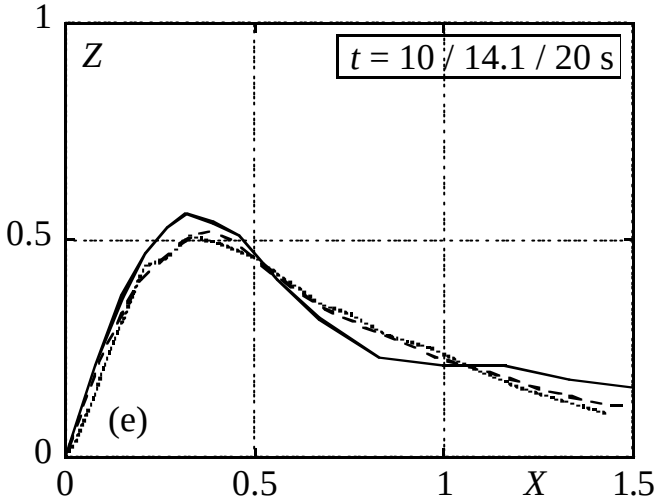


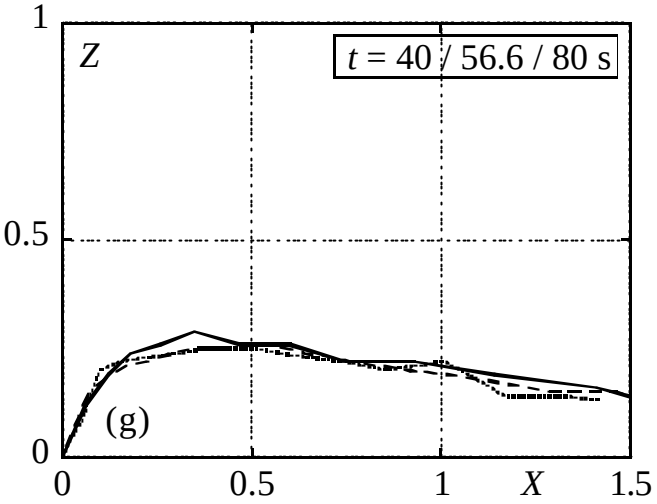


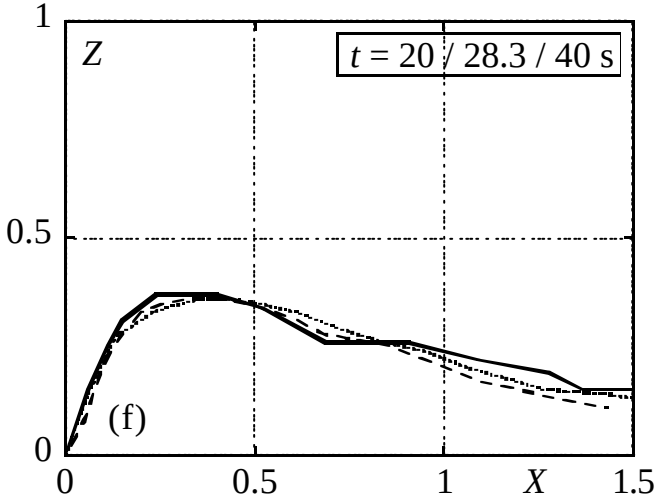


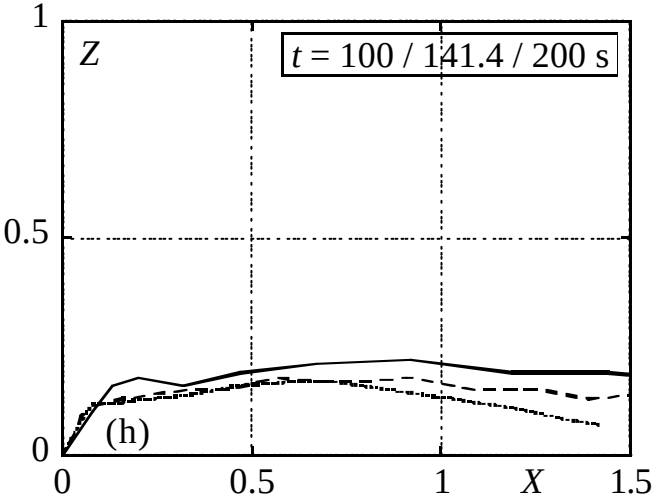
5 Scale Effects

Dike surface profiles $Z(X)$ at various times t









6 Conclusions

No major scale effects, if sliding failure is excluded!

Definite minimum model dike dimensions:

w = 0.20 m

b = 0.20 m

1.00 mm = d = 4.00 mm

q_o = 20 l/sm

Thank you!

Lukas Schmocker

Willi H. Hager

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratory of Hydraulics,
Hydrology and Glaciology