



Large scale experimental study of piano key weirs



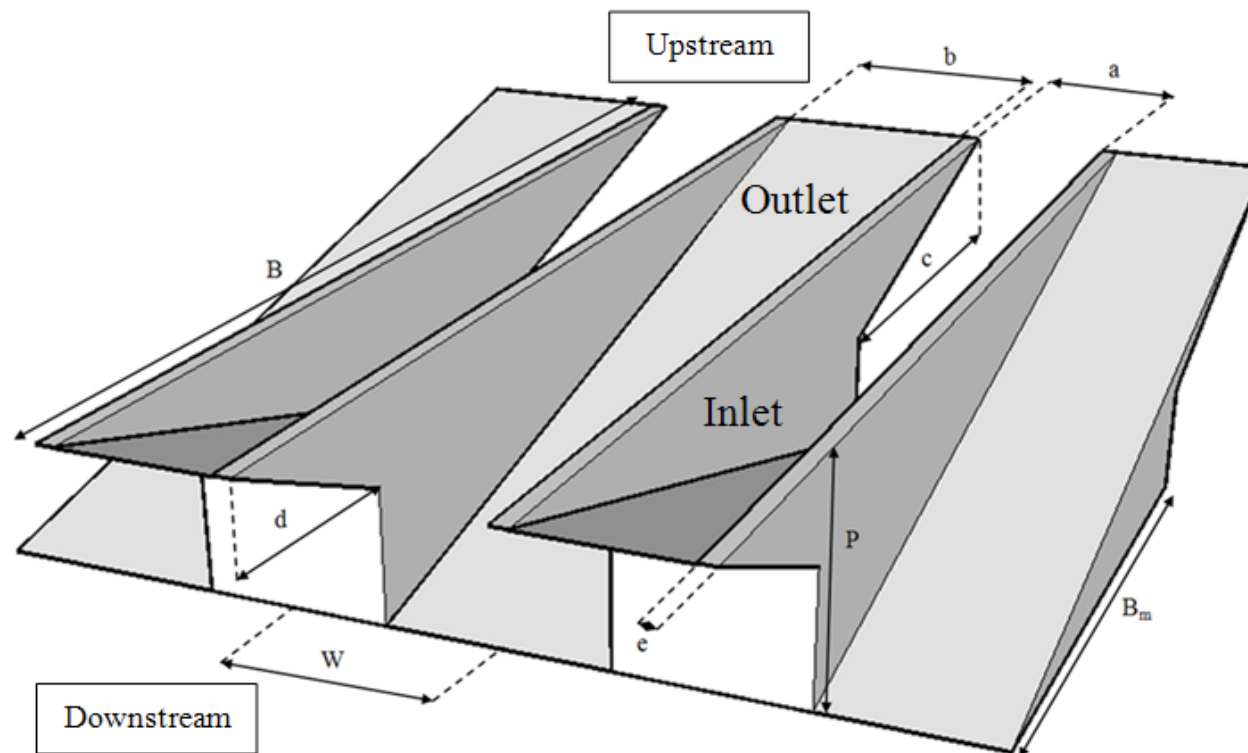
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Piano Key Weir (PKW)

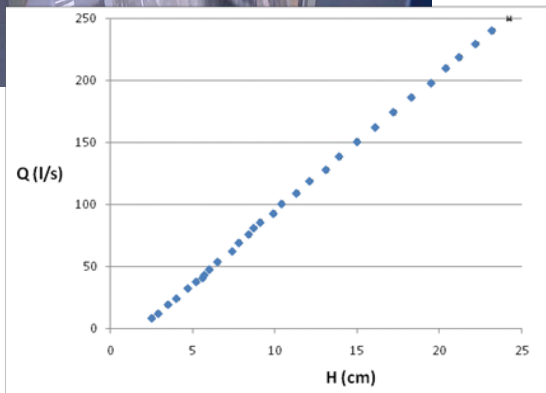


- Until four times more efficient than a traditional Creager
- Reduced basis length which permit a direct use on dam crest

- Complex geometry which induce a large set of variable parameters
- Lacks of understanding about flow conditions

First realizations

Experimental knowledge



Design by extrapolation
of existing experimental
results

Modification of the
geometry following the
project engineers ideas

Scale model study



Efficiency ?

Realization



**Need of efficient design rules based
on the hydraulic behaviour of PKW**

Goals and scientific strategy

Understanding of the physics

Large scale model

To define:

- Interests and limitations
- Mean parameters

Influence of the geometrical parameters

Scale models with variable geometries

Numerical modeling

To define:

- Most important parameters
- Influence on release capacity

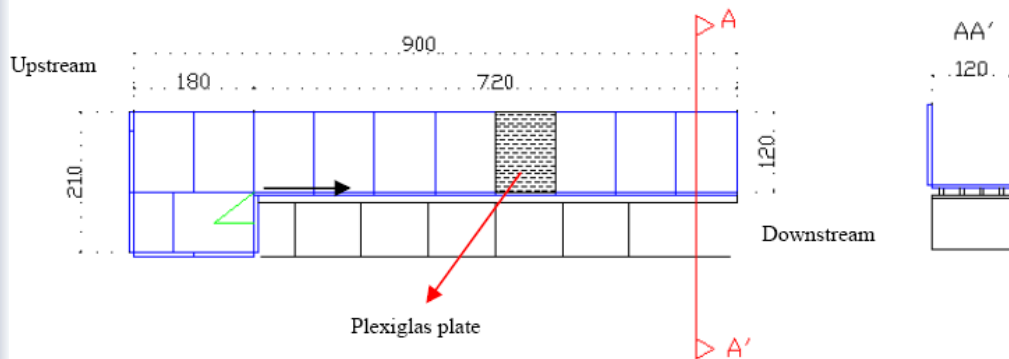
Physically based analytical formulations

Design of new structures

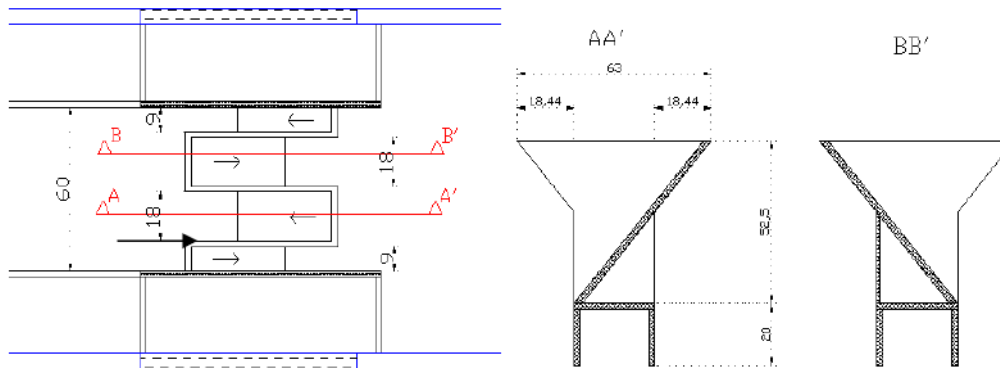


Experimental facility

Experimental channel

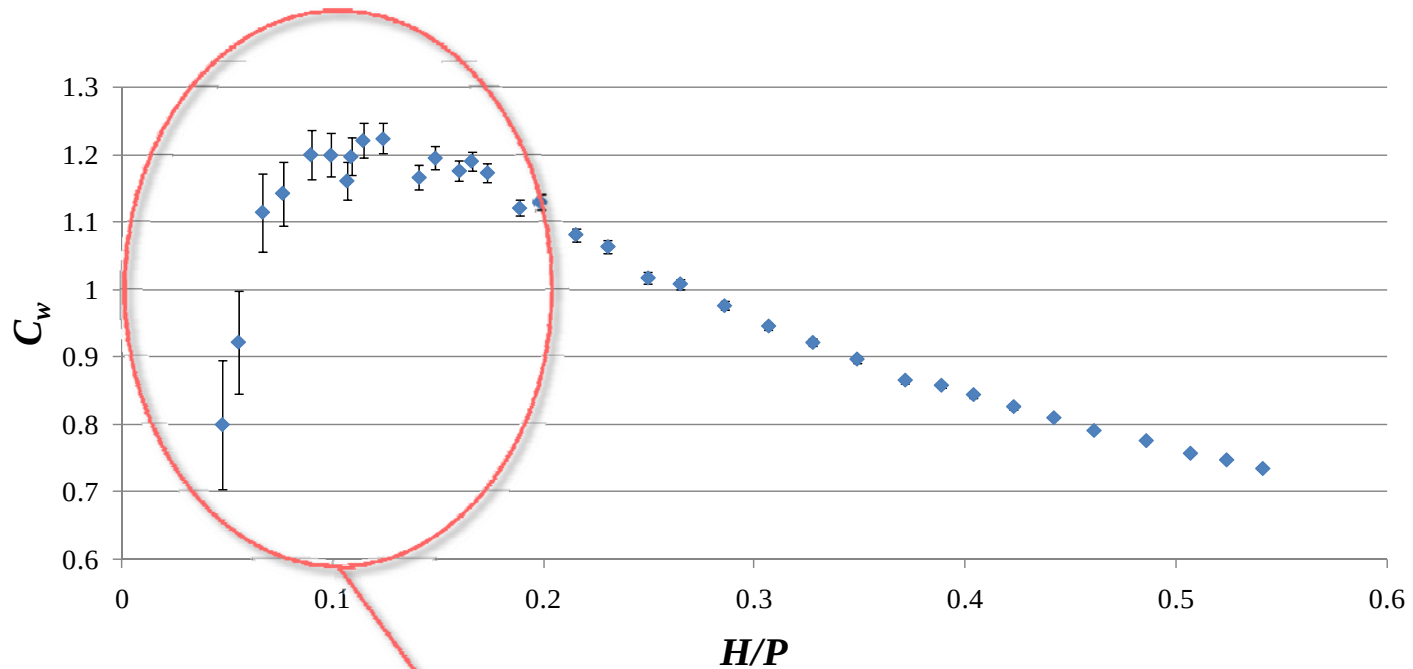


Large scale model



Release capacity

$$Q = C_w W \sqrt{2gH^3}$$



Wall thickness influence

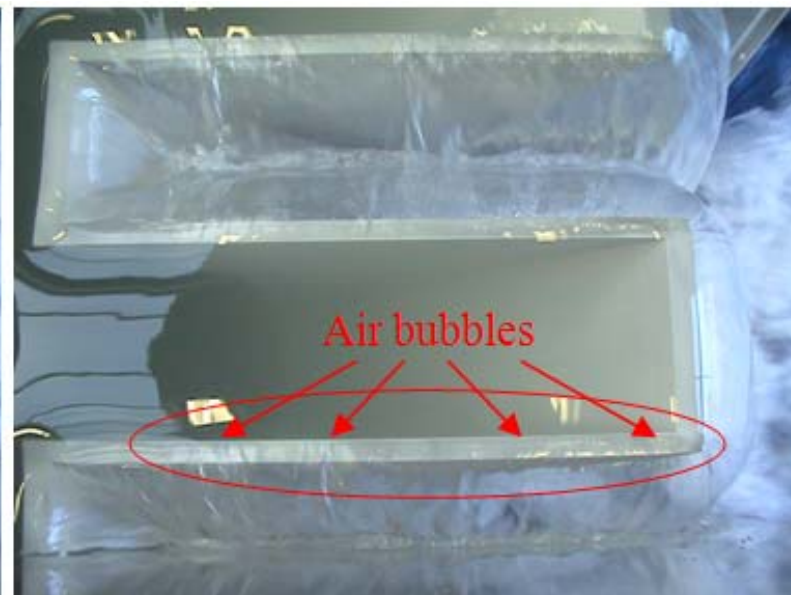


Low heads behavior

$H/e < 2.5$



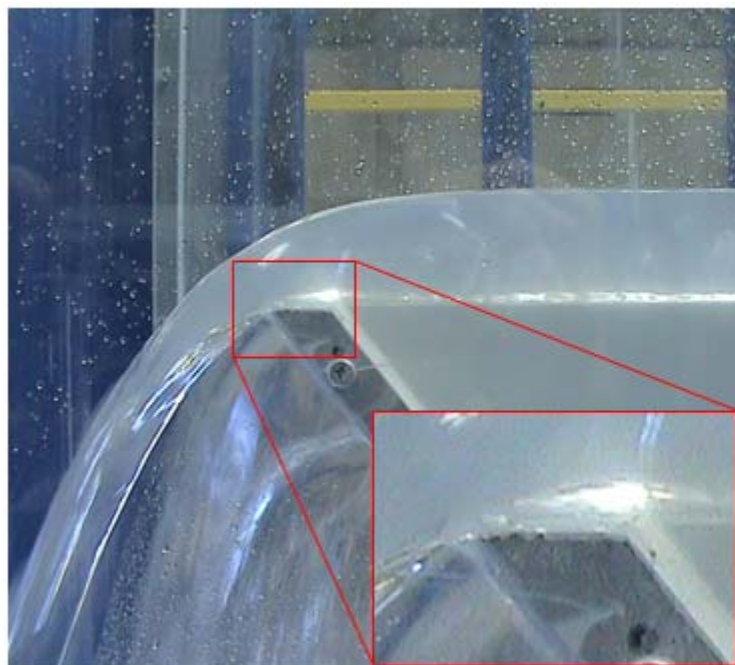
$H/e > 2.5$



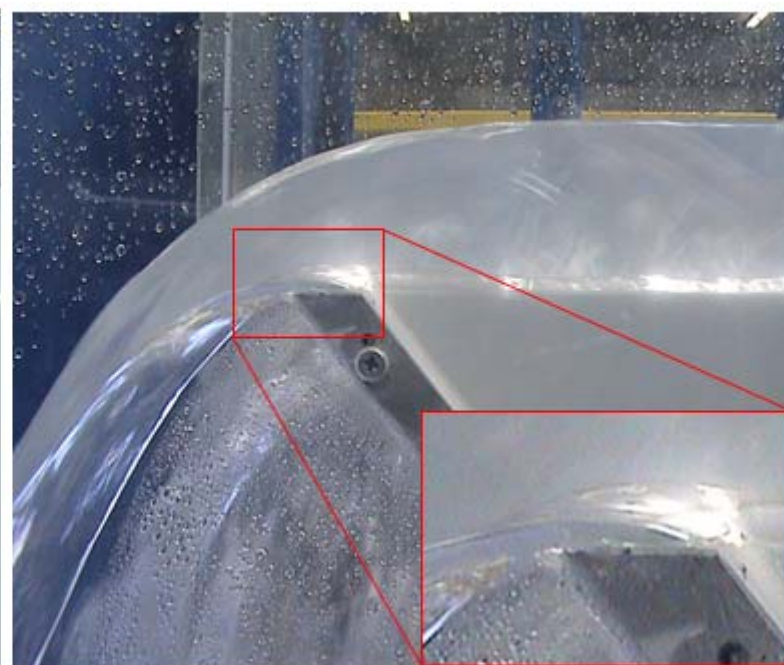


Low heads behavior

$H/e < 2.5$



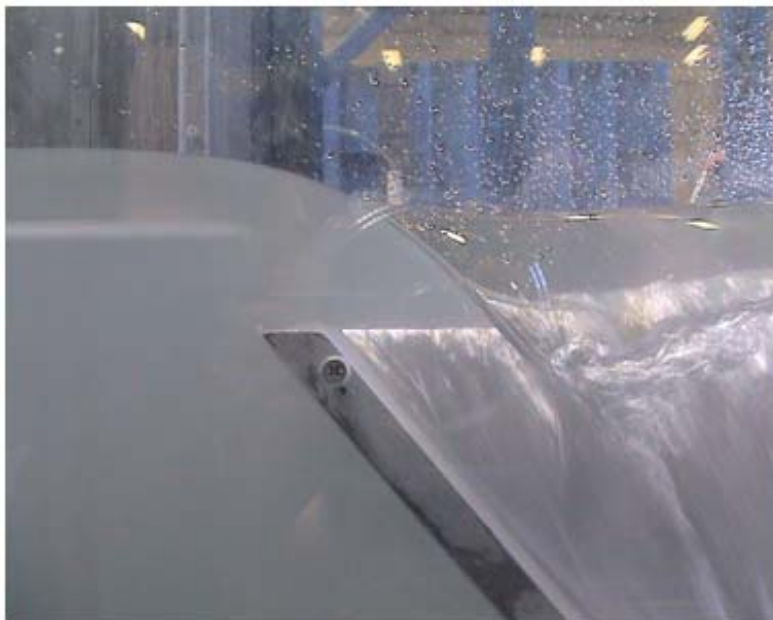
$H/e > 2.5$





Low heads behavior

$H/e < 3.5$

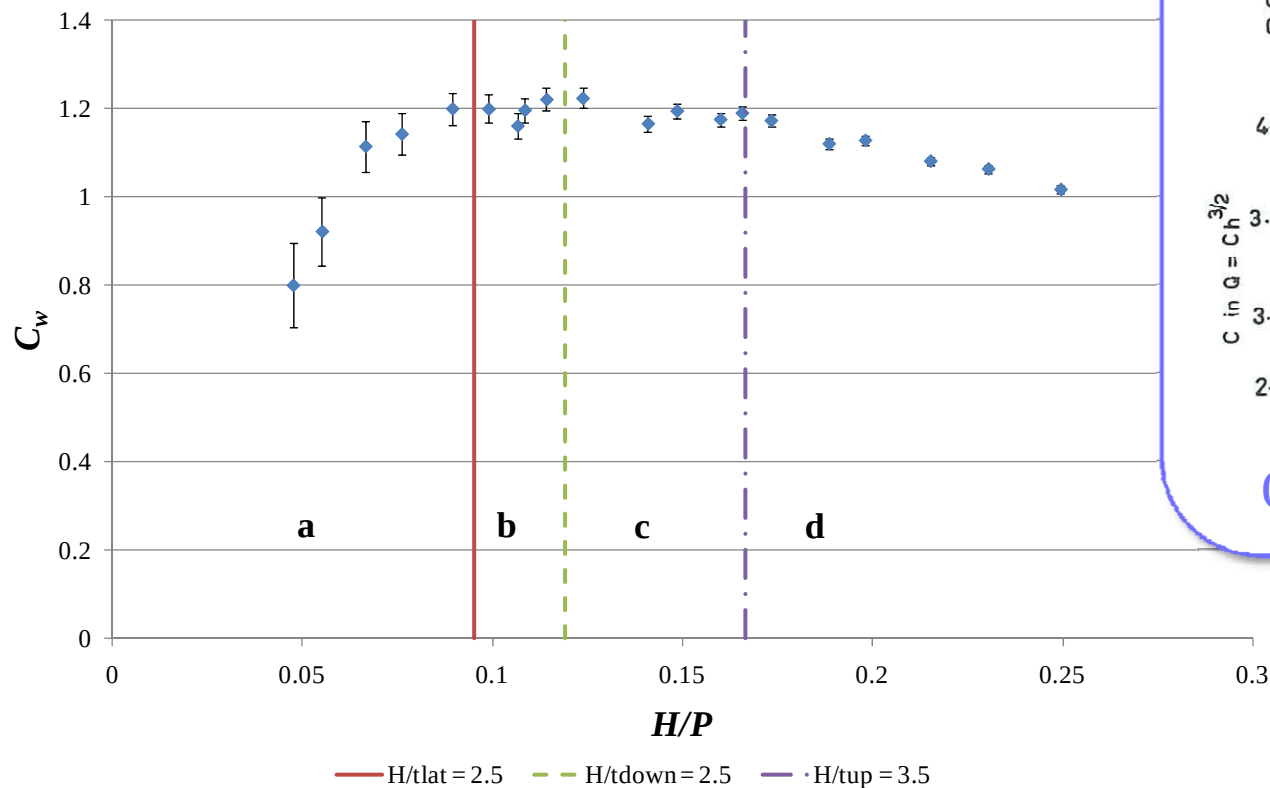


$H/e > 3.5$

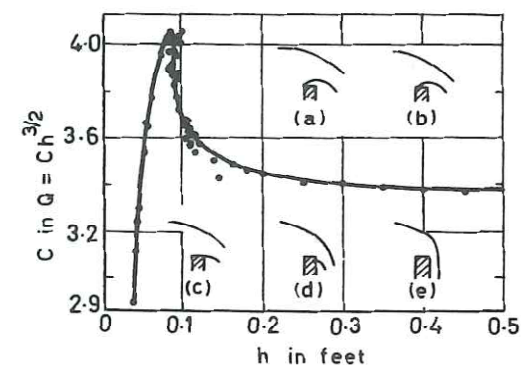




Low heads behavior



Head-range (ft)	Type of Nappe
(approx)	
0.0000 0.0419	(e)
0.0419 0.0793	Either (e) or (d)
0.0793 0.0878	" (d) " (c)
0.0878 0.1438	" (c) " (b)
0.1438 0.1960	" (b) " (a)
>0.2000 (Approx.)	(a)



(Lakshmana Rao 1975)



Conclusion

4-years experimental study of PKW

- To improve the understanding of flows over PKWs (Large scale model)
- To determine the influence of the mean geometrical parameters on the release capacity (scale and numerical model)

First results

- Enable to highlight the influence of the crest thickness for low heads
- Consistent with previous published results for sharp crested weirs

