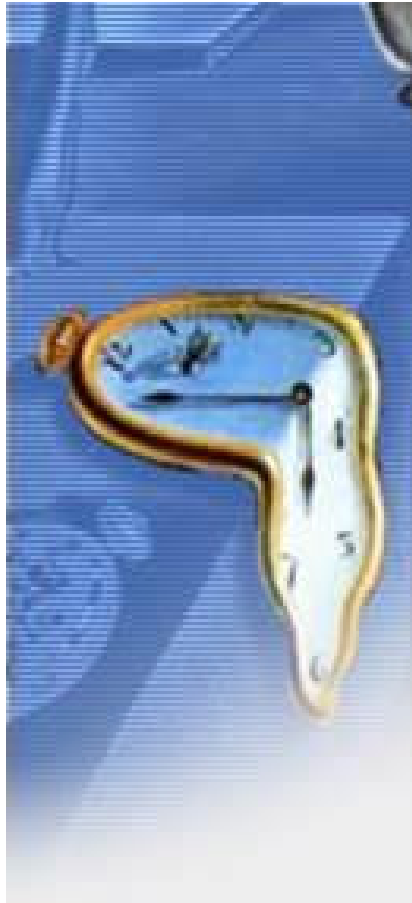


self



compacting

Dr. Jürgen Krell
sworn concrete expert
Germany

concrete SCC

Why to use SCC?

- 1) Improve Quality this we talk about in Europe
- 2) Keep about same quality
 - Save workman's cost (no vibration)
 - Increase amount of production

Improved Quality

- perfect concrete surfaces
- perfect edges of precast elements
- no blowholes
- ready to use surfaces

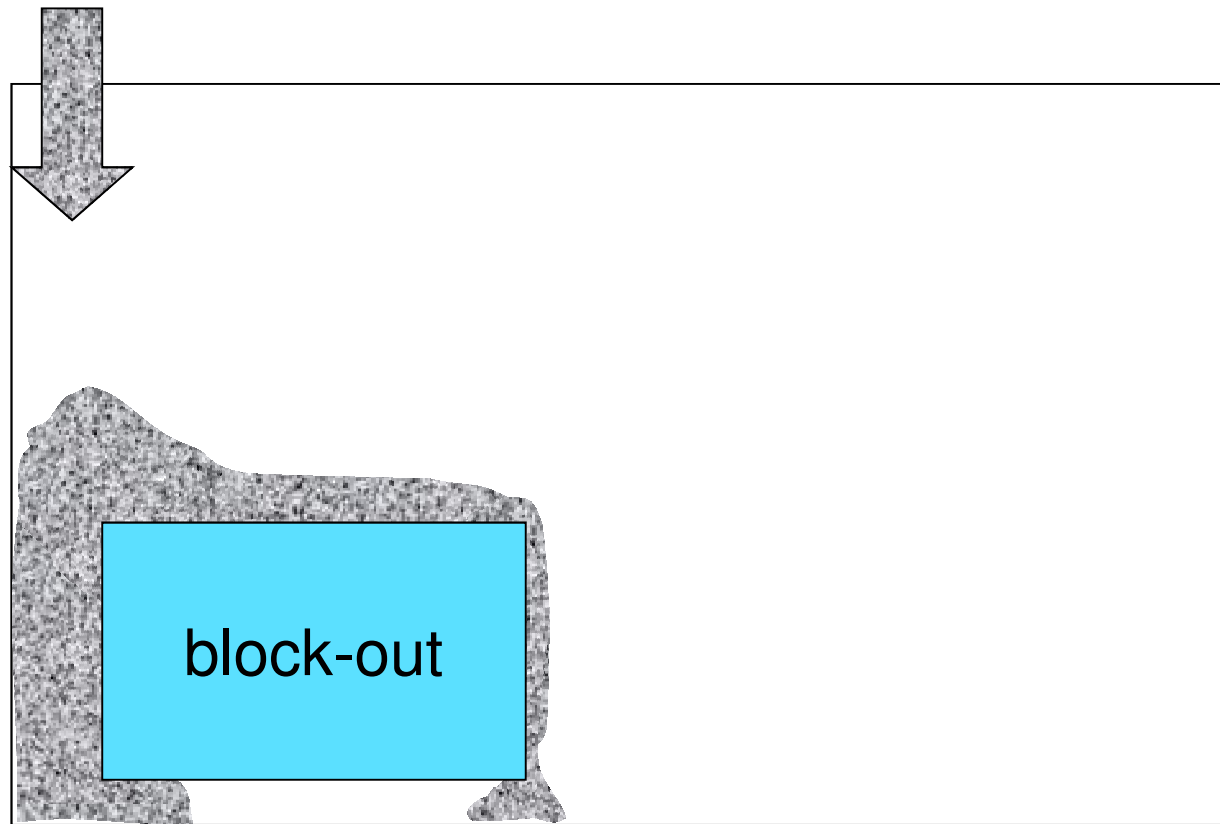
→ perfect elements!

high cost and high knowledge but you must get a definite higher price for your elements

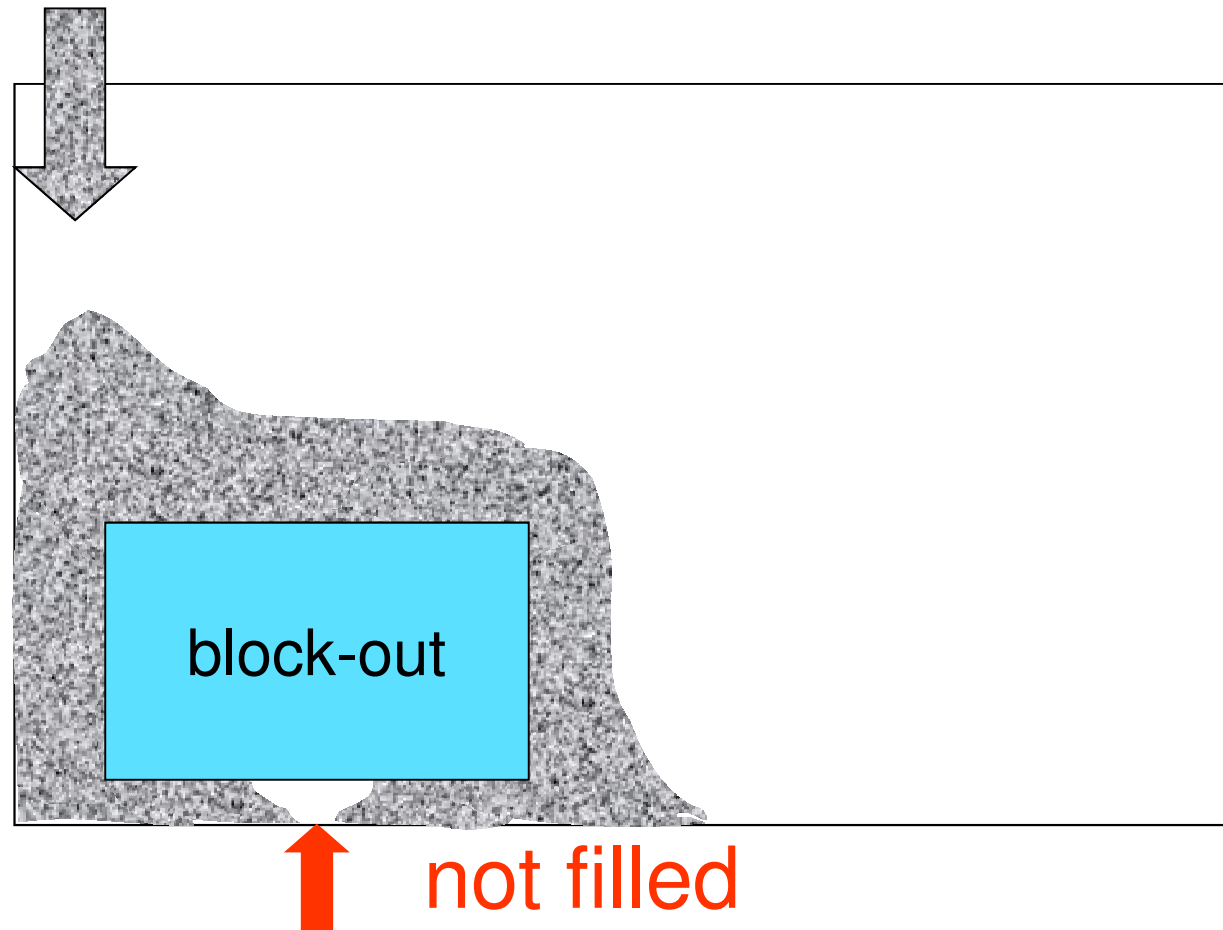
limits and specialties

- The formwork pressure is higher than for ordinary concrete
- The filling of formwork must be planned, that no air is encaptured
- it should be filled in continuously there should be no pouring in layers
- perfect mixdesign and constant properties of raw materials (cement, sand, gravel)

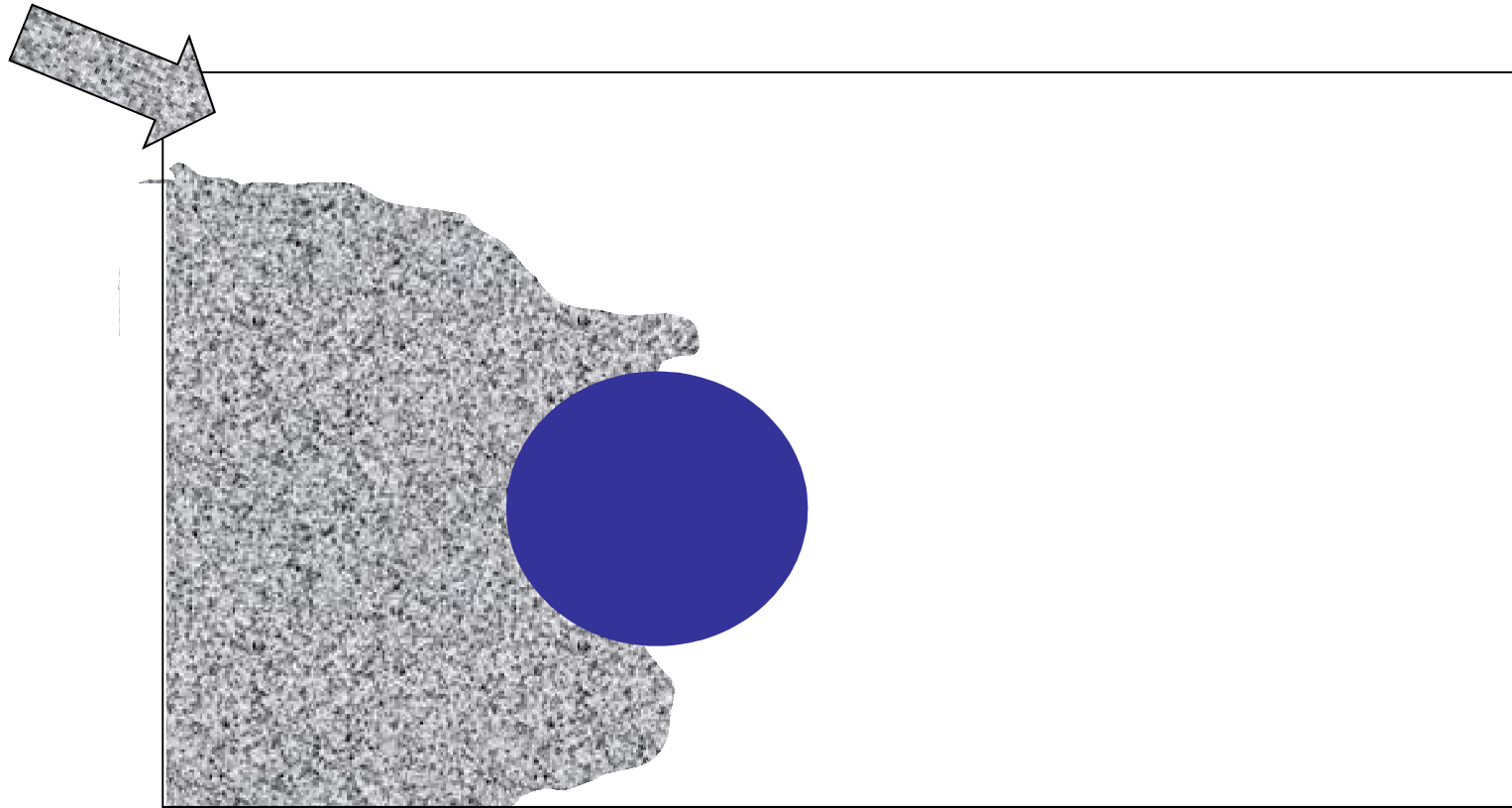
complete filling? block-out



what happens?

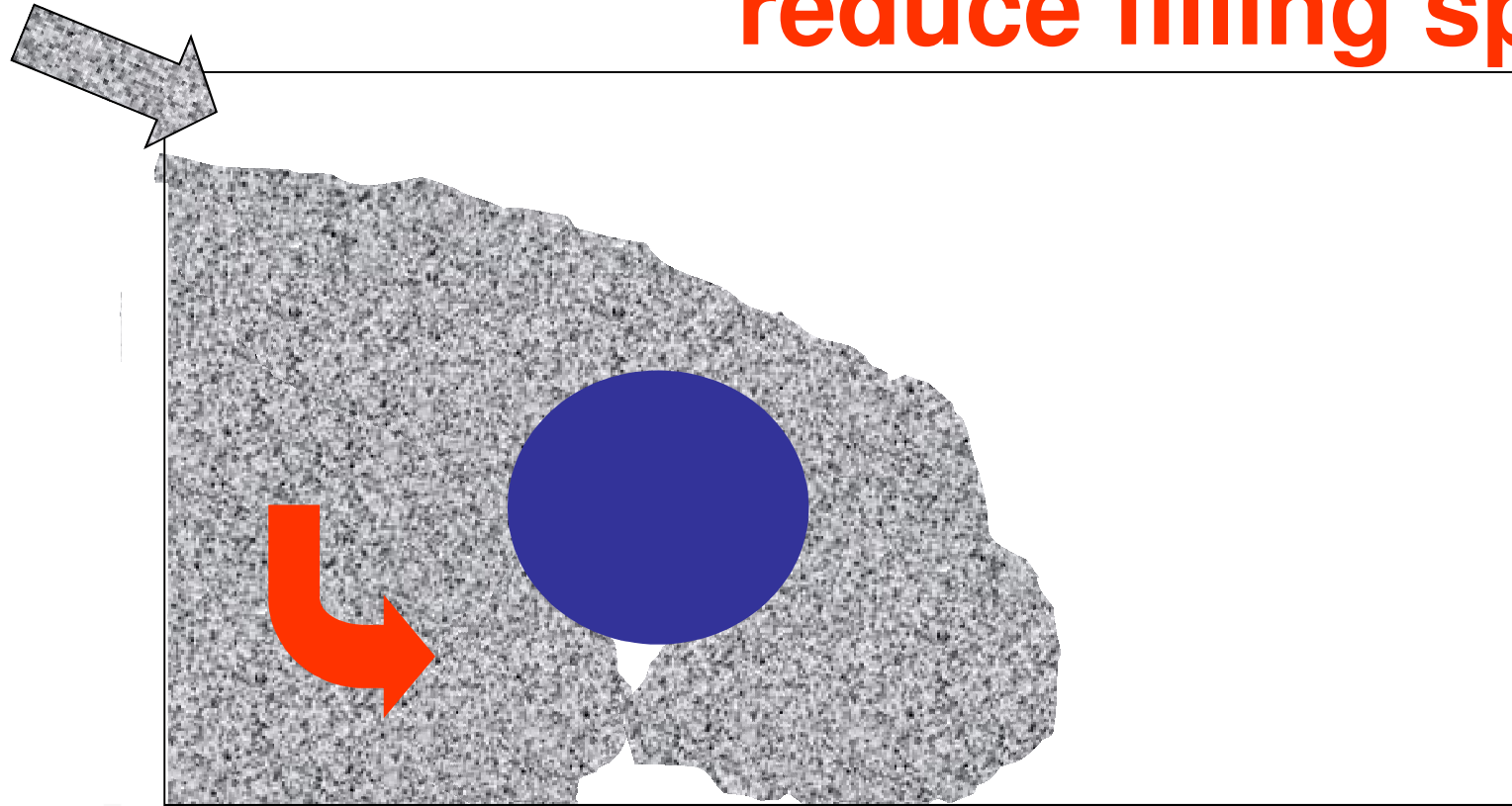


complete filling? reinforcement bar



complete filling?

reduce filling speed!





complete filling?

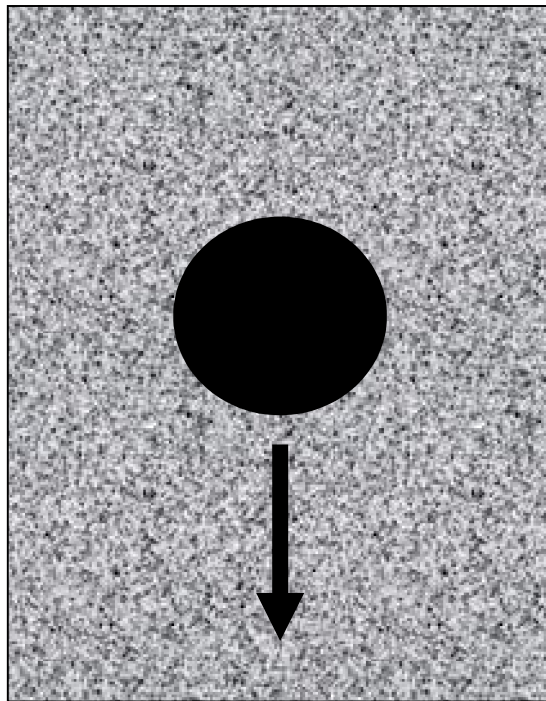
Even SCC is only able to fill the formwork properly, if the entrapped air can exhaust.

Plan the filling of formwork in advance and fill not too quick

In case of doubt, place pipes for getting the entrapped air out.

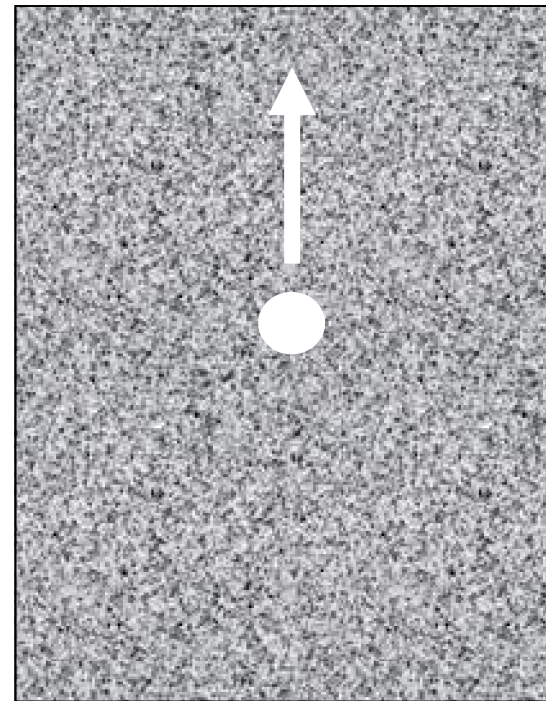
Necessary „Stickiness“ of Mortar

coarse
aggregate



should not sink down

air
bubble



but air should go up

The concrete design

- a lot of fines (ideal graded)
 - normal water content (around 190 l/m³, 30 °C)
 - very constant materials
 - no change in grading curve of aggregate
 - no change in water demand of
 - sand
 - cement
- very stable mix
- no bleeding and no segregation

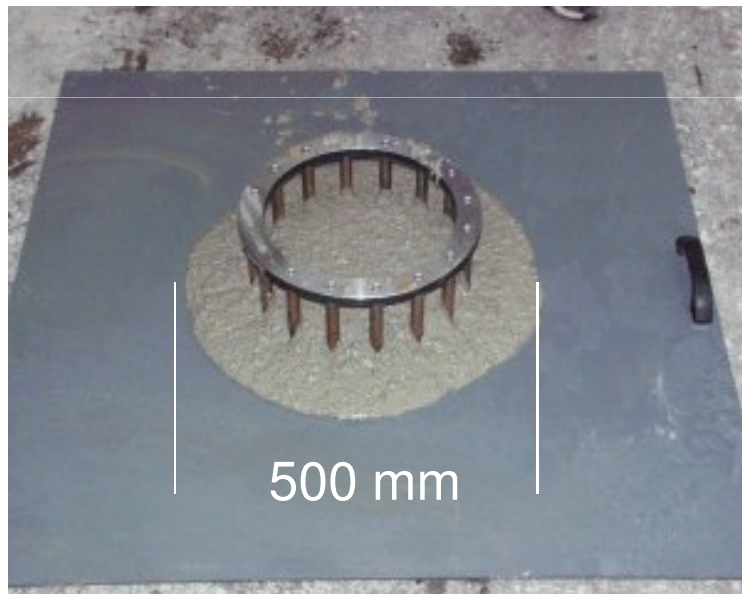
We like to see ... around 700 mm



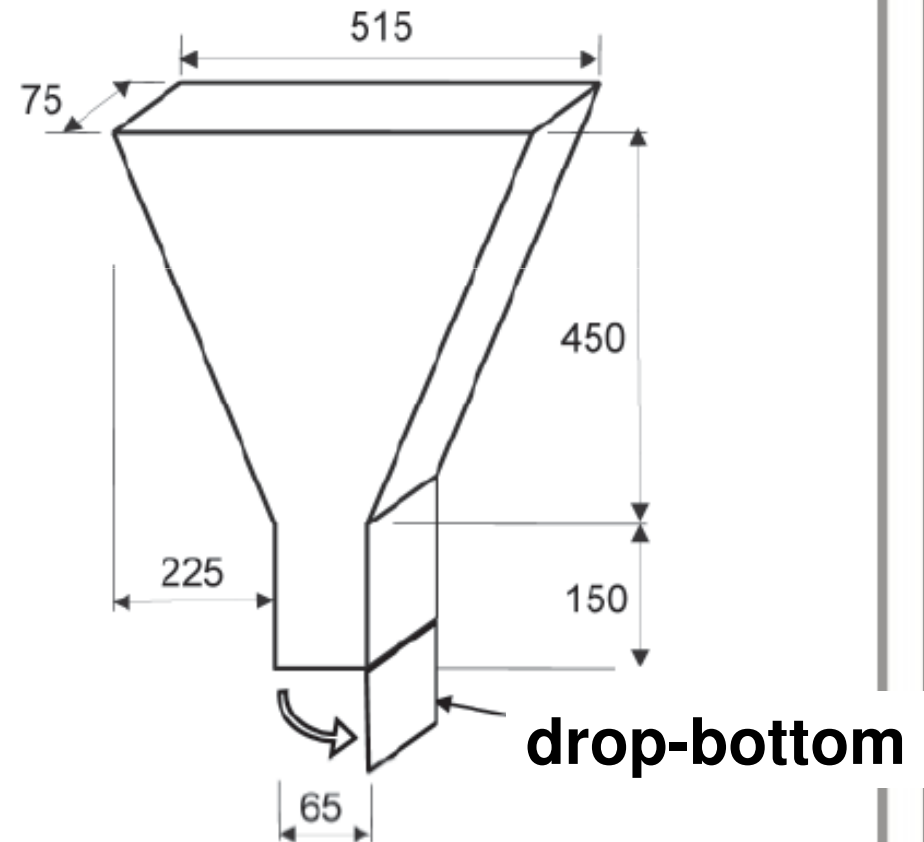
flow-time

Viscosity

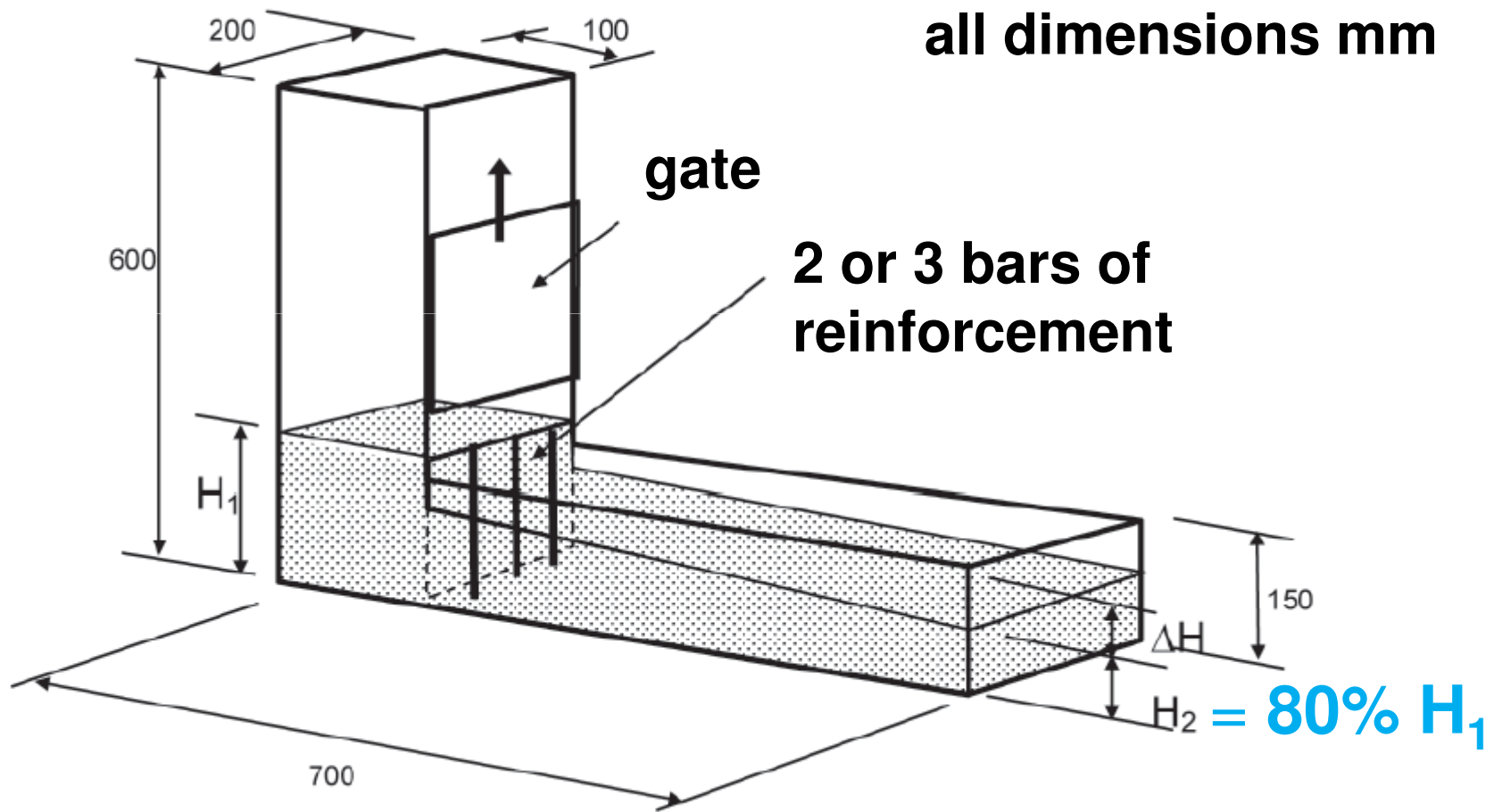
t_{500} -time (J-ring)

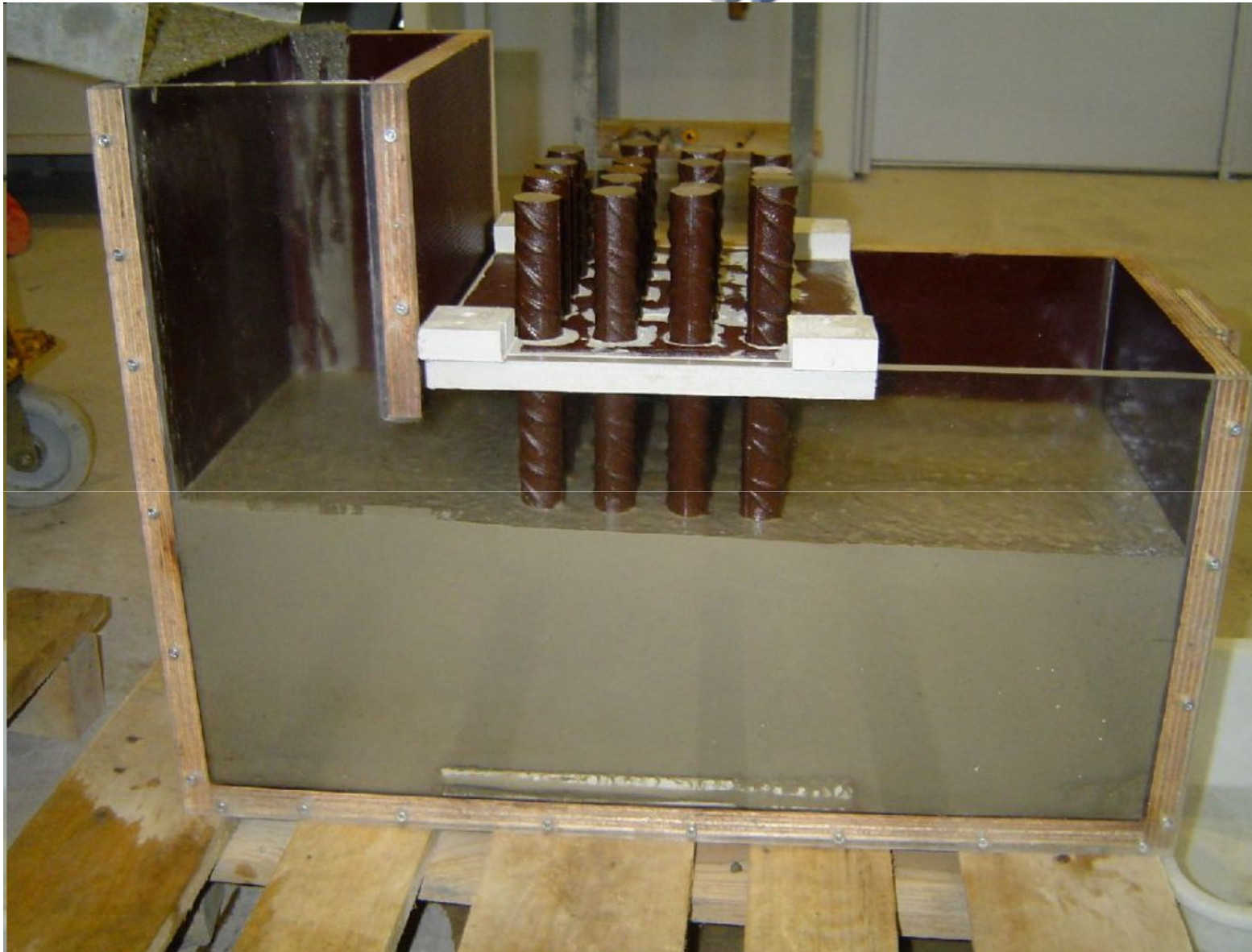


V-Funnel



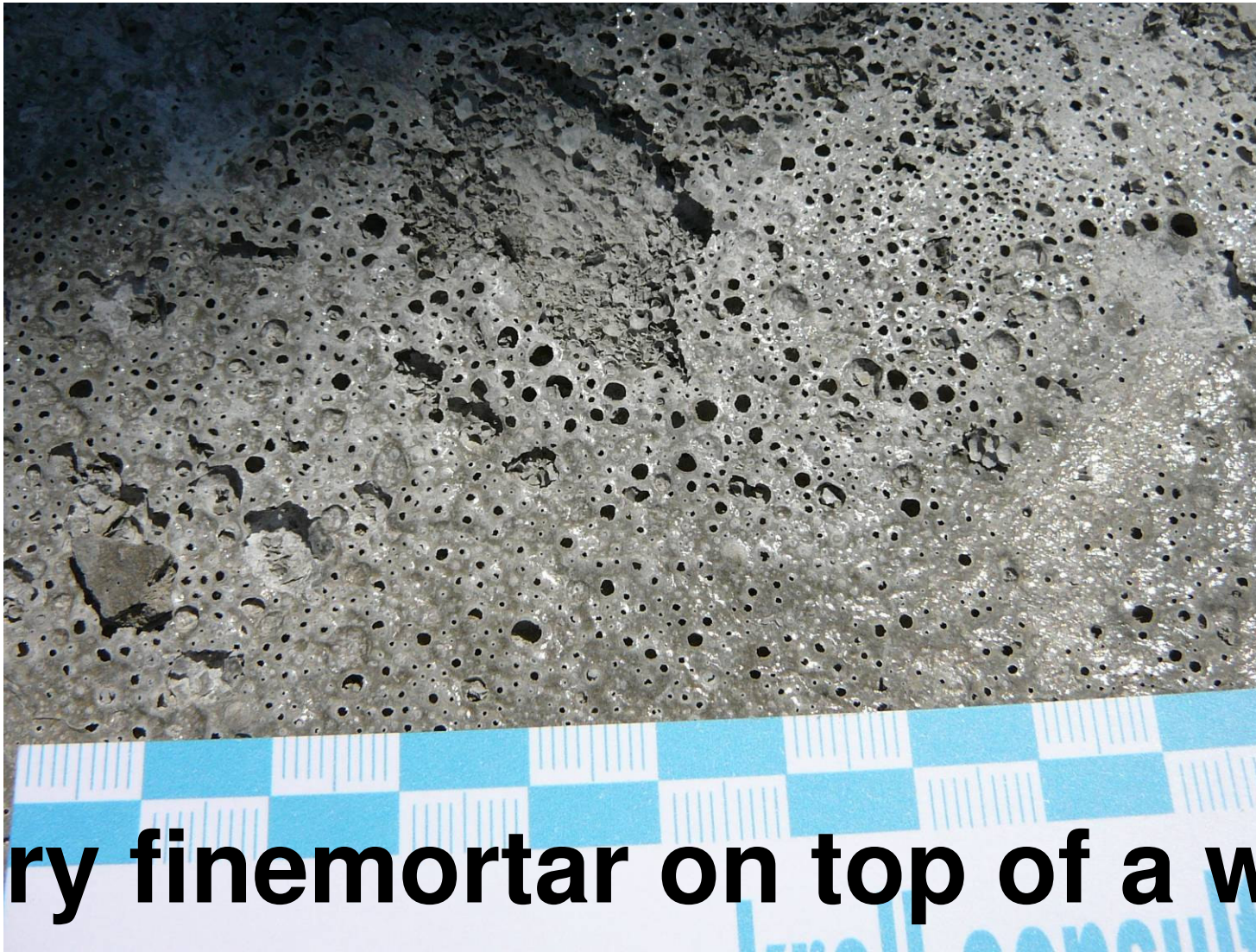
Passing Ability in L-Box





no coarse
aggregate
on the top





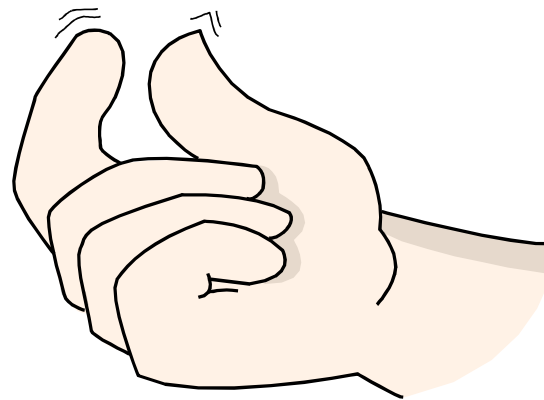
airy finemortar on top of a wall

high quality materials and production

narrow frame
for self compaction

not fluid

segregation of
coarse particles

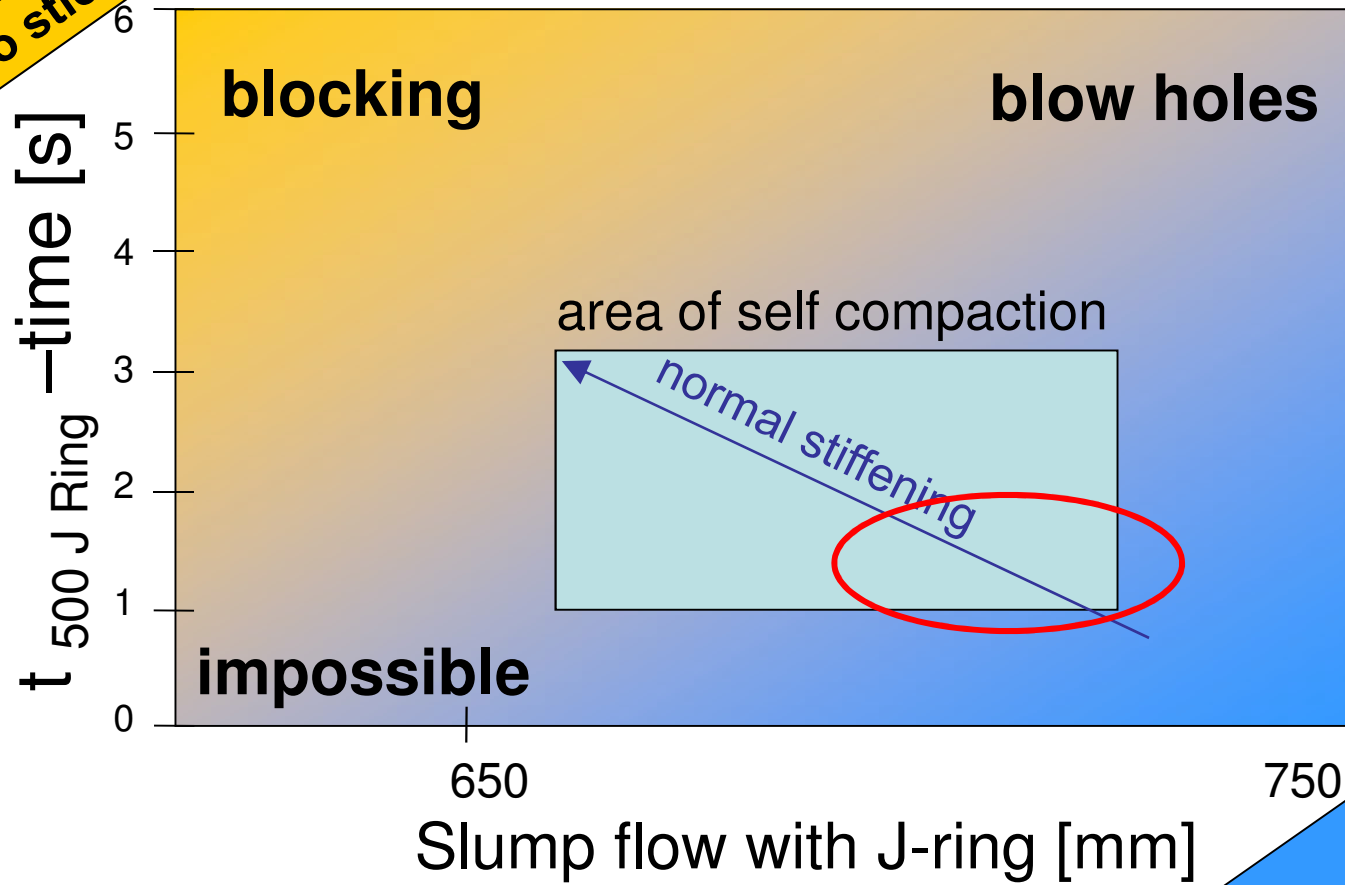


bleeding

too sticky

frame of workability SCC

too sticky (honey)



bleeding

air bubbles on surface of fresh SCC



mix design SCC

guide values for mix-proportion:

water	ca. 190	kg/m ³
finer (c + limestone ...)	> 550	kg/m ³
sand	ca. 40	M.-%
gravel diameter	max. 12	mm
super plasticizer (PCE = Polycarboxylatether)	ca. 3- 5	kg/m ³

different properties compared with ordinary concrete

bleeding	less
stickiness	higher
pressure on formwork	higher
self de-aeration	less
sensitivity ± 5 l/m³ water	higher
amount of blow-holes	higher
end of workability	later

blow holes on formwork



Quality Plan

- characteristics of all raw materials
- mix design for different temperatures/times
- tests on fresh concrete
- measurements in case of being „out of frame“ (i.e. retempering)
- proper pouring (fill in from one side slowly)
- proper curing (avoiding of evaporation)

characteristics raw materials

aggregate (sand)

- constant grading curve
especially no severe changes in fines
i.e. amount $\leq 0,25$ mm = 10 M.-% $\pm \leq 4\%$
- no light particles, which would swim on
the top of SCC (wood, charcoal)

High Quality SCC = fair faced concrete

If everything is well done:

- ideal for thin walls/columns and/or high amounts of reinforcement
- no noisy compaction necessary
- smooth good compacted concrete
- sharp edges, good surface qualities

here examples for high quality SCC elements

















High quality SCC

needs:

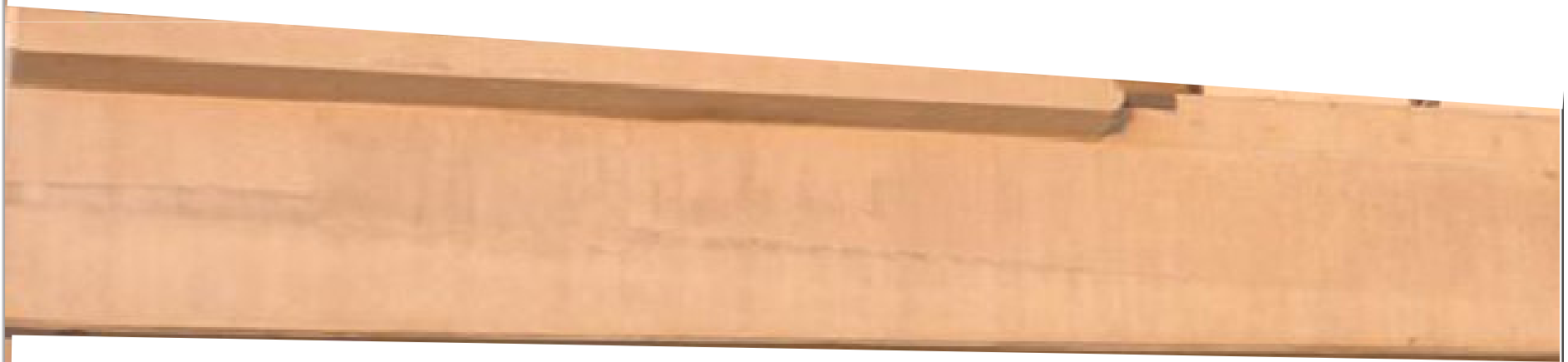
- careful initial testing (temp./time/ ± 3 l/m³water)
- constant fines content (sand/gravel)
- constant production (water, mixing time)
- skilled people on job site
(testing, formwork, pouring)
- **Gives high quality results**

The second way: keep quality

just make a highly workable concrete with almost constant materials: flow around 700 mm

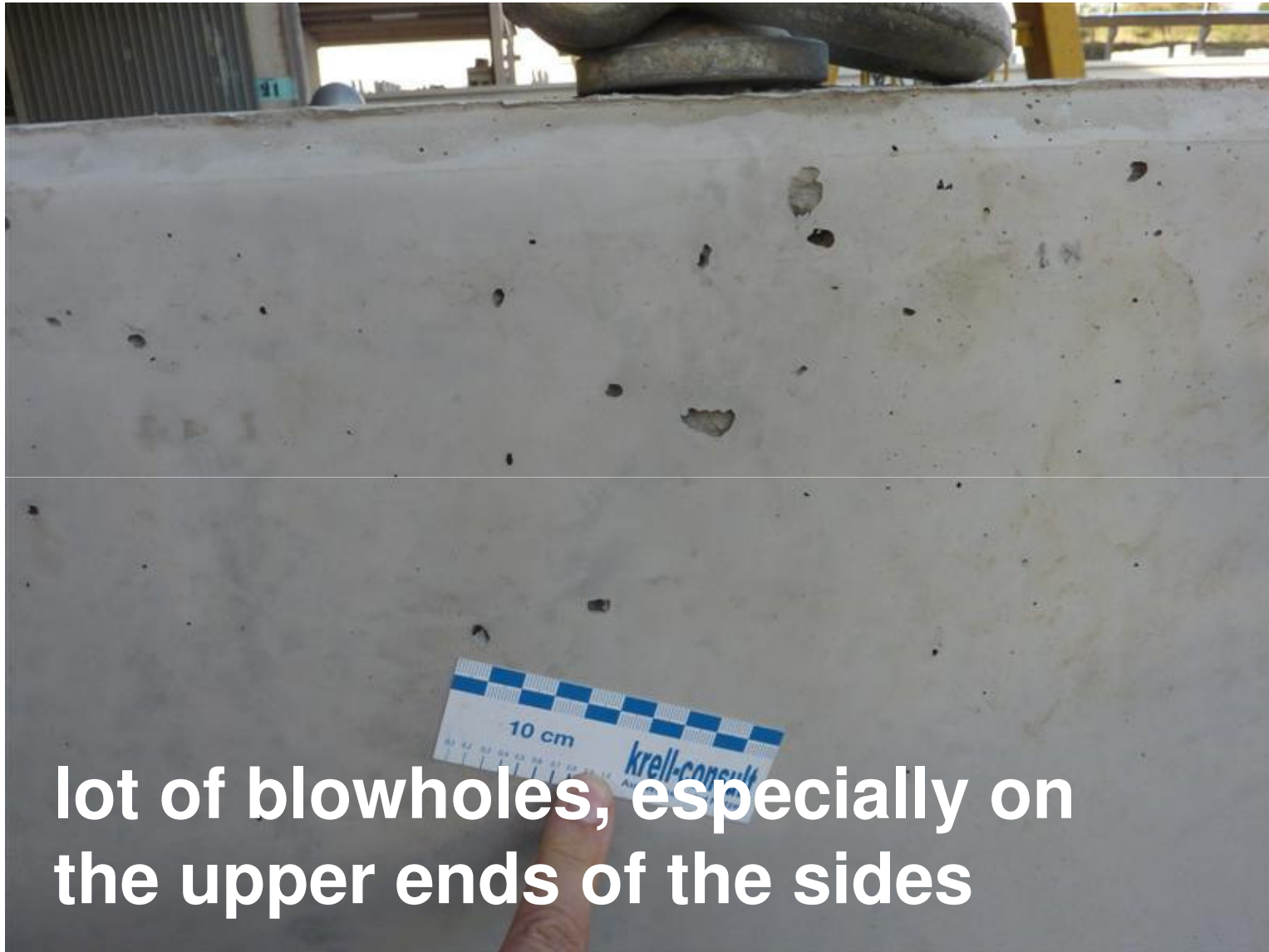
- fill in layers (but you **can see the layers**)
- stay on having **a lot of blowholes**
- but save vibration (manpower)
- increase your daily production (mixcapacity)

**This element was filled in layers
not continuously**





no sharp edges, concrete was running under the triangle



lot of blowholes, especially on the upper ends of the sides



0



SHOW 2010



krell-consult
Aus Wissen wird Nutzen



If that quality is OK

You have less of control but you have to use almost constant materials!

Usually it is a **high fluable** concrete
no testing on flowtime and passing ability

Be sure that there is no segregation, but a very little bleeding is helpful for getting the bond between the layers and for keeping the upper surface wet.

For SCC you have to decide:

Improve quality

**full SCC = high quality of elements
= fair faced quality**

Ease and/or increase the production

**mostly SCC = high fluability
= normal quality**

For SCC you have to decide:

Improve quality

a lot of expensive measurements

normally material cost is increased by 30%

Just do it, if you get the **adequate higher price** for those better elements

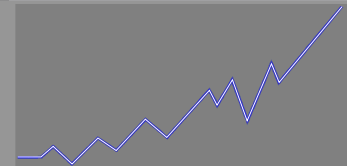
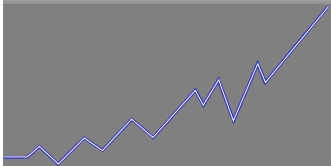
Ease and/or increase the production

keep quality, sometimes more blowholes

almost constant materials are necessary

increased material cost 15%, saving in manpower

Success
is the
sum of proper
decisions



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