

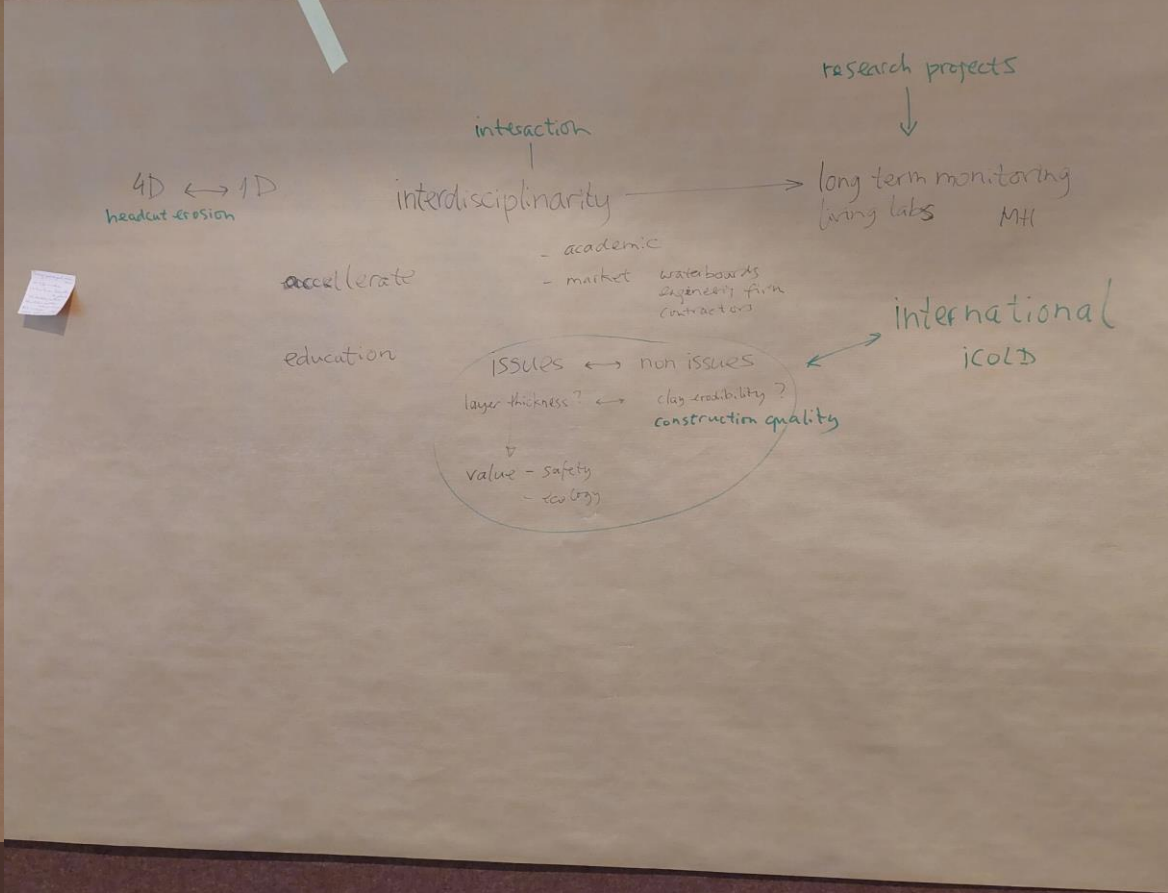
Expert Meeting 14 sept 2023 - HARVEST

Group 1

Group 2

Group 3

Group 4



Group 1

Shared slide

There is a need for a easy practical method to determine the erosive properties of local soil.
What is the quantitative impact of changes in materialogical conditions on erosion properties ?
- How sensitive are levees with a sand core and clay cover for drought cracks and animal burrows ?

Make a national handbook for soil erosion testing to promote the use of it

Model internal erosion through animal burrows with Hole Erosion Tests

PUT THE IMPERVIOUS LAYER COMPLETELY INSIDE!


erosive capacity of soil also depends on type of flow
- basic classification of these flow types need to be developed
- then smaller erosion tests can be applied

heterogeneity of loads is also important to make balancing of

New categories of erodibility are necessary. We need to select determining parameters

Climate change is important. We need to be prepared for dry conditions + super storm

clay layer on sand could be very wrong in future. We probably need thick clay layer

- make a national handbook for soil erosion testing to promote the use of it

investigate at many more locations / uniform tests / coordinate research proposals / 'aging model / erosion model with more material properties

Interaction model, standardize tests, scale levels micro macro in relation to measurable properties

Erosion > material vs structure/shape (> humidity, temperature, biology)

LIME-TREATED CLAY COVERS EVERYWHERE!

- Put the impervious layer completely inside (in the core)
- Erosive capacity of soils also depends on type of flow
- Basic classification of these flow types need to be developed
- Then smaller erosion tests can be applied
- Heterogeneity of loads is also important
- Lime-treated clay covers everywhere!

- Model internal erosion through animal burrows with Hole Erosion Tests

- New categories of erodibility are necessary. We need to select determining parameters.
- Climate change is important. We need to be prepared for dry conditions and super storm
- Clay layer on sand could be very wrong in future. We probably need thick clay layer.

Group 2

Shared slide

- There is a need for a easy practical method to determine the erosive properties of local soil.
- What is the quantitative impact of changes in materialogical conditions on erosion properties ?
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Group 3

Shared slide

- Short-term: add extra monitoring options to current projects to follow structure developments, either in situ, proximal, remote. If possible investigate differences between large cracks/eroded areas and surrounding material.
- Long-term: Living-lab setting, a stakeholder-focussed, iterative, open innovation environment operating in a defined context, to integrate concurrent research and innovation processes within a public-private-people partnership.
- Ambition: formulate research project to tackle questions together as an expert group

- Dike investigations are not standardized, yet that would help to better get hold of erosion processes + aging

- Understand relation between clay structure / aggregates & erodibility
- Easy practical method in field: test pit combined with water flow
- More cooperation between parties involved would improve coherence of dike reconstruction projects

Basis: "there is need"

- Why is there a need
- Scale
- Failure mechanism
- How to express materialogical conditions?
- Assumption that cracks are self healing
- Distinguish crack types: deformation, desiccation
- Understand interconnected mechanisms
- More attention for root zone + dynamics (thatch layer)

- Test pits at more different erosion projects (e.g. IJsselmeerdijk)
- Pits: why not just try out the variability on 3 levees, make many pits & find out

- Measure aging after dike reconstruction projects (cracks, compaction, organic content, etc.)
- Develop a method (maybe already exists) to quantify or measure clay structure / aggregates instead of merely describing
- Research in between the "Delft formulae" and "Wageningen conceptual approach" in research proposals NOW-M (purely scientific), NOW-TTW (+ contribution from non-university partners), or larger programmes (NWA, Perspectief, etc.)

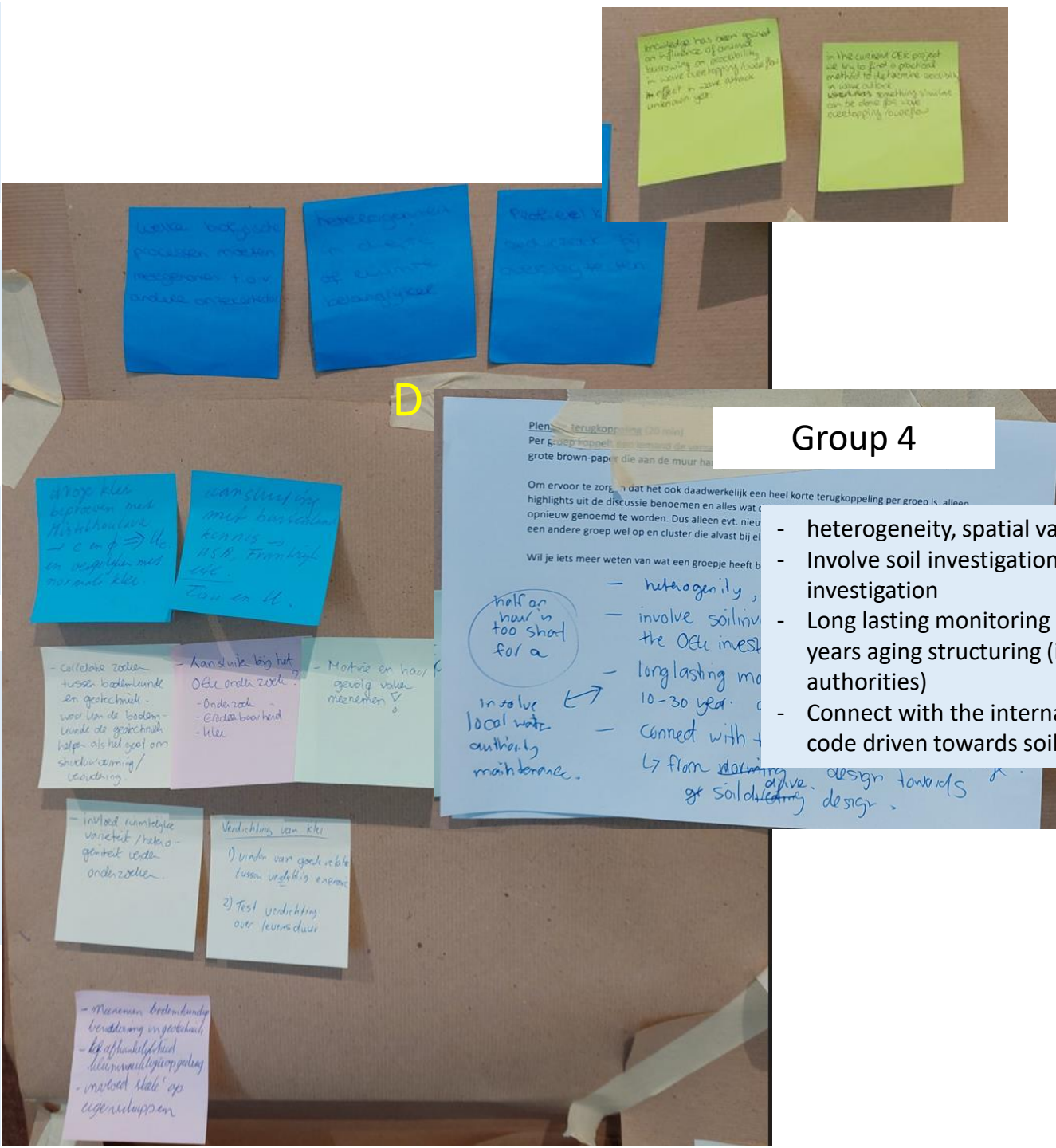
- Knowledge has been gained on influence of animal burrowing on erodibility in wave overtopping / overflow, but effect in wave attack unknown yet
- In the current OEK project we try to find a practical method to determine erodibility in wave attack. Something similar can be done for wave overtopping / overflow

- What biological processes should be taken into account compared to other uncertainties
- Heterogeneity in depth or space more important
- Test pits at overflow test locations

- Test dry clay with Mirtskhoulava > c en phi > U_c and compare with normal clay
- Connect with international knowledge: USA, France etc.

- Seek correlation between soil science and geotechnics. Where van soil science help geotechnics, when looking at structuring / aging?
- Connect to OEK research?
- Involve Martine and her peers!
- Apply long term monitoring: 3, 5, 10 t/m 30 years
- Further investigate influence spatial variety / heterogeneity
- Compaction of clay: 1) find a good relation between compaction and erosion, 2) test compaction over lifetime

- Involve soil science in geotechnics
- Influence clay mineralogy on behavior
- Influence 'state' on behavior



Group 4

Plen... terugkoppeling
 Per 6-100 koppelt...
 grote brown-paper die aan de muur ha...

Om ervoor te zorgen dat het ook daadwerkelijk een heel korte terugkoppeling per groep is...
 highlights uit de discussie benoemen en alles wat opnieuw genoemd te worden. Dus alleen evt. nieuw een andere groep wel op en cluster die alvast bij el...

Wil je iets meer weten van wat een groepje heeft b...

- heterogeneity
- involve soil science in the OEK invest
- long lasting monitoring 10-30 year
- connect with local water authority maintenance
- design towards soil driven design

half an hour is too short for a
 involve local water authority maintenance
 design towards soil driven design

Wat zijn de biologische processen die erin spelen?
 Hoe worden deze processen beïnvloed door de omgeving?
 Hoe worden deze processen beïnvloed door de omgeving?

Heterogeniteit in diepte of ruimte
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- Correlatie zoeken tussen bodemkunde en geotechniek - waar kan de bodemkunde de geotechniek helpen of het gaat om structureel ontwerp / verandering

- Kansen bij het OEK onderzoek - Onderzoek - Ervarenheid - Meer

- Motie en haar gevolgen voor monitoring

- invloed ruimtelijke variatie / heterogeniteit verder onderzoeken

Verdichting van klei
 1) vinden van goede relatie tussen verdichting en erosie
 2) Test verdichting over levensduur

- Meer weten over bodemkunde
 - bodemkunde / bodemkunde
 - bodemkunde / bodemkunde
 - bodemkunde / bodemkunde

- Beavers & badgers: do we know the failure mechanism towards breach of a river dike? Do we know how dangerous they are?
- We always have to connect the erodibility to the load: wave impact, wave overtopping, overflow
- Erodibility on its own does not exist

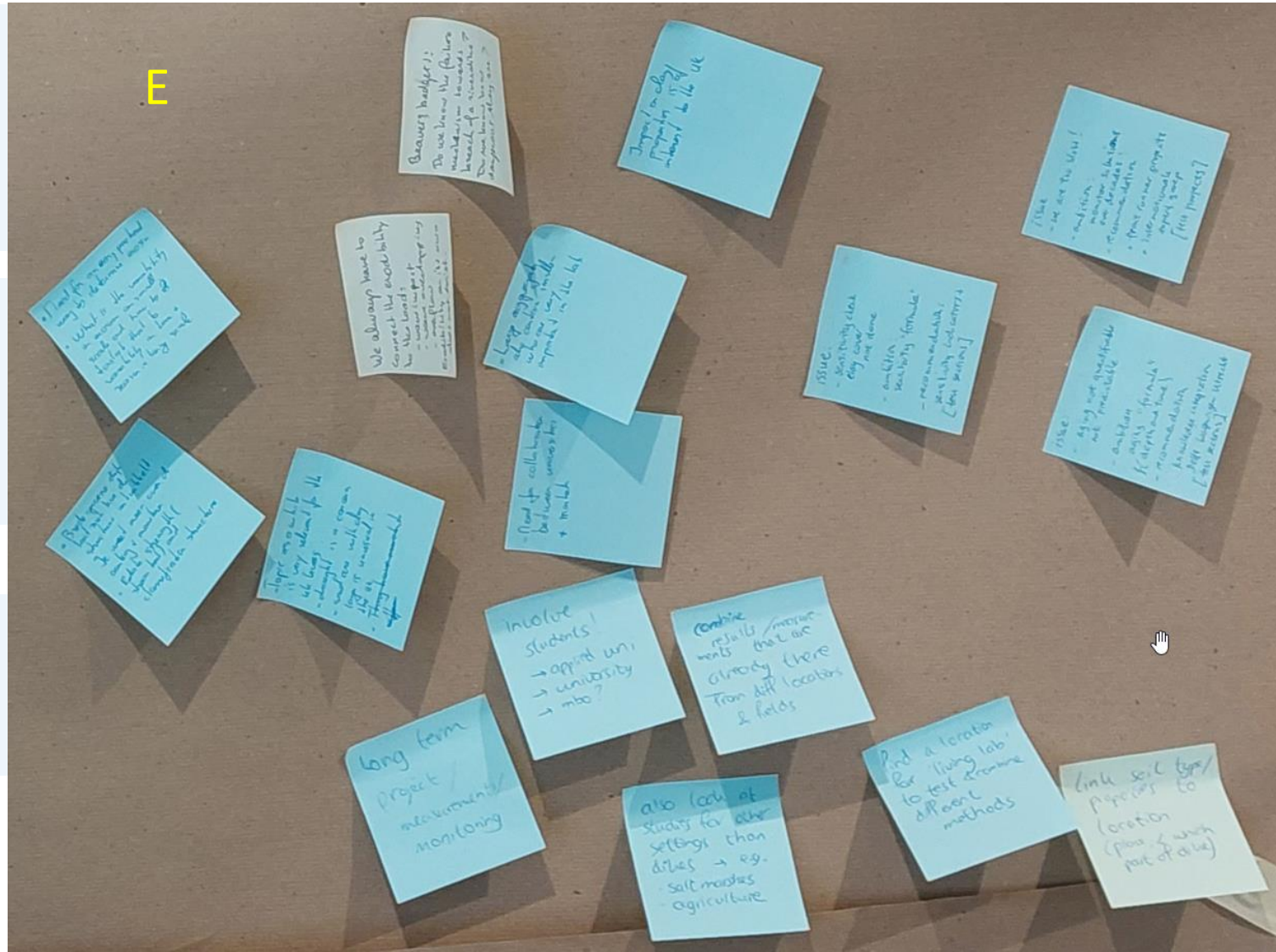
- Impact of clay properties is of interest to the UK
- Large aggregate also contains smaller who are very important in the lab

- Issue: we are too slow!
- Ambition: monitor solutions over decades
- Recommendation: front runner projects & international expert group + [test projects]

- Need for an easy practical way to determine erosion
- What is the variability in erosion on small scale and how to translate that to variability in time and season in large scale

- Brede Groene Dijk shows structure development, information construction phase, now monitoring phase
- Relate strength (flow test) and classification structure

- Topic as a whole is very relevant for the UK levees
- Drought is a concern
- Sand core with clay layer is unusual in the UK



- Issue: sensitivity check clay core not done
- Ambition: sensitivity formula
- Recommendation: sensitivity indicators + [test sections]

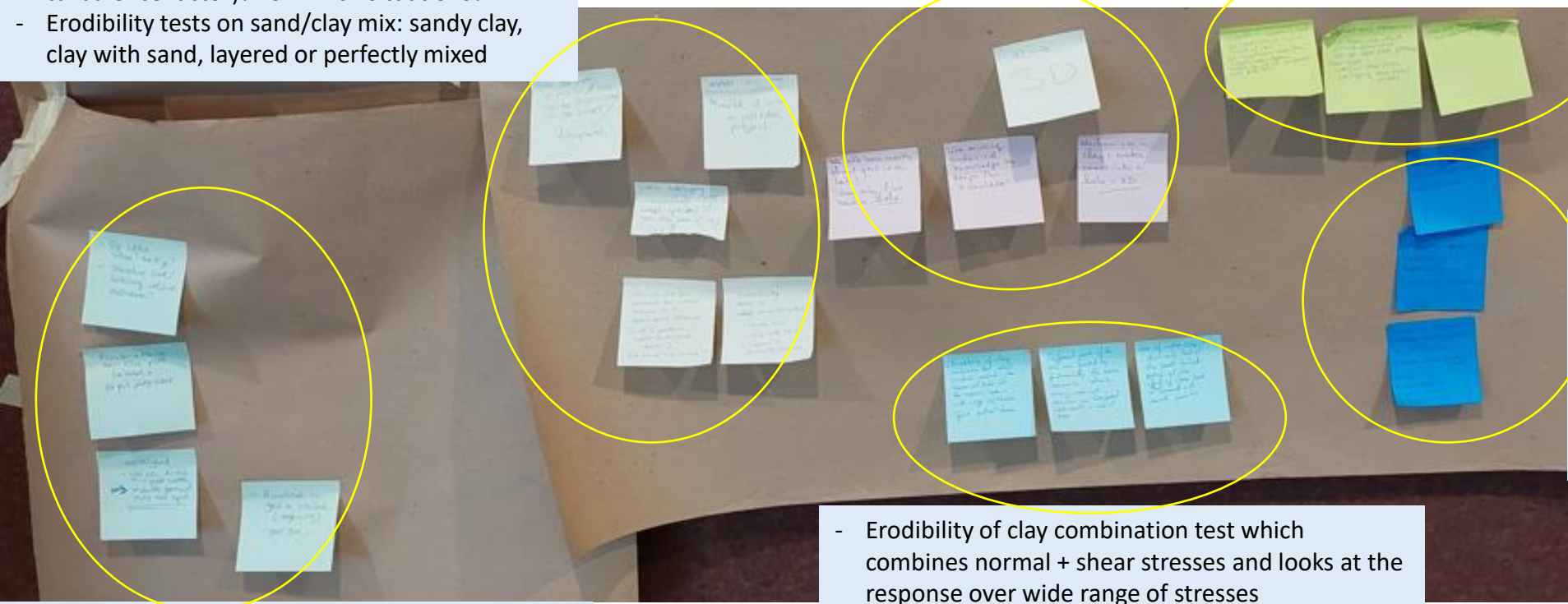
- Issue: soil aging not quantifiable / predictable
- Ambition: aging 'formula' as function of depth and time
- Recommendation: knowledge integration Delft Wageningen Utrecht + [test sections]

- Need for collaboration between universities and market
- Involve students: applied universities (HBO), universities, practical technical schools (MBO)?
- Combine results measurements that are already there from diff locations and fields
- Also look at studies for other settings than dikes e.g. salt marshes, agriculture
- Find a location for 'living lab' to test & combine different methods
- Link soil type properties to location (place & which part of dike)

- Link the models so results of one can be translated and compared to the others
- Indoor overtopping simulator: make it into a postdoc project, what options if you do see it as 1:1?
- Can we also put pressure dominated erosion in a shear-stress formula (with a pressure and/or turbulence factor)? For which situations?
- Erodibility tests on sand/clay mix: sandy clay, clay with sand, layered or perfectly mixed

- 1D > 3D
- We talk here mostly about grass cover tests! Clay only if we have a hole
- Use existing mechanical knowledge to design the simulator
- Mechanisms in clay: water comes into a hole = 3D

- Depends on governing load for wave attack await result of OEK, for overtopping / overflow models should be compared with field data
- Different load mechanisms outer slope wave attack pressure dominated, run up shear stress / pressure, inner slope overflow shear stress, overtopping shear stress / pressure
- Measure flow velocities and relate to front velocity



- Erosion model should be practical and applicable
- Different erosion models for erodibility depending on the loading mechanism
- Loading mechanisms differ along parts of the dike: wave impact outer slope / run-up / overtopping / overflow / transitions / erosion holes

- On what scale do you test?
- Structure of sod / include top layer?
- Pros + cons of each test: table + expert judgement
- Water safety: what across the levee en/or inside
- Mobile unit car with piston
- Roughness can be simulated (I think)
- Flume Bas

- Erodibility of clay combination test which combines normal + shear stresses and looks at the response over wide range of stresses
- Grass pullout stresses
- Different parts of the dike are loaded by fundamentally the same mechanism whereby energy, mass and momentum are transferred which results in instant stresses
- Use of indoor overtopping simulator
- Don't only look at the loads but also perhaps at the effects of these loads on materials with variable porosities

KEY ISSUES & COHERENCE

research projects

- Long term monitoring
- living labs / pit tests
 - waterboards
 - research projects

interaction

- interaction
- interdisciplinarity
 - academic
 - practice : waterboards/engineering firm / contractors

long term monitoring
living labs MHI

4D ↔ 1D
headcut erosion

- 4D reality ↔ 1D models
- inner slope: headcut erosion

accelerate

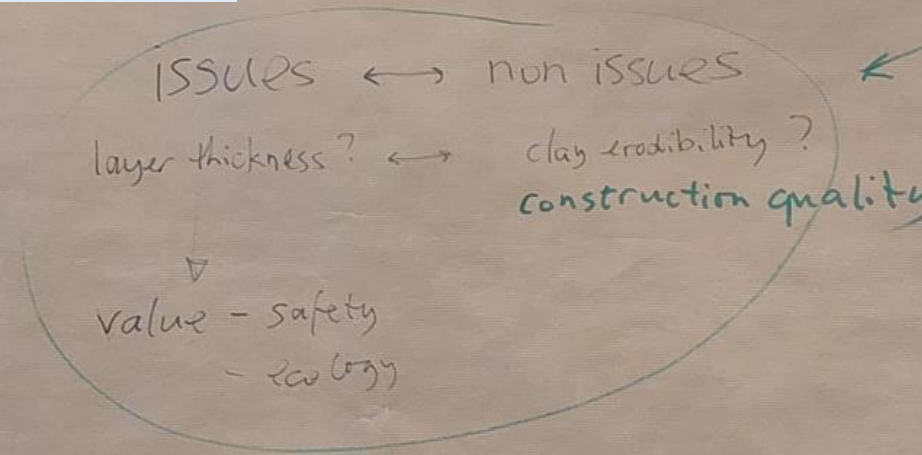
- academic
- market waterboards
engineering firm
contractors

- accelerate
- education

- International
- Icold

education

international
ICOLD



- Issues ↔ non-issues
- layer thickness ↔ clay erodibility
- construction quality / use value
 - flood safety
 - ecology

[Small sticky note with illegible handwriting]

huidige proeve goed, maar duur
ook lekp simuleren
combinatie van testmethode-
den gebruiken
ook bradslag methode!
kleine teste = veel teste =
beter voor inhomogenen
FOS: 1:2 te klein? veel gebel
ook teste: spleten, klei, gras, zout?

- Present tests okay but expensive
- Also simulate blow
- Use combination of tests, also firehose method
- Many small tests better to cover inhomogeneity
- Overtopping Simulator: 1: 2 too small?
- Also test: cracks, clay, moisture content, grass, salt?