

CLEANSTONE

- Thanks for taking part of this meeting!
- Who are we?
- Introduction of the members of Cleanstone team that will take part of this meeting regarding WP3 and WP4 from FH Kärnten:
 - FH-Prof. DI Dr. Martin Schneider
 - DI Sandra Ofner, BSc
 - M. Eng Peter Harsányi
 - DI Maria Fernanda Medrano, MSc
- Introduction of all of the members that will take part of the meeting

1) Main points of this meeting in WP3

Milestone 3.3

- Data collection quarries

Milestone 3.4

- Processing:
- Analysis of mining techniques
- Machine technology analysis and processing

2) Main points of this meeting in WP4

Milestone 4.3

- Evaluation of recycling options

3) Presentation of progress per milestone: The project partners can voluntary show a presentation of their progress during the meeting.

4) Possible conference participation: The idea of presenting a paper in the following conference will be discussed: <https://www.sgem.org/index.php/dates-deadlines>

5) Discussion and decisions on the further course of action

6) The list of participation will be taken as a screenshot of the Online Meeting

- **WP3 Milestone 3.3**

- Data collection quarries:
- Questionary list: proposed to share with quarry companies to get more information about the processing stages. Can be provided in EN/IT. Link: [Questionary link](#)
- Make an Online survey to share with industrial partners since it is not possible to travel to quarries
- How are the other PPs making the survey of the information till now?

- **WP3 Milestone 3.4**

Processing:

- Analysis of mining techniques
- Machine technology analysis and processing
- How are the other PPs doing this activities and in which format? Do they have a template or more information about processing?
- Marble process format (Hanieh) Link: [Environmental Assessment of marble quarries Hanieh](#)

- **WP4 Milestone 4.3**

- Evaluation of recycling options
- Discussion and opinions of results till now, voluntary presentation of the other PPs
- Exchange of ideas, opinions and results

- **UHPC Concrete** is a $>150\text{MPa}$ compressive strength concrete
- Goal: Check if quarries' secondary materials are suitable for UHPC since they have a **high content of fine particles** and **UHPC** has also a high content of fine powders **smaller than $<250\mu\text{m}$** ($0,250\text{mm}$)
- The dense microstructure of the powders in UHPC can be optimized at low water content if there is a **physical optimization**, meaning a high packing density in the grain size area.

Some models of optimization of particle size are:

- Fuller and Thompson (1907), $q=0.5$,

$$P(D) = \left(\frac{D}{D_{\max}} \right)^q \quad \text{eq. 1}$$

P = fraction that can pass the sieve with opening D ;

D_{\max} = maximum particle size of the mixture;

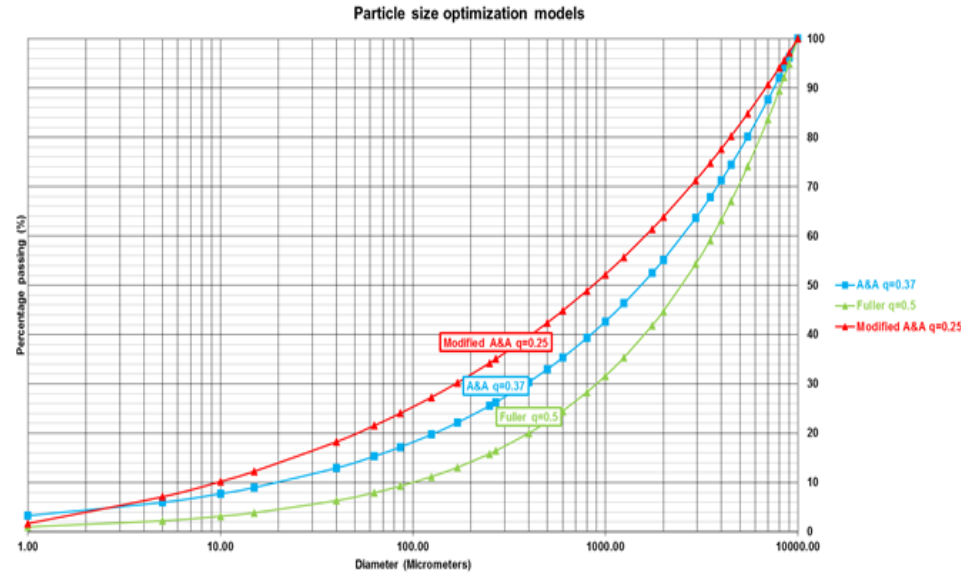
- Andreasen and Andersen (1930) (A&A) proposed a value of $q=0.37$ for the Fuller expression
- Funk and Dinger** (1994), $q=0.25$ suggested that any real size distribution of particles must have a finite lower size limit and modified the A&A curve. This modified version of the model incorporated the minimum particle size in the mixture as where D_{\min} = minimum particle size in the mix.

$$P(D) = \frac{D^q - D_{\min}^q}{D_{\max}^q - D_{\min}^q} \quad \text{eq. 2}$$

In order to obtain the optimum particle packing density, researchers have followed the modified A&A curve for particle size distribution

The aim of the models is to get a curve of the mixture of aggregates similar to the modified A&A curve from **Funk and Dinger** following the equation, where $q=0.25$:

$$P(D) = \frac{D^q - D_{\min}^q}{D_{\max}^q - D_{\min}^q}$$



The graph shows the curves of **part. size distribution of mixtures** from another universities in the world and the **comp. strength** of every mixture.

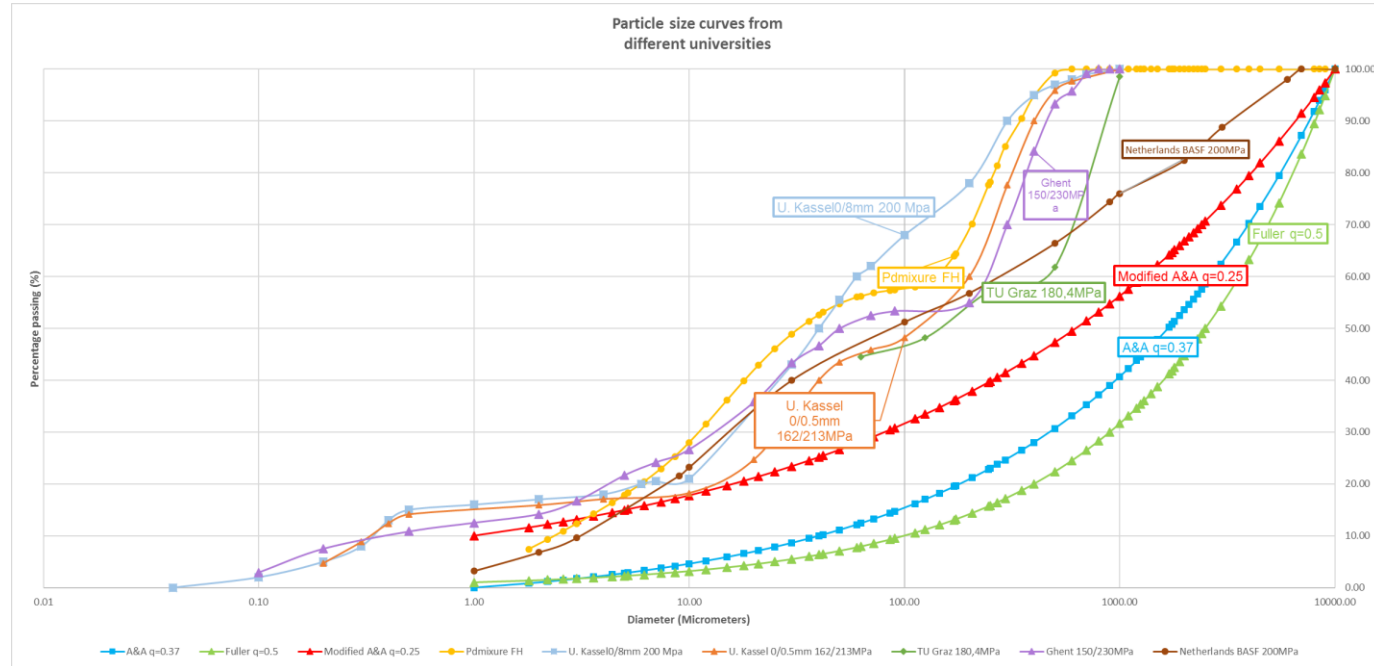
Analysis of mixture from the following **Universities**:

- UNI Kassel, Germany ,
- UNI Ghent, Belgium
- TU Graz, Austria
- BASF, Netherlands
- FH Kärnten

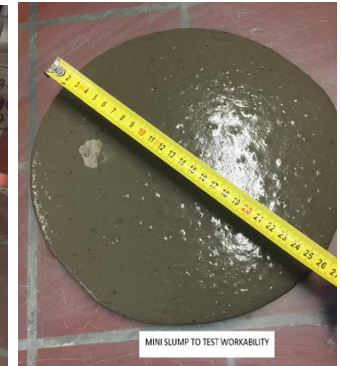
GOAL:

- Check what has been developed
- What is **theoretically possible to do** in real life with the materials available
- Are these mixtures fitting to the recommendations from the optimization models of A&A?

Conclusion: BASF got the most **homogeneous particle size matrix** and it is the most suitable curve to A&A



- **Iteration method:** the amounts of substituting materials were varied, further the graphs were checked after every iteration to see the modification of the mixture
- **Goal:**
 - **Get a homogeneous particle size distribution** curve similar to the optimization models with the secondary materials of quarries
 - **Use as much as possible from secondary materials** in recipes
- **Materials used:**
 - Julia marmi's powder (JM): limestone from marble, IT;
 - Diabas Sand (DS), AT;
 - Diabas Powder (DI): from washing process of Diabas Sand, AT;
 - Dolomite sand (DOS) and gravel (DOG): limestone, AT.



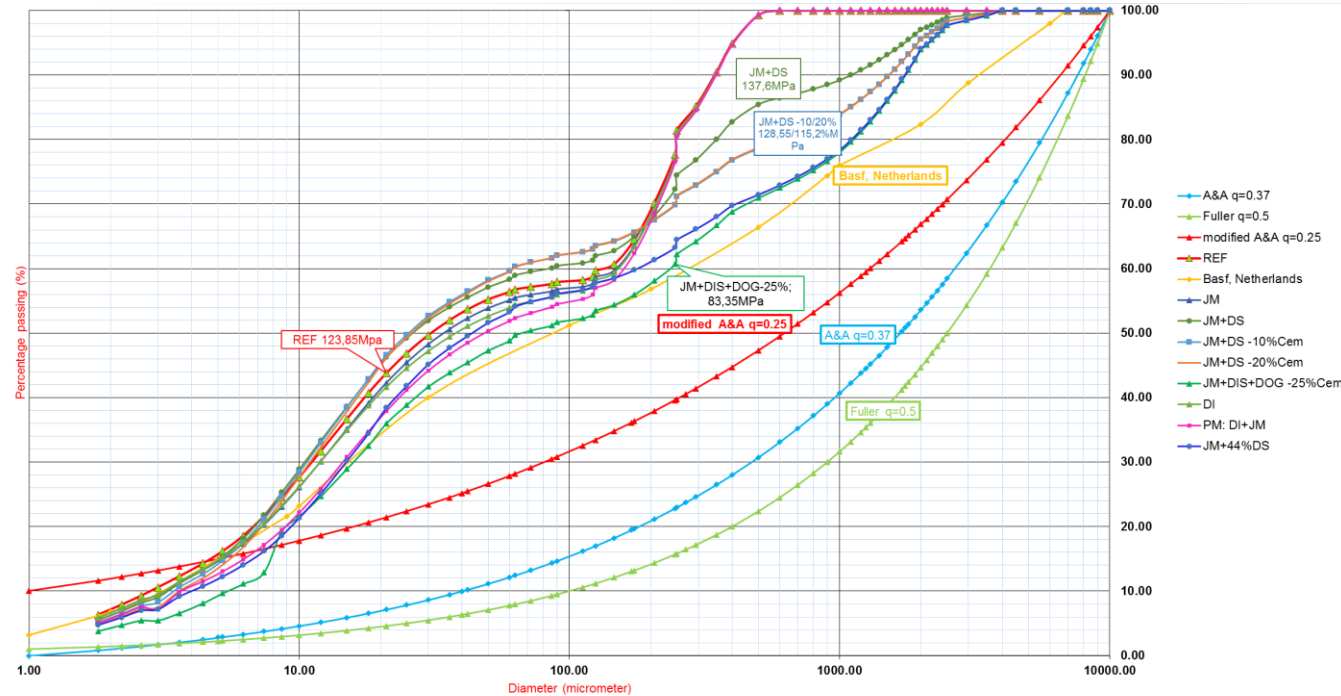


Mixtures		w/b	Compression strenght		Increase of compressive strenght between 7 and 28 days
Mixtur es	Mix designation		7 days	28 days	
1	REF: Reference	0.20	98.4	123.7	20.45
2	REF2: Reference2	0.20	96.4	123.85	22.16
3	JM: Julia Marmi's Powder	0.21	90.3	117.8	23.34
4	JM+DS: Julia Marmi + Diabas Sand	0.18	95.65	137.6	30.49
5	JM+DS -10%Cem: Julia Marmi's Powder+ Diabas Sand -10%Cement	0.20	90	128.55	29.99
6	JM+DS -20%Cem: Julia Marmi's Powder + Diabas Sand -20%Cement	0.22	77.9	115.25	32.41
7	JM+DIS+DOG -25%Cem: Julia Marmi's Powder + Diabas Sand+Dolomite gravel 8mm -25%Cement	0.31	44.55	83.35	46.55
8	DI: Diabas Powder	0.24	80.05	108.35	26.12
9	DI+DOS: Diabas Powder+Dolomite sand	0.18	72.5	108.15	32.96
10	PM: DI+JM: Diabas Powder+ Julia Marmi's Powder	0.24	74.6	83.5	10.66
11	JM+44%DS: Julia Marmi's powder+Diabas Sand	0.24	81.95	Not tested yet	#VALUE!

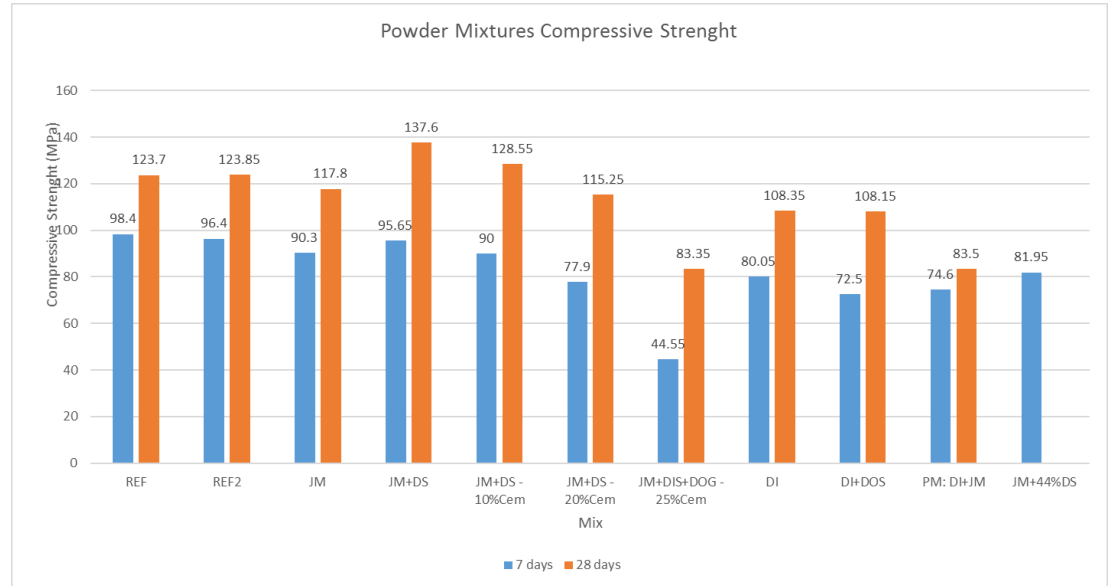
- **Traditional materials** used for UHPC are: Microsilica/silica fume, Quartz powder, Quartz sand, water and high amounts of superplasticizer and cement.
- Since **microsilica and quartz powder** are the **finest aggregates, replacements** of both of them were made with the finest powders from quarries: **Diabas powder and Julia Marmis powder**
- **Quartz sand** was replaced by **dolomite sand** or **Diabas sand** since the grain size is bigger
- **Replacements of cement** were also made by using **Julia Marmi's** marble powder instead
- **Higher amounts of superplasticizer** were needed to reach a good workability. Maybe the double dosis than for normal UHPC made with traditional materials

This graph shows the part. size distribution of every recipe.

- REF in pink is the reference mixture from our university
- The rest of the recipes were created by **iteration** and **checking how the curves changed with the different amounts of secondary materials** in UHPC mixtures with the aim to get a **homogeneous curve**



- Some observations:
- REF should be more than 150MPa but by using a planetary mixer it wasn't possible to get more because of low speed of mixing (energy input)
- JM+DS: Julia Marmi and Diabas sand replacements reached the highest compressive strength at 7 and 28 days. Followed by same recipe with 10% and 20% less cement, means this combination was the best
- JM+DIS+DOG: The admixture of Dolomite gravel made the values drop abruptly
- DI and DI+DOS: Diabas powder and diabas plus dolomite sand had similar values at 28 days
- JM+44%DS: another variation of Diabas sand and Julia Marmi's sand showed good values at 7 days



- The combination of **Julia marmi and Diabas** sand show very **good values of comp.strength** in comparison with REF sample.
- **REF** sample must have **higher compressive strenght** values, but all the mixtures were mixed initially with a **planetary mixer** for mortars to get an idea of the **workability**. However, this **mixer has not a high speed** of mixing as it is required for UHPC
- The **planetary mixer** was **useful** to find out how much **superplasticizer** and **water** was needed as a starting point to check **workability**
- **NEXT STEPS > OPTIMIZATION OF MIXING PROCESS:**
- The **mixtures** will be all mixed again in an **intensive mixer** since UHPC needs a higher velocity of mixing to check if it is possible to get higher values of compressive strenght



Planetary mixer



Intensive mixer Eirich

Writing a paper proposal:

- What do you think about a writing a paper in collaboration with Padua University about our research?
- Conference would take place on 26th June, papers must be submitted on may
- Detailed information:
<https://www.sgem.org/index.php/dates-deadlines>

21st International Multidisciplinary Scientific GeoConference SGEM 2021 is a week-long conference event and will be held in the period of 26 June - 5 July, 2021 at Albena Co, Bulgaria and hosted by the Paradise Congress Center.

- **Two days for participants' registrations** and accommodations - 26-27 June, 2021;
- **PRE-Conference Field Trip** /subject to conditions/ - 27 June, 2021
- **Seven days of Plenary Sessions** - 28 June - 4 July, 2021;
Morning/Afternoon Plenary Oral and Poster sessions will be conducted simultaneously in **4 conference halls**. Workshop presentations are arranged in respect to the general conference programme;
- **POST-Conference Field Trip** /subject to conditions - 5 July, 2021;

PAPER SUBMISSION DEADLINES

03 MAY 2021

ABSTRACT
SUBMISSIONS

03 May 2021 | Abstract
submission deadline

CALL FOR PAPERS

24 MAY 2021

WORKSHOP
PROPOSAL

24 May 2021 | Workshop
submission deadline

CALL FOR WORKSHOPS

24 MAY 2021

FULL PAPER
SUBMISSION

24 May 2021 | Full paper
submission deadline

PAPER REQUIREMENTS

As we cannot meet this year, our participation list will be a screenshot:

So please smile!

Thanks for your participation!



Thanks for your
attention!