FWO DMP Template - Flemish Standard Data Management Plan

Project supervisors (from application round 2018 onwards) and fellows (from application round 2020 onwards) will, upon being awarded their project or fellowship, be invited to develop their answers to the data management related questions into a DMP. The FWO expects a **completed DMP no later than 6 months after the official start date** of the project or fellowship. The DMP should not be submitted to FWO but to the research co-ordination office of the host institute; FWO may request the DMP in a random check.

At the end of the project, the **final version of the DMP** has to be added to the final report of the project; this should be submitted to FWO by the supervisor-spokesperson through FWO's e-portal. This DMP may of course have been updated since its first version. The DMP is an element in the final evaluation of the project by the relevant expert panel. Both the DMP submitted within the first 6 months after the start date and the final DMP may use this template.

The DMP template used by the Research Foundation Flanders (FWO) corresponds with the Flemish Standard Data Management Plan. This Flemish Standard DMP was developed by the Flemish Research Data Network (FRDN) Task Force DMP which comprises representatives of all Flemish funders and research institutions. This is a standardized DMP template based on the previous FWO template that contains the core requirements for data management planning. To increase understanding and facilitate completion of the DMP, a standardized **glossary** of definitions and abbreviations is available via the following link.

	1. General Project Information
Name Grant Holder & ORCID	Jentel De Vlieger
	0000-0003-0439-8514
Contributor name(s) (+ ORCID) & roles	Jiabin Li (0000-0002-7333-0321) - Promotor
Project number ¹ & title	1S78923N
	A FEASIBILITY STUDY ON THE USE OF FINE RECYCLED AGGREGATES IN 3D PRINTING CONCRETE
Funder(s) GrantID ²	1S78923N
Affiliation(s)	■ KU Leuven
	☐ Universiteit Antwerpen
	☐ Universiteit Gent
	☐ Universiteit Hasselt
	☐ Vrije Universiteit Brussel
	☐ Other:
	Provide ROR ³ identifier when possible: https://ror.org/05f950310

¹ "Project number" refers to the institutional project number. This question is optional since not every institution has an internal project number different from the GrantID. Applicants can only provide one project number.

² Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

³ Research Organization Registry Community. https://ror.org/

Please p	provide a	short pro	oject description	on
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New recycling processes and quality controls in the construction industry have transformed construction and demolition waste (CDW) into recycled aggregates (RA), mainly used as foundation and sub-foundation layers in road construction. However, this application results in a decrease in the value of the secondary raw resource, which is considered downcycling. To address this issue, innovative applications are needed to produce new building elements with low ecological footprint using recycled CDW. This project aims to assess the feasibility of using fine recycled aggregates (FRA) in 3D printing concrete (3DPC), which could improve the rheological properties of the mixture and reduce the use of polluting, expensive, and/or scarce materials like cement and admixtures. By replacing natural aggregates with FRA, the ecological footprint of 3DPC can be reduced while improving its printability. This project will validate the use of several types of FRA in 3DPC and offer requirements and maximum replacement rates for specific application areas and exposure classes in the construction industry, ultimately contributing to a more circular construction industry.

2. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data⁴.

				ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR PHYSICAL DATA
Dataset	Description	New or Reused	Digital or	Digital Data Type	Digital Data	Digital Data	Physical Volume
Name			Physical		Format	Volume (MB, GB,	
						TB)	
Geometrical	The dataset	⊠ Generate new	□ Digital		⊠ .png	⊠ < 100 GB	/
data –	consists of	data					
Microscope	microscope						
images of	images of sand						
aggregates	particles. The						
	images are						
	taken using a						
	microscope and						
	provide a						
	detailed view of						
	the shapes and						
	sizes of the sand						
	particles.						
Aggregate	The dataset	⊠ Generate new	□ Digital		⊠ .xlsx	⊠ < 1 GB	/
data –	consists of	data					
physical	physical						
properties	properties of						
	various						
	aggregates used						
	in construction						
	and civil						
	engineering.						

⁴ Add rows for each dataset you want to describe.

	These						
	properties						
	include water						
	absorption,						
	fines modulus,						
	density, and						
	other similar						
	parameters.						
Reference	The dataset	□ Reuse existing	□ Digital	⊠ NA	⊠ .txt	⊠ < 1 GB	/
mixtures –	provides	data					
Weber Saint	information on						
Gobain	the mix						
	proportions and						
	mix design of						
	the reference						
	mixture used in						
	this research.						
	This mixture						
	serves as a						
	standard against						
	which other						
	mixtures can be						
	compared. The						
	dataset provides						
	detailed						
	information on						
	the materials						
	used in the						
	reference						
	mixture, such as						

Rheological data – RM 100 PLUS	the type and proportions of aggregates, cement, water, and other additives. The dataset also includes information on the properties of the reference mixture, such as compressive strength, durability, and workability. The dataset consists of data obtained from a rheology meter RM 100 PLUS. The dataset contains	☑ Generate new data	⊠ Digital	⊠ Experimental	⊠ .txt	⊠ < 1 GB	/
data – RM	consists of data obtained from a rheology meter RM 100 PLUS.		Zi Digitui	Z Experimental		2 1 00	
	contains measurements of the						
	rheological properties of various materials, such as viscosity,						

	elasticity, and yield stress.					
Rheological	The dataset	□ Generate new	□ Digital	⊠ .xlsx	⊠ < 1 GB	/
data – Slump	consists of data	data				
test	obtained from a					
	slump test. The					
	test involves					
	filling a cone-					
	shaped mold					
	with freshly					
	mixed concrete					
	and then					
	removing the					
	mold to observe					
	the slump, or					
	deformation, of					
	the concrete.					
Rheological	The dataset	⊠ Generate new	□ Digital		⊠ < 1 GB	/
data – Slump	consists of data	data				
flow test	obtained from a					
	slump flow test					
	performed with					
	a shock table.					
	The dataset					
	contains					
	measurements					
	of the slump					
	flow diameter,					
	which is the					
	diameter of the					

	concrete spread					
	on the					
	horizontal					
	surface.					
Rheological	The dataset	⊠ Generate new	□ Digital	⊠ .txt	⊠ < 1 GB	/
data –	consists of data	data				
Penetration	obtained from a					
test	penetration					
	test, which is a					
	common test					
	used to					
	measure the					
	consistency and					
	stiffness of					
	mixtures. The					
	dataset contains					
	measurements					
	of the					
	penetration					
	depth.					
Rheological	The dataset	⊠ Generate new	□ Digital	⊠ .txt	⊠ < 1 GB	/
data – UCT	consists of data	data				
	obtained from					
	an unconfined					
	compression					
	test, which is a					
	common test					
	used to					
	measure the					
	strength and					

Mechanical data – Penetration test	deformation properties of materials. The dataset contains measurements of the compressive strength, deformation, and stress-strain behaviour of the concrete. The dataset consists of data obtained from a penetration test. The dataset contains measurements of the	⊠ Generate new data	⊠ Digital	⊠ Experimental	⊠ .txt	⊠ < 1 GB	/
	indentation depth.						
Mechanical data – Compressive and flexural strength	The dataset consists of data obtained from compressive and flexural strength tests.	⊠ Generate new data	⊠ Digital	⊠ Experimental	⊠ .txt	⊠ < 1 GB	/

Mechanical	The dataset	☑ Generate new	□ Digital		⊠ .xlsx	⊠ < 1 GB	/
data -	contains	data					
Shrinkage	measurements						
	of the						
	shrinkage.						
Durability	The dataset	⊠ Generate new	□ Digital		⊠ .xlsx	⊠ < 1 GB	/
data – Freeze	contains	data					
thaw	measurements						
resistance	of the freeze-						
	thaw resistance.						
Durability	The dataset	⊠ Generate new	□ Digital			⊠ < 1 GB	/
data –	contains	data					
Sulphate	measurements						
attack	of the resistance						
	to sulphate						
	attack.						
Printability	The dataset	□ Generate new	□ Digital		⊠ .xlsx	⊠ < 1 GB	/
data –	includes	data					
Pumpability,	measurements						
extrudability,	of three key						
buildability	aspects of						
	printability:						
	pumpability,						
	extrudability,						
	and buildability.						
Physical data	The dataset	⊠ Generate new	⊠ Physical	/	/	/	\boxtimes < 5 m ³
– tested	contains all	data					
samples	tested samples						
	of importance						
	for future						

		_			_	_		
	scanning and							
	reference.							
			,					
GUIDANCE:								
DATA CAN BE DIGITAL OF METHOD.	R PHYSICAL (FOR EXAMPLE	BIOBANK, BIOLOGICAL S	AMPLES,).	DATA TYPE: DATA	ARE OFTEN GROUPED BY TYPE	(OBSERVATIONAL, EXPERIME	NTAL ETC.), FORMAT AND/OR CO	OLLECTION/GENERATION
					TIONS); EXPERIMENTAL (E.G. I ATION DATA (E.G. CLIMATE M		CHROMATOGRAMS, GENE SEQU	JENCES);
	MATS: TABULAR DATA (.PC		TEXT OR MAR.	K-UP FILE XML, .TA	AB, .CSV), TEXTUAL DATA (.RT	F, .XML, .TXT), GEOSPATIAL D	4TA (.DWG,. GML,), IMAGE I	DATA, AUDIO DATA, VIDEO
DIGITAL DATA VOLUME:	PLEASE ESTIMATE THE UPP	ER LIMIT OF THE VOLUM	E OF THE DAT	TA PER DATASET OR	R DATA TYPE.			
PHYSICAL VOLUME: PLEA AFTER).	ASE ESTIMATE THE PHYSICAI	L VOLUME OF THE RESEA	RCH MATERI	ALS (FOR EXAMPLE	THE NUMBER OF RELEVANT B	OLOGICAL SAMPLES THAT NEE	D TO BE STORED AND PRESERVE	D DURING THE PROJECT AND/OR
source, preferab	ting data, please sp ly by using a persis OI, Handle, URL eto ype.	tent	The exist	ing data is pro	ovided by the compa	any Weber Saint Gob	ain.	
creation and/or (e.g. experiment	hical issues concer use of the data s on humans or an e describe these is	imals, dual	•	uman subject nimal data ual use	t data			
	cific datasets or da	L		ease describe	:			

⁵ These data are generated by combining multiple existing datasets.

Will you process personal data ⁶ ? If so, briefly describe the kind of personal data you will use. Please refer to specific datasets or data types when appropriate. If available, add the reference to your file in your host institution's privacy register.	 ☐ Yes ☑ No If yes: / - Short description of the kind of personal data that will be used: - Privacy Registry Reference:
Does your work have potential for commercial valorization (e.g. tech transfer, for example spinoffs, commercial exploitation,)? If so, please comment per dataset or data type where appropriate.	☑ Yes ☐ No If yes, please comment: The research has the potential to contribute to commercial valorization through the development of new commercial mixtures by companies. The results obtained from the research can be utilized in various industries to enhance their product offerings. This could lead to the creation of spin-offs or the transfer of technology to companies interested in utilizing the findings. The data generated from the research may be valuable for further studies in academia or industry, and could potentially lead to new discoveries and innovations.
Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements, research collaboration agreements)? If so, please explain to what data they relate and what restrictions are in place.	☑ Yes ☐ No If yes, please explain: In this research, a commercially available reference mixture provided by the company Weber Saint Gobain is utilized. As the reference mixture contains confidential information, there will be limitations in sharing the results. The research team will ensure that the dissemination of the data and findings does not compromise the confidentiality agreement with the company.

⁶ See Glossary Flemish Standard Data Management Plan

Are there any other legal issues, such as	⊠ Yes
intellectual property rights and ownership, to be	□ No
managed related to the data you (re)use?	If yes, please explain:
If so, please explain to what data they relate and	In this study, a commercially available reference mixture provided by Weber Saint Gobain is utilized. Due
which restrictions will be asserted.	to the presence of confidential information in the reference mixture, there will be limitations on the
	sharing of the research findings. To maintain confidentiality, the research team has signed a non-
	disclosure agreement with the company, and ensure that the dissemination of data and results does not
	violate the agreement.

3. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep **data understandable and usable**, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

The research team will adopt a thorough approach to capture all necessary accompanying information required to maintain the data's understandability and usability, now and in the future. This approach will include documenting the data at various levels and types, such as procedures used, which will be saved in .txt, Word, and .pdf files on the OneDrive provided by KU Leuven. The documentation will be systematically recorded and stored in a structured manner, making it easy to access and retrieve the relevant information. The team will ensure that the documentation is continuously maintained and updated throughout the research project, to ensure that it remains accurate and relevant.

Will a metadata standard be used to make it easier to **find and reuse the data**?

If so, please specify which metadata standard will be used. If not, please specify which metadata will be created to make the data easier to find and reuse.

REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIOUE IDENTIFIERS.

 \square No

If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used: In this research project, a metadata standard will be utilized to improve the discoverability and reuse of the data. The standard will involve assigning a specific code to each document, which will be based on the type of data that was collected, the method used to collect it, and other relevant information. This code will be included in the metadata for each dataset, along with other descriptive information such as the date and location of data collection, the research question being addressed, and any relevant variables or parameters. The metadata standard, will allow easy accessibility to others who may wish to reuse it. This will facilitate the validation of the results by other researchers, as well as enable the data to be integrated with other datasets for future analysis. Furthermore, the use of a standardized approach will also ensure that the data is consistent and of high quality, which is essential for enabling meaningful comparisons and analyses.

If no, please specify (where appropriate per dataset or data type) which metadata will be created:

4. Data Storage & Back-up during the Research Project		
Where will the data be stored?	The digital data generated from this research will be stored on a OneDrive cloud storage platform provided by KU Leuven, which offers a capacity of 1 terabyte.	
	All non-digital data generated during the course of this research, including tested samples and materials, will be stored in a secure, locked location within the laboratory at KU Leuven campus Brugge. This storage location will ensure that the physical data is kept safe and secure, minimizing the risk of damage or loss due to environmental factors or unauthorized access. By implementing these storage procedures, the research team can maintain the integrity of the non-digital data and ensure that it is accessible for future analysis or reference.	
How will the data be backed up? What storage and backup procedures will be in place to prevent data loss? Describe the locations, storage media and procedures that will be used for storing and backing up digital and non-digital data during research.7 Refer to institution-specific policies regarding backup procedures when appropriate.	To ensure the safety and security of the data, it will also be automatically backed up from OneDrive to the I drive of the computer, providing an additional layer of data protection. In addition, to ensure data redundancy and prevent data loss, all data generated from the research will be transferred to an external hard drive on a monthly basis. By implementing these storage and backup procedures, the research team can ensure that the data generated during the course of the research is not lost due to equipment failure or other unforeseen events. This will enable the research team to preserve their valuable data and ensure that it can be accessed and utilized in the future, contributing to the advancement of scientific knowledge.	

⁷ Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

Is there currently sufficient storage & backup X Yes capacity during the project? If yes, specify □ No concisely. If no or insufficient storage or backup If ves. please specify concisely: capacities are available, then explain how this Yes, there is currently sufficient storage and backup capacity for both digital and non-digital data will be taken care of. generated during this research. The OneDrive cloud storage platform provided by KU Leuven offers a capacity of 1 terabyte for digital data storage. Additionally, there is enough space in the lab to store all tested samples and materials, which will be kept in a secure, locked location to ensure their safety and security. These storage measures will guarantee that the data and materials are well-maintained and available for future analysis or reference. To further enhance data security, the data will also be automatically backed up from OneDrive to the I drive of the computer, and all data will be transferred to an external hard drive on a monthly basis to prevent any potential data loss. If no, please specify: How will you ensure that the data are securely To ensure that the data generated during the research is securely stored and not accessed or modified by stored and not accessed or modified by unauthorized persons, the research team will implement several measures. The digital data will be password protected to restrict access only to authorized personnel. In addition, the access to the data will unauthorized persons? be limited to those individuals who need to use it for the research purposes. Regular backups will be made CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY. to ensure data redundancy and prevent data loss in case of equipment failure or other unforeseen events. NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND This will include automatic backups from OneDrive to the I drive of the computer and monthly transfers to FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND an external hard drive. Data monitoring will be conducted regularly to ensure the data remains secure and TRANSFERRED DATA ARE SAFE. 7 to detect any unauthorized access attempts or modifications. This will allow the research team to take action if necessary to maintain the integrity of the data.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

No cost is expected for the data storage. The OneDrive cloud storage platform provided by KU Leuven is free of charge and offers a capacity of 1 terabyte for digital data storage. The storage of non-digital data, including tested samples and materials, in the secure, locked location within the laboratory at KU Leuven campus Brugge is also free of charge. Additionally, the external hard drive backup that will be used is privately owned by the researcher and does not incur any additional costs.

5. Data Preservation after the end of the Research Project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All digital data generated during the research project will be retained for a minimum of five years. This includes data stored on the OneDrive cloud platform provided by KU Leuven and the external hard drive used for backup purposes. Non-digital data, such as tested samples and materials, may not be stored for at least five years due to storage capacity limitations in the KU Leuven lab. However, some important or exceptional non-digital data deemed crucial to the research may be retained in the lab for a longer period to enable future research or examination.

Where will these data be archived (stored and curated for the long-term)?	Regarding the long-term archiving of data, the digital data generated during the research project will be stored on the OneDrive cloud platform and the external hard drive for at least five years. After this period, the research team will review the data and determine if it is necessary to keep them for a longer period or transfer them to a designated data repository for long-term storage and curation. In case of non-digital data, the important or exceptional data that can be retained in the lab for a longer period will be appropriately labeled, documented, and stored in the secure, locked location within the laboratory at KU Leuven campus Brugge.
What are the expected costs for data preservation during the expected retention period? How will these costs be covered?	No cost is expected for data preservation during the expected retention period. The OneDrive cloud platform provided by KU Leuven for digital data storage is free, and the external hard drive used for backup purposes is privately owned by the researcher. The storage of non-digital data in the lab at KU Leuven campus Brugge is also free. Therefore, the costs for data preservation during the expected retention period will be covered without any additional expenses.

6. Data Sharing and Reuse		
Will the data (or part of the data) be made available for reuse after/during the project? Please explain per dataset or data type which data will be made available.	 ✓ Yes, in an Open Access repository ☐ Yes, in a restricted access repository (after approval, institutional access only,) ☐ No (closed access) ☐ Other, please specify: 	
NOTE THAT 'AVAILABLE' DOES NOT NECESSARILY MEAN THAT THE DATA SET BECOMES OPENLY AVAILABLE, CONDITIONS FOR ACCESS AND USE MAY APPLY. AVAILABILITY IN THIS QUESTION THUS ENTAILS BOTH OPEN & RESTRICTED ACCESS. FOR MORE INFORMATION: HTTPS://WIKI.SURFNET.NL/DISPLAY/STANDARDS/INFO-EU-REPO/#INFOEUREPO-ACCESSRIGHTS		
If access is restricted, please specify who will be able to access the data and under what conditions.	Access is only restricted for dataset: "Reference mixtures – Weber Saint Gobain"	
Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain per dataset or data type where appropriate.	 Yes, privacy aspects Yes, intellectual property rights Yes, ethical aspects Yes, aspects of dual use Yes, other No If yes, please specify: In this study, a commercially available reference mixture provided by Weber Saint Gobain is utilized. Due to the presence of confidential information in the reference mixture, there will be limitations on the sharing of the research findings. To maintain confidentiality, the research team has signed a non-disclosure agreement with the company, and ensure that the dissemination of data and results does not violate the agreement.	

Where will the data be made available? If already known, please provide a repository per dataset or data type.	Open access via publisher.
When will the data be made available? This could be a specific date (DD/MM/YYYY) OR AN INDICATION SUCH AS 'UPON PUBLICATION OF RESEARCH RESULTS'.	Upon publication of research results
Which data usage licenses are you going to provide? If none, please explain why. A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENCE IS GRANTED, THE DATA ARE IN A GREY ZONE AND CANNOT BE LEGALLY REUSED. DO NOTE THAT YOU MAY ONLY RELEASE DATA UNDER A LICENCE CHOSEN BY YOURSELF IF IT DOES NOT ALREADY FALL UNDER ANOTHER LICENCE THAT MIGHT PROHIBIT THAT. EXAMPLE ANSWER: E.G. "DATA FROM THE PROJECT THAT CAN BE SHARED WILL BE MADE AVAILABLE UNDER A CREATIVE COMMONS ATTRIBUTION LICENSE (CC-BY 4.0), SO THAT USERS HAVE TO GIVE CREDIT TO THE ORIGINAL DATA CREATORS." 8	During the research project, certain data may be made available to other researchers or the public for further research and reuse. The determination of which data will be made available and the specific terms of the license will be established in accordance with project funders, institutional policies, third-party agreements, and legal requirements. Our goal is to ensure that the data is as widely accessible as possible while appropriately crediting the original data creators and addressing any ethical, legal, or privacy concerns. Any sharable project data will be released under the Creative Commons Attribution License (CC-BY 4.0), which requires users to provide credit to the original data creators.
Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, please provide it here. INDICATE WHETHER YOU INTEND TO ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.	 ✓ Yes ☐ No If yes: The researcher intends to add persistent and unique identifiers, such as a DOI number, to the datasets that will be made available to the public. Although a DOI number is not available yet, it will be assigned to the dataset(s) in order to facilitate their identification and retrieval.

⁸ Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

What are the expected costs for data sharing?	Data sharing costs are expected to be minimal for this project. The digital datasets will be made available
How will these costs be covered?	through several channels, including publication in open access journals and presentations at conferences.
	The cost for publication in journals will be free since the papers will be published in open access journals.
	The only cost associated with data sharing will be for presenting the data at conferences, which will be
	covered by the project funding.

7. Responsibilities		
Who will manage data documentation and metadata during the research project?	All data documentation and metadata will be managed by the researcher. However, the researcher may collaborate with data specialists or librarians to ensure that the documentation and metadata are accurate, complete, and consistent with best practices.	
Who will manage data storage and backup during the research project?	Data storage and backup during the research will be managed by the researcher.	
Who will manage data preservation and sharing?	Data preservation and sharing will be managed by the researcher and promotor.	
Who will update and implement this DMP?	The DMP will be updated and implemented by the researcher.	