D.T2.5.3 JOINT PEER REVIEW REPORT ON PILOT ACTIONS

FUA MARIBOR

2021

Use of Rainwater and Purified Wastewater for producing recycled construction material in Maribor

Version 1
11 2021

CONTENT

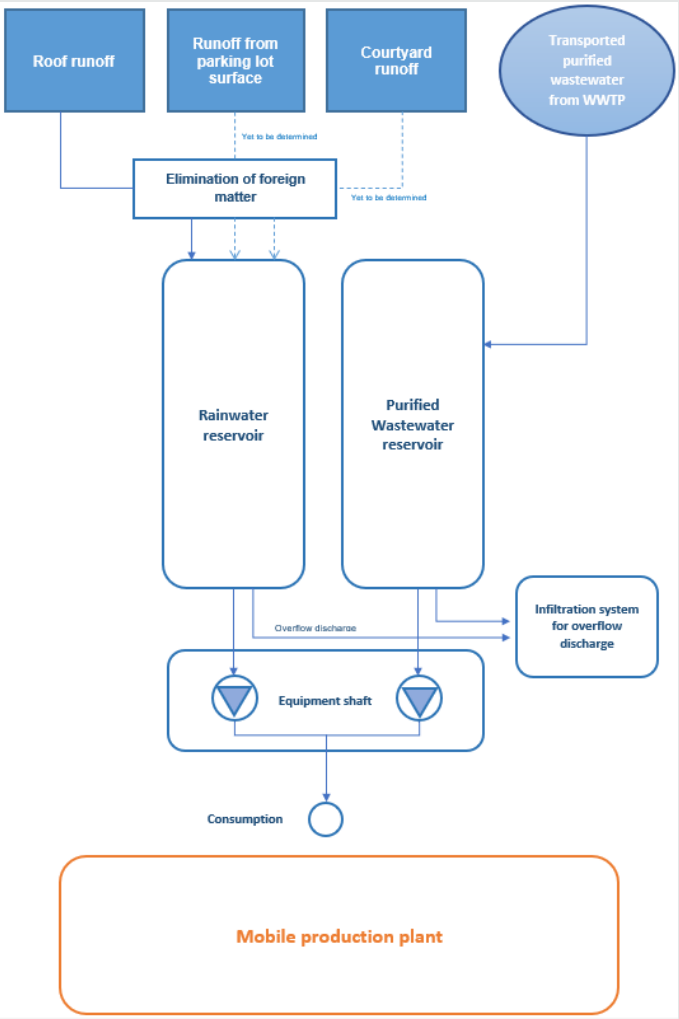
1. Pilot Action

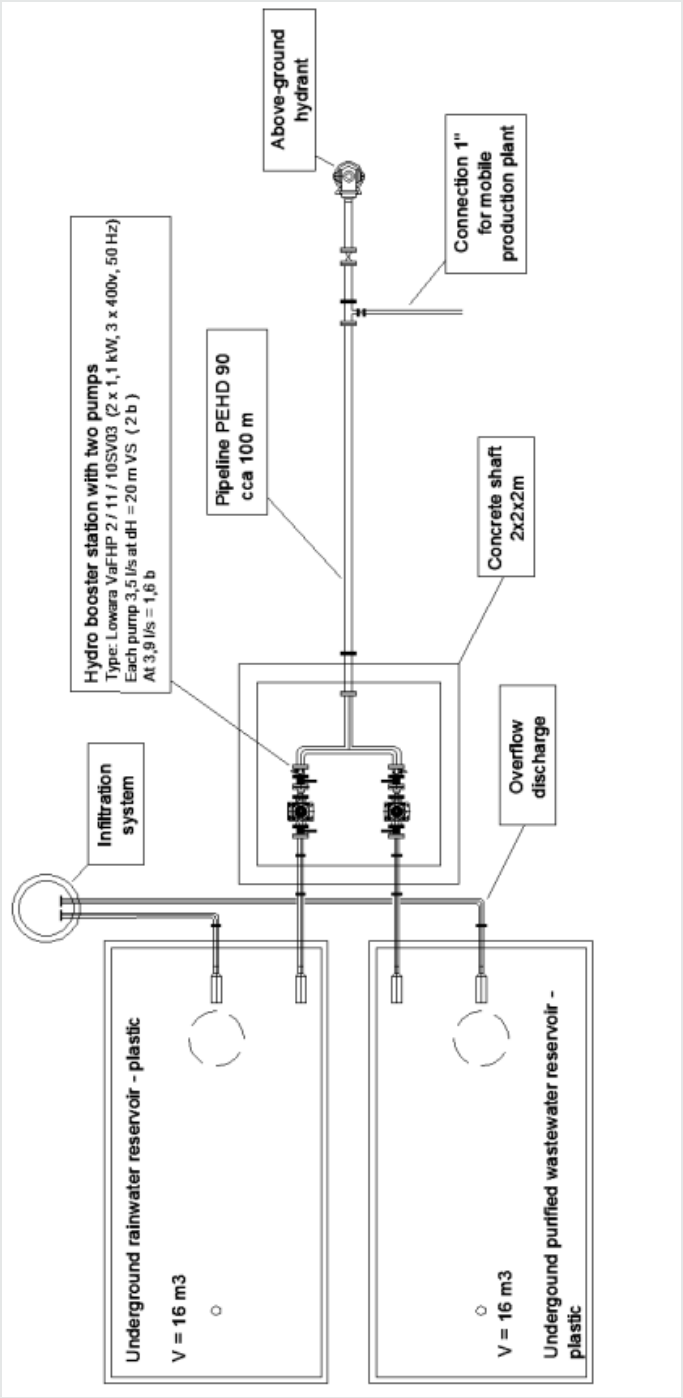
This section should include case study - description of pilot action (information prepared for study visit using the table below). All chapter is prepared by host partner.

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*The pilot action demonstrates the usability of purified wastewater and rainwater for the purpose of production of secondary raw materials (SRM) based construction products. Rainwater is harvested and stored in a reservoir and used in the production process, whereas purified wastewater is transported from the nearby wastewater treatment plant. Materials produced are used for road maintenance works and for revitalisation of degraded areas by Nigrad d.d., a public company, majority owned by Municipality of Maribor and concessionaire for public road maintenance. MBVOD showed that purified wastewater combined with harvested rainwater is suitable to be used in the production process.* *The pilot shows strong synergies with the Horizon 2020, Circ-01-2016-2017, Cinderela project, in which MBVOD is stakeholder, that aims to produce new construction materials from different types of wastes. However, it considers only the production process from the view of input/output materials, not taking into account using different types of recycled water for production. Thus there is no funding in Cinderela's budget for the use of recycled water and no risk of double financing.* *Within the current pilot, quality of products produced with purified wastewater and rainwater was monitored and suitability of use proven.* *The exact location of the pilot is at the degraded urban area in Dogoše, Maribor, where the pilot is directly connected to the production plant for*

	producing secondary raw materials based construction products operating at the same location. The Wastewater Treatment Plant is also nearby, making this the perfect implementation area. The location was selected in proposal phase of the project.
CWC GOALS	• *Promoting water efficiency measures and reuse of non-conventional local water resources* • *Enhance water conservation* • *Alleviating pressure on over-exploited freshwater resources as well as on urban drainage systems*
TECHNICAL DESCRIPTION	*Two underground plastic reservoirs, each with capacity of 16 m3 have been installed, one for rainwater storage, one for purified wastewater storage.* *Hydro-booster station with two pumps has been installed in shaft in front of the two reservoirs.* *Cca. 100m of pipeline has been installed to the connection point (above ground hydrant).* *System operation:* *The shaft has a built-in hydro booster station with two pumps, both pumps are frequency controlled - control is set to maintain constant pressure in the pressure system. Two probe modules are installed in the energy cabinet for each pump separately. As long as both reservoirs are full, both pumps are running, each approx. 50%. If one of the reservoirs is emptied, associated pump is not running until the water reaches the preset level. An additional dose*

	is mounted with two switches for remote switching on and off for each station separately. The energy cabinet contains fuses for each pump separately, fid switch, power switch, two probe modules with six probes included, additional fuse for light in the shaft, manual-automatic switch for each pump separately. Drain cocks for water sampling are installed on the pressure side after each pump. An additional cabinet with pump control is located outside the shaft in a dedicated space. Each pump has its own water meter installed to measure quantity of rainwater and purified wastewater used in the production process.

GRAPHIC DETAIL	


Above-ground hydrant
Connection 1" for mobile production plant
Hydro booster station with two pumps
Type: Lowara VaFHP 2 / 11 / 10SV03 (2 x 1,1 kW, 3 x 400v, 50 Hz)
Each pump 3,5 l/s at dH = 20 m VS (2 b)
At 3,9 l/s = 1,6 b
Pipeline PEHD 90 cca 100 m
Concrete shaft 2x2x2m
Overflow discharge
Infiltration system
Undergound rainwater reservoir - plastic
V = 16 m3
V = 16 m3
Undergound purified wastewater reservoir - plastic

	
PILOT PERFORMANCE	*Monitoring is detailed in D.T2.7.1 – Final Self-evaluation Report and is divided in three parts:* - *Quality of rainwater and purified wastewater* - *Quality of produced materials* - *Quantity of recycled water used in production/Quantity of saved potable water*
OPERATION AND MAINTENANCE	*Operation of the plant is mainly automatic (see technical description) and does not require special training. Operation will be supervised by MBVOD and Nigrad.*

	Maintenance will be performed by MBVOD and/or/assisted by manufacturers of equipment.
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	• *For dimensioning of rainwater reservoir, annual rainfall quantities for specific region and various other factors had to be considered* • *Building permit was obtained as part of Cinderela project by Nigrad* • *During the planning phase we have obtained Permit to carry out the pilot within the CWC project*
BENEFITS	*Environmental benefits: drinking water savings* *Social benefits: revitalisation of degraded area* *Economic benefits: reduction of water consumption*
CLIMATE CHANGE IMPACTS ON CITY / FUA	• *Promoting water efficiency measures and reuse of non-conventional local water resources* • *Enhancement of water conservation* • *Alleviating pressure on over-exploited freshwater resources as well as on urban drainage systems*
IMPLEMENTATION SCHEDULE	*Time required for planning phase; 2-3 months* *Time required for implementation phase; 2-3 months* *At what stage is the implementation of pilot action at the time of the visit? Operation stage*
COSTS	*Landworks: 9269,02 €* *Transport of purified wastewater: 3609,60 €* *Equipment / installation: 12298,00 €*

FINANCING SOURCES	*European Regional Development Fund / Interreg Central Europe; 85%* *Self-financing: 15%*
OBSTACLES	*COVID-19 related problems: Construction site was often partly or fully closed during construction phase, which caused the delay in schedule.* *We intended to collect rainwater from the roof of facility (laboratory and presentation building), which is currently in a very early construction phase (part of Cinderela project - Horizon 2020, Circ-01-2016-2017 – deadline was extended) . As it seems unlikely the facility will be built in time, we will only store and use purified wastewater for production process during the current operating phase. As the building will be constructed and drainage and pipes installed, we will activate both reservoirs (RW and purified WW) for their planned purpose. A decision made in consultation with PP-11 FBR.*
SUCCESS FACTORS / CRITERIA	• *Promoting water efficiency measures and reuse of non-conventional local water resources* • *Enhancement of water conservation* • *Alleviating pressure on over-exploited freshwater resources as well as on urban drainage systems*
PUBLIC INVOLVEMENT / OUTREACH	*The pilot was presented in various local, national and international conferences (online and live).* *Video showing different implementation phases with basic information about the pilot in english narration with local subtitles has been posted*

	online and shared via number of social media channels. *The pilot was also presented via online site visit to mentoring partner PP-11 FBR. The video of the site visit is available to other project partners via shared drive.*
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*The pilot is not transportable but can be easily implemented in other locations/regions.*

2. Evaluation of pilot action

The online peer-review visit in Maribor, Slovenia took place on Friday, 19 November 2021.

All project partners were invited, Poland and Hungary were the required Nations that had to participate. From each country we invited:

- *The 2 National PPs*
- *Relevant FUA stakeholders*
- *Facilitators of the local SMGs (recommended).*

Agenda of the online visit:

- *Part 1: Pilot action presentation*
  - *9.00-9.15 Welcome (Anja EZVD)*
  - *9.15-10.15 Pilot action presentation – videos (Aleš, Matej – MBVOD, Nuša Lazar – Nigrad, Tadej Žurman – Deltaplan)*
  - *10.15-10.30 Coffee break / collection of questions*
  - *10.30-11.00 Q&A session related to the pilot action*

- *Part 2: Preparation of assessment*

Interactive workshop

  - *11.00-12.00 Breakout rooms (Slovenia, Poland and Hungary): answering evaluation questions*
  - *12.00-13.00 Presentation of the breakout rooms answers and discussion*
  - *Wrap up of the online peer-review visit*

Here are the links the relevant documents about the pilot action in Maribor for the preparation:

- *AMATEUR VIDEO ON PILOT: https://www.youtube.com/watch?v=Yv9qDQLBEn0&t=185s*
  - *ONLINE MENTORING VISIT REPORT: https://drive.google.com/drive/folders/1NYJjBMF8cQdwMDbmKMKaC8aWfOmZWjAO*
  - *ONLINE MENTORING VISIT VIDEO: https://drive.google.com/drive/folders/1NYJjBMF8cQdwMDbmKMKaC8aWfOmZWjAO*
  - *PILOT CONCEPT: https://drive.google.com/drive/folders/15e0JkLypNm8WRKwT2gk69RrQmz0VF1C4*
  - *INTERMEDIATE SELF-EVALUATION REPORT: https://drive.google.com/drive/folders/1OyD1Nru0aystDmqHfWoIR2EdFzpcFvhb*
  - *FINAL SELF-EVALUATION REPORT (DRAFT): https://drive.google.com/drive/folders/1fLPwgmUOeun7vt6UmxzpeRAfxtiJ6JTx*
  - *WATER QUALITY ANALYSIS 1: https://drive.google.com/drive/folders/15e0JkLypNm8WRKwT2gk69RrQmz0VF1C4*
  - *WATER QUALITY ANALYSIS 2: https://drive.google.com/drive/folders/15e0JkLypNm8WRKwT2gk69RrQmz0VF1C4*

In the second part people were divided into three breakout rooms.

- *Hungarian*
- *Polish*
- *International*

Several questions were discussed in breakout rooms which provided the platform for collective discussion.

- *Which of the achieved pilot objectives are important in your FUA? Do you think a similar action would be an effective way to reach those objectives (or others) in your FUA?*
- *What is the most important information about the idea and the expected results of the pilot action for your FUA?*
- *Would a similar action be feasible in your FUA?*

The discussion took place with the following conclusions:

- *Budapest (HU):*
  - *Single municipality in a large city, wastewater is managed by the city*
  - *Nearly 100% of wastewater is treated in Budapest*
  - *A lot of possibilities to use treated wastewater, especially in construction industries*
  - *Economical feasibility of building a secondary pipeline network for reuse of treated wastewater is questionable*
  - *Similar pilot in Budapest – usage of rainwater and greywater*

- *Bydgoszcz (PL):*
    - *Similar objectives with Bydgoszcz pilot,*
    - *Priority is using rainwater,*
    - *WWTPS's outside the city – difficult to transport WW,*
    - *5 factories – concrete blocks*
    - *2 factories – silicate bricks (higher temperature – requires better quality of water – rainwater more suitable)*
    - *Treated wastewater would be useful for street cleaning*

- *International - Split (HR):*
    - *Limitations – a lot of fresh drinking water even for industrial purposes*
    - *In this point in time it is not feasible to implement a similar project – maybe in the future*
    - *Questions about the beneficiaries, investors – private or public institutions*

2.1. Summary

Everyone agreed a similar action could be done in their FUA but with certain limitations. Budapest team would be focused on using rainwater. Treated wastewater would be useful for street cleaning.

Everyone agreed that it is important that mechanisms must be put in place in the future to protect the drinking water sources, increase the reuse of water where it is possible and educate people on efficient water use and reuse of water.

3. Recommendations

Everyone agreed that it is important that mechanisms must be put in place in the future to protect the drinking water sources, increase the reuse of water where it is possible and educate people on efficient water use and reuse of water.

Attachments

1. Evaluation of pilot action by PP Zugló Municipality & Budapest Sewage Works P. Ltd.

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*Most important information about the idea and the expected results of the pilot action from your point of view* *The most important information of the pilot action is the purpose of the (re)use of treated water. The reuse of treated wastewater as secondary raw material instead of draining it back to natural water bodies demonstrates an excellent and clear example of circular economy.*
CWC GOALS	*Which of the achieved project objectives are important to you?* *As the upcoming EU regulations of water reuse must be implemented in all EU countries, the Maribor pilot action is an example to follow for other CE cities.* *The rising energy and water prices and future water scarcity scenarios highlight the importance of technology development and raising new attitude in water reuse.*
TECHNICAL DESCRIPTION	*Which of this information can you use? Who could carry out such investments?* *The Budapest Sewage Works P. Ltd. is responsible for the treatment and disposal of the communal wastewater and local municipalities are responsible for rainwater management.* *It needed further market and economic research to find potential business stakeholders for similar investment.*
GRAPHIC DETAIL	*Which of this information can you use?* *The graphic information provided by the pilot owner shows a clear overview of the system and the operation.* *The technical drawing is useful for technical experts but wider public, even decision makers and potential investors could receive proper information from the visual support of the videos photos and presentations.*

PILOT PERFORMANCE	*How can you use this information?* *The information materials of the pilot can be used in purpose of raising new attitudes, engage decision makers and further stakeholders and develop similar projects.*
OPERATION AND MAINTENANCE	*Who could manage such an investment?* *Further market research is needed.*
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	*Can you meet similar requirements in your FUA?* *The trends of prices and legal requirements are similar in the CE region.*
BENEFITS	*Whether and which benefits (environmental, social, economic) may be relevant in your FUA?* *Relevant environmental benefits:* • *alleviation of natural water bodies (especially the Ráckeve-Soroksár (a smaller) branch of the Danube) from treated wastewater* • *preventing natural water sources from overuse of construction industry* *Relevant social benefits:* • *awareness and attitude raising* • *technical innovation, knowledge transfer* • *potential cooperation of public, scientific, NGOs, business sector and local citizens* • *the communication of environmental benefits can alleviate the local conflicts caused by wastewater treatment* *Relevant economic benefits: however, it needs further analysis the following economic potentials are identified* • *savings in environmental charges (fees of deposing wastewater)* • *income from selling treated wastewater as secondary raw material* • *financial incentives of research and innovation (tax reduction, financial subsidies)*

CLIMATE CHANGE IMPACTS ON CITY / FUA	*What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?* *What climate and water challenges in cities / FUA could similar actions solve?* *Future climate scenarios are projected water scarcity periods in Budapest and restrictions of water use in industrial sector. The Maribor pilot provides solution for these challenges.*
IMPLEMENTATION SCHEDULE	*Was the implementation time too long in your opinion? Where do you see the possibilities to shorten the time?* *No available information.*
COSTS	*Will the cost level be acceptable in your FUA?* *As we have no information about similar investment in Budapest FUA, and there is no existing market of treated wastewater and rainwater, the costs cannot be assessed.*
FINANCING SOURCES	*What financing sources could be obtained for a similar investment in your FUA?* • *EU funds dedicated for technology and business innovation or in agriculture investment* • *Contribution of business sector* • *Contribution of the municipality*
OBSTACLES	*Can you meet similar requirements in your FUA?* *How could you avoid them?* *The reuse of treated wastewater and rainwater depends on the water quality parameters, so this would be a crucial point in a new developed project.*
SUCCESS FACTORS / CRITERIA	*Would such incentives work in your FUA / country? Would you have to consider other conditions?* *Considering all the benefits of the pilot, we see the potential to adapt it to Budapest as a new pilot.*

PUBLIC INVOLVEMENT / OUTREACH	*Would you have to involve stakeholders to implement a similar investment?* *The project is a potential field of cooperation of the public (municipality/municipal supply company), scientific (universities, research centres), NGO (awareness raising) and business sectors.*
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*Other areas where the described solutions can be used (different application area);* *Treated wastewater&rainwater* *Portability / system adaptation to local conditions / replication options in other FUAs;* *Replication is relevant in other FUAs with dynamic construction industry and high need of water.*
OTHER	-

2. Evaluation of pilot action by ISD, Bydgoszcz City and MWiK representatives

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*Most important information about the idea and the expected results of the pilot action from your point of view* An example of a circular economy solution using construction waste (production of secondary raw materials (SRM) based construction products) and treated wastewater. Win-win solution.
CWC GOALS	*Which of the achieved project objectives are important to you?* Using of treated sewage and rainwater.
TECHNICAL DESCRIPTION	*Which of this information can you use? Who could carry out such investments?* The pilot is a small-scale investment - it is a demonstrator, showing that such a solution is possible. In the case of implementing a similar solution in plants, the technical descriptions will be different.
GRAPHIC DETAIL	*Which of this information can you use?* Demonstrator – showing that such a solution is possible and what it is about.
PILOT PERFORMANCE	*How can you use this information?* The solution used is very interesting for a possible large-scale implementation in enterprises using water in technological processes that do not require high-quality water. To consider whether such a solution could be implemented in economic zones (economic zone - an administratively separated part of the territory of the country, in which economic activity can be carried out on preferential terms). Introducing the idea of a circular economy to water and waste management (e.g. the use of sludge from treatment plants for energy purposes).
OPERATION AND MAINTENANCE	*Who could manage such an investment?*

	Private investments; element of the technological process. Alternatively, the idea of incorporating science (research institute, polytechnic university) in the re-use of building materials and water reuse can be repeated - creating a circular economy center.
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	*Can you meet similar requirements in your FUA?* The city needs to have production facilities where the solution could be implemented. Location of a potential enterprise near a sewage treatment plant, because of construction of a pipeline supplying treated sewage to the plant costs. Transporting treated sewage in carts is justified only for short distances – e.g. for watering green, cleaning streets near the treatment plant. Rainwater or treated sewage quality may change during the year, for many reasons. In our FUA we found at least 5 factories that produce construction materials, but non of them are located near sewage threatment plant. Also 2 of the factories requires soft and pure water, because of production technology (high pressure and temperature). Probably rainwater (which is soft) after more advanced treatment technology would meet their requirements.
BENEFITS	*Whether and which benefits (environmental, social, economic) may be relevant in your FUA?* environmental - rainwater retention, water protection. economical - increased use of recycled water in industrial processes, drinking water conservation. Social – educational, potential new work places.
CLIMATE CHANGE IMPACTS ON CITY / FUA	*What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?*

	What climate and water challenges in cities / FUA could similar actions solve? Resistance to water shortages (the use of treated wastewater makes it independent of water suppliers and the availability of the source and weather conditions)
IMPLEMENTATION SCHEDULE	*Was the implementation time too long in your opinion? Where do you see the possibilities to shorten the time?* no, the delays depended on another project.
COSTS	*Will the cost level be acceptable in your FUA?* A solution to be implemented by the private sector.
FINANCING SOURCES	*What financing sources could be obtained for a similar investment in your FUA?* EU and private funds
OBSTACLES	*Can you meet similar requirements in your FUA?* *How could you avoid them?* The price of water from the water supply net, fees for using water from own intake will be lower than treated wastewater. Due to rainfall irregularity during the year it may be impossible to use rainwater only. During dry season other water source needs to be used.
SUCCESS FACTORS / CRITERIA	*Would such incentives work in your FUA / country? Would you have to consider other conditions?* Economic profitability of the investment / implementation of the solution
PUBLIC INVOLVEMENT / OUTREACH	*Would you have to involve stakeholders to implement a similar investment?*

	Yes, private investors, sewage treatment plants, water and sewage companies, national and local authorities.
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*Other areas where the described solutions can be used (different application area);* *Portability / system adaptation to local conditions / replication options in other FUAs;* private sector (like construction industry) A pilot from Maribor could be presented at a construction fair as an interesting ecological solution that can use unnecessary / secondary material and wastewater with rainwater at a low cost. It is worth considering whether a municipal company (MWiK - (City Waterworks and Sewerage) or the ProNatura waste incineration plant, which also deals with the circular economy) could implement the solution as an innovation and could conduct demonstrations of how it works or a university (construction department). Possibly in the form of a public-private partnership (MWiK and a construction company).
OTHER	