Down Under: What are the performance limits of CIPP liners?

Dr. Iain Naismith presenting interim results of our international LinKa – Liner for Sewers research project in Melbourne

Last week, the interim results of our international **LinKa – Liner for Sewers** research project were presented at the headquarters of the Water Services Association of Australia (WSAA) in Melbourne. The event brought together project partners from Australia and New Zealand in a hybrid workshop setting to discuss first findings and exchange expertise. Many Questions were asked, many answers were given.

LinKa – an international research project

With LinKa, we are investigating the performance limits of **Cured-in-Place Pipe (CIPP)** liner applications. CIPP is one of the most widely used trenchless rehabilitation methods for sewer systems worldwide. But how far can this method go when it comes to damaged or highly stressed pipes?

Ashwini Ausekar and Dr. Iain Naismith presenting on our hybrid workshop at WSAA headquarters.

To answer this question, we have set up several **1:1 scale test rigs**. These rigs replicate real-life sewer conditions and include a variety of predefined damage scenarios – such as cracks, fractures, or deformations. The scenarios were developed in close collaboration with a **steering committee of public sewer network owners**, ensuring that the research reflects practical challenges faced by operators.

Testing and evaluation

CIPP manufacturers have installed their liners in these full-scale test rigs. Our task is to **evaluate the performance** of the different CIPP liners employed under realistic conditions and to provide detailed reports to the participating sewer network owners. In this way, the project creates a transparent basis for evaluating liners and understanding their application limits.

James Gardner, Water Services Association of Australia (WSAA)

A broad international network

LinKa is truly international in scope: **40 sewer network operators** from Australia, Belgium, Germany, Ireland, the Isle of Man, the Netherlands, New Zealand, the States of Jersey and the United Kingdom are actively involved. This broad participation ensures that findings are relevant not only for one country, but for sewer operators worldwide.

Interim results in Melbourne

The interim results were recently presented by our colleagues **Dr Iain Naismith and Ashwini Ausekar** at WSAA in Melbourne. The hybrid workshop format allowed our partners from various Australia and New Zealand utilities to attend in person or online. The event sparked valuable discussions about the first findings and the next steps in the project.

James Goode, Water Services Association of Australia (WSAA)

Coordination in the Southern Hemisphere

In the Southern Hemisphere, the project is coordinated by WSAA, the national association of water suppliers and wastewater utilities in Australia. **James Gardner, James Goode and Greg Ryan** represented WSAA at the event. From our side, our Managing Director Roland W. Waniek joined the workshop in person.

Contact persons

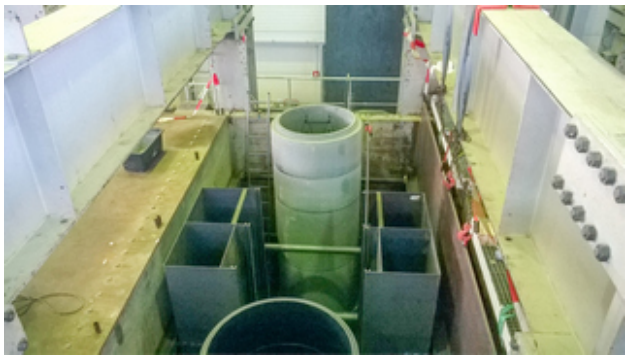
- **Iain Naismith, PhD**
  phone: +44 7983 605219
  email: naismith@ikt.institute

Greg Ryan, Water Services

Association of Australia (WSAA)

- **Ashwini Ausekar, M.Sc.**
  phone: +49 209 178060
  email: ausekar@ikt.institute

What Goes Back Into the Sewer Trench? – Flowable Backfill Materials Put to the Test



Test setup: One of a total of five chambers before the Temporarily Flowable Self-Compacting Backfill (TFSB) was filled. Set up in the IKT's large-scale test rig with dimensions 6 x 6 x 15 m.

Settlement damage, uneven bedding, and poor re-excavation capability – these are common issues on sewer construction

sites. Often, the cause lies in the backfill.
Temporarily Flowable Self-Compacting Backfill (TFSB) materials promise better performance – but which ones actually deliver?

We tested five different TFSB products in full-scale sewer trench simulations. The aim: to evaluate how these materials perform under realistic construction conditions.

The Approach: Large-Scale Testing, Real-Site Conditions

At the IKT's large-scale test facility in Gelsenkirchen, we set up actual sewer construction scenarios, including pipes, manholes, trench shoring, and bedding layers.

Pipe enclosure without defects (DN 100)

We tested the materials for:

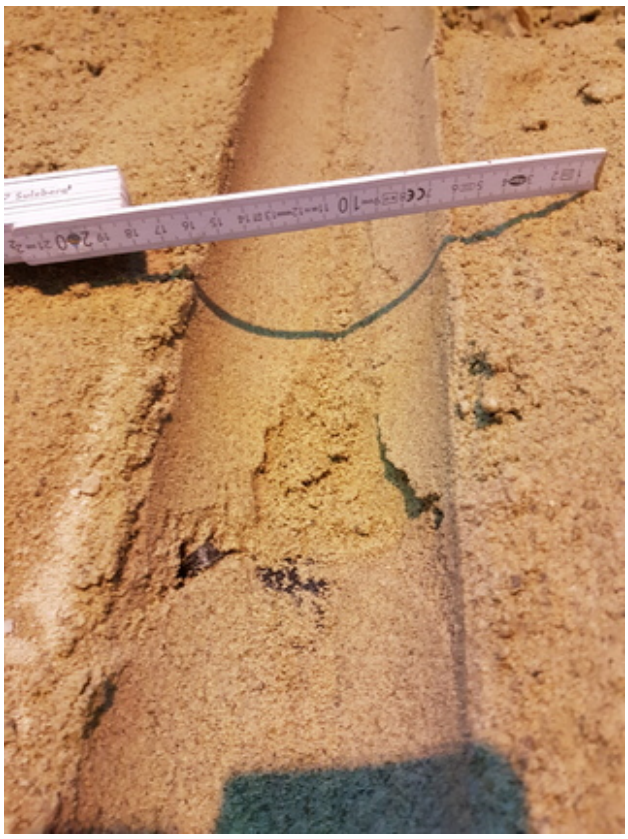
- Flowability and installation quality
- Walkability and early load-bearing capacity

- Re-excavatability after hardening
- Volume stability and risk of subsidence
- Environmental performance and recyclability

We used innovative inspection tools like the MAC system for pipe-soil stiffness and a walkability test after 3 hours to assess real-life performance.

Key results for sewer construction:

- Not all flowable backfills are created equal: Some harden too much, while others remain unsuitable for overbuilding, e.g. for road construction, for up to 56 days.
- Re-excavation is a challenge – for good excavation, TSFB must not exceed a compressive strength of 0.3 N/mm² after 28 days.
- New test methods like the Mini-MAC and walkability test ensure practical and measurable evaluation.
- Environmental compliance, shrinkage, and recyclability vary widely between products.
- Two materials stood out: RSS® Flüssigboden and carbofill® showed the best balance between performance, usability, and long-term suitability.



Pipe enclosure with minor defects (DN 100)

Comparative Test Results: Two Materials Performed Best – Others Failed Key Criteria

We graded each material on a scale from 1.0 (“very good”) to 6.0 (“inadequate”).

Special emphasis was placed on **re-excavation capability** and **early workability**, both essential for practical use.

Top performers:
RSS® Flüssigboden – well-balanced, walkable, easy to re-excavate
 carbofill® – strong technical performance and consistent usability

We observed critical issues with:
 Terrapact© – hardened too much, impossible to excavate
 WBM-Flüssigboden® – excessive shrinkage, ammonia emissions, and safety concerns

Materials that failed key performance or environmental criteria **were ruled out** for sewer construction use.

Pipe enclosure with minor defects (DN 300)

Why This Matters for Sewer Network Owners and the Industry

Our study provides clear guidance for sewer network operators, planners, and contractors:

✔ Backfill material can now be selected systematically and criteria-based

✔ Supports long-term performance and maintainability

✔ Promotes safer, more cost-effective, and more sustainable construction

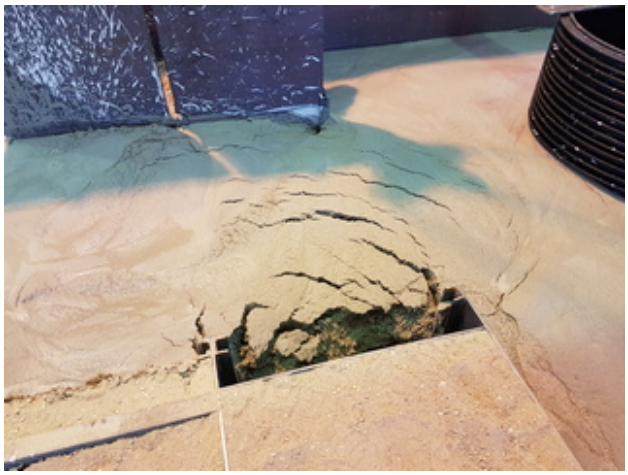
Especially in urban environments, where tight schedules and complex infrastructures are the norm, choosing the right

backfill is critical – not just technically, but also economically and environmentally.

Access the Full Study

The full paper is published in the journal:

Tunnelling and Underground Space Technology (Open Access)
Published: July 2025
Authors: Nicole Kimmling, Matteo Rubinato, Bert Bosseler et al.
 Read the publication



Inspection of the installation track: The TFSB has broken into the cavity of the installation box and does not show the desired flush cavity filling.

 Read also:
Liquid > Solid > Ready? Comparison of Five Flowable Backfills for Sewer Pipe Trenches

Acknowledgements

We would like to thank the members of the municipal steering committee for this project, who have closely accompanied our project and provided us with tremendous support.

The steering committee was composed of representatives from the cities:
Burscheid (Chair), Düsseldorf, Gladbeck, Hamm, Lünen, Mülheim, Oberhausen, Recklinghausen, Solingen, Troisdorf, Wuppertal

They also contributed to the financing of the project, as did the Ministry for the Environment, Nature Conservation and Transport of the State of North Rhine-Westphalia, Germany. We would like to express our sincere gratitude for this as well.

We would like to thank also the Cologne District Government, as well as Leibniz University of Hannover and Koblenz University of Applied Sciences for their support.

Contact

Prof. Dr.-Ing. habil. Bert Bosseler
E-Mail: bosseler@ikt.institute

Nicole Kimmling, M.Sc.
E-Mail: kimmling@ikt.institute

After six years: IKT researchers dig up their test stand for tree roots

After six years of growth: IKT researchers dig up their tree root test stand in Almere (Netherlands)

How to keep roots away from sewage pipes? IKT investigates protection systems in a long-term project. Researchers want to find out which protective measures are suitable. They have now dug up their worldwide unique in-situ test rig. The initial results are surprising.
At the start of the project, IKT laid wastewater pipes with various protection systems underground. They then planted trees on top.

The researchers left the roots to grow in peace for six years. They only checked on them from time to time. In August 2024, the time had come: they dug everything up to see how the roots had developed and how well the pipes were protected from them.

IKT researchers pull protective matting out of a sewer pipe trench that they installed six years ago to protect against root ingrowth.

Roots obstruct drains

Sewage network operators are constantly struggling with root ingrowth in sewage pipes. Obstacles to drainage can form and even cause complete blockages. These then have to be laboriously milled out. In the worst case, the only solution is expensive excavation. Structural protection measures are designed to prevent precisely this, so that trees and pipes can coexist in harmony in cramped urban spaces.

Material mix in the experimental setup

IKT researchers therefore want to find out which passive measures are suitable for protecting pipes. Six years ago, they set up a worldwide unique in-situ test stand for this purpose. At a depth of 1.20 metres, they laid two 30-metre-long DN 150 and DN 300 sewer pipes in parallel. On top they planted five fast-growing poplars, each five metres apart.

Root protection mat installed in the ground is removed.

To see how roots interact with different pipe systems, they chose pipes made of concrete, PVC, PP and GRP. The total of 15 pipe connections are standard push-in joints, shrink sleeves, transition sleeves and an experimental bentonite tape.

What works against root ingrowth?

In the bedding area around the trees, the IKT researchers installed eight root barriers, such as foils and vertical panels from various manufacturers, as well as two mineral encapsulations.

That was six years ago. The poplars are now ten metres tall and in great shape. Time to see how the roots have grown and whether the protective measures are working.

With archaeological care: root excavation in the IKT test stand

Digging like archaeologists

The IKT researchers took archaeological care when excavating the roots of their trees so as not to damage the roots.
They meticulously documented how the roots had grown. Their painstaking work took a whole week with the help of hand shovels, suction excavators and compressed air lances.

Roots surprise researchers

Visually alone, there was something unexpected: even thick roots branched out like an ancient Roman trident when they encountered resistance. They followed the relatively loose soil space around the sewage pipes. They looked for their way and found it. They bypassed the built-in obstacles – successfully at first glance.

Despite protective mats: Roots continued to grow merrily

Some roots penetrated deeper into the earth along the vertical protective plates, only to grow upwards again behind the obstacle. Others bypassed the protection systems sideways. All of them grew towards the bedding zone of the pipes, probably because the soil is less compacted there and they can advance more easily than in the natural soil space.
Of the 15 pipe connections, 13 withstood the roots, two did not. The connections between the vertical protective plates were also not impenetrable in all cases. The roots snaked through here too.

Back to the lab
Now it’s back to the lab, where the researchers will investigate exactly what the roots have done. The final results of this research project are expected in early 2025 – we will report back.

IKT root expert Dr Mirko

Salomon and biologist Prof Dr Thomas Stützel from Ruhr University Bochum (right)

Thanks to the Netherlands

The IKT root test stand is located in a new development area in the city of Almere, near Amsterdam. It was set up in the winter of 2018/2019 and has now been dismantled.

We would like to thank the city of Almere and the Dutch foundation RIONED for funding the project to the tune of 205,000 euros. Prof Dr Thomas Stützel, Director Emeritus of the Biological Garden at Ruhr University Bochum, supported us with his impressive wealth of knowledge as a biologist and root expert.

Photo gallery: Excavation of the IKT tree root test field in Almere/Netherlands

Click on pictures for full view

The IKT test field with poplar trees in a new housing estate in Almere/Netherlands

Researchers in the field: Prof Dr Thomas Stützel from Ruhr University Bochum and Kilian

Protective mat to stop roots

Tree roots are cleared with suction excavators, shovels and by hand.

Möllers, M.Eng. from IKT (r.)

Horizontal root ingrowth in the pipe trench

Root mats excavated from the IKT test stand

Protective mat, roots and sewage pipe

Almost like an ancient Roman trident: tree roots grow towards the sewage pipe

Looking vertically down into the pipe trench: The black protective mat against roots is clearly

Suction excavator carefully removes soil around sewer pipes without damaging tree roots

Roots and sewage pipes are excavated with great patience and sensitivity.

Information board at the IKT test field in Almere/Netherlands

visible