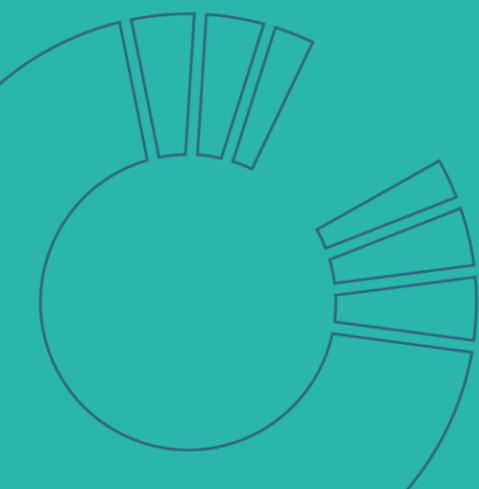


Case Studies in Bioeconomy Education, Training and Skills Development

Case study sample: Bio-composite Bridges

The Netherlands (cities
of Eindhoven, Almere,
and Bergen op Zoom)
plus Germany (city of
Ulm)

BTG





Bio-composite Bridges

1 Abstract

The bridge serves as an ideal object for testing the properties and possibilities of new materials. In 2016, the world's first bridge made of 100% biomaterials (biocomposites) was realized on the campus of TU Eindhoven. Materials used in the pedestrian biobridge include PLA (poly lactic acid) foam, cork, hemp and flax fibres and a bio-based epoxy resin. The original bridge was a collaborative effort involving TUD, TU/e, CoE BBE, schools for pre-vocational secondary education (VMBO) in Eindhoven, and composite company NPSP.

The bridge concept is advanced in the Interreg NW Europe project Smart Circular Bridges. In 2022 a new bridge design was tested and demonstrated at the world horticulture exhibition Floriade in Almere. Materials used in the bridge include 100% natural flax fibers and resin with 25% bio-based share. Further bridges will be piloted in Ulm (D) and in op Zoom (NL). The EU-funded project is carried out by a partnership of universities, AVANS, seven companies and three municipalities.

2 Target Groups

General public (awareness raising). Material innovators. Students (multiple EQF-levels)

3 Case Study Category

Art to communicate messages, inspire people and raise their interest and awareness

4 Training Provider

TU/e, TUD, Hogeschool Avans, Koning Willem 1 College and Bossche Vakschool (i.e. two Research Universities, a collaboration of two Universities of Applied Science, and two vocational training providers).

5 Region

The Netherlands (cities of Eindhoven, Almere, and Bergen op Zoom) plus Germany (city of Ulm)

6 Language

English and Dutch

7 Objectives of the education Format

Other

8 Scope and context of the education format

The education format focuses on Research, Development, and Design (RD&D) of a novel construction material applied in infrastructural objects within the built environment. Students from different education levels collaborated to realise the pilot bridges.

9 Specific Skills and competencies addressed

No exclusive focus on technical, valorisation or transversal competencies. The first category may be of the highest relevance.

- Aspects of various competencies came together in the students' involvement:
- Technical competencies e.g. material research
- Valorisation competencies e.g. conducting lifecycle assessment
- Transversal competencies: working together in teams

10 European Qualification Framework level/s

A range of EGF levels (students of 4 different educational levels, from University towards vocational training, were involved).

11 Main benefit of the participant

Direct input/contribution to the design, production and testing of a (publicly accessible) demo bio-based pedestrian bridge.

12 Main cost categories considered

The total budget for the second project amounted to 6.86 million Euros, with the majority of costs allocated to Research, Development, and Design (RD&D), which included structural health monitoring and lifecycle assessment of the bio-based bridges. In the first pilot, students played a substantial role, contributing significantly to the project's workforce. The direct costs associated with involving students in this format were likely relatively low.

13 Importance and impact

The first project engaged enthusiastic students across four different educational levels, ranging from university to vocational training. These students played integral roles throughout the bridge's lifecycle, contributing to the design optimization, material strength and stiffness testing, and modeling the material behavior during the production and assembly phases.

14 Relevance (of the format)

The use of biomaterials in bridge construction holds significant relevance in the Netherlands and Germany, especially given the impending need for renewal of numerous existing bridges. In the Netherlands, there are over 12,000 pedestrian and cyclist bridges maintained by municipalities, with 41% currently in poor to very bad condition. Similar figures are observed in Germany.

15 How can it inspire BioGov.net (Why was it designed in this specific way / what are the success factors?)

The bridge in Eindhoven was exceptionally unique at its inception, being the world's first bio-composite bridge. The engagement of students in Research, Development, and Design (RD&D) projects is a standard practice at the educational institutes involved.

In theory, the transfer of involving students in RD&D projects should not be overly challenging and could be replicated in other countries, regions, and educational settings.

16 Data sources

- **Online resources:** <https://www.4tu.nl/bouw/Projects/Bio%20Based%20Bridge/>
<https://www.restructgroup-tudelft.nl/biobased-composite-footbridge>
<https://www.nweurope.eu/projects/project-search/smart-circular-bridge-scb-for-pedestrians-and-cyclists-in-a-circular-built-environment/>
<https://www.nweurope.eu/programme-2014-2020/nwe-making-an-impact/smart-circular-bridge-making-infrastructure-circular-with-biomaterials/>
- **Resource persons:** Prof. Dr.-Ing. Patrick Teuffel, Chair of Innovative Structural Design (ISD), Faculty of the Built Environment, TU Eindhoven
- **Other sources, if any:** -

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