Hook-and-Loop fastener – application for the technical building equipment

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THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

IN CO-OPERATION WITH

BOKU University of Natural Resources and Applied Life Sciences, Vienna
ETH zürich
KIT Karlsruhe Institute of Technology

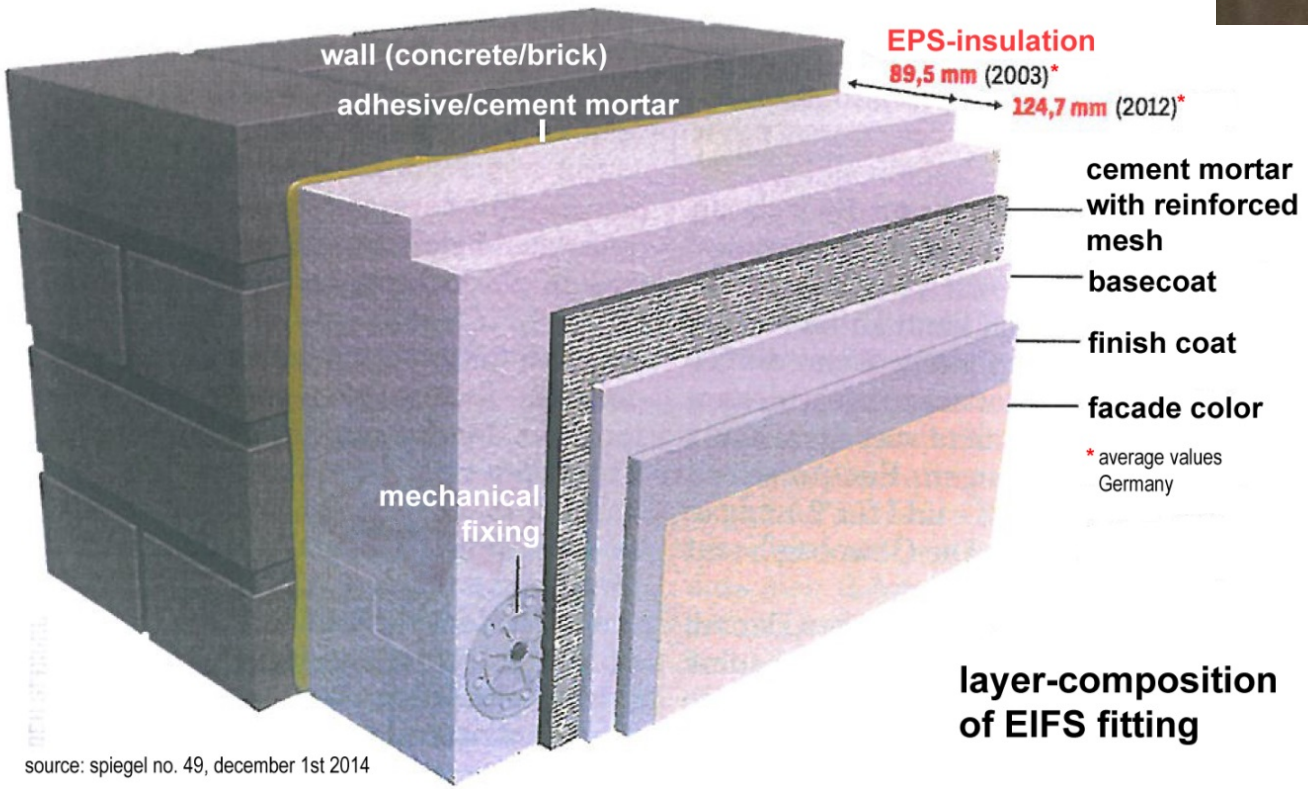
SBE19 Graz
SUSTAINABLE BUILT ENVIRONMENT D-A-CH CONFERENCE 2019
Graz University of Technology, Austria
11 - 14 September 2019

Problem statement

EIFS problems
no recycling and no reuse (special waste)

Exterior Insulation Finishing System fitting:
cement mortar / glue between
_wall and insulation
_insulation and finish coat/plaster

No separability of facade components



source: spiegel no. 49, december 1st 2014

layer-composition of EIFS fitting

Research project - facade4zeroWaste

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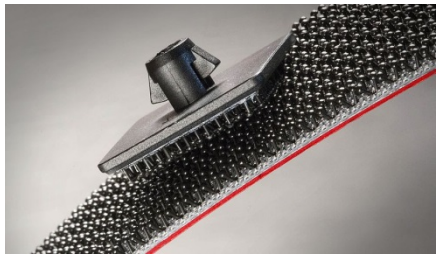
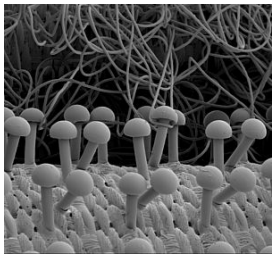
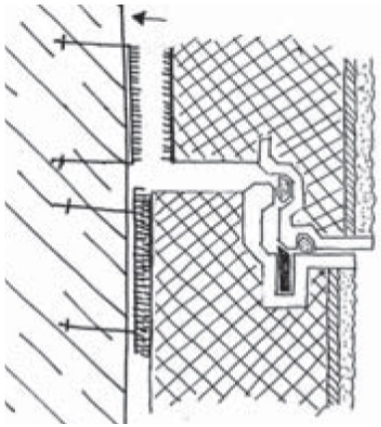
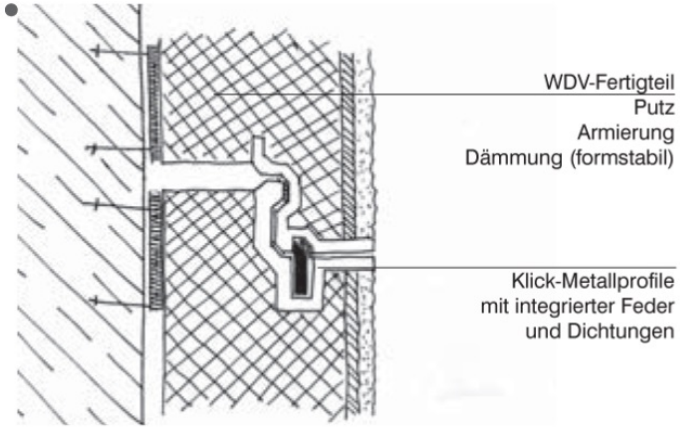




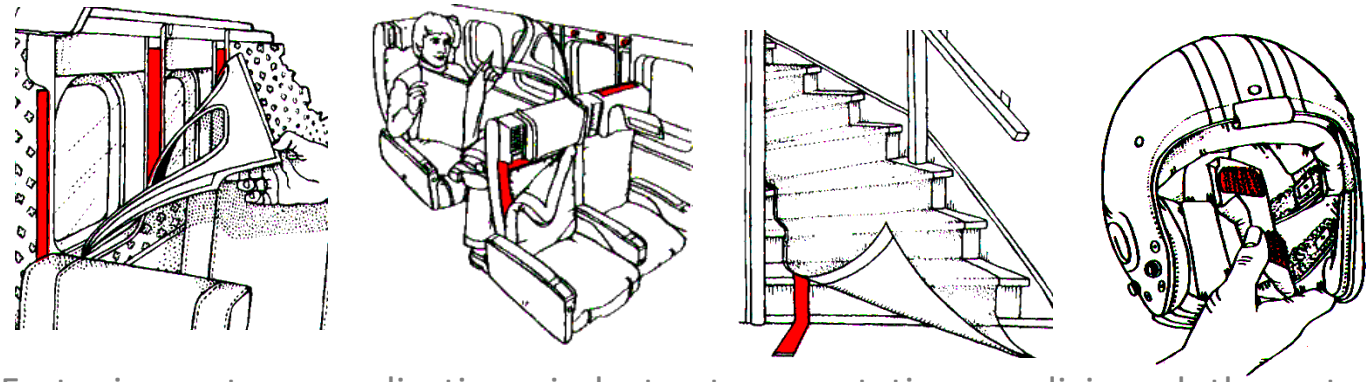




First idea prefabricated **“Click-System-Modul”** with fastener fixation / “Velcro”

- Reuse but no single-origin seperability **(Recycling)**
- Is a Velcro fastener for the facade application even possible?

“barnacle” at flora and fauna - biological term



Fastening systems applications: industry, transportation, medicine, clothes, etc.
almost at any branch, expect the **building construction branch**

The prickly heads of these plants are noted for easily catching onto fur and clothing , thus providing an excellent **mechanism for seed dispersal**.

The first artificial reclosable fastener fixation the “hook-and-loop fastener” was **conceived in 1941** by Swiss engineer, George de Maestra.
Hook-and-loop fasteners, are known as Velcro ® in English, in German speaking countries as “**Klett**”.

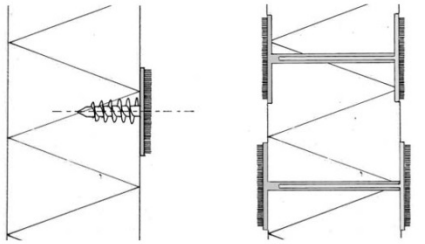
Development

Connection between VELCRO and building component
Industry manufacturing - practicable and cheap

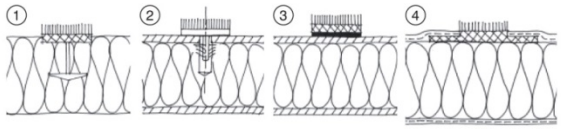
Manufacturing insulation or façade panel with integrated Velcro

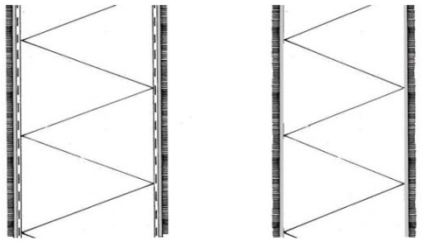
Idea:
insulation with integrated Velcro –during production process
_laminate Klett during EPS extrusion
_bed of heated nails to extrude Velcro

Finally:
façade panel (recycled glass) with integrated Velcro fleece laminating during production process
StoVerotec Lauingen Germany

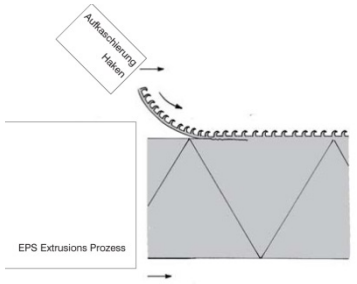


Befestigungsvarianten Dübeln, Steckverbindung Dübel

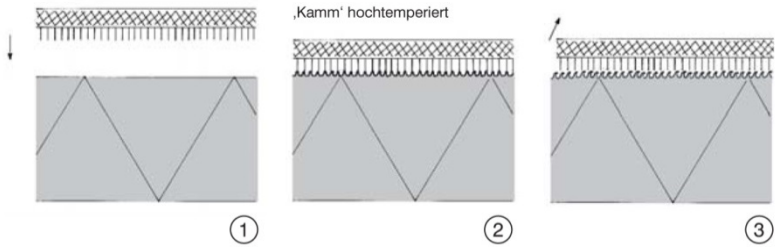


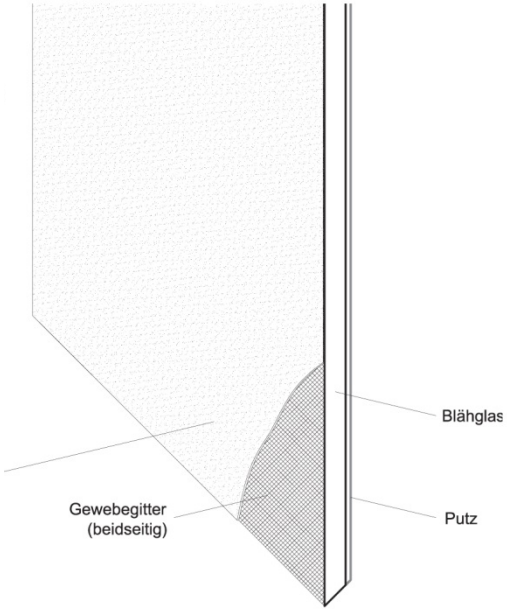


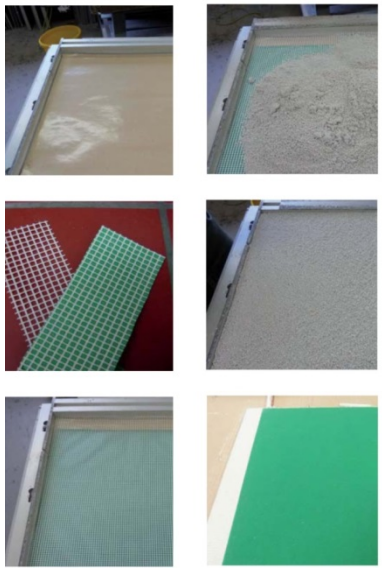
Befestigungsvarianten Verklebung, Dämmung=Klett



Produktionsverfahren Aufkaschieren/Kleben







Certification Testings

weather resistant (long life span)

EOTA test-application (European Organisation for Technical Assessment)

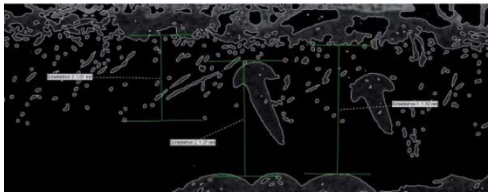
weathering-test ETAG 04 (European Technical Approval Guidelines)

Construction statics (without glue)
wind suction and pressure test - ETAG 017 (European Technical Approval Guidelines)

fire behaviour, reduce risk of fire
SBI Single Buring Item EN 13823 at IBS-Institute Linz

Fastener fixation tests
with CT (Computer Tomography)

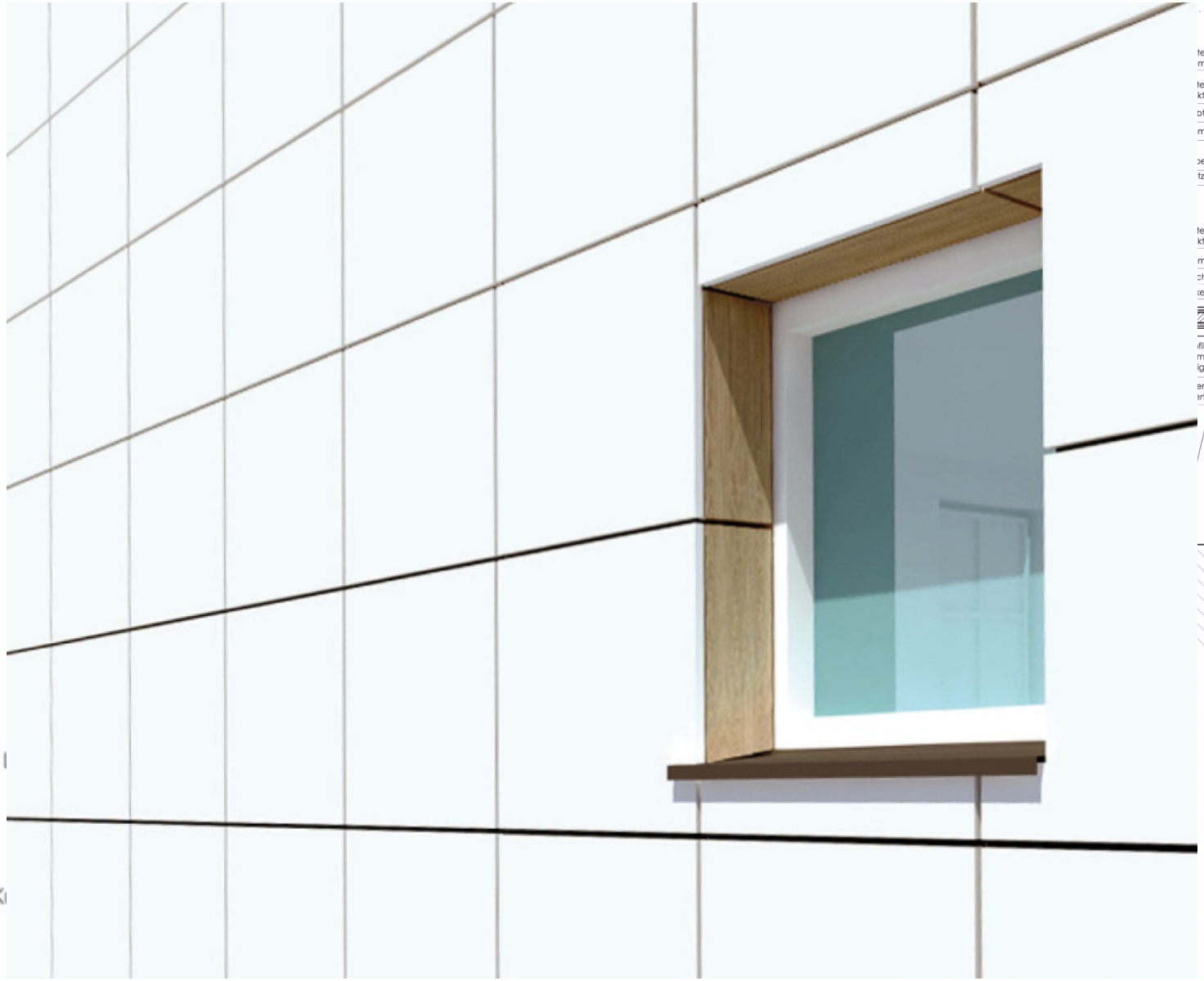
weathering-tests and static tests

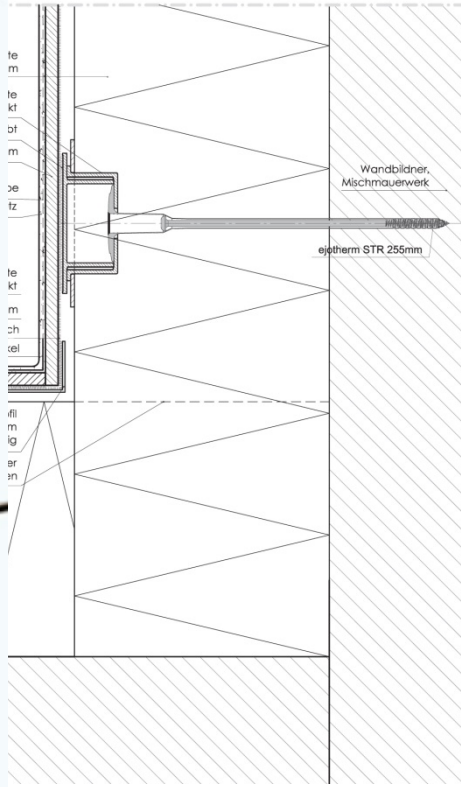


Certification - development of crucial details - corners and openings

problem: corner detail fixation, no areal bonding but only point loads

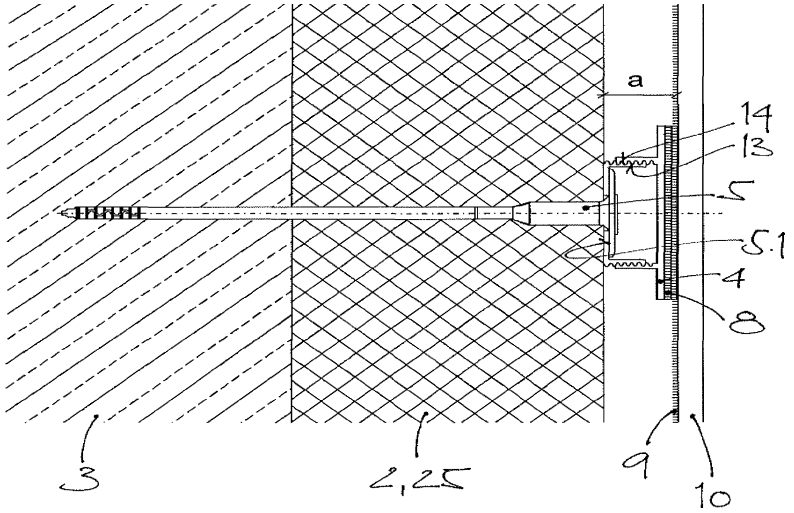
developing Velcro-corner-angle

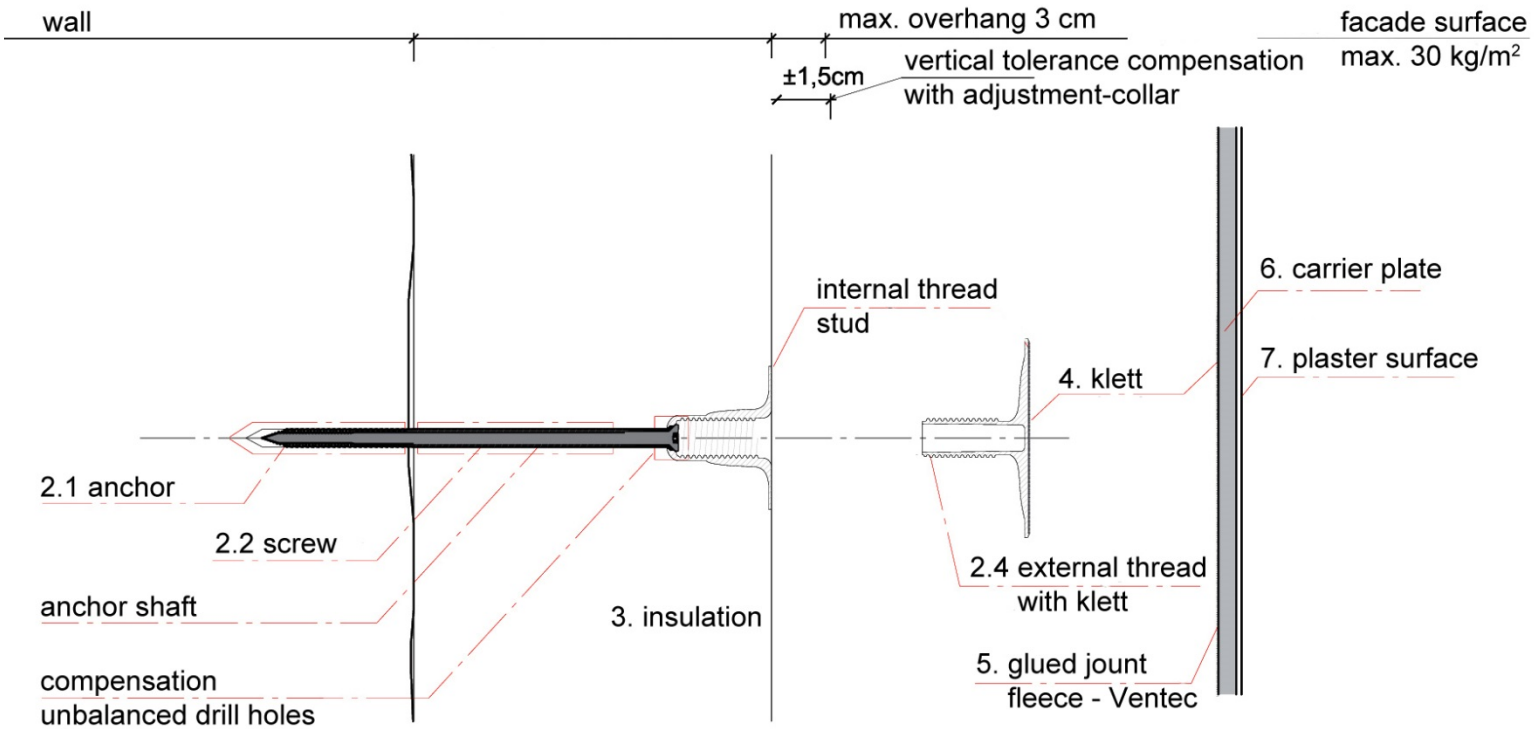




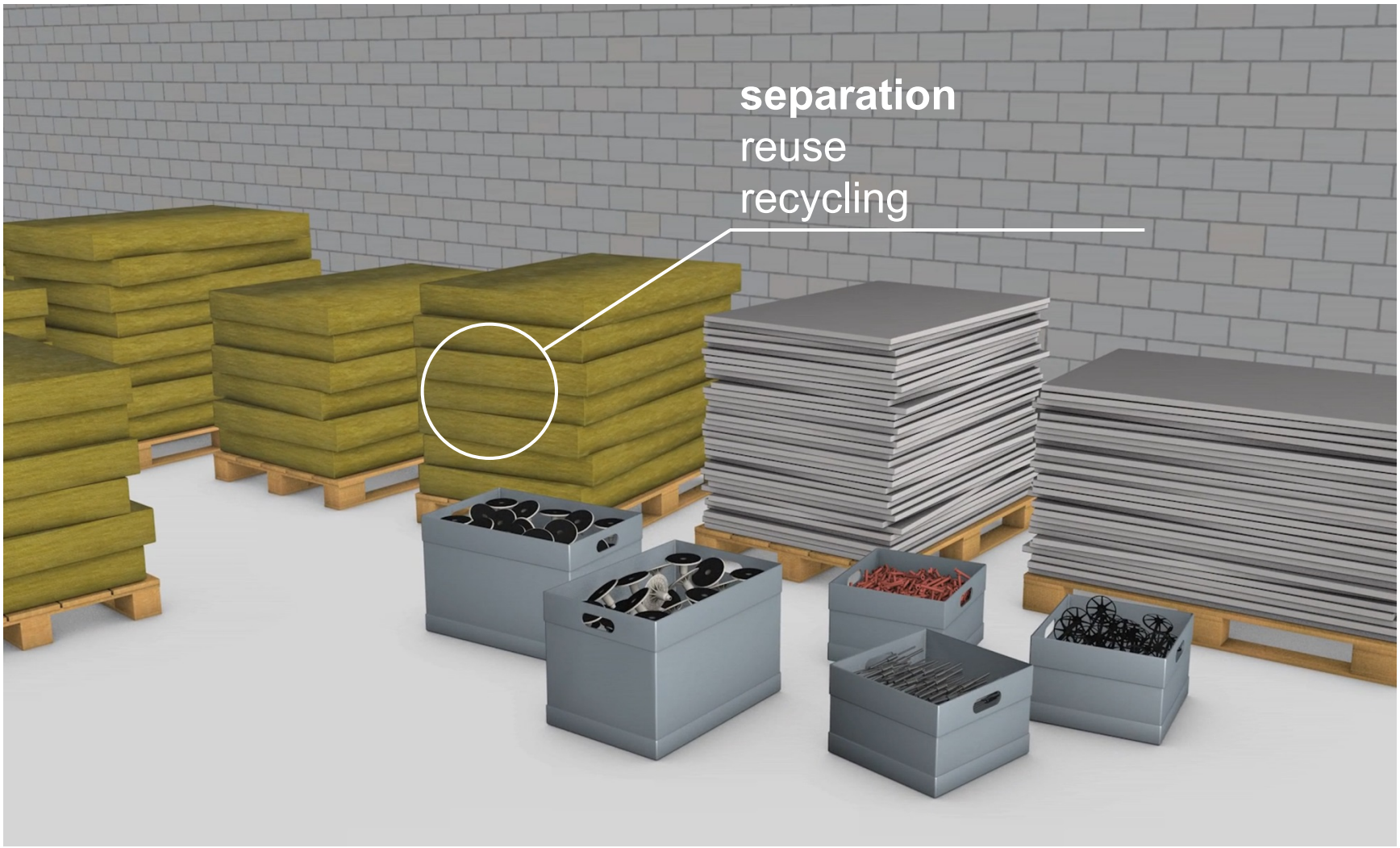
European Patent Grant No: 102010047242.5, published on 6.April. 2012

Grip fixing instead of adhesive –
Exterior Insulation Finishing Systems (EIFS)
as a sorted recyclable façade system
with reclosable Velcro fastener fixation





StoSystain R:
Grip fixing instead of adhesive



European Recycling Award 2015

Award-Winning Project „facade4zeroWaste“

08 May 2015, Rotterdam, NL

EQAR
European Quality Association for Recycling e.V.

Research Team IAT-LAB
ROGER RIEWE, FERDINAND OSWALD, TIM LÜKING
and WALTER WIEDENBAUER, ANDREAS WEIER

Research title:
Exterior Insulation Finishing Systems (EIFS) as a sorted recyclable façade system with reclosable fastener fixation - **facade4zeroWaste**

TU Graz
IAT | Institut für Architekturtechnologie

award winner

BAU 2017

16. – 21. Januar · München

Weltleitmesse für Architektur, Materialien und Systeme

Innovation Award for
Architecture and Building

Product **„StoSystain R“**
Awarded from AIT and XIA
on the Building Fair in Munich

sto

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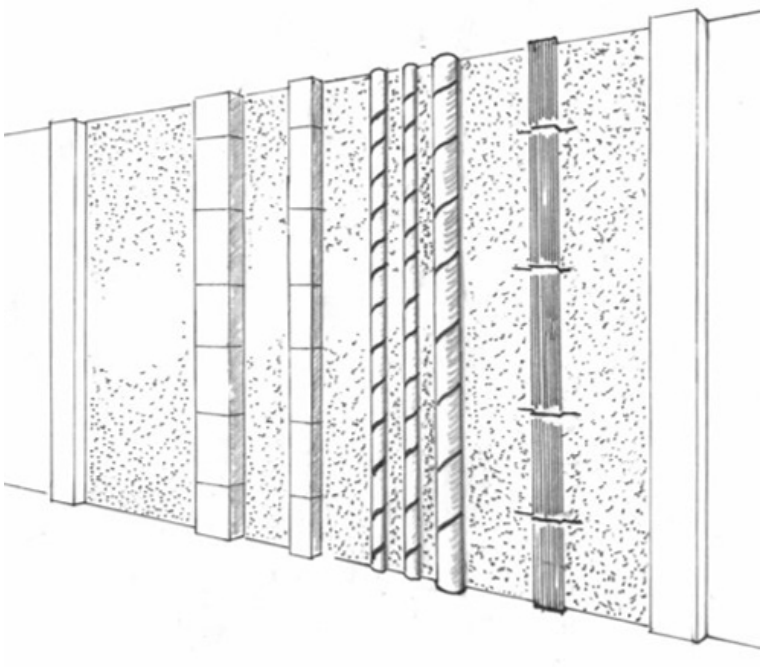
Dr. Ferdinand Oswald, University of Auckland

Hook-and-Loop fastener – application for the technical building equipment

Public funded exploratory project
Institute of Architecture Technology
Laboratory of Structural Engineering



Graz University of Technology

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IAT | LAB

LKI

mhs box SYSTEME

HERESCHWERKE energy solutions

STEINBACHER
»Dämmt besser. Denkt weiter.«

Federal Ministry
Republic of Austria
Transport, Innovation
and Technology

FFG
Österreichische
Forschungsförderungsgesellschaft

STADT der Zukunft

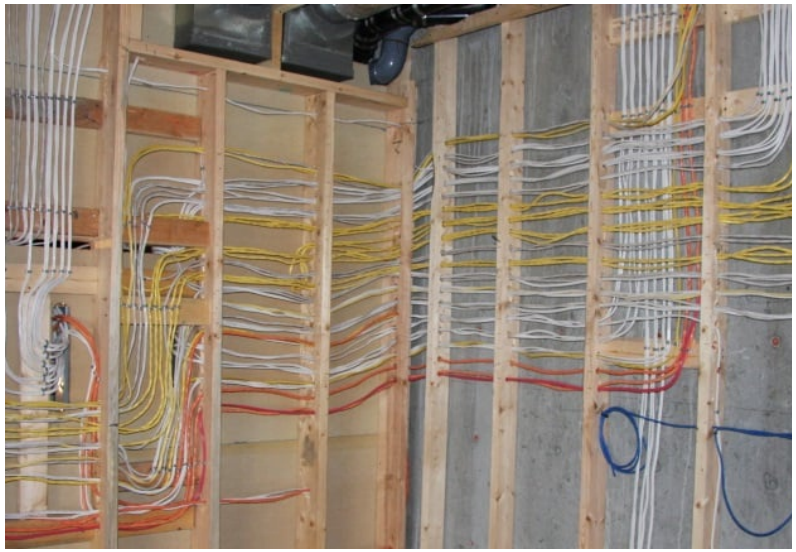
Hook-and-Loop fastener – application for the technical building equipment

State of the art / Innovation content

Avoiding waste production and improving recycling

Hook-and-Loop fastener – application for the technical building equipment

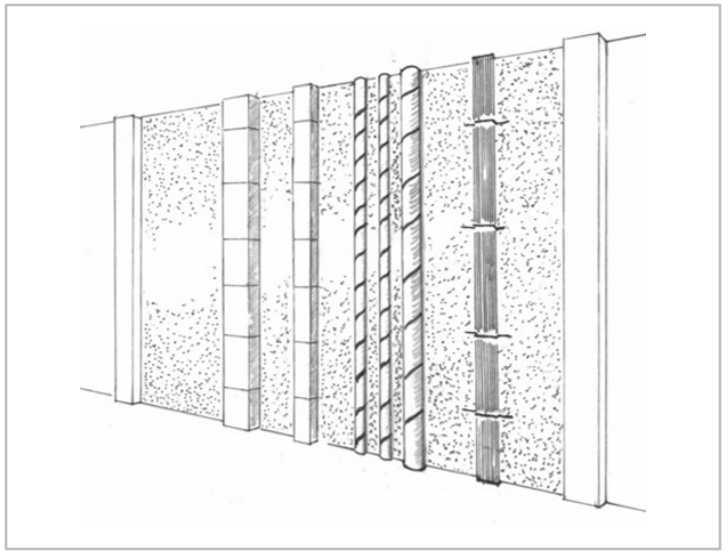
State of the art / Innovation content



Creating more flexibility in the implementation

Hook-and-Loop fastener – application for the technical building equipment

State of the art / Innovation content



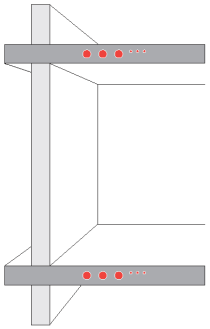
Less destruction of building components

Hook-and-Loop fastener – application for the technical building equipment

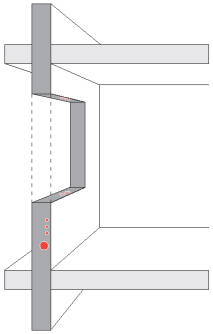
State of the art / Innovation content

Increasing the attractiveness of the handicraft profession

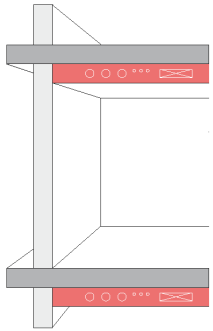
Aim of project: Potential for use of Velcro at technical building equipment

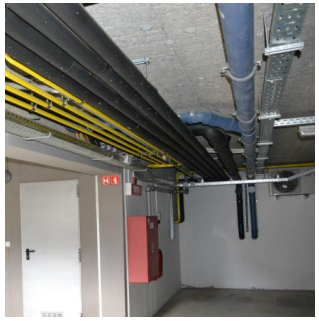


Cable arrangement in horizontal building components

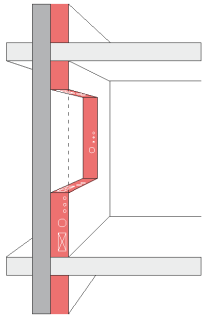


Cable arrangement in vertical building components

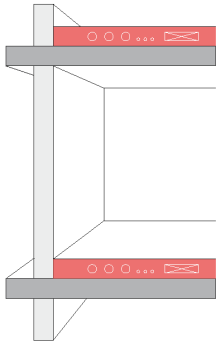


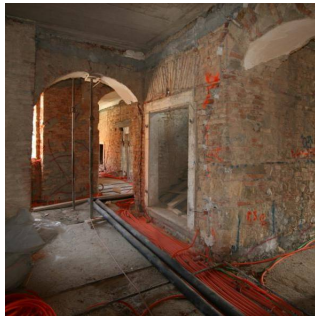


Cable arrangement below horizontal building components

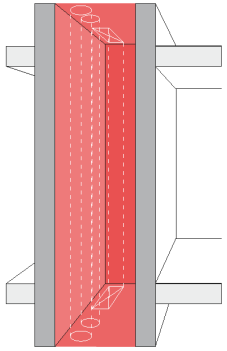


Cable arrangement in front of vertical building components





Cable arrangement above horizontal building components



Cable arrangement inside vertical installation shafts

Dr. Ferdinand Oswald, University of Auckland

Aim of project:

Application:
_Installation of sanitary components
_Insulation of water and ventilation pipes
_Fixation of electrical installations

Aims:
_Simplified assembly processes
_Flexible mountings and adaptability
_Damage-free connections

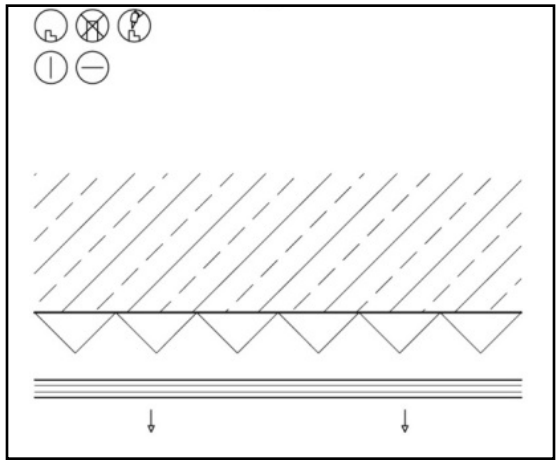
The aim was to develop concepts for the production of surfaces with hook-and-loop-compatible surfaces in buildings, which could serve as a base-surface for simplified mounting of building`s installation lines.

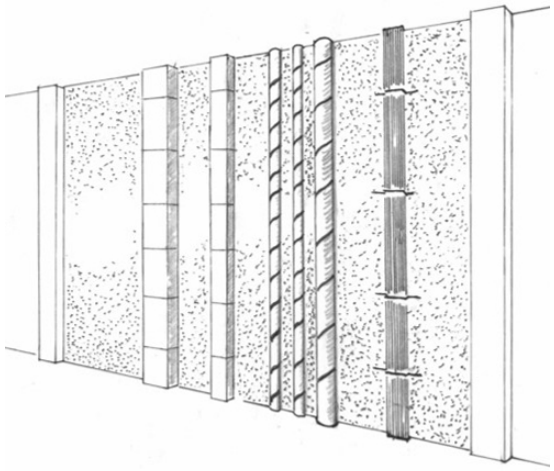
Results

Based on the innovation matrix, a total of 143 concepts for connections between Velcro and building materials were developed

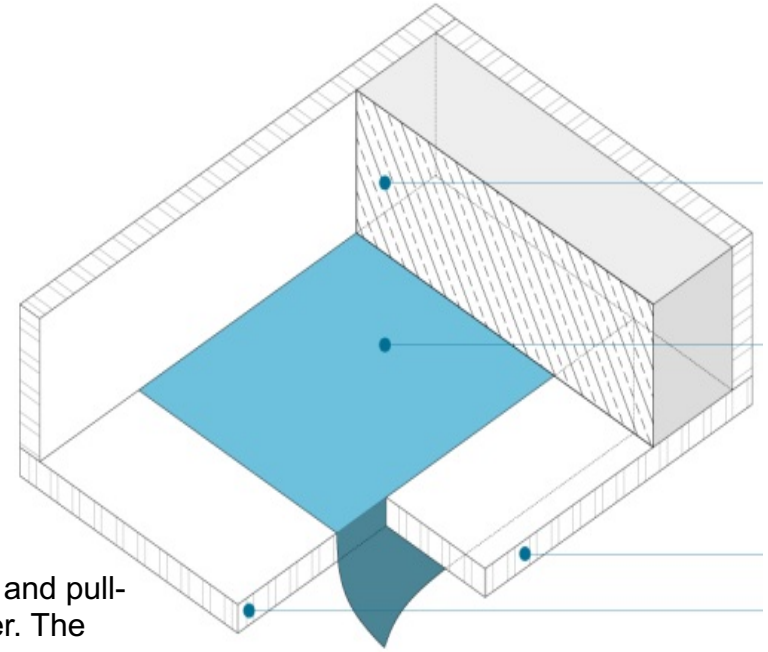
Laboratory Tests

Promising concepts have been physically tested by the Laboratory of Structural Engineering at Graz University of Technology.





Testing concept, Fixations of the inserted Hook-and Loop-fastener



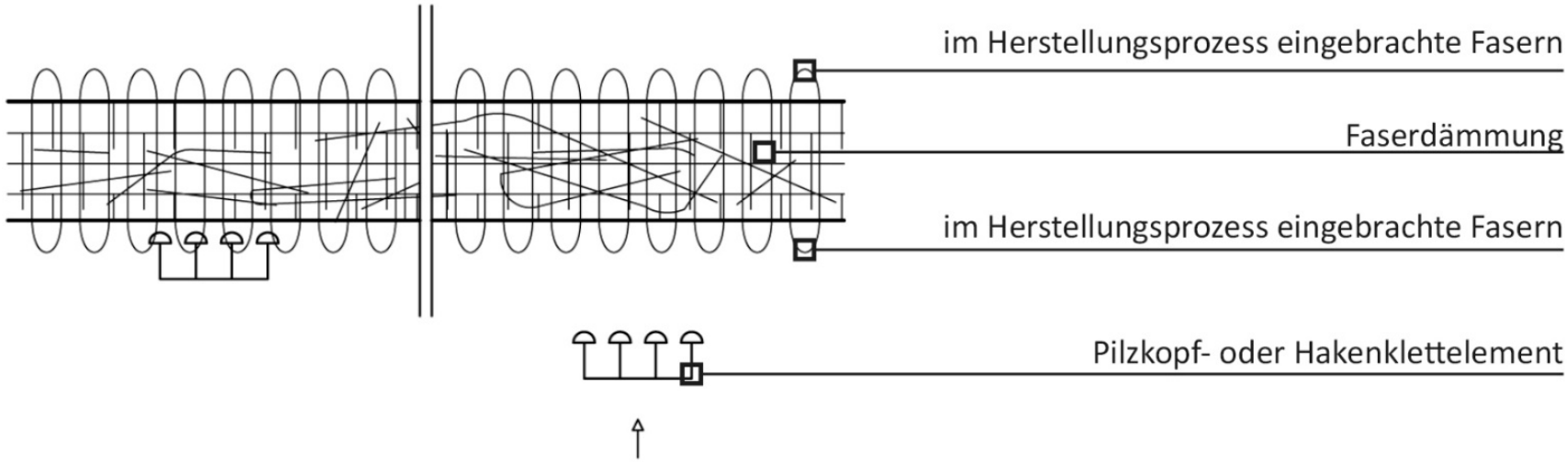
Experimental Setup of the peeling and pull-out tension test with Loop-Fastener. The width of the test strip is 5 cm.

Results

Velcro compatible fibre insulation

The structure of a fibre insulation enables reversible mounting with a hook or mushroom-head fixation. A hook-and-loop connection always requires two components or connection partners, a loop element and a hook or mushroom element**.**

This invention uses the insulation as the loop component.

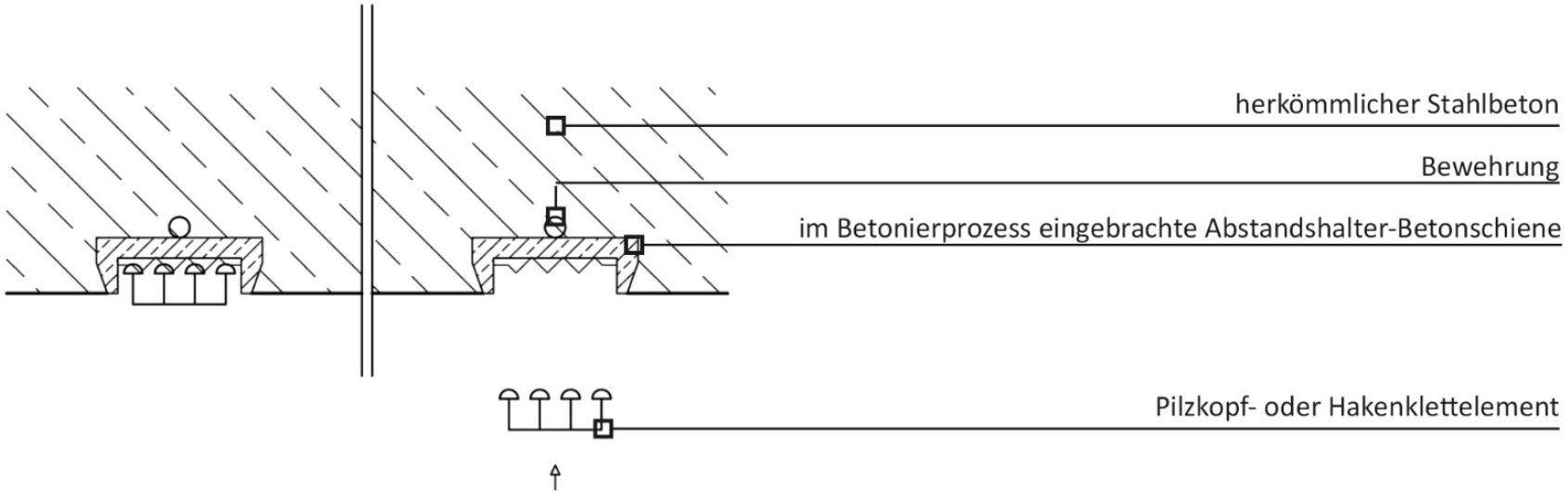


Results

Velcro-suitable loop elements integrated in concrete

Inventor's notification and patent grant

The core idea of the invention is the joint of a socket or track with loop (or hook) element with concrete by the use of the concreting process itself. Afterwards the loopsurface can be used for reversibel mounting of the technical building equipment (TGA) or further applications.
Spacers between reinforcement and concrete surface.



The further development either in the form of a state-funded project or together with corresponding and well-known partner companies will be the focus of the future research work.

Thank you very much for your attention!!!

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