A NEW LOAD-BEARING INSULATION MATERIAL MADE OF CATTAIL

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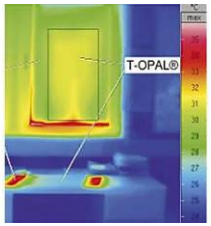

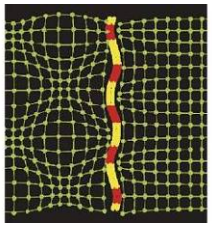

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Innovative Technological Development

Advantages of Cattail (Typha) for Building Materials:

Very special leaf texture with

+ Sponge-like tissue with low thermal conductivity $\lambda \approx 0.032$ W/mK

+ structure with extreme high compressive strength

+ reet-plant with high natural microbiological resistance (no biozide necessary)

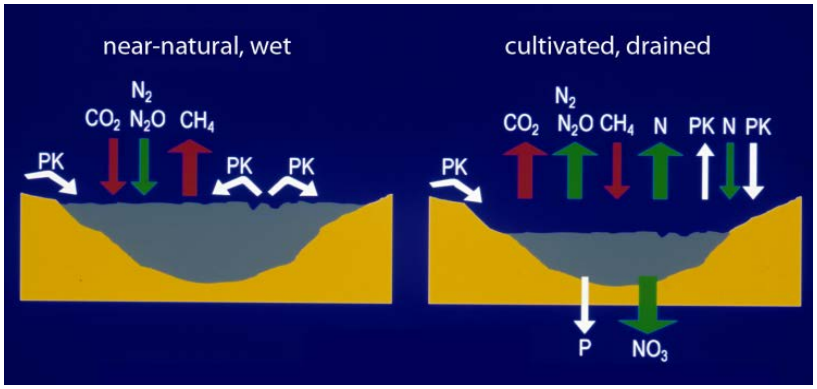
➔ Development of Building Materials

Relevance for agriculture

- **Cultivation in lowland moors, fens and valley plains**
- **Resilient natural monocultures**
- **High agricultural crop (15-20 t/ha)**
- **After 2 years harvesting possible**
- **Harvest in wintertime (advantage for farmer and fen animals)**
- **No competition to food production**

Environmental Relevance

- Ensures natural functions of peatland, like retention of nutrients and water
- Sustainable alternative fen use for the future
- Prevention of CO_2-loss by re-wetting of dried fens
- Bond of CO_2 and other greenhouse-gases with its cultivation in fens
- Cleaning of nutrient polluted surface water



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Development of a new building material

- Selection of suited species
- Design of a building material combining all positive properties of Typha

➔ No defibration of the raw material

- Longitudinal cutting into typha bars

Development of a new building material

- **Gluing with a pure mineral bond**

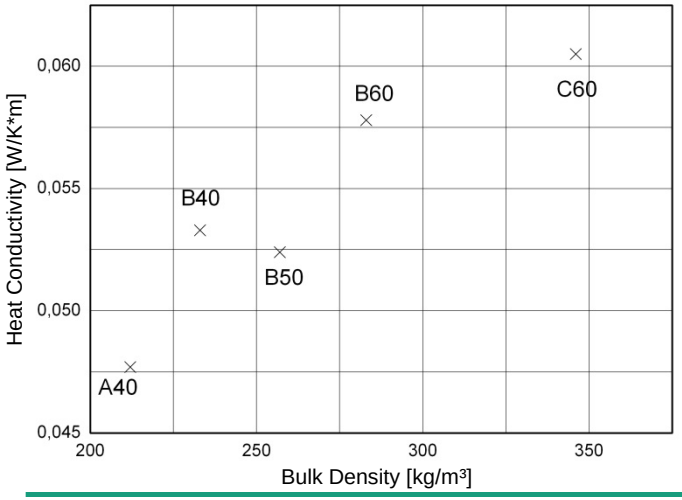
➔ **Magnesite–Bound Building Board**

- **Optimization of the Material properties**

Type	Density [kg/m³]	Magnesite part [%]	Bearing load [N/mm²]	Heat conductivity* [W/Km]
1a	257	50	0,54	0,055
1b	283	60	0,46	0,058
1c	233	40	0,34	0,053
2a	237	50	0,36	-
2b	243	60	0,36	-
2c	217	40	0,29	0,048
3a	318	50	1,01	-
3b	346	60	0,76	0,061

* orientated, not normative measurement

For example: heat conductivity



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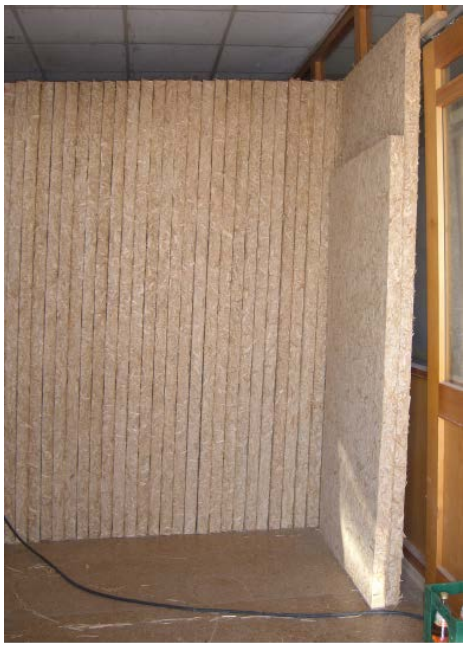
Simple Manufacturing

Manufacturing Process:

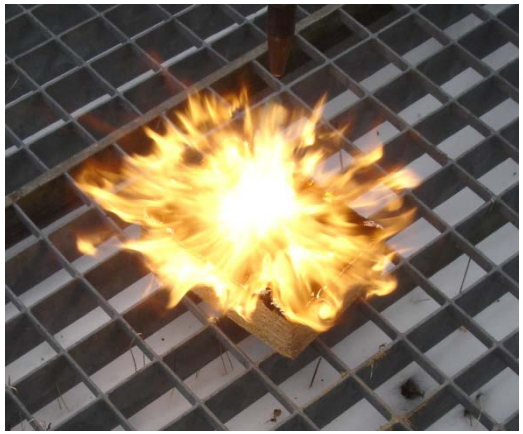
- **Splitting and Cutting to Typha-Particles**
- **Spraying of the Particles in glueing barrel**
- **Inserting in the Mould and Hardening**

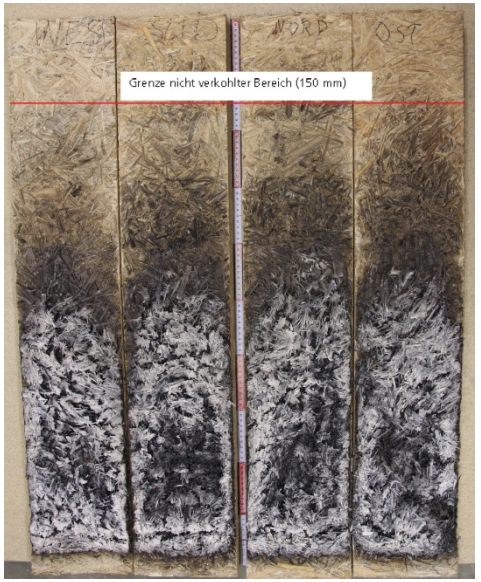


Innovative Technological Development

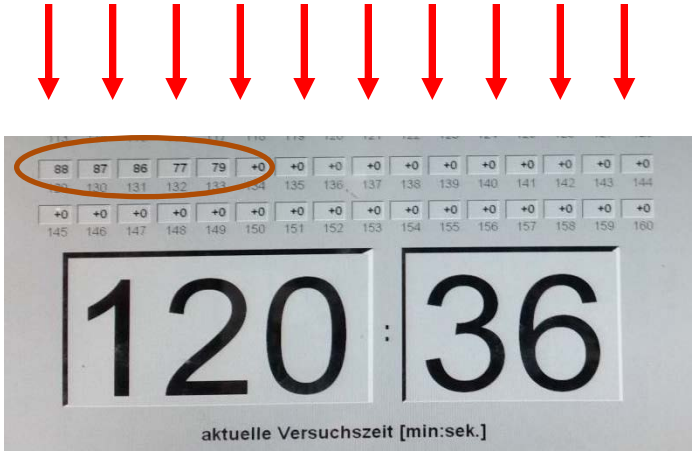
Advantages of the Magnesite–Bond Typha Board :

- **<u>High Compressive Strength</u> at low heat conductivity ($\lambda \approx 0.055$ W/mK)**
- **good acoustical and especially fire protection properties (EN 13501-1: B-s1d0; low flammability, no smoke, no dripping)**
- **no glowing!**





Innovative Technological Development



- **<u>High Compressive Strength</u> at low heat conductivity ($\lambda \approx 0.055$ W/mK)**
- **good acoustical and especially fire protection properties (EN 13501-1: B-s1d0; low flammability, no smoke, no dripping)**
- **no glowing!**
- **fire resistance class F120 with 120 mm Board**
- **fire resistance class F60 with 60 mm Board**

Innovative Technological Development

Advantages of the Magnesite–Bond Typha Board :

- High Compressive Strength at low heat conductivity ($\lambda \approx 0.055$ W/mK)
- good acoustical and fire protection properties
- high heat capacity (Heat protection in Summertime)
- medium diffusion resistance
- capillary active
- good workability with common tools
- easily accepted for cultural heritage
- 100 % compostable
- low energy input for production
- high sustainability

Examples of Application

Renovation of a half-timbered house in Nürnberg

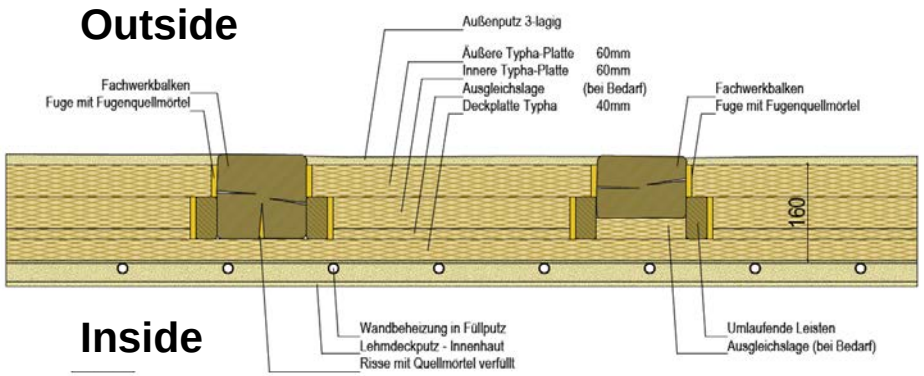
- Very bad condition of the framework with constructional problems
  - ➔ energetical measures in combination with stiffening measures necessary
  - ➔ Magnesite-Bond Typha-Board

Examples of Application

Renovation of a half-timbered house in Nürnberg

- Very bad condition of the framework with structural problems
  - ➔ energetic measures in combination with stiffening measures necessary
  - ➔ Magnesite-Bond Typha-Board

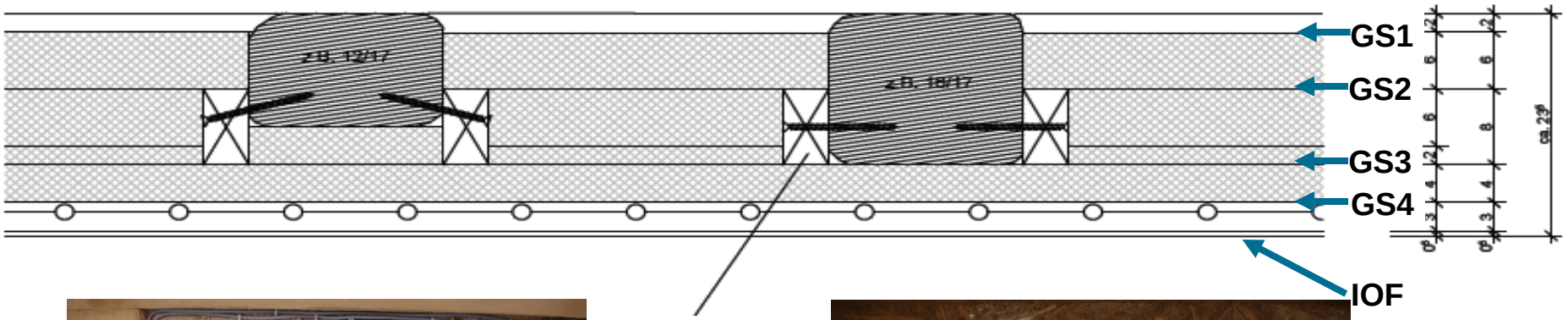
- Insulation within the stud and additional inside insulation



Examples of Application

Renovation of a half-timbered house in Nürnberg

monitoring of relevant parameters at different layers within the construction

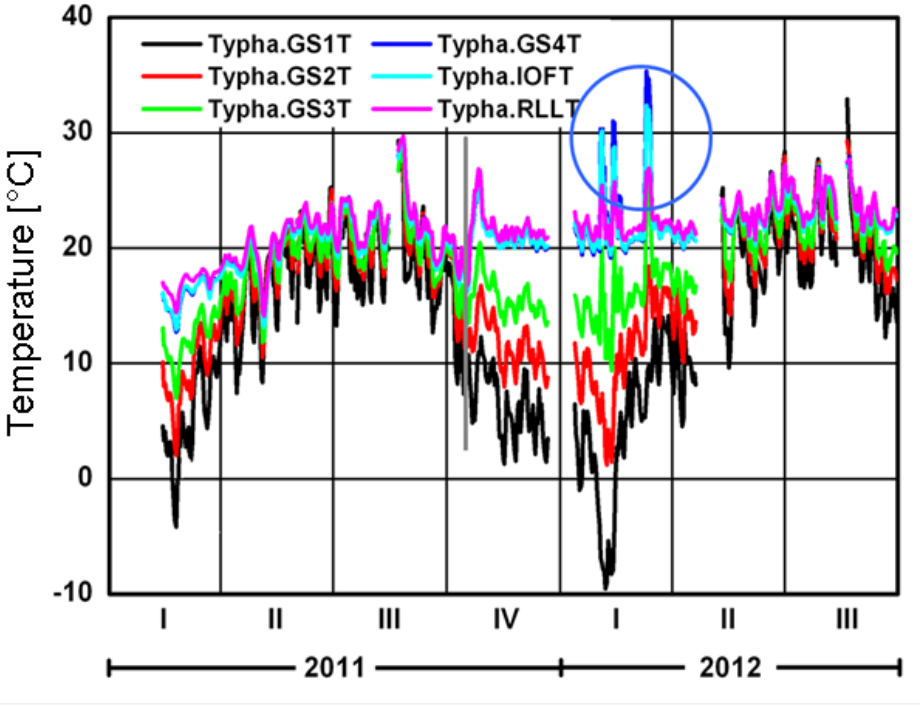


Temperature, RH, Wood moisture

Temperature, RH, Heat flow

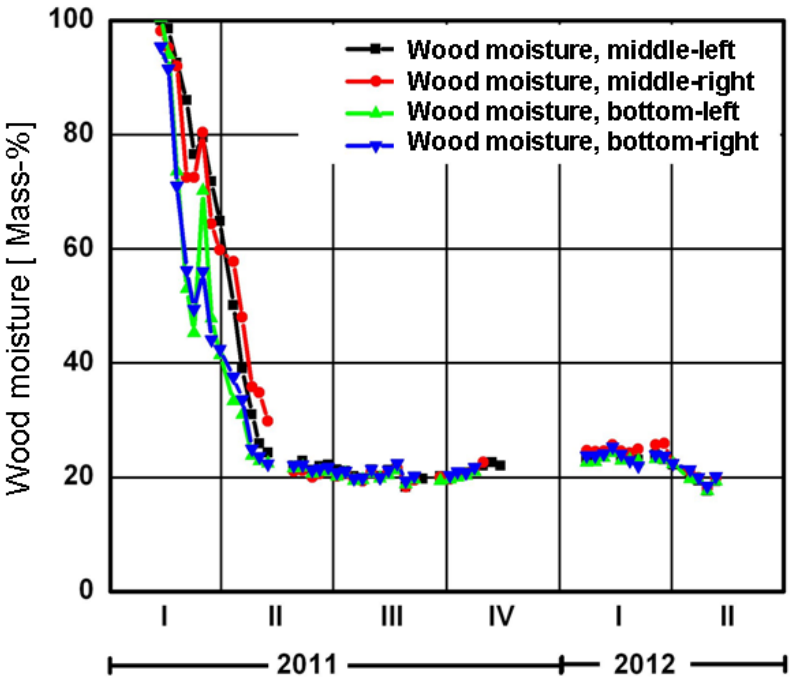
Examples of Application

Renovation of a half-timbered house in Nürnberg



Without wall heating

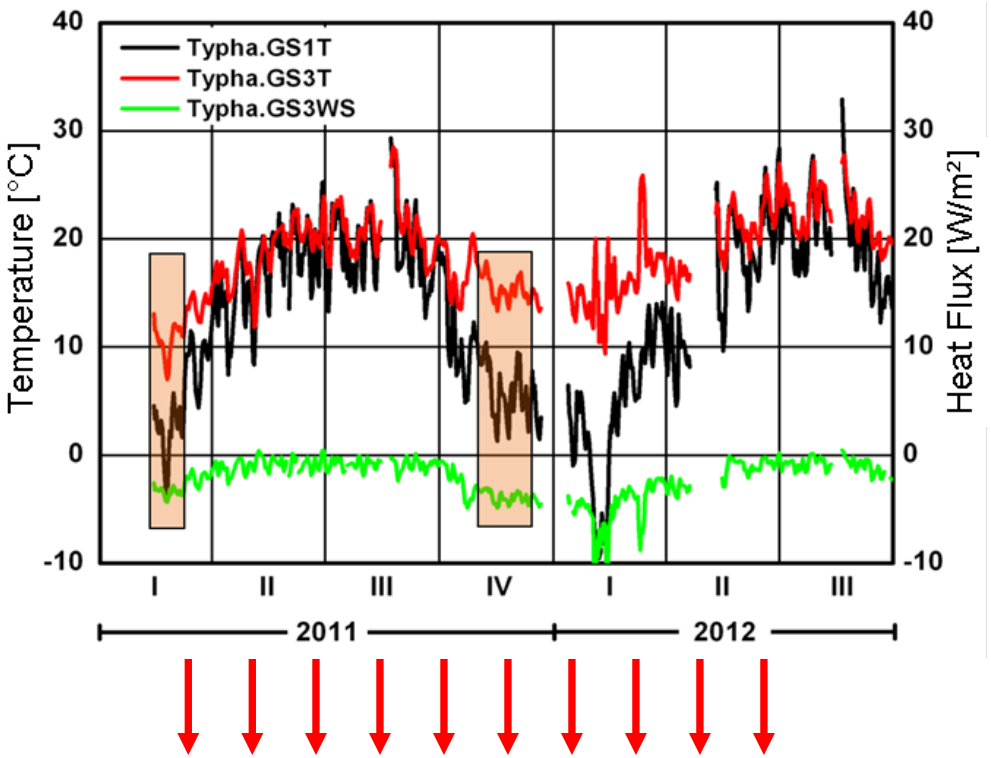
With wall heating



Fast drying of the wooden construction

Examples of Application

Renovation of a half-timbered house in Nürnberg



Resulting U-Values: 0.29 W/m²K for the infill
0.35 W/m²K for the entire wall construction

With a total wall thickness of 20 cm!!

Examples of Application

Renovation of a half-timbered house in Nürnberg

Ground floor with interior insulation

Examples of Application

Internal insulation of the masonry

Easy mounting with 3 dowels/m²
Clay plaster reinforced with typha seed

No monitoring
➔ Hygrothermal calculations:

30 cm Masonry
4 cm Typhaboard
1 cm clay plaster

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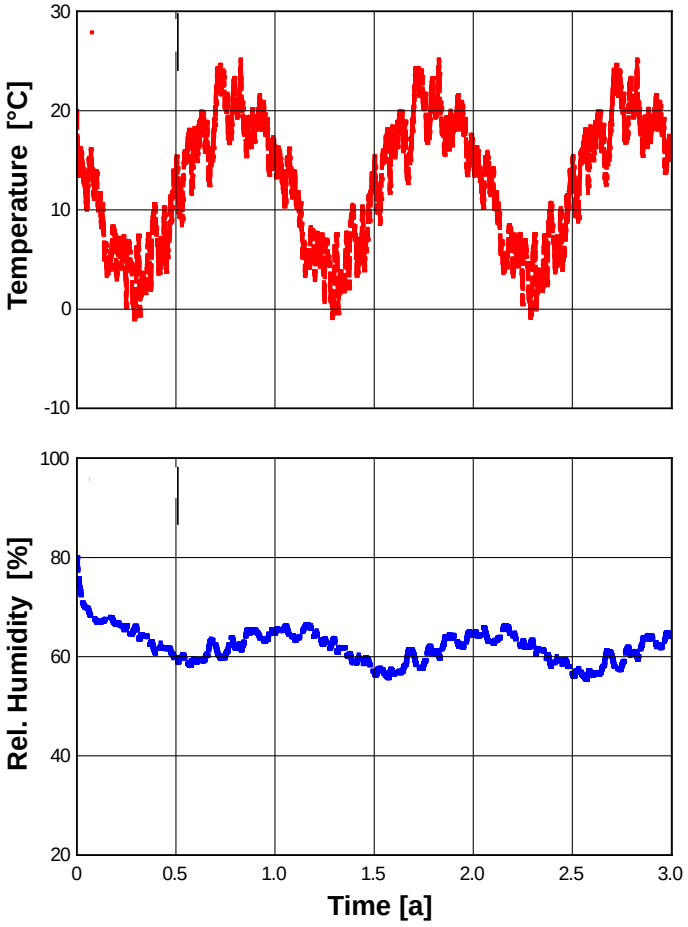
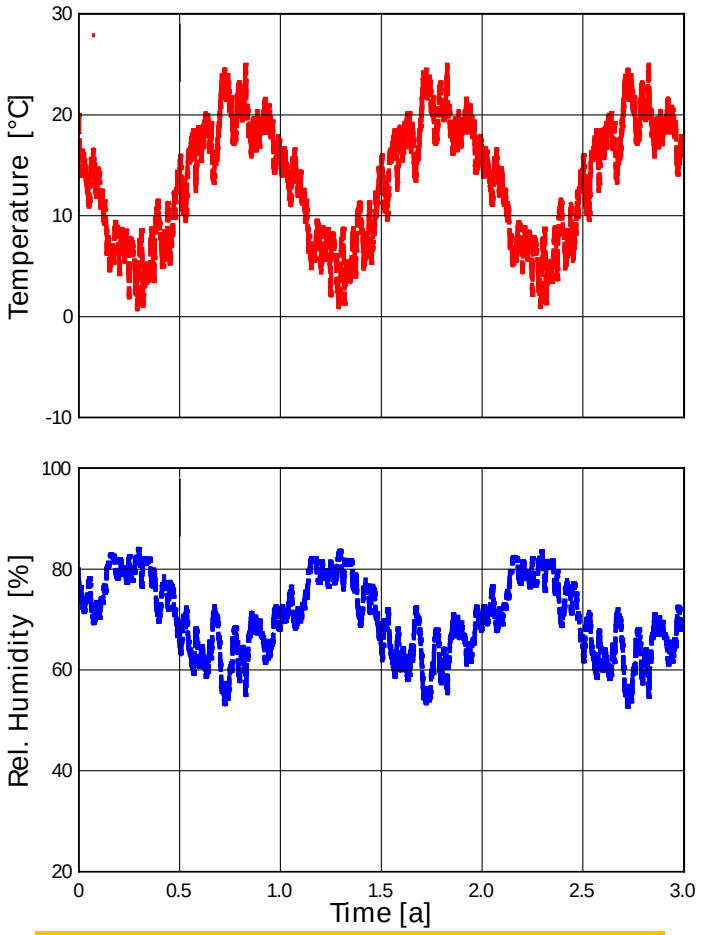
Examples of Application

Internal insulation on the masonry



No moisture accumulation
No risk of mould growth

Leakage with backflow of 1m³/md



R.H.s higher than 80%
➔ Risk of mould growth?

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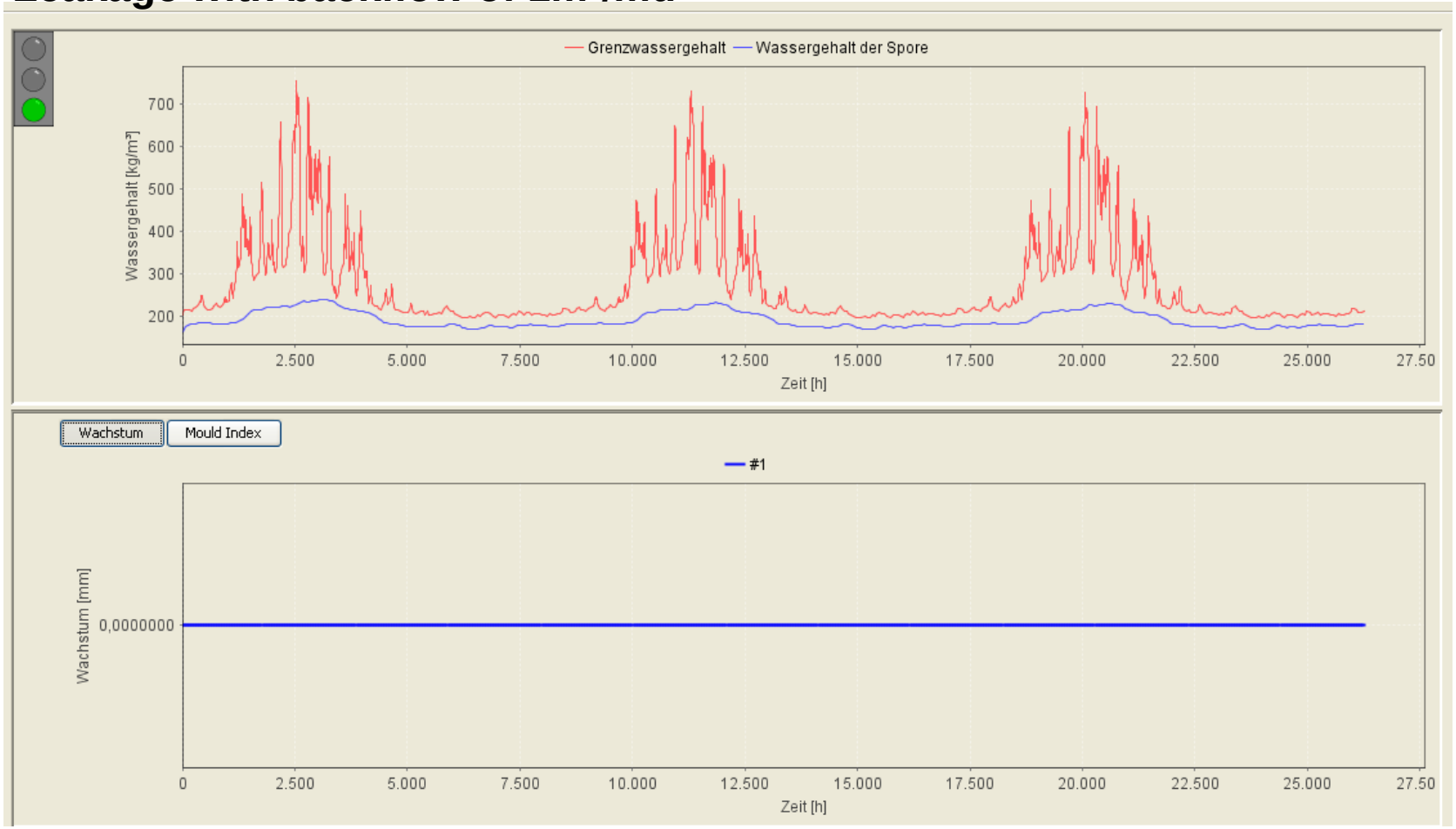
Examples of Application

Leakage with backflow of 1m³/md

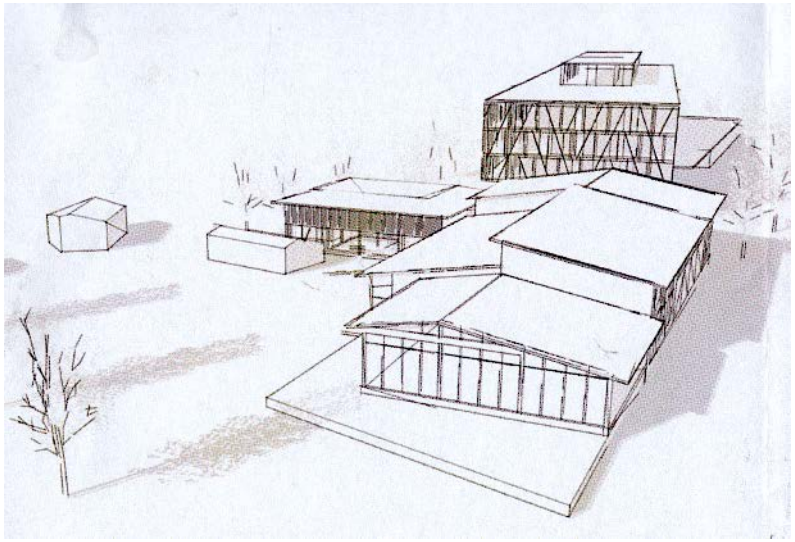


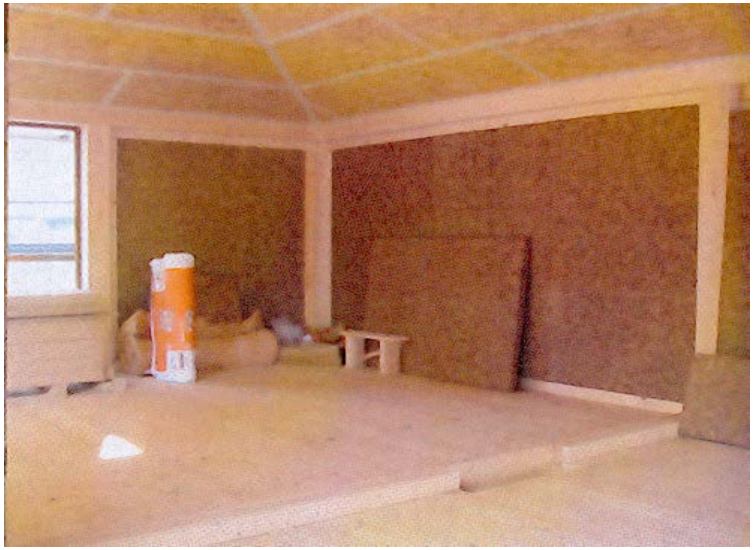
Due to lack of nutrients no risk of mould growth
➔ High tolerance of the construction

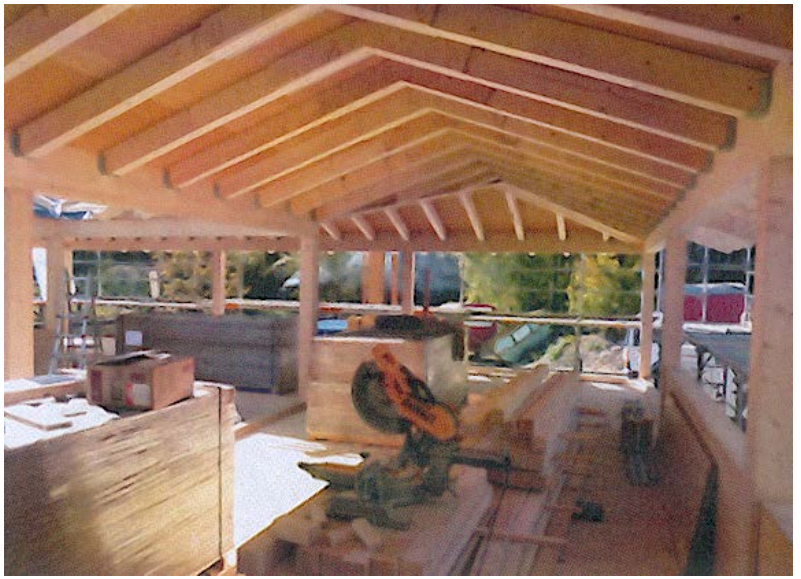
Examples of Application

on a wood frame construction

- wooden frame construction (4.3 m raster!)
- outer walls, inner walls and roof with Magnesite–Bond Typha Boards
- outside lime plaster, inside clay plaster
- fulfills all requirements concerning fire and acoustics
- U-value of the walls 0.23 W/m²K

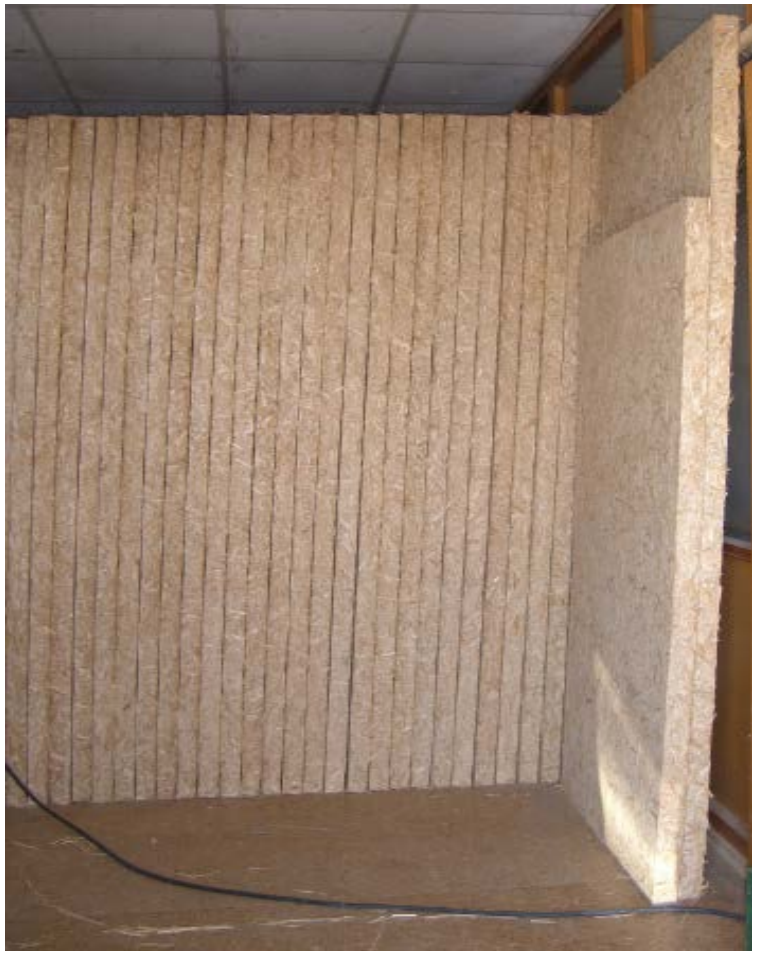






Expo 2015 in Mailand

Summary:



- Development of an innovative Material with numerous positive properties

- enables sustainable building
  - of renewable building material
  - produced with low energy amount
  - easy dismantling
  - completely compostable
  - meets “Cradle to Cradle” demands

- enables simple building techniques, since Typhaboard unites all qualities relevant for constructions: heat insulation, static stiffening, fire prevention, moisture protection, acoustics, plaster base…)