



S T R A W

SUPPORTING THE USE OF STRAW IN URBAN AND
PUBLIC BUILDINGS

YEARBOOK | 2018

Interreg 
North-West Europe
UP STRAW
European Regional Development Fund



FOREWORD

Dear reader,

This is the 2018 UP STRAW Yearbook.

This yearbook is the first of three to be published during the Interreg NWE funded UP STRAW project (2017-2020).

The theme of this yearbook is **“the strawbale experience to live in”** and aims to inform and inspire you about the application of straw as a building material in houses. In this document you can find articles that have been written by members of our project partners (France, United Kingdom, Belgium, Germany and the Netherlands).

In presenting this yearbook, we would like to thank all contributors.
We wish you a good reading experience.

From the UP STRAW project partners





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01 INTRODUCTION

UP STRAW is an Interreg-NWE funded program (2017-2020) in which French, Belgian, Dutch, United Kingdom and German partners cooperate. The aim is to position straw as the premium biobased building material, positively affecting healthy buildings, CO² reduction and environmental impact. UP STRAW stimulates and facilitates the application of straw in urban, public and private buildings.

Reducing the emissions of greenhouse gas CO² can make an important contribution to solving the global climate challenge. Approximately 36% of CO² emissions in Europe are caused by buildings. Reducing the energy consumption of existing buildings and constructing new buildings with CO² neutral or CO² negative building materials can make a major contribution to addressing this challenge.

Straw is an excellent insulation material that can be used in new buildings and also for the insulation of existing buildings. Straw is CO² negative (CO² is stored in straw during growth), widely available, fully recyclable and has a rapid growth cycle (annual harvest). In addition to the insulating quality of straw (it keeps the warmth inside), the heat buffer capacity is important. Summer heat (from outside) barely penetrates the interior, because straw buffers the heat. The effect is more comfort and less energy use for cooling. Straw as an insulation material is often, together with clay, used in a vapour-open construction system. This creates a positive effect on the indoor climate. Because straw can be used without further processing and can be fully recycled, the total environmental impact is minimal.

Despite the positive effects of straw as a building material, it is applied on a very modest scale. In the UK, Belgium and the Netherlands (and also in other European countries) straw buildings are a small part of the total building production. In France there are about 5000 buildings in straw but there is also a big opportunity for upscaling. Straw is -so far- mostly applied in a craftsmanship production approach. The development of more industrial applications (prefabricated elements, blown-in straw) is recent. These techniques make straw more applicable in the existing concrete and brick- building industry.

The application of straw for insulating existing buildings is, as yet, hardly known. Straw as a building material is not included in building education programs in universities or professional training contexts. The general public is becoming more oriented towards healthy and environmentally-friendly living and building methods. Public buildings and schools can benefit from the positive effects of natural building materials. Especially in schools, the positive impact of biobased construction methods on an inner climate that facilitates learning is high.



02

EXPERIENCE: Elmfield (Canterbury, England)

For this project, Straw Works and the School of Natural Building worked with clients Harriet and Andrew Wishart on their farm near Canterbury in the south of England. Harriet and Andrew already had 2 brick-built holiday rentals and wanted to increase the quality and type of accommodation they could offer. Straw Works designed a terrace of 3 loadbearing 2 storey houses, to be used as holiday rentals for people with mobility difficulties and their carers.

The clients knew they had a limited budget, and so they proposed to do the bulk of the building themselves, supported by courses and mentoring from SNaB. To build with loadbearing straw was an obvious choice because it is a simple technique that people like themselves, with no building experience, could still achieve with good guidance. The other attractive aspect for them was that the thermal efficiency of strawbales meant that the new rentals would have a much lower heating cost than that of their existing more conventional rentals. Long term running costs would be very much reduced, plus they would be reassured that their building choices were having minimal adverse impact on the environment.

Local planners were concerned that the terrace should resemble a barn in style, which meant that the design was more expensive to build than it could have been, but Straw Works used this stipulation to create a large and airy atrium space within the 3-bedroomed houses that also had the function of providing space for a lift to be installed in the future, should this be required. Straw Works achieved Planning and Building regulation approval, and provided detailed construction drawings to enable the self-builders to do most of the work themselves.

The School of Natural Building ran training courses with Harriet and Andrew on site, to teach them and members of SNaB, plus other public participants, how to build with straw, plaster with lime and clay, and make clay plaster from found earth. Andrew worked full time on the houses for 18 months, very proficiently learning by doing, and acting as a labourer when they had to bring in more expertise, to tile the roof for instance.

Harriet worked on the houses as much as she could and learned lots of practical skills as well as keeping up with the children and the animals. The external walls were rendered with lime, (they even included hair from their herd of Alpacas to strengthen it!). Internal walls were plastered with clay, made using straw fibre left over from the walls, and most of it was done by Harriet, with her friends and family, during plastering parties.

At the end of the build, Harriet and Andrew found there was almost no waste from the construction, apart from plastic used to wrap building materials. All timber waste was stored to become fuel for the heating system of the new houses, straw was used for plastering, and for animal bedding and mulch round the trees. Any surplus materials and tools/equipment were sold or passed on to others.

They also were able to build these houses for £750/m² because they put so much of their own time and labour into it. This is a possibility that is particularly relevant to strawbale buildings, because of the simplicity of the building technique.

They have been able to monitor the actual savings in running costs because of the excellent thermal properties of straw, as compared to their existing houses made of brick, and can see a huge difference. The strawbale houses are saving them a lot of money.

And finally, they have found that the holidaymakers who come to stay in the houses return again, because the houses feel cosy, peaceful, comfortable and make them feel happy!

[Click here for a video on the Emfield project.](#)

By Allan Sutherland





03 EXPERIENCE: Jules Ferry residence (St Dié-des-Vosges, France)

Mrs. Marchal, 80 years old, has lived alone in her apartment type 3 (76m²) for almost 5 years on the 3rd floor of the largest building of the Residence Jules Ferry in St Dié-des-Vosges. She is one of the first inhabitants of this building, made of wood and straw and unique in Europe.

How did you imagine this accommodation would be before living here?

When I saw this building for the first time, I wondered how it was inside. It is very good!

What surprised you the most?

It was hot! In a very well insulated house I have always been cold. I'm really good, there are no draughts like in my old house.

Is there any inconvenience?

Not on the interior comfort. The rain comes a little on the balcony and the layout of the kitchen could have been more functional.

What do you like most about your accommodation?

Madame Marchal appreciates the comfort of life at a lower cost, whatever the season.

What do your loved ones think of your home?

Her children are happy for her and for themselves when they visit and enjoy the comfort inside.

How is your life spent in your home in summer and in winter?

In the summer, I dine in the morning, I open the windows on the north side and I close them on the south side. With outdoor temperatures of up to 30-35 degrees, the indoor temperature does not exceed 25 degrees. In winter, the in-door temperature is maintained at 21 - 21.5 degrees without heating. Last winter, I only turned on the heat in February for a period of only a month and a half! It is very warm and comfortable throughout the year.

You have been here for several years, how are your relationships with your neighbours?

The relations are cordial, without more. Habits remain very individual.

Finally, what would you like to say about your life in a building that represents a first in Europe?

I'm happy in this building. I feel good! I do not miss my old house.

Mrs. Manam, 35, has lived with her daughter in her apartment type 3 (76 m²) on the 7th and top floor of the largest building of the Jules Ferry Residence in St Dié-des-Vosges since September 2017.

How did you imagine this accommodation would be before living here?

I do not like wood. I was reluctant during the visit. But the apartment was very bright and comfortable. Since I live here, I am very happy!

What surprised you the most?

I arrived in September and I quickly discovered a lot of comfort related to insulation. Energy consumption is very low. Also, even though it's an apartment, the living space is very interesting. The apartment is very well proportioned, the layout is well designed. There is good sound insulation, not to mention the elevator and the large balcony.

Is there any inconvenience?

There is no inconvenience!

What do you like most about your accommodation?

What I appreciate most is the living room, the kitchen open to the living room. It's very nice!

What do your loved ones think of your home?

My loved ones want to live here! Because it's super warm!

How is your life spent in your home in summer and in winter?

In summer, on the living side to the south, I draw my blackout curtains during the day and open them in the evening. During the hottest days of summer, it was 24 degrees in the apartment. In winter, I only turned on the heat for one month in February because the outside temperatures had dropped to -10 degrees. This comfort is very important economically, costing me only 10 euros per month for heating and 12 euros per month for hot water).

You have been here for a year - how are your relations with your neighbours?

No special relationship with neighbours but great respect. And thanks to the insulation we do not hear the neighbours.

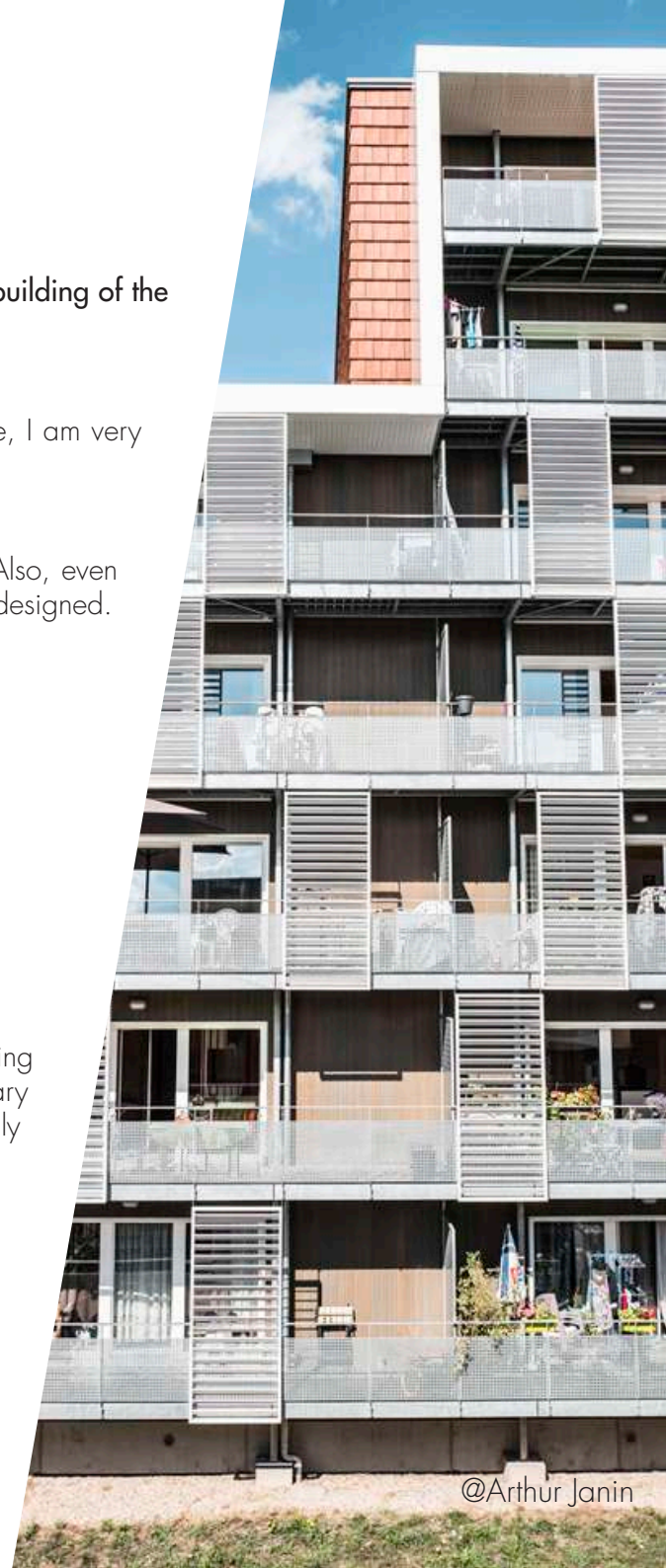
Finally, what would you like to say about your life in a building that represents a first in Europe?

It's pride! Many people envy my housing. Comfort, proximity to all businesses and energy savings are very positive points.

[Click here for a video on the Jules Ferry residence](#)

By Fabienne Pasquier

@Arthur Janin





04 PROJECT: Plankstetten Benedictine Abbey (Bavaria, Germany)

A new and natural building made from wood and straw

The monastery, which is part of the Benedictine Congregation in Germany, has identified the need for a new building with guest rooms, rooms for the parish administration and a 2-group kindergarten.

Based on the ecological philosophy and the regional self-sufficiency concept of the monastery to bring the entire life and economy in harmony with God's creation, the monks decided to use the required timber from their own monastery forest and straw from their own fields for this new building.

Financing and planning were started and the largest straw bale building in southern Germany is now being built. With this exemplary construction project, Plankstetten Benedictine Abbey became a partner in UP STRAW.

In 2019, the straw and wood parts will be initiated and there will be a series of events accompanying the development of this building.

By Benedikt Kaesberg



www.kloster-plankstetten.de



05 EXPERIENCE: A straw house to live in (Sombrefe, Belgium)

Client: Yoann Verminck
Architect: Bureau Desmedt Purnelle
General contractor: Paille-Tech

Yoann Verminck is a 39 years old IT specialist. He is married and is a father of three children. He used to live with his family in an old stone house. As he couldn't easily extend it he decided to build a new one in wood, straw and clay with the company Paille-Tech.

"We were looking for an energy efficient home and we wanted to include natural materials. When our architect, Jérôme Desmedt, suggested this innovative solution at the time we trusted his expertise and took the plunge. And the least we can say is that the whole family is delighted. We have such great comfort compared to our old house", says Yoann with enthusiasm. "In our previous home, we used to feel the cold coming from the walls as well as humidity from time to time. We only heated a third of the house to control energy spendings. There is nothing like that here. Indeed, thanks to the combination of biobased materials (wood, straw and clay) and 45cm thickness the walls feel naturally warm. It is very different from stone or concrete in terms of perception and experience."

Moreover, the house reaches passive standard and is also incredibly energy efficient: On the coldest days of the year, a 2000w electric heater can easily heat the 200 square metres. It feels warm all year long with an average temperature at 21°C.

"I'll give you an example: it is now December 7 but as soon as I come home I will put on shorts and I'll spend the evening wearing this outfit. Another advantage of natural materials: a good indoor climate. And this is particularly true: I am asthmatic. Each year I had bronchitis once or twice a year. Since our move to the new house, I barely have one. It's amazing!"

Is a straw house a perfect house? "There are two minor problems: it is too hot at the beginning of the spring and in autumn because the sun enters directly in the house through the patio door. But solar protection would solve the problem immediately. In fact, and I say that humorously, our biggest issue is the fact that the house is too well insulated to install a fireplace, which is my wife's dream. But I heard that new models specifically designed for passive houses have been developed. We will have to look at it. As for what's left our perception is excellent. We live in a house that looks like any other house, except it has lots of advantages: technically well thought out, very pleasant to live in, energy-efficient and environment-friendly. We feel good and comfortable when we are home. And that's the most important thing for us."

Interview by Denis Vasilov

06 EXPERIENCE: Eco Village Sieben Linden (Beetzendorf-Poppau, Germany)

Our experience in strawbale building

The beginning, some 15 years ago, was very difficult: with a bad-tempered straw bale press and people having to drag a thousand bales from the press onto a trailer, into a barn, again onto a trailer and eventually to the building site. Then, having to fill in and dismantle one part of the straw wall five times until it eventually fit, and finally an architect being knocked to the ground by ambitiously compressed straw bales which broke free of the wall.

Every day was 'search and discovery' but eventually Strohpolis, the first three-storey straw bale apartment house in Europe, was built in our eco-village in 2004.

The advantages of building with straw are:

- the bales are simultaneously wall building material, insulation and plaster base;
- highest CO₂ and energy savings in the manufacturing process;
- good insulation properties;
- recyclability;
- and last not least – comfortable homes.

So, straw bale building complies with all of the goals of the eco-village: regional value creation based on renewable raw materials with a long service life and quality. No wonder the villagers continued building with straw. Over the years, they have developed an efficient, constructively thought-out design.

Straw bale building has become a true core competence of the eco-village, a mature technology to proudly rely on. Tools and techniques for sewing, straightening, installing, compressing and shaving straw have been developed. Knowledge has increased, helping us to organize building processes with professionals as well as empowering inexperienced people to build with straw. This has led to a continuous improvement of the necessary steps in constructing a straw bale building.

Today (2018) there are 11 major straw bale buildings in Sieben Linden. Each house has its own background story. In detail, all the planning issues, social processes and economic aspects would be too much for this article, so come and see for yourselves: Welcome to Sieben Linden.

Bettina Keller is a carpenter and, recently, also an architect. She's living in Sieben Linden, the place in Europe with the highest density of straw bale buildings, and she participated in the construction of some 20 houses. Her business card says she's a straw bale builder.



07 PROJECT: Floating straw boat (Amsterdam, Netherlands)

Amsterdam enjoys world-wide recognition, partly because of its many waterways. Living by the water is now supplemented with living on the water. In the ecological housing estate barge at the Johan van Hasselt canal in Amsterdam, floating houses will be built.

The Johan van Hasselt canal, a side canal of the IJ river in Amsterdam-Noord, is now quiet. But that will change: the floating Schoonschip residential area will be created here in the coming years. The district will provide space for 46 households and one collective user space, on 30 water plots.

The first water houses will be realized in 2018, creating the most sustainable floating residential area in Europe between 2018 and 2020, with a total of 46 households and just over 100 residents. Schoonschip is being built in Buiksloterham, a neighborhood in Amsterdam North where the robustness of the old industry goes hand in hand with sustainable new construction projects (source: schoonschipamsterdam.org).

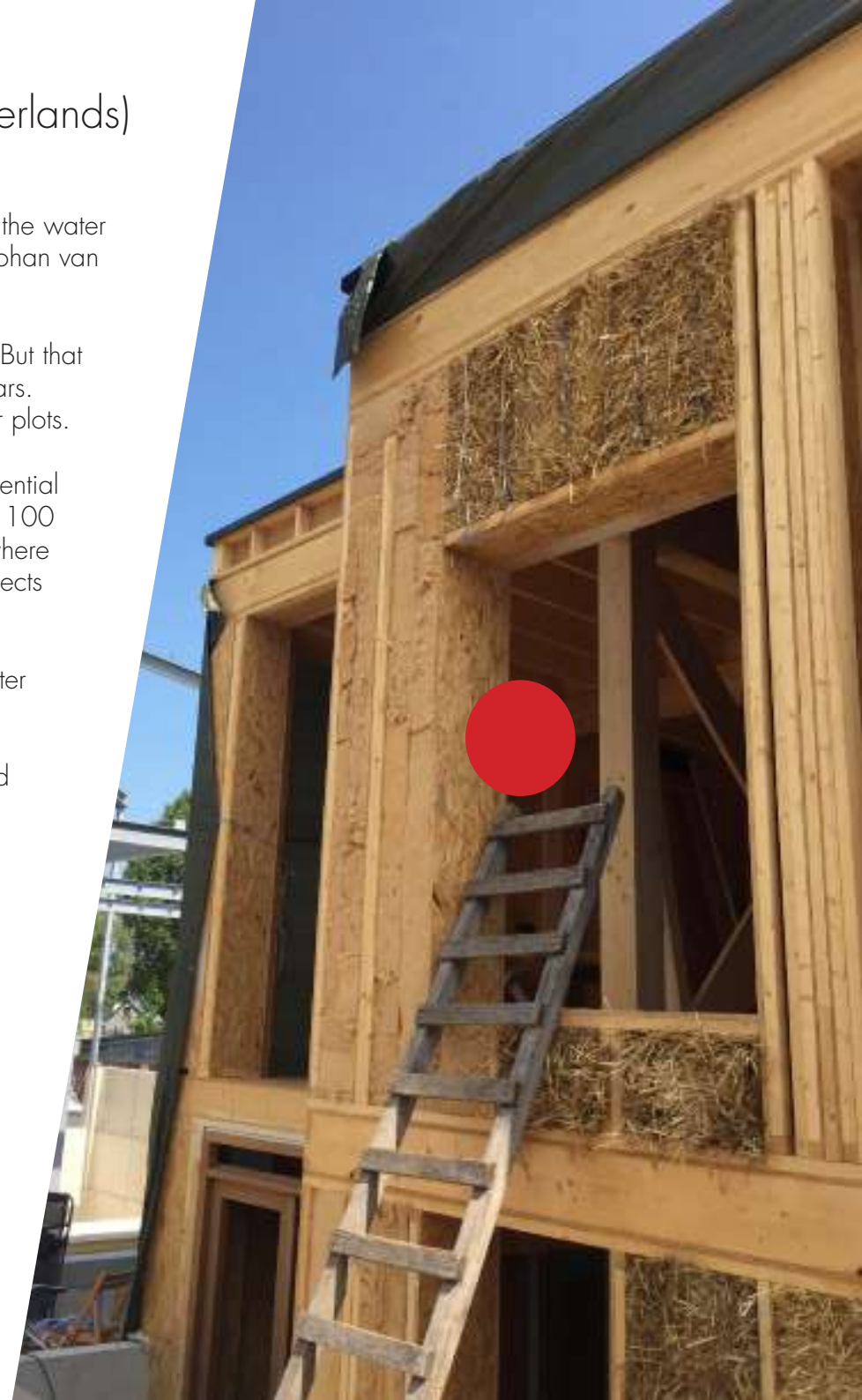
The houses in the floating residential area have a coupled energy system, clean their dirty water and are heated with heat pumps that take their energy out of the canal water.

All the homes are well insulated and there is one which particularly catches the eye. Insulated with straw, it is one of the most durable types.

**schoon
schip**
AMSTERDAM

By Marcel Zwart

More information about this project



08

EXPERIENCE: Maison Feuillette (Montargis, France)

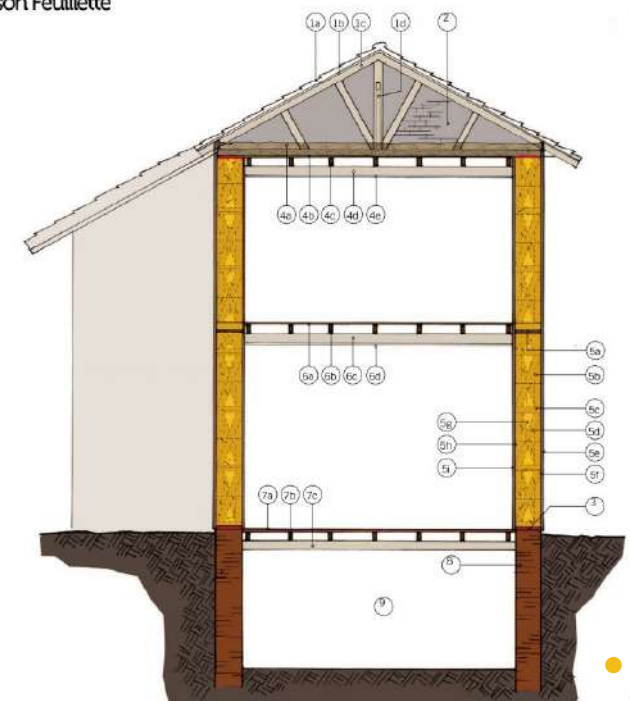
In 2012, the French Construction Straw Network (RFCP) discovered that a rather special house was for sale in Montargis in the Loiret. It is the Feuillette House, named after a prolific engineer, Émile Feuillette. It was a post-war context in 1920 and, because of a shortage of building materials, the Feuillette House was inaugurated on October 11, 1920.

The Feuillette House is made of timber frames and straw in-fill to favour economy and simplicity. The shell is in excellent condition and the two levels are in beautiful oak wood. The frames of the uprights are also in oak, while the frame and the spacer are in pine. The insulation of the house is made with wheat straw, its coefficient is greater than 7. The straw was compressed with a baler and remains in perfect condition. Today, experiments demonstrate that the straw material is intact, thus proving the durability of this bio-based material.

The Feuillette House had four different owners until 2012, before the RFCP decided to acquire it in order to preserve this architectural heritage. Since 2012, the Feuillette House has welcomed many visitors.

Vue en coupe de la maison Feuillette

- 1 Couverture
 - a. tuiles
 - b. liteaux
 - c. ferme
 - d. stabilisateurs au vent
- 2 Pignon en briques
- 3 Carlon goudronné
- 4 Plafond de l'étage
 - a. mélange copeaux et sciure
 - b. parquet en bois massif
 - c. solives
 - d. poutres
 - e. plaques de plâtre armé
- 5 Murs
 - a. lisse haute
 - b. montants
 - c. entretoises horizontales
 - d. contrevents
 - e. enduit extérieur
 - f. grillage
 - g. paille 400 mm
 - h. grillage
 - i. enduit intérieur
- 6 Plancher de l'étage
 - a. parquet en bois massif
 - b. solives
 - c. poutres
 - d. plaques de plâtre armé
- 7 Plancher du rez-de-chaussée
 - a. carreaux ou parquet
 - b. solives
 - c. poutres
- 8 Soubassement et fondation en briques maçonnées
- 9 Cave



The aim was to turn it into a National Centre for Straw Construction that would train people in straw construction, raise awareness about the use of this material, and show the site to the general public. In November 2013, a major campaign of donations and loans helped safeguard the Feuillette House. In June 2014, the National Centre for Straw Construction (CNCP) was inaugurated after some work on the rehabilitation of outdoor spaces and the establishment of regulatory standards in reception and public safety. CNCP organized the 17th National Straw Construction Meetings for professionals and the general public. It also offers Pro-Straw training. In May 2015, the CNCP hosted the 19th National Meeting of Straw Construction, three days of exchanges and working groups.

In August 2015, CNCP prepared the European Meeting of Straw Construction: 18 countries were represented for 6 days, which included visits to buildings, a European panorama of techniques used and various demonstrations. At this time, CNCP-Feuillette became an approved training centre. In October 2015, they organized a professional workshop for 3 days, the aim of which was to create a project for the global development of the site.

Adjacent land will be purchased for the construction of this exemplary building. This space of approximately 300 m² will be the first two-storey building made of straw with a decennial guarantee. It will offer a technical platform, an R & D centre, a library and meeting rooms. The Feuillette House continues to write the history of straw construction in France, as well as in Europe.

Since 2012, CNCP-Feuillette have tried to live up to the architectural heritage represented by the Feuillette house. To do this, they have continued their development of the place and have increased awareness of a large number of straw constructions.

By Fabienne Pasquier



A possibility of valorization of the CNCP-Feuillette site





09 TECHNICAL: Inblown straw (Municipality of Tilburg)

The UP STRAW investment by Tilburg Municipality in the Netherlands was specified with the application of blown in straw. For this renovation project, several straw renovation methods were evaluated. Based on the situation at the Roomley Sports Facility in Tilburg it was decided to select blown-in-straw as the most favourable pilot option. To create a better insight into this relatively new technique, several investigating tests were conducted to learn more about this material and its application.

Blown in straw technique uses regular wheat straw that is cut into particles of maximum 3 cm. This straw must be applied in rigid cavities with a minimal density of 105 kg/m³. It can be used for roofs, floors and outer walls. It can also be used as soundinsulation for inner walls. To create a better view of the practical aspects and limitations of blown in straw, we concluded that several tests should be done:

- Are there difficulties to reach the required density?
- How do regular blow-in machines handle the straw?
- What will be the volume that can be blown in per hour?
- Are there design limitations for the construction that will be insulated?

Schedule:

- 7-03-2018 Construction of test-box
- 4/5-04-2018 Equipment
- 18/19-04-2018 Training
- 17/18/19-05-2018 Testing

Sample construction

Blown in straw is applied in rigid, stable and loadable cavities. For a vertical application and roofs that are steeper than 45 degrees, the maximum height is 3 metres. The maximum width of a cavity is 75 cm. Inspired by the renovation of the Roomley Sports Facility at Tilburg a sample construction has been made with a height and thickness that corresponds with this project. This test box is equipped with two small windows with some internal obstructions around them in order to see the results. The weight / volume of the box is measured to calculate the blown in density. (62.8kg, 0.393m³)

Blown in test

We ordered a pallet with Sonneklee blown-in straw and with the assistance of Ekoplus with an EM320- X-floc machine some tests were done.

Density

After some adjustments and testing the blown-in settings for the EM320 were found and then we could fill the test box with straw. To do some practical testing and measuring, first the density of the blown in straw was determined. The test box was filled in a vertical position, with a hose. After opening the box the result was clearly visible: with equal density and no spots with lower values. We tried to sample the density with a cellulose measuring device but with straw this device was not working. After measuring the weight of the filled sample-box we could calculate the overall density. (42kg for $0.393\text{m}^3 = 107\text{kg}/\text{m}^3$).

In a previous test we tried to fill the sample box with an entrance opening that is not near the top side. With cellulose it is easy to fill the top-side, but with straw this was not successful during the first tests.

Limitations

With the straw and machine settings that were used we recognised that the areas under construction can stay open during the blowing in of the straw. Possibly this is also related to the vertical compression that takes place during the very last seconds of blowing in the straw inside the cavity.

These type of openings under obstructions must be investigated in detail at a later stage, with different types of straw and different settings.

Volume per hour

To find a basic estimate of the volume that can be blown in within an hour, some testing was done at one of the equipment (X-floc) suppliers. A test-box with a volume of 0.1m^3 is filled with blown-in straw with different machines and different settings. To blow in the relatively loose and disconnected straw particles, it is advised to use maximum settings for the volume of air. All the tests were executed with maximum air volume. As expected, the use of additional boosters will give higher performance of the equipment and also higher density of the blown in material.

Test box of 0.1m^3 is filled with straw in 31 seconds.

X-floc machine type	set value air	set value material	valve position	blower	booster	time frame 0.1m^3
M99-DS-PRO	10	7	4,5	2	no	130
M99-DS-PRO	10	7	4,5	2	VS28 (2,8kw)	135
M99-DS-PRO	10	7	9	2	VS28 (2,8kw)	64
EM325/1	10	10	10	3	no	38
EM325/2	10	10	10	3	internal	31

By Wouter Klijn





10 USEFUL LINKS / FURTHER READING

Websites

Website UP STRAW

Website European Straw Building Association (ESBA)

Website Fachverband Strohballenbau Deutschland (DE)

Website Réseau Français de la Construction Paille (FR)

Website Centre National de la Construction Paille (FR)

Website European Straw Bale Gathering 2019 (UK)

Website Straw Bale UK

Further reading

Toolkit and tips straw construction site (FR)

Market research and resources by Barbara Jones (UK)

Dutch and International straw building projects (NL)

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**GEMEENTE TILBURG**

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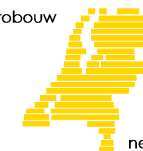
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12 COLOPHON

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08.Project: Maison Feuillette (FR): CNCP-Feuillette

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