Interreg
EUROPEAN UNION
France (Channel Manche) England
CobBauge
European Regional Development Fund

WPT1. Output:

Four optimised cob mixes

From 20 mixes, 4 innovative cob mixes (which will be the best low carbon products) will be designed from local materials (soils and natural fibres). Their enhanced properties will allow them to comply with actual regulation and encourage the take-up of earth construction.
Compressive strength over 2 MPa and thermal conductivity less than 0,7W/m.K will be obtained along with more accurate parameters that reflect the comfort of earth building such as moisture buffer capacity.

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(This output summarises the main points from the T1 Technical report:
Soil and fibre characterisation, mixes choice and mixes characteristics.)

A matrix of six French soils and six UK soils along with six suitable fibres was created in order to establish the 20 mixes.

20 CobBauge mixes listed by formulation.

Mixes type: 1 – 12 Structural, 13 – 14 Insulating

Mix	*Soil*	*Fibre*	*Fibre added mass content (%)*	*Water content (%)*
1	*FR2*	*Hemp straw*	*5*	*25.0*
2	*FR2*	*Hemp straw*	*5*	*28.5*
3	*FR2*	*Hemp straw*	*2.5*	*28.5*
4	*FR2*	*Flax straw*	*2.5*	*28.5*
5	*UK1*	*Flax straw*	*2.5*	*31.4*
6	*UK1*	*Reed*	*2.5*	*29.3*
7	*UK3*	*Flax straw*	*2.5*	*37.0*
8	*UK3*	*Wheat straw*	*5*	*37.0*
9	*FR6*	*Flax straw*	*2.5*	*31.0*
10	*FR6*	*Wheat straw*	*2.5*	*31.0*
11	*FR6*	*Reed*	*2.5*	*31.0*
12	*FR6*	*Wheat straw*	*5*	*31.0*
13	*UK3*	*Hemp shiv*	*50*	*65.6*
14	*UK3*	*Hemp shiv*	*50*	*107.3*
15	*UK3*	*Hemp shiv*	*25*	*107.3*
16	*UK3*	*Reed*	*25*	*107.3*
17	*FR3*	*Reed*	*25*	*131.3*
18	*FR3*	*Hemp shiv*	*25*	*131.3*
19	*UK4*	*Reed*	*25*	*62.1*
20	*UK4*	*Reed*	*50*	*62.1*

From the testing of these 20 mixes, the 4 optimised mixes were chosen.

The first criteria was compressive strength.

Mixes type	Mix	R_{cmax} (Mpa)	$R_{c2\%}$ (Mpa)
Structure	1	3.59	1.11
	2	2.63	1.01
	3	2.07	1.45
	4	1.87	1.50
	5	1.47	0.57
	6	0.76	0.46
	7	1.07	0.97
	8	1.32	0.38
	9	1.39	0.95
	10	1.28	0.77
	11	0.93	0.89
	12	1.21	0.30
Insulation	1	0.39	0.09
	2	0.49	0.14
	3	0.73	0.34
	4	0.28	0.11
	5	0.13	0.08
	6	0.44	0.20
	7	0.47	0.20
	8	/	/

Results show that 5 structural mixes have a compressive strength at 2 % shrinkage greater than 0.9 MPa. So, these mixes can be used to build a R+1 building.

The next criteria was thermal conductivity. This was performed on the 7 most promising thermal mixes.

Mix	λ ($W.m^{-1}.K^{-1}$) *(PU)*	ρ ($kg.m^{-3}$) *(PU)*	λ ($W.m^{-1}.K^{-1}$) *(ESITC)*	ρ ($kg.m^{-3}$) *(ESITC)*
1	0.104	356.0	0.131	441.7
2	0.109	359.0	0.156	494.6
3	0.209	719.4	0.194	677.8
4	0.181	680.9	0.179	688.9
5	0.172	645.0	0.150	627.3
6	0.193	696.2	0.167	592.0
7	0.160	609.2	0.248	830.9
8	/	/	/	/

Results show that thermal conductivity of insulation mixes goes from 0.10 to 0.21 W.m-1.K-1

On the basis all mixes results and the determination of several parameter roles, four optimised mixes have to be chosen. In these four optimised mixes, we choose to have two mixes with UK soil and two mixes with FR soil. To choose the fibre type, fibre availability is one of the criteria.

The four optimised mixes proposed are:

- FR2 soil, 2.5 % of flax straw, plastic state
- FR3 soil, 50 % of reed, liquid state
- UK6 soil, 2.5 % of hemp straw, plastic state
- UK3 soil, 50% of hemp shiv, liquid state