Week3 Zhou Yuhan

A 3 m high and 5 m wide wall consists of long 32 cm 22 cm cross section horizontal bricks (k =0.72 W/m • ° C) separated by 3 cm thick plaster layers (k =0.22 W/m • ° C).
There are also 2 cm thick plaster layers on each side of the brick and a 3-cm-thick rigid foam (k 0. 026 W/m • ° C) on the inner side of the wall The indoor and the outdoor temperatures are 20° C and 10° C, and the convection heat transfer
coefficients on the inner and the outer sides are h1=10 W/m2 • ° C and h2 =25 W/m2 • ° C, respectively.Assuming one-dimensional heat transfer and disregarding
radiation, determine the rate of heat transfer through the wall.

Ri=1/hi*A=1/10*0.25=0.4℃/W
Rf=Lf/Rf*A=0.03/0.026*0.25=4.615℃/W
Rpc1=Rpc2=0.32/0.22*0.015=96.97℃/W
Rb=Lb/Rb*Ab=0.16/0.72*0.22=2.02℃/W
1/Rtot=1/Rpc1+1/Rpc2+1/Rb
Rtot=1/0.516=1.94℃/W
Rp1=Rp2=Lp1/Kp*Ap1=0.02/0.22*0.25=0.363℃/W
R0=1/h0*A=1/40*0.25=0.1℃/W
Rtotal=R1+R0+2Rp1+Rtot+Rf
Rtotal=7.781℃/W
Q=T1-T∞/Rtot=30/7.781=3.86W

When the thickness of brick in this composite wall is 16cm,
Rtotal=6.81℃/W
Q=T1-T∞/Rtot=4.41W

Conclusion:
The heat transfer rate decreased ,after increasing wall thickness. So if we increase the thickness of the brick, the indoor heat can be retained more.

You should solve again the simplified wall calculation procedure replacing the glass fiber one with **urethane rigif foam** and while replacing the fiberboard with **plywood** and find the two R_unit values

Construction		Wood	Insulation
1	Outside surface(24Km/h wind)	0.03	0.03
2	Wood bevel lapped siding	0.14	0.14
3	Poly wood	0.11	0.11
4	Urethane Rigif Foam	No	0.98*90/25=3.528
5	Wood Studs	0.63	No
6	Gypsum Board	0.079	0.079
7	Inside Surface	0.12	0.12

Rwood=0.03+0.14+0.11+0.63+0.079+0.12=1.109(m^2 ℃/W)
Rinsulation=0.03+0.14+0.11+3.528+0.079+0.12=4.007(m^2 ℃/W)