Safe and Sound Housing: A 2nd Year Study Using Rice Byproducts as a Substitute for Adobe in Seismically-Active Regions in Developing Nations

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My project is a second year study using paper and pozzolanic reactions to design a safe, affordable, and environmentally sound building material for seismically active regions in the developing world to use in place of adobe. This year's project is using rice hull ash (RHA) and lime with paper to be a more suitable option for people in developing countries. Blocks also were made of RHA/Lime and blocks made of RHA/lime and rice hull in place of paper. This would eliminate the use of mechanical power in production. The results were that the RHA/Lime Papercrete blocks were lighter than adobe and lime/fly ash papercrete. The compressive strength ranged from .3 MPa to .5 MPa. While this is low, it is sufficient for simple single-storied houses and does meet minimum building strength for structures made of earthen materials in some countries. They also experienced no 'fail' point, meaning they were very ductile. The 1:1 ratio of RHA/Lime blocks had an MPa of .77, but had a high density and they were very brittle, making them an unsuitable replacement to adobe. These were the same problems with RHA/lime RHcrete blocks (blocks made with rice hull in place of paper). RHA/Lime papercrete blocks were fire resistant and had a thermal conductivity level similar to fiberglass insulation. RHA/Lime Papercrete is comprised of 85% waste products, reduces carbon emissions, and would lead to a decrease of fuel burning in houses due to its insulating properties. RHA/Lime Papercrete can be used as a bonding material. Its mortar joint strength is 2/3 of engineered cement. With complete analysis, RHA/Lime Papercrete would be better than adobe in earthquake zones due to its light weight and ductile nature.

Awards Won: