

## Experimenting with Clay 3D Printing Technology to Create an Undulating Facade

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**Abstract :** In recent years, new experimental approaches with the help of the new technology have bridged the gaps between the application of natural materials and creating unconventional forms. Clay has been one of the oldest building materials in all ancient civilizations. The availability and workability of clay have contributed to the widespread application of this material around the world. The aim of this experimental research is to apply the Clay 3D printing technology to create a load bearing and visually dynamic and undulating façade. Creation of different unique pieces is the most significant goal of this research which justifies the application of 3D printing technology instead of the conventional mass industrial production. This study provides an abbreviated overview of the similar cases which have used the Clay 3D printing to generate the corresponding prototypes. The study of these cases also helps in understanding the potential and flexibility of the material and 3D printing machine in developing different forms. In the next step, experimental research carried out by 3D printing of six various options which designed considering the properties of clay as well as the methodology of them being 3D printed. Here, the ratio of water to clay (W/C) has a significant role in the consistency of the material and the workability of the clay. Also, the size of the selected nozzle impacts the shape and the smoothness of the final surface. Moreover, the results of these experiments show the limitations of clay toward forming various slopes. The most notable consequence of having steep slopes in the prototype is an unpredicted collapse which is the result of internal tension in the material. From the six initial design ideas, the final prototype selected with the aim of creating a self-supported component with unique blocks that provides a possibility of installing the insulation system within the component. Apart from being an undulated façade, the presented prototype has the potential to be used as a fence and an interior partition (double-sided). The central shaft also provides a space to run services or insulation in different parts of the wall. In parallel to present the capability and potential of the clay 3D printing technology, this study illustrates the limitations of this system in some certain areas. There are inevitable parameters such as printing speed, temperature, drying speed that need to be considered while printing each piece. Clay 3D printing technology provides the opportunity to create variations and design parametric building components with the application of the most practiced material in the world.

**Keywords :** clay 3D printing, material capability, undulating facade, load bearing facade

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