Modern methods of construction

DEFINITION:

It can be defined as the " the process to produce or construct good quality buildings rapidly with less consumption of resources "

Explanation:

3D PRINTING

INTRODUCTION

3D printing(sometimes referred to asAdditive Manufacturing(AM)) is the computer-controlled layering ofmaterialsto form 3 dimensional shapes. It is particularly useful for prototyping and for the manufacturing of geometrically complex components.

Depending on the technique adopted, printing can produce multiple components simultaneously, can use multiplematerialsand can use multiple colours.

Accuracy can be increased by a high-resolution subtractive process that removes material from an over-sized printed item. Some methods include the use of dissolvablematerialsthat support oscillating features during fabrication.

Materialssuch as metal can be expensive to print, and in this case, it may be more cost-effective to print a mould, and then to use that to create the item. [G1]

CONSTRUCTION INDUSTRY

In theconstruction industry, Construction 3D printingis used to create construction components or to ' print' entire buildings. Construction is well-suited to3D printingas much of the information necessary to create an item will exist as a result of thedesign process, and the industry is already experienced incomputer aided manufacturing.

With the help ofbuilding information modelling(BIM), we can facilitate greater use of3D printing.

Also,[G2]construction 3D printingallows, faster and more accurate construction of complex or modified items as well asit will minimise labour costs and waste. It[G3]also enables us to carry out construction process in harsh or dangerous environments not suitable for a human workforce e. g. cold areas like Alaska and Siberia.[G4]

China has adopted the technique and with the mass movement of population from rural areas to the cities they consider this technique suitable for making cheap houses costing the country (£9700) respectively.

<u>Materials used:</u>

The most common types of materials used by the printers are:

- Recycled plastic
- Bioplastics
- Concrete
- Synthetic stone-like material made of sand and chemicals

Hua Shang Tengda:

Hua Shang Tengdais a Chinese company which has manufactured or printed a two storyvillathat measures about 4, 305 square feet. When put to test the structure was able to retain itself at an earthquake of 8 scales. Moreover, the[G5][MH2(6]house was completely finalised within 45 days.

The company carried out the process in one go rather than making pieces and then assembling them. The process included three printers operated by a software, which is responsible for formulating the ingredients, mixing the concrete, transmission, and to 3D-print the structure. The team first erected the frame of the house, completed with rebar support and plumbing pipes and then the printed started The printer has a sort of bifurcated extruder that simultaneously lays concrete on both sides of the structural material, allowing it up and encasing it securely within the walls.

The concrete used was C30 which weighted approximately 20 tonnes, it[G7]had the desired strength and inexpensive as waste was[G8]also utilised as well as wastes resulted from the process were very[G9]low. The walls of the structure are approx. 8cm thick and is resting firmly on the ground.[G10] [G11]

ADVANTAGES:

The advantages of the system are mentioned as under

TIME EFFICIENT:

3d printers used in construction are very time efficient and a house with the desired strength can be constructed in small time frame.[G12][G13]

CLIENT SATISFACTION:

With this process, it is assumed that the client satisfaction is more as they will be given[G14]a catalogue from which they will be able to choose the structure of their own choice.

ACCESSIBILITY: [G15][G16]

The 3d printers are accessible everywhere even on the moon.[G17]

COST EFFECTIVE:

This process of construction is very cheap as the printers consume the minimal amount of raw materials and waste production is very less.[G18]

NEW SHAPES AND DESIGNS:

The 3d printers can construct different types of structures ranging from curvilinear to rectilinear and from circular to boxed structures.

PRECISION:

With 3d printers, we can achieve more precision as it is a controlled process and is not affected by the environmental conditions.[G19]

ENVIRONMENTAL EFFECT:

It is also assumed environmental friendly as the wastes resulting from the process are less.

DISADVANTAGES:

Some disadvantages are mentioned as:

INITIAL COST AND MAINTENACE COST: [G20][G21]

The printers initial cost is very high and requires a cleaning process after 12 hours of operation.

LIMITED MATERIALS:

The types of materials used in these printers are limited. Some are limited to a single type of material. Also, the printers are unable to deal with reinforcements.[G22]

TRANSPORTATION:

The transportation may sometimes cause problems because of their sizes

RELIABILITY: [G23]

Machines cannot be trusted and a major problem may occur resulting in the delays.

FUTURE:

Currently, there is a research going on at the[G24][G25]University of Southern California which I lead by " Berok Khoshnevis. They are testing a fabrication process called contour crafting. The aim of this research is that all the processes involved in construction are self-automated. Khoshnevis hopes to print a residential building(house) in a single print. It will include conduits for electrical, plumbing, drywall, and insulation. His aims are to achieve the possible results by 2020 for residential buildings and by 2025 for high rise. [G26]

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