

# Chapter 5

## An Overview on 3D Site Modelling in Civil Engineering

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### ABSTRACT

*In past decades, for developing a site, engineers used the process of creating a scale model in order to determine their behaviour and to sketch the details collected manually using the drafting process, which behaves as a referring material during the construction of structures. Due to the boom in technology and limitations in drafting, the drawings have been digitized using computer-aided design (CAD) software as a two-dimensional structure (2D). Currently, these drawings are detailed as a three-dimensional structure (3D) that is briefly noted as 3D modelling. Three-dimensional site modelling is an active area that is involved in research and development of models in several fields that has been originated from the scale modelling. In this chapter, the topic 3D site modelling in civil engineering is discussed. First of all, the basic concepts of scale modelling, architectural modelling, and structural modelling are discussed. Then the concept of virtual-based 3D site modelling, its importance, benefits, and steps involved in site modelling are briefed.*

### INTRODUCTION

As all knows that Shelter is one among the basic needs of people to survive in this world, it leads to the development of shelter in the form of structures that is buildings. The development of buildings deals with the design, construction and maintenance of them which were carried out by the developers or engineers. The engineers usually communicate their ideas through their personalized language named Engineering Graphics. In the ancient history the structures were build by the creation of a scale model as a reference. Scale model is the one which was used to identify the behaviour of the structure initially. After which engineers spend numerous time to draft manual drawing using pencils, drafters, compass, protractors, triangular scales and other drawing devices. Since the hand drawings were time consuming and larger efforts were needed by the engineers to draft, computer program was evolved. In the late twentieth century the evolution of drawing occurred through the usage of computerized software. The

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first and foremost computer program was Computer Aided Drafting and Design software (CADD) which was implemented by the usage of engineering graphics.

CAD system was easier and faster than manual drawing process and also it had capability to reduce the time period for the development of design. It also helped to reduce time consumption and the workload levied by the engineers. Drafting with the software had an advantage in storing the drawing electronically so that viewing; editing could be done directly at any time when it is necessary. Initially the drafting was done two dimensionally (2D) which also had a drawback in communicating. In order to build from the drafted drawing, an engineer must visualise the referral document for the purpose of constructing it which was an error prone area as it was very difficult to interpret the data. Two dimensional models had also drawback in designing. Hence due to these drawbacks the two dimensional models were evolved into a three dimensional model recently (Songer, Dickmann., & Al.Rasheed, 1998) (Zbigniew & Tomasz, 2014). In order to understand the concept of three dimensional models it is necessary to comprehend the basic concepts of models which are going to be discussed in the fore coming topics.

### **SCALE MODEL**

The concept of three dimensional model was progressed from the basics of scale model. To express in simple words, Scale model is nothing but a miniature of an object which maintains exact relationship between all aspects of a model. This scale model usually helps in testing the behaviour or property of original object without directly demonstrating test over the original model. Toy cars, Madurai Meenakshi Amman Temple model, a scale replica model of demolished capitol theatre in Causeway Bay are some of the examples of a scale model. The Toy model in Figure 1 represents an example of a scale model.

Scale models are opted at many fields such as engineering, architecture, film industry, military field etc. Though each field used scale model for different purposes, the physical property and the principle was similar in all such types but the detail functional requirements may vary. To be a perfect scale model, the materials to be used must be the same as that of the original object in accordance to verify its behaviour in the outside world. From this concept several types has been emerged, among which the most important ones in civil engineering field are as follows.

- Architectural Scale Model
- Structural Scale Model

### **ARCHITECTURAL SCALE MODEL**

Architectural model is one of the types of Scale model which was opted by the engineers. It was defined as the physical representation of a structure which was used to communicate design ideas, the aspects of the exterior view and the interior view of a structure. In other words, it is simply known as the miniature of a structure to be built. Models could be created by considering variety of scales depending over the purpose and the needs of the modeller. In the past the architectural scale model was developed using several materials whereas some of the models were produced as a readymade pieces or components such as people figurines, vehicle, furniture, and vegetation etc., Due to the emerging techniques and trends in the current scenario the architectural model could be provided as a rapid prototyping model that



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