

# A Stepped Wise Approach and Barriers towards Implementation of BIM Toolkits of Infrastructure Project in Pakistan

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**Abstract:** Building Information Modeling (BIM) has been playing a vital role in all over the world and got success in the vertical construction field. In Pakistan, so far it has been dominant in showing stepped wise approach for its adoption at each phase of Building projects. After its success in all aspects for vertical construction, BIM started to gain the attention for many researchers about its implementation for infrastructure projects. However, literature review reveals that study of BIM's implementation and its approach is still limited up to buildings only, especially in Pakistan. For this purpose, a stepped wise approach towards BIM's Implementation through collaboration of data by using software (AUTOCAD, GIS, INFRAWORKS-360, NAVISWORKS and BIM-360 DOCS has been proposed. A simple housing colony's infrastructure (Roads & Drainage) is modeled to better represent the capabilities as well as barriers of BIM in adoption for infrastructures in Pakistan. Hence, we believe that this proposed approach provides better way and awareness in Pakistan for acquiring BIM in Infrastructure as for buildings. In addition, the highlighted barriers in its implementation will be helpful for the researchers to make their studies more effective under this scope.

**Keywords:** BIM Toolkits, Stepped wise approach, Barriers, Colony's infrastructure

## I. INTRODUCTION

Building information modeling (BIM) is an intelligent 3D model-based method that gives the tools and software to the professionals of Architecture, structure, Engineering, and construction management at different stage of the project. BIM has been successful to reduce the cost, wastages of materials, time of the project, ensures the more safety, and at the end achieving the maximum and unbelievable efficiency of the project [1]. The Dodge data and Analytics smart market report explores the use of BIM and level of implementation in infrastructure for the four developed countries USA, UK, France and Germany. The majority (87%) of BIM users in the study report that they are receiving positive value from their use of BIM in infrastructure [2]. BIM implementation in Pakistan construction industry increased up to 9.05 % during the period 2016-2017. In 2018 only 11 % of related industry has implemented BIM and only to generate 3D models which is a very limited part of BIM. While in case of infrastructures, only classical software AutoCAD, and CIVIL 3D are being used for designing and 3D modeling [3].

Lots of work and researches about implementation of BIM have been made. Project of buildings their architectural, structural, and MEP design, enabling the early, quick better decision taking, quantity, cost and time estimation before the commencement of projects have been proposed using BIM. So, it already has been a great significance by dealing a project through BIM.

The unification and implementation of BIM in Pakistan is in flow, but the gap of the current BIM implications appears in the infrastructure projects as it at present have been adopting for the workflow and supervision of buildings only. Despite the fact, BIM is facing several barriers in implementation within Pakistan, but this topic is under study of many researchers to meet the gaps [3]. Literature review under the area of concern has shown some benefits and the limitations of BIM in infrastructures. Where in one place the savings and value of the projects have showed to improve while on the other hand the extent to which BIM can be applied to buildings cannot be equally applied to infrastructures projects. The adoption and use of BIM in infrastructure projects are still slow. There was not any study and research about implementation of BIM for infrastructure in Pakistan.

So, a stepped wise approach is missing for the implementation of BIM in infrastructure projects in Pakistan from zero level. Therefore, to come up with a stepped wise approach, a site is selected in the boundaries of Mehran UET. Although this work is limited to a small residential colony, this approach can be taken as a benchmark for infrastructure projects in Pakistan.

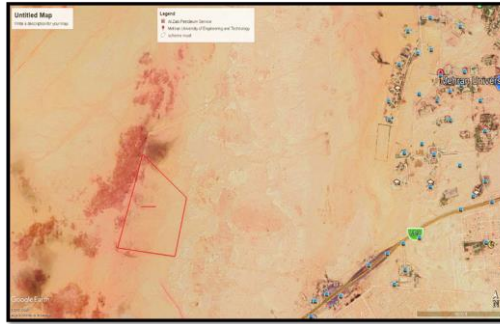


Fig. 1: Site for proposed colony (source: Google Map)

## II. MATERIALS & METHODS

### A. BIM Toolkits for Infrastructures

#### i GIS

ARC-GIS played an important role in BIM. Through GIS, every site in the world could be easily digitized as it gives the geographical information of that particular site. After the digitization of the required site, the SHP files are made with names of respective components involved like roads, buildings at surroundings, topography, environment conditions etc. Showing each detailed information of the site and its surrounding.

#### ii AUTOCAD

It was released in December 1989 as design and draft software application developed by Autodesk. It is being used in Pakistan for buildings, roads and drainage.

#### iii INFRAWORKS-360

Infraworks-360 software supports connected BIM processes, enabling designers and civil engineers to plan and design infrastructure projects in the context of real world [1]. It is the advanced and updated software which has real world design for road networks for societies, highways, urban roads etc. the main advantage of using infra-works is that it designs according to real world context, which enables the designers and site engineers to make better and fast decisions at the time of execution of the project.

### B. WHY INFRAWORKS-360?

The main issue now a days with clients is that they cannot imagine what the final project will look like by just looking at the 2D drawings of the projects. However up-to level best, BIM has solved this problem in case of buildings by providing the 3D real time modeling and visualization of the building projects. Which provides the 100% satisfactory and helps the clients for making better decision [1]. If the level, class, scale, area and cost of the building's projects are compared with infrastructure & colony development projects, obviously the risks, costs and scale of infrastructure projects are high. Infraworks-360 gives the ability to the professionals of AEC industry to quickly design, collaborate and visually communicate the big picture to customers and clients and stakeholders via 3D real world modeling. Infraworks -360 fasters the team collaboration by providing the geographically dispersed teams the ability to review designs intent and provide comment. So that one can access and view design alternatives via a web browser or mobile devices in the field helping to verify conditions.

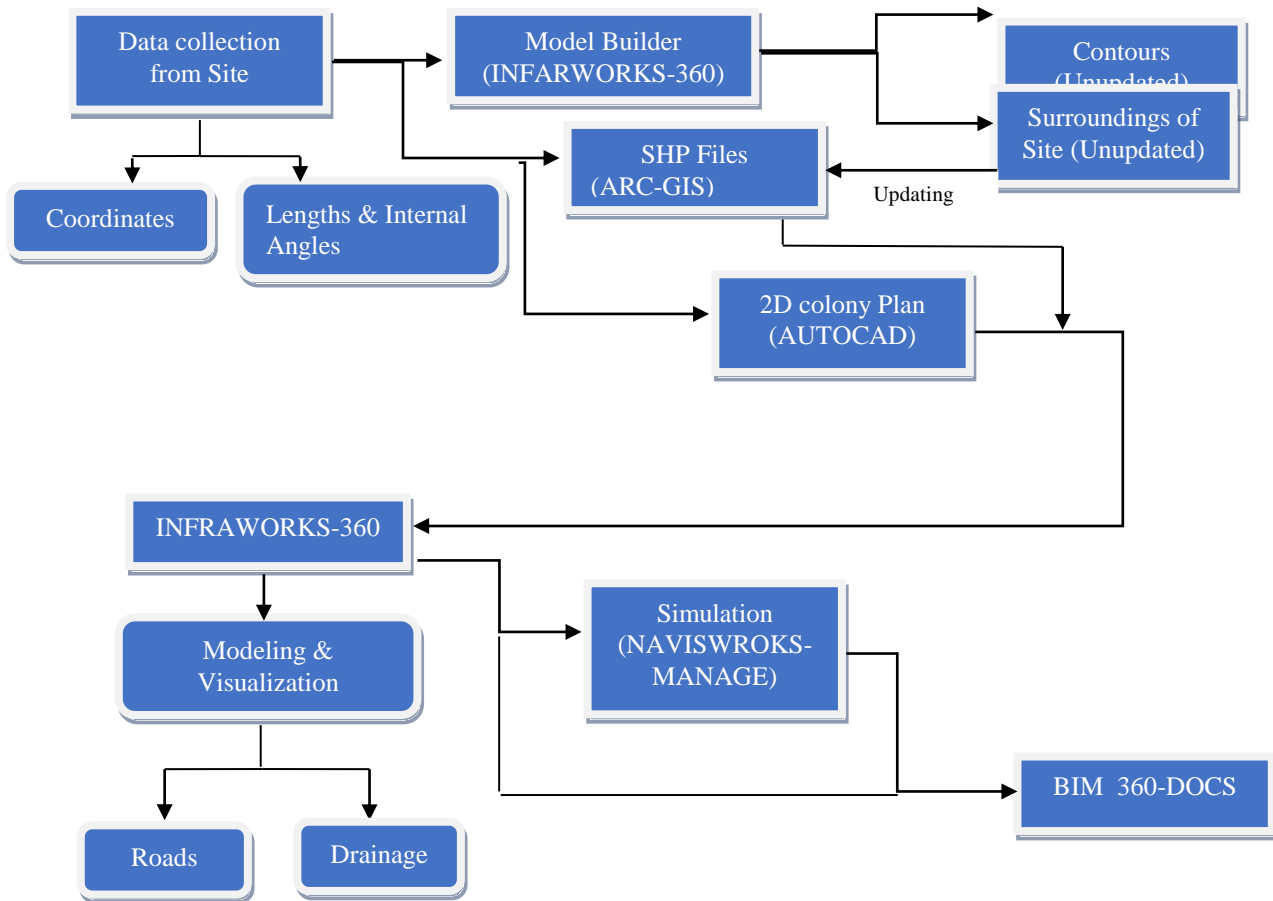
#### i NAVISWORKS MANAGE

It is BIM collaborated software that manage and enable the greater coordination, construction simulation, and whole-project analysis for integrated project review. As construction projects become increasingly complex with many moving parts, it's more important than ever to be able to simulate the flow of the project site from start to finish. The Navisworks manage enable the construction managers to have foresight into their projects before they even begin [1].

#### ii BIM 360-DOCS

It is a great application that sits alongside the other apps in the BIM-360 family. It provides an online service to store and manage all project plans, models and documents [1]. It allows the publishing and viewing features from the design files and models.

C. Methodology



D. Stepped wise Approach

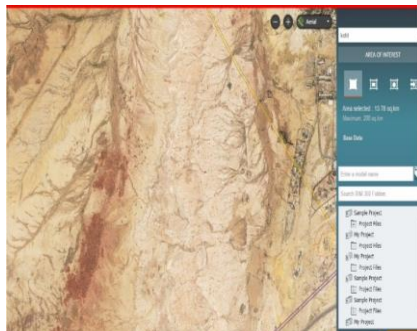


Fig.2 (a): Unupdated Site (Model Builder)

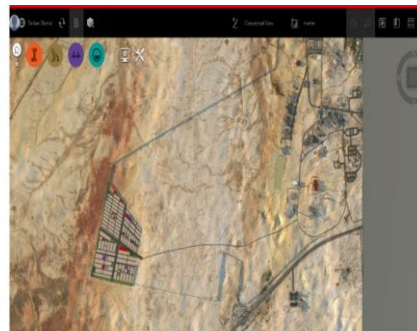


Fig.2 (b): Updated Site (SHP files, CAD Plan)



Fig.3(a): Road Model (INFRAWORKS-360)



Fig.3(b): Drainage Model (INFRAWORKS-360)



Fig. 4:Sight Distance Analysis on Road model (INFRAWORKS-360)



Fig.5 (a) Simulation of Road Model (NAVISWORKS-MANAGE)

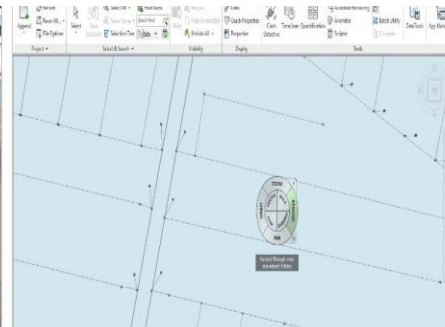


Fig.5 (b) Simulation of Drainage Model (NAVISWORKS-MANAGE)

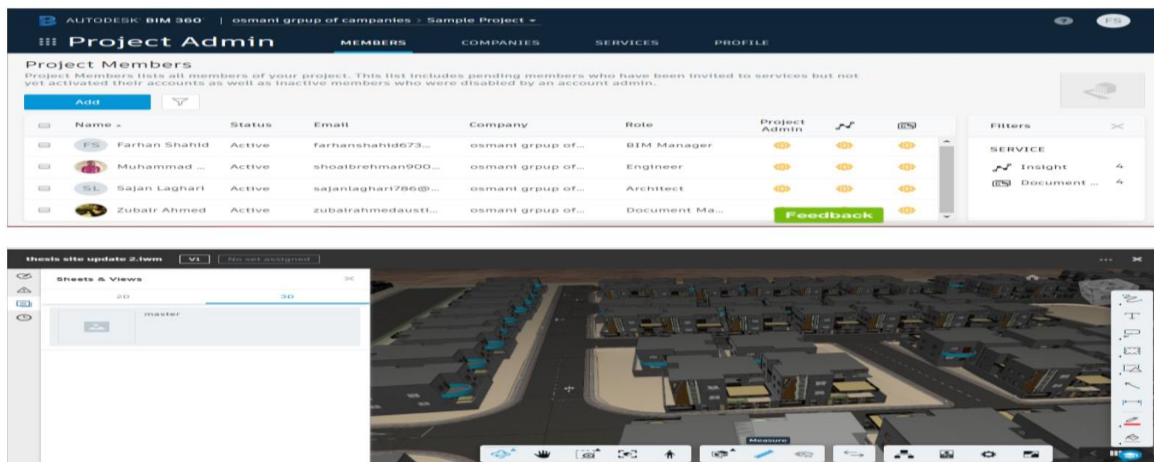


Fig.6: Adding Stakeholders & Sharing of Files (BIM 360 -DOCS)

### III. RESULTS

The coordinates of the site were obtained from surveying to find out the exact location of the site to extract the site contours from the Model builder. The site from the Model builder was not updated so as to update the site, SHP files were used, and the CAD plan of the colony is shifted on the updated site. After updating the site, the geometric parameters of road networks in the model like stopping sight distance , overtaking site sight distance and intersection site distances were analyzed in Infraworks .The modeling of the drainage system was done but to very limited extent . The simulation of the road and drainage network was done in Navisworks Manage by uploading the separated components of roads and drainage. Lastly because of the cloud-based nature of the BIM 360 DOCS, the coordination of Infraworks along with Navisworks-Manage was done to share the files with stakeholders.

### IV. CONCLUSIONS

INFRAWORKS-360 is totally based on the preliminary design of infrastructure. It had different features for the design and analysis of the Infrastructures. The 3D coordinates obtained from Model builder was not as accurate which restricted the

different features of Roads design like profile-based design of road for earthwork quantities and cloud-based traffic simulation along with the automatic drainage design, sizing the drainage network and analyzing the drainage system. The site that was extracted From Infracworks was not updated and ARC GIS was used to do the updating. The unavailability of rainfall content aided the barriers that impeded in the analyses of drainage network.

The barriers that occurred limited this work that it could have done, had the barriers did not occur .However, this stepped wise approach would be helpful when any infrastructure project is done.

## V. RECOMMENDATIONS

The unavailability of the updated data was the main barrier that restricted the use of Infracworks . If the data was updated, then this could have proven to be an effective software and would have helped in different stages of infrastructure project in Pakistan.

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