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# IUCEL 2019

INTERNATIONAL UNIVERSITY CARNIVAL ON E-LEARNING

*“Inspiring Innovations for Sustainable Futures”*

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## **ABOUT IUCEL 2019**

The 2019 edition of International University Carnival on E-Learning (IUCEL) will be held for the first time in the island of Borneo on 21 and 22 August 2019. Universiti Malaysia Sarawak (UNIMAS) is proud to be hosting the event. IUCEL acts as a platform to promote, explore, and share best practices and global expertise in e-Learning applications at all levels of learning institutions from all over the world. This year's theme "*Inspiring Innovations for Sustainable Futures*" signifies the call for future-proof practices and innovations that are impactful to the community at large.

# THE ADOPTION OF BIM 360 AS A CLOUD COLLABORATION PLATFORM FOR METHOD OF DOCUMENTATIONS AND MEASURED DRAWINGS MODULE

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**Highlights:** The Methods of Documentations and Measured Drawings are aimed at preserving the value of heritage buildings. However, the production of drawings and coordination methods still rely on traditional approaches where the workflow is fragmented, hence resulting in issues such as discrepancies, inaccurate drawings, insufficient information, poor means of communications and visualization, redundant work process and dependency on hardcopies. As the current building industry is aligning towards sustainable project delivery, it is vital that an integrated and innovative approach is adopted. This paper will address the highlighted issues by exploring the applications of BIM 360 as cloud-based eLearning platform for coordination of measured drawings.

**Keywords:** Measured Drawings, Cloud Collaboration, Cloud Computing, Common Data Environment (CDE)

## Introduction

Heritage buildings are iconic and symbolize the backgrounds of a nation's identity in both historical and cultural contexts. Mustapa et al. (2005) reported that there are 39000 heritage buildings in Malaysia that were built between 1800 and 1948. To date, a total of 183 buildings have been gazetted as national heritage. Unfortunately these buildings still face threats of defects, negligence and deterioration (Ali et al., 2018; Harun, 2011). In the current architectural conservation study, the process of preserving the values of heritage buildings has been taught in specific modules such as Methods of Documentations and Measured Drawings. However, the production of historical building documentations is still based on traditional 2D approach where the documentation process is conducted manually, using written reports, 2D drawings, photos and sketches (Harun, 2011). This method of documentation is time consuming due to the nature of work which is disparate and fragmented. Furthermore, students are still depending on the traditional approach of coordination by showing drawing progress in paper format. The approach would result in discrepancies where the drawings are not representative and the information associated would encounter issues of unreliability, insufficiency limited means of visualization and communication, redundant work process and high dependency on hardcopies for review and coordination between tutors and students.

In addition, students depend heavily on multiple conventional tools to produce a single set of drawings, for instance AutoCad 2D for 2D drawings and SketchUp 3D for building modelling, where it consumes time and is prone to unreliability (Eastman, 2011; Shafiq, 2013). As the current industry is aligning towards sustainable project delivery such as Building Information Modelling (BIM), it is vital that an integrated and innovative approach is adopted. Hence, the aim of this paper is to address the highlighted issues by exploring the parameters of Autodesk BIM 360 as an e-Learning platform for coordination and review of measured drawings activities. This cloud-based system integrates in real-time, the 2D & 3D drawings as well as the model information in a single platform namely the Common Data Environment (CDE) for efficient coordination and reviewing process among project team members. The findings of the case study had shown significant improvement in supporting the coordination process with high level of accuracy, speed and improved communication. This innovative approach would further enhance the sustainable way of learning in future architectural studies.

## Definition of Collaboration for Revit and BIM 360 Cloud Server

The course requires students to utilize a single software namely Autodesk Revit 2019 as the authoring tool to produce 3D models and drawings of heritage buildings. The built-in functions of the software, namely 'Collaboration in Revit' enables the project team members to concurrently authorize a model in a single and integrated cloud-based server namely Autodesk BIM 360 Team. The cloud platform connects team members as well as the lecturers with direct, real-time chat within project models to reduce dependency of traditional face-to-face coordination and usage of conventional tools such as email and phone.

## Case Study on the Adoption of BIM 360 Team for Measured Drawing Coordination

The measured drawing work production process involves collaboration among students and monitoring by the lecturers. Collaboration among students becomes problematic when coherence and accuracy of 3D building model and drawings authoring fail to keep up with constant amendments and development. Mistakes in information input may occur if students are not able to keep track on the updated status of the 3D building model and drawing development. Students' work progress monitoring by lecturer is not efficient when access to the 3D building model

softcopy is limited due to time and location constraints. Progress review often requires physical drawing printouts which may incur cost and time. Students may not be able to track previous review comments if documentation is not executed properly. The lack of coordination among students and lecturer appears to be the main challenge for effective work production and progress monitoring in measured drawing work production.

As shown in Figure 1, the above issues could be addressed by leveraging the functionalities of Revit's Collaboration and Autodesk BIM 360 inclusion into the current process. Collaboration among students is made possible via Revit's Collaboration tools which allow real-time access to the common data (3D building model and drawings) on a network platform. Autodesk BIM 360 offers the convenience of Cloud Computing by providing the network infrastructure also known as the Common Data Environment (CDE) to store, reload and synchronize the common data efficiently. Furthermore the workflow supports three (3) main elements of drawing coordination namely Collaboration, Coordination/Review and Monitoring. BIM 360 Team grants the lecturer access to the real-time and updated version of the common data for progress monitoring. The Document Management tool in BIM 360 serves as the web interface for coordination and progress review. Lecturers are able to view students' work, provide comments and annotations of 3D building model, and drawings can be made either in co-located or remotely through live review. All these enable students to keep track on the feedback and respond accordingly.

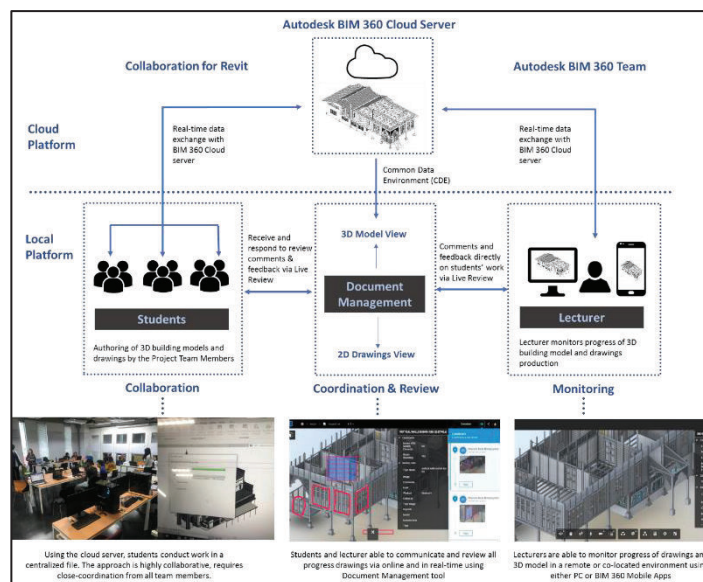


Figure 1. The BIM 360 Workflow for Coordination of Measured Drawings

### The Benefits of Cloud Collaboration for Coordination of Measured Drawings

Further to the applied case study, a preliminary survey was conducted with 20 students and lecturers actively involved in the measured drawing process to further assess the potential benefits of BIM 360 workflow for efficient drawing and model collaboration. Respondents are required to rate based on scale of agreement from '1' to least agreed and '5' to most agreed and the results are displayed in Table 1 below.

Table 1: Advantages of BIM 360 Cloud Collaboration for Measured Drawings.

Benefit Factors	Results	
	Mean (M)	Rank (R)
Improved time efficiency and speed	4.52	1
Enhanced and effective communication among team members	4.33	2
Improved drawing and model visualization for coordination purposes	4.31	3
Enhanced quality of drawings and model	4.22	4
High potential to reduce risks of errors/discrepancies in drawings and model	4.18	5
Centralized and integrated information	4.12	6
Improved understanding of project	4.07	7

### Conclusion and Recommendations

Considered as a rapid emerging technology, Cloud-BIM based computing has become a new research area in architecture, engineering and construction (AEC) industry since year 2010 (Afsari, 2016). In Malaysia, efforts have been

made to spearhead BIM-based collaboration to Level 2 by year 2020 (CIDB, 2017). Hence, to keep up with the upcoming trend it is essential that this sustainable approach to project delivery be adopted especially within the architectural conservation education as currently, the industry is still facing numerous challenges to adapt new technologies into its practices. The cloud collaboration process will provide significant impact as a powerful tool in transforming the fragmented method of collaboration into an efficient and highly integrated workflow to support the process of teaching and learning in the near future.

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