

Digital Earth in a transformed Society

3D BUILDING MODELLING RECONSTRUCTION FOR SUSTAINABLE SAFEGUARDING NATIVE MALAY URBAN ARCHITECTURAL IN MALAYSIA



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INTRODUCTION

- The SDG 11.4 is strengthening effort to protect and safeguard the worlds cultural heritage including the native architecture that formed a nation traditional cities that still remains in this country.
- The documentation methods through the 3D model reconstruction become essential in regards to preserve and conserve a documentation system for heritage conservation for this country (Abdullah et al, 2018; Aicardi et al, 2018 and Camparano et, al, 2016) – since the building material is consider fragile (woods and bamboo).

INTRODUCTION

- The geospatial approach in heritage conservation especially in major context of architecture such cities is not well explored in this country.
- Three dimensional (henceforth 3D) virtual models are an excellent way to introducing these cities to people (additional usage of drone and TLS technology).

OBJECTIVE

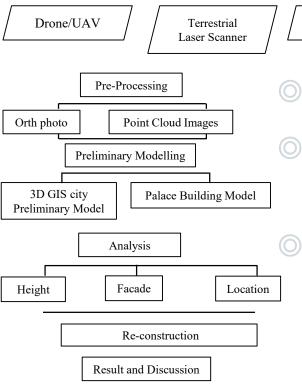
- The objective of this paper is to reconstruct a native Malay cities based on urban traditional urban form using 3D GIS Modeling.
- This work a part of massive grant of Malay architecture research awarded by Ministry of higher Education Malaysia (MOHE). To formulate the Malay Architecture principles in modern development in Malaysia.
- Resulting virtual models can be used for documentation and preservation of cultural heritage for this country.

STUDY AREA

Old traditional malay settlement located Kota Bharu (East Part of Peninsula Malaysia) to be reconstructed in 3D modeling based on urban form (building) rules.



METHODOLOGY



Spatial Data / Historical Data /

- Four (4) main process in getting reconstructed.
- Data collection primary data collection using drones and terrestrial laser scanning.
 - We used Multirotor Phantom 4 specification (RGB camera) and Leica P40 (Nikon SLR D3000 digital camera) Agisoft, cyclone 9.1.6, Revit and ArcGis

Methods

- The flight planning for drones have been designed to capture aerial photo that were then has been through the preprocessing process for obtaining orthophoto (The specific parameters on altitude (80m), 45°camera, 70/80 overlaps).
- Terrestrial laser scanning was used to obtain the specific data for the building in the cities and 3D mapping from drone purposely for city in overall.
- 3 rules/aspects of building analyzed for the base of 3D modeling processing.

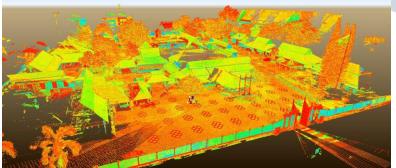




Methods

- The cloud point data then were being processed and transfer to revit software to become structure of 3D for the building in order to identify façade in detail.
- The interoperability data of orthophoto and cloud point have been conducted in GIS software whereby both datas combined in order to further process the analysis.
- The reconstruction (texturing and rendering) and further furnishing was conducted in GIS - city engine



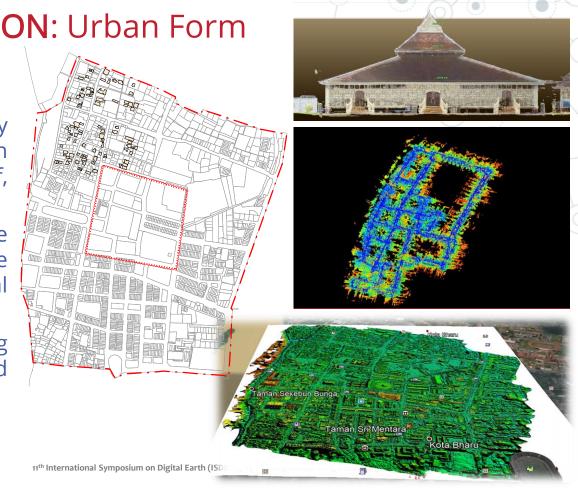




RESULT AND DISCUSSION: Urban Form

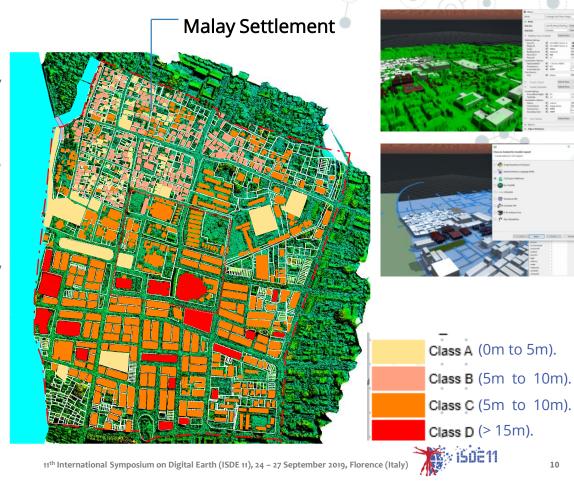
1. Location

- The location of malay settlement based on "perabung design" roof, wall and window design
- 60++ are remains the traditional Malay architecture design (palace, communal and shops).
- Two types of building arrangement; organic and grid pattern.



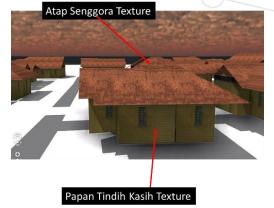
2. Height

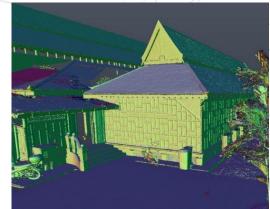
- The building height for malay settlement and historical building (Royal palaces, mosque and royal building) was between 0 meters to 10 meters. (Class A & B).
- Most of the building height in Class represent by commercial building and building apartment non malay settlement

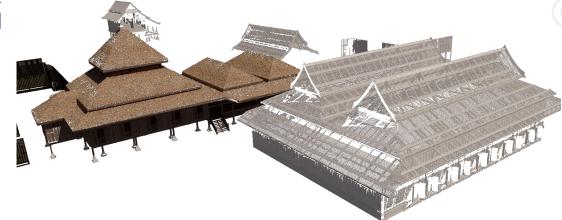


3. facade

- Based on roof, wall and windows
- Most of Roof pattern shows the Malay design identified existed since 1840.
- The malay wall (Janda berhias) and window patterns also have been identified based on cloud point analysis in revit.





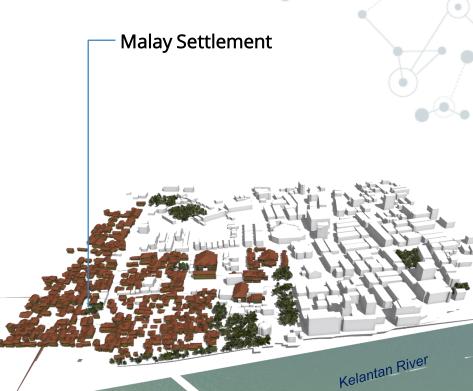




RESULT AND DISCUSSION: 3D Reconstruction

- Reconstruction resulted based on evaluation criteria of building rules shows that there are pattern of native Malays architectures.
- Both geometric and radiometric parameters were corrected for reaching the most optimal result.
- The based information from drone and TLS are essential in reconstructing the whole cities and specific pattern on building.

Level of detail (Lod) 3 has been obtained for this model.



Cont.....





3D block Massing for study Area (specific for Malay settlement – left side)



- The result represent most of the external features of facades and roofs of each building.
- Solution

 In a settlement are visually aesthetic and geometrically accurate.
- The digital reconstruction this study requires data collected at ground and processing with high manual workload- resulting 3D models comparatively much more detailed than traditional methods.

CONCLUSION

- Based on result of three building rules/aspects shows that the elements of urban form based on building aspects has been proven a part of basic fundamental to recognize the pattern of native malay urban architectural and its clearly proven through the 3D GIS modeling reconstruction that has been performed.
- The geospatial technologies (3D modeling and technologies in data collections) are important in ensure a speedy process of getting result in safeguarding heritage conservation in Malaysia.

