GLOBAL HERITAGE CONSULTANCY SDN. BHD.

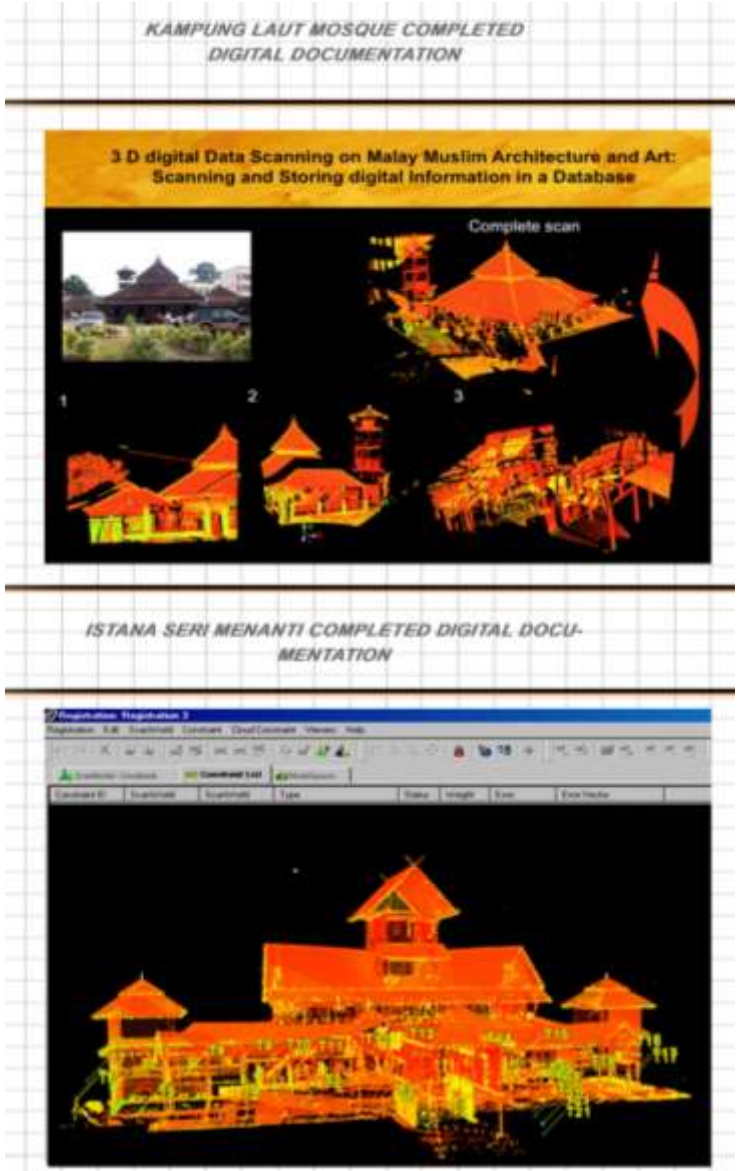
"digital solution & visualization for sustainable cultural preservation"

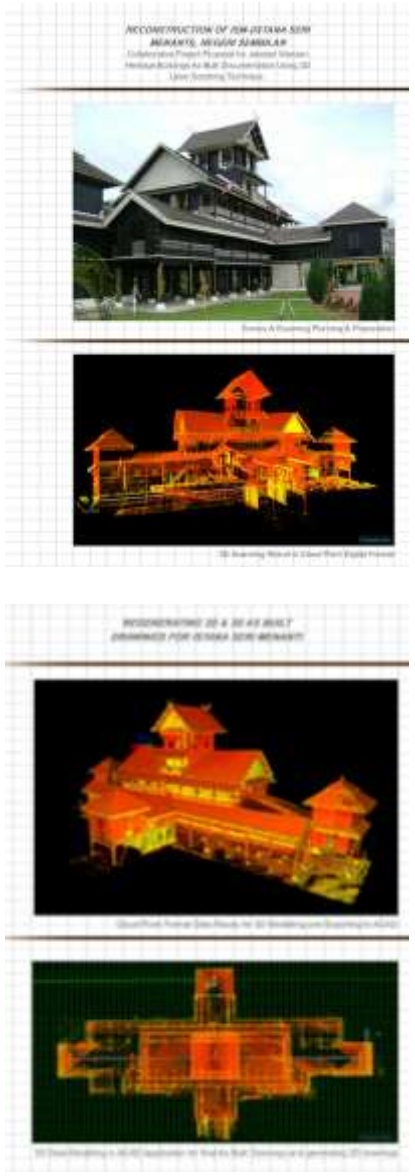
Application of 3D Laser Scanning and Digital Tools in Preparing Conservation Management Plan Report for Masjid Negara Kuala Lumpur

INTRODUCING GHC

GHC SERVICES:

- **3D TERRESTRIAL LASER SCANNING (DIGITAL HERITAGE DOCUMENTATION)**
- **BUILDING INFORMATION MODELLING (BIM)**
- **BUILDING AUDIT & ASSESSMENT**
- **DIGITAL REPLICATION & 3D PRINTING**
- **DRONE & VIDEOGRAPHY**

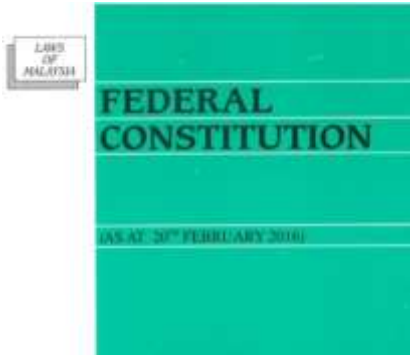




RELEVANT LAWS AND REGULATIONS FOR HERITAGE

1. FEDERAL CONSTITUITION 1957
2. UNESCO - CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE -1972 (Malaya/Malaysia UNESCO member since 1958)
3. COPYRIGHT ACT 1987 (Act 332)
4. NATIONAL HERITAGE ACT 2005 (Act 645)
5. LOCAL AUTHORITIES, ETC.

Source: IHCS 2016



UNDANG-UNDANG MALAYSIA

VERSI ATAS TALIAN TEKS
CETAKAN SEMULA YANG KEMAS KINI

Akta 332

AKTA HAK CIPTA 1987

Sebagaimana pada 1 Julai 2012

LAWS OF MALAYSIA

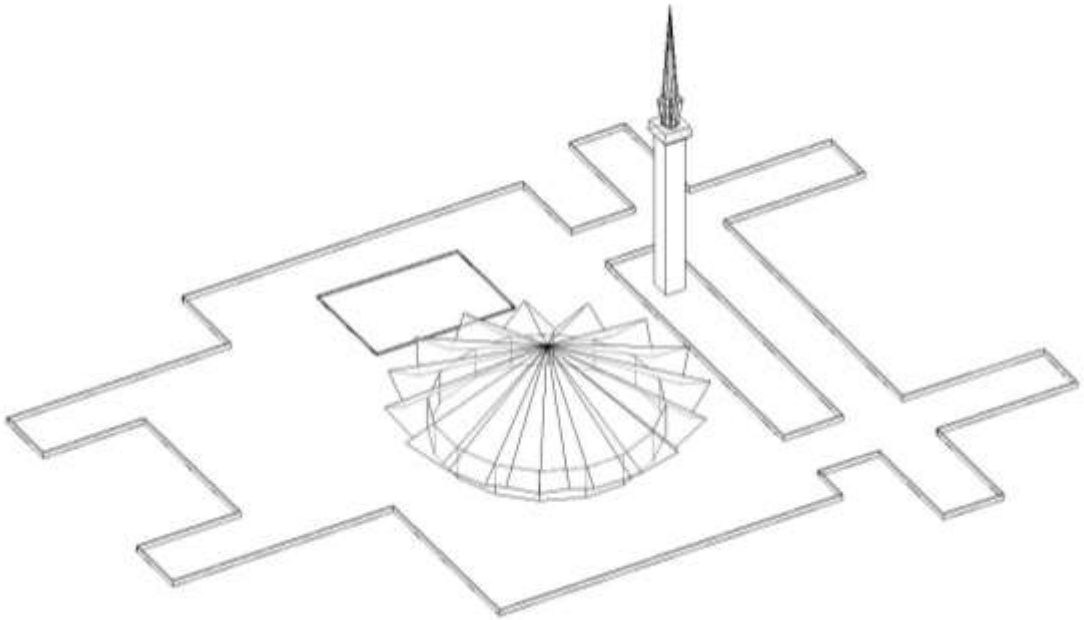
REPRINT

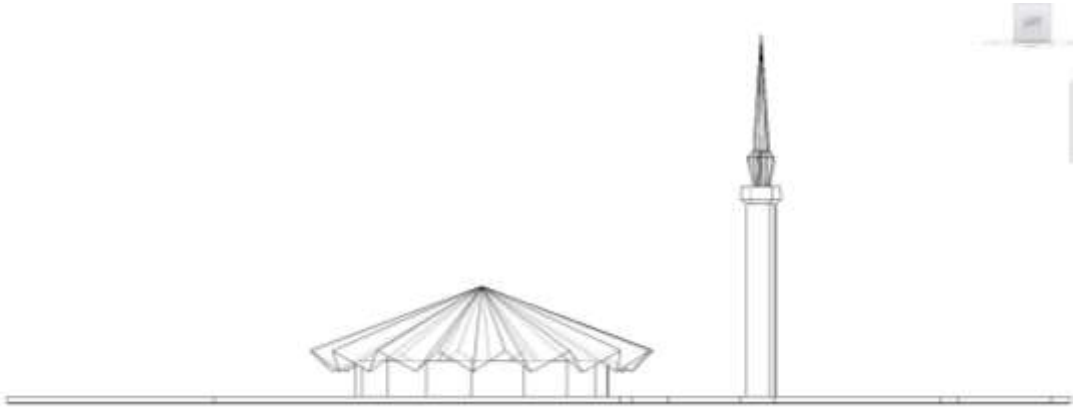
Act 645

NATIONAL HERITAGE ACT 2005

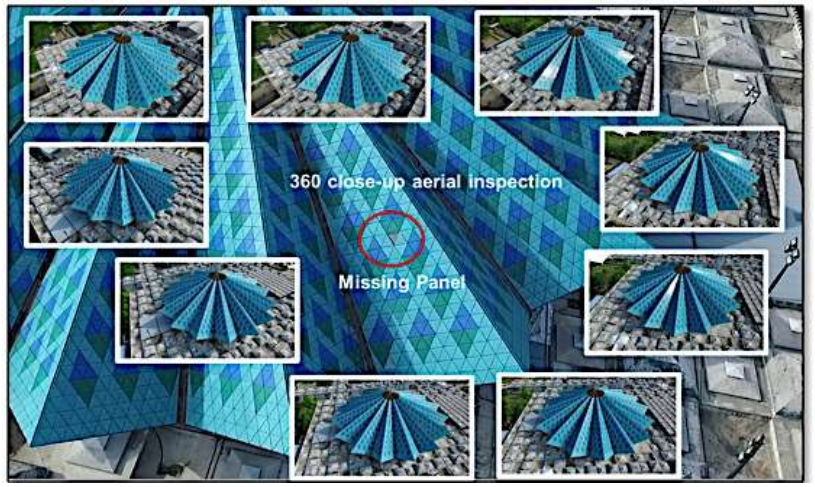
Incorporating all amendments up to 1 June 2006

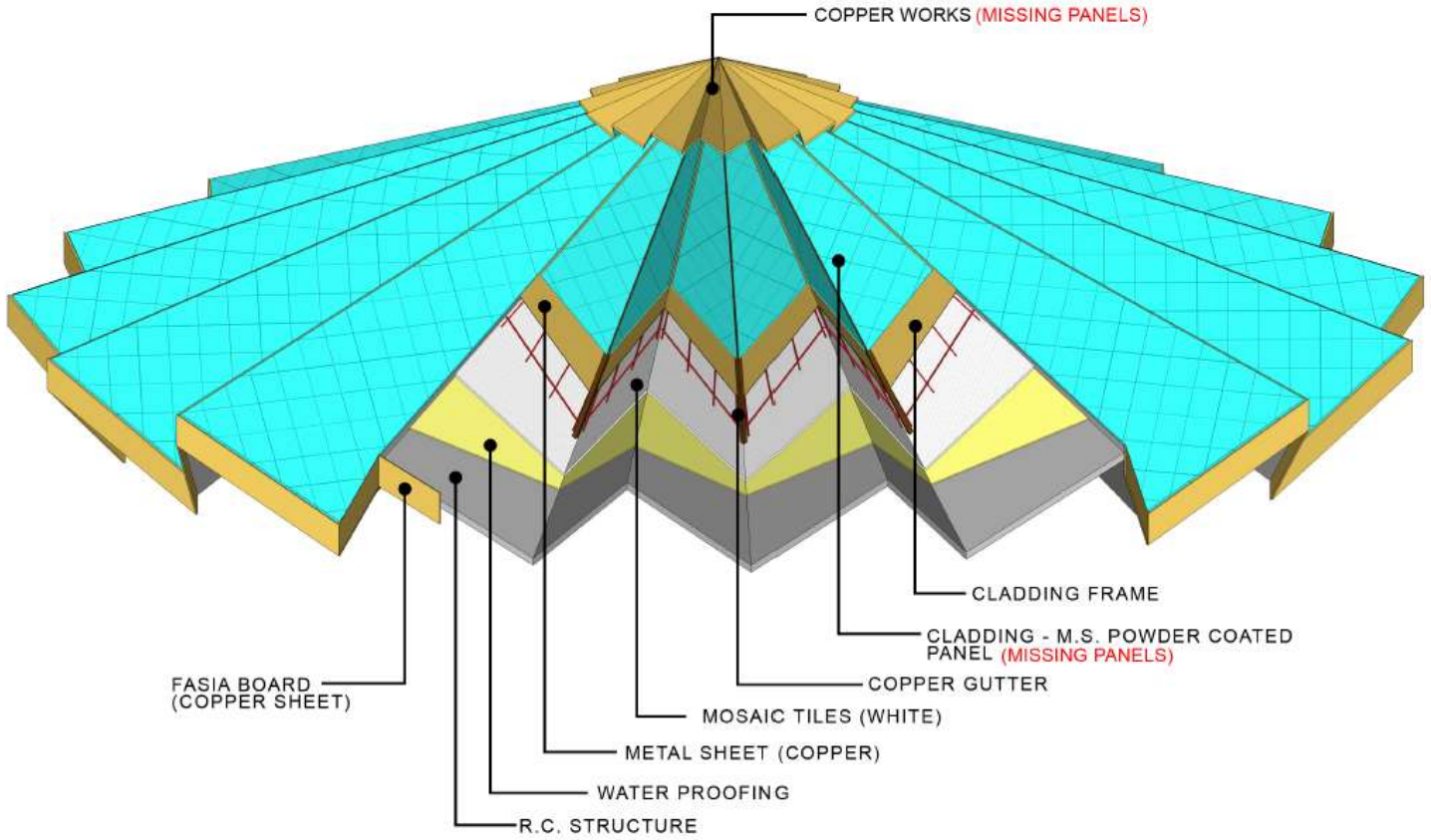
POINTCLOUD TO 3D MODEL FOR BIM





APPLICATION OF DRONE TO ASSESS AND RECORDING OF EXISTING CONDITION OF MASJID NEGARA

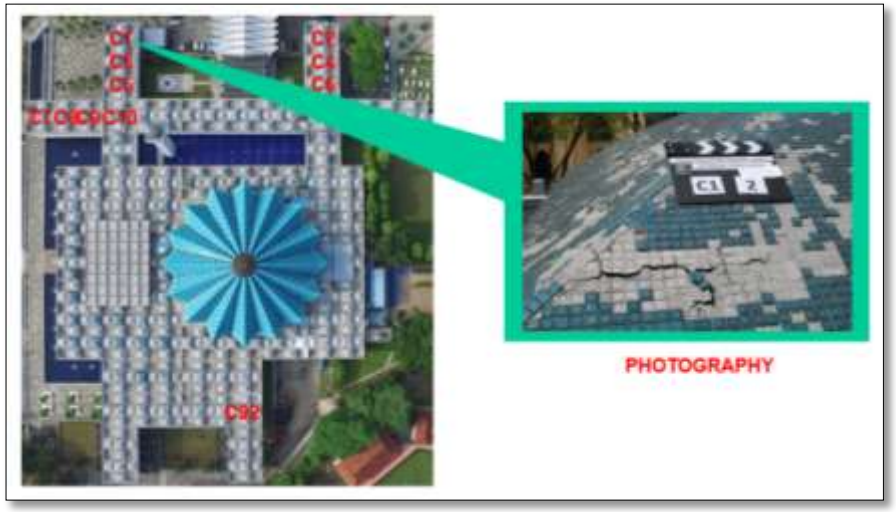


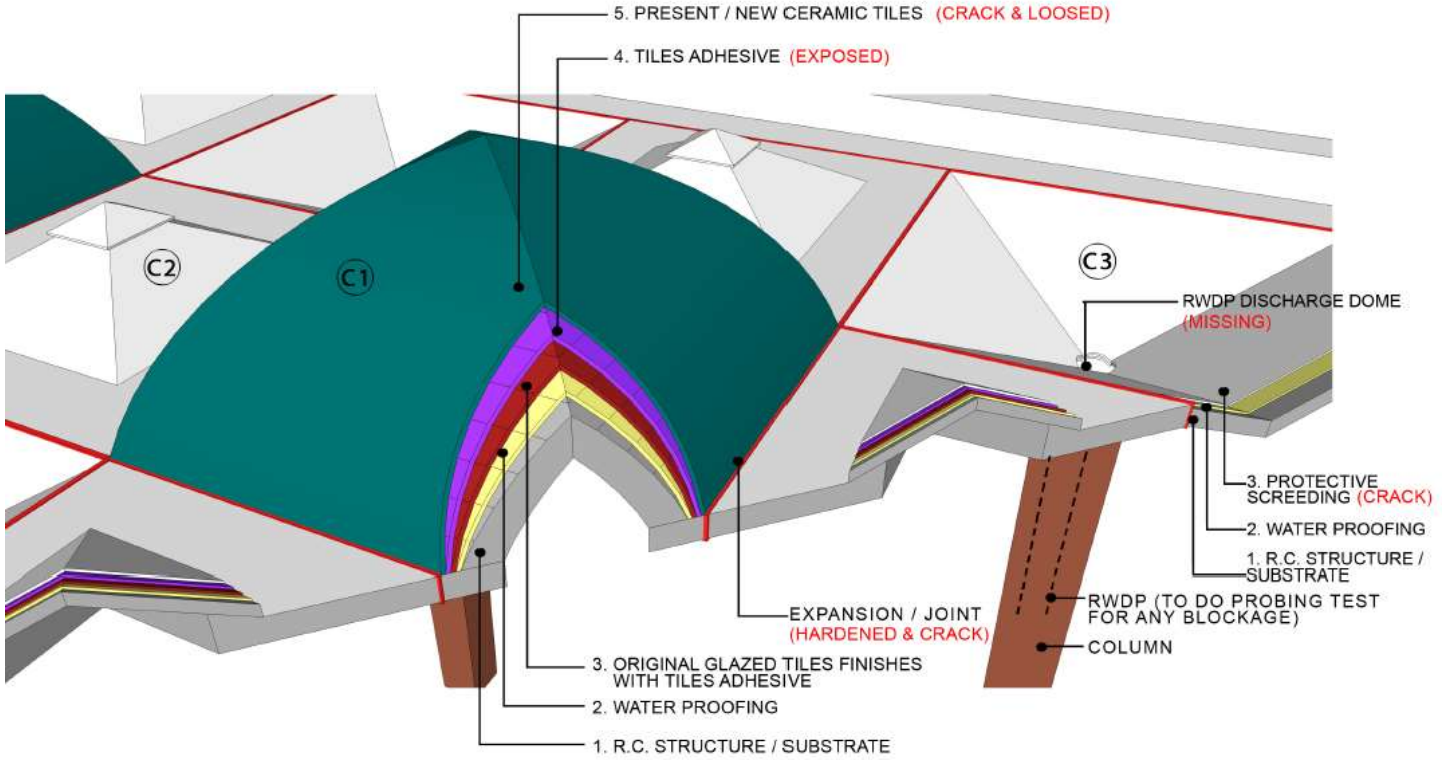


TYPE A MAIN DOME - EXISTING CONDITION

ARKITEK M AZAHARI

APPLICATION OF DRONE TO ASSESS AND RECORDING OF EXISTING CONDITION OF MASJID NEGARA





TYPE C1 & C3 - EXISTING CONDITION/DEFECTS

ARKITEK M AZAHARI

HERITAGE ACT 2005

(Chapter 5 : *Conservation area and conservation management plan*

Pelan pengurusan pemuliharaan

46. (1) Pesuruhjaya hendaklah, selepas berunding dengan Majlis, menyediakan suatu pelan pengurusan pemuliharaan bagi maksud—

(a) menggalakkan pemuliharaan, pemeliharaan, pemulihan, pembaikpulihan atau pembinaan semula suatu tapak warisan;

(b) memastikan pengurusan wajar sesuatu tapak warisan termasuk penggunaan dan pembangunan semua bangunan dan tanah dalam tapak warisan itu dan pemeliharaan persekitaran termasuk langkah-langkah memperelok persekitaran hidup dari segi fizikal, perhubungan, kesejahteraan sosio-ekonomi, pengurusan lalu lintas dan penggalakan pertumbuhan ekonomi; dan

(c) menggalakkan skim bagi pendidikan, atau bagi bantuan praktikal dan kewangan kepada, pemunya dan penduduk, dan bagi penglibatan masyarakat dalam membuat keputusan.

46. Conservation management plan

(1) The Commissioner shall, in consultation with the Council, prepare a conservation management plan for the purposes of—

(a) promoting the conservation, preservation, rehabilitation, restoration or reconstruction of a heritage site;

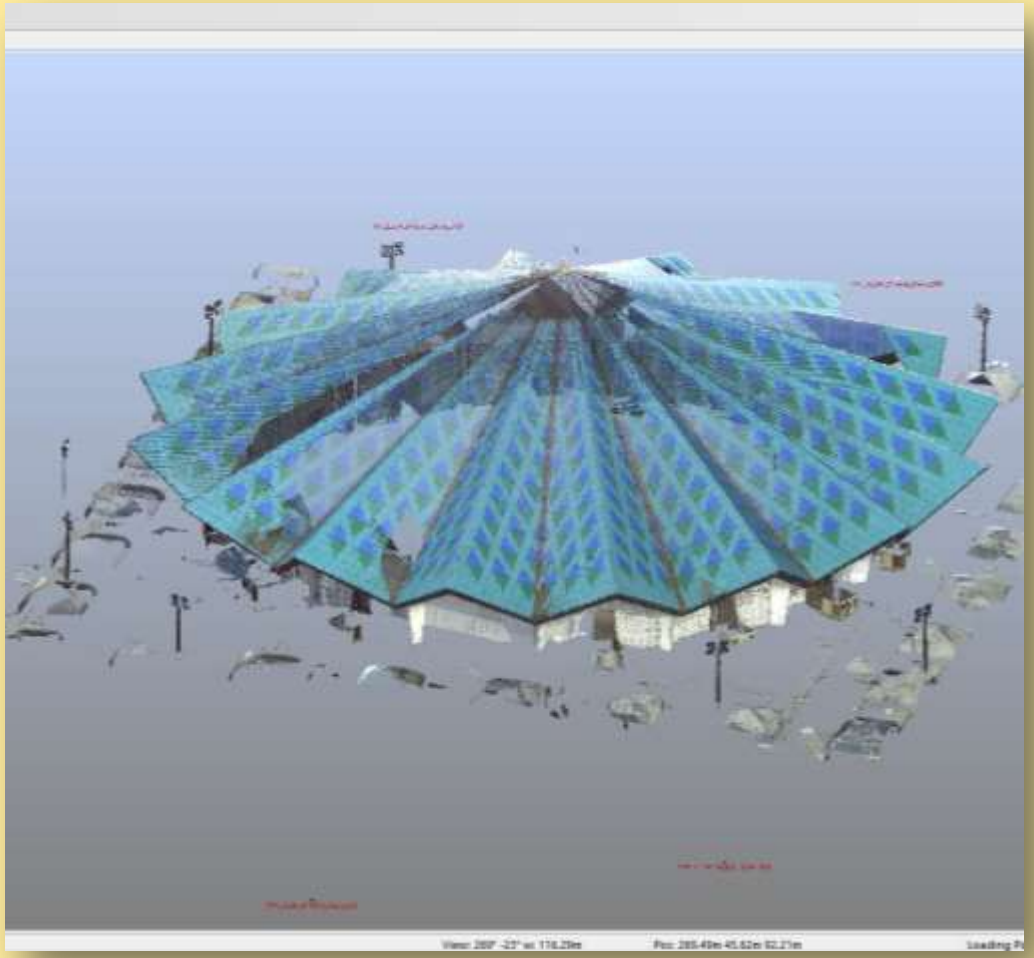
b) ensuring the proper management of a heritage site including the use and development of all buildings and lands in the heritage site and the preservation of the environment including measures for the improvement of the physical living environment, communications, socio-economic well being, the management of traffic and the promotion of economic growth; and

(c) promoting schemes for the education of, or for practical and financial assistance to, owners and occupiers, and for community involvement in decision making.

HERITAGE ACT 2005

Nos	Phases	Methodology/ Technology	Deliverables
1	Reconnaissance Survey	a. Field survey of existing condition of the building	• Determine scope of work and extent of repair • Determine suitable methods/ techniques employed
		b. Visual documentation	• Aerial photography and videography using drone • Identification of roof parts and elements (Figure)
2	Dilapidation Survey	a. Manual tagging and indexing	Tagging of each roof element (Figure)
		b. Photography (Figure) and videography (Figure)	• Documentation of existing condition of building • Identification of extent of damage and repair required
		c. 3D laser scanning: non-intrusive, efficient and accurate	• 3D documentation of existing building • As-built drawing (HABS 1)
3	Forensic Investigation	a. On-site test:	Technical Report
		i. Ground Penetrating Radar (GPR) (Figure)	Forensic report on the condition of rainwater downpipes
		ii. Infrared Thermography (Figure)	Forensic report on the heating and cooling cycles of the building fabric.
		b. Off-site/ Laboratory Tests	Technical Report
		i. i. Petrography Test	• Conservation work method statement. • Proposed restoration treatment of the roof.
		ii. X-Ray Fluorescence Test	
		iii. X-Ray Diffraction Test	

DEFINING BEST PRACTICE IN APPLICATION OF DIGITAL TOOLS AND 3D LASER SCANNING FOR HERITAGE DOCUMENTATION



“Burra Charter (2013) states that the fundamental need of any conservation project is to understand the object and gather as much data about its physical condition prior to any action and intervention that might change the object (Hassani 2013).”

BIM WORKFLOW

Scanning Process
Using FARO Focus 3D X130 Laser Scanner System

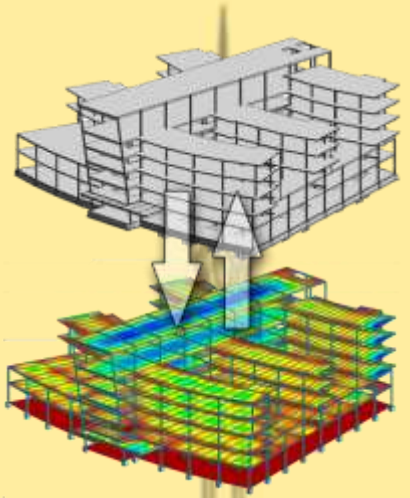
FARO SCENE

Merge/ Registration
Scene 6.0 (.fls/.lsporj)

VirtuSurv

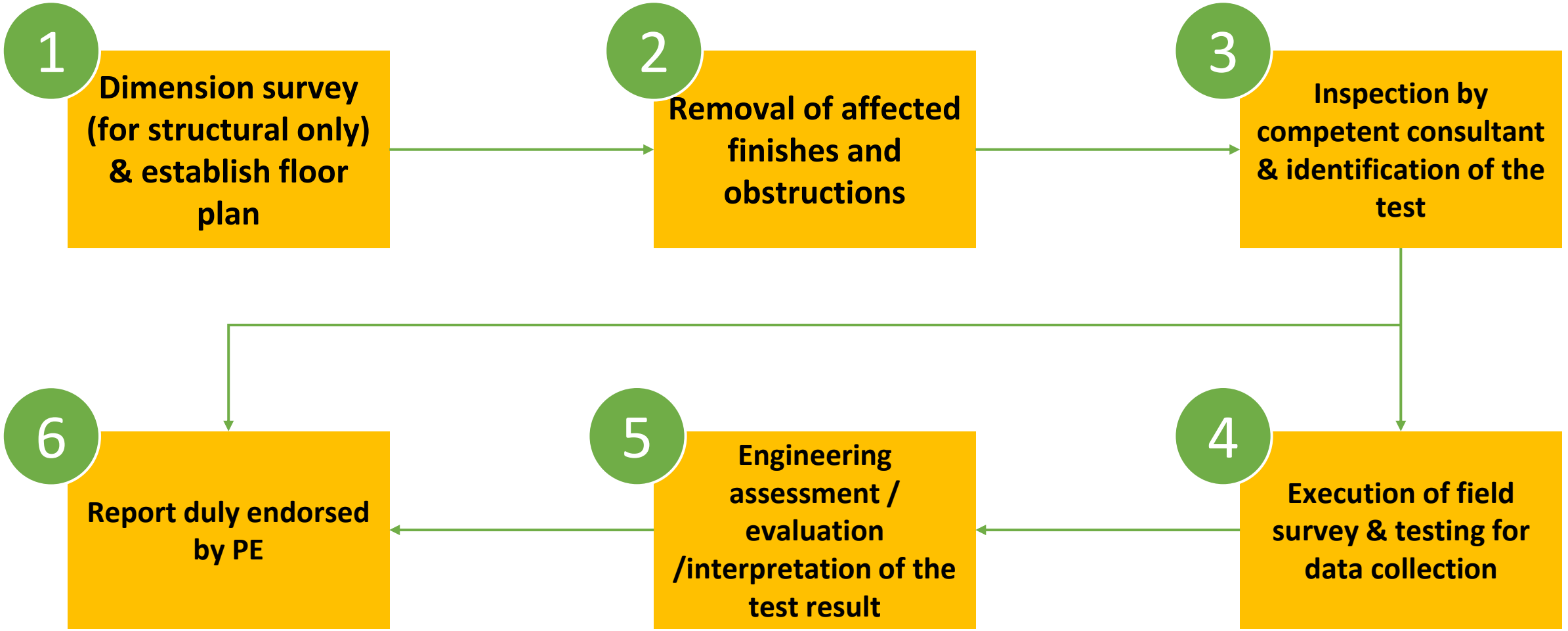
AUTODESK REVIT
AUTODESK AUTOCAD

Processing Modelling
Pointsense for Revit
Pointsense for Building (AutoCAD) and VirtuSurv



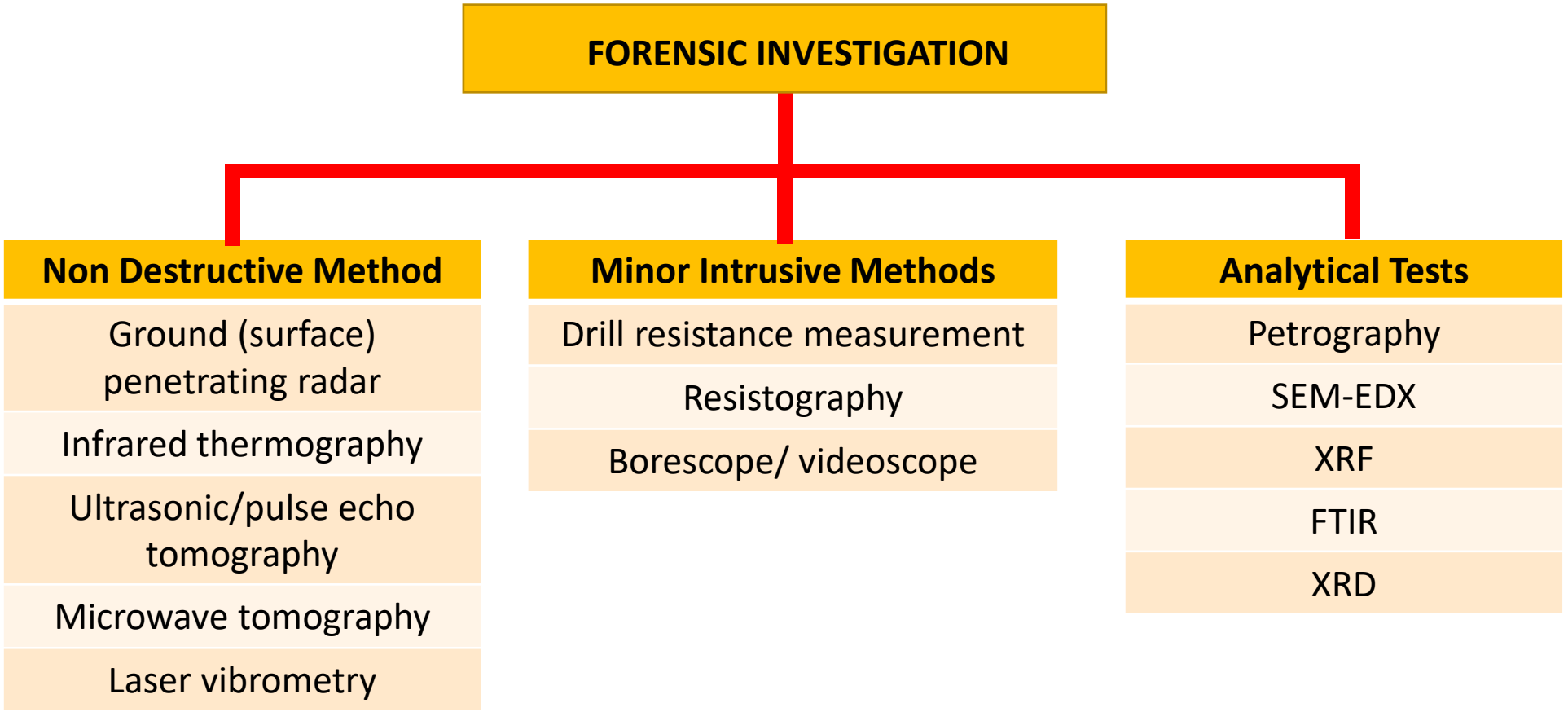
BIM
Building Information Modelling

FORENSIC INVESTIGATION WORKFLOW (STRUCTURE ONLY)



EMERGING TECHNOLOGIES AND DIGITAL TOOLS

Making the invisible visible



Equipment for Non Destructive Method

Infrared Thermography

Ground penetrating Rada detection using StructureScan Mini

PROFOMETER 5 COVER METER – Device to find location of rebar, measurement of concrete cover and bar diameters

ULTRASONIC THICKNESS GAUGE - measuring instrument of a material's thickness using ultrasonic waves

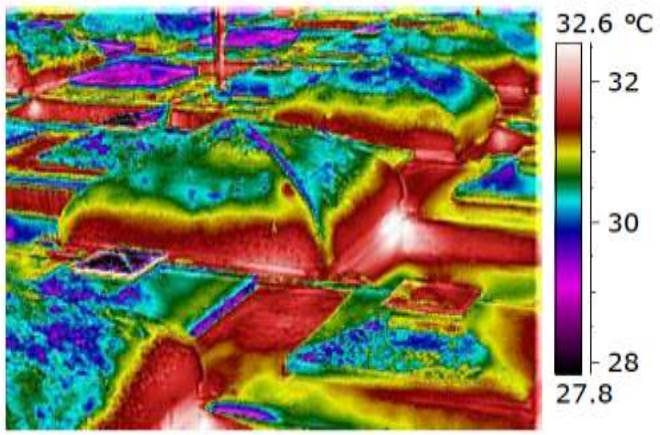
Equipment for Minor Intrusive Method

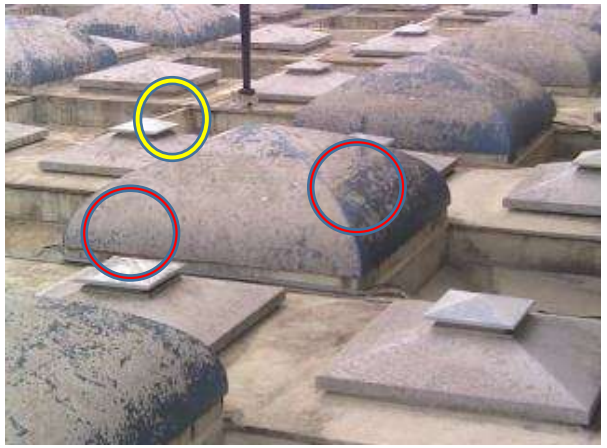
Borescope/
Videoscope

DRMS Cordless (Drilling Resistance Measurement System- measures the force needed for drilling and the position of the bit during drilling

FORENSIC TEST

Infrared Thermography





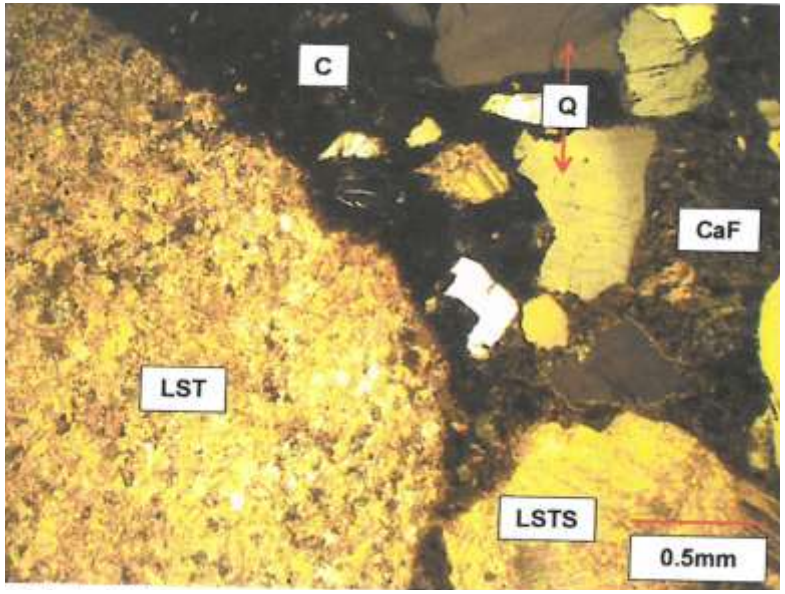
Sample of thermograms showing the observations made at the dome to capture both the heating and cooling cycles of the building fabric.

cold spots (red) are indication of trapped moisture, whilst the hot spot (yellow) are signs of delamination or subsurface void.

FORENSIC TEST

Analytical Test : Petrography Test

Petrographic testing is the use of microscopes to examine samples of rock or concrete to determine their mineralogical and chemical characteristics.



3.	SAMPLE C-53-1 (Concrete)				
	Limestone-dolomite fragment, quartz, calcite, very fine-grained calcite, gypsum, illite	NIL	NIL	NIL, no crack observed	In general, the limestone fragment and quartz grains are from fresh sources, most probably from limestone and granite quarries.

CONCLUSION:

Output & Specification

3D TERRESTRIAL LASER SCANNING

Purpose

CAPTURE EXISTING CONDITIONS

of a building or/and environment

Equipment

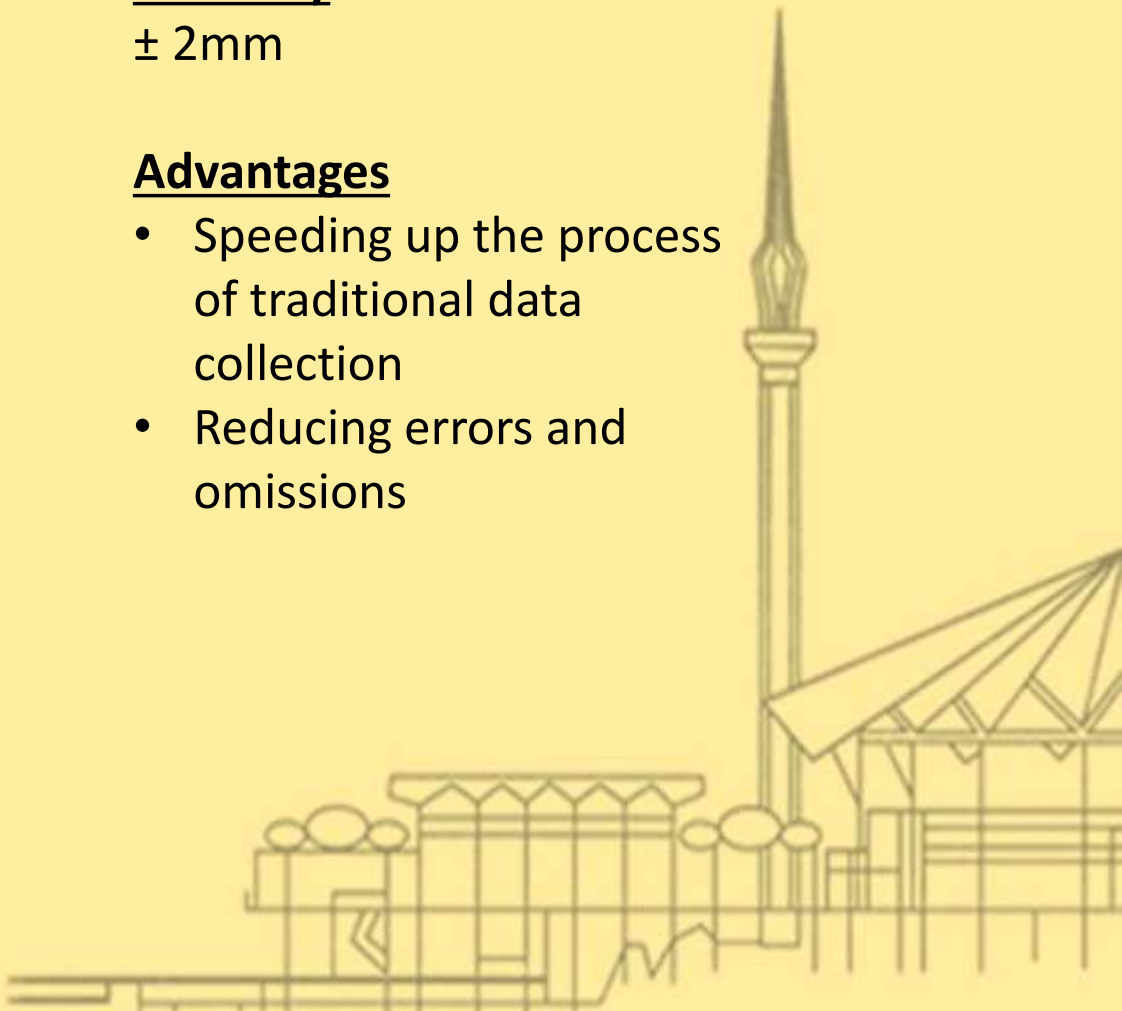
Laser Scanner – Faro Focus3D

Accuracy

± 2mm

Advantages

- Speeding up the process of traditional data collection
- Reducing errors and omissions



CONCLUSION & DISCUSSION:

THE NEED OF HISTORICAL BUILDING TO BE MAINTAINED SMARTLY AS PART OF INVESTMENT TO PRESERVE OUR NATIONAL HERITAGE

Historical Buildings → **Smart Buildings** → **Return of Investment (ROI)**

i) Upgrading of Building Facilities i.e. Facility for disabled & elderly communities
ii) Upgrading building function, i.e. refurbishing classrooms and other requirement for the mosque communities.
iii) Proper Planning for building extension & expansion to suit contemporary functions
iv) Proper & sustainable facilitating conservation executions

BETTER INFORMED PUBLIC = Sustainability ← **Creative Innovation (*IOT)**

Heritage Application as one of the component within implementation of Smartcity

***Internet of Things (IOT)**

THANK YOU