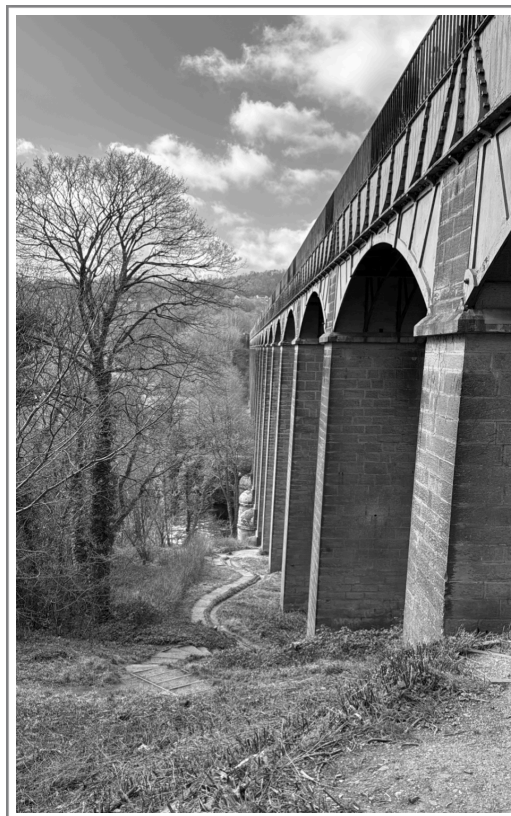




CLOSE-RANGE PHOTOGRAMMETRY FOR LARGE HERITAGE OBJECTS:



FULL COURSE PROSPECTUS

Advanced Training for Immovable Heritage Documentation

A comprehensive, hands-on training program designed to equip heritage professionals with advanced skills in documenting large, challenging heritage objects through close-range photography and photogrammetry.

1. Introduction

Every heritage digitisation project begins with a fundamental **'why'**: the imperative to preserve, study, and share our invaluable cultural heritage for future generations. Large, immovable objects present unique challenges in this mission, often remaining inaccessible to traditional imaging setups and demanding specialised on-site techniques.

This intensive course is built upon the principle that adequate digital documentation is not a top-down mandate, but a strategic endeavour driven by clear objectives and executed by skilled practitioners. We aim to bridge the gap between the critical 'why' of heritage preservation and the advanced 'how' of capturing even the most challenging assets.

This program offers an in-depth exploration of advanced close-range photography and photogrammetry specifically tailored for monumental sculptures, architectural elements, archaeological sites, and other substantial heritage assets. We will focus on the indispensable role of **image editing** in transforming raw photographic data into precise visual records. Crucially, you'll learn how this data can be **seamlessly integrated with other digital capture techniques and equipment, such as** laser scanning and LiDAR, empowering you to create comprehensive digital twins and adapt methodologies to your specific on-the-ground contexts.

2. Who Should Attend?

This course is ideally suited for professionals and enthusiasts committed to the preservation and study of cultural heritage, including:

- **Cultural Heritage Professionals:** Seeking to enhance their digital documentation capabilities.
- **Archaeologists:** Requiring precise 3D records of excavations and standing structures.
- **Conservators and Restorers:** For condition monitoring, virtual restoration planning, and detailed surface analysis.

- **Museum Curators and Collections Managers:** Working with large objects that remain in situ.
- **Photographers:** Specialising or looking to specialise in heritage and cultural documentation.
- **Researchers and Academics:** Utilising digital methodologies in art history, architecture, and archaeology.
- **Anyone** involved in the digital preservation and study of our larger significant heritage assets.

3. Course Objectives: What You Will Achieve

Upon successful completion of this course, participants will be able to:

- **Strategically Plan:** Develop robust workflows for the efficient and accurate photographic documentation of large, complex heritage objects, informed by project objectives and site-specific conditions.
- **Master Advanced Capture Techniques:** Confidently deploy specialised lighting, cross-polarisation, ring lighting, and other advanced photographic and photogrammetric capture methods in challenging on-site environments.
- **Optimise Image Processing:** Utilise professional image editing software to process, enhance, and ensure the accuracy and integrity of photographic data for heritage applications.
- **Integrate Diverse Data:** Understand and execute the process of combining photographic data with information from other capture technologies (e.g., laser scanning, structured light).
- **Perform 3D Reconstruction and Refinement:** Generate high-quality 3D models from photogrammetric data, and effectively clean, repair, and optimise meshes for various heritage purposes.
- **Apply 3D Models in Conservation:** Leverage 3D models for condition recording, virtual reconstruction, monitoring change, and advanced analysis in conservation contexts.
- **Implement Best Practices:** Adhere to international standards for data acquisition, management, archiving, and long-term preservation of digital heritage assets.
- **Learn from Global Case Studies:** Gain insights from successful real-world projects, understanding both their challenges and innovative solutions.

4. Course Structure & Modules

This course is structured over four intensive days, with a valuable but optional bonus fifth day dedicated to advanced 3D modelling and conservation applications. Each module combines theoretical instruction with practical demonstrations and hands-on exercises.

Day 1: Foundations of Close-Range Photography & Equipment

- **Introduction to Heritage Object Documentation:**
 - The unique challenges of documenting large, immovable heritage objects.
 - Importance of high-fidelity visual and spatial data for research, conservation, and public engagement.
 - Overview of digital documentation methodologies in heritage.
- **Essential Equipment for On-Site Capture:**
 - Detailed review of camera bodies (DSLR/Mirrorless), sensor sizes, and their suitability for heritage.
 - Understanding Lenses: Focal Lengths, Aperture, and Their Impact on Depth of Field and Perspective
 - Tripods, monopods, and specialised camera support systems for stability and precision.
 - Tethering solutions for live view, remote control, and immediate data review.
 - Calibration tools and colour charts for consistent results.
- **Lighting Fundamentals for Heritage:**
 - Principles of light: direction, quality (hard/soft), intensity.
 - Utilising natural light: understanding its behaviour throughout the day, managing shadows and highlights.
 - Introduction to artificial lighting: continuous lights vs. flash, understanding their advantages and limitations on-site.
 - **High Dynamic Range (HDR) Photography:** Techniques for capturing extended tonal ranges in challenging lighting conditions.
 - **32-bit Photogrammetry Techniques:** Understanding the benefits and workflow for using 32-bit images in photogrammetric reconstruction for enhanced detail and colour accuracy.
- **Workflow Planning for Complex Objects:**

- Pre-site survey and assessment: identifying challenges and planning solutions.
- Setting up on-site: safety, equipment deployment, and power management.
- Systematic capture strategies: ensuring complete coverage, consistent overlap, and optimal viewing angles.
- Data management strategy: naming conventions, folder structures, and initial backups.
- **Introduction to Photogrammetry Principles:**
 - The fundamental concept: reconstructing 3D from 2D images.
 - **Introduction to Metrology and Close-Range Photogrammetry:** Understanding measurement principles, accuracy, and precision in digital documentation.
 - Key parameters: overlap (front and side), baseline, focal length, and their influence on model quality.
 - Understanding the role of camera calibration and lens distortion.
 - **Ground Sample Distance (GSD) and Resolution Specifications:** Defining and calculating GSD for desired detail levels, and understanding how image resolution impacts reconstruction accuracy.

Day 2: Advanced Photogrammetry Techniques

- **The Lighting Setup:**
 - In-depth exploration of ring light benefits for reducing shadows and achieving even illumination on textured or sculptural surfaces.
 - Practical setup guidance for various object shapes and sizes.
 - Challenges and Solutions for Specific Heritage Materials.
- **Cross-Polarisation Photography:**
 - Theory of polarisation and its application in photography.
 - Setting up cross-polarisation: polarising filters for the lens and light sources.
 - Techniques for eliminating specular glare and revealing true surface texture, pigment, and condition.
 - Applications for painted surfaces, varnished objects, and glossy materials.

- **Reflectance Transformation Imaging (RTI):**
 - Introduction to RTI: capturing surface shape and colour from varying light directions.
 - Setup and capture techniques for RTI, including dome and highlight RTI methods.
 - Applications for revealing subtle surface details, tool marks, and inscriptions.
- **Advanced Artificial Lighting Strategies:**
 - Strategic placement of multiple **continuous lighting setups** for dramatic or analytical lighting.
 - Using flash for infill and reflection capture or overcome challenging natural light conditions.
 - Off-camera flash techniques, diffusers, and modifiers for controlled illumination.
 - Creative lighting for highlighting specific features or revealing hidden details.
- **Targeting and Scale Reference:**
 - Importance of coded and uncoded targets for accurate model scaling and alignment.
 - Placement strategies for optimal photogrammetric processing.
 - Using precise scale bars and georeferencing techniques (GPS integration).
- **Data Acquisition Best Practices:**
 - Ensuring high-resolution capture settings (in RAW format and with optimal camera settings).
 - Systematic image naming conventions and metadata embedding for traceability.
 - On-site quality control and error detection.

Day 3: Image Editing & Data Integration for Heritage Objects

- **Raw Image Processing & Optimisation:**
 - Non-destructive workflow using industry-standard software (e.g., Adobe Lightroom, Capture One, Darktable).

- Essential adjustments: exposure, white balance, contrast, highlights, shadows.
- Advanced techniques: sharpening, noise reduction, lens profile corrections.
- Batch processing for efficiency with large datasets.
- **Advanced Retouching for Accuracy:**
 - Techniques for dust and scratch removal, avoiding alteration of heritage information.
 - Correction of chromatic aberrations and fringing.
 - Ethical considerations in heritage image manipulation.
- **Advanced Masking Techniques:**
 - Leveraging luminosity masks, colour range masks, and gradient masks for precise selections.
 - Non-destructive masking workflows for complex objects and backgrounds.
 - Refining selections for optimal integration and photogrammetric processing.
- **Combining Imagery with Other Data:**
 - Understanding different data types: point clouds (from laser scans/LiDAR), meshes (from structured light), orthophotos.
 - Techniques for aligning and registering photographic datasets with other 3D data sources.
 - Creating hybrid models for enhanced documentation and analysis.
- **Colour Management & Calibration:**
 - Importance of a calibrated workflow from capture to display/print.
 - Using colour checkers (e.g., X-Rite ColorChecker) for accurate colour reproduction.
 - ICC profiles and their role in ensuring consistent colour.
- **Preparing Images for Photogrammetric Software:**
 - Exporting images in appropriate formats and resolutions.
 - Masking techniques for removing background noise or challenging elements.
 - Optimising image sets for efficient and accurate 3D reconstruction.

Day 4: Specialised Capture Methods & Digital Outputs

- **360-Degree Photography for Immersive Documentation:**
 - Equipment for spherical panoramas (e.g., nodal panorama heads, 360 cameras).
 - Stitching software and techniques for seamless panoramic images.
 - Creating interactive virtual tours for online platforms and exhibitions.
- **Videophotogrammetry:**
 - Principles of extracting 3D data from video sequences.
 - Applications for documenting movement, change over time, or dynamic heritage processes.
 - Best Practices for Video Capture in Photogrammetric Processing.
- **Drone-Based Close-Range Photogrammetry (Introduction):**
 - Overview of drone technology for accessing complex or elevated heritage objects.
 - Legal and Ethical Considerations for Drone Operations in Heritage Contexts.
 - Basic flight planning and data acquisition strategies for photogrammetry.
 - *Note: This module provides an introduction; hands-on drone flight training is outside the scope of this course.*
- **Data Export & Visualisation:**
 - Exporting 3D models in various formats (e.g., OBJ, FBX, PLY, GLB) for different applications.
 - Preparing models for web-based interactive viewers (e.g., Sketchfab).
 - Generating orthophotos, elevation maps, and cross-sections from 3D models.
 - Creating compelling visualisations for presentations, reports, and publications.
- **Maintaining Data Integrity:**
 - Strategies for digital archiving and long-term preservation of photographic and 3D data.

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- Metadata standards for heritage documentation.
- Versioning and change tracking for evolving digital records.



Bonus Day: 3D Modelling, Mesh Fixing & Conservation Applications

- **Introduction to 3D Modelling Software:**
 - Overview of industry-standard photogrammetry software (e.g., Agisoft Metashape, RealityCapture, Zephyr).
 - Introduction to 3D modelling and sculpting software for refinement (e.g., Blender, **Rhino** basics).
- **Generating High-Quality 3D Models:**
 - Step-by-step workflows for aligning photos, generating dense point clouds, and building meshes.
 - Optimising processing parameters for different object types and desired detail levels.
- **Point Cloud Modelling and Processing:**
 - Understanding point clouds: generation, density, and accuracy from photogrammetry and laser scanning.
 - Techniques for cleaning, filtering, and segmenting point clouds.
 - Converting point clouds to meshes and other usable formats.
 - Software tools for point cloud manipulation and analysis.
- **Mesh Cleaning and Repair:**
 - Identifying common mesh errors: holes, non-manifold geometry, noise, floating elements.
 - Techniques for automated and manual mesh repair (filling holes, decimation, smoothing) LOD, quad meshing.
 - Workflow for preparing models for 3D printing or complex analysis.
- **Texture Mapping and UV Unwrapping:**
 - Principles of texture mapping: applying photographic detail to the 3D mesh.
 - Creating efficient UV unwraps for optimal texture quality and rendering.
 - Baking ambient occlusion, normal maps, and other advanced textures.
- **Conservation Applications of 3D Models:**

- Utilising 3D models for detailed condition recording and damage assessment.
- Monitoring change over time through comparative analysis of successive models.
- Virtual reconstruction of missing elements or original states.
- Planning and documenting conservation treatments.
- Creating accurate replicas through 3D printing.
- **Practical Workshop:**
 - Hands-on exercises working with provided real-world datasets from various heritage contexts.
 - Troubleshooting common processing issues and optimising results.
 - Individualised feedback and guidance on participant projects (time permitting).

5. Course Delivery Options

This course offers flexible delivery to meet your organisation's specific needs:

- **Face-to-Face Public Course:** Join scheduled open-enrolment sessions at a dedicated training facility. These courses provide a structured learning environment with diverse participants.
- **On-Site Organisational Training:** We bring the training directly to your institution's premises. This option is ideal for:
 - Training multiple staff members simultaneously.
 - Focusing on your specific heritage objects and internal workflows.
 - Tailor the course content to your unique collection or site challenges.
 - Reducing travel and accommodation costs for your team.
- **Short Courses & Workshops for Academic Institutions:** We welcome inquiries from universities, colleges, and research institutions interested in bespoke short courses or workshops. These can be designed to fit specific curriculum requirements, research focuses, or student cohorts, providing a condensed yet impactful learning experience on key aspects of close-range photography and photogrammetry for heritage.

6. Real-World Case Studies

Our training is grounded in extensive practical experience and features compelling case studies from diverse international heritage projects:

- **Jordan: Documenting Ancient Rock-Cut Architecture:**
 - Challenges of scale, uneven surfaces, and harsh environmental conditions in Petra and other archaeological sites.
 - Application of photogrammetry to record intricate facades and interior spaces.
 - Integration with terrestrial laser scanning for comprehensive spatial data.
- **Seville, Spain: Capturing Intricate Details of Historic Facades:**
 - Detailed documentation of highly ornate architectural elements on historic buildings.
 - Use of cross-polarisation to mitigate glare from reflective stone surfaces and reveal carving details.
 - Creating high-resolution orthophotos for architectural analysis and conservation planning.
- **Westminster Cathedral. Polished ceramic tiles and fresco capture in multi-source and varying lighting conditions**
 - Navigating challenging lighting conditions and large spaces and dynamic range.
 - Capture of intricate 5mm mosaic tiles, mirrors as gold leaf and tile patterns using advanced lighting and close-range techniques.
 - Generating 3D models for virtual exploration and conservation monitoring.
 - Colour Calibration workflow for Standard colour calibration of imagery and derived 3D Modules.
 - Combining drone, Static and mobile LIDAR and CP RP
- **Granada, Spain: Detailed Recording of Complex Decorative Elements within the Alhambra:**
 - Navigating challenging lighting conditions and confined spaces.
 - Capture of intricate Nasrid stucco work and tile patterns using advanced lighting and close-range techniques.

- Generating 3D models for virtual exploration and conservation monitoring.

7. Course Schedule & Fees

Duration: 4 days core modules + 1 optional bonus 32 modelling day)

Standard Public Course Dates:

- *Please check our website for dates and locations.*

Upcoming venues in 2025

- Chester (UK).
- York (UK)
- Amman,(Jordon)
- Perth (WA), Brisbane (QNS)
- Stirling (UK)
- Bangalore (India)
- Syracuse (Italy)
- Madrid (Spain)
- Copenhagen (Denmark)
- Frankfurt -Alongside InterGeo.

Course Fee:

- **Public Course:**
- 4-day Course Price: e.g., £1,250 + VAT per participant
- 5 Day Course Including 3D modelling £1,650 = VAT per participant
 - Both courses include: all course materials, image and data sample files, and software licences for practical exercises during the course, daily refreshments, and a certificate of completion.
 - Recording of all live sessions.
 - *Early bird discounts and group rates are available. Please enquire for details.*



- **On-Site Training:**

- Pricing for on-site training is tailored to your specific requirements, number of participants, location, and any customisation needed.
- Please get in touch with us for a detailed proposal and quote.

8. What to Bring (Recommendations)

- A laptop computer capable of running image editing and photogrammetry software (specifications will be provided upon registration).
- A digital camera (DSLR or Mirrorless) if you wish to practice with your equipment.
- A tripod (if bringing your camera).
- Notebook and pen for notes.

9. About the Instructors

Our team of instructors, led by Chief Instructor Barry Bassnett, comprises highly



experienced professionals with extensive backgrounds in heritage documentation, advanced photography, photogrammetry, surveying, and digital heritage. We bring a wealth of practical knowledge from real-world projects, and are dedicated to providing clear, engaging, and practical training.

10. Enrolment & Contact

Ready to elevate your heritage documentation skills and unlock the full potential of close-range photography and 3D modelling?

To discuss your training needs, receive a detailed syllabus, or get a tailored quote for your organisation, don't hesitate to get in touch with me:

- **Email:** barry@therichpixel.com
- **Phone:** [+44 (0)7393657047]

- **Website:** www.knowledgement.co.uk

We look forward to helping you master the art and science of documenting our world's precious heritage!

