# Guide to RTI Photography for Gravestones

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Embsay-with-Eastby Churchyard Project 2019



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## Equipment

#### Camera

With manual exposure and focus mode settings and support for off-camera flash (e.g. DSLR or interchangeable lens mirrorless camera).

You will need the following accessories:

- Remote flash trigger (either infra-red or radio)
- Remote shutter release
- Monopod and length of string
- Flash gun (must be able to use remotely and have manual exposure control)

The camera will need to support off-camera flash, either natively or with an additional flash trigger unit. A more powerful flashgun will permit working in a greater range of light conditions. A flash with a guide number of over 45 is recommended.

The string is used to maintain a consistent distance between flash and gravestone.

#### • Spare batteries (for flash and camera) and memory cards

Ensure you have 2 or more sets of charged batteries for the flash, as well as additional charged camera batteries.

RTI involves taking 50-80 photographs in a short period of time. With this intensity of usage, most batteries are not suitable for the flash. They will become very hot (too hot to handle) and could damage equipment.

For the flash, we recommend the use of re-chargeable batteries with a capacity of at least 2850mAh. We use AA NiMH Digital batteries manufactured by Ansmann (available from Amazon). Please research the use of other batteries carefully.

#### Lens

#### 35mm focal length (full frame) or 24mm cropped sensor

Note: If using for vertical downwards shots (read: horizontal gravestones) ensure that the zoom lens does not move involuntarily (a.k.a. 'zoom creep'). Ideally, use a prime lens (occasionally a wider angle lens may be required).

#### Tripods

You will need 2 sturdy tripods, at least one of which must be adjustable to support camera at high and low levels and remain stable on uneven surfaces.

#### Snooker Ball

A shiny black or red snooker ball (57mm diameter).

To mount the ball, fix a ¼ UNC nut to the back. This can then be mounted onto standard camera mounting platforms.

The snooker ball should be mounted in front of a white background. This assists the RTI software in locating the snooker ball. A CD painted/covered white or a piece of card are suitable.

The software that combines the multiple pictures into a single image requires a "spherical datum". A snooker ball is of the correct scale for gravestone photography. Snooker balls are available from sporting goods suppliers such as <u>www.thurstons.co.uk</u>



- 1: Hand held trigger for remote shutter release
- 2a and 2b: Flash triggers (for camera and flash)
- 3: Remote shutter release (camera)
- 4: Remote flash

- 5: White card/CD backing
- 6: Red snooker ball
- 7: Snooker ball tripod rig

#### Additional Equipment for Horizontal Gravestones

You will need to construct a rig for mounting the camera. This requires:

- 1. 4-6ft (1.2-1.8m) strong metal or wooden bar
- 2. 2 tripods for the rig, 1 for mounting the snooker ball (3 tripods in total)
- 3. Bracket for mounting the camera to the crossbar
- 4. Laptop or phone to remotely view the camera viewfinder, or use a camera with a flip out screen



In order to take full-length photos of a table top or box tomb, you will also need to set up a remote live-view from the camera to a laptop. This is necessary so as to see whether the memorial is within the camera frame and to assess exposure levels. If your phone and camera have Bluetooth technology, this helps enormously.

Alternatively, bring the level of the bar down so that you can use the camera view finder (even if you have to stand on a ladder!) and take a series of shots on just one section of the memorial at a time.



Horizontal camera setup

- 1: Remote shutter release (camera)
- 2: Flash trigger (camera)

- 3: Cable connecting camera to laptop
- 4: Bracket attached to crossbar

# The RTI Photographic Session

#### The Team

An experienced team can cope with two people, but a team of three is preferable.

- <u>Person 1/photographer</u>: sets up camera, operates shutter control, and monitors the live view
- <u>Person 2/flashgun operator</u>: holds flash unit in the correct position for each shot in the sequence
- <u>Person 3/string-holder</u>: monitors the distance between the flash gun and the camera lens in order to ensure consistency

#### The Conditions

- <u>Ideal conditions</u>: Dull, grey day (not too sunny, not too breezy, not raining)
- <u>Poor conditions</u>: Dappled light, sunny, windy, raining, changing light

Depending on the efficiency and power of the flash unit, RTI may also be less effective on a cloudy day if the clouds are white and reflecting sun.

#### The Setup

- 1. Set up tripod mounted with snooker ball and white CD/card (Tripod #1) next to gravestone make sure to leave at least a few centimetres between the backing/snooker ball and gravestone so that the tripod and snooker ball can easily be cropped out of the photograph.
- 2. Position the snooker ball on one side of the gravestone so that it aligns with the middle of the area of interest and will be able to be seen in all pictures.
- 3. Place the snooker ball on the same focal plane as the front of the gravestone with approximately half the sphere in front of surface of the gravestone.
- Position camera-mounted tripod (Tripod #2) approximately 1 metre way from gravestone, or until the gravestone/area of interest and snooker ball are in frame.
- 5. Mount flashgun to monopod.
- 6. Tie string (approx. 2 metres in length) to monopod just below flash to measure distance between flash and gravestone between each picture.



7. Set up flashgun so that it fires automatically when camera shutter is released via the remote flash trigger.

#### Taking Test Shots

Before setting up for RTI, it is highly advisable to take an ordinary photo with an ID card (a laminated white or cream card can be easily wiped clean and written on with a black dry erase or permanent marker). This serves to identify the gravestone when you later organise the photographs on your computer and/or archival storage systems. It also serves to show the appearance of the gravestone under real conditions in comparison to the RTI results.

- 1. Make sure Tripod #1 and Tripod #2 are steady, with the camera on Tripod #2 facing parallel to the surface of the object.
- 2. Set camera to Auto Focus and enable emote shutter control. Alternatively, you can use manual focus if you can obtain a sharp focus.
- 3. Set camera to Manual exposure mode.
- 4. Set flashgun to Manual flash output.
- 5. Set an initial shutter speed (e.g. 1/100 on a dull day, 1/500 on a bright day).
- 6. Set an initial ISO of 200 or 400.
- 7. Set the aperture to f/5.6 for a crop sensor camera or f/8 for a full frame camera.
- 8. Without using the flashgun, take a photo and check that the gravestone is in sharp focus. Switch the focus control to Manual focus.

RTI relies upon consistency between photos - if left on Auto Focus the camera will automatically re-adjust its settings with each photo, spoiling the results.

- 9. Take further photos, adjusting the exposure using shutter speed and/or ISO to produce an image that is sufficiently underexposed so as no detail can be seen on the surface of the gravestone. It should still be possible to see the white card/CD behind the snooker ball and the outline of the gravestone.
- 10. Without changing any camera settings take a photo using the flashgun, positioned using the string. Adjust the output of the flashgun so as to give a well exposed image of the gravestone.

In extreme cases, you may need to either move the camera closer to or further away from the gravestone or modify the length of string to bring the flashgun closer or move the flashgun further away.

11. If either tripod is accidentally moved during the sequence, you will need to start again from the beginning, including a re-focus.

#### **RTI Sequence**

A series of about 50 to 80 photographs should be taken using the following method:

<u>Person 2</u> (flashgun operator) moves the flashgun throughout the sequence so that Person 1 can operate the camera shutter and capture how different angles of the flash interact with the inscriptions/contours of the gravestone to create high-contrast, high-shadow images. The aim is to create a series of angles of light around an imaginary half-sphere in front of the gravestone. Most important are the steep oblique angles over and around the sides of the gravestone, as these produce the deepest shadows.

<u>Person 3</u> (string-holder) checks the distance between the flash and the gravestone is consistent (ensuring the light is of comparable strength in all the photographs). The end of the string is placed against the gravestone, at a spot close to the centre of the intended image. The flash unit position is adjusted to keep the string taut. The string is then removed out of shot for the photograph to be taken. This step is repeated for each photograph.



Person 2 and Person 3 work together to maintain a consistent distance between the flash and the gravestone. The solid arrow shows how the camera points down the string toward the centre of the gravestone - this strategy should be replicated from different angles (represented by the yellow stars). There should be several arcs like this that capture the flash on the gravestone from different angles. If combined, the arcs would create the shape of an umbrella in front of the gravestone.

### Processing RTI Photographs

NOTE: The following software guide is for Windows computers only. Unfortunately, many of the required applications do not work on Macs.

To process and view RTI images, you will need to download and install the following (free) software.

To simply look at processed .ptm files, all you need is the RTI Viewer software.

The .ptm file is created by the RTI Builder software and can be exported, shared, emailed, etc. If you just need to view .ptm files, it would be best to just download the RTI Viewer as it is a simple program to download and takes up little space.

RTI Builder	http://culturalheritageimaging.org/What We Offer/Downloads/Process/
RTI Viewer	http://culturalheritageimaging.org/What We Offer/Downloads/View/
PTM Fitter	http://culturalheritageimaging.org/What_We_Offer/Downloads/Process/         The above page directs you to the following links:         http://forums.culturalheritageimaging.org/topic/615-ptmfitter-software-         download-link/         https://www.dropbox.com/sh/jfsy0lhxu6zv4i4/AADJpq6E_GJmNw_s5C8r94CVa         ?dl=0
Java	Must install V.6 or later (most will have this already)

#### Installing RTI Builder

WARNING: We have aimed to provide as clear a set of instructions as possible, but RTI Builder is not intuitive, so it is recommended that you seek a practice tutorial with an experienced user.

#### Before installing the RTI Builder software, you will need:

- Internet access
- To temporarily disable any anti-virus software (since this software is both old and open source, it is often incorrectly identified as an 'unsafe' program do not worry, we have used it safely for years). Firewalls occasionally result in similar problems, and it is worth disabling them temporarily if you run into problems.

When installing the RTI Builder software, you **must** install in the Root (C:/) directory. DO NOT INSTALL ANYWHERE ELSE. The file structure will appear as follows:



You will need to be aware of the location of the PTM.exe file when you reach the end of the processing sequence.

PTM = Polynomial Texture Mapping. RTI = Reflectance Transformation Imaging.

#### Preparing Your Photos for Processing

1. If you have taken your photos in RAW format (which produces clearer photographs) then these need to be converted into jpegs first. If given the option, outputted files should have the .jpg file extension (not .JPG, .jpeg or any other).

To convert from RAW format, you can use software supplied with your camera, Canon Digital Photo Professional or Adobe Lightroom. Other free options (e.g. XnConvert) are available via a quick Google search. Video tutorials can usually be found on Youtube (e.g. search: 'raw to jpg xnconvert').

- 2. Move your .jpg photo files into the "My Pictures" or "Pictures" folder on your PC. Create a separate folder containing each batch of photos <u>per gravestone</u> and name the folder after the identification number assigned to the gravestone before photographing.
- 3. Double check that each image has the .jpg file extension (NOT .jpeg, .JPG or any other), and that each filename is all lowercase with **no spaces or uppercase letters**. Use underscores or hyphens to denote spaces if necessary.

If you need to rename your picture files, the easiest way is by using a batch-renaming application that can alter hundreds of filenames in one operation. Free software options include IrfanView and File Renamer, others are available, and there are numerous video tutorials available on Youtube.

- 4. Delete the obviously useless photos, including completely black, white-outs, accidental obstructions etc. Keep the photo with the id flashcard.
- 5. Create the folder structure:
  - Within C:/ create a top-level folder called 'rti-projects'. Never put RTI Builder files into My Documents. They must go in the C:/ root directory.

When naming folders, **do not use spaces or uppercase letters**. Use underscores or hyphens to denote spaces if necessary.

- Within 'rti-projects' create another folder named after your project, e.g. 'st-marys2017'.
- Create additional folders within the project folder for each batch of images (ie. each gravestone). These folders will likely be named according to the gravestone's identification numbers (e.g. 't56-emmot').
- Within each gravestone folder create a 'jpeg-exports' folder. Note that it is 'jpeg-exports' not 'jpg'!
- Copy the .jpg files from where they were stored and edited (e.g. the 'My Pictures' folder) into 'jpeg-exports'.
- Check the photos again, removing any that should not be processed, e.g. the gravestone ID card.

OPTIONAL: Create an 'originals' folder alongside 'jpeg-exports' to store backup/archive copies of the original photos.

Local Disk (C:)

PerfLogs Program Files

Program Files (x86)

RTIbuilder v2 0 2

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lightcliffeSFM RTlexample

st-marys2017 t56-emmot

jpeg-exports

originals

RTItest2

rti-projects lightcliffe2

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#### Using RTI Builder

**If you cannot open or run RTI Builder**, you may need to temporarily disable virus protection - 15 minutes should be adequate. Some antivirus applications identify a trojan within RTI Builder (Artemis!9032434) – this is a false positive, RTI Builder is safe. It is possible to solve the problem by adding the suspected file (usually RTIbuilder.exe) to the 'trusted files' or 'exceptions' list, but some antivirus software do not allow this.

#### 1. Build a new project file.

Each 'project' is essentially a collection of the photographs for one object, which will be processed to produce a .ptm file. This .ptm file can be viewed by using a separate software application (RTI Viewer) offered by the same group that created RTI Builder (Cultural Heritage Imaging).

- Run the RTIbuilder.exe file (located in the C:\RTIbuilder\_v2\_0\_2 folder) or use the Desktop shortcut icon for the RTI Builder. If that fails, try the RTIBuilder (console).exe file or right-click and select 'Run as Administrator'.
- Once open, in the dialog box underneath 'Project Name', enter the project name, which will likely correspond with the gravestone identification number (e.g. 't56\_emmot'). <u>You must avoid using</u> <u>spaces or upper case letters.</u> If you must separate words or numbers, use underscores or hyphens instead of spaces.
- In the list under 'Operation Sequence', select
   'Highlight Based (PTM Fitter)' and then click 'Start
   New Project' in the bottom left corner of the window.

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- Select 'Open Folder' and click on either 'Find' or 'Add' (depending upon the version of RTI Builder you have downloaded) to select the desired gravestone-id folder. Note: <u>Do not</u> open the 'gravestone-id' folder and/or select the 'jpeg-exports' folder. Only select the parent folder with the gravestone id (e.g. 't56-emmot').
- Once the appropriate folder is selected, click '**Open**' to import the photos. RTI Builder will extract the .jpg files from the jpeg-exports sub-folder. After the images load, they will automatically be processed into a gallery and displayed as thumbnails.

Optional: Once all the photos are uploaded into the thumbnails gallery, add metadata under the 'Project Properties' box in the lower left corner of the window. It is often useful to record data such as the date when photos were taken, photographer's name, location, name of project groups, etc.

- Click 'Next' in the lower right hand corner of the window.
- 2. Locate snooker ball.
  - Within the photo on the left side of the screen, click and drag your computer mouse so that a light green square contains the red snooker ball. This will help the RTI Builder recognise the direction of the flash. Note: the light green square will be very faint, so it may be difficult to see at first.
  - Click 'Add Area' in the bottom left corner of the window this will turn the green square red and allow you to resize the dimensions of the box, if necessary.

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- Under 'Process Configuration' click the down arrow next to 'Glossy Ball' and select the colour of the snooker ball used.
- Directly underneath this, tick the box beside 'Use Hough Transform (slower)' and leave the other one unticked.

Red	~	Glossy Ball
	United Transform (dame)	

- Click 'Detect Sphere' located below the photo gallery on the right side of the screen.
- Select any/all photos to ensure the red box contains the snooker ball and then click 'Next'.
- 3. Locate centre and perimeter of snooker ball
  - Check that the program has accurately recognised the centre and size of the snooker ball. Is the circular red selection now precisely over the ball in the photo on the left side of the window? To help you decide, you can use the **Image Scale** in the bottom left hand corner of the screen to zoom in and out.

The red circle typically won't recognise the white reflection on the snooker ball of the rig backing. This is okay. Try to position the circle so it best fits all the pictures.

Any changes you make will apply to all photographs, so you should check a selection of images to ensure a good fit across the whole set.

- If the circular red selection is not correct, you can adjust the area manually. Either click and drag the crosshair in the centre of the sphere and/or click and drag the sizing box at the edge to adjust the circumference of the circle. Once you have done this, click 'Set New Centre' located below the gallery, and then click 'Re-do Process' in the bottom right hand corner of the screen.
- Once you are satisfied that the position of snooker ball has been correctly identified, click 'Next'.



- 4. Locate snooker ball highlights
  - Click 'Highlights Detection' and wait for the program to identify the highlights.
  - Once the 'Highlights Detection' process is completed, check to see if the highlight from the remote flash is identified in each picture by clicking on a picture's thumbnail. This will display the picture on the left side of the window so that you may inspect the snooker ball more closely. Each photo should have a small, red crosshair that identifies the remote flash highlight.

- If highlights are unclear or incorrect you can adjust the selection for each specific image.
- Drag the red crosshair over to the correct highlight or double click within the correct highlight in the enlarged image on the left side of the window.
- Once the crosshair is in the correct position, click '**Redefine Highlight**' for each adjustment you make. This saves the new position. Be patient as sometimes this may take some time.

Unlike Step 3 (Locate centre and perimeter of the snooker ball), 'Redefine Highlight' only applies changes to the current photo. You are advised to check each individual photo for the correct positioning of the highlights. This is especially important if the photos were taken on a sunny day, when the flash might be confused with the reflection of the sun.



• Click 'Next' once all of the highlights have been located.

- 5. OPTIONAL: Crop the images to hide the snooker ball
  - Select 'Use Crop' and select the crop style 'Rectangle'.
  - Click and drag (similar to Step 4) to select area you would like to be in the final photo.

6. The fitting process

This step creates the .ptm file which will be used to view the gravestone from several lighting angles when uploaded into the RTI Viewer. At this stage you are still working within the **RTI Builder** program.

- The first time you use RTI Builder you will need to specify the location of PTMFitter.exe
  - Navigate to the right side of the screen and click 'Find' next to the box labelled "PTMFitter Location".
  - Locate the PTMFitter.exe file (usually within the 'Fitters' sub-folder inside the 'RTIbuilder' folder) and click <u>once</u> to select. Do <u>not</u> double click.
  - Click **'OK'**.

The file path should now be permanently displayed in the **'File Location'** or the **'PTMFitter Location'** box.

IMmitter Location :	Ibuilder_v2_0_2\F	itters\PTMfitter.exe	Find
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		E	equite

- After specifying the location of the PTMFitter.exe, continue by skipping the section titled 'Actual Size and selecting 'LRGB' under 'PTM Type'.
- Enter output file name for the PTM file, which will likely be the grave identification number. Once again, <u>avoid using space or uppercase letters</u>. If necessary, use underscores in lieu of spaces.

• Click 'Go' or 'Execute' and wait for processing to finish. CROSS YOUR FINGERS!

PTM Type :	t56_emmot_cropped.ptm
Select sphere :	Sphere 1 🗸
	Execute

Note: If you find the program is not progressing at this stage it may be because (a) it cannot find the PTMFitter.exe file or (b) the virus protection program has automatically turned back on and is blocking the RTI Builder program.

- Click '**OK'** once program notifies you of 'Fitting Completed'. The .ptm file will automatically be placed within a new folder titled '**finished-files**' set up inside the gravestone-id folder (e.g. t56-emmot) selected at the beginning of the process.
- You can now close RTI Builder and restart your antivirus software.

#### Viewing the .ptm file

The .ptm file contains all the images compiled into the RTI image. This file can used by anyone who has installed the RTI Viewer program onto their computer. The RTI Viewer can be installed on both Windows and Mac.

The .ptm file can be found inside the folder you created for your gravestone (e.g. t56-emmot), in a sub-folder called **'finished-files'** 

When opened in RTI Viewer, you can click and drag the mouse around the green sphere to observe light hitting the gravestone at different angles.

You can also experiment by changing the **'Rendering mode'**. Each of these modes has further options for fine-tuning the displayed image.

- 'Specular Enhancement' is the most useful rendering mode.
- Toggle 'diffuse', 'specularity', and 'highlight' within the different modes to see which ones bring out the details of the gravestone better. For 'Specular Enhancement', it is suggested to set 'Diffuse' to 10 to 20, 'Specularity' to 30 to 60, and 'Highlight' to 1 to 5.
- 'Normals Visualisation' produces an image using varying shades of colour to represent different values of depth.
- 'Diffuse Gain' and 'Dynamic MulitLight' are less useful but may sometimes produce variations which are helpful. This will depend upon each individual case.

Once you are happy with a finished image's rendering mode and light source, click on the snapshot button represented by the camera icon to save that version as a new **.jpg** photo file. You can use, copy transfer this as you would any normal .jpg photo.

Alternatively, you may Bookmark the final image within the RTI Viewer and attach any relevant notes. This allows you to return to the same settings again in the future; however, Bookmarking does <u>not</u> save the image as a new .jpg file.



#### **OPTIONAL:** Further Fine-tuning

A snapshot (ie. .jpg) of the best image is often improved by importing the .jpg into a photo editing program and converting the image to '**Monochrome'**. You may then select '**Vivid Landscape**' (or whatever equivalent in your software of choice) and enhance the image by increasing or decreasing the contrast and brightness. This will make individual details become more noticeable.

For difficult images, you may also want to use additional 'Filters'. Those recommended for Adobe Photoshop include the options '**Stylize**' – '**Find Edges**', '**Other**' – '**High Pass**', '**Sketch**' – '**Photocopy**', and/or '**Adjustments' – 'Invert'**.