"Good" close-range photogrammetry example from Ostia Antica, Italy. Note that the object (the temple) is framed tightly, and that all objects (both near and far) are in sharp focus.

When it comes to close-range photogrammetry, the difference between "good" photos and "bad" photos can be the difference between getting useful 3D information and having complete failure. There are many different variables contributing to success or failure of a project, but to help avoid the most common mistakes a photographer can follow the general guidelines outlined below.

Basic photographic concepts that, when followed, generally produce acceptable digital images:

   Camera/lens Properties:
   -Use a mid to high resolution camera (at least 12-15MP)
   -Use a fixed (non-zoom) lens
   -Tape the focus ring (and set to manual focus)
   -If using a zoom lens, tape the zoom ring and use one focal length for the entire project

   Camera Placement:
   -Use a tripod and stable tripod head
   -Frame the subject tightly, making use of the entire sensor area
   -Maintain 60-80% overlap between photos
   -Ensure all important areas of the object are visible in at least three images
   -Be aware of camera geometry required by software (baseline, convergent angles)

   Camera Settings:
   -Use aperture priority mode (set to between f/8 and f/16)
   -Use a timer or wired/wireless shutter release to minimizes motion blur
   -Use mirror lock-up, if available, to further minimizes motion blur

A list of common mistakes made while capturing digital images for a close-range photogrammetry project:

   Camera/lens:

"Bad" close-range photogrammetry example. Note that the object (the temple) is not framed tightly, and that most objects are blurry and out of focus.

- Use of low resolution camera (8MP or less)
- Changing zoom (focal length) between images
- Use of loose/damaged lens
- Significant re-focusing due to varying distance from object

Camera placement:
- Handheld camera (no tripod)
- Insufficient overlap between images
- Inefficient use of sensor area (too far from subject)
- weak camera geometry (multiple images from one position, short baseline, overall poor network of image locations/orientations)

Camera settings:
- shallow depth of field (below f/8)
- manual shutter release (causes motion blur)

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General Photography and Close-Range Photogrammetry Standards and Guides

Learn more about depth of field, bit depth, EXIF metadata, file formats, and more...

Glossary of terms found at Digital Photography Review website (dpreview.com)
http://www.dpreview.com/learn/?/Glossary/

ADS Guides to Good Practice
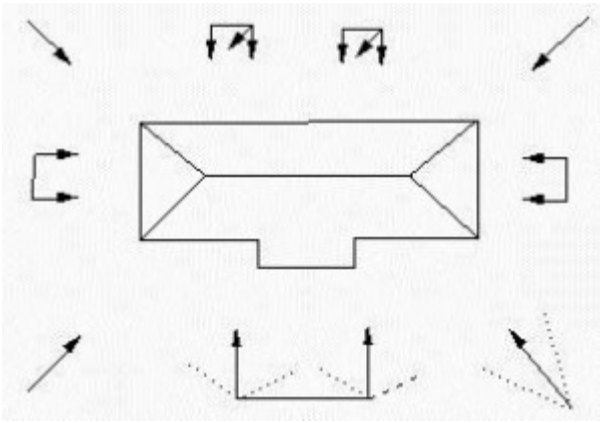
Learn more about the ADS Guides to Good Practice for close-range photogrammetric documentation...
Barnes, A; J. Cothren, K. Niven (2011) *Guides to Good Practice: Close-Range Photogrammetry*. Archaeology Data Service / Digital Antiquity: Guides to Good Practice.
http://guides.archaeologydataservice.ac.uk/g2gp/Photogram_Toc

Documenting Surfaces

An excellent guide for using close-range or aerial photogrammetry to document surfaces (e.g. rock art, trackways, surfaces prone to erosion).
Matthews, N. A. (2008) *Aerial and Close Range Photogrammetric Technology: Providing Resource Documentation, Interpretation, and Preservation*. Technical Note 428. National Operations Center, Denver, Colorado: U.S. Department of the Interior, Bureau of Land Management.
http://www.blm.gov/nstc/library/pdf/TN428.pdf

HABS/HAER/HALS

Learn more about architectural and engineering documentation for long term archival in the Heritage Documentation Programs collections in the Library of Congress.
National Park Services: Heritage Documentation Programs (HABS/HAER/HALS)
http://www.nps.gov/history/hdp/

Cultural Heritage Site Surveying

What makes a successful and useful survey of cultural heritage sites? Learn what to record, how to record it, and what performance indicators are important...
Bryan, P., B. Blake, J. Bedford, D. Barber, J. Mills, and D. Andrews (2009) *Metric Survey Specifications for Cultural Heritage*. English Heritage, Swindon.
http://www.english-heritage.org.uk/publications/metric-survey-specification/

English Heritage on Photogrammetric Survey of Historic Buildings

An extensive and detailed guide for the photogrammetric survey of historic buildings...
D'Ayala, D., and P. Smars (2003) *Minimum requirements for metric use of non-metric photographic documentation*, University of Bath.
PART 1: http://www.english-heritage.org.uk/publications/metric-use-of-non-metric-photographic-documentation/metricextraction1.pdf/
PART 2: http://www.english-heritage.org.uk/content/publications/publicationsNew/metric-use-of-non-metric-photographic-documentation/metricextraction2.pdf

Intro to Architectural Photogrammetry

A nice introduction to close-range photogrammetry and methods for architectural photogrammetry...
Hanke, K., and P. Grussenmeyer (2002) *Architectural Photogrammetry: Basic Theory, Procedures, Tools.*
September 2002, ISPRS Commission 5 Tutorial, Corfu.
http://www.isprs.org/commission5/tutorial02/gruss/tut_gruss.pdf
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http://gmv.cast.uark.edu/photogrammetry/hardware-photogrammetry/canon-5d-mark-ii/canon-5d-workflow/acquire-image-for-close-range-photogrammetry-2/
http://gmv.cast.uark.edu/photogrammetry/hardware-photogrammetry/canon-5d-mark-ii/canon-5d-workflow/acquire-image-for-close-range-photogrammetry-2/#comments Tue, 12 Apr 2011 14:54:41 +0000
adam http://gmv.cast.uark.edu/?p=911

The following post describes in detail the basic steps for acquiring close-range digital images for a generic photogrammetric project.

In Office Setup: Begin the Metadata Process

1. Choose a method for documenting the project (e.g. paper, laptop)
2. Fill in known project metadata items (e.g. project name, date of survey, site location, etc.)
3. Create a sketch map of the area (by hand or available GIS/maps)

Plan project and prepare equipment

1. Develop a project plan based on desired end product and required accuracy (review CRP steps if needed)
2. Decide what equipment will best suite the project (e.g. what camera? what lens? method for white balance?)
3. Print and check off items for close-range photogrammetry checklist
4. Print other applicable metadata forms and have ready

In Field Setup: Configure Camera Settings

1. Photo quality (RAW and JPEG Large)
2. White balance (custom or auto)
3. Auto rotate (off)
4. Live View function (stills only)
5. Mirror lock up (enabled) *recommended for shutter speeds longer than 1/30th
6. Self-timer (2 or 10 second)
7. Turn off any image stabilization features

In Field Setup: Set Focus

1. Though some projects may require an auto focus for each image, in an ideal project the focal length

(and therefor focus) of the lens will remain constant throughout a CRP image set.

1. For architectural photogrammetry, or other projects with a distance of more than 10 meters between the camera and object, find the switch on the lens with "AF" and "MF" and switch to MF (Manual Focus), then manually rotate and secure the focus ring to infinity

Focus Ring

2. For projects with a shorter, constant distance (e.g. all photos will be captured from 6 meters), autofocus the lens for the first photo, then switch the lens to manual focus and secure that focus setting for all remaining photos
3. For projects with a shorter, varying distance (e.g. photos will be captured anywhere from 2-5 meters), use autofocus for all images
2. Turn the Mode Dial to "Av" (Aperture value) mode
3. Set aperture to appropriate value (between F8 and F16)
4. Take test photo and check for sharpness throughout the object of interest
5. Adjust settings as necessary

Taking the Photos: Setting Up

1. Have documentation materials ready
    1. As you collect images, document the process according to ADS
    2. Make sure you capture a color checker chart, gray card, or other means of white balancing the images in the lab
2. Choose appropriate photo location
    1. Obstructions between the camera and object should be minimized
    2. The tripod should be stable and should not move throughout the image capture

Frame and Take the Photo

1. Frame the Photo

    1. Adjust the tripod head to position the aim of the camera
    2. The object should fill the frame
2. Press the shutter button
3. Pressing the button should initiate the mirror lockup, followed by the timer and image capture
4. You should hear one thump, a series of beeps, and then the shutter
    1. Review the image for sharpness and exposureset.
        1. By default, the camera will display the image for a few seconds
        2. If the LCD goes black, push the Playback button to review
        3. Push the Magnify button to zoom in, and pan across the image
        4. Be sure to review objects both near and far for sharpness

5. Look at the histogram and make sure the brightness values are well distributed and not clipped

Reconsider your Settings

1. If the image is not sharp make sure you're choosing appropriate aperture

    1. Is your aperture too large (meaning the f/ number is small)? Maybe try one or two stops smaller (e.g. from f/10 to f/16)
    2. Did the tripod move during image capture? With small apertures, you can expect long exposure times. Be sure the tripod remains 100% motionless during the entire exposure
    3. Did you have an extremely long exposure? More than 10-20 seconds? This could indicate you aperture is too small (e.g. f/22 or a higher number) for the amount of available light, or you are suffering from diffraction as light passes the aperture. Stop down closer to f/16 and try again

If the image is sharp...

Move to the next location (according to your strategy) and repeat.

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