

PHOTOGRAMMETRIC CAPTURE : THE '3x3' RULES*

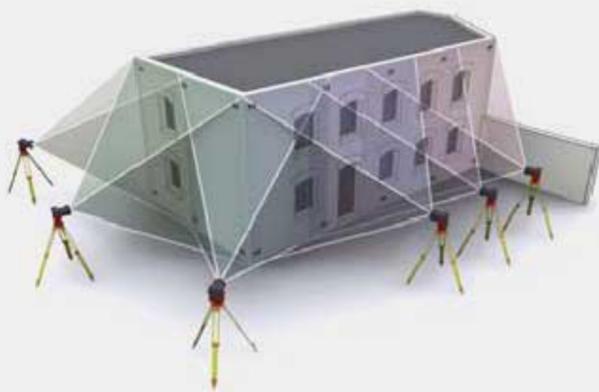
1 - THE 3 GEOMETRIC RULES

1.1- CONTROL

- ◆ Measure long distances between well-defined points.
- ◆ Define a minimum of one vertical distance (either using plumb line or vertical features on the building) and one horizontal.
- ◆ Do this on all sides of the building for control.
- ◆ Ideally, establish a network of 3D co-ordinated targets or points from a loop traverse around the building.

1.2- STEREO PHOTOCOVERT

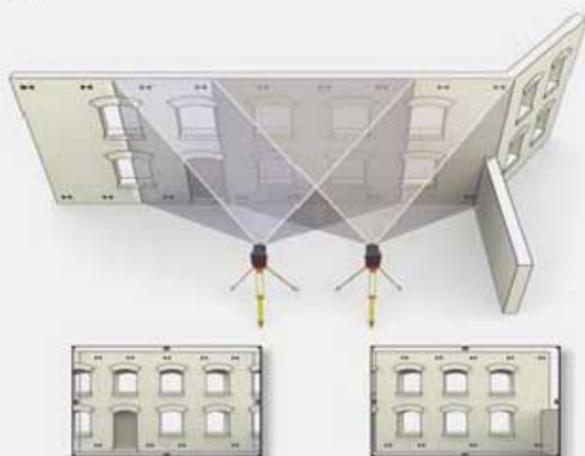
- ◆ Take a 'ring' of pictures around the subject with an overlap of at least 60%.
- ◆ Take shots from a height about half way up the subject, if possible.
- ◆ Include the context or setting: ground line, skyline etc.
- ◆ At each corner of the subject take a photo covering the two adjacent sides.
- ◆ Include the roof, if possible.
- ◆ No image should lack overlap.
- ◆ Add orthogonal, full façade shots for an overview and rectification.



1.3- DETAIL STEREO PHOTOCOVERT

Stereo-pairs should be taken:

- ◆ Normal case (base-distance-ratio 1:4 to 1: 15), and/or
- ◆ Convergent case (base-distance-ratio 1:1 to 1: 15).
- ◆ Avoid the divergent case.
- ◆ Add close-up 'square on' stereo-pairs for detail and measure control distances for them or place a scale bar in the view. Check photography overlaps.
- ◆ If in doubt, add more shots and measured distances for any potentially obscured areas.
- ◆ Make sure enough control (at least 4 points) is visible in the stereo image area.



2 - THE 3 CAMERA RULES

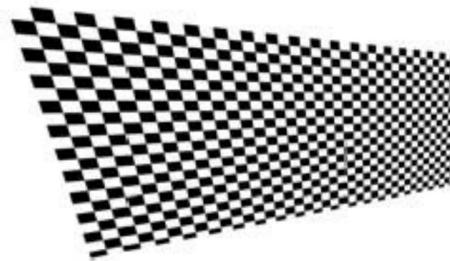
2.1 - CAMERA PROPERTIES

- ◆ Fixed optics if possible. No zooming! Fully zoom-out, Do not use shift optics. Disable auto-focus.
- ◆ Fixed focus distance. Fix at infinity, or a mean distance using adhesive tape, but only use one distance for the 'ring'-photography and one distance for close-ups.
- ◆ The image format frame of the camera must be sharply visible on the images and have good contrast.
- ◆ The true documents are the original diapositives, negatives or digital 'RAW' equivalents. Set the camera to use the camera its highest quality format.

2.2 - CAMERA CALIBRATION

Use the best quality, highest resolution and largest format camera available:

- ◆ 'Medium' format is better than small format. A large sensor is better than a smaller one.
- ◆ A wide-angle lens is better than narrow angle for all round photography. Very wide-angle lenses should be avoided.
- ◆ Calibrate the camera with a fixed focus lens and tape it there.



- ◆ Standard calibration information is needed for each camera/lens combination and each focus setting used. Shooting the calibration screen before capture with each lens will help.
- ◆ A standardised colour chart should be used in each sequence of frames.



2.3 - IMAGE EXPOSURE

Consistent exposure and coverage is required.

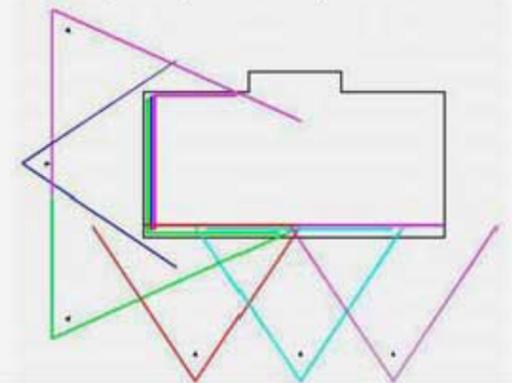
- ◆ Work with consistent illumination: beware deep dark shadows. Use a lighting rig.
- ◆ Use HDR to capture difficult, unbalanced exposures.
- ◆ Plan for the best time of day
- ◆ Use a tripod and cable release/remote control to avoid camera movement and get sharp images.
- ◆ Use a panoramic tripod head to get parallax-free panoramic imagery
- ◆ Use the right mode: Black-and-white is best for tracing detail but colour is good for recording material type and pigment.
- ◆ Use RAW or 'high quality' and 'high sensitivity' setting on digital cameras.
- ◆ Geotag the images.

3 - THE 3 PROCEDURAL RULES

3.1 - RECORD PHOTO LAYOUT

Make witnessing diagrams of:

- ◆ The ground plan with the direction of north indicated.
- ◆ The elevations of each façade (at an appropriate scale 1:50, 1:100 - 1: 500).
- ◆ Photo locations and directions (with frame numbers).
- ◆ Single photo coverage and stereo coverage.
- ◆ Control point locations, distances and plumb-lines.
- ◆ If using 'natural' points a clear diagram showing each point is required.



3.2 - LOG THE METADATA

Include the following:

- ◆ Site name, location and geo-reference, owner's name and address.
- ◆ Date, weather and personnel. Client, commissioning body, artists, architects, permissions, obligations, etc.
- ◆ Cameras and optics, focus and distance settings.
- ◆ Calibration report, including the geometric and radiometric results if available.
- ◆ Description of place, site, history, bibliography etc.

Remember to document the process as you go.

3.3 - ARCHIVE

Data must be complete, stable, safe and accessible:

- ◆ Check completeness and correctness before leaving the site.
- ◆ Save images to a reliable location off the camera. Save RAW formats and TIFF copies.
- ◆ Remember a DVD is not forever!
- ◆ Write down everything immediately.
- ◆ The original negatives/diapositives/RAW files are archive documents. Treat and keep them carefully.
- ◆ Don't cut into the format if cutting the original film. If using digital cameras, don't crop any of the images and use the full format.
- ◆ Ensure the original and copies of the control data, site diagrams and images are kept together, as a set, at separate sites on different media.

*The above text is adapted from a paper presented by Peter Waldhäusl (University of Technology, Vienna, Austria) and Cliff Ogleby (Dept. of Geomatics, University of Melbourne, Australia), at the ISPRS Commission V Symposium "Close Range Techniques and Machine Vision" in Melbourne, Australia, 1994. Simple rules that are to be observed for photography with non-metric cameras have been written, tested and published at the CIPA Symposium in Sofia in 1988.