1. INTRODUCTION

This paper presents a design for a photographic reference plate for use in conservation documentation photographs. The design complies with recommended practices for photographic documentation described in the American Institute for Conservation (AIC) Commentaries to the Guideline for Practices and with suggested procedures in The AIC Guide to Digital Photography and Conservation Documentation.

The plates provide an efficient way to include photographic reference standards as well as size, date, and artifact identification information in documentation photographs. To maximize image size, the plates have a linear format and are designed to consume the minimum amount of space in the field of view. Templates are available in four different sizes: three to accommodate the photography of both very small subjects, such as daguerreotypes or photographs of details; and one for the photography of larger artifacts such as paintings and sculpture. Each plate has the following elements (See Figure 1a): X-Rite ColorChecker® grey scale (A) and color (B) patches; a lighting indicator associated with a photogrammetric indicator (C); a size scale (D); and an area for date and object identification information (E). (See Materials and Resources list below for links to download files of accurately sized templates.)

Figure 1a. Reference plates
Note that the plate at the bottom for large artifacts is not to scale
Figure 1b. Smallest plate, in use

Note: Precut sets of X-Rite ColorChecker® patches for all plate sizes as well as downloadable construction template files are available from the AIC Photographic Materials Group (see Materials and Resources, below).

Although the plate design is based on the use of the sets of pre-cut grayscale and primary color patches from the X-rite ColorChecker® chart available through the AIC Photographic Materials Group, one could, if desired, reconfigure the design to use gray scales from other manufacturers.

2. ELEMENT DESCRIPTION AND CONSTRUCTION

Precision is critical in the construction process especially for the three smaller plates where small misalignments may become quite evident in the photographs. The exact placement of each element is provided in the templates, and the general plate structure is seen in Figure 2.

Figure 2. Section view of the elements


2.1. Construction Templates

These templates should be printed out prior to construction of the plates. The printout serves as the base surface of the plate and provides: grids for the placement of patches; the photogrammetric pattern and gnomon height label for the illumination indicator; a size scale (small plates) or area for the attachment of size scales (large plate); and an area for the placement of date and ID information. The black blank areas on the ends provide room for clamping the plate in position in the field of view should that be necessary.

2.2. Base

Construct the plates on a rigid thin base for durability and sturdiness. Materials such as G-10 epoxy impregnated fiberglass sheet or 2-ply or 4-ply mat board (black or toned with indelible black ink) are recommended (see Materials and Resources). If desired, a thin metal-cored paper (see Materials and Resources) can be attached to the back of the base so the plate can be attached to a magnetic surface, or a thin magnetic sheet can be adhered to the back so that the plate can be attached to a metal surface.

Since the three smaller reference plates may be in contact with the object’s surface, as might be required in detail shots, for example, make sure the back of these plates are smooth. If desired, a soft material such as Velour paper can be applied to the back (see Materials and Resources).

The dimensions of the base for Plate 4 (large plate) can vary. (See Figure 1 and Appendix 2.) All the prepositioned elements (patches, scales, and illumination guide) are on one end; the remainder of the plate is for ID/date information and can vary in length depending on system used. When assembled, the color patches, size scales, and illumination indicator portion of the plate measures 3 cm x 26 cm. Typical additional length for ID/data information is 18 cm. If needed, additional length for a clamping area on either end should measure perhaps 2 to 3 cm each. In total, the base can measure from 3 cm x 44 cm to 3 cm x 50 cm. The base can also be made wider than 3 cm, if the size of magnetic numbers or labels requires it, or to make space for the addition of a fluorescence ruler above the gray/color patches. The ID/data information area and the added ends should be painted black.

As just mentioned, Plate 4 is large enough to accommodate magnetic numbers and letters for ID labeling, if desired. If that is anticipated, metal-cored paper should be adhered to the front of the plate overall or just in the ID area. The paper should be painted black where exposed. (See section 2.7 below)

2.3. Grey Scales and Color Patches

![Color Patches]
The plate design utilizes the X-Rite ColorChecker six-step grey scale and six primary color patches RGB and CMY. As indicated above, kits containing sets of precut X-Rite patch material for all four plate sizes are available from the AIC Photographic Materials Group (see Materials and Resources). The patches are best adhered using double-sided tape. Tweezers and care are advised when attaching the patches. Avoid touching the surface of the patches.

2.4. Illumination Indicator

The illumination indicator is a sundial like area with a central gnomon to create shadows that document the character and positioning of lights. Such a record is critical when, for example, creating a series of comparative photographs documenting changes in an artifact during treatment, and especially with comparative raking light images. The number of shadows indicates the number of lights; the shadow position indicates the placement of the lights; the shadow length shows the angle of illumination; the shadow sharpness denotes the extent of diffusion. Additionally, if the gnomon has a rounded top with a reflective metal surface, the appearance of the gnomon itself will indicate whether polarized illumination was used; if reflections of the lamps are not seen in the top of the gnomon, the photograph was made using full polarization, i.e., polarizing screens on the lamps and a polarizing filter on the camera all adjusted for maximum extinction of glare.

The gnomon can be made of a common pin or escutcheon pin, preferably with a rounded top with a shiny metallic surface. It should be cut to height and inserted into a pre-made hole and secured with a drop of adhesive. The gnomon heights suggested below are calculated so that the shadow cast in a typical raking light setup (10° angle) will not be likely to extend beyond the field area of the illumination indicator. The templates provide a space for the actual gnomon height to be indicated.

Plate 1. Background field width 10mm: gnomon height = 1.0 mm
Plate 2. Background field width 14mm: gnomon height = 1.25 mm
Plate 3. Background field width 20mm: gnomon height = 1.75 mm
Plate 4. Background field width 80mm: gnomon height = 7.0 mm

To prevent the adjacent grayscale and color patches or adhered rulers from casting a shadow onto the illumination guide surface, print out an extra template, cut out the illumination indicator section and adhere it over the one on the plate. This should bring the background field up to the same level as the patches.

2.5. Photogrammetric Indicator

The crosshairs and circle of the illumination guide also serve as an indicator of perspective distortion recording the extent of parallelism with the camera focal plane.

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1 This selection of patches is for white balancing and exposure purposes only, and only the gray scale patches serve these functions. The six primary color patches function only as a viewing aid to indicate immediately to the viewer that the photograph is in color. (Color documentation images of black and white photographs, for example, can be problematic this way.) These twelve patches alone cannot be used for instrument profiling; the entire X-Rite chart of 24 patches is required for this purpose. For additional information on the use of photographic standards see The AIC Guide to Digital Documentation for Conservators.
2.6. Size Scale

A size scale can be cut from a manufactured ruler or the one printed on the template can be used. Plastic rulers used in forensics documentation printed black on grey are recommended (see Materials and Resources). Another option is to use a section of a forensic ruler designed for fluorescence photography. The inks on this ruler fluoresce under ultraviolet irradiation and can thus be recorded in fluorescence photographs. Instead of this, a fluorescence photography ruler can, of course, just be placed adjacent to the plate when doing fluorescence photography. Note that the template for Plate 4 (large plate) contains areas for both centimeter and inch scales, and that the base can be widened to include a fluorescence photography ruler if desired.

2.7. Data Label Holder (small plates)

The data label holder for date and identification information is made from a strip of 3 mil (0.003 inch) clear polyester film like Mylar®. The top and bottom edges are folded over to create a channel to hold the printed slip-in paper label. Because of the small size of the holder, make the first fold and trim to the desired width (from 1.5 mm to 2.0 mm); then cut a shim from a strip of 1-ply mat board (or other rigid but thin material) just slightly narrower than the desired width of the data label area. Place the shim under the first fold and fold the second fold against the shim, then trim off the excess polyester. The data holder can be attached to the template/base with double-sided tape.

Slip-in labels can be printed easily using the Microsoft Word slip-in label template file provided with the other templates. If using the plate for fluorescence photography, the paper used for the labels should have low optical brightener content because papers with excessively bright fluorescence may cause flare that can extend into the subject area and result in a loss of information.

2.8. Data Labeling (large plates)

While an appropriately sized slip-in label holder can be incorporated into the design of Plate 4, the area available for date and identification information is large enough for the use of magnetic letters and numbers. If this is desired, adhere a metal-core paper facing (see Materials and Resources) to the information area or to the entire front surface of the front of the base and spray paint it black. The black surface of the identification area can be also coated with shellac or other fluorescent resin so the plate can be used for fluorescence photography. This is because most magnetic letters do not fluorescence under ultraviolet irradiation; the contrasting fluorescence of the shellac will allow them to be seen.
3. SUGGESTED CONSTRUCTION SEQUENCE

1. Download the appropriate template files. Print two copies of the template to provide a second image of the illumination indicator guide for cutting out and adhering onto the image on the base surface. (See step 6.)
2. Construct the base. Attach metal-cored paper or magnetic sheet or velour to back surface as desired. If magnetic labels and letters are to be used on Plate 4 for ID/date information, the front surface should be covered with metal-cored paper, painted black. (For UV induced fluorescence photography this area should also be coated with a fluorescing resin like shellac.)
3. Attach template to the base
4. Cut ruler(s) to size and adhere to plate surface using double-sided tape.
5. Attach a second illumination guide surface over the corresponding area on the overall printed template to bring it level with the surface of the adjacent patches and rulers.
6. Construct and attach the slip-in data holder (except for Plate 4, unless a slip in labeling system is desired).
7. Make the perforation to insert the gnomon
8. Attach the grey scales and color patches
9. Attach the gnomon and secure with an adhesive.

4. SLIP-IN IDENTIFICATION LABELS

Because of the small size of reference plates 1, 2, and 3, the identification information on the data label (E, Figure 1) should be printed to insure maximum legibility in the photograph. A convenient Microsoft Word template has been created to facilitate this and is available along with the construction templates. Both Mac and Windows computers allow the file to easily be converted to a Stationary Pad or to a read-only template to insure the original file remains unchanged each time it is opened. (See instructions on the template for doing this.)

Suggested font sizing for printing are as follows:

**PLATE 3** (label dimensions 1 x 5cm)

Two lines (18 spaces/line):
- Arial 10 or Times New Roman 10

Three lines (22 or 24 spaces/line respectively):
- Arial 8 or Times New Roman 8

**PLATE 2** (label dimensions 3cm x 0.8cm)

Two lines only
- Arial 7 = 15 spaces/line
- Arial 6 = 18 spaces/line
- Times New Roman 7 = 17 spaces/line
- Times New Roman 6 = 20 spaces/line

**PLATE 1** (label dimensions 2 x 0.6cm)

Two lines only
- Arial 6 = 12 spaces/line
- Arial 5 = 15 spaces/line
- Times New Roman 6 = 13 spaces/line
- Times New Roman 5 = 16 spaces/line

Figure 3. Template for printing and cutting data label
While not necessary, a cutting template made of mat board or other rigid material can be constructed to aid in cutting the printed labels to size (see Figure 3) with a scalpel. The cut edges of the cut-out openings should extend beyond the corners to facilitate cleaner cutting.

5. CARE OF PLATES

Avoid touching the surface of the plate, especially the photographic reference patches. Keep the plate stored in a protective enclosure when not in use. Just as done with any photographic reference standard, the plate should be replaced if the reference patches (especially those in the gray scale) become soiled or damaged.

6. MATERIALS AND RESOURCES

The following list includes the type of material and suppliers used for the reference plates by the authors, and is not intended to endorse any specific material or supplier.

a. Templates and precut color and grayscale patch sets: Sets of precut X-rite ColorChecker® patch material and templates for constructing the reference plates and for printing slip-in labels are available through the AIC Photographic Materials Group website: http://aic.stanford.edu/sg/pmg/index.html (accessed 2008). (Also see d., below.)

The plate PDF construction templates should be printed without any reduction or enlargement. The .doc Microsoft Word template file for printing slip-in labels should be converted to a Stationary Pad (Mac) or read-only template (Windows) before the first use. A new separate file will then be created each time the template is used, thus keeping your blank template file intact. Instructions for doing this are provided on the template itself.

b. G-10 is a laminate sheet of fiberglass fabric imbedded in epoxy resin. Check the following websites for information and pricing.

c. Metal-cored paper for magnets: A metal core sandwiched between paper facings. MagnaVisual Corporation offers selection of different thicknesses. They are, however, not listed in their on-line catalogue. Call and ask for “Magna Hold Paperboard, MH-2340, 14 mils thick, which is the thinnest.

d. X-Rite ColorChecker® color sheets:
   The patches for the kits were professionally laser cut from 8 x 11” sheets purchased from X-Rite (www.xrite.com). ($27.50/ sheet, 2007) The patch specifications are as follows:

<table>
<thead>
<tr>
<th>Color</th>
<th>Color-Checker patch number</th>
<th>R</th>
<th>G</th>
<th>B</th>
<th>Munsell notation</th>
<th>Color-Checker patch number</th>
<th>R</th>
<th>G</th>
<th>B</th>
<th>Munsell notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (.05)</td>
<td>19</td>
<td>243</td>
<td>243</td>
<td>242</td>
<td>N 9.5/</td>
<td>Red</td>
<td>15</td>
<td>175</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>Neutral 8</td>
<td>.23</td>
<td>20</td>
<td>200</td>
<td>200</td>
<td>N 8/</td>
<td>Green</td>
<td>14</td>
<td>70</td>
<td>148</td>
<td>73</td>
</tr>
<tr>
<td>Neutral 6.5</td>
<td>.44</td>
<td>21</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>N 6.5/</td>
<td>Blue</td>
<td>13</td>
<td>56</td>
<td>61</td>
</tr>
<tr>
<td>Neutral 5</td>
<td>.70</td>
<td>22</td>
<td>122</td>
<td>122</td>
<td>121</td>
<td>N 5/</td>
<td>Cyan</td>
<td>16</td>
<td>8</td>
<td>133</td>
</tr>
<tr>
<td>Neutral 3.5</td>
<td>1.05</td>
<td>23</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>N 3.5/</td>
<td>Magenta</td>
<td>17</td>
<td>87</td>
<td>86</td>
</tr>
<tr>
<td>Black (.90)</td>
<td>24</td>
<td>52</td>
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<td>52</td>
<td>N 2/</td>
<td>Yellow</td>
<td>16</td>
<td>231</td>
<td>199</td>
<td>31</td>
</tr>
</tbody>
</table>
e. **Black Velour paper:** a velvet-textured paper manufactured by Hahnemuhle is available from Talas:

f. **Rulers:** Armor Forensics carries various types of durable inexpensively priced rulers for forensic use (“Photo Evidence Scales”). Rulers with black printing on grey and those designed for fluorescence photography are suggested.

**Acknowledgements:**
This project was created under the generous support of Andrew W. Mellon Foundation and Art Conservation Department at Buffalo State College. The authors would like to thank in particular Grant Romer, James Reilly, Directors of the Advanced Residency Program in Photograph Conservation at the George Eastman House, and Elizabeth Peña, Director of the Art Conservation Department, Buffalo State College, for their support. Finally we would like to thank Buffalo State College Art Conservation Department students Ariel O’Connor and Josiah Wagener for suggestions on fabrication techniques.
APPENDIX #1
Plates 1, 2, and 3 --
construction templates.
(Download pdf file for printing.)
APPENDIX #2:

Plate 4 --
(large plate) construction template.

(Note: Final plate dimensions (h and w) are determined by area designated for ID/date information. When assembled, the photographic scales, size scales, and illumination indicator measure 3 cm x 26 cm. Typical additional length for ID information is 18 cm. If needed, additional length for a clamping area on either end should measure perhaps 2 to 3 cm each. As an example, the plate below was made 4 cm x 50 cm to accommodate a fluorescence ruler and the magnetic numbers and labels.)
APPENDIX #3:

TEMPLATES FOR PRINTING SMALL REFERENCE PLATE SLIP-IN LABELS

(Download MS Word file and convert to Stationary Pad (Mac) or Read-Only template (Windows) before using.)

Before the first use, this MS Word template file should be converted to a Stationary Pad (Mac) or Read-Only template (Windows). A new separate file will then be created each time the template is used, thus keeping your original blank template file intact.

Mac:
Highlight the template file icon > Press Command + i to open File Info window> Check the “Stationary Pad” box.

Windows:
Right click on template file icon > Select Properties > In General Properties menu, click Read Only box under Attributes > click Apply button.

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or
Times New Roman 6 = 13 spaces/line  
Times New Roman 5 = 16 spaces/line