

Appendix 2: Advanced Exposure Techniques: The Zone System for Color Photography

What Is the Zone System?

In the late 1930s Ansel Adams and Fred Archer devised the Zone System as a method of explaining exposure and development control to students in black-and-white photography. It is based on the old photo adage, “Expose for the shadows and develop for the highlights.” Since then, it has been continually refined and expanded. According to Adams, its purpose was “to provide a bridge between sensitometry and practical creative work by offering step-by-step working methods that do not require extensive training or equipment.” Today it offers a conduit between analog and digital processes in color and black-and-white photography.

What Is a Zone?

A “zone” is not a place but a concept. It is the relationship between a subject’s brightness and its photographic representation, as density in the negative and a corresponding tone in the final print. Under the Zone System, a full-range print has tones that have been divided into a gray scale of eleven zones (Zone 0 to Zone X), which are identified with roman numerals to avoid confusing them with all the other numerical combinations used in photography. Each zone is equivalent to a one f-stop difference in subject brightness and exposure (see Table A2.1 for a list of the basic zones and their physical equivalents).

Previsualization

The photographer measures the brightness range of the subject and “previsualizes” the print tonal range that is wanted to represent the subject and then picks a combination of exposure and development procedures to make this happen. Previsualization is a mental act in which the photographer imagines how the final print will look, before the camera exposure is even made. It involves combining vision and technique to achieve the photographer’s personal response to the subject. The term can be found in the writings and work of Edward Weston, Ansel Adams, and Minor White, and has become the keystone of the modernist, realistic approach to photography. The principles of the Zone System can also be found in the curves and levels (histogram) and high dynamic range (HDR) functions of imaging processing software, providing concrete examples of how present methods have evolved from past ones.

In order to achieve maximum effect and control, a photographer needs to make equipment and material tests to determine the “true” speed of the film being used, and to learn precisely what alterations in the development process are needed in order to shrink an extremely long tonal range (so it will fit on a piece of paper or film) or to expand a subject’s limited brightness range to normal. Once this is done, it is possible, based on the exposure given to the subject, to determine what changes in development are necessary to obtain the desired visual outcome.

The Zone System and Color

Using the Zone System for color photography is similar to the method for black-and-white. The photographer has to learn the zones, be able to previsualize the scene, and

place the exposures. The major difference is the greatly reduced flexibility in processing color, since it is necessary to maintain the color balance between all the layers of the emulsion to avoid color shifts and crossovers. Another difference is that contrast is determined not only by light reflectance but by the colors themselves.

Film-Speed Testing

The film-speed test is at the heart of the Zone System. The biggest technical obstacle most photographers encounter when working with color film is making the correct exposure, which is more critical than in black-and-white photography since it determines not only the density but the color saturation. Even with proper exposure techniques, if the film's speed does not agree with your working procedures, the results will not be as expected. If you do not have exposure troubles, leave well enough alone. There is no reason to do a test when you could be making photographs. However, if you have had problems with exposure—especially with underexposed negatives or overexposed slides—run a test and establish your personal film speed. If your exposures are still erratic, it indicates either a mechanical problem or the need to review your basic exposure methods.

The manufacturer's stated film speed is a starting point that is not engraved in stone. It is determined under laboratory conditions and does not take into consideration your personal lens, camera body, and exposure techniques, nor the subject and the quality of light. You can customize your film speed to make it perform to your own style and taste.

The film-speed test recommended here is based on the principles of the Zone System, though your results will be determined visually rather than through the use of a densitometer.

The Zone System and Transparency Materials

Exposure is absolutely critical with transparencies, since the film, and not a print, is the final product. If a mistake is made, such as overexposure or underexposure of the film, it cannot be readily corrected in the secondary process of printing, although some correction is possible through scanning and the use of digital software. What is true for negatives is the opposite for positives (transparencies). For both, the areas of greatest critical interest for judging proper exposure are those of minimal density. However, with negatives these are the shadow areas and with transparencies they are the highlight areas. When using the Zone System method of exposure control, meter off the important previsualized highlight and then open up the lens to the required number of stops for proper zone placement. All other tones will then fall relative to the placed zone. The darker values will show up as long as the highlight is metered and placed correctly.

Finding Your Correct Film Speed with Transparencies

You will discover your personal film speed upon a correct rendering of the highlights.

The zone used for this test is Zone VII. The characteristics of Zone VII (the lightest textured highlight) include blonde hair, cloudy bright skies, very light skin, white-painted textured wood, average snow, light gray concrete, and white or very bright clothes.

Zone VIII has even less density and is so close to clear film that it can be difficult to

visually distinguish it as a separate tone. It is the last zone with any detail in it. Zone VIII subjects include smooth white-painted wood, a piece of white paper, a white sheet in sunlight, and snow entirely in shade or under overcast skies. It is easy to lose the sense of space and volume in such light objects. Zone VIII contains values so delicate that when seen beside those of Zone II or III they may be sensed as a pure white without texture.

Test Procedures

For this test, use a standard Zone VII value like a white-painted brick wall, a textured white fence, or a textured white sweater. Make the test with your most commonly used camera body and lens, and set the meter to the manufacturer's suggested film speed (ISO). Take the meter reading only from the critical part of the subject and place it in Zone VII. This can be done by either opening up two f-stops or their shutter speed equivalents. Remember the meter is programmed to read at Zone V (18 percent reflectance value, as with the gray card). "Correct" exposure is one that renders Zone V as Zone V (or any single-toned subject as Zone V, if the meter is working correctly). Then, make a series of exposures, bracketing in 1/2 f-stops, three stops more and three stops less than the starting film speed. Next, develop the film following normal procedures. Mount and label all 13 exposures, and then carefully examine them with a film loupe or magnifying glass. Look for the slide that shows the best Zone VII value—one that possesses the right amount of texture with correct color and is not too dark. This exposure indicates your correct film speed.

Transparency Film-Speed Observations

Transparency films generally have a more accurate manufacturer's film-speed rating than do negative films. The slower films are usually very close, and you may even want to test them in 1/3 f-stop intervals, two full f-stops in both directions. Medium-speed transparency films tend to run from right on to 1/3 to 1/2 f-stop too slow. High-speed films can be off by 1/2 to one full f-stop. Usually most photographers raise the transparency film speed from the manufacturer's speed. Why? This slight underexposure produces richer and fuller color saturation. With slide film it is imperative that you meter with the utmost accuracy. When in doubt, give it less exposure rather than more. Do not hesitate to bracket and be certain you have what you need and want.

Highlight Previsualization

Once you have determined your personal film speed, correct exposure entails previsualizing the highlights only. Pick out the most important highlight area, meter it, and place it in the previsualized zone in which you want it to appear. You do not have to bother to meter the contrast range between the highlights and shadows. If you are in the same light as the subject being photographed, the correct exposure can be determined by metering off an 18 percent gray card or, if you are Caucasian, simply metering the palm of your hand in the brightest light in the scene and then placing it in Zone VI by opening up one f-stop. The contrast of the image, just as with color negative film, will be largely a matter of the relationship of the colors that are in the scene being photographed.

Working with Negative Film

All the major color negative films can be developed using Kodak's C-41 process. This is not only convenient but also necessary. Attaining the correct balance of color dyes in the design of negative film has not been an easy task. Standardization within the industry has made this less difficult. Even so, though it is possible to develop many different types of film in a common process, your results will vary widely. This is because each film has its own personality based on its response to different colors. You will need to try a variety of films and even different types of C-41 processes until you come up with a combination that matches your personal color sensibilities.

Exposing for the Shadows: Zone III

Color negatives, as with black-and-white, are exposed for proper detail in the shadow areas. Adequate detail in a Zone III area is generally considered to indicate proper exposure. Zone III indicates "average dark materials." This includes black clothes and leather. In the print, proper exposure shows adequate detail in the creases and folds of these areas. Form and texture are revealed, and the feeling of darkness is retained.

Film-Speed Tests

A Simple Exposure Test

The simplest exposure test is one in which you find a Zone III value (subject) and then meter and place it using a variety of different film speeds (bracketing). The film is

developed and carefully examined with a loupe or magnifying glass to determine which exposure gives the proper detail in Zone III. The result provides your proper film speed.

A Controlled Test

Here is an easy and controlled method that provides more accurate results. On a clear day in direct sunlight, photograph a color chart and gray card. Make the test with the camera body and lens you use most often. Set the film speed according to the manufacturer's starting point. Take all meter readings off the gray card only. This way there is no need to change exposure for different zone placements. Make an exposure at this given speed. Then make a series of different exposures by bracketing in $\frac{1}{2}$ f-stop increments; go two full f-stops in each direction.

As an example, say you set your film speed at 400 and determined that your exposure is f/8 at 1/250. You would make your initial exposure at this setting and then make four exposures in the minus direction and four in the plus direction. Leave your shutter speed at 1/250 for all exposures. Table A2.2 gives you the f-stops you would need to expose at and their corresponding film speed.

Visually Determining the Correct Exposure

After making the exposures, process the film following your normal procedures. Next, identify and/or label each frame according to its film speed, and then critically examine them with a loupe in the order they were exposed, beginning with the highest film speed. Pay close attention to the black-and-white density scale on the page photographed. As you look at the negatives, you should notice more of the steps becoming distinct as the

speed of the film drops. Your correct exposure will reveal visible separation for all the steps in the scale.

What If You Cannot Decide?

What often happens is that you can narrow your choice to between two frames but then cannot decide which one is correct. If this occurs, choose the one that has more exposure. Color negatives do not suffer as much from overexposure as black-and-white negatives. Because the final print is made up of layers of dyes and not silver particles, slight overexposure does not create additional grain. In fact, overexposing by even as much as two f-stops will not make a negative unprintable. Given the choice of range of exposure for color negatives, overexposure is preferable. It builds contrast, offers protection against loss of detail in the shadow areas, and increases color saturation, which is directly controlled by exposure. Underexposure causes a loss of saturation, making the colors look flat and washed out. This cannot be corrected during printing, though some digital correction is possible.

The “No Time” Approach

If you do not have the time to test a new film, the guidelines in Table A2.3 are offered as starting film speeds for negative film. When in doubt, give color negative film more exposure. Table A2.4 recommends starting speeds for transparency film. When in doubt, give color transparency film less exposure.

Contrast Control

With color negative films there are two important considerations that determine the contrast. The first is that contrast is produced from the colors themselves in the original scene. Complementary colors (opposite each other on the color wheel) produce more contrast than harmonious colors (next to each other on the color wheel). This factor can be controlled only at the time of exposure or by post-exposure software. The addition of fill light when shooting and masking when printing are other methods to control contrast.

Brightness Range

The second factor in contrast control of color negatives is the overall range of light reflectance between the previsualized shadow and highlight areas. This is the same as with black-and-white negatives. To a limited degree, the contrast can be changed by modifying the development time. However, when compared to black-and-white film, the allowable change in development time is much smaller, as any change will affect the color balance, which is finalized during development. With most color negative films, it is possible to adjust the contrast by one zone of contraction or expansion without serious color shifts or crossovers.

Table A2.5 suggests starting development times for Kodak's C-41 process in fresh developer for the first roll of film.

What Is "N"?

In the Zone System, "N" stands for normal developing time. N minus 1 (N-1) is used when you have a higher-than-normal range of contrast and wish to reduce it. N plus 1

(N+1) is used when you have a scene with lower-than-normal contrast and want to increase it.

Paper and Contrast Control

Compared to black-and-white, contrast control during analog color printing is very limited. It is possible to slightly increase the contrast of the final print by using a higher-contrast paper. By combining the higher-contrast paper with an N+1 development, you can increase the contrast to a true N+1 or to an N+1½ and maybe even an N+2. Corrections beyond these limits require digital assistance.

Table A2.1 Basic Zones and Their Physical Equivalents

Low Values
Zone 0: Maximum black. The blackest black that a film or paper can produce when exposed to white light. Doorways and windows opening into unlit rooms.
Zone I: The first discernible tone above total black. When seen next to a high-key zone it is sensed as total black. Twilight shadows.
Zone II: First discernible evidence of texture; deep tonalities that represent the darkest part of the picture in which a sense of space and volume is needed.
Zone III: Average dark materials and low values showing adequate texture. Black hair, fur, and clothes in which a sense of detail is needed.
Middle Values
Zone IV: Average dark foliage, dark stone, or open shadow in landscape. Normal shadow value for average white (Europe, North Africa, Middle East) skin portraits in daylight.

Also brown hair and new blue jeans.
Zone V: 18 percent gray neutral test card. Average black skin, dark skin, or tanned Caucasian skin, average weathered wood, grass in sunlight, gray stone.
Zone VI: Average white skin value in sunlight, diffuse skylight, or artificial light. Light stone, shadows on snow in sunlit landscapes.
High Values
Zone VII: Very light skin, light gray objects, average snow with acute side lighting.
Zone VIII: Whites with texture and delicate values, textured snow, highlights on white skin.
Zone IX: White without texture approaching pure white, similar to Zone I in its slight tonality without a trace of texture.
Zone X: Pure white of the printing paper base, specular glare, or light sources in the picture area.

Table A2.2 Film Speed Test Exposures

f-stop	Film speed
f/16	1600
f/11 ½	1200
f/11	800
f/8½	600
f/8 * Starting exposure	400 * Starting exposure

f/5.6 ½	300
f/5.6	200
f/4 ½	150
f/4	100

Table A2.3 The “No Time” Modified Film Speed for Negative Materials

Starting speed	Modified speed
100	50–80
200	100–125
400	200–300

Table A2.4 The “No Time” Modified Film Speed for Slide/Transparency Materials

Starting speed	Modified speed
50	64– 80
100	125– 150
400	500– 600

Table A2.5 Suggested Starting Development Times in Kodak's C-41 at 100 °F

Scene contrast	Development time*
N-1	2 minutes 40 seconds
Normal	3 minutes 15 seconds
N+1	4 minutes

* All times based on first roll in fresh developer.