

## Understanding Depth of Field

By Chuck Palmer

Subject sharpness may be the single most important design element to consider in most photographs and understanding Depth of Field (DOF) is key to placing sharpness where you want it.

Depth of Field is really just the range of distance that appears sharp to the viewer. It varies based on aperture (f-stop), focusing distance (subject distance), and the size of your camera's image sensor. Most experienced photographers understand the relationship between aperture and the range of sharpness. However, many photographers don't intuitively understand the impact focusing distance has on the range of sharpness. Let's take a closer look at the factors that influence Depth of Field.



Using a DOF Calculator is an effective method to help understand how different factors affect Depth of Field. As you might expect, there are several DOF calculators available for cell phones, but one of the most intuitive on-line calculators can be found at <http://www.dofmaster.com/dofjs.html> Let's take a

look at some typical situations. The following table reflects the results of the dofmaster on-line calculator:

**Typical Depth of Field for Full Frame Sensor Camera**

<b>Focal Length - f-stop</b>	<b>50 mm - f/2.8</b>		<b>50 mm - f/16</b>		<b>200 mm - f/2.8</b>		<b>200 mm - f/16</b>	
<b>Subject distance (ft.)</b>	<b>10</b>	<b>40</b>	<b>10</b>	<b>40</b>	<b>40</b>	<b>160</b>	<b>40</b>	<b>160</b>
<b>Depth of field (ft.)</b>								
<b>Near limit (ft.)</b>	<b>9.08</b>	<b>28.3</b>	<b>6.35</b>	<b>12</b>	<b>39</b>	<b>145.1</b>	<b>35</b>	<b>101.1</b>
<b>Far limit (ft.)</b>	<b>11.1</b>	<b>68</b>	<b>13.6</b>	<b>Infinity</b>	<b>41</b>	<b>178.4</b>	<b>46.7</b>	<b>383.5</b>
<b>Total DOF (ft.)</b>	<b>2.06</b>	<b>39.7</b>	<b>17.2</b>	<b>Infinite</b>	<b>2.04</b>	<b>33.3</b>	<b>11.8</b>	<b>282.4</b>
<b>In front of subject (ft.)</b>	<b>0.92</b>	<b>11.7</b>	<b>3.7</b>	<b>28</b>	<b>1</b>	<b>14.9</b>	<b>5</b>	<b>58.9</b>
<b>Behind subject (ft.)</b>	<b>1.13</b>	<b>28</b>	<b>13.6</b>	<b>Infinite</b>	<b>1.04</b>	<b>18.4</b>	<b>6.7</b>	<b>223.5</b>

A study of the table shows how each factor contributes to Depth of Field. In general we can make the following observations:

1. Larger apertures (smaller F-Stop number) result in a shallower depth of field, or shorter range of sharpness. Changing from f/16 to f/2.8 on a 50 mm lens the DOF is reduced from 17 ft. to just 2 ft. if your subject distance is 10 ft. away. But this is often very good news to photographers!. We can use this very shallow depth of field to place focus only on our subject and turn that cluttered distracting background into an out of focus blur.
2. Closer focusing distances result in a shallower depth of field, or shorter range of sharpness. – With a 200 mm lens set at f/2.8 focusing on a subject pretty far away... let's say 160 ft., our DOF will be 33 ft. However, take the same lens and focus on a subject 40 feet away, the DOF or range of sharpness drops to just 2 ft. Knowing we have a fairly large DOF at greater focusing distances, photographers can feel comfortable using a larger aperture for those situations where subjects are moving in low light and a greater shutter speed is desired. Note the impact focusing distance has on a 50 mm lens too!
3. Telephoto lenses appear to create a much shallower depth of field. But this is because they are used to magnify the subject. If the subject occupies the same fraction of the image (constant magnification) for both a telephoto (200 mm), and a normal lens (50 mm), the total depth of field is almost the same. Note the DOF for a 200 mm lens at f/2.8, focused on a subject 40 feet away (Approx. 16% of the 200 mm focal length), is virtually the same as a 50 mm lens at f/2.8 focused on a subject 10 feet away (Approx. 16% of its focal length). So contrary to popular belief, lens focal length by itself has little influence over depth of field.
4. Although not shown in the table, at a similar focusing distance Depth of field appears shallower for full-frame SLR cameras than for so-called "cropped sensors" on compact digital cameras because full-frame SLR cameras require a longer focal length to achieve the same field of view.
5. It is important to note that Depth of Field or the range of sharpness does not abruptly change from tack sharp to unsharp. Sharpness gradually transitions from sharp to unsharp in front of

and in back of the point of camera focus or subject distance as can be seen from the near and far limits in the table. You may find sharpness to be unacceptable at or near these defined near and far limits for your particular image.

Applying many design elements, including subject sharpness, in your photographs can result in some remarkable photos. Happy shooting, and may the remarkable photos always be yours.