WHAT IS EYEWITNESS PERSPECTIVE?
DSLR Photographic Evidence

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February 26, 2023

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INTRODUCTION

Since 1999, when I obtained my investigator's license I have witnessed (like many of you) technology rapidly change and advance. I was routinely upgrading camcorders and cameras, going through various recording formats from 8mm to disc, then to CFI cards, SD and micro SD, etc.

Through this rapid technology change to auto-tech convenience, and the advent of high quality cell phone cameras, many have forgotten or never learned a couple fundamentals of basic forensic photography. The one aspect I want to address is developing Eyewitness Perspective, or what someone saw with their naked eye.

Eyewitness Perspective is when a photographer can stand in the same spot where a witness previously stood, and capture an image with the same depth of field and perspective as the witness' naked eye view. Then with a printed 8x10 photograph held at roughly arm's length, it would accurately reflect the eyewitness perspective from where the photo was taken. This type of photographic evidence in the courtroom can replicate the detail of what a person may or may not be able to see due to distance and obstacles.

NOTE: **This article is intended as a basic "How To" template for the investigator that is a novice to intermediate photographer. Professional and Forensic Photography is much more in depth and complex.**

HISTORICAL STANDARD FOR CONSISTENCY

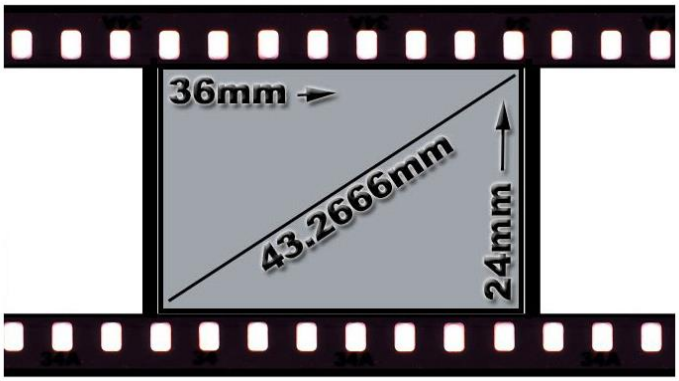
Recounting several POST classes and courses I've attended on basic crime scene investigations, it's well known that law enforcement agencies in the 20th century routinely used 35mm film, Full Frame SLR (Single Lenses Reflex) cameras and a prime lenses with a fixed focal length of 50mm.

The 35mm images printed in 8x10 became a photography standard for crime scene investigations for a consistency purposes in investigations and courtroom testimony.

WHAT IS NAKED EYE VIEW?

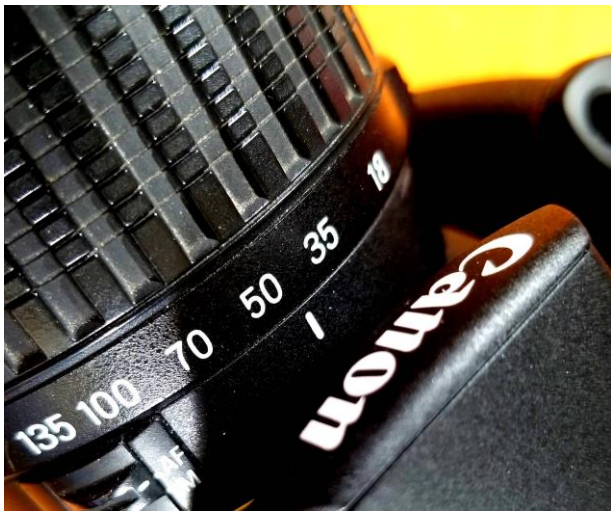
In 35mm film photography, the 24mm by 36mm rectangle of the film frame has a diagonal measurement of about 43mm. Thus, by this definition, a normal lens for full-frame 35mm is 43mm.

Naked Eye View is achieved when the lenses Focal Length setting of a 43mm, matches the 43mm diagonal measurement of one frame of 35mm film, so there is no magnification of the image.

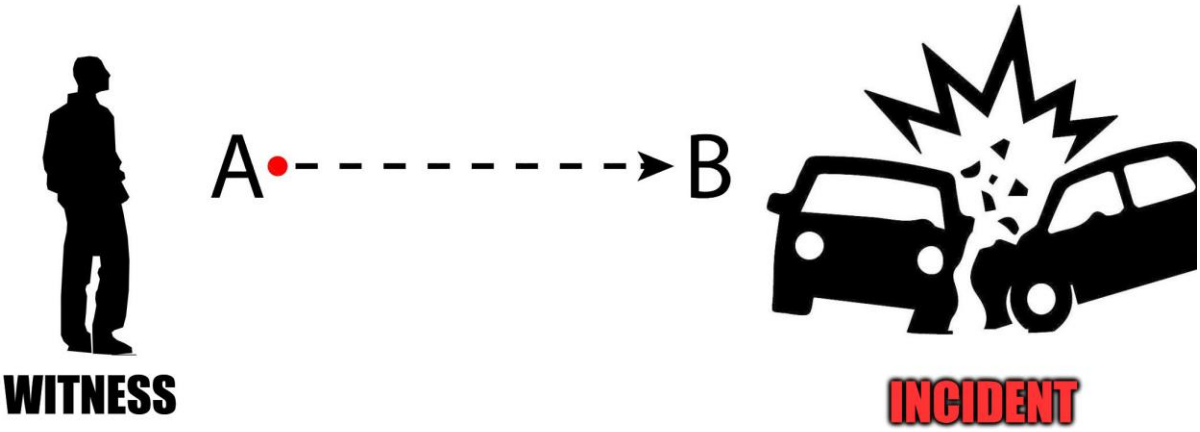


It would be easier to simply buy a fixed 43mm lenses (below left), unfortunately they are not very common. The alternative is to use a zoom lenses where 43mm falls within the adjustable focal length range. On many zoom lenses, 43mm focal length setting falls within a zoom range of a typical 18mm to 55mm lenses.

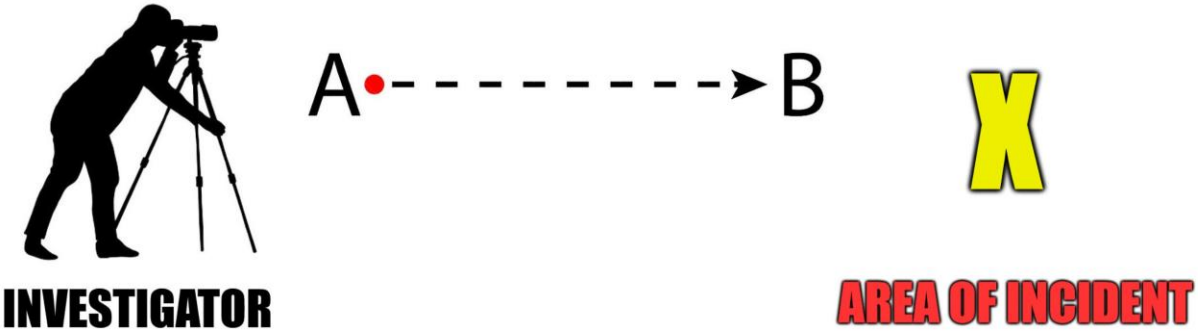
Since there is usually no specific marking for 43mm on a lenses, as you can see in the following image (below right), the lenses Focal Length markings often jump from 35mm to 50mm, with a 15mm gap. Center or half of the 15mm gap is 7.5. When you add 7.5 to 35mm, you get 42.5 … so on this lenses, midway between 35 and 50 is approximately 43mm, which is equivalent to the Naked Eye View on a full frame camera.



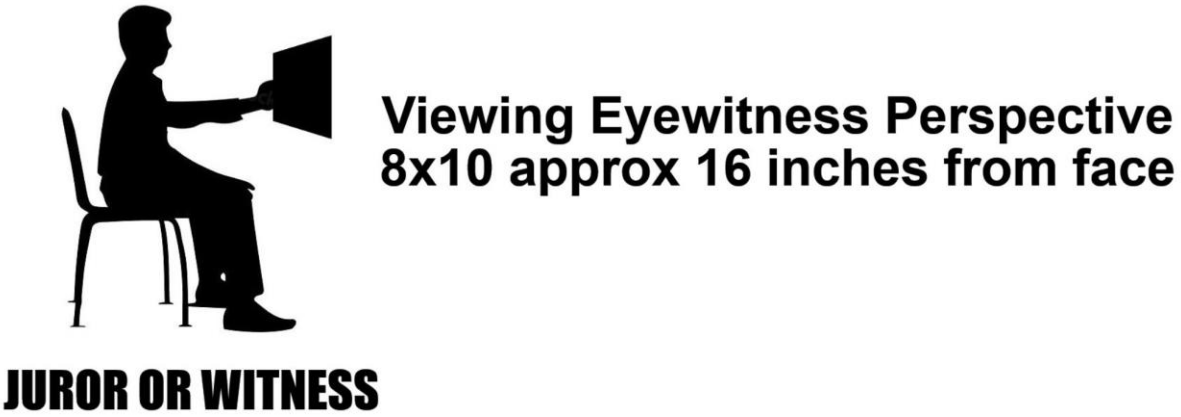
The following three images are a visual concept of recreating the eyewitness perspective through photography.



Using the correct reference points, the investigator attempts to recreate the witness perspective, using 43mm lenses focal length on a full frame camera to replicate the naked eve view.



When taken with the proper lenses settings, then printed in 8x10, the witness or juror can hold a photograph in front of them and see the correct eyewitness perspective with the naked eye view.

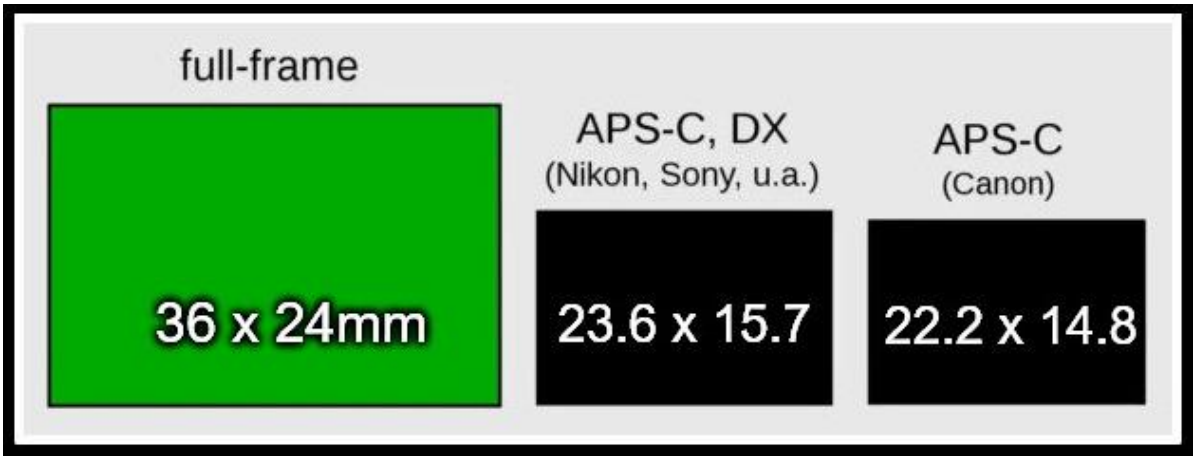


Now that we know to replicate the Naked Eye View is 43mm focal length lenses setting on a Full Frame SLR Camera, this brings us to modern digital camera equipment with a variety of sensor sizes that can drastically affect the final image product.

MODERN ERA DSLR CAMERAS

The modern era DSLR camera body with a Full Frame sensor is designed to replicate the 35mm film camera standard, where the image sensor is 43.2666mm diagonally. This part explains the importance of understanding the sensor size of your DSLR camera sensor, and how it will affect the image, if you plan to use it for evidentiary work.

Popular manufacturers like Canon and Nikon have produced several types of DSLR cameras. The Full Frame camera where the digital sensor is consistent to 35mm photography standard previously mentioned, AND what's known as APS-C camera sensors, where the camera sensor is actually smaller. Below is an example of sensor sizes.



While both DSLR cameras look very similar (below), the results can be very different based on sensor size. The side by side image below demonstrates the size difference in the body and sensor, between the Full Frame camera on left, and the smaller APS-C camera with a smaller sensor on the right.

Sensor Full Frame Sensor APS-C

The top two consumer DSLR camera bodies sold are Canon and Nikon, both with APS-C sensors. What is the difference between Full Frame DSLR camera and the APS-C sensor camera bodies?

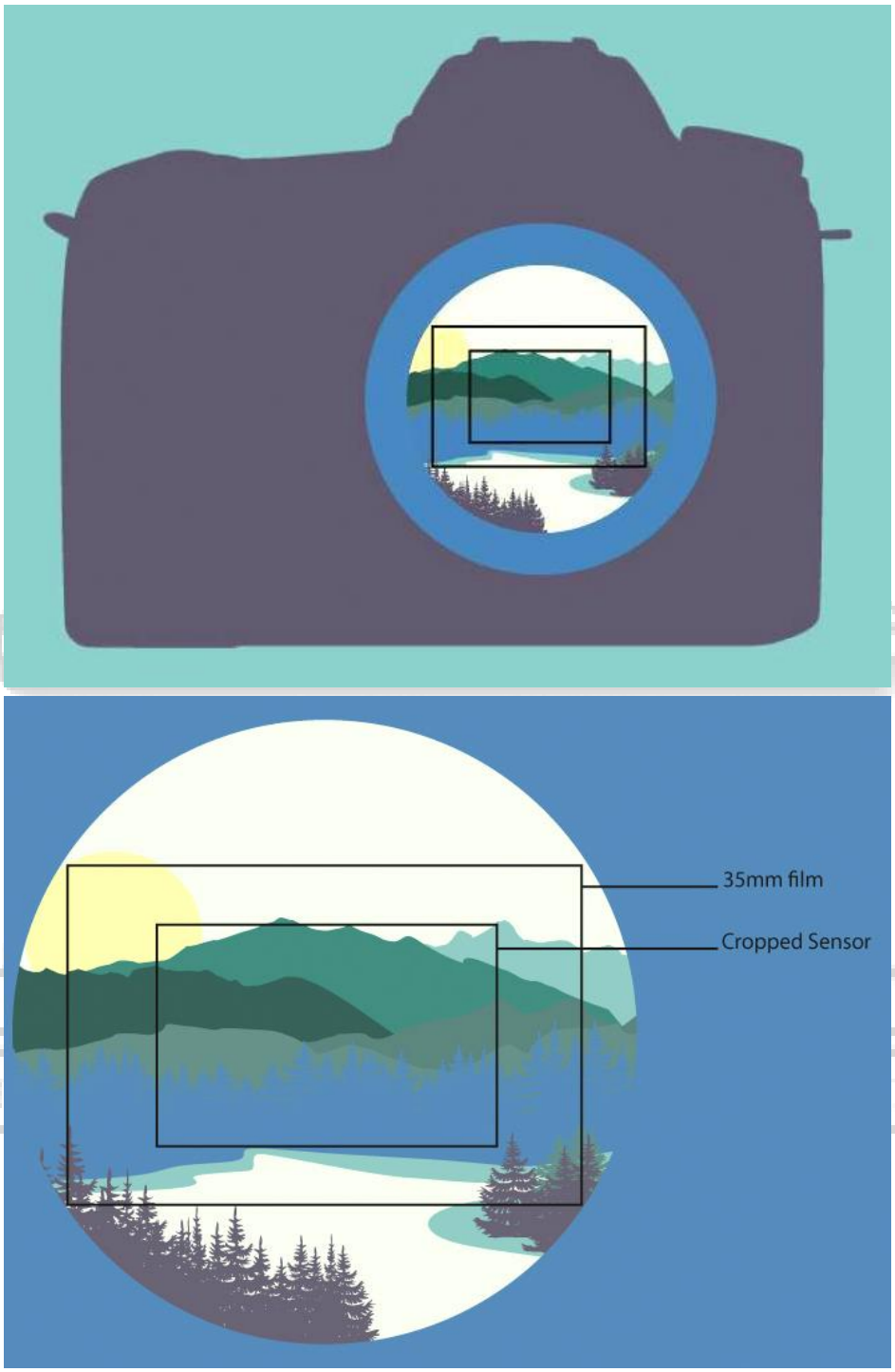
<u>Full Frame Camera Bodies:</u>

- **Replicate the standard 35mm film frame (36mm x 24mm)**
- **Larger camera body**
- **Heavier camera body**
- **are considerably more expensive**
- **more advanced features**
- **geared towards professional photographers, portrait studios, etc.**
- **larger pixels, and sometimes more**

<u>APS-C Sensor Camera Bodies:</u>

- **Smaller sensor (22.2mm x 14.8mm)**
- **Affordable for the average consumer, novice to midrange photographer**
- **Smaller camera body**
- **Lighter weight camera body**
- **Reduced field of view (image height & width)**

You can see in the following images on P.6, the smaller sensor size affects the field of view for the camera. It does not affect the focal length of the lenses itself; the focal length remains the same. The major difference caused by the smaller APS-C sensor is what's known as CROP FACTOR, is where the image has a reduced field of view with regards to overall height and width.



APS-C SENSOR CROP FACTOR

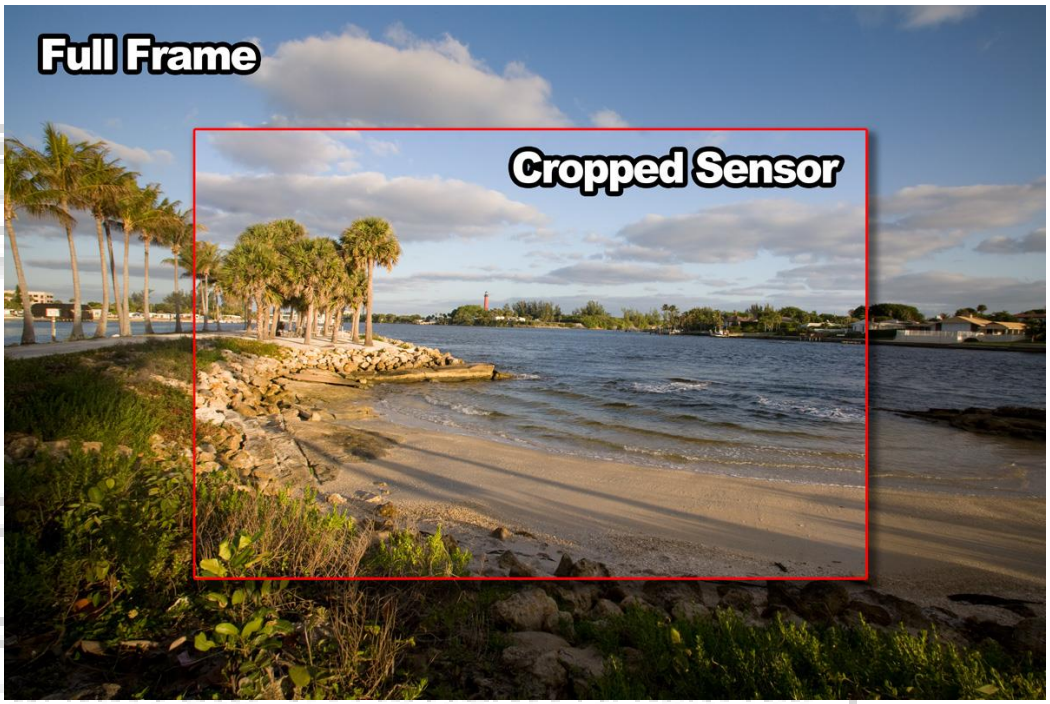
If you took a scenic image with two DSLR cameras side by side, one with a Full Frame Sensor and the other with an APS-C sensor, both with the same lenses focal length, at first they will look almost identical. Upon closer examination, you will notice the APS-C camera does not possess the same field of view (width & height). And what can be

deceiving, is even though both images were taken with the same lenses focal length, the APS-C image will appear closer.

Below is an example of the same scene, taken with a Full Frame sensor camera next to a smaller APS-C sensor camera. Both cameras possess the same lenses focal length setting at 50mm.

The difference between the Full Frame DSLR camera and the more popular DSLR camera with an APS-C Cropped Sensor becomes much more obvious. The shoreline and palm tress are the same size in both images however, the Field of View (height & width) of the Full Frame camera is 1.6 times greater. This is an example of CROP FACTOR.

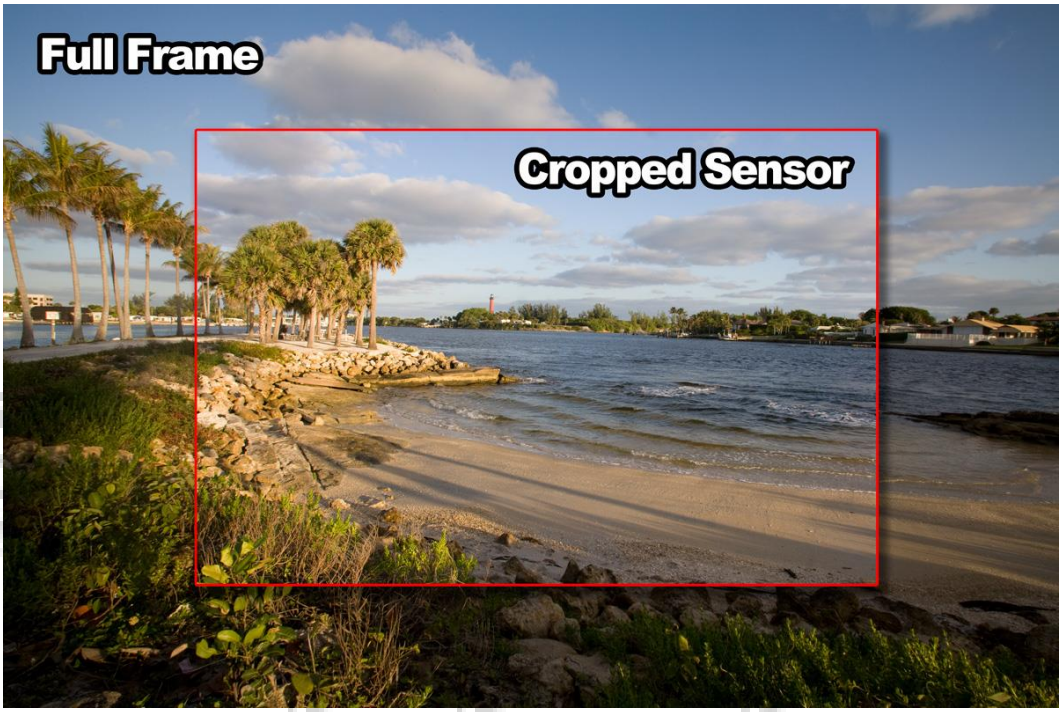
Original Full Frame size



Original APS-C Sensor size

So if the lenses focal length is the same setting for both cameras, why is this important? As previously stated, the Full Frame image is 1.6 times larger than the APS-C sensor image. When we transfer the digital file from the SD Cards to our computer or a photo store to have both images printed in 8x10, the software automatically adjusts and increases the size of the smaller cropped image by over 1/3.

Full Frame Sensor Image Printed in 8x10



The smaller Cropped Sensor image will appear zoomed in closer than it actually is, as seen below. Now you've lost your Eyewitness Perspective.

Cropped Sensor Image Printed in 8x10

An incorrect term frequently applied to the smaller APS-C sensor is Focal Length Multiplier, giving the impression that the smaller camera magnifies your lenses 1.6 times. The focal length for both cameras is still the same at 50mm, as seen on page7 illustration. The problem is when the reproduced image from the smaller APS-C sensor camera is printed in 8x10, the Eyewitness Perspective is lost and appears much closer than it actually is … as demonstrated on page 8. The Cropped Sensor image appears to be a zoomed-in equivalent of an 80mm lenses setting on a Full Frame camera. Then how do we create an Eyewitness Perspective with a reduced sensor camera?

<u>THE CROP FACTOR FORMULA</u>

My Canon APS-C cameras have a crop factor of 1.6x due to the smaller sensor and reduced field of view.

In order to determine the eyewitness perspective where Crop Factor is an issue, you simply divide the Naked-Eye-View focal length of 43mm by 1.6 to compensate for the reduced Field of View. Your adjusted lenses Focal Length setting on a Canon camera with an APS-C sensor is now 27mm.

NAKED EYE VIEW FULL FRAME EQUIVALENT		APS-C SENSOR CROP FACTOR		ADJUSTED FOCAL LENGTH LENSES SETTING
43mm	**÷**	**1.6**	**=**	**26.875** **(or 27mm)**

Different camera brands and models have different Crop Factors. I used Canon as an example since it's my camera of choice, where the crop factor increases the image 1.6 times.

The grid below compares the various sensor types and their crop factor.

Sensor Type	Width & Height (mm)	Diagonal (mm)	Sensor Area (sq. mm.)	Crop Factor
Medium Format	53.7×40.2	67.08	2159	0.65
35mm Full-Frame	35.8×23.9 to 36×24	43.1–43.3	856–864	1.0
APS-H	27.9×18.6	33.5	519	1.29
APS-C (Nikon, Pentax, Sony, Fujifilm, and Sigma)	23.6×15.6	28.2–28.4	368–370	1.52–1.54
APS-C (Canon)	22.3×14.9	26.82	332	1.61
Four Thirds / Micro Four Thirds	17.3×13	21.6	225	2.00
1" Type	13.2×8.8	15.86	116	2.72

Below is another example calculation for a Nikon camera with a 1.52 Crop factor.

NAKED EYE VIEW FULL FRAME EQUIVALENT	APS-C SENSOR CROP FACTOR	ADJUSTED FOCAL LENGTH LENSES SETTING
43mm ÷	**1.52 =**	**28.28** **(or 28mm)**

Here is where the crop factor compensation or adjustment comes into play.

On a Full Frame camera, set at 43mm lenses Focal Length, when you print an 8x10 picture, you will accurately replicate the Naked Eye View or Eyewitness Perspective, when the picture is held approximately 16 inches from your face.

On a camera with a reduced APS-C sensor, the Crop Factor formula allows you to replicate the field of view of an 8x10 picture produced from a Full Frame camera set at 43mm lenses focal length, maintaining the Naked Eye View or Eyewitness Perspective.

In closing, if you're on the stand and have to testify regarding images you took capturing the Eyewitness Perspective, you can intelligently convey that on a Full Frame camera, the lenses focal length setting of 43mm accurately reflects the naked eye view.

If the image was taken with a camera with a smaller or reduced sensor, you will be able to explain the formula and adjusted setting to accurately replicate the depth of field and field of view of a Full Frame camera with a lenses focal length of 43mm.

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ABOUT THE AUTHOR

Randall Alexander has been a Legal Investigator and California state licensed investigator since 1999, specializing in Civil Litigation Support and Family Law Litigation. Randall served several years in multiple capacities with the California Association of Licensed Investigators, where he was specifically recognized for "Exceptional Service" to the association and its members.

In 2008, Randall was recognized as a Subject Matter Expert by the Bureau of Security and Investigative Services, a division of the California Department of Consumer Affairs. He has testified in civil and criminal matters in both state and federal courts, as well as a state administrative hearing.

Randall earned his Associate of Arts in Paralegal Studies from the Southern California College of Business and Law; an American Bar Association approved program where he completed coursework in: Advanced Legal Research, Torts & Personal Injury, Civil Litigation, Business Law Contracts, Criminal Law, Family Law Litigation, Legal Procedures, and Advanced Legal Writing.

Additional training in photography includes:

Crime Scene Investigations - POST Advanced Officer Training, Fullerton College
Crime Scene Investigations – POST Admin of Justice, Golden West College
Crime Scene Investigations – POST San Diego Police Academy
Forensic Photography as Evidence - George Reiss, Forensic Photographer, NBPD
Digital SLR Photography – North Orange County Regional Occupational Program
B&W Photography (35mm SLR) – Golden West College, Huntington Beach