

# High Dynamic Range photography – a quick primer

By Rich Phelan for the Photo Venture Camera Club - October 9, 2008

## What is HDR?

High Dynamic Range

## Why do we need it?

The real world contains a range of light that far exceeds what we can capture with a camera – something on the order of a dynamic range of 50,000:1. Our eyes and brains interpret that information and let us see most of that information, often adjusting while we view a scene to interpret it. Unfortunately, printed media has a dynamic range of about 300:1. Some digital displays will get much more range, but we are still very limited by what we can put onto a static piece of paper.

## Traditional photographic solution

With film and the proper technique, you could get 6 f-stops of dynamic range – up to 9 with negative development and print contrast enhancement techniques. Ansel Adams was the first master of this and it led to the development of his famous zone system. When printing an image, high contrast papers as well as dodging and burning were used to extend the range of an image. While this worked to an extent, it only succeeded on images with a limited range. Another method is to use a split neutral density filter. This assumed, however that the boundary between the light and dark areas of the image fall along a straight line.

## The digital answer

Introduced in Photoshop CS2 was a new utility – merge to HDR – and a new way to store files – 32bit.

Why 32bit? Traditionally images are stored in 8bit or 16bit color depths giving us up to 32k colors. (Photoshop only uses 15 of the 16 bits for color depth) While this seems like a lot of range it's not enough for HDR so PS uses 32bit floating point math instead.

## How to do it!

As HDR works best with static images, you'll need a tripod in addition to the camera. If you have a remote shutter release you'll need it as well. If you don't have one, use the timer on your camera as we don't want to introduce any camera shake. Also as some of the exposures may be rather long, we want a very steady platform.

After you compose your scene, you want to take a range of exposures that capture every detail. A simple way to start is to let your camera decide on the exposure and then work up and down from there. One important thing to note is that the depth of field must remain constant – so we must keep the f-stop the same for each of the images and vary only the exposure time. I put my camera in aperture priority mode and then dial in +3 exposure. I'll then take one at +2, +1, 0, -1, -2 and -3. This will give seven exposures and usually more than enough to cover the range of the scene. You should, however, check the histograms of the images to make sure that the +3 doesn't go off the left edge (looses shadow detail) and that the -3 image doesn't go off the right side (blown highlights). If you've captured the entire dynamic range of the image continue, otherwise take a few more images (+4 or -4, etc.) to get it all.

#### *Additional exposure details:*

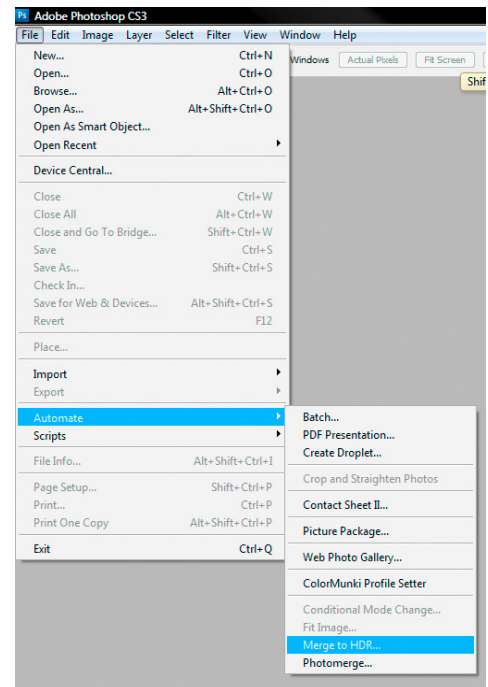
Since we are shooting a static scene we want a few variables as possible. Therefore it would be best to have no automatic settings for the exposure. I would actually recommend setting the camera to Manual exposure (and use the in camera metering as a starting point), daylight white balance, the lowest ISO you can get to achieve 30 second or less exposures, and a raw file capture. And just to be really anal, turn off any image stabilization or vibration reduction features. We want everything in the images to be a similar as possible except the intensity of the light.

## Processing

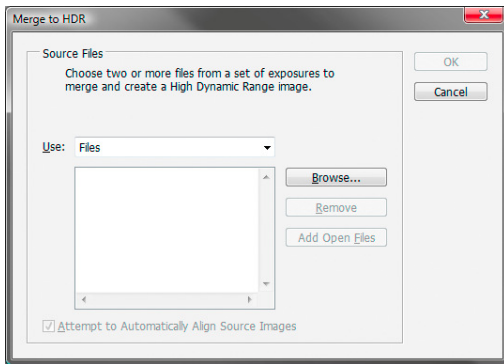
Now we need a method to combine the images into a single scene. Before the HDR utilities, you would overlay the images and mask out only the properly exposed part of the image. It can work fairly well but takes a lot of time and patience as well as a bit of artistic skill. As an exercise I once tried it and once was enough.

There are several programs that will process HDR images and a few of them are listed at the end in the Additional Resources section. For now we'll be using Photoshop CS3.

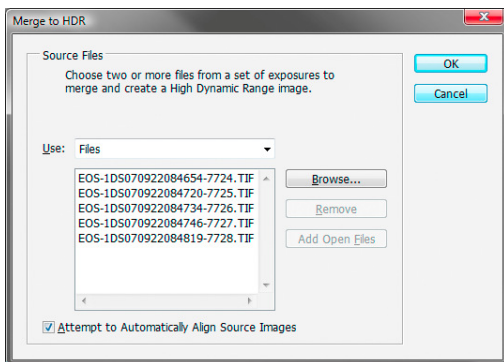
Start by opening up the HDR dialog –  
File / Automate / Merge to HDR...



And we get the following dialog:

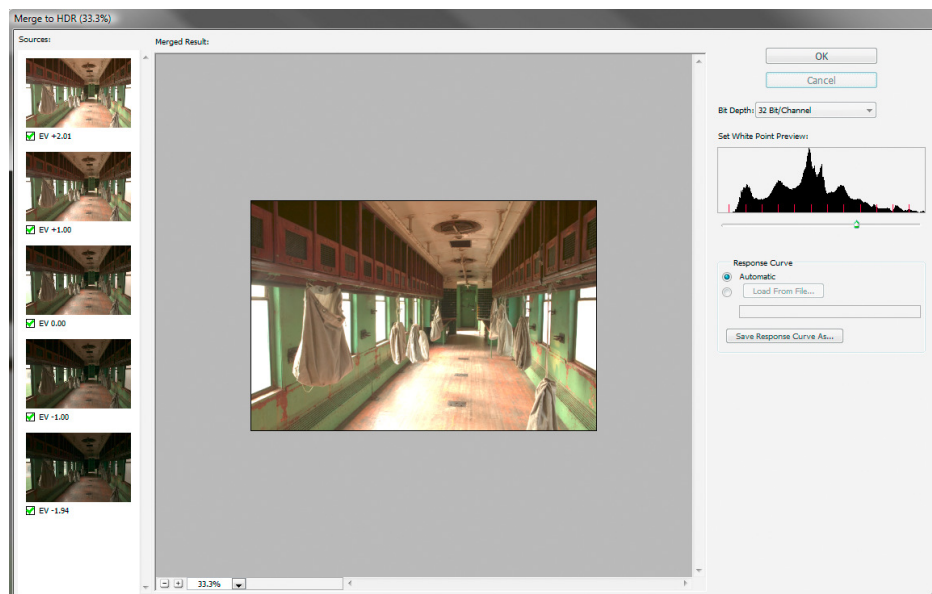


Using the browse button, find your files and pull them into PS.



For the checkbox "Attempt to Automatically Align Source Images" Photoshop recommends using if you are hand-holding the camera while taking the pictures. If you turn it on it will take much longer to process the files. As we are using a tripod, turn it off.

Now is the time that you will want to have a really fast computer as this is the part that takes the most processing. After a while PS will come back with something like this:



Important parts of this screen are:

Set White Point Preview – this is a non-destructive adjustment that sets the brightest point in the displayed image. Use this control to see if you have enough exposures to cover all of the range.

Sources – Each of the imported images will be displayed along with their relative exposure value. The checkbox allows you to exclude any of the images if they don't add any additional information. This could save processing time later.

Zoom Level – In the lower left of the image area is the zoom control. Use this to zoom into the light and dark areas of the image to verify the amount of information. Standard zoom controls will work (Ctrl -, Ctrl +, Ctrl 0, and using the spacebar to bring up the pan tool).

Bit Depth – leave this at 32 bit. Otherwise, what's the point?

If you think that you've enough images and have all of the information that you want, hit OK and wait a bit for PS to generate your 32-bit image. What you should see is the same image as the preview. The white point preview slider is now in the lower left of the image space.

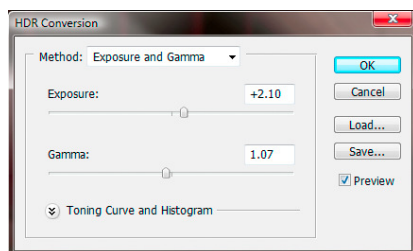
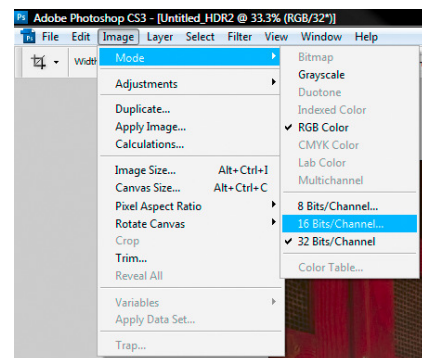
What you now have is a 32-bit image. Some of the standard PS tools will work, but the list is rather short. Still I think that it's impressive that you can work with a 32-bit image in PS.

At this point you will want to save your file. Treat this as you would an original image. As you convert to a 16-bit file you may not like the results and will want to start again with this image.

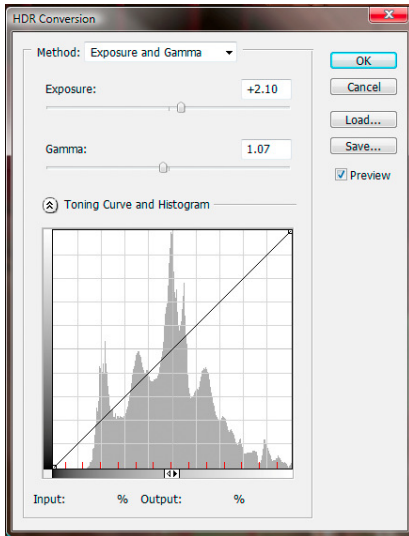
As our editing options are very limited, and the print option is not available, we are going to convert the image to 16 bit.

From the menu bar: Image / Mode / 16 Bits/Channel...

And you will get the following dialog box:



Expanding the Toning Curve and Histogram button gives:



The Method selection has four options:

Exposure And Gamma, Highlight Compression, Equalize Histogram, Local Adaptation.

### **Exposure and Gamma**

Using the Exposure and Gamma sliders you can adjust the brightness and contrast, respectively. Adjust the image until you think you have something that you can work with.

### **Highlight Compression**

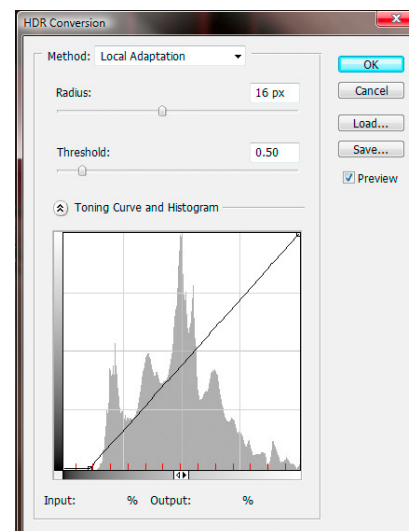
This has no options and will reduce the contrast of the highlights so that all of the luminance values will fit within a 16-bit or 8-bit file.

### **Equalize Histogram**

This method attempts to compress the dynamic range to preserve the contrast of the image. Again, there are no options. Click and see if you like the result.

### **Local Adaptation**

This is the most flexible conversion and the one that usually works the best. This method uses information around a pixel before adjusting the value – much like local contrast enhancement. This method also enables the Toning Curve for much finer control of the image.



Additional resources:

Excellent web site and home of the HDRI Handbook:

<http://www.hdrilabs.com>

The books:

The HDRI Handbook by Christian Bloch, 2007 ISBN 987-1-933952-05-5

Complete Guide to High Dynamic Range Digital Photography by Ferrell McCollough, 2008, ISBN -13 : 978-1-60059-196-9

Very quick and easy read on the subject:

<http://www.visualphotoguide.com/quick-introduction-to-hdr-photography/>

A very excellent brief tutorial on the subject and source for much of this presentation:

<http://range.wordpress.com/2006/07/15/modern-hdr-photography-a-how-to-or-saturday-morning-relaxation/>

Norman Koren is very technical and very thorough – proceed at your own risk:

[http://www.normankoren.com/digital\\_tonality.html#Human\\_vision](http://www.normankoren.com/digital_tonality.html#Human_vision)

Some more good reads:

The Luminous Landscape always has good tutorials:

<http://www.luminous-landscape.com/tutorials/hdr.shtml>

From the DPRReview glossary section:

[http://www.dpreview.com/learn/?/Glossary/Digital\\_Imaging/dynamic\\_range\\_01.htm](http://www.dpreview.com/learn/?/Glossary/Digital_Imaging/dynamic_range_01.htm)

Digital Photography Tutorials:

<http://www.cambridgeincolour.com/tutorials.htm>

Software:

<http://www.hdrsoft.com/index.html>

<http://www.idruna.com/photogenicshdr.html>

<http://www.hdrshop.com/>

And a review of many of them on Wikipedia:

[http://wiki.panotools.org/HDR\\_Software\\_overview#HDR\\_creation\\_and\\_tonemapping](http://wiki.panotools.org/HDR_Software_overview#HDR_creation_and_tonemapping)

Groups

Flickr: <http://www.flickr.com/groups/hdr/>

From : <http://www.cybergain.com/tech/hdr/resources.html>