## Study Model Rendering for the masses

Accompanying this article I am providing the fruits of my labor, which include a seed file and corresponding Rendering Setup File, .rsf, and other files including the models shown in figures 5-10. Please try these settings on some of your new or existing models and let me know what you think. The file is “Study Model Rendering - Attachments.zip”. See “Study Model Rendering - Attachments.pdf” for an explanation of what is included in the .zip file. I am also including “Study Model Rendering - Rendering Statistics.pdf”, which indicates the rendering times for the various images used in this article.

In August I posted a thread to the Bentley Visualization newsgroup, entitled “Re: Rendering Challenge - Quick Study Model Rendering”. This generated quite a bit of feedback. This has not been a solo effort in the least and much was garnered from that feedback as well as a great deal of advice from many on the newsgroups as well as Bentley personnel. Please see the Acknowledgements section at the end of this article.

My intention in posting the thread to the newsgroup was to solicit information regarding how others have or have not approached the generation of simple study model renderings within MicroStation. Such renderings are also sometimes referred to as “chipboard” or “chalk” renderings.

What I was after was an approach that would require as little user intervention as far as lighting and material setups, yet be able to produce nice quality renderings with fairly crisp, well defined edges and surfaces, and to do so consistently for a majority of models. My hope was that an approach could be developed, such that models and renderings could easily be done at the earliest stages of a project, before full details are known, regarding specific materials and lighting within a space. I also wanted to leverage these models, not only for renderings, but to serve as the basis for producing CD (construction drawings/contract document) sets. The more this could be done with MicroStation out-of-the-box the better. I had in fact been brought on board at CDH Partners, Inc., specifically to show that by going to MicroStation V8, TriForma & Bentley Architecture, and taking on the Building Information Modeling (BIM) mindset, that these were two very attainable goals. I was also tasked with the responsibility to develop a solution and any additional tools necessary to make these capabilities available for the majority of our projects/clients and in the hands of our 80+ architects and engineers.

I understand the benefits possible from photo-realistic renderings with full material development, proper lighting, adding caustics, photons, etc. However, these are very expensive (performance wise) and require much more art, and many projects just simply do not have the budgets and timelines necessary to support such development. Our in-house animation department and a rendering “house” we occasionally use for very high-end renderings and animations both use 3ds max. Although, we are working on streamlining the process of translating files between MicroStation and 3ds max, the problem is that it still is a translation effort and therefore rarely seamless. Therefore there is a real need to put the ability to do rudimentary modeling and rendering in the hands of the architects early in the design process before many details are fully worked out. Later in the project if the budget and timelines are appropriate we can utilize our in-house animation department and/or contract out the work.

If I could develop a setup that would allow the architects themselves the ability to easily produce study models for their own use, such as working out proportions, and/or for client presentations and without having to do any file translations or the intervention of the animation department we would be way ahead of the game. I have found that the 3ds max study model type renderings done by our animation department to have a crispness yet softness to them that is enviable and worth mimicking, and therefore, I used them as my baseline to judge and develop a setup that would give similar results in MicroStation.

One major benefit of being able to keep all this within MicroStation, would be that the architect could show a client a study model of their space, make some adjustments to the model, and then render it again. Client meetings and the exchange of design ideas would then have the potential of becoming a whole lot more productive and interactive both visually and verbally. Granted such interactivity may require a slight decrease in quality in favor of increased speed. Even animations, to some extent, are static because the paths, etc. are pre-determined. If the client says "That looks pretty much like what we are after, but how does the space look from inside *this* room looking > > through *this* window?" or "What if we were to move the pipe organ over to here?" We would be faced with having to respond "We'll have to re-render some stills and an animation and get back to you with them in few days/weeks." To me the goal is interactivity.

When I originally posted the challenge to the newsgroup I really thought there should be a semi-automatic cookie-cutter setup for simplistic study model rendering in MicroStation. If 3ds max had it, why couldn't MicroStation?

I soon realized that there were two mindsets: 1) 3ds max provides a default setup that seems to work consistently for most scenes. If desired there are multiple options, including plug-ins for tweaking. Note that enclosing a space with a roof/ceiling presents a major problem even for 3ds max without having to get into some actual lighting setups, see Figures 13-16. 2) MicroStation provides multiple options for a user to manually control their rendering environment to their liking, but not a default that works reasonably well for most scenes and for most rendering modes.

I also learned there was a lot more art involved even in the simplistic approach I was hoping to take than I originally thought would be. I learned that many great computer renderings, including those from 3ds max, are often tweaked by plug-ins and/or "PhotoShopped". Initially, this disturbed my purist thinking of wanting to do everything in straight MicroStation.

I came up with an analogy regarding these realizations and my endeavor. MicroStation is like a very expensive camera with individual settings for aperture, shutter speed, focal length, etc. This is great for the avid photographer. However, sometimes you just want to put it in auto mode and let it figure all that stuff out. Furthermore, cameras use filters to alter the "true" picture, so why not with computer renderings? The auto mode and filters/plug-ins are two things lacking in MicroStation. At times there are some things that we see with our eyes that are difficult at best to capture on film without a great deal of artistic experience. For instance, sit in your living room late at night with all the lights out. Can you see anything? Most likely more than you thought. However, now try to take a picture of that scene and capture the subtlety of the light.

Since there is no auto mode or filters provided out-of-the-box in MicroStation it seemed it would be up to me or someone else with the initiative to try and develop a fairly well "coordinated" default/baseline setup. Or we could demand that Bentley provide this, however, that did not seem to be a viable alternative. Therefore, I decided I would bite the bullet and so I went back to school in the figurative sense to learn and decipher as much as I could.

## Original Images posted to newsgroup


**Figure 1 - What I am trying to achieve (3ds max)**

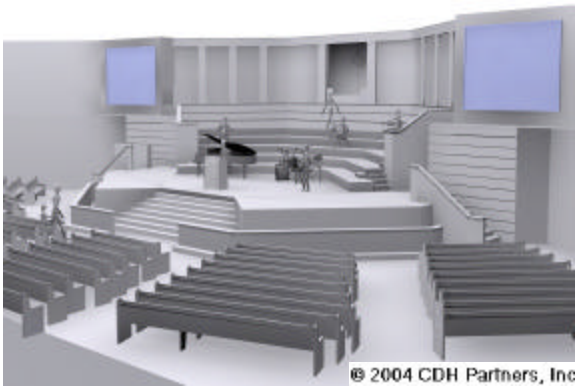


**Figure 2 - My best at the time using Particle Tracing**


**Figure 3 - 3ds max (with ceiling but no roof)**

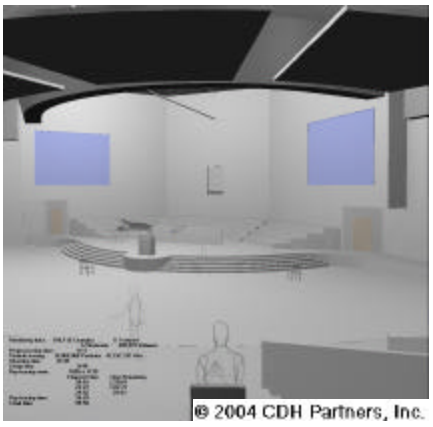


**Figure 4 - My best at the time using Particle Tracing**

## “School” Models used to develop new baseline settings

In order to develop a baseline rendering setup I decided to go back to basics. Therefore, I took two physical models that I had built while in my first year of college and modeled them in Bentley Architecture, TriForma and MicroStation V8 2004 Edition. I felt these were simple enough to clearly see the effects of the various settings. I found two settings in particular, cloudiness and turbidity (air quality) that dramatically affect the softness of shadows, etc. I quickly settled on setting the cloudiness to 0.75 and the turbidity to 9.0, which is the max and would represent a very smoggy environment. So right away you can see I am not after realism of the environment so much as the “look” of the actual rendering. Another key setting is sky samples, which affects the graininess of the shadows. Although for some images setting this to as high as 2000 will render very nice smooth shadows it is usually prohibitive in rendering time on any but the simplest of models. I therefore do not recommend it unless you have several machines that can do network/banded rendering. Even 500 can be a big hit in rendering time. On the other hand dropping this down to low can create blotchy images. Therefore, I recommend a value of 145, which gives satisfactory results in most cases.

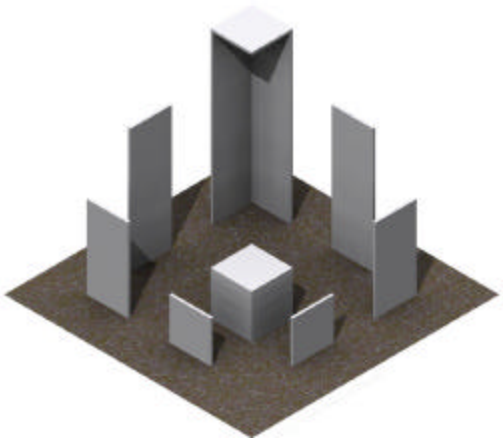

**Figure 5 - Movable Museum**

**Figure 6 - Semi-movable Museum**

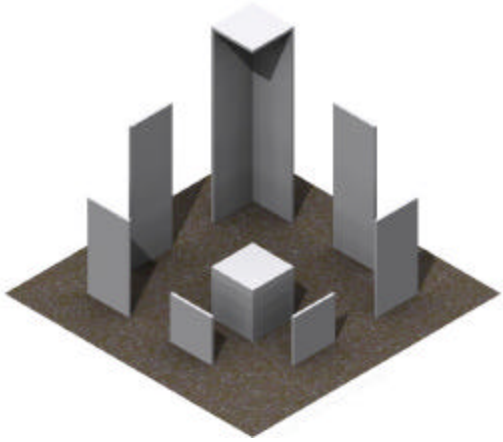

**Figure 7 - Sky Samples bumped up to 2000**

**Figure 8 - Sky Samples bumped up to 500**

**Figure 9 - Sky Samples dropped down to 4 (min)**

**Figure 10 - Sky Samples dropped down to 64**

## Using new Rendering Settings and Ray Traced in MicroStation

Taking the setting I developed as a baseline while using the models illustrated in Figures 5-10 I applied them to some existing models including the ones I had originally posted to the newsgroup to see if they indeed could be applied to a broad number of modeling scenes. I believe these images illustrate that these settings are quite adaptable.


**Figure 11 - 3ds max**


**Figure 12 - MicroStation**


**Figure 13 - 3ds max**


**Figure 14 - MicroStation**

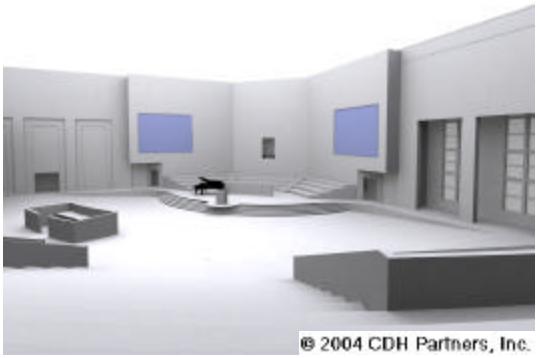


**Figure 15 - 3ds max (ceiling removed)**

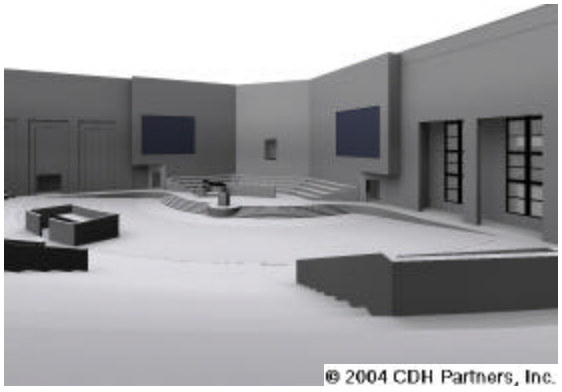


**Figure 16 – MicroStation**


**Figure 17 - 3ds max**


**Figure 18 - MicroStation**

## Additional Examples - Adjusting MicroStation settings from baseline

I also wanted to see if I could minimize what settings might need to be adjusted if the baseline settings did not work as-is because of materials and/or the scene itself. I was happy to find that in most cases I could adjust the Real World Lighting settings to achieve a desirable image. The Real World Lighting settings are comprised of: Adapt to Brightness (ATB) and contrast. Contrast is usually best kept to 1.0. However, the Adapt to Brightness setting can effectively lighten an otherwise dark image. These settings as well as enabling or disabling Solar Shadows do not significantly effect rendering time. On the other hand disabling Sky Shadows will dramatically reduce rendering time, even with Antialiasing being enabled. Therefore, for quick interim/check renderings you may wish to disable Sky Samples. Just keep in mind that there will be some loss in the “softness” and subtlety of tones, creating more of a “flat” image, almost like that achieved with constant or smooth shading.


**Figure 19 - 3ds max**


**Figure 20 – MicroStation ATB 500**


**Figure 21 - Materials based on element color**


**Figure 22 - Materials “forced” to chipboard using .mat file**


**Figure 23 - ATB changed to 375**


**Figure 24 - ATB changed to 1000**


**Figure 25 - Solar Shadows disabled**


**Figure 26 - Sky Shadows disabled, ATB 1400**

## Post Processing

Lastly, I wanted to see how I could alter the original rendering by going outside the pure rendering environment. Here are some examples of taking the images from Figures 12 & 24 and adding some PhotoShop effects. It is amazing how these effects can totally change the “feel” of the original “true” image.

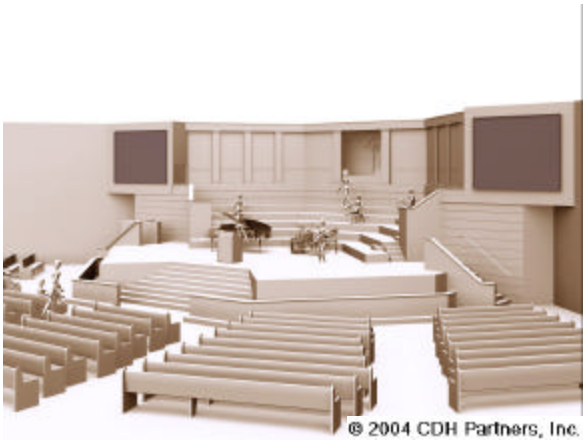


**Figure 27 - Sepia Tone**


**Figure 28 - Adding some diffused glow**

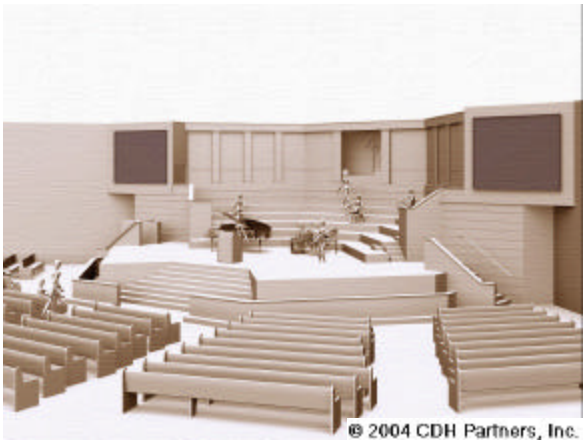


**Figure 29 - Adding a little texture**

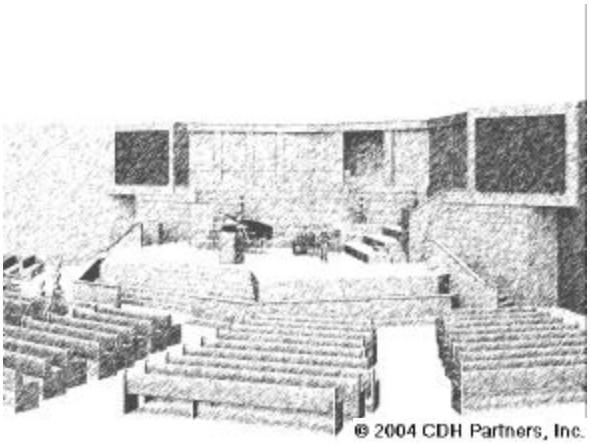


**Figure 30 - Graphic Pen**


**Figure 31 - Rendered with Visible Edges overlaid on top***


**Figure 32 - Graphic Pen**

* This effect can be achieved by creating a Visible Edges file from within MicroStation. You may open the file and “render” it out as an image in wireframe mode to the same resolution as the rendered image. Take the Visible Edge image into PhotoShop and make the background transparent. Then overlay it on top of the rendered image. This is the method I employ here. As an alternative: if you are just doing screen captures, you can attach the Visible Edge file as a reference and turn it off as well as any highlighting of reference files. Render to the screen, and then turn the Visible Edge reference file on, and then perform a screen capture. Visible edge processing can be a big performance hit.

## What's next

**Me:**

- Take this setup and some of the same models to develop a similar baseline for interior scenes.
- Drawing Extraction Manager. I intend to really get my hands around this one. As great as these models are, if we can't produce CD's (construction drawings/contract documents), then their value is fairly limited.

**Bentley:**

- I would like to see Bentley "publish" an API, or something along those lines, that would allow the development of rendering plug-ins/filters much like those available for 3ds max and PhotoShop. Procedural Textures were a start. However, they really only seemed to be something that they (Bentley) could develop. Some VBA controls/access would be great. They should talk to the folks at cebas computer GmbH, http://www.cebas.com/, the developers of FinalRender, and FinalToon, http://www.finalrender.com/products/products.php?UD=10-7888-35-788&PID=37.



Cebas may be more willing to work with them than they might think. FinalToon is a True Line Renderer (TLR), which means that it is possible to render important line work needed for technical illustrations in a way that is not possible or efficient through a shader only implementation. Think of the effect on both user communities if they could say "FinalToon plug-ins now available for Bentley MicroStation. Integrate models between MicroStation and 3ds max and retain a consistent rendering look in both."

## Acknowledgements, Copyrights & Credits

First and foremost I must thank several who have contributed directly or indirectly to this (in no specific order): Andrew Novinc, Rob Snyder, Stefano Toneli, Thomas Rast, Patrik Rosen, Justin Hunt, Daniel Abney, Robert DiMauro, Jerry Flynn, David Zareski, as well as the entire Bentley visualization newsgroup/community.



**Figures 1,2,11,12,27-30** - Mt. Paran North - Church of God. Modeled by Ben Salley in 3ds max by discreet. Translated and adapted by John Finkell in MicroStation V8 2004 Edition by Bentley Systems, Inc.
**Figures 3,4,13-16** - Oak Hill Baptist Church. Modeled by John Finkell in Bentley Architecture, TriForma & MicroStation V8 2004 Edition by Bentley Systems, Inc.
**Figures 5-10** - Physical models done my first year of college in 1980. Modeled by John Finkell in Bentley Architecture, TriForma & MicroStation V8 2004 Edition by Bentley Systems, Inc.
**Figures 17 & 18** - Gardendale First Baptist Church. Modeled by John Finkell in Bentley Architecture, TriForma & MicroStation V8 2004 Edition by Bentley Systems, Inc.
**Figures 19 & 20** - Johns Creek Baptist Church. Modeled by Noel Page, John Finkell, and Shannon Carpenter in Bentley Architecture, TriForma & MicroStation V8 2004 Edition by Bentley Systems, Inc.
**Figures 21-26,31,32** - St. Peter Chanel Catholic Church, © 2004 CDH Partners, Inc. Modeled by Todd Groves in Bentley Architecture, TriForma & MicroStation V8 2004 Edition by Bentley Systems, Inc.

## Anomalies

Through my research I uncovered some limitations. I submitted these as Service Requests (SR) which have been evaluated by Bentley Technical Support and resubmitted as Change or Trouble Requests (CR, TR). Here is a brief summary:

CR #136345 (SR #1-242382101) - Modify what is currently stored in the Rendering Setup Files, .rsf, to be strictly rendering specific settings.

CR #136342 (SR #1-242381601) - Add Brightness/Contrast sliders to other rendering modes, namely, Constant, Smooth and Phong.

CR #136343 (SR #1-242381901)- Add an option to Filled Hidden Line rendering mode to use material assignments from the .mat file rather than the element color.

CR #136344 (SR #1-242382001) - Provide a color picker for edge lines with Filled Hidden Line mode and when the display edges option is enabled.

CR #133371 (SR #1-230457422) - Provide an optional "thickness" slider for the edge lines with Filled Hidden Line mode and when display edges option is enabled with graphics acceleration.

CR #70304 (SR #1-230443201) - Ability to display edges for both accelerated and non-accelerated modes, and in all rendering modes.

CR #91086 (SR #1-222751101) - Make saved views model independent.

CR #130564 (SR #1-215526701) - Provide a pick list for saved views.

CR #128157 (SR #1-205383201) - Make the ACS Triad a display only graphic in the corner of the view window.

TR #133558 (SR #1-213799101) - View settings are not being saved properly.