

AccuCal™

Audio/Video Reviews

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Front Projection Screen Material Report

Overview

Front projection screens are a large part of the performance of a front projection system. The screen materials tested in this report in no way encompass all of the materials on the market, but does explore some of the products from Carada, Da-Lite, Elite Screens, Screen Excellence, Seymour AV, Stewart and Wilsonart. Data in this report includes results from previous tests to make it easier to compare results for various products.

These measurements examined each screens reflectivity and color neutrality when viewed from the center and a seating position to the side in a dedicated home theater environment with a ceiling mounted projector mounted about 10 inches above the screen. The tests did not compare the mounting systems for the various materials tested. Visual observations of how these materials perform is also included.

Summary

My personal favorite of those tested was the SnoMatte 100 for its neutrality and light output. The ability to use this material will depend on the level of light control in your home cinema, screen size and projector light output. The difference between Snow Matt 100, Classic Cinema White, Brilliant White, Da-Mat®, HD Progressive 0.9, CineWhite, and MaxWhite was not large. Either one of those may fit your needs better than Sno-Matte 100 depending on your situation.

The best angular reflective material tested was the StudioTek 130 G3. This screen material may be useful where the ceiling or walls will reflect light on the screen or projector light output is not sufficient to illuminate the screen size desired with a more neutral screen. The Wilsonart Designer White laminate was the next best material tested for this purpose.

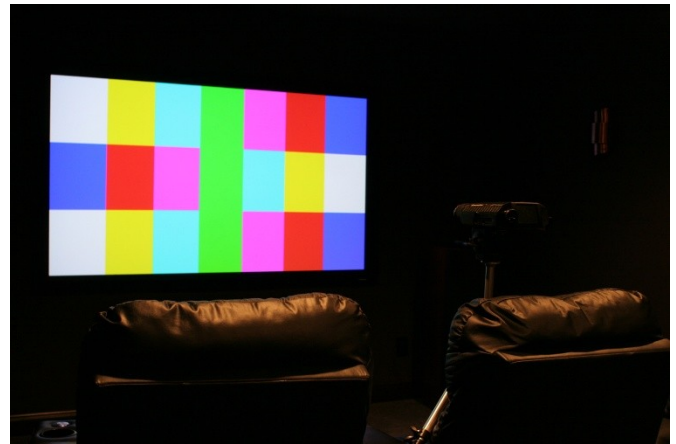


Figure 1 - Room and spectrophotometer used.



Figure 2 - Spectrophotometer used.

The best acoustically transparent material tested was the Enlightor 4K. As long as you sit at least 9 feet back from the screen this material should work very well if you have sufficient light to illuminate the screen size desired. The Center Stage XD is a good choice if you can sit 11 or more feet from the screen and need the additional gain from this material.

The High Power screen material is a retroreflective material with unique properties that can make a larger screen work with a lower light output projector. It does have very special projector mounting requirements to achieve the maximum screen gain. Please refer to the manufacturer for more information.

Things like velvet edges and quality tensioning systems will improve the performance of your theater and should be considered during the screen purchase.

Nothing works better for front projection than a light controlled room with dark walls and furnishings. All attempts should be made to achieve this if the best results are to be expected. Screen material tricks are no substitute for a great room.

Measured Test Results

| Material | 0° Gain | 18°Gain | 0° Max x | 0° Max y | 18° Max x | 18° Max y | 0° Avg x | 0° Avg y | 18° Avg x | 18° Avg y |
|--------------------------------|---------|---------|----------|----------|-----------|-----------|----------|----------|-----------|-----------|
| Classic Cinema White | 0.97 | 0.95 | 0.001 | 0.003 | 0.001 | 0.003 | 0.000 | 0.002 | 0.000 | 0.002 |
| Brilliant White | 1.03 | 1.01 | 0.004 | 0.003 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 |
| Da-Mat® | 1.09 | 1.00 | 0.002 | 0.001 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 | 0.002 |
| HD Progressive 0.9 | 0.98 | 0.95 | 0.003 | 0.002 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| HD Progressive 0.6 | 0.72 | 0.70 | 0.003 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Cinema Vision | 1.04 | 0.95 | 0.005 | 0.008 | 0.008 | 0.010 | 0.002 | 0.004 | 0.003 | 0.004 |
| Video Spectra 1.5 | 1.27 | 1.15 | 0.002 | 0.003 | 0.002 | 0.007 | 0.001 | 0.001 | 0.001 | 0.004 |
| High Power | 1.82 | 0.96 | 0.002 | 0.006 | 0.009 | 0.012 | 0.001 | 0.003 | 0.004 | 0.005 |
| SnoMatte 100 | 1.02 | 1.00 | 0.001 | 0.003 | 0.002 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 |
| StudioTek G3 | 1.27 | 1.19 | 0.002 | 0.003 | 0.003 | 0.004 | 0.001 | 0.001 | 0.001 | 0.002 |
| FireHawk G3 | 0.90 | 0.75 | 0.007 | 0.005 | 0.008 | 0.006 | 0.003 | 0.002 | 0.004 | 0.002 |
| GrayHawk RS G3 | 0.88 | 0.71 | 0.002 | 0.002 | 0.003 | 0.004 | 0.001 | 0.001 | 0.002 | 0.002 |
| MaxWhite | 1.03 | 0.99 | 0.003 | 0.004 | 0.002 | 0.005 | 0.001 | 0.002 | 0.001 | 0.002 |
| MaxWhite FG | 1.04 | 1.02 | 0.003 | 0.003 | 0.004 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| CineWhite | 0.99 | 0.97 | 0.004 | 0.004 | 0.005 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 |
| StarBright™ 7 | 2.87 | 1.95 | 0.006 | 0.006 | 0.003 | 0.005 | 0.003 | 0.003 | 0.001 | 0.003 |
| Wilsonart Designer White (DIY) | 1.29 | 1.04 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Center Stage XD (AT) | 0.94 | 0.93 | 0.002 | 0.004 | 0.003 | 0.004 | 0.001 | 0.002 | 0.001 | 0.002 |
| Audio Vision (AT) | 1.05 | 0.96 | 0.002 | 0.001 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 | 0.002 |
| AcousticPro1080™(AT) | 0.82 | 0.82 | 0.010 | 0.010 | 0.011 | 0.011 | 0.004 | 0.005 | 0.005 | 0.005 |
| Enlightor 4K (AT) | 0.84 | 0.83 | 0.004 | 0.004 | 0.003 | 0.005 | 0.001 | 0.002 | 0.001 | 0.002 |
| Enlightor 1 (AT) | 0.87 | 0.85 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| Enlightor 1 Silver Back (AT) | 0.88 | 0.86 | 0.001 | 0.003 | 0.002 | 0.003 | 0.000 | 0.001 | 0.001 | 0.002 |
| Enlightor 3 (AT) | 0.79 | 0.74 | 0.005 | 0.005 | 0.002 | 0.004 | 0.002 | 0.002 | 0.001 | 0.002 |

0° - Measurements at this angle are perpendicular to the screen

18° - Measurements at this angle were taken 18 degrees to the side and 6 degrees down, but are of the same location as the 0 degree point on the screen

Gain - Average of 10 colors ratio of light at the observer to light sent to the screen.

Max. x or y - Maximum absolute change in CIE color measured as caused by the screen for the 10 colors measured

Avg x or y - Average absolute change in CIE color measured as caused by the screen for the 10 colors measured

(DIY) - Do it yourself alternative material

(AT) - Acoustically transparent material

Screen Material Observations And Comments

Classic Cinema White - This material was very color neutral. It does have a slight amount of texture, but this was not visible at a 9' viewing distance. It did not appear to lend much character to the image which is a good thing. It has a very slight sheen compared to a piece of paper, but I did not notice it in real images. This is the closest alternative to SnoMatte 100.

Brilliant White - This material was mostly color neutral. It does have a slight amount of texture, but this was not visible at a 9' viewing distance. It has a very slight sheen compared to a piece of paper, but I did not notice it in real images.

Da-Mat® - This material was very color neutral. It does have a little more texture than the Classic Cinema White, but this was not visible at a 9' viewing distance. It had a slight sheen to it which was visible on images infrequently.

HD Progressive 0.9 - This material is very color neutral. It appeared to be a very smooth surface. It also has a very slight sheen to it which was visible on images infrequently. This may explain its gray coloring and yet a gain very nearly 1.0. It did not add much character to the image. This material is designed to aid with rejecting light from reflections and may help in that situation.

HD Progressive 0.6 - This material is very color neutral. It appeared to be a very smooth surface. It also has a very slight sheen to it which was visible on images infrequently. The sheen on this was stronger than the HD Progressive 0.9 sample. This material would require much more light to illuminate the same screen size than any other sample tested here. A product like this is for special circumstances and would not fit most people's requirements.

Cinema Vision - This material is not as color neutral as one would like. It does have a slight amount of texture, but this was not visible at a 9' viewing distance. The color shifts induced by this material were strong enough to bother some people. This material did add character to the image that was distracting compared to the other samples. The sheen on this product was visible on brighter images. The gain of this material was not high enough to justify its use. The negatives of this product did not offset its positive attributes and is not one I would recommend.

Video Spectra 1.5 - This material was mostly color neutral. The surface was patterned on this product. The color shifts induced by this material would not be strong enough to bother most people. This material did add character to the image that was very distracting compared to the other samples. The sheen on this product was obvious on brighter images. The gain of this material would aid in increasing the image brightness for projectors with lower light output than the screen size desired. This was the most objectionable material of those tested for home theater use and is not one I would recommend.

High Power - This material was the least color neutral of those tested. It appeared to be a very smooth surface. The color shifts induced by this material may be strong enough to bother some people. This is a retroreflective material that works best when the projector is mounted near the viewers head. The ceiling mounting in this theater is more common and shows the reduction in performance from this orientation. This product did contain some sparkling elements that are visible when viewed at closer distances. The gain of this material would aid in increasing the image brightness for projectors with lower light output than the screen size desired.

SnoMatte 100- This material was very color neutral. It appeared to have a very smooth surface. It had no surface sheen or sparkling elements. This material is exceptional at extreme viewing angles. This is the best material tested for a neutral screen material.

StudioTek 130 G3 - This material was very color neutral. It appeared to have a very smooth surface. It had many sparkling elements to increase the screen gain. The shimmering caused by these elements was visible in brighter elements of images. The gain of this material would aid in increasing the image brightness for projectors with lower light output than the screen size desired. Off axis gain was also good. This was the best sample tested of an angular reflective material for increasing screen gain.

FireHawk G3 - This material is not as color neutral as one would like. It appeared to have a very smooth surface. It also had many sparkling elements to increase the screen gain. The shimmering caused by these elements was visible at moderate light levels with images. The actual gain of this material was not high enough to offset the light lost by the dark gray tint. This material is intended to aid in rooms with significant scattered light from walls and ceilings. It is a special use material that should be considered with care.

GrayHawk RS G3 - This material was very color neutral. It appeared to have a very smooth surface. It also had many sparkling elements to increase the screen gain. The shimmering caused by these elements was visible at moderate light levels with images, but a little less than the FireHawk material. The actual gain of this material was not high enough to offset the light lost by the dark gray tint. This material is intended to aid in rooms with significant scattered light from walls and ceilings. It is a special use material that should be considered with care.

Screen Material Observations And Comments Continued

MaxWhite & MaxWhite FG- These materials were very color neutral. It does have a some texture. This was slightly visible at a 9 foot viewing distance. This material also has some sheen that is visible on bright images.

CineWhite - This material was reasonably color neutral. It does have a slight amount of texture, but this was not visible at a 9 foot viewing distance. It did not appear to lend much character to the image which is a good thing. This material also has some slight sheen, but I did not notice it on images.

StarBright™ 7 - This material is very color neutral. It is a very smooth surface. This material is much more stiff and thin others tested. It can be permanently creased very easily. This material did add a strong character to the image that was very distracting compared to the other samples. The sheen on this product was obvious on brighter images. The gain of this material would aid in increasing the image brightness for projectors with lower light output than the screen size desired. This was very objectionable material for home theater use and is not one I would recommend.

Do It Yourself Screen Material Observations and Comments

Wilsonart Designer White - This material is very color neutral. It is also reasonably smooth so that the surface was not an issue at 9 feet. This is a rigid laminate material that is not made specifically for screen material and must be adapted by the consumer for this purpose. Shimmering caused by the surface was visible in brighter elements of images. The gain of this material would aid in increasing the image brightness for projectors with lower light output than the screen size desired. Off axis gain was not as good as the StudioTek 130 which does resemble this material. This is a very good angular reflective material for increasing screen gain. Catalog Number D354-60-107

Acoustically Transparent Screen Material Observations And Comments

Center Stage XD - This material was mostly color neutral. It does have a strong texture from the weave used to pass the audio through the screen. At 9 feet it was slightly visible. This material would be best for eleven foot or greater viewing distance. At eleven feet this material looked very good. Treble was 2 db down at 20 kHz compared to the level at 2 kHz. The black backing added another 1 db loss at 20 kHz. The audio response effect was a relatively smooth loss from 3kHz to 20kHz. This material is recommended for 11 feet or greater viewing distances.

Audio Vision - This material was very color neutral. It does have a little more texture than the Classic Cinema White and an obvious hole pattern. The hole pattern was visible up to 15 feet. It had a slight sheen to it which was visible on images infrequently at 9 feet. Treble was 6 db down at 20 kHz compared to the level at 2 kHz. The audio response effect was a relatively smooth loss from 4kHz to 20kHz.

AcousticPro1080™ - This material was very tinted for a screen material. It does have a strong texture and a very open weave used to pass audio through the screen. The weave was also streaking the image because of variations in the thread density. The sample provided did not include the black backing that can be purchased with this material so a Seymour backing was used for light measurements and observations. At 9 feet the weave was frequently visible. This material would be best for 17 foot or greater viewing distances. Moiré will be more of an issue with this weave because it is so open as well as the visibility of objects behind the screen if no backing is used. Treble was 2 db down at 20 kHz compared to the level at 2 kHz. The audio response effect was a relatively smooth loss from 8kHz to 20kHz. This is not a material I would recommend because of its low screen gain, and open non-uniform weave.

Enlightor 4k - This material was mostly color neutral. It is the finest weave tested in an acoustically transparent screen.. It does have a slight texture from the weave used to pass the audio through the screen. At 8 feet it was slightly visible. This material would be best for 9 foot or greater viewing distance. At ten feet this material looked very good. The material does add a slight sheen to the image. Treble was 2.5 db down at 20 kHz compared to the level at 2 kHz. The black backing added another 1 db loss at 20 kHz. The audio response effect was a relatively smooth loss from 3kHz to 20kHz. This material is recommended for home theaters with less than 11 foot viewing distances or situations where sufficient light is available to use on a larger screen..

Acoustically Transparent Screen Material Observations And Comments Continued

Enlightor 1 - This material was very color neutral. It does have a strong texture from the weave used to pass the audio through the screen. The material added a slight sheen to the image. The weave added a very slight banding to the image on about a 3/8" interval that was only visible on bright uniform fields. It does have a strong texture from the weave used to pass the audio through the screen. At 9 feet it was slightly visible. This material would be best for eleven foot or greater viewing distance. At eleven feet this material looked very good. Treble was 2 db down at 20 kHz compared to the level at 2 kHz. The black backing added another 1 db loss at 20 kHz. The audio response effect was a relatively smooth loss from 5kHz to 20kHz. This is not a material I would recommend because of its low screen gain.

Enlightor 1 Silver Back - This material was very color neutral. It does have a strong texture from the weave used to pass the audio through the screen. The material added a slight sheen to the image. This material imprinted obvious patterning on the image visible to about 16 feet. Treble was 2 db down at 20 kHz compared to the level at 2 kHz. The black backing added another 1 db loss at 20 kHz. The audio response effect was a relatively smooth loss from 5kHz to 20kHz. This is not a material I would recommend because of the image patterning and low screen gain.

Enlightor 3 This material was mostly color neutral. It does have a strong texture from the weave used to pass the audio through the screen. At 9 feet it was slightly visible. This material would be best for eleven foot or greater viewing distance. At eleven feet this material looked very good. The material used added a slight sheen to the image as well. Treble was 4 db down at 20 kHz compared to the level at 2 kHz. The black backing added another 1 db loss at 20 kHz. The audio response effect was a relatively smooth loss from 3kHz to 20kHz. This is not a material I would recommend because of its low screen gain.

How To Use These Results

These measurements and observations may help you understand what can affect screen performance and help you judge how well the screen will perform for home theater use. Please refer to the manufacturer for more information on these products. You should always obtain a screen sample before ordering a screen to see if it fits your needs. It is best to use the sample in your theater after the room is setup except for the screen. The projector you choose, mounting, screen size, screen position, distance from the screen along with the viewing angles in your situation will determine how well the screen performs for you. The screen gains observed in this report are going to match a ceiling mounted projector system best. Screens with gain may perform better than that observed if the projector is mounted closer to the observers eye level.

The closer your viewing position is to the screen the more problems you will have with its texture, sheen and sparkling elements. At 14 feet or more only the sparkling elements, color problems and gain are likely to be visible. At less than 10 feet you need to be very careful about material selection to avoid seeing artifacts caused by texture and sheen.

Do it yourself materials will require more work on your part, but are a lower cost screen option to a front projection system. Front projection is a system and the best overall performance may mean using a purchased screen material. These materials are provided for comparison purposes to manufactured screens for those considering this option. Being able to jump up in projector quality by keeping the screen cost down is a good option if the screen cost is keeping you from the next jump in quality. The suppliers in this document vary greatly in price. Unfortunately, the absolute best materials tend to be the most expensive.

Acoustically transparent materials are more complex and can induce interference patterns (moiré) depending on the system. These materials should be installed very carefully with consideration to both the audio and video performance. Equalization can be used to compensate for the treble loss caused by these products. However, blown tweeters are the most common equipment failure that I find in the field. Care should be taken to understand the system capabilities before boosting the treble level to compensate for the screen loss. When the treble boost can be kept at or below 3db tweeter damage is not common.

Test Conditions

This room had no windows, dark walls, equipment rack was in the hall not facing screen and minimal light sources were present in the room. All room lighting was off at the time of the tests. The most significant light source was a PC that was dimmed, in the back of the room and facing the rear of the room. Background light sources with the projector off were measured to add 0.000073 fL to the Carada Classic Cinema White screen. All color and screen luminance measurements were made with the PR-670 carefully positioned and tripod mounted to measure an area that was projected as a target from the projector. This was true for both luminance and illuminance measurements. The same measurement series taken at the beginning of the test was also repeated at the end to help ensure that nothing had drifted significantly.

The Carada Classic Cinema White screen used in these tests is the screen installed in this theater. All other screen materials in these tests were samples from Da-Lite. Screen gain measurements could be influenced by the screen samples not being tensioned like the Carada. Multiple attempts were made to position the sample to keep the sample flat in the area being measured. All screen samples were taped to the Carada screen for measurement. Only one screen sample was used for each screen material tested. None of the samples appeared to be damaged.

The projector in this case was ceiling mounted in the center of the screen horizontally and vertically above the screen. Maximum vertical shift was used in this product. The projector was also warmed up for 2 hours before color measurements were taken to stabilize the output colors as much as possible. The spot measured was 32.5" lower than the projector's center of projection. The projector was also on high lamp mode and the image sized for an 86" diagonal 16:9 screen near the minimum throw of the projector. This provided a bright image to maximize the signal to noise ratio of the measurements.

The test patterns used to measure light output and color were all created by an Accupel HDG-4000. The patterns used were window patterns to minimize the scattered light sent to the walls, floor and ceiling. The colors measured included red, green, blue, yellow, magenta, cyan, desaturated blue, desaturated green, desaturated red and white.

The PR-670 was set to measure a 1 degree field of view and extended range with the smart dark feature off. The PR-670 was AC powered during these tests. Actual screen light levels measured between 0.4 fL and 16.5 fL. At no time did the PR-670 report a value as being out of range. Nominally the light levels ranged between 1 fL and 10 fL. The MS-75 lens attachment was used to measure the screen and a CR-670 cosine corrector was used to measure the light from the projector directly.

Screen material observations were made in normal room lighting and with light from the projector. Screen observations included test patterns and a variety of movie material. Observations of movie images were made at 9' at 18 degrees off center and sitting at the center of the screen with an 86" diagonal image and a maximum light level of 15 fL from the Classic Cinema White screen.

No measurements were attempted to measure hot spotting because these problems can vary with the projector, but screens with more gain tend to have more issues with luminance varying with the location of the image on the screen. Retroreflectors like the High Power tend to have fewer problems with this than other high gain options.

Audio was measured with an ACO Pacific MK224PH Class I microphone and Sencore SP495 preamp at 1/24 octave. The microphone was positioned 24 inches from the tweeter and on axis with it. The screen material was 3 inches from the tweeter. Wideband pink noise was measured with and without the material in the sound path and the difference was taken using TrueRTA. Strong problems with comb filtering were observed when the material was positioned very close to the speaker which is not recommended by the manufacturer. This caused an additional 6db variation from 5 to 20 kHz. A Class 1 microphone was used to reduce the interaction with the room at these frequencies. The background noise was NCB 19.

Manufacturers Websites:

- Carada www.carada.com
- Da-Lite www.dalite.com
- Elite Screens www.elitescreens.com
- Screen Excellence www.screenexcellence.com
- SeymourAV www.seymourav.com
- Stewart www.stewartfilmscreen.com

Equipment Associated With Review:

| | | | |
|----------------------------|-----------------------------|----------------------|------------------------------|
| HDTV Generator: | Accupel HDG-4000 | Projector: | Ceiling Mounted JVC DLA-RS20 |
| Light & Color Measurement: | Photo Research PR-670 | BD Player: | Sony PS3 |
| Low Light Measurement: | Custom low light instrument | Receiver: | Yamaha RX-V4600 |
| Microphone: | ACO Pacific MK224PH | Speaker: | Hales Revelation 3 |
| Microphone Preamp: | Sencore SP495 | Video Test Material: | Various Movie Trailers |
| | | Audio Test Material: | Avia Wideband Pink Noise |

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