CASCADE COIL
DEFENSE SYSTEMS

GuardianCoil™ Optical Properties
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Increasingly consideration of the solar optical transmission, reflection, and absorption are required for fenestration installations. In the case of the use of the GuardianCoil™ blast protection system, architects and engineers may need values for these optical characteristics for wire mesh.

Optical measurements were made on GuardianCoil™ wire blast curtains and are reported here. Certain considerations and assumptions must be kept in mind for satisfactory application of mesh in these cases.

First, one must keep in mind that blast curtains will usually be applied behind existing glass windows. The optical properties of the preceding window will usually control the majority of the resulting optical properties of the combination of glass and mesh. Further, with the advent of thin films applied directly to glass, the complete engineering of the total effect of these optical properties lies beyond the scope of what is reported here, especially considering the large and variable value for the emissivity of steel.

Second, since GuardianCoil™ blast mesh is made from steel or stainless steel wire, and since optical transmission, reflection, absorption, and emissivity are all strong functions of the metal surface finish of the wire, these properties may change with time in certain moist or corrosive environments.

That said, measurements of mesh transmission were made and seem fairly robust. These measurements were made for two optical conditions. Diffuse transmissions were measured first with a light box behind the mesh and a detector in front of the mesh with a field of view smaller than the illuminated area of the mesh. The idea here is that because the wire is somewhat reflective, more light will be scattered forward than would be calculated from just the proportion of open area in the mesh. Unfortunately, these measurements were more sensitive to exact wire placement and yielded results which were problematic (see below). The light source for the light box was a compact fluorescent lamp with an approximate daylight spectrum.

The shadow transmission measurements of the meshes were measured between collimating lenses. Here the angular size of the illuminating source, a modulated white LED, approximated the apparent size of the sun presented to the mesh. In this way, these measurements will more fairly represent the conditions where the sun is in view and heat flow considerations will be more important than in the case of the whole sky is white and where diffuse measurements are more relevant. These measurements were all made within +/- 3% standard deviation error and seem to be reproducible. The white LED light source approximates daylight and since transmission of an opaque mesh is measured, the wavelength of the source is irrelevant. Again, these measurements were made on clean freshly made mesh and may not fully represent field measurements. Even so, the shadow transmission measurements should be those least of affected by surface condition since

they contain only a small fraction forward scattered light. Our published optical properties will make use of these shadow transmission measurements.

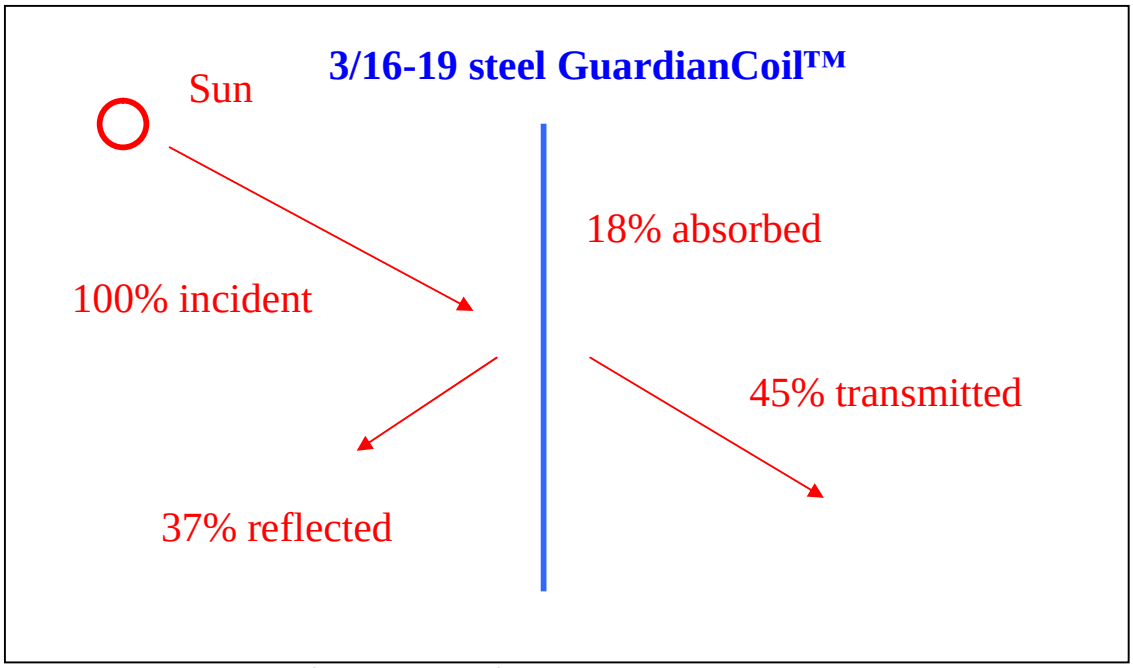

Figure 1. Example of the typical use of GuardianCoil™ in direct sunlight application. Results ignore additional influence of glass window which may be used in same opening.

Shadow transmission measurements for GuardianCoil™ range from 33% to 45%. Given the wide latitude for absorption and reflection coefficients for bare steel the following specifications assume mean solar reflection coefficient of 67% and a mean solar absorption of 33% for steel mesh. The 1/8-19 GuardianCoil™ stainless steel mesh optical properties are calculated using 70% for the mean solar reflection coefficient, and 30% for the mean solar absorption value. In the following results, the transmission values are subtracted for the incident 100% intensity and the resulting portion of the light actually intersecting the mesh is divided between absorption and reflection for the various meshes. The average of the four different mesh configurations is then used to yield the stated specification. The shading coefficient result is the actual mesh transmission compared with the transmission through a single weight float window glass. The value for transmission through the glass was taken to be a total loss of 7% which is mainly due to the two first surface reflections from the bare glass and equal to 93%.

Cascade Coil Drapery GuardianCoil™ optical mesh properties:

Solar Transmittance = 33% - 45%
Solar Reflectance = ~37% - 45%
Visible Light Transmittance = 33% - 45%
Solar Absorbance = ~18% - 22%
Shading Coefficient = 35% - 48%

5400	5256	5814	5756	data
5176	5279	5904	5704	data
4917	5626	5923	5674	data
4647	5729	5934	5599	data
4431	6104	5947	5533	data
4116	6260	5970	5490	data
4158	6337	6027	5368	data
4200	6412	5984	5348	data
4325	6488	5957	5209	data
4489	6612	6129	5201	data
4666	6718	6159	5213	data
4853	6749	6199	5212	data
4961	6681	6361	5351	data
4990	6551	6626	5514	data
4894	6387	6697	5474	data
4863	6247	6788	5355	data
4710	6260	6812	5310	data
4424	6107	6813	5115	data
4297	5990	6814	5228	data
4215	5907	6792	5407	data
4636.6	6185.0	6282.5	5403.1	data Ave
365.9	442.4	382.9	185.2	data standard deviation
80	88	89	82	background zero
4556.6	6097	6193.5	5321.05	Ave normalized
13662	13671	14210	14206	100% signal
0.334	0.446	0.436	0.375	Straight transmission
33.4	**44.6**	**43.6**	**37.5**	**% shadow transmission**
0.078908	0.071532	0.060942	0.03427	raw%error
0.026	0.032	0.027	0.013	error
2.6	**3.2**	**2.7**	**1.3**	**% error**
1/8-19SS	**1/4-19s**	**3/16-19s**	**3/32-21s**	**Mesh description**
7287				data
7285	9697		7400	data
7160	9643	7985	7240	data
7340	9358	7690	7350	data
7470	9155	7500	7440	data
7480	8920	7510	7590	data
7450	8930	7510	7560	data

7353.1	9283.8	7639.0	7430.0	data Ave
19950	20035	19980	19985	100% signal
0.369	0.463	0.382	0.372	Diffuse transmission
36.9	**46.3**	**38.2**	**37.2**	**% Diffuse transmission**
119.5	340.4	209.1	131.1	data standard deviation
0.016246	0.036666	0.027375	0.017651	raw error
1.6	3.7	2.7	1.8	% raw error
0.6	**1.7**	**1.0**	**0.7**	**%error**
0.90	0.96	1.14	1.01	shadow/diffuse transmission
1.11	1.04	0.88	0.99	diffuse/shadow transmission

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