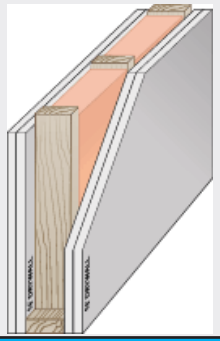
GREEN GLUE VS. EXTRA DRYWALL

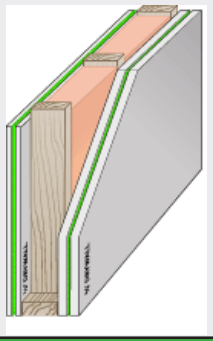
One of the most frequent and rational questions about Green Glue is this: “Sure, Green Glue performs well, but does it really outperform just adding more layers of drywall?” We will answer that question herein.

TEST DESCRIPTION – CONVENTIONAL DRYWALL ASSEMBLY -VS- GREEN GLUE ASSEMBLY

To address this question, The Green Glue Company ran a series of tests at Orfield Laboratories, a NVLAP certified independent lab in Minneapolis, MN. Below are the wall configurations, from source room to receive room. All details of the walls were identical, including insulation, screw length and spacing, stud configurations, and so forth.



Drwall Assembly II
Double 5/8” drywall
2x4 single wood studs, 24” on center
R13 fiberglass insulation
Double 5/8” drywall
OL 05 1059



Green Glue Assembly II
5/8” drywall + Green Glue @ 58 fluid ounces per 4’ x 8’ sheet + 5/8” drywall
2x4 single wood studs, 24” on center
R13 fiberglass insulation
Double 5/8” drywall with 5/8” drywall + Green Glue @ 58 fluid ounces per 4’ x 8’ sheet + 5/8” drywall
OL 05 1049

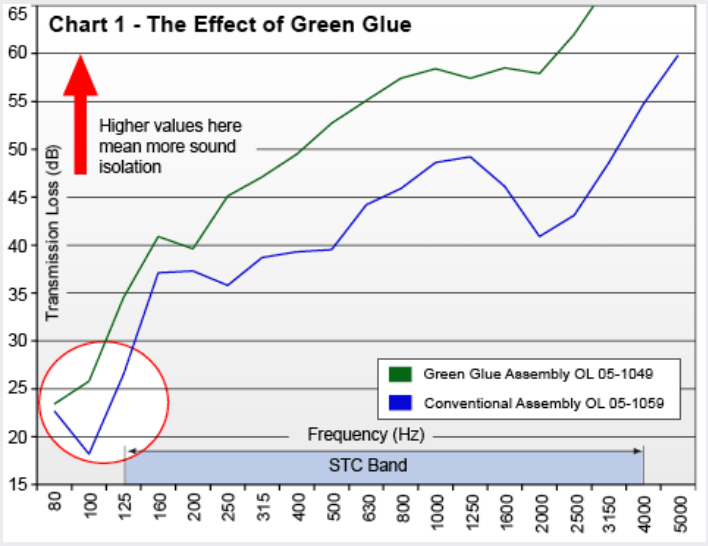
Wall configurations, from source room to receive room.
Official lab reports are available; the applicable test numbers are given in the chart below.

PART 2 – THE AFFECT OF GREEN GLUE

By testing an identical wall configuration with and without Green Glue it is possible to divine the effect of Green Glue on this type of wall.

This graph illustrates the effect of Green Glue as demonstrated by the above tests. It must be noted that the Green glue wall may have been limited by flanking noise in the laboratory over much of the frequency range. The important point of this flanking discussion is that the real benefit of Green Glue may be even larger over much of the frequency range if flanking noise was not present. In real world situations, the level of flanking noise may also affect results.

The difference is impressive. Unlike resilient decoupling methods that cause performance to suffer at some part of the low frequency range, Green Glue has a sizeable positive effect at low frequencies.



Wall Setup	STC	OITC	Full band flat noise reduction, dBA [A]	Theater noise equal loudness reduction [B]	Assembly weight (lbs/sq ft)	Material cost of added product and drywall [C]
Conventional	44	33	42	43	10.4	$3.76
Green Glue	55	39	50	53	9.95	$5.68

[A] An assessment of wall performance that is not an official standard, but is utilized by The Green Glue Company as a superior method to STC or OITC for music and theater applications where low-frequency content is high. It calculates using the ISO 226 equal loudness standard, and using a bandwidth of 31.5-5000Hz. Equal Loudness attempts to correlate to how people actually hear.

[B] The A-weighted sound reduction for a noise source having flat response from 31.5 to 5000Hz. For additional information about how these ratings are calculated, and for spreadsheets that will allow you to calculate them, visit our website at www.greengluecompany.com

[C] Detailed discussion in appendix 1.

Simply adding more mass would not close the performance gap economically, as will be more thoroughly discussed in the next section. It is important to

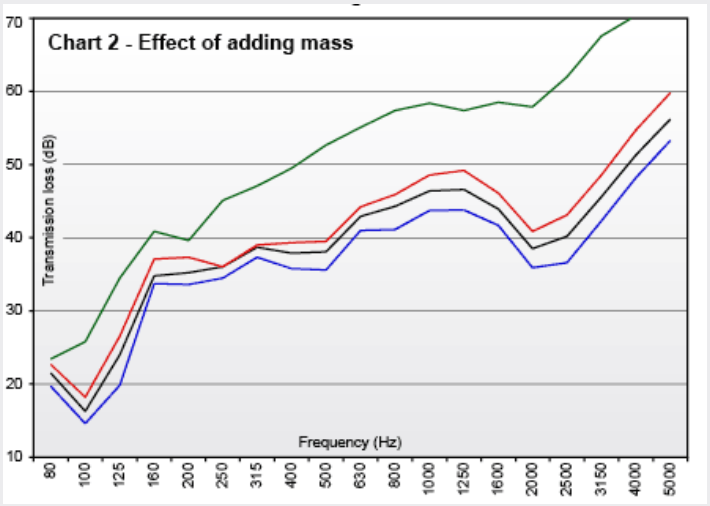
PART 3 – THE EFFECT OF JUST ADDING MASS

Green Glue Assembly II
OL 05-1049

Drywall Assembly II
OL 05-1059
(2) Sheet per Side (4 layers total)

OL 05-1058
(2) Sheets one side (3 layers total)

Drywall Assembly I
OL 05-1057
1 sheet per side (2 layers total)



Effect of adding mass is only incremental.
Note how the red and black lines are only slightly higher than the lighter blue wall? This is because the effect of simply adding mass to the common wall is only incremental. Based on a survey of historical data (NRC Canada, IR761 and IR818, USG/RAL data circa 1983, Owens Corning data circa 1972), doubling the number of layers results in about 4-5 dB of overall improvement. In this case, the net improvement was about 4dB regardless of what calculation was used to assess performance.

It is the ratio of mass that is important.
Another important thing to remember about adding mass to the common wall is that it is the ratio of the increase in mass that matters. To get as much improvement as you did from going from 1 layer on each side of the wall to 2 layers (doubling the mass), you would have to again double the mass – to 4 layers per side.

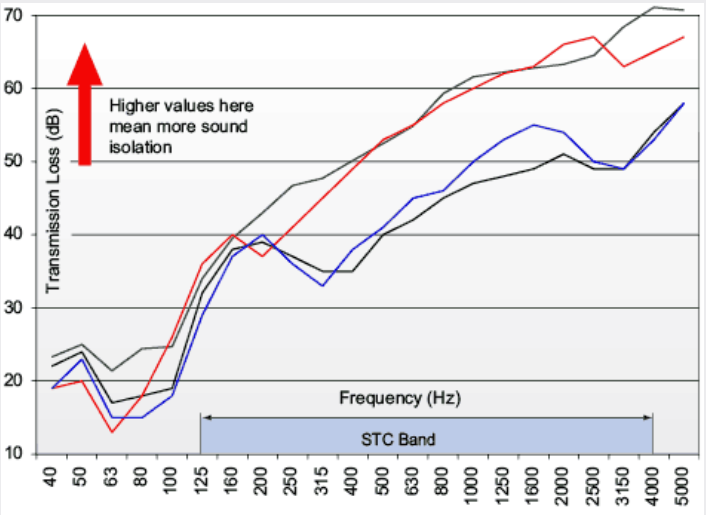
So, you see, simply adding mass to the common single-wood-stud wall does not have an enormous effect. Adding mass + damping in the form of Green Glue, however, has a great effect.

PART 4 – GREEN GLUE AND OTHER COMMERCIAL PRODUCTS

Other products, such as Mass Loaded Vinyl (MLV) or pre-fabricated damped panels are often utilized for sound isolation applications. This chart outlines the performance and cost of a Green Glue wall compared to these other options. The assemblies were as follows:

Green Glue	Green Glue used on both sides of a wall with 5/8” and 1/2” drywall
MLV limply hung	5/8” drywall was used on one side, 1/2” on the other, with MLV limply hung under the source room side
MLV as constrained layer damping	1/2” drywall was used on the receive room side, and double 1/2” drywall sandwiching MLV was used on the source room side. So, 3 layers of 1/2” drywall + MLV
Prefab damped panels	Pre-damped panels were utilized on both sides

All the assemblies featured the same stud and insulation configuration as previous.



Green Glue Assembly II

Prefab damped panels

MLV as CLD Assembly

MLV limply hung

Wall Setup	STC	OITC	Full band flat noise reduction, dBA [A]	Theater noise equal loudness reduction [B]
MLV, limply hung	45	31	42	42
MLV, sandwich assembly	44	33	42	42
Prefabricated damped panels both sides	54	33	46	46
Green Glue on one side of the wall	52	36	47	48
Green Glue on both sides of the wall (show in graph)	56	39	51	53

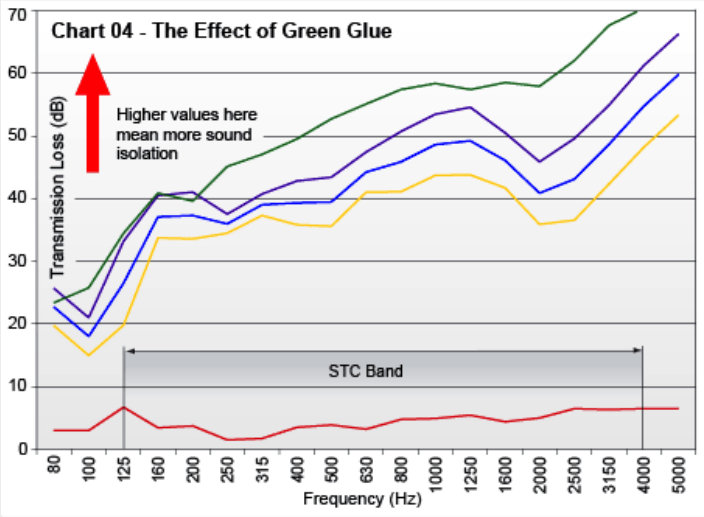
Green Glue easily outperforms these other products, both in absolute performance and in cost/performance. The prefab damped panels easily outperform the limp mass materials in most calculations as well. Green Glue is certainly not the only quality sound isolation product, but it is a very good one, and among the most economical options available.

SUMMARY

The performance and cost effectiveness of Green Glue on the common wood stud wall are evident. It is worth mentioning that we are not aware of any other commercial product which has been so directly compared to conventional walls and other products in the same lab. If you are wondering how Green Glue compares to other products, we have a variety of such information available on the web site.

APPENDIX 1 - ESTIMATING PERFORMANCE OF EVEN HEAVIER WALLS

The test series was stopped at 2 layers of drywall per side. However, we can estimate the performance of a wall with 4 layers of 5/8" (16mm) drywall on each side by adding the gains that were observed when moving from one layer of drywall per side to 2 layers per side. Add the gains that resulted from doubling the mass, and a very good estimate of the performance of a wall with 4 layers of drywall per side can be attained.



Green Glue Assembly II
2 Layers of drywall per side
1 Layer of damping per side
OL 05 1049

Drywall Assembly II
2 Layers per Side
OL 05-1059

Drywall Assembly I
(1) Layer per Side
OL 05 1057

Estimated Performance
4 Layers of Drywall per sides

Gains due to double the # of layers

WALL ASSEMBLY PERFORMANCE

Working from this type of estimation, we offer the following table of performance.

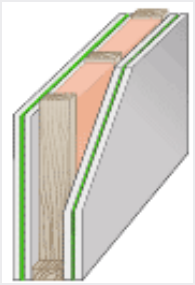
Assembly Description	1 layer of drywall each side	2 layers of dry-wall + 1 layer of drywall	2 layers of drywall on both sides	2 layers of drywall on both sides + 1 layer of GG per side	3 layers of drywall on both sides	4 layers of drywall on both sides	6 total layers of drywall + 3 total layers of GG
STC	40	42	44	55	46	48	57**
Rw	39	42	43	54	46	47	56**
Rw + Ctr	32	35	36	44	38	40	49**
OITC*	29	31	33	39	35	37	43**
Flat noise reduction	38	40	42	50	44	46	53**
Test Number	OL 05-1057	OL 05-1058	OL 05-1059	OL 05-1049	Estimated	Estimated	Estimated

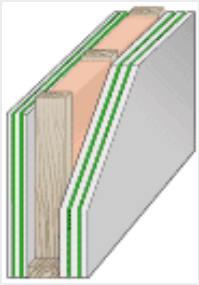
* - A detailed discussion of the curves utilized for these calculations is found in the appendix
** - This wall was considerably flanking limited, see above and the test report for details.

Even doubling the number of conventional layers (relative to a Green Glue wall) will not match the performance of a Green Glue assembly on the common wall.

COST ANALYSIS OF THESE WALLS

Here we will take a look at the cost of each of the assemblies that feature product on both sides.



	Green Glue II 2 layers drywall each side + 1 layer of GG each side	**Drywall Assembly II** 2 layers of conventional drywall each side	**4 layers** 4 layers of conventional drywall each side	**3 Layers** of conventional drywall each side + 4 layers of GG (75% coverage)
Drywall, materials	$1.36	$1.36	$2.72	$2.04
Drywall, labor	$2.40	$2.40	$4.80	$3.60
Green Glue, materials	$1.56	0	0	$2.34
Green Glue, labor	$0.36	0	0	$0.54
Framework, materials	$0.40	$0.40	$0.40	$0.40
Framework, labor	$0.60	$0.60	$0.60	$0.60
Insulation, materials	$0.33	$0.33	$0.33	$0.33
Insulation, labor	$0.40	$0.40	$0.40	$0.40
Sealant, materials & labor	$0.65	$0.65	$0.65	$0.65
Mudding/taping, materials & labor	$0.56	$0.56	$0.56	$0.56
Total Cost, materials	**$3.85**	**$2.29**	**$3.65**	**$5.31**
Total Cost, materials + labor	**$8.62**	**$6.70**	**$10.49**	**$11.46**
Depth of wall	**6.0”**	**6.0”**	**8.5”**	**7.25”**
Total cost including floor space adjustment*	**$10.92**	**$9.00**	**$17.39**	**$16.09**

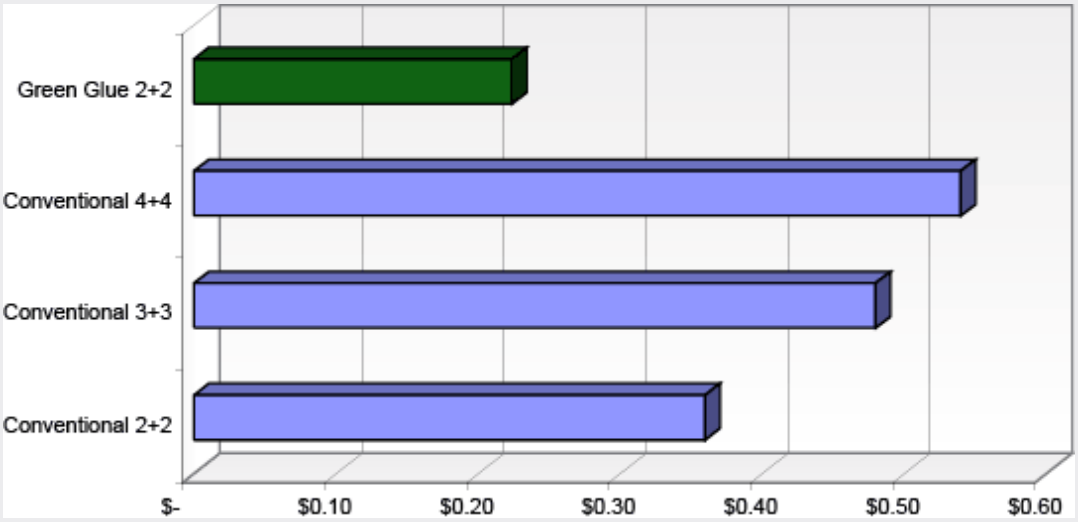
* - In some situations it is necessary to compensate for floor space consumed by the wall, as the consumed floor space represents lost saleable value. In this calculation we assume a 9-foot high demising wall, and floor space valued at $200 per square foot. We normalize to a 4.75” deep wall. Labor for saw-cut panels assumed to be 15% higher than for scored drywall.

About these costs: All costs based on national average material and labor rates taken from the National Construction Estimator, a Craftsman product. Rates will vary considerably depending on location, time of year, and other factors. Labor will vary the most. You can browse some of the data presented in the National Construction Estimator at www.get-a-quote.net

Results: Looking at the costs, it seems that in situations where space is a relevant factor Green Glue is overwhelmingly cost effective. When considering that 4 layers of conventional drywall on each side is very unlikely to match the performance of 2 layers with Green Glue, we can see that GG is easily cost effective from a materials + labor standpoint, or even from a just-materials standpoint (important to the DIYer).

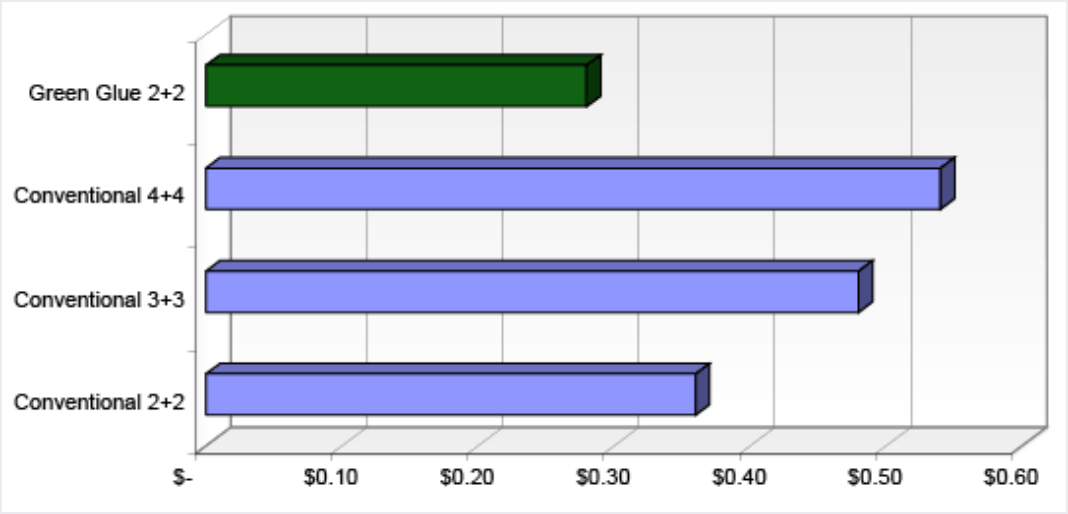
It can be interesting to look at the economic performance of Green Glue in terms of improvement per money spent. This can be done by comparing the cost of any given improvement relative to the base wall (just one layer of conventional drywall per side) divided by the improvement in performance. One can select any of the performance ratings listed above, or any other performance rating that you wish to consider.

Cost per square foot per improvement in STC
When compared to a standard wall with a single layer of drywall on each side.



Green Glue is notably cost effective in this analysis. Only materials and labor are included, if floor space was accounted for, the margin would be immense. The flanking limit of the lab may make this comparison somewhat unfavorable to Green Glue, as the STC of the Green Glue assembly may in fact be higher.

Cost per square foot per improvement in the full-band flat noise rating

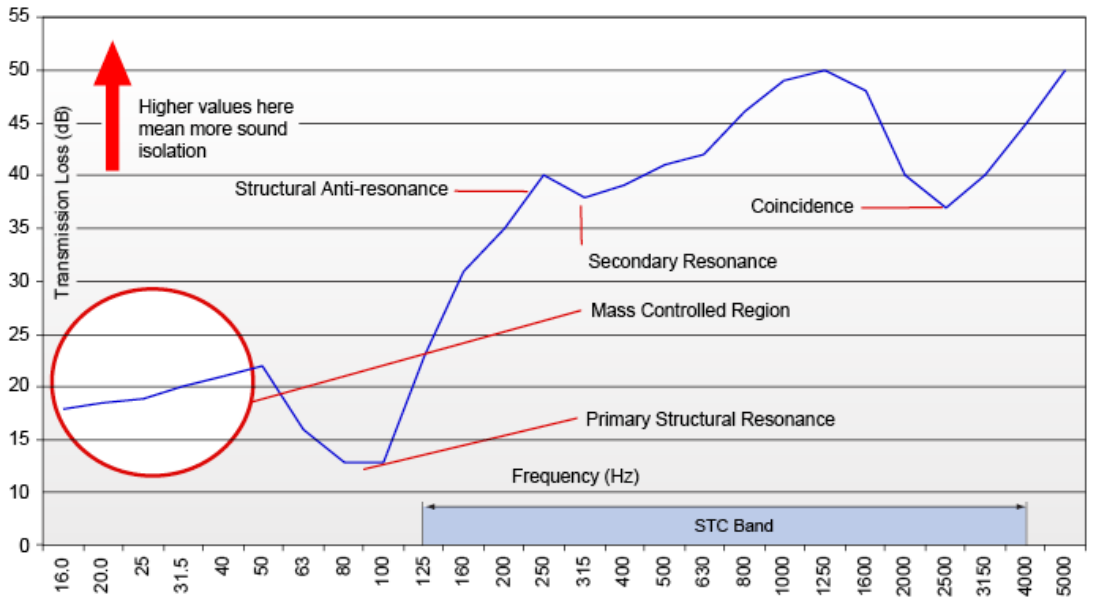


APPENDIX 2 – UNDERSTANDING THE PERFORMANCE OF THE COMMON WOOD STUD WALL

The sound isolation behavior of the common wood stud wall was explained fantastically in JASA, 1977 by Linn and Garrelick. Their paper was:

Sound Transmission through periodically frame parallel plates JASA, vol. 61, #4, pages 1014-1018, 1977

They predicted a series of mechanical resonances, anti-resonances, and a mass-controlled region below these. These predictions are outlined in this chart:



The basic regions predicted by Lin and Garrelick are outlined above. Data from 50-5000 Hz is taken from IR-693, copyright NRC Canada, used with permission, and available at www.nrc.ca

There is a primary structural resonance at which performance is very poor. Then we see an anti-resonance at which performance is good, more resonances, and then coincidence (a different form of resonance). Well below the primary structural resonance, the performance of this type of wall is controlled by the mass and size of the partition in question. Data below 50 Hz is the graph above is hypothetical and included to illustrate the points.

Green Glue has large low frequency effect at this primary structural resonance due to its damping action. Below this primary resonance, the wall is mass controlled. The effect of damping is at a minima at the first anti-resonance and above this anti-resonance damping can deliver 10-30 dB of improvement.