HOW TO MODIFY A TESTED FIRE-RATED WALL TO IMPROVE ITS STC SOUND RATING, WHILE MAINTAINING ITS OFFICIAL FIRE-RATED QUALIFICATION

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Codes and regulations governing building design and construction are generally issued by municipal and provincial governments. The regulations covering the designs for fire safety usually are based on standards issued by the Underwriters Laboratories Canada (ULC). Wall must be constructed in accordance with designs that have been tested in approved facilities to meet different ratings, such as 1 hour or 2 hour resistance to fire.

Walls are also designed to meet certain sound transmission loss values and are rated on their Sound Transmission Class or STC. There are hundreds of examples of wall partition designs that have been tested for their STC, but there is no general obligation for a designer to actually have to select a tested design to be able to meet sound criteria.

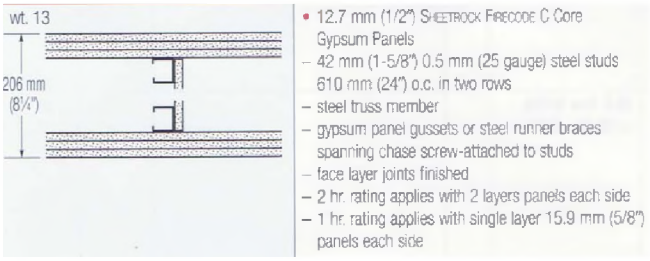
Several publications list both the fire and sound test results of many types of walls with huge numbers of permutations and combinations of materials, thicknesses, etc. The two most prominent lists are in Table A-9.10.3.1.A, Fire and Sound Resistance of Walls, in the National Building Code of Canada and in brochures issued by CGC Inc. and USG Corp. Unfortunately not all wall designs that have been tested for fire have also been tested for sound, and vice versa. This often creates a dilemma for the designer who is searching for a single design that will satisfy two independent criteria.

Fortunately, there is a legitimate way to work around this limitation. Underwriters Laboratories Canada has issued design guidelines for fire ratings (ULC document No. BXUVC). These guidelines outline modifications that are permitted to a tested design that do not affect the tested fire rating. Excerpts from ULC BXUVC are:

1. The dimensions and gauge of steel studs are minimums. The hourly ratings apply when the steel studs are of a heavier gauge and/or larger dimensions than specified in a design.
2. Spacing between parallel rows of studs are minimums unless otherwise stated in a design.
3. Additional layers of gypsum board are permitted to be added to any design.
4. Listed and labelled mineral fibre thermal building insulation processed from rock, slag and glass only may be used in ULC non load-bearing wall assembly designs consisting of wallboard and steel or wood studs with a fire-resistance rating not exceeding two hours when illustrated without insulation, without detracting from the rating assigned to the assembly.

Every one of the allowable modifications can be used to improve a wall's STC. So a designer starts by selecting a wall design that is close to the desired configuration that has been tested to the required fire rating. He can then proceed to modify that wall design step by step, in accordance with the ULC guidelines, until the wall conforms to a tested design with the desired STC.

Here is a specific example of modifying a wall. A mechanical shaft within a condo needed a 2 hour fire rating as well as a high STC rating of 62. The starting point was to select an approved chase wall (double stud) design #A36 from CGC brochure #SA-100, that has a 2 hour fire rating, per UL test No. Des U436, when constructed with two layers of ½" gypsum board on each side. It is shown below.



The following modifications were applied to that design:

1. Substitute 63 mm (2-1/2") CGC C-H 25 ga. steel studs @600 mm (24") o.c. on the rear side of the wall, replacing the 42 mm (1-5/8") 25 ga. studs.
2. Substitute 1" Sheetrock on the rear wall, replacing 2 layers of ½" GB. (The C-H studs and 1" Sheetrock are special designs that permit the studs and GB to be inserted from the front face where the shaft side of the wall is inaccessible.)
3. Substitute 64 mm (2-1/2") 25 ga, studs @ 600 mm (24") on the front side of the wall, replacing the 42 mm (1-5/8") 25 ga. studs.
4. Change the total external width to 9.0", to maintain the 2.0" spacing between the studs. The original width was 7-1/4".
5. Add 65 mm (2-1/-2") rock or glass fibre insulation batts to both sets of studs (original had no insulation).

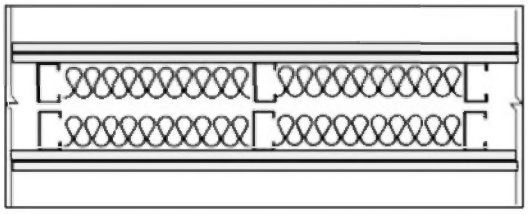
The resulting design was a shaft type of wall, 17 ft. high, with a 2 hour fire rating per UL test U436, and an STC rating of 62, per NRC test No. TL-93-305.

NRC-CNRC National Research Council Canada

TestID | TL-93-305

Element	Description:
1	single layer of 13 mm type X gypsum board
2	single layer of 13 mm type X gypsum board
3	65 mm steel studs at 610 mm on centre
4	65 mm of glass fibre insulation in cavity
5	16 mm gap filled with cross brace
6	65 mm steel studs at 610 mm on centre
7	65 mm of glass fibre insulation in cavity
8	single layer of 13 mm type X gypsum board
9	single layer of 13 mm type X gypsum board

2G13_SS65(610)_GFB65_AIR20_SS65(610)_GFB65_2G13



Finally, the following table lists a compendium of several different wall types with their corresponding fire and sound ratings. The ratings are based either on direct test results or by extensions of the original test results after modifications that comply with the ULC design guidelines, to improve their STC ratings. The list certainly does not cover all possible combinations of wall materials, and the fire ratings based on the extension of test results of similar walls may be questionable in some cases. Nevertheless this table can be very helpful for those trying to achieve both specified fire ratings and sound transmission ratings on wall types that have not been tested in the configuration of interest.

Compendium of Gypsum Board Wall Assemblies

Stud				GB		Absorptive	Max.	Resilient	STC		Fire resistance		Total
Size	Gauge	Spacing	Stud gap[1]	Qty	Size	filler	stud ht.	channel	Value	Test No.	Time	Test No.	width
CHASE WALLS													
2.5 "	25	24 " cc	20 mm	4	0.625 "	2.5 "	16'-0"	-	64	TL-93-302	2 hr*	UL Des U436	8.29 "
2.5 "	25	24 " cc	20 mm	4	0.500 "	2.5 "	16'-0"	-	62	TL-93-305	2 hr*	UL Des U436	7.79 "
2.5 "	25	24 " cc	65 mm	4	0.625 "	2.5 "	16'-0"	-	65	TL-93-321	2 hr*	UL Des W454/U493	10.06 "
2.5 "	25	24 " cc	65 mm	4	0.500 "	2.5 "	16'-0"	-	63	TL-93-308	2 hr*	UL Des U436	9.56 "
STANDARD WALLS													
3.625 "	25	24 " cc		4	0.625 "	3.0 "	13'-6"	-	56	USG 840818	2 hr	UL Des 411/419	6.13 "
3.625 "	25	24 " cc		4	0.625 "	3.5 "	13'-6"	-	56	NBC S6a	2 hr	NBC S6a	6.13 "
3.625 "	25	24 " cc		4	0.625 "	3.5 "	13'-6"	-	57	TL-92-369	2 hr*	UL Des W453/440	6.13 "
3.625 "	20	16 " cc		4	0.625 "	3.5 "	16'-9"	RC-1	61	NBC S14a	2 hr*	UL Des U404	6.63 "
3.625 "	20	16 " cc		4	0.625 "	3.5 "	16'-9"	-	55	NBC S6b	2 hr	NBC S6b	6.13 "
6.0 "	25	24 " cc		4	0.625 "	6.0 "	15'-0"	-	59	NBC S9a	2 hr	NBC S9a	8.50 "
6.0 "	25	16 " cc		4	0.625 "	6.0 "	20'-0"	-	59	NBC S9a	2 hr	NBC S9a	8.50 "
6.0 "	20	24 " cc		4	0.500 "	5.0 "	24-11"	RC-1	63	RAL-TL-87-141	2 hr	UL Des W453/U454	8.50 "
6.0 "	20	24 " cc		4	0.625 "	5.0 "	24-11"	RC-1	62	RAL-TL-84-139	2 hr	UL Des W453/U454	9.00 "
6.0 "	20	24 " cc		5	0.625 "	5.0 "	24-11"	RC-1	65	RAL-TL-84-150	3 hr	UL Des W453/U455	9.63 "
SHAFT WALLS, USING C-H STUDS													
4.0 "	25 C-H	24 " cc		1 2	1.000 " 0.500 "	3.0 "		RC-1	53	USG-040909	2 hr	UL Des U415	6.50 "
4.0 "	25 C-H	24 " cc		1 3	1.000 " 0.500 "	3.0 "		RC-1	58	USG-040910	2 hr	UL Des U415	7.00 "
2.5 " 2.5 "	25 C-H 25	24 " cc 24 " cc	51 mm	1 2	1.000 " 0.500 "	2.5 " 2.5 "	 13'-6"	- -	62	TL-93-305	2 hr*	UL Des U436	9.00 "

Notes:

All gypsum board (GB) panels to be fire rated Type X

1 - Space between studs in double stud (chase) walls

* 2 hour fire rating will qualify by extension

NBC - National Building Code

TL - National Research Council

RAL - Riverbank Acoustical Laboratories

UL - Underwriters Laboratories

USG - U.S. Gypsum Corp.