Underlayment Sound Tests

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Introduction:

Sound transmission tests were run against 3 different underlayments. All are foam based. The goal is to find an underlayment that will transfer the least amount of sound to the plywood subroadbed.

Lowest density tested was 1-1/2" strips cut from a typical Yoga mat. Cheap, easy to work, and comes in long sections.

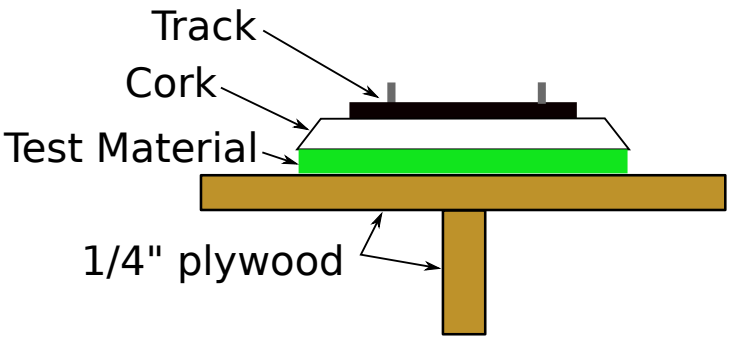
Next densest material was a foam that comes in small sheets and is about 1/4" thick. The original purpose for this material is craft work. The specific one tested was purchased from Hobby Lobby.

Highest density was a type of floor underlayment. This was the same material that was used on the Ross layout. The remnant used was from a roll purchased from Menards.

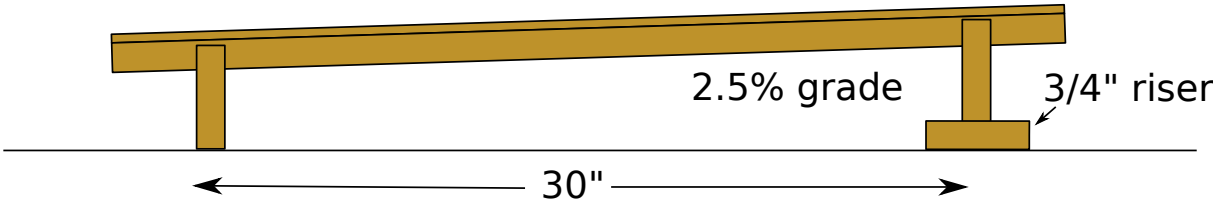
Setup:

Blanks were prepared out of 1/4" plywood - each is 36" long and 2" wide. A 1" spline was glued down the middle for stiffness. The cross section is expected to be type used for the new modules.

The test material was then glued to the plywood blank using caulk. Cork was then glued to that, also using caulk. The track was attached to the cork using white (PVA) glue.



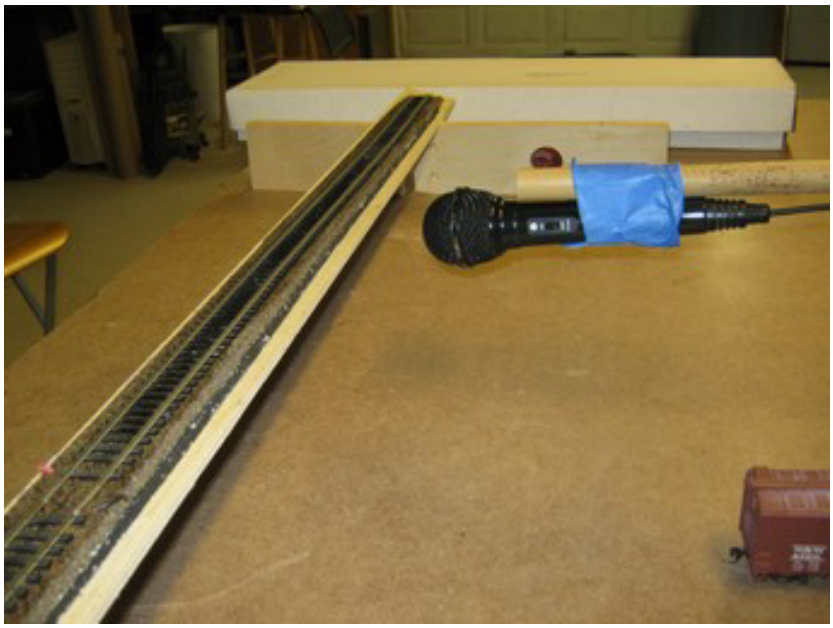
The blanks were then placed on a pair of 3" wide 3/4" thick blocks of plywood to establish a slope to allow gravity to roll the test car. A 3/4" block was placed on one end to establish a 2.5% slope.



A number of cars out of the traveling rolling stock set were tried (about a dozen) until one could be found that would freely roll down the slope.

Procedure:

A microphone was placed at the midpoint of the ramp, level with the plywood top, and 3" away from the closest rail. The microphone has a cardioid sensitivity pattern and exhibits a high degree of directionality.



The microphone was taped to a support rod that was supported by an external stand. This ensured that bumps to the table were not transmitted to the microphone.

Similarly, the laptop that the microphone was connected to was placed on a separate table for the same reason.

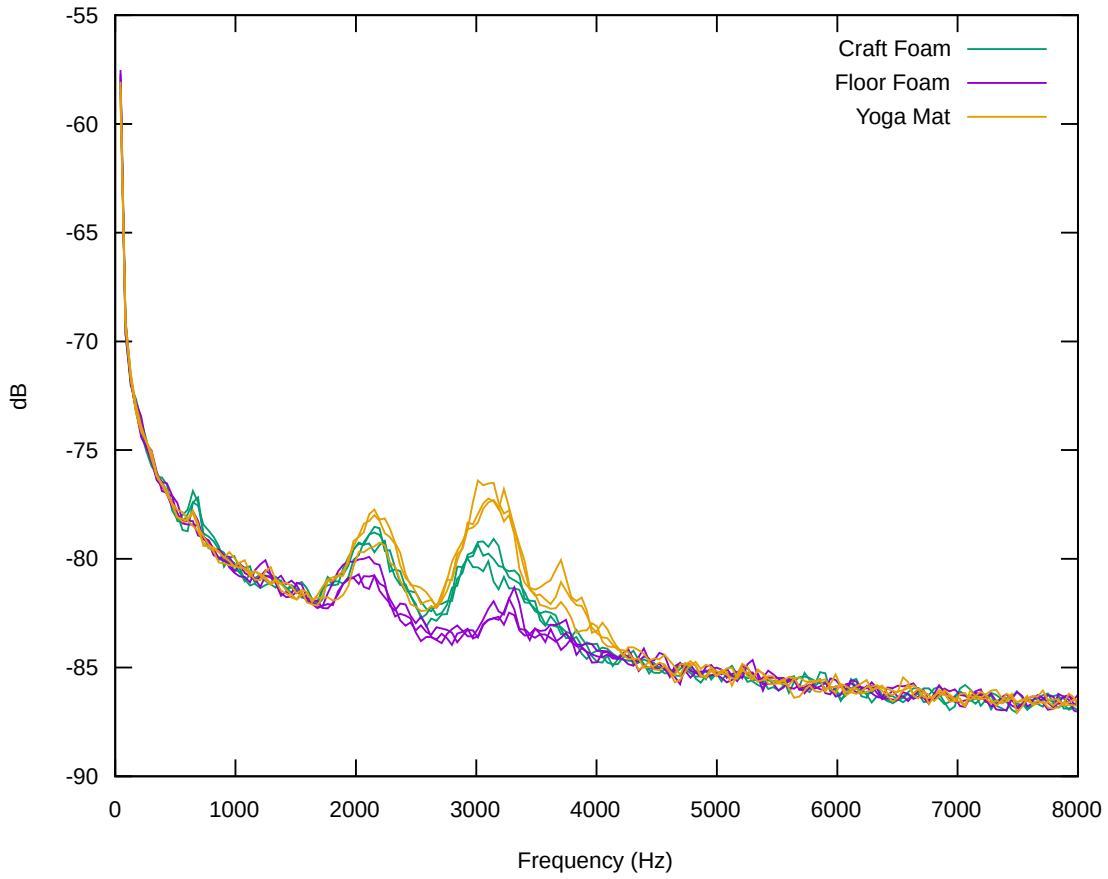
The software used for both the recording and analysis was Audacity v2.2.2 running on a Debian10 Linux laptop. Graphs were generated using gnuplot v5.2.

3 replicated runs were done for each type of underlayment. Each set was was recorded as a unit and the gravity roll-by sections edited out and placed in separate files. No manipulative processing was done other than the editing step. Each file was processed separately through Audacity to generate a spectral analysis that was then exported for plotting.

Results:

The recordings used only a small portion of the available range of the interface. Noise in the line was most of what was recorded. A more sensitive microphone or one in contact with the plywood would be preferable.

The spectral energy for each replicated run is shown (lower is better):



The results make intuitive physical sense. The foams with the lowest mass absorb or reject the least sound. The difference between the Yoga mat and the Floor underlayment is about 7dB at the largest separation.