

THE EFFECT OF HUMIDITY ON THE REVERBERATION PERIOD OF A ROOM

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It has been said that broadly considered there are only two variables in a room which affect its period of reverberation—shape, including size, and materials, including furnishings¹. There are, however, other factors that have an effect upon the reverberation period,² and it is with one of these factors, namely, humidity, that this paper is concerned.

The following experiment was carried on in a room that has been used for zoology conferences and which is located in the basement of Biology Hall at Indiana University. It is rectangular, approximately 22 feet by 15 feet, with a 12 foot ceiling. It has three small windows and two ordinary doors.

A determination of the period was made from the following measurements and calculations:

Cement floor.....	315 sq. ft. at	.01 — 3.15 units
Plaster.....	1,057 sq. ft. at	.025—26.42 units
Wood.....	245 sq. ft. at	.03 — 7.35 units
Glass.....	32 sq. ft. at	.027— .86 units
Metal.....	95 sq. ft. at	.01 — .95 units
Slate.....	20 sq. ft. at	.02 — .40 units
Observer.....		4.70 — 4.70 units

Total absorption.....43.83 units

The volume of the room is 3,900 cubic feet. Using these values, $T = .05 \times 3900 \div 43.83 = 4.449$ secs. This determination was followed by five hundred observations of the period, made on different days, with a general average of 4.465 secs. as a result, the error between the calculated and observed values being 0.35 percent.

In order to start with the humidity as low as possible several large pans of calcium chloride were placed at different points in the room and allowed to remain for several days with the room well sealed. These pans were frequently taken out of the room and heated and the moisture thus driven out so that the calcium chloride could be used again. The humidity was then increased by permitting water to evaporate from shallow pans placed at various points in the room. This evaporation was accelerated by the use of an electric heater. The wet-and-dry-bulb-thermometer method was used to measure the humidity.

In making the observations two organ pipes of pitches 384 and 480 vib./sec. were used. Fifty observations were made with each pipe for each value of the humidity. These values were averaged for each pipe to obtain the period for that frequency and that particular humidity. These values were rechecked several times, making several hundred observations for each value of the humidity.

In measuring the period the observer would first blow the pipe for five seconds or more and upon stopping would simultaneously start the stop watch. The watch was stopped just as the sound became inaudible. Observations were made when

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¹"Collected Papers on Acoustics," W. C. Sabine, p. 10.

²"Acoustics of Buildings," F. R. Watson, pp. 28-29, 33.

the observer stood at ten different positions in the room. These same positions were used for each value of the humidity.

The following table of period and humidity will help in showing the results obtained.

Room Temperature	Absolute Humidity	Relative Humidity	Period for 480 pipe	Period for 384 pipe
23.5°C.	9.770	.4545	5.136 secs.	5.040 secs.
22.5°C.	9.780	.4832	5.036 secs.	4.952 secs.
23 °C.	10.060	.4823	4.904 secs.	4.846 secs.
25.5°C.	12.229	.5047	4.640 secs.	4.540 secs.
24 °C.	13.859	.6256	4.560 secs.	4.432 secs.
26 °C.	17.660	.7076	4.556 secs.	4.352 secs.
26.5°C.	19.168	.7457	4.444 secs.	4.304 secs.
27 °C.	21.591	.8156	4.560 secs.	4.300 secs.

Absolute humidity is given in millimeters of mercury. The graph of period and absolute humidity which follows will aid in showing the variation obtained.

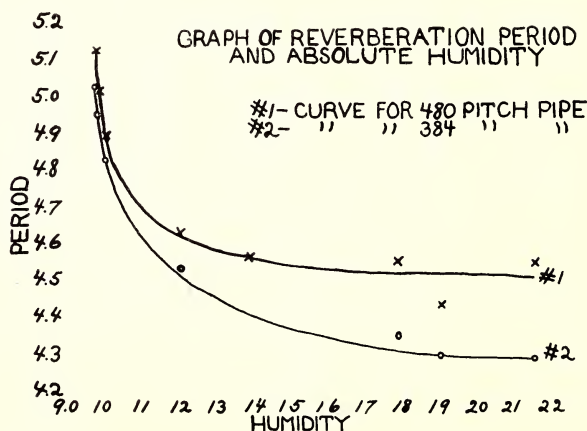


Fig. 1.

From the results obtained it appears that the period in this room varies inversely, approximately .05 sec. for each millimeter of change in absolute humidity. It seems to hold in this case until the humidity is approximately 19 mm. when the period becomes fairly constant and is almost equal to the general average of the observed values of the period.

At this time the writer wishes to express his most sincere thanks and appreciation to Dr. A. L. Foley, who suggested the problem, and to Dr. R. R. Ramsey and the other members of the staff of the Physics department of Indiana University whose interest and assistance made the investigation possible.

Note: As the result of additional work after the presentation of this paper, it is the opinion of the writer that the effect described is due to absorption.