OFFICE MEMORANDUM

MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

January 31, 1975

To: L. T. Oehler
Engineer of Research

From: R. C. Mainfort

Subject: Laboratory Evaluation of "Elastizell" as a Lightweight Fill. Research Project 75 TI-265. Research Report No. R-956.

As a result of a meeting on December 27, 1974 it was decided that a lightweight material, "Elastizell," might be suitable as a fill for certain special construction problems. Because the weight of Elastizell is a function of its moisture content it is important to know how much the weight of the porous mass would be affected by any moisture increase that could be expected under field use. Samples of Elastizell for test purposes were furnished the Research Laboratory by Leo A. Legatski, President of the Elastizell Corporation, including the data shown in Table 1.

Elastizell is produced by air-entraining Portland cement in such manner that the dry density of the resulting mixture can be controlled within narrow limits at any point between about 20 to 140 pcf. Three samples of different densities were submitted for testing. Table 2 shows the pertinent properties of these mixtures as determined by the Research Laboratory. Most of the tests were made using 1-1/2 by 1-1/2 by 4-in. samples cut from the block furnished. Data points represent an average of two or more tests. Saturation of the sample was achieved by boiling in water for about five minutes. The wet density at this saturation point is indicated in Table 2 as the maximum wet density. This condition is also used in Figure 1 as the expected wet density if the material were placed at zero feet above the watertable. To determine the moisture contents to be expected at various distances above the watertable, the samples were placed in a pressure plate moisture tension apparatus and allowed to drain under pressures equivalent to moisture tensions at 10, 20, 30, and 40 ft above the watertable. Drainage was considered to have ceased when there was no further water loss during a two-hour period. Results of these tests for all samples tested are shown in Figure 1, expressed as wet density of the materials. This figure, therefore, shows the weight of the fill material in relation to its position in the fill, should it reach its maximum possible moisture content at the particular position.

To determine the rate of water absorption, and the time required to reach the maximum moisture contents shown in Figure 1, capillary tests of the Elastizell samples were made by placing the samples on a pad of wet sand and recording the moisture content (wet density) as a function of time. These data, shown in Figure 2, show that the rate of moisture intake is a function of the dry density of the material; that the greater the dry density, the greater is the rate of absorption. Under normal moisture conditions to be expected in the field, Elastizell being a cellular material, the rate of water change would be very slow and dependent upon whether the process were of draining or sorption (hysteresis effect). Elastizell is placed at a "design wet density" (see Table 1) after which, due to hydration and evaporation during curing and set, it loses moisture. Therefore, after placing, the material is at a relatively low moisture content. Based on the data shown in Figure 2 it can be said that the densities (moisture content) shown in Figure 1 would never even be approached under field conditions. Figure 3 was thus extrapolated from the data of Figure 2 to show the maximum wet density likely to be obtained by each mixture over a total of 40 years field use, when placed in an embankment at or above a watertable.

No freeze-thaw tests were performed on these samples but previous tests indicated poor resistance to such conditions. Also, Elastizell is a good insulator. Therefore, to avoid the possibility of deterioration by frost action and to minimize the possibility of differential icing on the pavement (as has happened with styrofoam), it is recommended that Elastizell be placed below the design maximum depth of frost penetration.

This memorandum was prepared from data developed by E. C. Novak, Jr.

TESTING AND RESEARCH DIVISION

Physical Research Engineer
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RCM:bf

TABLE 1
ELASTIZELL PROPERTIES FURNISHED BY PRODUCER

Specimen Mark	Design Wet Density, pcf	Measured Wet Density, pcf	Weight of Cement, Type I, pcy	Water Content By Weight	Date Cast
H 25.62	25	24.5*	417	0.62	1-4-75
H 30.60	30	28.6*	506	0.60	1-4-75
H 35.56	35	34.8*	606	0.56	1-7-75
11857	40	38.9	697	0.55	1-2-75

* These mixes were not pumped. Pumping reduces the accidential air content and slightly increases the density.

TABLE 2
ELASTIZELL PROPERTIES DETERMINED BY
RESEARCH LABORATORY

Sample I.D.	Density, pcf		Maximum Saturation, percent	Dry* Compressive Strength, psi	Apparent Specific Gravity
	Oven Dry	Maximum Wet			
H 25.62	16.5	68.7	93	50.5	2.60
H 30.60	20.2	68.0	89	299.0	2.60
H 35.56	25.4	70.2	86	177.3	2.60
11857	29.7	75.0	82	269.5	2.60

* Samples failed by crushing rather than shear.

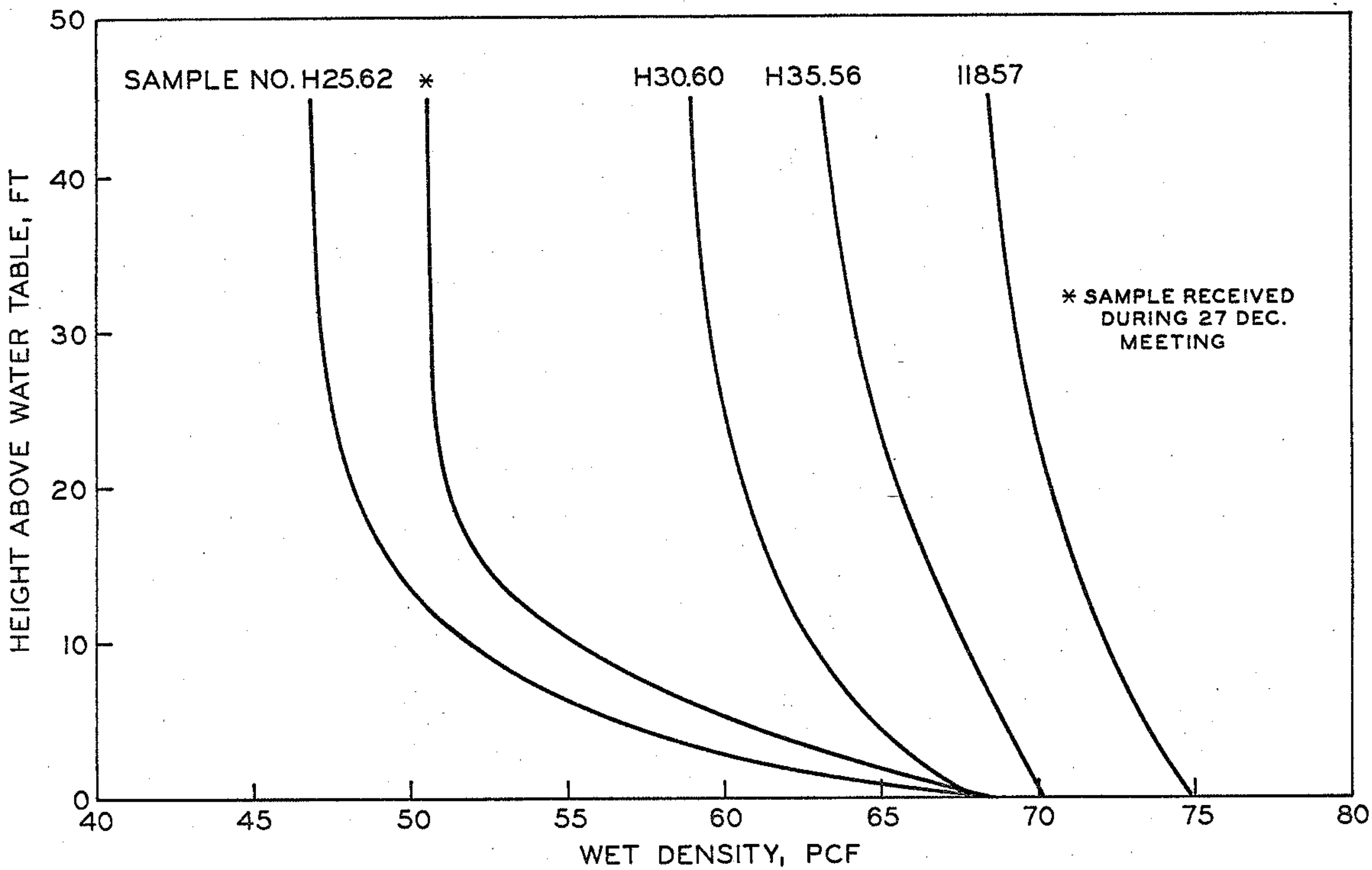

Figure 1. Variation in wet density of Elastizell samples at different heights above watertable (as determined by laboratory moisture tension tests).

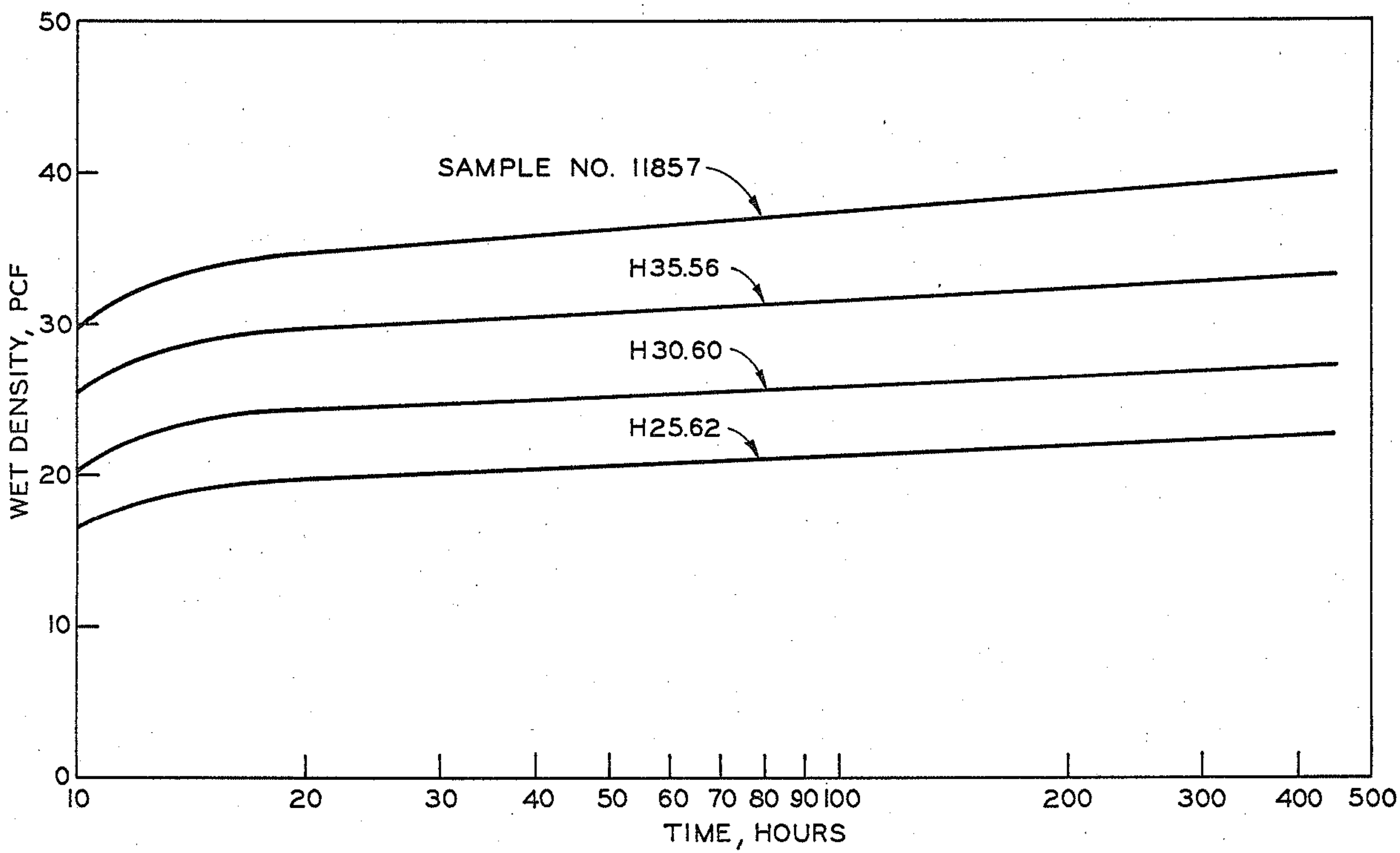

Figure 2. Effect of sorption time on the wet density of the Elastizell samples.

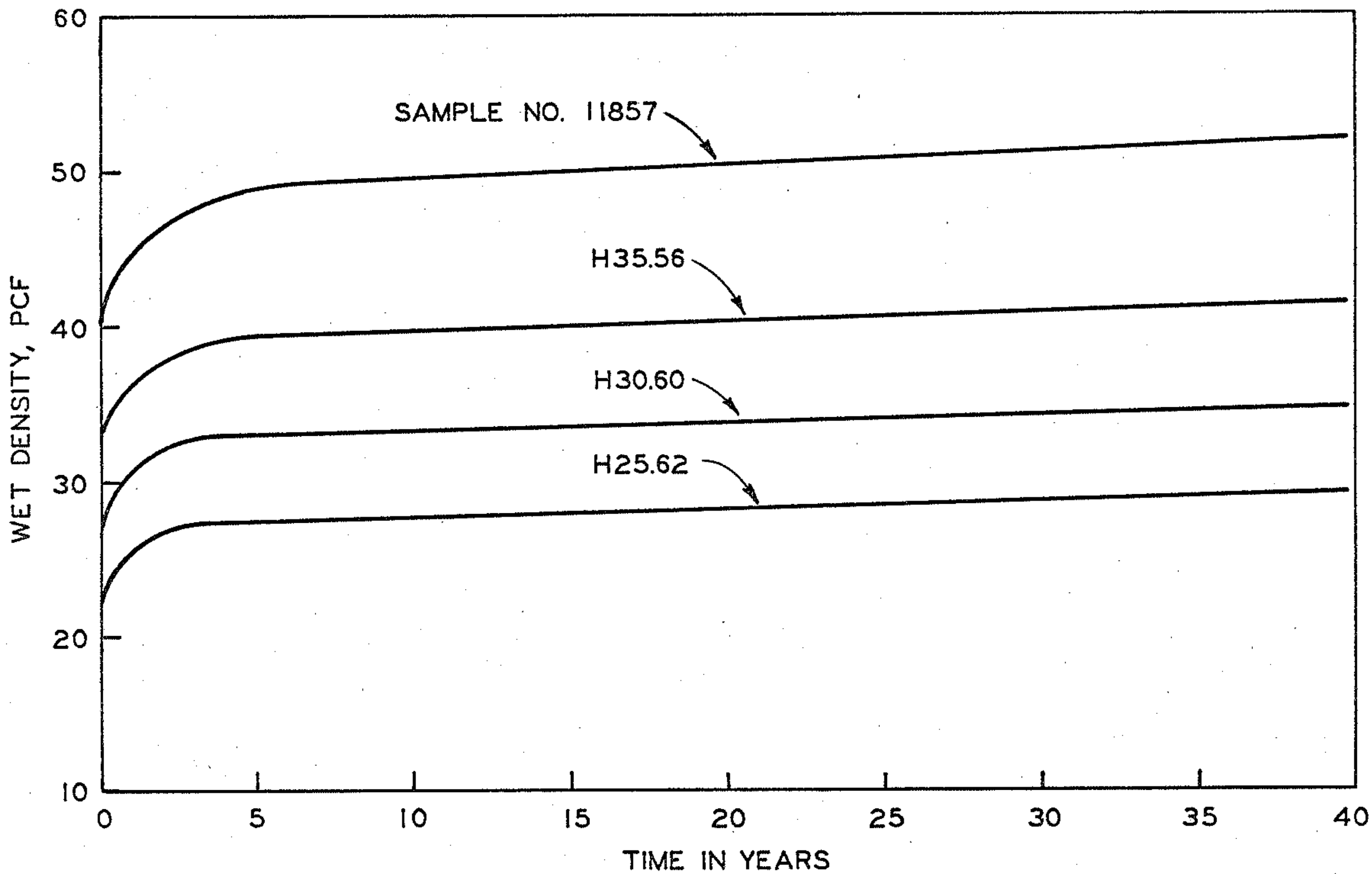

Figure 3. Wet density of Elastizell samples to be expected over a 40 year period.