OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT

August 25, 1965

To: R. L. Greenman
Assistant Testing & Research Engineer

From: E. A. Finney

Subject: Depth of Nuclear Gage Influence in Subbase Testing. Research Project 61 E-22. Research Report No. R-544.

In accordance with a request to R. L. Greenman from the Bureau of Public Roads and the Office of Construction, the Research Laboratory was requested to provide information concerning the depth of influence of the nuclear gages being used to control compaction on the US 127 job, particularly during the placement of the 4-in. selected subbase. Because this material will be of higher density than the underlying sand, it is important to know whether the influence of the nuclear gage could extend through the 4-in. subbase into the sand to give a composite reading of the two materials, rather than the desired reading for the subbase alone.

To study this problem, two series of tests were conducted at the Research Laboratory in which the densities and moisture contents of different thicknesses of aggregate, placed on a sand foundation, were determined under controlled conditions. In these tests a typical sand foundation was placed in a 24-in. square box, compacted, and tested for density. On top of this, incremental layers of compacted 22A aggregate were placed to a total thickness of 3 in. or more. As each layer was compacted, density and moisture content were determined by nuclear methods.

Fig. 1 shows the plot of the density determinations. At zero thickness of aggregate the density reading was that of the sand foundation only. As the higher-density layers of aggregate were added, the density measured by the nuclear gage increased. Values obtained on the thinner aggregate layers clearly indicate the influence of the lower-density sand foundation on the gage readings. Above 3 in. of aggregate, however, the count rate leveled off and further additions to the thickness of aggregate caused no change, indicating that a maximum density had been reached and that the sand foundation no longer exerted a significant influence on nuclear gage readings.

At the conclusion of the tests, Rainhart density measurements were obtained for the aggregate layer. These values, shown in Fig. 1, closely checked those measured by the nuclear gage at the leveling-off point of the curve. This verified that the density being measured was that of the aggregate alone and that the sand foundation had no measurable effect on the results.

Fig. 2 shows the change in nuclear gage moisture count rates as the thickness of aggregate increased. In these tests, average moisture content of the sand was 6.4 percent and that of the aggregate 4.6 percent. Although the difference between the two was not great, a progressive change in moisture content was indicated by the gage readings until the values leveled off at about 4 in. of aggregate, showing no significant influence of the sand at and beyond this thickness.

Based on these tests it appears that the nuclear gage can be used to measure the density and moisture content of a 4-in. thickness of aggregate as used in normal selected subbase construction.

OFFICE OF TESTING AND RESEARCH

E. A. Finney

E. A. Finney, Director
Research Laboratory Division

EAF:RCM:nw

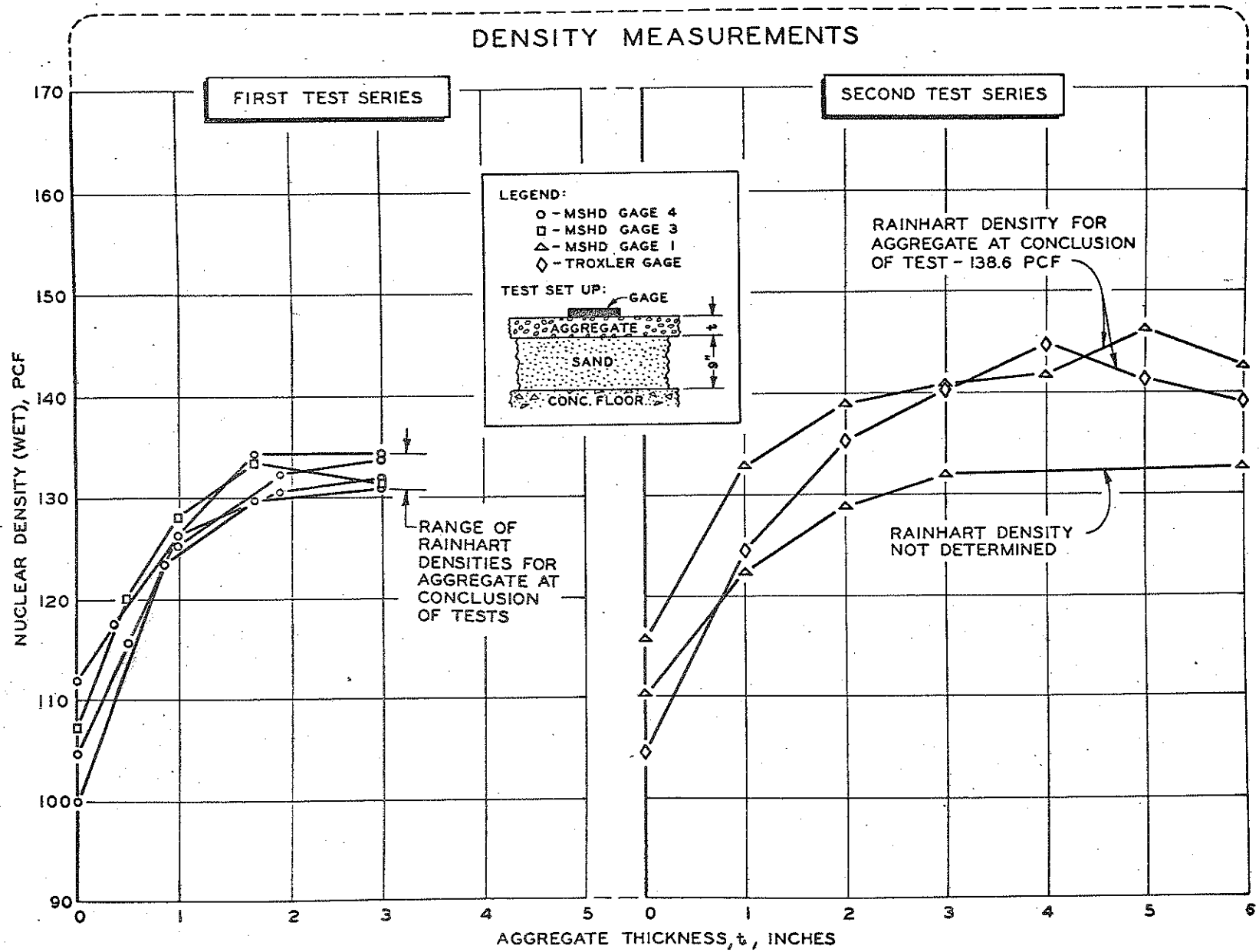

Figure 1. Effect of aggregate layer thickness on depth of nuclear gage influence, at different compacted densities.

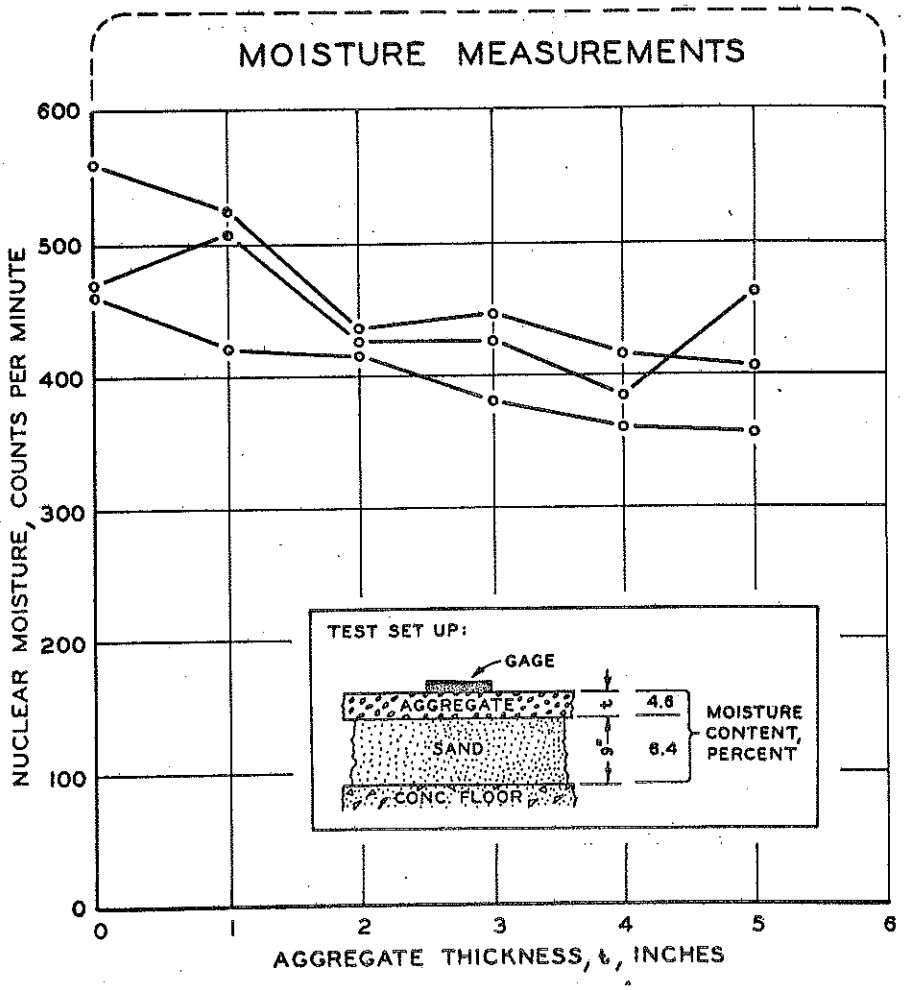

Figure 2. Effect of aggregate layer thickness on depth of nuclear gage influence (using Michigan gage No. 1).