COMPACTION CHARACTERISTICS OF MICROSURFACES AND SLURRY SEAL BY TRAFFIC SIMULATION WITH THE LOADED WHEEL AND WHEEL TRACKING TESTS

PART II: Effect of Wheel Load and cycles run on ambient LWT rate of compaction using 6 variables.

The *OBJECTIVE* of these LWT studies over the years has been to be able to predict the field performance of slurries and microsurfaces by laboratory tests.

The importance of producing materials combinations that will perform in the field by maintaining the desired grade in spite of variable layer thickness cannot be over emphasized as shown in these schematics, A and B:

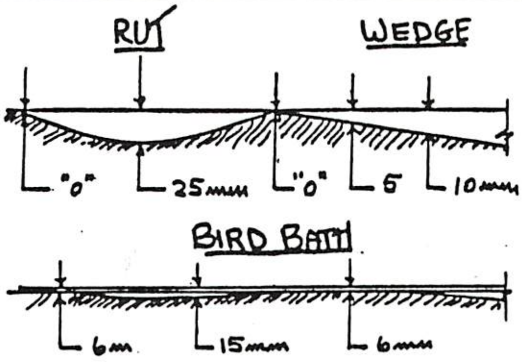


FIGURE 1. VARIABLE THICKNESS SECTIONS
RUT, WEDGE, BIRD BATH

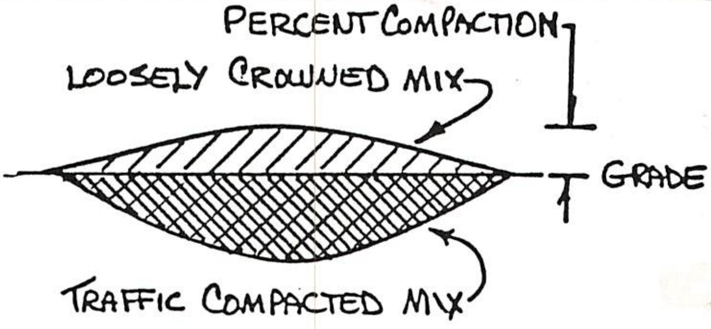
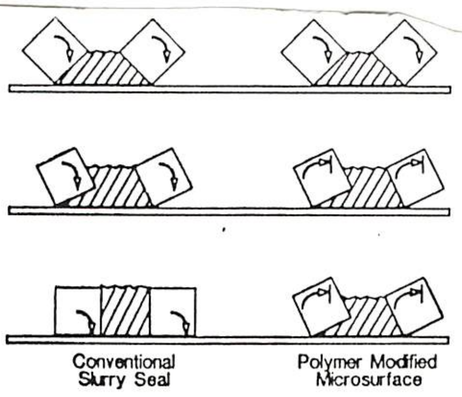


FIGURE 3. LOOSE "OVERFILL" COMPENSATION FOR TRAFFI[illegible]PACTION

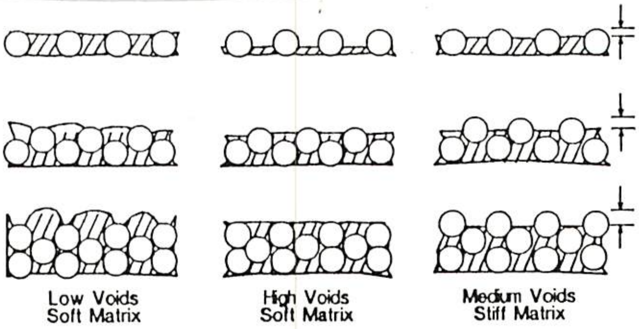
The primary difference between conventional slurry seal and microsurface is found in *DIFFERENCE IN RESPONSE TO COMPACTION BY TRAFFIC*.

MONOLAYERED slurry systems will typically lose macrotexture due to soft matrix extrusion as traffic compacts the mix; i.e., the larger aggregates assume their "most comfortable position." On the other hand, Polymod cold MACs resist compaction because of a matrix stiff enough to prevent complete compaction; more like mix consolidation rather than compaction.

MULTILAYERED soft matrix slurries lose macrotexture as layer thickness increases, while the stiff matrix cold MAC's macrotexture actually increases with layer thickness.



MONOLAYER COMPACTION, MATRIX EXTRUSION & MACROTEXTURE CHARACTERISTICS



EFFECT OF LAYER THICKNESS & MATRIX PROPERTIES ON MACROTEXTURE DEPTH

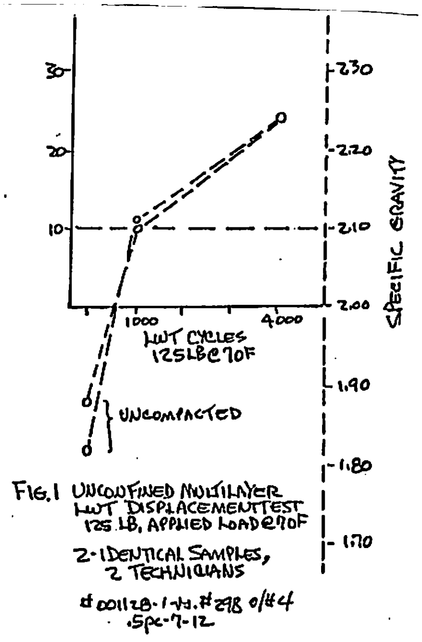


FIG.1 UNCONFINED MULTILAYER LWT DISPLACEMENT TEST 125 LB. APPLIED LOAD @70F

2-IDENTICAL SAMPLES, 2 TECHNICIANS

#001128-1-Ls.#298 0/#4
.5pc-7-12

Figure 1 shows two identical LWT mixes prepared by different technicians. While their uncompacted specific gravities were initially 1.82 and 1.88, their specific gravities approached each other at 2.10 and 2.11 after 1000, 125 lb. LWT cycles. At 3000 more cycles each sample had identical compacted specific gravities of 2.24. This finding led us to experiment with the compaction behaviors at 4000 and up to 8000 cycles on several samples and to observe the effects of more compaction effort.

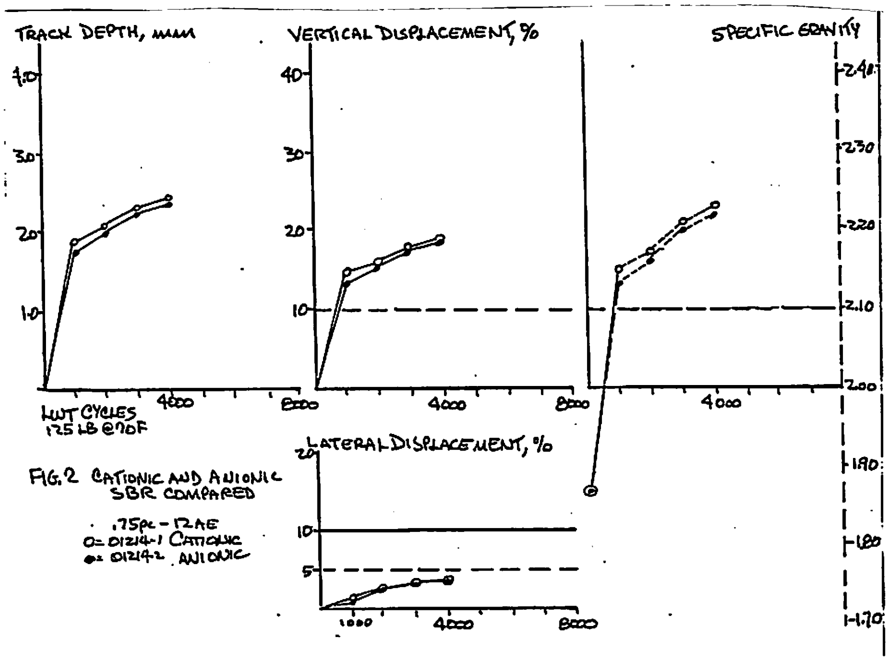


FIG.2 CATIONIC AND ANIONIC SBR COMPARED

Figure 2 compares Anionic and Cationic SBR coemulsified latex mixes at 4000 cycles. There is a high initial rate of compaction which levels off after 1000, 125-lb. ambient LWT cycles into a steady rate of displacement. the curves are practically identical or parallel with the anionic latex resisting compaction at a slightly lower level but at the same rate.

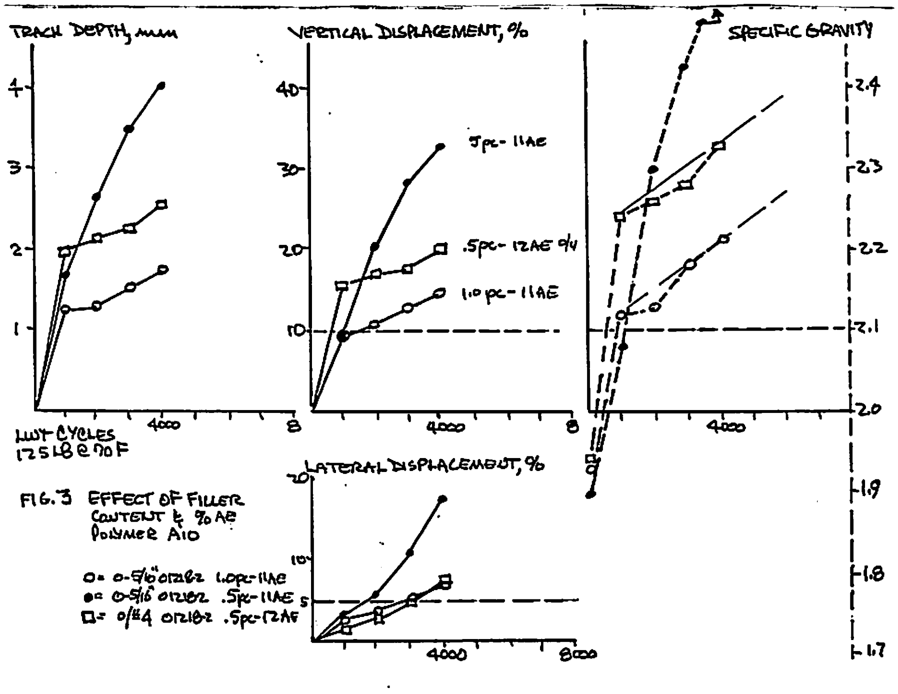


FIG. 3 EFFECT OF FILLER CONTENT & % AE POLYMER A10

Figure 3 compares a polymer "A" modified system at .5 and 1.0% cement. Each show a high initial rate of displacement. At .5% pc this high rate is continued while at 1% pc the rate makes a much slower turn and continues the lower rate for at least 4000 cycles. This is a pattern which becomes quite familiar in future tests.

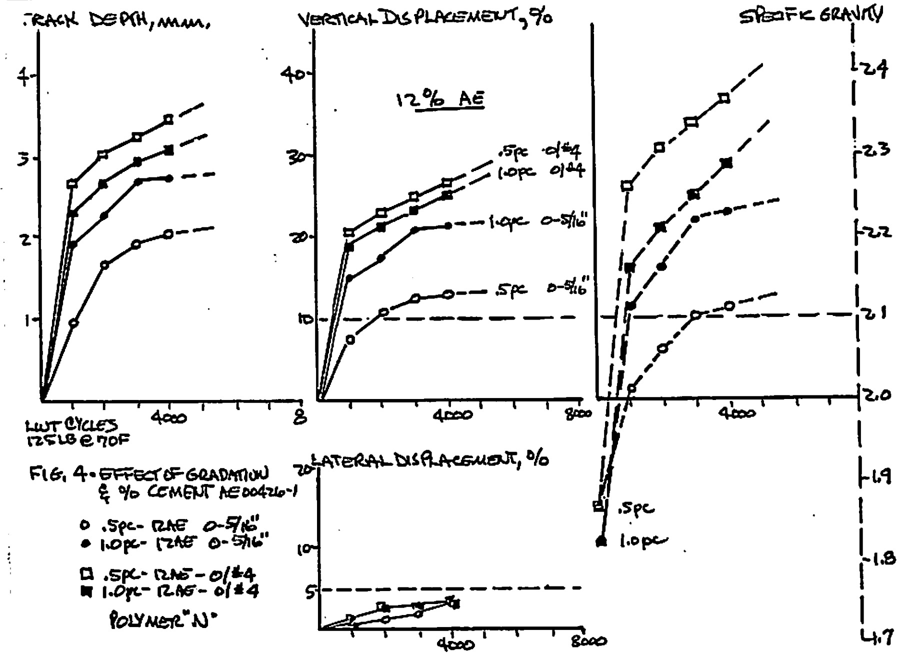


FIG. 4 • EFFECT OF GRADATION & % CEMENT AE004216-1

Figure 4 shows the effect of gradation and cement content on a natural latex emulsion. The 0/#4 gradation has a very high initial compaction but stabilizes at steady rate at 1000 cycles while the 0-5/16" does not stabilize until 3000 cycles and then at a lower rate or slope.

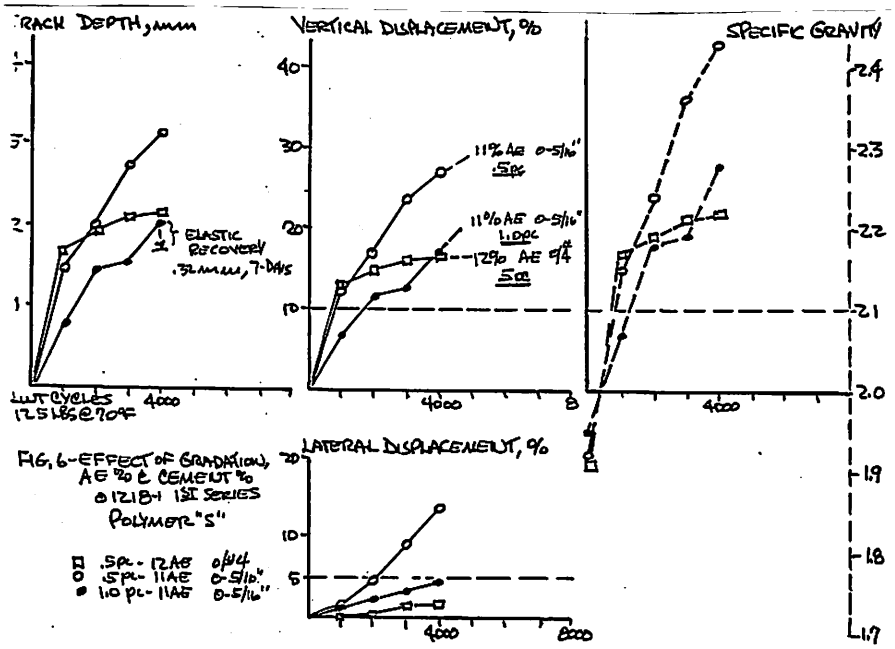


Figure 5 This natural latex system shows the effect of emulsifier pH and filler contents. The low pH, in this case, had comparatively high rates or displacement slopes while the high pH displacement rate was lower. Note the much lower compaction rate at high pH and high cement.

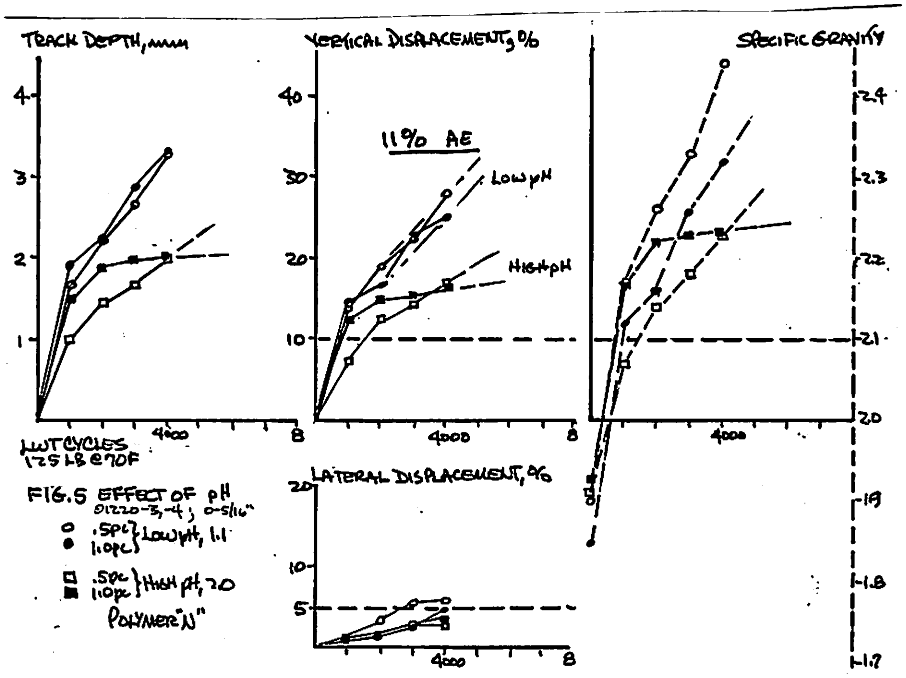


Figure 6 Yet another SBR system shows 11% AE compacting at a constant rate without pause while the 12% AE rate slows considerably after 1000 cycles. Of special interest is one specimen which recovered 30% of its original compaction upon standing for 7 days. (elastic recovery?, error?)

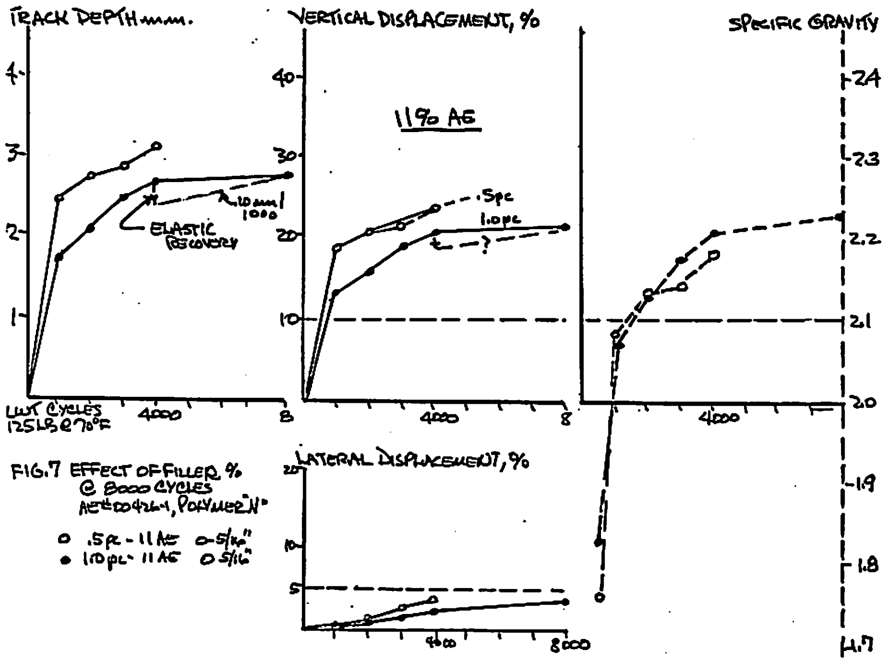


FIG. 7 EFFECT OF FILLER %
@ 8000 CYCLES
AE #004264, POLYMER "N"

Figure 7 After observing this "elastic recovery" we found the same thing happening with a natural latex specimen which we discovered had recovered 11.5% of its compacted track depth. After 4000 (8,000 total), additional 125 lb. LWT cycles the slope or rate of compaction had become practically flat, thus adding a whole new dimension to our researches; that of elastic recovery, cycle rate or rest periods to allow more time for recovery between load applications.

The actual load on our wheel varied from 157 to 130.5 lbs. depending upon the crank position and bears on a contact area of about .8in^2. We estimate these loads to approach 4 times the contact pressure of a loaded truck tire. By reducing our applied load from 125 to 75 lbs. the contact area is slightly reduced and the actual wheel load is from 117 to 90.0 lbs. or a reduction in average load from 143.5 to 103.5 lbs.; about 2½ times truck tire contact pressure.

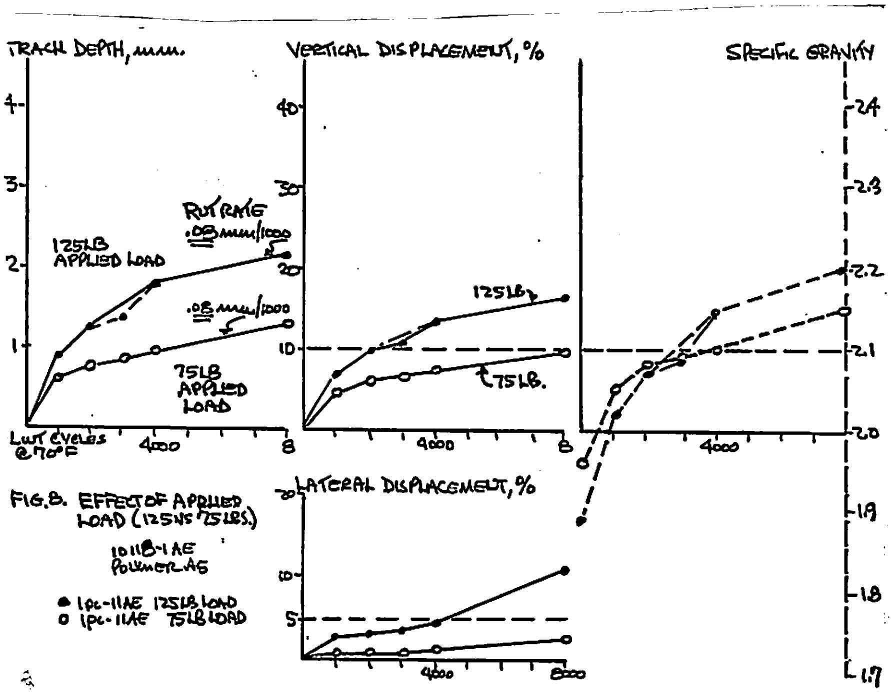


Figure 8 A polymer "A" system compares the difference between the 125 and 75 lb. applied loads. What we see with 125 lb. load is a constant rate of compaction after 4000 cycles or a track depth rate of .08mm/1000 cycles or .20 mm per hour.

With applied load reduced to 75 lbs., a constant rate of compaction after 2000 cycles or track depth rate of the **identical** .08mm/1000 cycles or .20 mm per hour, though at a much lower level.

It's noted that a steady-state rate of compaction at a 125 lb. load was not achieved until 4000 cycles while at 75 lb., the steady-state rate was achieved at 1000-3000 cycles, AT 25-75% LESS COMPACTION EFFORT than the heavier load.