

THE ARROW MOBILE HYDRAULIC HAMMER

TAMPING/COMPACTING FEATURES

TAMPING WITH THE ARROW HAMMER

TAMPING:

With Arrow's automatic hammer control each stroke of the 1,350 pound hammer weight is uniform and controllable from 12 inches to the full length drop, eliminating the hazard of human error when tamping over shallow installations.

Leads can be squared up when working on a slope or uneven ground by power. Arrow's angling feature permits keying backfill material into the original side of the trench. Many engineers feel this is a ***must*** for good compaction.

Arrow Hammers tamp backfill to specified density in lifts up to six (6) feet, faster and cheaper than any other method.

When the side shift is used, a wide strip can be tamped without skips and misses. Arrow Hammers have been used to tamp to maximum required density over transite, concrete, cast iron, or PVC pipe, and even fiber optic cable, without damage to either pipe or pipe joints.

ENGINEERING VIEW

Advantages of the dropping-weight compactor.

One of the characteristics of the dropping-weight of compaction is that high compactive efforts applied to soils of low dynamic modulus results in disruption of the upper layers so that the rammer penetrates more deeply and starts compaction at this lower depth. There, the weight of the overlying soil prevents disruption and movement and the particles are driven more closely together, resulting in improved properties. A gradual decrease in the mean pressure applied to the soil as the penetration becomes less (obtained by decreasing the drop) results in full compaction through depths which cannot be handled by rolling or vibration.

The physical advantages possessed by the dropping-weight compactor in being able to effect full compaction in narrow places and in areas where rollers can have little effect (e.g. behind bridge abutments) is obvious. The second advantage is that of being able to compact effectively deeper layers of soil than can be brought up to a uniform and acceptable density by other means. These two advantages make the dropping-weight compactor ideal for small areas of soil of some depth, or for cutting trenches through loose soil, by compacting the soil rather than by removing it. This gives a dense bottom layer for the construction of drains or the laying of services.

Full details of test carried out on this machine have not always been adequately recorded. The relative compaction against the AASHO standard or the BS standard, which is equivalent, has, however, been obtained in a few experiments, and these are shown in *the Chart*. However, uncertain these figures are - they refer to different soils and varying numbers of passes, they show a consistently high standard of compaction. The "satisfactory" of this report was assumed to be at least 95% relative compaction.

There is a slight dropping off in relative compaction as the lift to be compacted increases, but the compaction effected is acceptable even up to six feet of depth. The dropping-weight compactor cannot compete with rollers over large areas, but in narrow and confined spaces it is economic, effective and fast and can deal with deep lifts.

The output of the Arrow machine with which tests have been made, has not been found to be increased by decreasing the drop of the rammer. This would however be a sound technique in deep soils as the compaction increases towards the surface. We found that the speed of traverse of the mechanism controlled the output, which was recorded as 25 ft²/minute or, to an acceptable standard for earthworks, a rate of from 17 yd³/hour for uniformly graded granular material, to 46 yd³/hour for cohesive soil. These figures are, of course, only guides, for site conditions influence the results.

ARROW MOBILE HYDRAULIC HAMMER
DROPPING-WEIGHT COMPACTOR
TRENCH COMPACTION TRIAL

The Arrow Hammer, dropping weight compactor has already been the subject of an investigation by a road research laboratory. Details of the machine and its operation can be found below. Their results show that a satisfactory state of compaction would be achieved after two passes on 24 inch thick compacted layers of cohesive soils and after four passes on 24 inch and 18 inch thick compacted layers of well-graded granular soils and uniformly graded materials respectively. The purpose of this trial was to assess the performance of the compactor in a trench reinstatement in one deep five foot layer. Three passes of the machine were used with the maximum height of drop of the rammer.

On completion of backfilling and compaction, the trench was re-excavated in increments and the bulk density determined at levels throughout the depth of the trench backfill. The trench was re-excavated by machine to within 3 inches of the required level, then the final 3 inches removed carefully by hand.

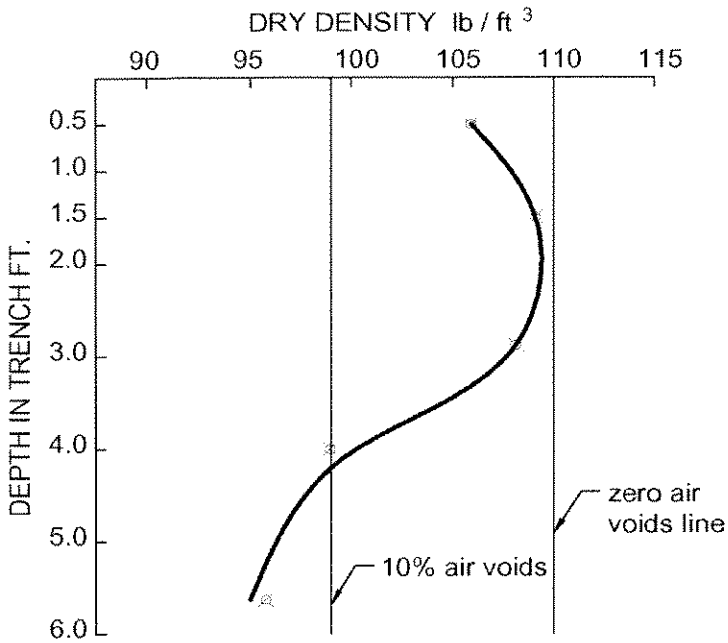
The dry density was determined, using a water filled balloon volume measure. Two measurements were made at each level.

TABLE 1

Depth Below G.L.		Bulk Density	Moisture Content	Dry Density
ft.	in.	lb/ft. ³	%	lb/ft. ³
0	6	128.0	21.0	106.0
1	6	131.0	19.8	109.5
2	6	131.0	20.2	109.0
4	0	119.0	20.4	99.0
5	6	119.5	23.0	97.0

The results are shown in Figure 1 and Table 1. Laboratory compaction tests at ordinary BS and heavy BS levels of compaction were carried out on the trench backfill material. The results are shown in Figure 2. The degree of compaction obtained through the depth of the trench has been expressed as relative compaction referred to the ordinary BS compaction. The test results are shown in Figure 3.

Figure 1

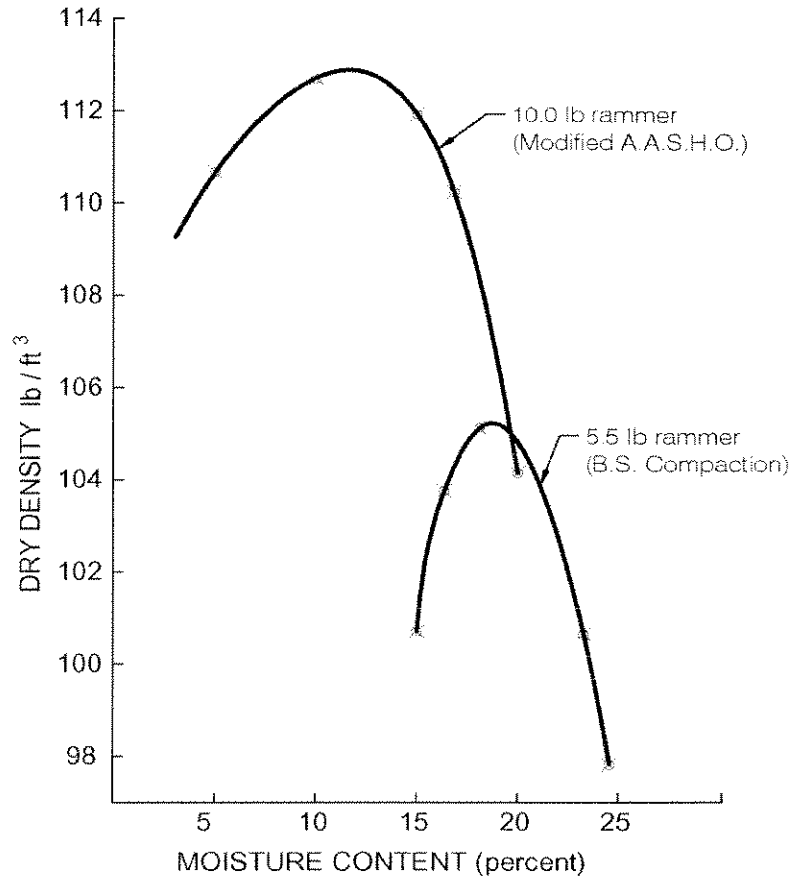


Silty inorganic clay of intermediate plasticity
Moisture content 20.5% s.g. 2.73

3 passes of ARROW dropping weight
compactor. Maximum height of drop.

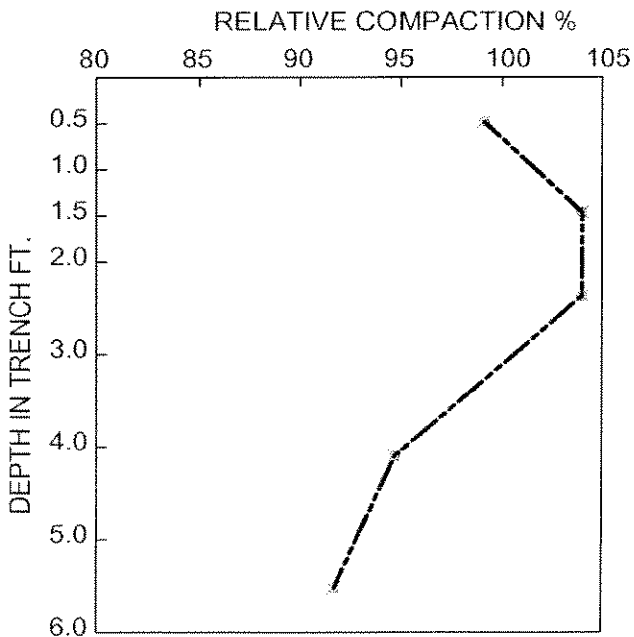
DRY DENSITY VERSUS DEPTH
IN RECOMPACTED TRENCH.

Figure 2



B.S. COMPACTION TEST ON
TRENCH BACKFILL MATERIAL

Figure 3



RELATIVE COMPACTION REFERRED TO B.S.
COMPACTION (5.5 lb rammer) VERSUS DEPTH
IN RECOMPACTED TRENCH.

TRANSIT PIPE NOT DAMAGED

by Tamping with ARROW Mobile Hydraulic Hammer

EXAMPLE 1

Here are the results of tests made with an ARROW Mobile Hydraulic Hammer, tamping over 8" Transite Pipe laid in a 4' trench.

TEST CONDITIONS: Each end of a length of Transite Pipe was placed on an 8" mound of dirt as the only support for the pipe. The 4' trench was filled and dirt was mounded a foot high. The ARROW made one pass the length of the pipe, using a 1,350 lb. hammer weight and tamping with automatic hammer control. Then the trench was filled once more and was again mounded with a foot of dirt, and the ARROW made a second pass. On a third pass, the desired 95% compaction was obtained.

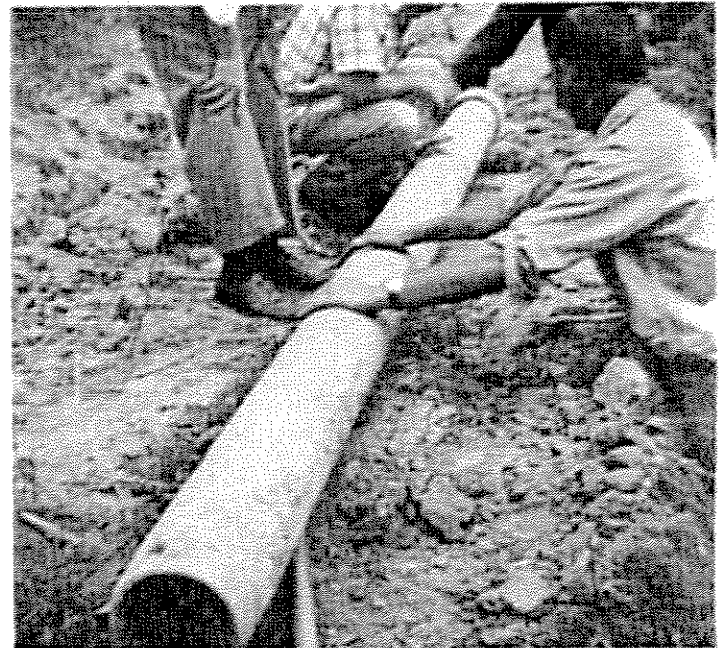
TEST RESULTS: The pipe was carefully dug up. It was found that the backfill had compacted properly under the entire length of the pipe, providing a highly satisfactory bedding. Inspection of the pipe showed that it had not been the least bit damaged.



1. This picture shows how the backfill material was compressed after two passes, using a 1,350lb. hammer weight, tamping with automatic hammer control. The required 95% compaction was obtained on a third pass.



2. Here is the imprint left by the pipe after it was carefully dug out of the ground. Originally laid upon an 8" mound of dirt at each end of the pipe as sole support, this picture shows the bedding that resulted from tamping with the ARROW Mobile Hydraulic Hammer. Compaction was entirely satisfactory.



3. A length of 8" Transite Pipe has been dug from the ground and is being carefully inspected after tamping with the ARROW Hammer. It was found to be in perfect condition.

EXAMPLES

EXAMPLE 2

Problem:

Compaction of 14 feet deep x 2 feet-6 inches wide trenches - heavy clay. The clay had hardened off due to the effect of sun and atmosphere. After 8 weeks work using all types of conventional compaction equipment, the best figures achieved were 30% voids.

Solution to Problem:

An Arrow Mobile Hydraulic Hammer was demonstrated on site using the automatic stroke control in operation. Three passes using six foot fills gave 9.8% voids.

Note: The time taken by the Arrow Hammer is a fraction of 1% of the time taken by other equipment.

Result:

Arrow was in! Customer bought a machine. This customer is now supplementing their own machine capacity by using a second machine as required.

EXAMPLE 3

Demonstration:

14 ft. deep x 2 ft. 6 ins. Wide trenches. Medium heavy clay.

Test figures taken by county.

Note: Using six foot fills, three passes with Arrow Hammer gave 0.5% voids to 1.2% voids compared with 14.2% voids using conventional equipment.

Note:

Time taken by the Arrow would be a fraction of 1% of the time taken by other methods.