

## **A portable ultrasonic concrete-testing apparatus\***

by R. H. Elvery, B.Sc.(Eng.), A.M.I.C.E.  
and D. W. Vale

### **Contribution by T. N. W. Akroyd**

I have had the advantage of inspecting the authors' equipment and agree that, contained in two relatively small units, it is easily transportable. In this respect it has a great advantage over the original apparatus made at the Road Research Laboratory. The commercially available model, however, made by Cawkell compares not unfavourably. In fact so far no difficulty has been experienced in moving it about the site, even on such widely different sites as the top of a church tower, a reinforced concrete jetty and a coal washery plant. A wooden box lined with sorbo-rubber and fitted with handles and hooks has been found satisfactory for moving the instrument by hoist or crane, and fitted with two long handles it can be carried rather like a small sedan chair by two men and, incidentally, the box forms a convenient instrument stand.

I note that the instrument described by Elvery and Vale has a smaller cathode ray tube and I suggest that this is rather a retrogressive step for, from the operator's view-point, tubes should be made bigger and not smaller. Any advantage gained in compactness of the apparatus may be lost in the eye strain caused to an operator having to peer for long periods into the small tube. On site work a period of operation of 8 hours is not uncommon.

Apart from compactness I feel that the advantages claimed for the mounting of the new tube are more apparent than real. In the commercial model the tube is already adequately protected. The usual rubber viewing mask is sufficient to keep out extraneous light from the screen, and finally the instrument should not be put on the ground but should be mounted on a stand at a convenient height for the operator.

In operating the commercial instrument one can switch to any of the three time base ranges without any other adjustment being necessary, so that there is no difficulty in counting the number of 10 micro-second markers. The usual range of time intervals on site work has been up to 100 micro-seconds and I feel that to count up to ten 10 micro-second "blips" is no hardship and does not justify the use of a special scale.

I note that 40 minutes is required for the new instrument to become stable and this, I think, compares un-

favourably with the 10 minutes required by the Cawkell instrument. Even this 10 minutes is a nuisance, but it has been found better to wait until the instrument becomes stable than to carry out constant checks with the danger, as on all site work, of the operator forgetting to check the "magic eye" before and after taking a reading.

Elvery and Vale make no mention in their paper of the use of a Variac or other constant voltage output control. This I consider to be essential. Errors of up to 0.3 micro-seconds have been encountered with a change in the voltage from 230 to 245 volts.

### **Reply by the authors**

Mr Akroyd's observations with regard to the use of ultrasonic equipment under field conditions certainly show that the commercially available equipment may be used in the field. The authors feel, however, that their paper was not intended to cast any doubts on this matter, since no reference was made to the Cawkell apparatus. The paper was intended to describe a modified form of the Road Research Laboratory equipment since that was the only one described fully in the literature of this country at that time. Although the authors have had no direct experience with the Cawkell apparatus, they feel that in regard to transportability, the original Road Research Laboratory equipment is as good as the Cawkell version.

It was realized at the outset of the development of the new equipment that its success or otherwise would depend mainly on the principle of whether or not the use of a smaller cathode ray tube would represent a disadvantage. The final adoption of the smaller tube was certainly not arrived at without considerable forethought. As a result of some five years' experience with the original Road Research Laboratory equipment, it was realized that in spite of a tube screen diameter of  $3\frac{1}{2}$  in., the only portion of the display which was viewed in detail was that in the immediate vicinity of the onset of the pulse, a region not more than 1 in. in diameter. It appeared evident, therefore, that a tube of only  $2\frac{1}{4}$  in. diameter (with suitable electronic magnification such that the display was similar in actual size to that on the  $3\frac{1}{2}$  in. tube) would prove no disadvantage whatsoever. The adoption of this principle has since proved to have been correct, and far from being retrograde has allowed high accuracy to be obtained while dispensing with the now obsolete "sedan chair", as well as the crane and

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\*Pages 161-164.

## Discussion

hoist. It is, of course, preferable to mount the equipment on a stand, but such comforts are not always possible under site conditions and where it is possible, a stand could equally well be provided for either form of apparatus (although a more robust stand would be necessary for the earlier forms of equipment).

The disadvantage of warming-up stability has been admitted by the authors, but it requires a magic eye check, taking only two seconds on each reading, if it is required to use the equipment during the first 40 minutes. In the experience of the authors no danger of forgetting to check the magic eye has been experienced, since elementary training of the operator has soon led to a simple routine whereby checking becomes automatically part of the skill acquired.

With regard to the change-over of time base sweep speeds mentioned by Mr Akroyd, the portable form of equipment may be used in exactly the same ways as the

Cawkell apparatus since, if reliance is placed on counting time markers only, then no adjustment is required. The authors agree that the additional facility of a special scale for checking timing "blips" is probably unnecessary up to 100 micro-seconds (say only about 12 in. of concrete), but for greater periods of time the additional check is very useful and provides a scale up to 700 micro-seconds.

The authors did not mention the use of any mains supply voltage control except that it was pointed out that a meter was incorporated so that mains fluctuation might be detected. A Variac does not in itself stabilize the supply voltage unless operated manually in conjunction with a suitable meter which Mr Akroyd omitted to mention. If serious fluctuations are encountered the new apparatus will indicate this quite clearly and some form of voltage stabilization would then be necessary, as for either form of the equipment.