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A STUDY OF THE USE OF PILE SUPPORTS FOR THE ACCELERATOR PIPE

STANFORD LINEAR ACCELERATOR M

P R E L I M I N A R Y

REPORT TO PROJECT M - NO. ABA-21

STANFORD UNIVERSITY SUBCONTRACT S-128

UNDER AEC CONTRACT AT(04-3)-363

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This report presents the results of a brief study, made at the request of Project M, in which the accelerator pipe would be supported on piles spaced at intervals along the accelerator.

In this study certain assumptions were made to form a basis for analysis. These assumptions should be further investigated before definite conclusions can be drawn. For example, the elevations of the rock along the accelerator alignment were assumed, as were the pile penetrations into the rock. It is also possible that the elevations of certain rock formations at the site will vary as time elapses. Based on data obtained to date it appears that the elevations of certain portions of the site vary with time. Definite information has not yet been obtained as to the magnitude of vertical movements and the geologic formations in which the movements occur. The investigative program presently proposed should shed considerable light on this subject.

For purposes of this study, piles were assumed to be drilled a definite distance into the underlying rock as it is possible that some of the vertical movements occur in the upper layers of the rock formations. To allow for differential movement between the accelerator housing and the piles, an annular space filled with a plastic material was assumed.

The following drawings illustrate the type of construction and the conditions assumed:

Pile Supports for Accelerator Pipe in Cut Section	SK-C-07131A
Pile Supports for Accelerator Pipe in Fill Section	SK-C-07141
Assumed Rock Line Profile	SK-C-07131B

These drawings show cast-in-place concrete piles, and the estimate was made on this basis. Steel piles might be given consideration provided they could be driven a sufficient distance into the rock to obtain the necessary embedment. Steel piles would probably be more expensive than cast-in-place concrete piles and concrete encasement might be required to prevent corrosion.

It will be necessary to case the holes for piles in the fill. In the sections where the accelerator housing is founded on fill, a total length of about 2800 feet, the holes would be drilled down until they are at least 10 feet into the hard material. A 20-foot penetration below the assumed rock line was used in the cost estimate as there is no sharp line of demarcation between the soft rock and the sandstone. If the method of supporting the accelerator pipe on piles is adopted, a more extensive program of core drilling should be instituted in order to obtain more information on the location of the sandstone.

After placing reinforcing steel cages, the concrete would be poured up to a short distance below the wide flange columns shown. If feasible, steel columns should be used. Otherwise aluminum could be used provided it was specially treated to ensure bond with the concrete. The columns and support beams shown should not be placed until after the accelerator housing, with the fill in place above it, has had the maximum time possible to settle and

consolidate. In addition, placement of ~~the support~~ columns at a later date will leave the housing clear for the travelling forms, which will probably be used in its construction.

The support beam would be bolted to two of the metal columns and would be accurately aligned before pouring the concrete around the columns. In case future modifications in the vertical alignment were necessary, shims, as shown at the tops of the columns, could be removed or added. It should be noted that all connections to the accelerator pipe should be made as flexible as possible so that any minor movements of the housing will not be transferred to the pipe. An alternate method to the one shown would be to construct a reinforced concrete pedestal on top of the pile, with anchor bolts to take the aluminum support beam.

In the area where the housing will be constructed in cut, a distance of about 10,400 lineal feet including the beam switchyard, the same type of pile support for the accelerator pipe is proposed. However, it will probably be unnecessary to case these piles and they will be much shorter. An average length of 10 feet was used in the estimate of cost. A contingency factor of 30 percent was used in case later information requires an increase in the length of the piles or conditions are materially different from those assumed.

The following estimate of cost includes the poured-in-place concrete piles as shown on the drawings but does not include the accelerator pipe support beams, columns, or pedestals.

Piles through fill	$ 77,800
Piles in cut areas	95,600
Contingency (30%)	52,000
Total	$225,400

Conclusions: With the information presently available it cannot be definitely concluded that piles as shown would increase the stability of the accelerator pipe. Further data is necessary before a recommendation can be made for or against piles. If some of the rock formations contract and expand with change in moisture content, piles would not necessarily be the proper solution. A carefully compacted fill with a moisture content maintained substantially constant, might then be a better solution.