AN INVESTIGATION OF SOIL CORROSIVITY AT PALANI FOR LAYING A WATER PIPE LINE

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Study of the site

The cast iron pipe line of 15" dia. is to be laid for feeding the water by gravity to the reservoir. The total distance from the point of supply of water (Head Works) to the reservoir is 35,000 ft. In order to increase the water supply, they wanted to duplicate the existing 7" pipe line (feeding line) with 15" pipe line. The reservoir is situated at a height of 1035 ft. on a top of a small hill on the outskirts of the town. At the foot of the hill, a road is passing. Sketch is given in Fig. 1. Between this canal and a river the pipe line is bursting at a number of points. The proposed new line is to be laid across this trouble spot. The pipe line is bursting because of water logging for nearly 4 to 5 months in a year (mainly due to the rain water and paddy fields containing full of water) when the corrosion shall be severe and later during summer (June to July), because the soil is dried up, cracks are developed in oxide scale. It was observed that the bursting was taking place during summer. Secondly it is reported that the bursting was taking place whenever the water was drained by turning the cover valve. This is because of the increase of the velocity of water flow which blows off the rusted portions of the pipe line. The land between the canal and the river is not exactly flat. There are depressions and elevations.

There is every tendency of water logging at the depression. As a matter of fact the water was found when pits were dug to the depth of pipe line. Paddy fields are situated very near to the pipe line path on either side. The fields are full of water which means the pipe line path is always wet with the oozing of water into the pipe line which is at a level below the fields. Rain water collected in nearby trenches may also seep

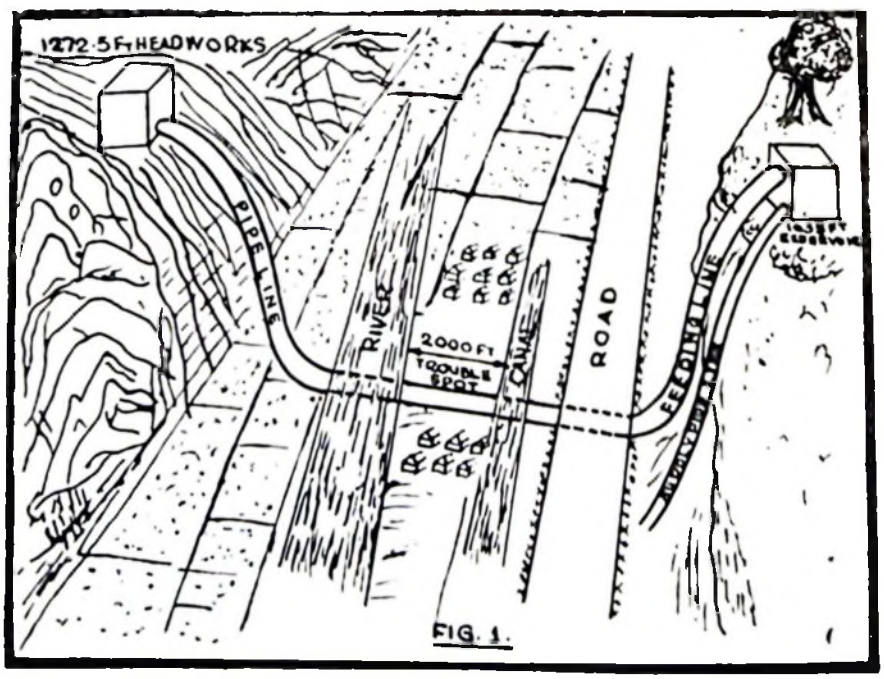


FIG. 1.

into the area of pipe line. The soil consists of clay, quite black at some places and grey or brown at other places.

The problem consists in finding the solution for laying the pipe line with protective measures being observed.

Resistivity Measurements:

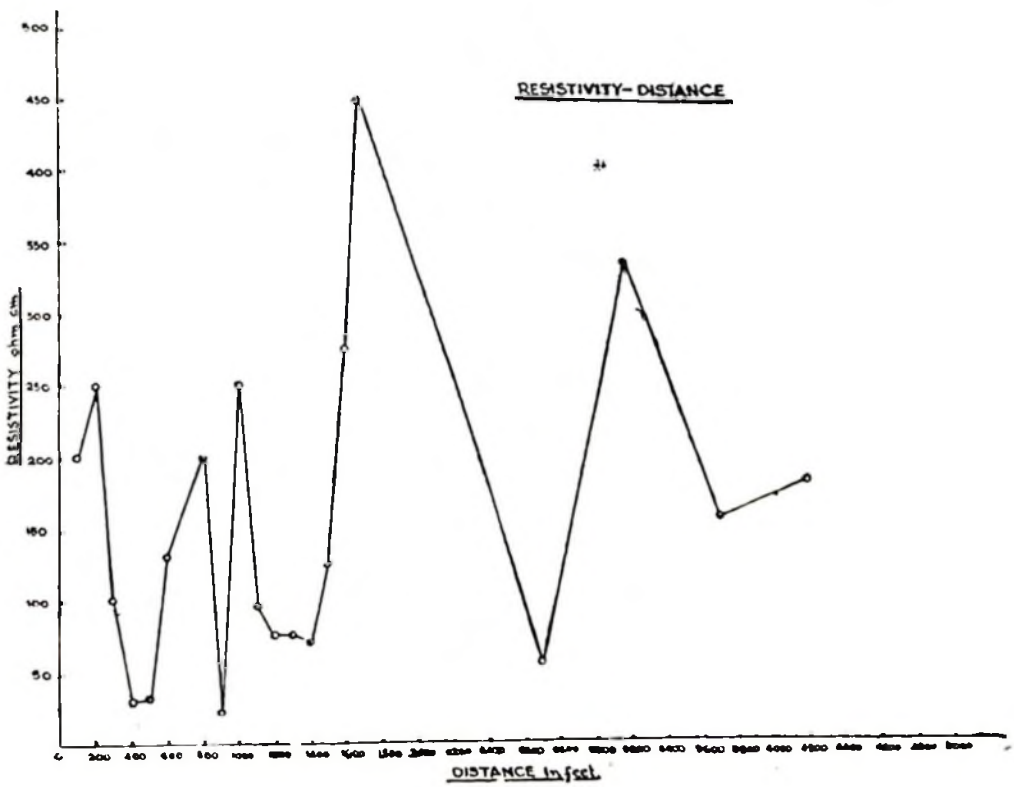
The resistivity measurements were made along the pipe line route at every distance of 100 ft. in the trouble spot and at every distance of 500 ft. after the trouble spot. The pits were made upto the depth of the old pipe line, whose depth was varying between 3 to 5 ft. Where the sub-soil water was found the resistivity measurements were made at the top of the soil. The resistivity measurements were made with the Tellohm Resistivity Meter. The observations are given in the graph (resistivity-distance).

Polarisation Measurements:

The polarisation measurements were conducted with copper/copper sulfate electrode by polarising a cylindrical mild steel pipe of 1" dia. and 4" length. The pipe was surrounded by cylindrical iron electrode as shown in Fig. 2. The potentials were measured making use of vacuum tube volt meter. The pipe was polarised anodically and cathodically at two places, where the bursting is taking place and where the bursting is not taking place. The observations were plotted in the graphs Pit No. 1 and Pit No. 5.

Inspection of the corroded pipe line:

Corroded pipe line of 10-12 ft. length was inspected. The corrosion took place for 4 to 5 ft. length continuously. This indicates that the short line corrosion is playing the role rather than the long line corrosion. However, the long line corrosion is not absent. Secondly no graphitisation of iron was observed. Inside



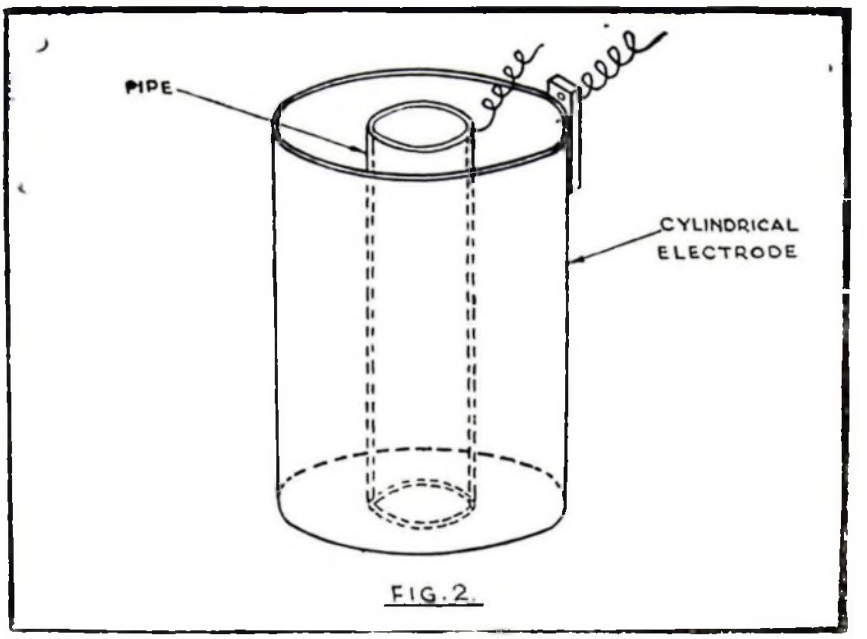
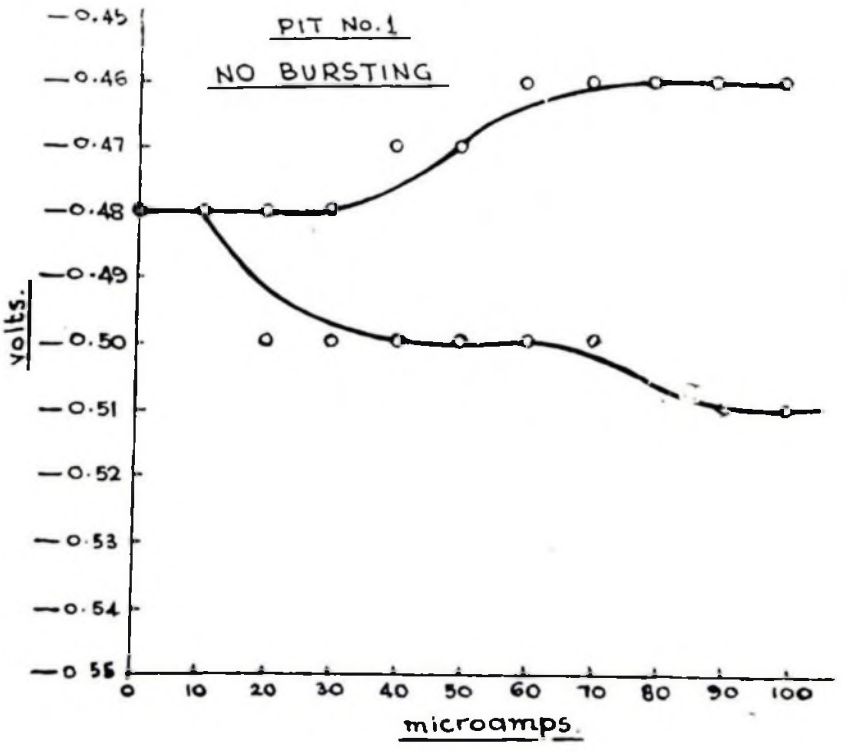

PIPE
CYLINDRICAL
ELECTRODE

FIG. 2.


PIT No. 1
NO BURSTING
volts.
-0.45
-0.46
-0.47
-0.48
-0.49
-0.50
-0.51
-0.52
-0.53
-0.54
-0.55
0
10
20
30
40
50
60
70
80
90
100
microamps.

the pipe line alega of $\frac{1}{2}$" thickness was found. However, no tuberculation of pipe line was observed.

Discussion and conclusion:

The resistivity of soil was varying from 21 to 450 ohm-cm. The soil can be classified under extremely low resistivity soil, which suggests that the soil is quite corrosive. Further the polarisation studies give an indication that the soil is extremely corrosive since the pipe could not be polarised easily either anodically or cathodically. The polarisation was very small and required 100 current to polarise by 10 mV where the bursting takes place (pit No. 5) and 30 mV at the place where the bursting is not taking place (Pit No. 1).

From the above discussion, it can be concluded that the soil is quite corrosive. Secondly when one wants to adopt a cathodic protection by mere impressing the current the installation may not be economical.

Recommendation for protecting pipeline:

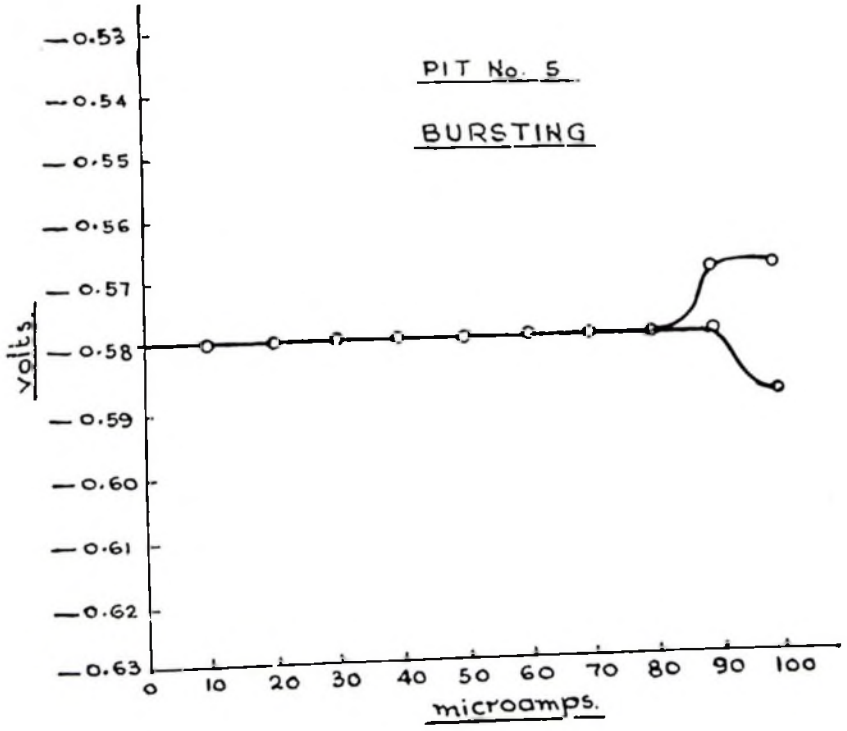
For the protection of the pipeline anyone of the following methods can be adopted:

(i) the pipeline can be diverted through some other route where the corrosivity of the soil is less;

(ii) the pipeline can be elevated above the ground; and

(iii) the pipeline can be given a bituminous coating reinforced with aspects flat. Additional protection can be given by installing magnesium electrodes at hot spots.

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APPENDIX

(Comments from P.W.D., Soil Mechanics and Research Division, Madras).

It is not quite correct to say that whenever water was drained by turning the scour value bursting was found to occur. It was stated that after rains, during the summer months bursting occurred frequently which may probably be due to weak portions of the pipe affected by corrosion getting punctured.

The presence of water in the pits when dug was not due to water logging because of difference in elevation of the place. Actually the entire stretch was excavated for laying new 15" pipeline and even the pipes were lying near the trenches. Due to rains rain water collected in these trenches and this seeped through the pits when excavated.

Also paddy fields are situated only to a part of the pipeline path between the river and the canal. Hence it cannot be said that the entire pipeline stretch is wet because of oozing water. However it can be wet during several months because of the low permeability of the clay soil surrounding the pipeline. Hence the influence of other factor should also be taken into consideration.