RESISTANCE OF BITUMINOUS FIBER PIPE TO PENETRATION BY RATS

Harold W. Wolf, M.S.

BITUMINOUS fiber pipe has many characteristics that eminently suit it for the transport of sewage. Among these characteristics are its lighter weight than the conventional sewer materials, resilience, and resistance to the severe conditions of lengthy underground service as well as to the thermal shock of freezing and thawing. Because of its lighter weight, it is manufactured in longer lengths, which results in fewer pieces, less handling, and fewer joints on each job. Joints of bituminous fiber pipe are so constructed that they can easily be made watertight, thereby eliminating the problems caused by plant roots. Manufacturers of this pipe do not recommend it for continuous high-temperature, industrial use, or subjection to continuous pressures in excess of 5 pounds per square inch (*1*).

Although bituminous fiber pipe is relatively inexpensive, some municipalities still have ordinances precluding its use for the transport of sewage. However, one of the reasons for this preclusion has been that the resistance of this pipe to penetration by rats has been unknown.

Studies on the resistance of various construction materials to penetration by rats, published in 1953 (*2*), did not include bituminous fiber. Also, studies published in 1955 on plastic pipe for potable water supplies, including its resistance to attack by rats, omitted bituminous fiber (*3*).

Since it is known that rats can penetrate deteriorated concrete and thin sheet metal with relative ease, inspection of bituminous fiber pipe could readily lead one to believe that rats could penetrate it with even greater ease. However, unless it were subjected to such a test, its resistance in this respect would remain largely conjecture. Then there was the gnawing question asked me by my associates, "Do you suppose rats will find this distasteful?" The obvious thing to do was to expose it to rats and find out.

Mr. Wolf, a sanitary engineer with the Technical Development Laboratories, Communicable Disease Center, Public Health Service, is currently assigned to the W. M. Keck Engineering Laboratory, California Institute of Technology, Pasadena.

Method

A test bait box was constructed of a 6-inch length of pipe, 6 inches in diameter (fig. 1). It was covered on each end with a cap of sheet metal lapped one-half inch. A ¼-inch-diameter hole was drilled through the ½-inch-thick pipe wall into the interior, 1 inch above the

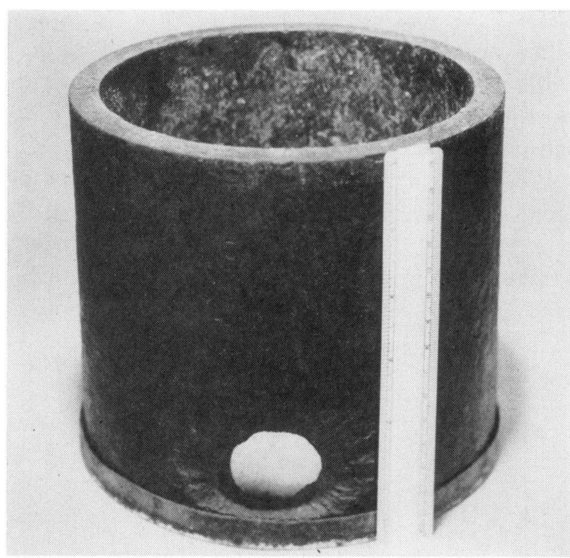

Figure 1. Original ¼-inch-diameter hole in bituminous fiber pipe enlarged by rats in 86 nights.

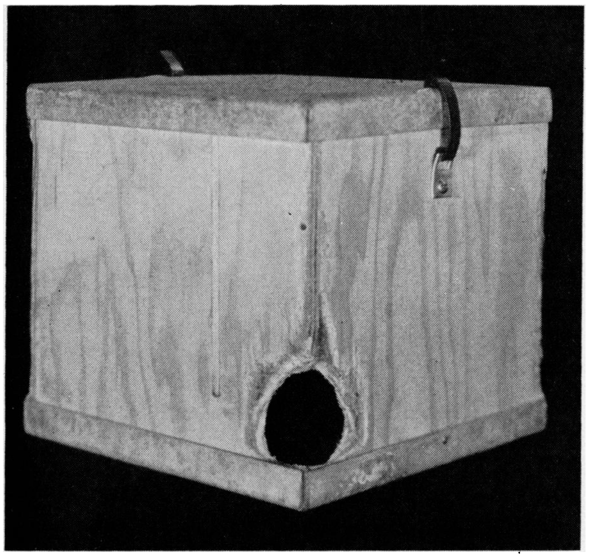

Figure 2. Control bait box of ¼-inch plywood penetrated by rats in 2 nights.

bottom, to (*a*) better enable the animals to smell the food within, (*b*) serve as a biting edge, and (*c*) help insure that the rats would concentrate their attack at one point rather than distribute it at several points.

The importance of providing a biting edge had been established in the studies published in 1953 (*2*). The authors stated: "It became evident that a gnawing edge, or point of attack, should be provided in order to give the rats additional opportunity to penetrate the panels, if they were unable to do so without it. Furthermore, such edges are more representative of actual structural features, such as construction joints or accidental fractures which occur when the materials are used."

The test box was exposed in a cage of freshly hand-caught wild roof rats (*Rattus rattus*) from infested farm outbuildings of southeast Georgia. These animals were found to be superior gnawers to laboratory-reared white rats, wild Norway rats, laboratory-reared roof rats, and also to wild roof rats that have been in captivity for 2 or 3 months (*2*).

Since it had previously been established that 10 grams of lab chow per animal per day would keep them hungry but still maintain their health (*2*), this amount was fed the animals. Prior to the departure of laboratory personnel at the end of a workday, the number of rats in the cage was multiplied by 10 and the resultant number of grams of lab chow was placed in the bait box. The box was then capped and inserted in the cage. Water in abundance was provided the animals at all times. The following morning the bait box was removed and inspected for damage and then replaced in the cage without a lid, and the rats were allowed to feed during the day. Prior to weekends or holidays, normal (16 grams per rat per day) or more than normal rations of lab chow were placed in the uncovered bait box and the rats were allowed to feed freely. On the following Monday afternoon (or the first workday following a holiday) the restricted ration would be placed in the bait box and it would be capped and exposed that night. Only the number of nights of capped exposure were counted.

Results and Discussion

The number of rats in the cage to which the test box was exposed varied from 5 to 33, the mean being 18.6. At the end of 86 nights of exposure, the box was penetrated. The animals apparently could not get a good bite on the ¼-inch drilled hole, because until the 83d night, they continually gnawed around this hole creating a cone of depression which became successively deeper with time. However, once the cone had been gnawed to a depth equal to the thickness of the wall of the bait box, the animals could then take a substantial bite and penetration was swift (fig. 1). A similar box without a hole was exposed, but after several weeks only slight scratching was visible.

During the course of the observations, a control bait box constructed of ¼-inch plywood, measuring 5 inches cubed, capped with metal on the top and bottom and drilled with a ¼-inch hole through a corner into the interior, was substituted for the test bait box. At this time there were seven rats in the cage. The animals penetrated this box in 2 nights (fig. 2).

In a separate series of unpublished experiments, I exposed test materials to attack by rats in two different, controlled ways. One method was as described above, by means of a bait box appropriately capped and drilled, and the other was with a panel, in which the test material separated rats from their food and water supply (*2,3*). These experiments demonstrated that the bait-box method was a much more severe test of the material. Far greater damage was inflicted on the bait boxes than on the panels in a considerably shorter period of time.

Conclusions

Extreme care must be used in interpreting laboratory results for subsequent field application. This is particularly true of biological studies when laboratory conditions can never be exactly equated to field conditions. Nevertheless, in this particular study, it was clearly demonstrated that bituminous fiber is neither distasteful nor harmful to rats.

It may also be safely concluded that this pipe should not be used in areas where actual rodent problems exist, since this could quite conceivably compound ratproofing problems. However, this does not rule out its use in many other areas of application.

The results of the studies indicate that inspection of newly installed bituminous fiber pipe is essential.

REFERENCES

(1) Orangeburg root-proof or perforated pipe and fittings. Catalogue No. 307. Orangeburg Manufacturing Co., Inc.

(2) Tarzwell, C. M., et al.: The resistance of construction material to penetration by rats. PHS Publication No. 277 (Public Health Monograph No. 11). U.S. Government Printing Office, Washington, D.C., 1953.

(3) Tiedeman, W. O., and Milone, N. A.: A study of plastic pipe for potable water supplies. National Sanitation Foundation, School of Public Health, University of Michigan, Ann Arbor, 1955.

Elderly Brides and Grooms

One or both marriage partners are aged 65 years or older in an estimated 35,000, or 2.4 percent, of the marriages in this country each year, according to a study reported in the July issue of *Aging*, published by the Department of Health, Education, and Welfare. The study is based on data collected from 29 States by the National Vital Statistics Division, Public Health Service.

The study showed that the older the marriage partner, the more likely he or she is to choose a much younger mate. Among grooms aged 75 years or older, 12 percent chose brides at least 25 years younger than themselves, while only 9.5 percent of the 65- to 70-year-old grooms did so. The pattern is less pronounced among elderly brides. Among brides aged 75 years or older, almost 18 percent married men 10 or more years younger than themselves, while only 7 percent of the brides 65 to 70 years old did so.

The 65 to 70 age group accounts for the majority of all late-in-life marriages; 64 percent of all brides and 54 percent of all grooms in the study were under 70 years old.

The marriage rate for women in the 65 and over age group (1.6 per 1,000) is one-third the rate for men in that age group (4.8).

It was the first marriage for 7 percent of the brides and grooms aged 65 and over. About 78 percent of the brides were widows and 73 percent of the grooms were widowers; 13 percent of the brides and 18 percent of the grooms were divorcees. Approximately two-thirds of both brides and grooms had been married only once before; 20 percent had been married twice, and about 5 percent had had three or more previous marriages.