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Introduction

In 1961 at the request of the Traffic and Service and Supply Departments, a general investigation of hose used for traffic counters was initiated by the Materials and Research Department (W.O. 61-19U51H14). The objective of the project was to develop a test method and purchasing specifications for traffic counter hose. It was believed that the conventional physical tests, or an accelerated direct test (simulated field service), would yield information for use in the development of a criterion for the selection of suitable hose.

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Traffic Count

State of California
Department of Public Works
Division of Highways
Materials and Research Department

April 1963

Proj. W. O. R-60229

Mr. George Hill
Traffic Engineer
Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is:

A PROGRESS REPORT
ON
STUDY OF TRAFFIC COUNTER HOSE

Study made by Structural Materials Section
Under general direction of E. F. Nordlin
Work supervised by R. N. Field
Report prepared by K. R. Leutner and R. E. Smith

Very truly yours,

F. N. Hveem
Materials and Research Engineer

EFN/RNF :mw
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A PROGRESS REPORT ON STUDY OF TRAFFIC COUNTER HOSE

INTRODUCTION:

In 1961 at the request of the Traffic and Service and Supply Departments, a general investigation of hose used for traffic counters was initiated by the Materials and Research Department (W.O. 61-19U51H14). The objective of the project was to develop a test method and purchasing specifications for traffic counter hose. It was believed that the conventional physical tests, or an accelerated direct test (simulated field service), would yield information for use in the development of a criterion for the selection of suitable hose.

TEST PROCEDURES:

- A. The first investigations included the conventional burst test, elongation, and others performed on hoses in general. Hose specimens were also tested for ozone susceptibility. No correlation with field service life was found from the results of these tests.
- B. An experimental rotary testing machine was designed and constructed by this department. This device incorporates a rotating plate to which short lengths of hose are fixed. The rotating plate is motor driven by a rubber tire acting perpendicular to the plate. The tire runs over the hoses as the plate turns. To date we have found no direct correlation between results from the rotary hose testing machine and the field service of traffic hose and no further tests on this machine are planned at this time.
- C. The most recent investigation has included testing for modulus of elasticity at 100% elongation, percent of permanent set after testing to failure in tension and ultimate tensile strength. No direct correlation with service life has been determined by these tests, except that hose specimens with extreme results in the forementioned tests do not perform well in the field. In other words, for a given load or elongation, those hoses that stretch too much or too little in the test do not perform well in the field.

DISCUSSION:

- A. This laboratory is not the only agency having trouble judging the suitability of traffic hose by means of laboratory tests. We are informed by the Bureau of Public Roads that other states, as well as the National Bureau of Standards, have not been able to develop a positive test method for the selection of traffic hose.
- B. Rubber hose is a natural or synthetic organic compound and is affected by all of the following: sunlight, oily fumes,

bitumen solvents, ozone, temperature, moisture, road surface, the type and the weight and frequency of traffic. The performance of traffic hose is dependent upon its ability to maintain a tube-like shape capable of transmitting an air impulse under service conditions (with some small perforations permitted), and remain stretched across the road. Performance under the above conditions is not directly related to tensile strength or other physical tests normally performed.

- C. The limitation of a direct accelerated test method is illustrated by the rotary hose testing device. This device gives favorable results to unsatisfactory hose of hard, high-strength rubber having a hole of small diameter. These tubes perform poorly in the field because the interior diameter is too small to count properly, and the hole clogs quickly with rubber particles when the inside of the tube begins to break down. The stiff, thick walled tubes also tear more quickly under traffic and have a more prominent interior crack growth than the hoses with larger holes. Furthermore, this device does not test the effect of environmental conditions such as sunlight, temperature, and length of exposure. These factors certainly compound the destructive mechanical effect of traffic on the hose.
- D. The following qualitative observations are the result of direct examination of hoses brought in after failure from the field test site.
 - 1. The best hoses (satisfactory counting and long life) have an interior diameter of approximately .25" (.23" to .27"). (All hoses offered by industry for this service have an outside diameter of approximately .55" (.54" to .57").
 - 2. The poorest hoses (failure to count, short life) have interior holes of a diameter less than .20" (.18" to .20").
 - 3. The very hard and the very soft hoses do not perform as well as the medium grades.

RECOMMENDATIONS:

- A. The purchase of a medium grade, good quality hose of the recommended geometry will eliminate much of the very unsatisfactory tubing presently offered for service as traffic hose. Interim specifications should specify that such hose shall be resilient (modulus at 100% elongation, 150 to 350 psi), resistant to cut-growth, not soften or become sticky at temperatures to 175° F., be of uniform physical characteristics, and otherwise be of good quality and workmanship. The outside diameter of round traffic hose should be a nominal .55" (.53" to .57") and the interior diameter approximately .24" (.22" to .26") with a minimum wall thickness of not less than .14" nor more than .17", all measurements to the

nearest .01". The tubes with the half-oval or half-moon exterior profile shall be acceptable if the interior hole diameter and wall thickness on top and bottom meet the requirements above and otherwise comply with these recommendations.

- B. We recommend that the present field test site on Highway 40 eastbound just west of the Watt Avenue Interchange be maintained for the purpose of continuing critical observation and record of traffic hose tested there. With additional field test data from this site it should be possible to recommend a standard test procedure for limits of hardness and softness of rubber and for the limits of modulus of elasticity.
- C. The above test site (22,000 to 29,000 ADT in one direction) is limited in that it may require several months to test a hose to failure. As presently set up, it is unsuitable for other than a restricted experimental program of hose testing. The above site would be inadequate if it should be necessary to initiate an extensive program of controlled field testing, or if it is necessary to include a standard performance test in future purchase specifications for traffic hose. Serious consideration should then be given to the establishment of a permanent traffic hose test location at a point (or points) of very high representative ADT on asphalt and PCC surfaces. This facility might be included in plans for new construction, with study given to the ease and safety in the inspection and changing of the hose.
- D. A formal (if limited) program should be included in the present study for the observation and record of hoses in service at different locations in the state. A minimum of effort expended in careful observation and recording of the actual field performance of hose under service conditions should yield valuable supplemental data at a minimum expense.