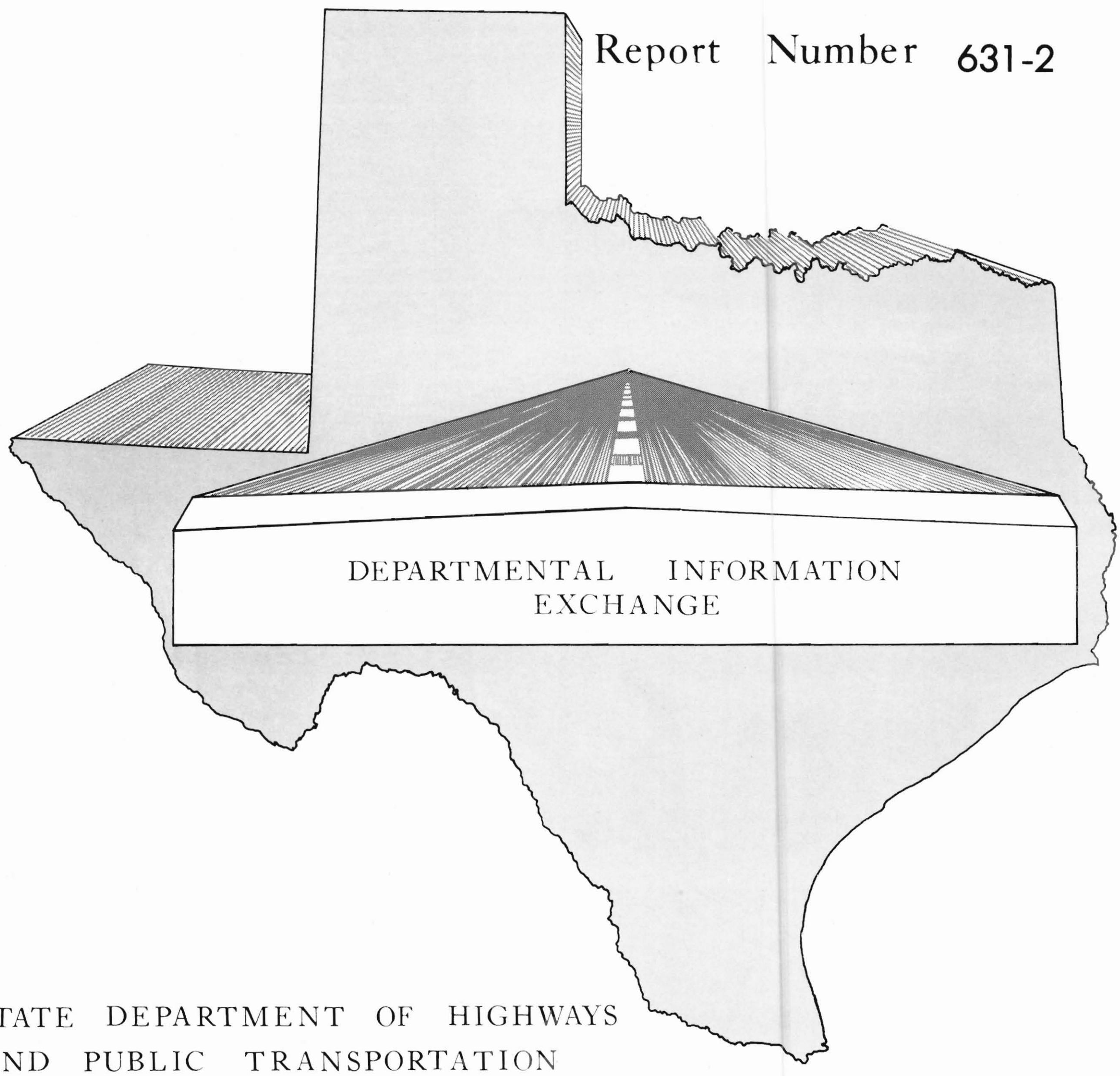
EXPERIMENTAL PROJECTS

IN-HOUSE

EXPERIENCES WITH LATEX IN HMAC

Report Number 631-2



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This report was originally given as a speech by David A. Bass to the Texas Hot Mix Paving Association at their meeting in El Paso, Sept. 23, 1985.

16. Abstract

This report outlines Fort Worth District's recent experience with latex-modified asphalt on a preventative maintenance project on State Highway 121 northeast of IH 80. This project was the first of several let in the summer of 1985 for latex-modified asphalt.

Latex-modified asphalt was chosen for its characteristic effect of flattening the temperature susceptibility curve. A fabric underseal, "Trevira," was used to help prevent water intrusion.

Problems were experienced in developing an asphalt/latex blend that was homogeneous and met Departmental specifications. Several asphalts were found to produce an acceptable blend. Of them Kerr-McGee AC-10 was used. It was introduced into the drum dryer just below the asphalt nozzle.

No problems were experienced in placing (done at 315°F) or compacting the latex-modified HMAC; in fact, the latex mix seemed to be more forgiving of variances in asphalt content.

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EXPERIENCES WITH LATEX IN HMAC

The use of rubber in asphalt is certainly not a new concept. Volume 11 of the "Proceedings of the Association of Asphalt Paving Technologists," dated January 1940, addresses this subject. In this issue, George W. Eckert lists some eight articles, from periodical literature, dealing with admixtures of rubber to bituminous materials.

The Fort Worth District used a latex-modified asphalt in a thin lift (1/2-inch) overlay in the early 1970's. We have also required the addition of latex to the asphalt used in much of our recent seal-coating work.

In 1984, the Dallas District contracted for a latex hot mix overlay to be placed on IH 30 near downtown Dallas. They added 3 percent latex solids to the asphalt at the pugmill. So far the job is considered a success.

Based on this success and on current literature, District 2 decided to let several contracts for latex-modified hot mix in the Fort Worth area.

The first of these projects was a preventative maintenance project on SH 121, known as "Airport Freeway," from downtown Fort Worth, northeast, to IH 820 (Fig 1, pg 5). The existing facility was approximately seven miles of six- and eight-lane continuously reinforced concrete pavement. The pavement was still in good shape; however, predicted traffic would change this before long.

A fabric underseal was considered to help prevent the intrusion of water from the surface to the underlying soil structure. The fabric would be placed across the entire roadway, from outside of shoulder to outside of shoulder.

Darren Hazlett, with the Materials and Tests Division (D-9), had done some recent work on the effects of adding latex to several asphalt cements. He used asphalt from two refineries, AC-5 and AC-10, and two brands of latex. From this study, and the work of others, it was concluded that the addition of latex would offer the advantage of flattening the temperature susceptibility curve. Results of this flatter curve can be simply described as:

1. The asphalt has a greater viscosity (is thicker) at higher temperatures. This would help reduce hot-weather rutting and bleeding.

2. The asphalt is more pliable or ductile at lower temperatures. This would help reduce cold-weather cracking.

With these characteristics, latex-modified asphalt would allow us to use an AC-10 in our mixes, rather than the very hard AC-20 we were having to use.

The latex can be added at the refinery, at the pugmill or at the drum dryer. Each method has advantages and disadvantages. Some feel that the mixing is more complete at the refinery; however, the heated storage life of this blend is somewhat limited. The latter also helps us ensure against that accidental load from the wrong tank. We elected to specify that the latex would be added at the hot mix mixing plant, in the drum or pugmill.

The cost of the latex was approximately:

$6.00 per gallon of latex emulsion;

$4.60 per ton of lightweight hot mix;

$6.40 per cubic yard of hot mix;

$0.18 per square yard per inch of overlay depth.

At $63.40/cubic yard of hot mix, the latex increased the cost about 10 percent.

This 10 percent increase in cost is quite small if you consider that a 5-year overlay would only have to last 6 additional months to pay for the increased cost. These figures represent the cost of the latex only and do not address the cost of the required higher mixing temperature.

A contract was let, in the spring of 1985, to Austin Road Co. for a fabric underseal and a two-inch latex hot mix overlay. The contractor chose to use the fabric "Trevira," supplied by ARMCO, for the underseal. TXI furnished the lightweight aggregate from the Streetman plant. The latex was manufactured by Dow Chemical Co. and distributed by Tex-Crete Inc. of Zion, Illinois. The anti-strip agent used was Pavebond-LP. The addition of latex seemed to have no effect on the stripping characteristics of the aggregate. It neither helped nor hurt.

ASPHALT PROBLEMS

The asphalt? Well, that's where the problems began. We discovered that not all asphalt will blend to meet State Department of Highways and Public Transportation specifications. Special Provision (SP) to Item 300, 300---021, was used for this project. This SP required that a minimum of three percent latex solids be added to the AC-10 used in the hot mix. It also required that the asphalt/latex blend have a viscosity of no more than 3,200 stokes and a ductility value of not less than 100 cm at 39.2 degrees Fahrenheit.

Don O'Connor, D-9 Austin, tested the proposed asphalt/latex blend. He found it produced an unacceptable mixture. The ductility met the specification; however, the viscosity was in the vicinity of 4,300 stokes and produced a non-homogeneous blend. The latex did not dissolve well in the asphalt. Overnight hot storage in the laboratory was disastrous. A large rubber ball formed in the bottom of the sample.

Other asphalt sources were blended with the latex and tested. Several asphalts were found to produce an acceptable blend. Kerr-McGee AC-10, distributed by Southern Asphalt and Petroleum Co., was selected by the contractor for the project.

Future specifications for the asphalt/latex blend will probably address several new areas:

1. Rather than a ductility requirement, a "force" ductility will probably be required.

2. A mixing or compatibility requirement will probably be addressed.

3. The maximum viscosity may be reconsidered.

BLENDING CENTER

Tex-Crete furnished not only the latex, but the personnel and equipment to add the proper amount of latex to the mix (Fig 2-3, pg 5).

One of the things that make this a somewhat more interesting project is that this is probably the first time latex has been introduced into a drum mixer in the Southwest. And it has been done very few times elsewhere.

Tex-Crete sent two technicians, Betty and Larry Scheck, to the plant. They set up their control center which consisted of pressure gauges, pump, flow meter, and contact with the master plant control panel (Fig 4, pg 5 and Fig 5-8, pg 6). They installed a1-1/2-inch guide tube, just below the hot asphalt line in the drum. The guide tube would serve to hold the 3/4-inch latex nozzle assembly in place during the mixing process (Fig 9, pg 7). The guide tube was positioned to introduce the latex approximately six feet downstream of the asphalt discharge and seven feet upstream of the drum's discharge (Fig 10, pg 7). These distances were calculated to introduce the latex at a point at which the aggregate was 90 percent coated with asphalt.

This system required constant attention of a knowledgeable technician for the following reasons:

1. The operation was not automatic. Changes in the rate of flow of latex had to be changed as the plant production changed.

2. The latex is supplied as an emulsion. The heat from the dryer will evaporate some of the water from the nozzle assembly causing it to clog. Pressure must be changed constantly to compensate for this condition.

3. Because of this clogging, each time the plant shuts down, the nozzle assembly is removed. A spare nozzle is inserted, and the original nozzle assembly cleaned. (Fig 11-12, pg 7).

TEMPERATURE

Temperature is another important factor when considering latex hot mix. The mixing and compacting temperatures are going to be considerably higher than normal.

Dr. Jon Epps, formerly of the Texas Transportation Institute, has established guidelines for the proper viscosity to be used in shooting, mixing and compacting asphalt mixes. He has recommended a temperature be used which would produce a viscosity of approximately 0.7 poises for shooting, 1.7 for mixing hot mix, and 2.8 for compacting. Using these recommendations as a guide, Don O'Connor furnished the field with recommended mixing temperatures.

The Austin Road project was rather successful using a temperature of 340 degrees Fahrenheit at the discharge from the drum mixer. Most of the mix was delivered to the road at about 315 degrees Fahrenheit.

PLACING

There were no particular problems placing the latex hot mix. It went down much like a regular hot mix. If anything the latex mix was more forgiving to variances in asphalt content.

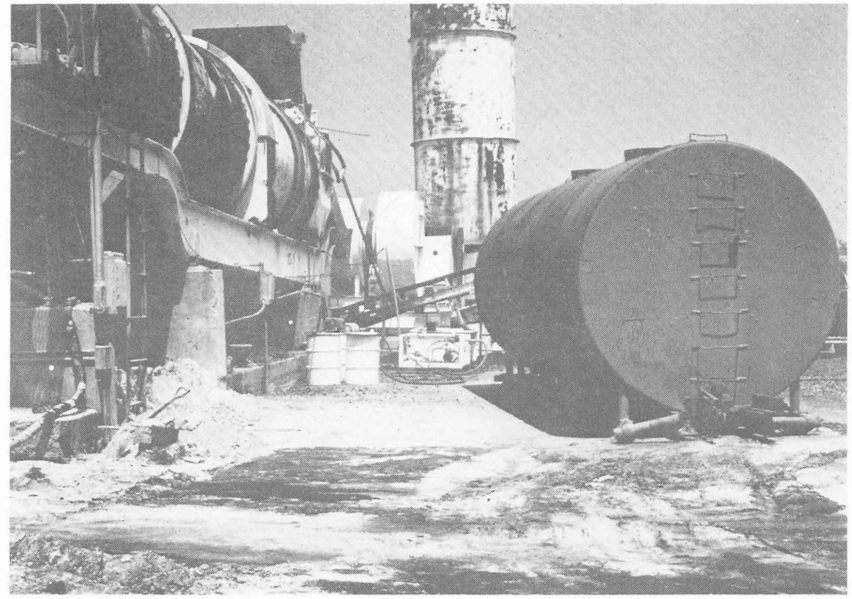
COMPACTION

This project probably had less problems with compaction than any other put down in the summer of 1985. It is evident that Ray Buzalsky, the Resident Engineer, and Bill Bertram, the contractor, used their influence to provide the necessary temperature, rollers and supervision to obtain these results. Other projects in our area have used heavier asphalts, and not maintained temperatures quite as high (or viscosities quite as low). Their success has not been as good as that attained by Austin Road on this project.

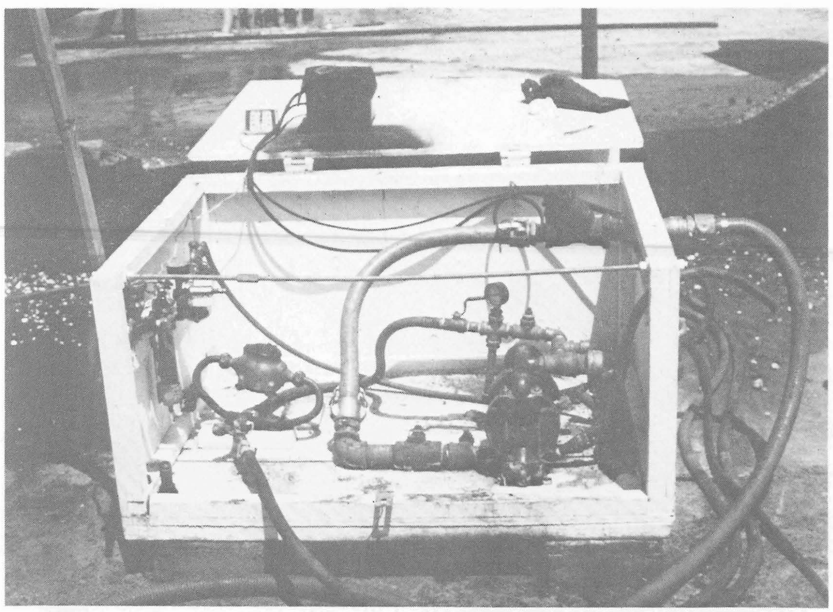
CONCLUSION

In conclusion, I feel that discovering the use of latex in hot mix is like rediscovering the wheel. For years, those in the industry have spoken of its advantages. The few problems that were uncovered by this project can be easily overcome. I think it is time for us to spend that extra dollar and provide the taxpayer with this better product.

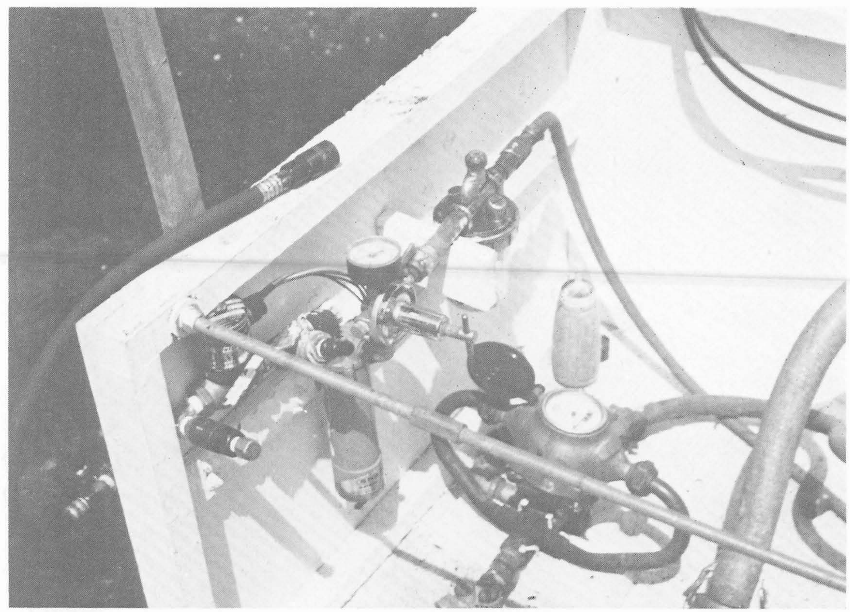
1. SH 121 east of Fort Worth



2. Latex blending center

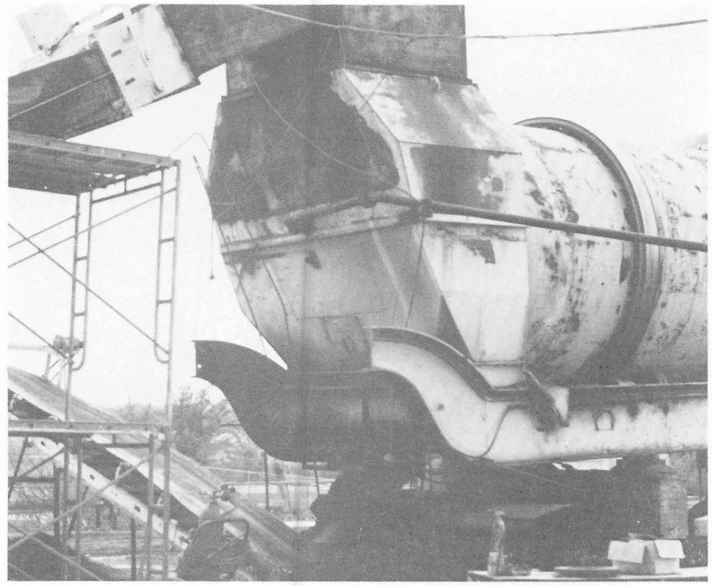


3. Drum mix plant, latex blending center

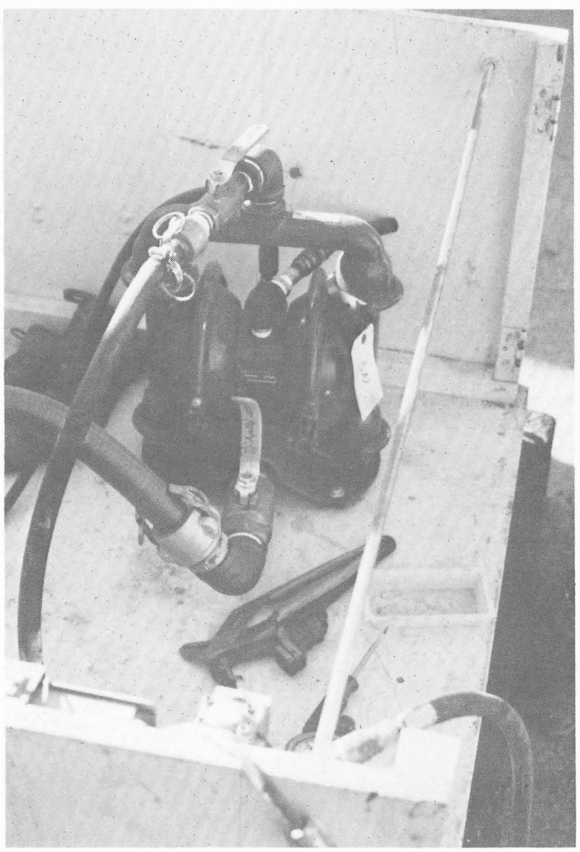


4. Pneumatic controls

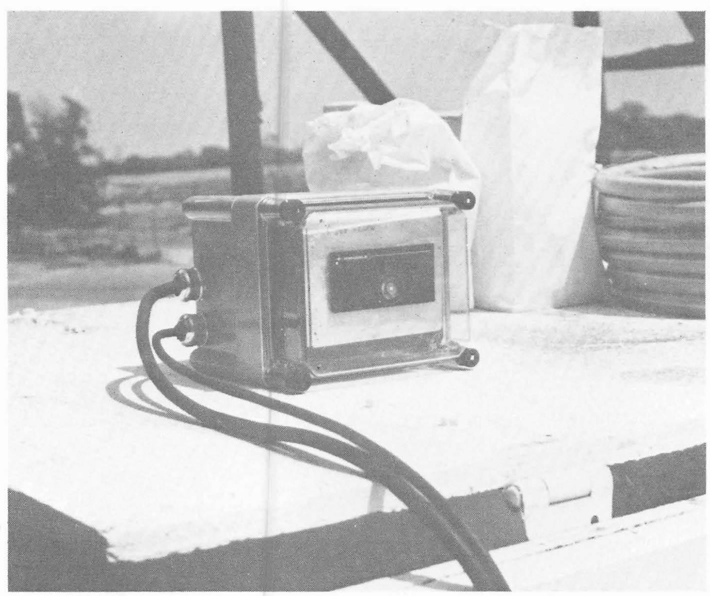
5. Flow meter



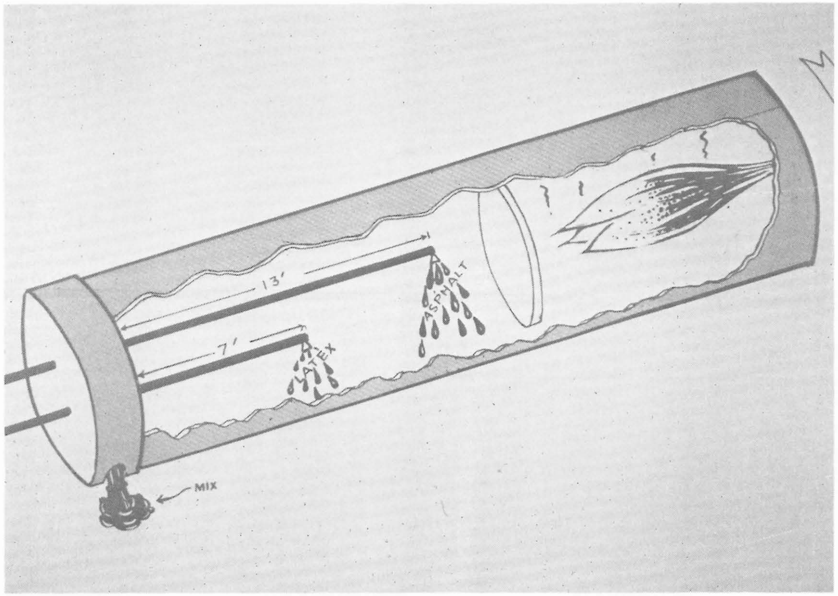
6. Rear of drum showing asphalt line and latex nozzle assembly guide tube



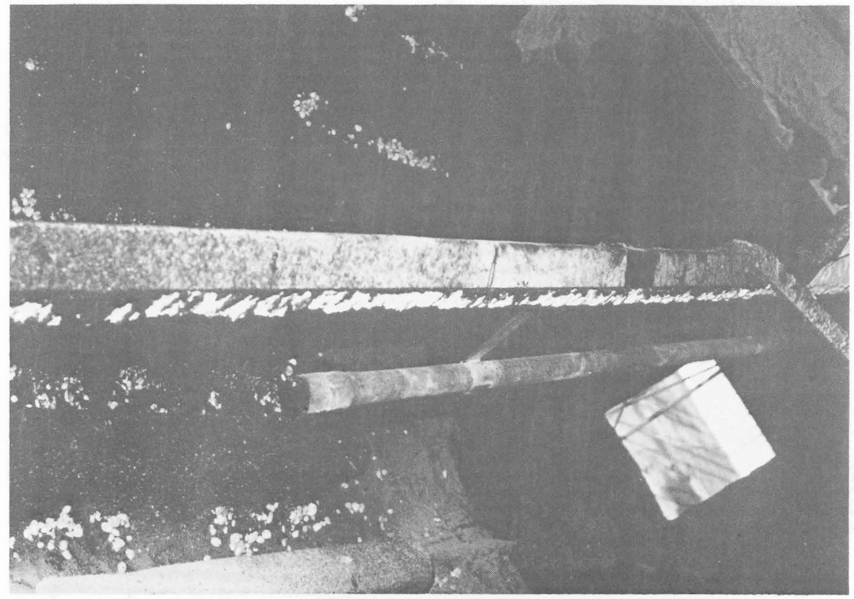
7. Pump

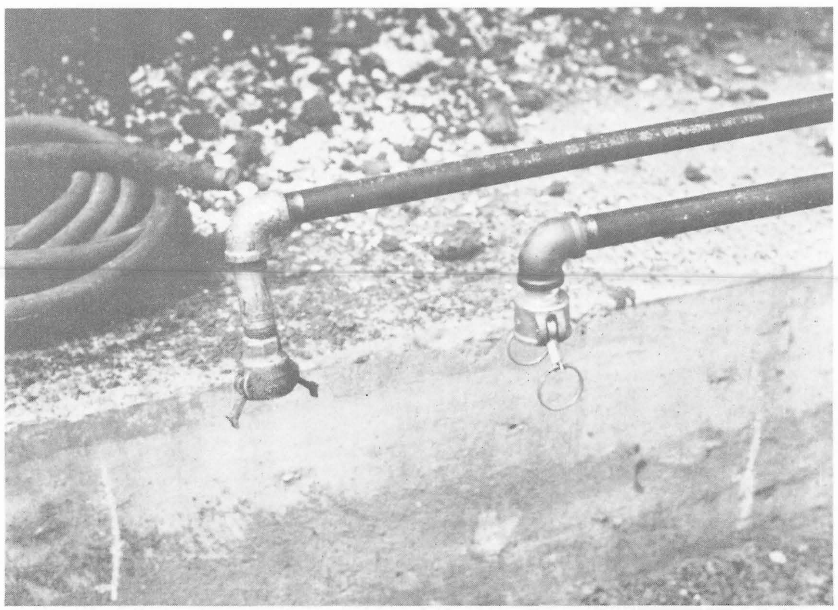


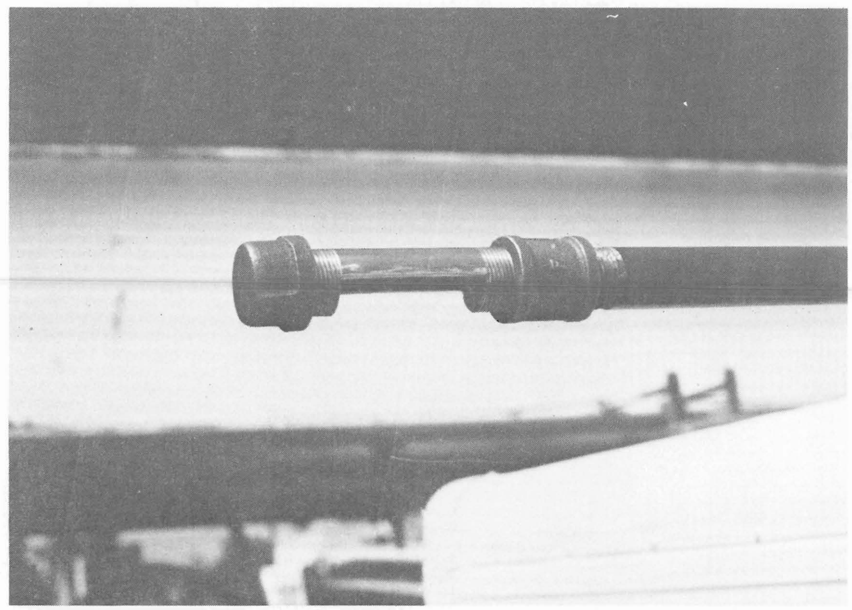
8. Communication with plant control



9. Location of asphalt and latex nozzles


10. Inside of drum looking at latex nozzle assembly guide tube


11. Disconnected end of latex nozzle


12. Nozzle end of latex nozzle assembly