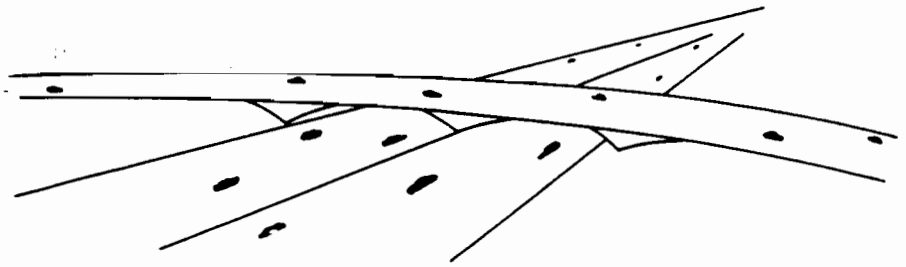
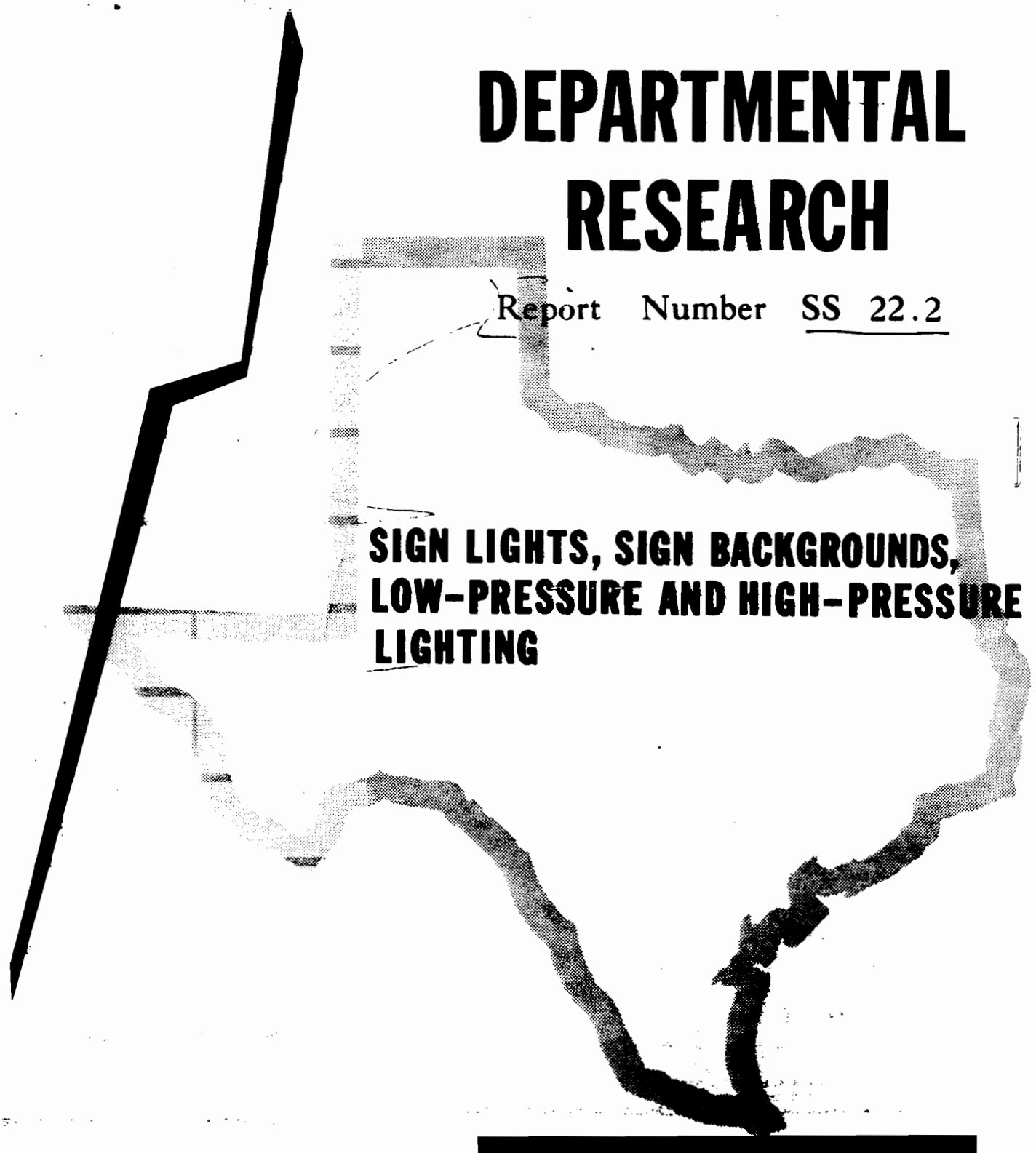


DEPARTMENTAL RESEARCH

Report Number SS 22.2



SIGN LIGHTS, SIGN BACKGROUNDS, LOW-PRESSURE AND HIGH-PRESSURE LIGHTING

STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

Sign Lights, Sign Backgrounds, Low-Pressure and High-Pressure Lighting

By

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A Report Given at the
1980 Traffic Engineering Conference

The first part of this talk will cover Project 1-18-75-222, "Evaluation of Overhead Sign Background Materials and Mercury Vapor Sign Lighting Fixtures". This is the sixth year of a five year project. We have just submitted the renewal for the seventh year. Actually it is an ongoing project now and will be evaluated each year.

First of all we went into the sign lighting and tested twelve different manufacturers' sign lights. We reworked several of them and were able to reduce the wattage from 250 watt to 100 watt. The mercury light has much better aspects as far as maintenance is concerned. You are operating just one lamp instead of two. The lamp life is 24,000 hours versus about 6000 or 7000 hours. So maintenance goes way down. We found recently that some districts were still putting in new fluorescent lights. This was brought to the attention of the Austin Office and now fluorescents are not allowed. Sign lighting is preety well stabilized now. The standard is the 100 watt clear mercury.

Okay, we will discuss sign background materials. The Department has been experimenting for sixteen years with various different sign background materials. The work has been done in the Urban Office and District 12 as well as some of the other districts. Two different films were previously developed; one was polyvinyl fluoride and one was acrylic film. The two films were basically placed on plywood but could be put on other substrates. Due to lack of usage, the manufactuers discontinued the manufacture of the films and for all practical purposes they became unavailable. They can still be

obtained if a sign fabricator places an order for at least a 10,000 foot roll. He can get the material and put it on the substrate that you specify. The PVF film and the acrylic film are still looking good. Thermosetting and thermplastic polyester proved to be very good materials. The materials have been tested in the weatherometer for 12,000 to 14,000 hours. The polyesters showed slight degradation at 6,000. PVF_2, polyvinylidine fluoride, showed no degradation at 10,000 hours. All of the materials are still in the test. We have them on a test rack above D-10. We have them on a test rack in Nueces Bay in District 16. The polyesters and the PVF_2 now are the standard background materials. Porcelain has been ruled out because it started degradation at 2,000 hours in the machine or 2 years in the field. We have made full scale panels of these various materials and put them up on the freeways in Houston. The tests in the field on the freeway have correlated with the lab tests and our exposure rack tests.

We then went into a part of the project trying to refurbish old deteriorated porcelainized backgrounds. District 12 maintenance forces erected 17 panels in the Houston area most of which are refurbished panels. Colored and clear polyurethanes were tried. Polyesters and various other different coating materials were tried. I must report at this time that we are not satisfied with the results of the refurbishing aspects of this project.

There is another phase of the project in which we are looking at reflective sheeting overhead with the possible elimination of sign lighting. This would save construction costs on new projects.

It would save immense amounts of maintenance monies if lighting could be eliminated on existing installations. This would also eliminate a lot of the hazards to maintenance people plus the traveling public. A search was made of all of the research projects throughout the nation through HRIS to see what had been done. We found that several states and the Feds have worked on this. If there is eleven to twelve hundred feet clear sight distance prior to the sign installation with no horizontal curve, no vertical curve, and no sight obstruction such as a pedestrian structure or roadway structure, reflective sheeting can be used. This distance gives the light time to go from the headlights to the sign, come back to the driver, he reads it, understands it, and makes his manuever. We are trying both engineer grade and high intensity reflective backgrounds. There is some discussion on this amongst the team members but the general feeling is that with ambient lighting in urban areas such as commercial lighting, continuous freeway lighting, the HI is better. In a rural area with no ambient lighting from commercial establishments, etc., engineer grade would be sufficient. We have some engineer grade and HI signs up in Houston as well as in District 16 and some of the other districts. The Urban Office is working on a massive combination District 12 and Houston Urban project on I-45 that goes from the Walker Co. line down to 61st in Galveston. The project is 93 miles long. Reflective sheeting will be used on a great portion of this project. District 18 is constructing a project on I-20 on which in one direction HI will be used and the opposite direction engineer grade will be used. This project will be evaluated under 222.

Forms were devised to gain statistical backup data. I have made surveys in Houston, El Paso and Corpus Christi. I will make the same survey in San Antonio. In the surveys we ran the freeway systems and determined which structures are so located that sign lighting could be eliminated if the signs were replaced with reflective sheeting. We have a roller coaster, Disneyland type of configuration in Houston so we found that only 33% of our signs in Houston could be replaced and the sign lights taken off. We found out that if we took the removed mercury sign lights and put them on the structures that had existing fluorescents, we would only have 6 fluorescent sign lights left in the district. In El Paso we haven't the full figures from Manny yet. But from a preliminary run, it looks like we can eliminate about 70% of the sign lights. In Corpus, it was 66% and from just making a cursory run through San Antonio during the Maintenance Conference, it looks like some 50% of the sign lights could be eliminated.

In addition to making this location study, we are going to make a legibility study using various age groups of people with varying backgrounds. We are also making cost studies of the monies that the Department is expending on maintenance for sign lights, how much is paid in energy costs and how much it would cost to take the sign lights off, and how much it would take to remove and replace the lights from one structure to the other. A second project report is scheduled to be published this year.

In October, 1979, a project report was issued on Low Pressure Sodium Lighting. We've been working on this project for 5 years. Now I don't like the color of the light and I don't like the monochromatic aspects of the light. Monochromatic means there is no color rendition from the light itself. On a freeway, ambient lighting from headlights, commercial lighting, etc. does produce color rendition. I don't like the physical size of the unit because a 180 watt unit is very large. If the existing structures, pole arms, and anchor bolts can withstand the additional wind loading, using the new improved low pressure sodium light that was developed on this project a 180 watt low pressure sodium light can replace a 400 watt high pressure sodium light or a 1000 watt mercury light, one for one, up to 300' spacing on a ten lane facility with median lighting or comparable side mount lighting. One must be careful with the support structure to make sure that it will work and accept the yellow color and lack of color rendition. The L.P.S. systems will save money. I have on the board right now a project in which we will be placing L.P.S. on the S.H. 288 main lanes. We have it in a couple of rest areas, the SH 225-SH 146 Interchange, and we also have it at the ferry landing in Galveston. The ferry pilots love it. The pilots could not find the landings with the mercury or any other lights they had down there. We put the L.P.S. up and in the fog they could find the landings. The benefits of the L.P.S. are not just energy savings. Visual acuity is better. The eye can discern objects better in the yellow spectrum than it can in the blue or orange spectrums. Lighting uniformity is better. It is not unusual to design two to one uniformity.

average to min. Glare is not there. So those are other aspects of it that are very definitely pluses. The City of Houston, especially with the problems we are having with H.P.S., has told us to go ahead and start putting L.P.S. in as understructure lights and then put them on main lanes. They are even entertaining the thought of section by section replacement of the mercury and H.P.S. with L.P.S.

You say, "Oh, I thought H.P.S. was the greatest thing since sliced bread." That's what we thought until we started putting them up. I know Manny has the border highway that is five years old. He has no problems, but he has the old style lamp. I don't know whether he has base up or base down. He does not have the universal burning lamp. The reason that I know that is the job is too old. Universal burning lamps came out after that job was put in. Half of Loop I-610 is dark. It is so bad that the City told the Power Company to turn the systems off. I made a survey the other night, three circuits out of thirty three were burning. Problems on S.H. 183 in Austin were encountered. The largest problem, especially with G.E., is the lamp. As long as the lamps were base up or base down, the amalgam reservoir was in the end of the lamp that was down. Now what is amalgam? Amalgam is the mixture of sodium and mercury. Amalgam produces the light. Okay, G.E. for years said you can't have a universal burning lamp and I'm beginning to believe them, at least in their case. When they started producing the universal burning lamp is when we started having problems. Most freeway lighting systems burn the lamp in a horizontal or slightly tilted up position. The laws of gravity say that the amalgam is not going to run uphill. Industry puts an excess of amalgam in the lamp

to increase the lumen per watt output, to make it more favorable against mercury or L.P.S. and theoretically increase the lamp life. It does not work that way. When the amalgam isn't in the reservoir, it is resting on the arc tube. When a truck goes by, the unit gets a shock from the gusting or possibly Mama Nature produces gusting. In the shock, the amalgam is shaken off of the arc tube and a lot of it falls on the electrodes. The electrodes heat the amalgam, it gasifies, it increases the pressure in the envelope. The increased pressure makes the lamp call for additional voltage to operate. Now the H.P.S. lamp must operate within a trapezoid; volts on one side, watts on the other. ANSI standards say it starts at 90 volts and at 160 volts the lamp will drop out. G.E. has chosen to shorten the trapezoid and start the lamp at 95 volts. As it starts up, at 140 volts, the lamp starts becoming unstable. G.E. historically produces a high voltage lamp. A lot of their lamps are running 130 volts to 135 volts. We checked them even to 145 volts. When the amalgam gasifies and the pressure increases, the lamp calls for more voltage and there is a 30 to 35 volt surge which pushes this lamp right out of the trapezoid and it goes out. You say, "So what if the light goes out?". This system has to have a starter board that on a 400 watt lamp produces a 2500 volt impulse once a cycle or 60 times a minute until the lamp starts again. The lamp is not burning, so that starter board's hitting that lamp. That's working the starter board and ballast. While the lamp is out, the system is still working. The starter board and ballast are working. The lamp cools down, the amalgam returns to its original state and the lamp comes

back on. It burns fine until it gets another vibrational shock. When it gets another vibrational shock you start all over again. The gasification of the amalgam wears away the electrodes. The lamp never goes back to the exact same voltage as before. It's always a little higher. This artifically ages the starter board, the ballast, and the lamp. This was brought to G.E.'s attention. The vibrational problems were brought to the attention of every lamp manufacturer. Every manufacturer knew they had the problem and have known they had the problem since the inception of H.P.S. but they didn't tell us and we feel like we have been sold down the river. We have found in conversations with other states that they too have been having this problem. Wisconsin, New York, Ohio, Mississippi, Hawaii and others have had the problem. Some of them have done several different things to minimize the problem. It is so prevalent that P & K and some of the other manufacturers have designed vibration dampeners for their poles. The dampener is a couple of wires with pendulum weights down in the bottom of the pole that decreases the vibration in the pole. They have also put supports in the ends of the lamps. One state now is working with Westinghouse, which happens to have the best lamp that we can find, where they are going to remote the ballast back up on the pole where we used to have it years ago. So, we are going to be looking into all of these possibilities. We've also found out that they have had to change some of the components in the starter boards. They have had to add some shunts in the ballast and a bunch of other stuff. We don't have the answer to the problem yet.

Now I am married to H.P.S. with this Z pattern high mast side mount. H.P.S. is the only source that will produce the Z pattern. The Feds have been peddling H.P.S. all the way across the nation for fuel conservation. We have talked to the FHWA district office in Austin, the regional office in Ft. Worth and to the Washington, D.C. Office. They are awaiting a report that we are now preparing. G.E. has designed a new reservoir that was supposed to have corrected their problem but it didn't. We are going to have to look to see what combination of the dampening features will lessen the problem.