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This report is the first in a series of reports expected to prepared on research being conducted to develop practical treatments for preventing imported fire ants from damaging traffic signal systems. This initial report describes the findings of a one-week field survey conducted in the states of Alabama, Florida, Georgia, Louisiana and Mississippi. Additional information from Texas was added to the survey. The survey found that fire ants are a concern to all agencies contacted, including four cities and five state departments of transportation. A wide variety of insecticides are being used. The report contains a list of these treatments, evaluates them in a preliminary sense, and recommends a future course of research to be pursued within this study to achieve contract objectives.

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A SURVEY OF FIRE ANT INFESTATION IN TRAFFIC SIGNAL SYSTEMS

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Research Report 1135-1
Research Study Number 2-18-86-1135
"Prevention of Fire Ant Damage to Signal Control"

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Texas Transportation Institute
The Texas A&M University System
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ABSTRACT

This report is the first in a series of reports expected to be prepared on research being conducted to develop practical treatments for preventing imported fire ants from damaging traffic signal systems. This initial report describes the findings of a one-week field survey conducted in the states of Alabama, Florida, Georgia, Louisiana and Mississippi. Additional information from Texas was added to the survey. The survey found that fire ants are a concern to all agencies contacted, including four cities and five state departments of transportation. A wide variety of insecticides are being used. The report contains a list of these treatments, evaluates them in a preliminary sense, and recommends a future course of research to be pursued within this study to achieve contract objectives.

KEY WORDS: Traffic Signals, Fire Ants, Signal Maintenance.

SUMMARY

The fire ant has recently become a potentially serious problem to the security and efficacy of traffic signal systems in Texas. Fire ants are reported to have gotten inside the signal conduit and to have eaten the insulation off the wires causing a short circuit which causes an unexpected outage of the traffic signal. Fire ants are reported to have also gotten inside the electrical power cable sheathing and to have created a void whereby water could get inside the waterproof sheathing and cause a short which could also cause an outage of the signal. Fire ants also have gotten inside the flasher controller inside the cabinet of the control box and caused a short that could also knock the system out of service.

In response to the observed fire ant infestation of traffic signals in Texas, State Department of Highways and Public Transportation (SDHPT) initiated and sponsored a research project entitled, "Prevention of Fire Ant Damage to Signal Control," Project 2-18-86-1135, to develop short-term and long-term solutions to fire ant infestation of traffic signal systems in Texas. A twenty-six month research program was begun July 1, 1986 to address the fire ant infestation problem and develop recommended treatments and solutions. Implementation guidelines and likely effects on personnel and impacts on the environment were desired.

This report is the first in a series of reports expected to be prepared on research being conducted to develop practical treatments for preventing imported fire ants from damaging traffic signal systems. This initial report describes the findings of a one-week field survey conducted in the states of Alabama, Florida, Georgia, Louisiana and Mississippi. Additional information from Texas was added to the survey. The survey found that fire ants are a concern to all agencies contacted, including four cities and five state departments of transportation. A wide variety of insecticides are being used. The report contains a list of these treatments, evaluates them in a preliminary sense, suggest some interim actions, and recommends a future course of research to be pursued within this study to achieve contract objective.

Implementation

The findings of the survey can be used by SDHPT traffic and maintenance personnel as relevant information to guide their selection and application of insecticides for treating the problem of fire ant infestation at traffic signal cabinets.

The potential benefits accruing to the State of Texas are sizeable. It is estimated that at least one problem maintenance call will be eliminated every five years at an estimated savings of $200 per call. As there are about 15,000 signals in Texas, this results in an estimated annual savings of $600,000 per year. Over a ten-year period, the potential benefit-cost ratio for this study would be 33-to-1. This savings does not include reductions in potential tort liability claims.

Acknowledgement

The authors wish to thank the state departments of transportation located in Alabama, Florida, Georgia, Louisiana and Mississippi for their time and information during the preparation and execution of the field survey. The following state individuals merit special acknowledgment:

Charles Alexander	Alabama	Dept. of Highways
Wesley Jackson	Alabama	Dept. of Highways
Gary Price	Florida	Dept. of Transportation
Grady Bryan	Georgia	Dept. of Transportation
John Vaughn	Louisiana	Dept. of Transportation
Fred Kyle, Jr.	Mississippi	Dept. of Highways

Four cities also participated in the survey. Personnel in these cities which actively contributed to the survey were as follows:

Mark Bailey	Jackson, Mississippi
Robert Brown	Jackson, Mississippi
Harvel Buford	Mobile, Alabama
William Smith	Mobile, Alabama
Tony Blankenship	Montgomery, Alabama
Ector Matherly	Montgomery, Alabama
Stanley Ferguson	Talahassee, Florida

Mr. Stan Swinton of D18-T of SDHPT serves as the study technical coordinator. He has ably served to identify the research problem needed and to assist in the preparation of the research approach for addressing the problem of fire ant infestation.

Disclaimer

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I. INTRODUCTION

Problem Background

The imported fire ant has rapidly spread across the southern United States. The ant entered the United States in about 1918 in Mobile, Alabama, from Brazil or Argentina. By 1940, the ant had infested five southern states.

The fire ant has recently become a potentially serious problem to the security and efficacy of traffic signal systems in Texas. Fire ants are reported to have gotten inside the signal conduit and to have eaten the insulation off the wires causing a short circuit which causes an unexpected outage of the traffic signal. Fire ants are reported to have also gotten inside the electrical power cable sheathing and to have created a void whereby water could get inside the waterproof sheathing and cause a short which could also cause an outage of the signal. Fire ants also have gotten inside the flasher controller inside the cabinet of the control box and caused a short that could also knock the system out of service.

In some other cases, the fire ants have caused damage by accumulating in a mass, bridging sensitive electrical switches and causing electrical circuit malfunctions. If ants should invade a flash transfer relay, they could prevent the emergency flash operation from functioning. Regarding traffic signal and safety lighting installations, the ants are a potentially serious safety hazard in Texas and other southern states wherein fire ants are found.

Research Program

In response to the observed fire ant infestation of traffic signals in Texas, State Department of Highways and Public Transportation (SDHPT) initiated and sponsored a research project entitled, "Prevention of Fire Ant Damage to Signal Control," Project 2-18-86-1135, to develop short-term and long-term solutions to fire ant infestation of traffic signal systems in Texas. A twenty-six month research program was begun July 1, 1986 to address the fire ant infestation problem and develop recommended treatments and solutions. Implementation guidelines and likely effects on personnel and impacts on the environment were desired.

Objectives of Report

Two of the project's research objectives were (1) to identify what, if anything, other southern states' departments of transportation have done or are doing to specifically ameliorate fire ant infestation of traffic signal systems and (2) to develop short-term strategies for the Department to consider implementing that would reduce the negative effects of fire ants on traffic signal systems.

This report contains the research conducted, field survey results and recommended short-term actions that may be taken by SDHPT to treat the fire ant problem at traffic signals.

Southern States Survey

An out-of-state field trip was conducted by two TTI study researchers during the week of August 17-23, 1986 using a TTI automobile. Personal interviews and field surveys were conducted with administrative and technical personnel to obtain the maintenance experiences and current design practice of traffic and electrical engineers in addressing the fire ant problem. Five state departments of transportation and four cities which had previously been infested by fire ants were interviewed. The following state agencies were interviewed:

1. Alabama Department of Highways
2. Florida Department of Transportation
3. Georgia Department of Transportation
4. Louisiana Department of Transportation
5. Mississippi Department of Highways

Several cities in the South were also surveyed similarly to the state DOT'S. The cities queried were:

1. Jackson, Mississippi
2. Mobile, Alabama
3. Montgomery, Alabama
4. Tallahassee, Florida

A general questionnaire form was prepared before the field trip began. The form was used to guide the interview process as each interview was personally conducted by the research team's designated interviewer. Each interview was conducted in an unstructured, informal manner. Written notes were made during each interview by the designated staff recorder of the research team.

A typical interview scenario began with a general discussion of the problem with an administrative-level traffic engineer, usually the person who had been contacted previously by telephone and with whom the meeting had been authorized and arranged. Staff signal engineers and/or signal technicians were usually present or were frequently brought into the interview process shortly thereafter. Visits to the signal shop, warehouse and/or visitations to infested sites commonly concluded the interview activity. Samples of signal and detector cable were usually obtained during the visit together with copies of signal plans and/or specifications on occasion.

II. SURVEY RESULTS

Fire Ant Experience

All the southern states and cities contacted had some experience with fire ant infestation of traffic signals. Recent experiences in Texas with fire ants seem to reflect the general set of experiences noted in the survey. Fire ants had been observed in signal cabinets, either ground-mounted or pole-mounted, in flashers, relays, and electronic circuit boards. Ants were personally observed to have eaten the insulation off of signal cable wires exposed in the base of ground-mounted cabinets.

Reflections of the survey provide some perspective of the fire ant infestation problem. The survey indicated that the signal maintenance personnel generally were more aware of the extent and details of the problem than were administrators. None of the state DOT's or cities contacted felt fire ant infestation was a big problem to them. For example, every organization consistently rated lightning strikes and resulting power surges a very bad (5) signal maintenance problem, on a small-problem, big-problem sale of 1 to 5. Fire ants and other insect infestation usually scored a one (1), or small problem in relative terms. On the other hand, many signal technicians, particularly in the cities interviewed considered fire ants a major pest or nuisance to routine signal inspection and maintenance activity. Some literally hated the fire ants and desired to annihilate them with an insecticide on sight in or around a signal cabinet or pull box. Some signal technicians have been severely bitten by fire ants located around pads of signal cabinet. Comments of signal maintenance personnel indicate that other insects also cause problems, such as sugar ants, wasps, yellow jackets, and spiders.

Several aspects of signal design and maintenance practice may have modified the magnitude of the fire ant problem experienced in the South as compared to what might be expected based on recent Texas experiences with fire ants. These aspects will be discussed in following sections.

Traffic Signal Design and Construction

All the DOT's interviewed placed a critical emphasis on sealing up base-mounted signal cabinets. This emphasis is the result of the goals to weather-proof as well as to insect-proof the cabinet, which would include the invasion of fire ants. While no figures were obtained, it is apparent that a lot of the DOT's signal installations have been pole and span-wire systems due to cost and high water table considerations. This type of design may reduce fire ant infestation problems compared to in-ground conduit and ground-mounted cabinet designs. However, it was evident that all organizations interviewed were moving toward the installation of a higher percentage of ground-mounted signal cabinets due to the increasing cabinet space requirements of microprocessor-based traffic signal systems. An increase in exposure to fire ant infestation is an anticipated and likely outcome.

The following descriptive specifications obtained from two states for the design and installation of ground-mounted signal controller cabinets illustrate the seal-proofing objective. One state requires that:

1. "All conduit connections to the cabinet shall be made watertight by the use of clear silicone rubber sealant."
2. "The joint between the bottom of the cabinet and the concrete base shall be sealed (inside and outside of cabinet) with a clear silicone rubber sealant."

Another state DOT has the following related specifications:

1. "Caulk around base of cabinet as required."
2. "On completion of the installation of wiring in conduit in the controller cabinet, all exposed conduit openings shall be sealed with a watertight compound."
3. "It shall be the responsibility of the contractor to install in the pole footings and base mounted controller footings, one 2-inch space conduit for possible future use."

The last specification reflects the fact that all of the southern-state DOTs cast-in-place concrete around the conduit leading into ground-mounted cabinets. No state uses a box-type gravel drain to provide conduit entry as SDHPT permits and sometimes installs in contract jobs.

The height of the signal cabinet off of the ground was considered by one engineer to be worth evaluating. One state is reported to have started using 18-inch high footings on some jobs to expedite maintenance activity. No consensus was found on this point other than some reasonable height should be provided for drainage, water flooding, and ease of maintenance. Fire ants had also been found in cabinets mounted fairly high on both wood poles and steel poles. While the sample size was small, neither pole type was considered a strong repellent to fire ants should they become attracted to the contents within the cabinet. Given a reasonable height, sealing of the cabinet was strongly considered a more critical control issue to fire ant infestation.

Each state and city were asked about the types of wire and cable specifications used in their signal system designs. In most cases, samples of wire and cable in stock were also obtained. IMSA wire and cable specifications were the most frequently used source and were receiving good experience reports. The survey revealed that the IMSA wire and cable specifications were becoming the dominant source for both aerial and in-ground applications. IMSA 51-3 loop wire and IMSA 50-2 lead-in (feeder) cable were dominate. Some Belden 8720 lead-in cable was still used, usually because of existing inventories, but reorders were more likely to be IMSA 50-2. The IMSA 50-2 feeder cable was sometimes stated to be preferred over Belden 8720 because aerial applications with Belden 8720 indicated its deterioration with exposure to sunlight. Apparently, ultraviolet light ages the covering causing brittleness and cracking of the outer insulation covering.

Materials used for conduit runs between pull boxes and signal cabinets were also determined. Most trenched conduit used was Schedule 40 PVC. Some agencies used PVC except when boring or jacking under highways where steel pipe is used. Electrical power leads were usually placed in steel conduit. One state used rigid galvanized steel conduit for all signal system

applications. Some agencies sealed around the conduit entry to pull boxes, but most did not. In any case, no agency selected conduit materials based on fire ant infestation problems.

Pull box designs varied over a wide range of design types. However, one state and some cities do not use pull boxes, per se. Junction convolutes with galvanized steel conduit or direct continuous wire runs were used. One state emphasized the need for water-resistant, dust-proof pull box design; whereas, most other agencies did not do so because their pull boxes were frequently filled with water. However, all agencies contacted emphasized the use of strong, waterproof splices between the loop wire and the lead-in cable. Most have approved elaborate splicing methods.

In summary, the survey found that all the agencies recommended sealing the signal cabinet at the base as tightly as possible. In no case, however, was any agency aware that any design specification or application practice of loop wire, lead-in cable, pull box design, conduit design, signal cable, or cabinet design had been made or altered to specifically repel or prevent fire ant infestation or consequences thereof.

Signal Maintenance

Two types of signal maintenance were noted: (1) failure-mode response and (2) routine preventive maintenance program. In addition, one state DOT does no signal maintenance as it is performed by the cities and counties of the state. Perhaps due to risk management of potential liability claims, there was an expressed awareness of those performing maintenance to conduct routine signal inspections and to perform scheduled and observed needed tasks at the signal installation. About half of the agencies contacted stated that they tried to perform routine inspections at least twice per year or more frequently, if possible. One state DOT noted that some districts perform routine maintenance while others do not. Of those that performed routine, scheduled signal inspections and maintenance, a responsible traffic engineer believed that major signal problems arising from fire ants could be controlled with frequent signal inspections and application of effective repellents.

Fire Ant Control

The survey revealed that several types of insecticides and pest control treatments have been tried and/or are currently being used by signal technicians to kill, remove and/or repel fire ants from signal cabinets. The following treatments were reported in the survey:

1. Wasp and Hornet Spray (Raid)
2. DIAZINON - 5% HI-YIELD (Ortho)
3. Amdro
4 797-A powdered insecticide (State)
5. Pro-Drone (Stoffer)
6. Hot Water
7. Rainbow Heptachlor (Rainbow)
8. Rainbow Insectape (Rainbow)

Since the Environmental Protection Agency banned the use of MIREX in the mid-1970's, state highway departments, telephone companies and other transmission companies have sought other products to control fire ants. As the above list shows, a variety of treatments have been tried by signal technicians. Wasp and Hornet Spray is often carried by maintenance personnel to run wasp out of signal cabinets. It was also used to spray fire ants observed in the cabinets and to treat existing nests. Apparently, the spray is a quick-fix so the technicians can work at the site, but there is minimal intermediate or long-term repellent power.

Amdro is another modern commercially available product. It is seldom used in traffic signed maintenance because of its expense, its failure to quickly eliminate existing fire ant problems, and its relative short life.

Four of the agencies contacted said they are using DIAZINON grandular insecticide with some success. One state no longer uses it within the signal cabinet because of its relatively short life. They are now using the Rainbow products.

The telephone companies in the South have also experienced fire ant infestation problems for many years. They apparently have had some success with fire ant and other insect control with the two products made by Rainbow; namely, Rainbow Fire Ant Control (Heptachlor) and Rainbow Insectape. A total of 7 of the 9 agencies surveyed had been recently contacted by Rainbow representatives and several were beginning some initial application and testing of their products. One southern state DOT reported that they had been using Rainbow Heptachlor for about four months and that the signal maintenance technicians reported good, fast results. All fire ant control results that have been obtained have been favorable. The product is EPA-approved for controlling fire ants in telephone pedestal and electric transformer pads. Apparently, it is not approved for outdoor use where it might get into the water supply system (Clear Air Act, Section 311). Four advertised features of the Heptachlor Rainbow product, which signal technicians indicated that appealed to them, were:

1. Kills existing fire ants within 24 hours.
2. Remains effective for 10 years or longer.
3. Specially packages in small, individual bags.
4. Non-corrosive to power and telephone wires and cables.

Another Rainbow product that was noted in the survey was Insectape, strips of multi-layered adhesive tape containing a controlled release of an insecticide (Baygon). As an insect crosses the tape, it is claimed that the insect absorbs the insecticide--causing quick knockdown and death within 30 minutes. It is claimed by Rainbow that the strips remain active for two to three years. The packaging is convenient. There are six 1x4-inch strips to each odor-proof, sealed pouch, and 60 pouches to a box.

Texas Experience

A modest amount of information has been obtained from local Texas experience with fire ants. College Station is using a liquid product "MC-96" with some success; whereas, its twin city Bryan has recently begun using the powdered insecticide "797-A" from State Chemical with some reported and

observed success. The local SDHPT district office uses a third treatment derived from an insecticidal treatment for termite control.

Some preliminary testing of the Rainbow Heptachlor have been reported from the Houston district. District 12 reports that one bag of the Heptachlor product was dusted in the signal cabinet at FM 517 and FM 1266 in Dickinson in June 1985. Maintenance personnel reported all fire ant were gone by July. A recent inspection in September 1986 observed no new fire ant infestation of the cabinet.

III. CRITICAL EVALUATION OF PRESENT IMPORTED FIRE ANT CONTROL PROCEDURES

The Problem

From various interviews with traffic signal maintenance personnel to administrative highway personnel and onsite inspections, there appear to be three major problems with fire ants in traffic signal cabinets and associated equipment. One is the movement of fire ants into the electrical equipment that can cause electrical shorts and malfunctions of the equipment. Second is the movement of soil and other material into the cabinet by the ants that can cause corrosion, electrical shorts due to moisture, and mechanical damage and shorts. Third, the ants can damage wire insulation possibly leading to shorts particularly during wet weather.

There also appear to be two basic types of approaches to addressing the problem. One is the need to rapidly remove fire ants from the signal cabinet and site so that maintenance personnel can safely reach and perform various signal maintenance procedures. Second is the applications of products in such a way as to keep the fire ants out of the equipment in the cabinet.

Quick Removal

There are available several products that have been used to remove ants from signal cabinets so that maintenance can be performed. One is "Wasp and Hornet" Spray from Raid; another is a product consisting of 1,1,1-trichloroethane referred to as "MC-96"; and another is a product from State Chemical referred to as "797-A powdered insecticide" which contains pyrethrin, piperonyl butoxide to give rapid kill, and amorphous silica gel for residual activity. The first two products give immediate kill and are only temporarily effective because the products rarely kill a fire ant mound. Thus, the ants will rapidly reinvade the cabinets. The State 797-A powdered insecticide has some residual activity but the duration of effectiveness is not known.

Residual Insecticide

To reduce or prevent the movement of ants into signal cabinets, a residual insecticide may have potential. Many of the residual products can agitate the ants when first applied, making it difficult to work around the equipment treated with these products for perhaps an hour. The State Chemical 797-A powdered insecticide which does give a fast kill also has amorphous silica gel which has residual activity but how long the residual activity is effective when exposed in a signal cabinet is unknown. This product is a powder, is easy to apply, and sticks well to surfaces. However it is difficult to use on windy days and precaution against breathing the dust should be taken.

Granular formulations are also easy to apply and stay where they are applied. Granular formulations also can be used even in windy weather, but being heavy they remain on the bottom and do not stick to vertical surfaces like the powders. There are several granular formulations available each of which has varying degrees of effectiveness and presents various problems.

The Heptachlor granular material contains a very persistent insecticide (lasting 10 years or longer). Heptachlor is a chlorinated hydrdocarbon that can be environmentally damaging and can not be used if there exists the possibility of water supply contamination. Rainbow Chemical has made heptachlor available as a granular product in easy and convenient packages for buried telephone cables, cable television pedestals, and pad-mounted electric power transformers. Rainbow markets the heptachlor product under the label "Fire Ant Control". It is approved for these uses by the Environmental Protection Agency. However, the use of heptachlor causes some environmental concerns. further, the provision of ant-free maintenance problems for 10 years may be longer than required as the treated area remains contaminated. Consequently, upgrading the signal equipment or replacing the equipment results in personnel having to deal with a heptachlor contaminated site.

It should be noted that heptachlor has been available for many years. The insecticide, mirex, was first developed in the late 1950's to replace heptachlor as the standard control agent for imported fire ants. Heptachlor had been used as a granular ground application which primarily killed adult fire ants that left the mound. Heptachlor's toxicity to wildlife, persistence, and sometimes marginal effectiveness led to its replacement by mirex. Mirex, itself, was totally banned for use by the Environmental Protection Agency on June 30, 1978 due to questions of its safety in the environment.

Two other granules, diazion and Dursban (chlorpyrifos) have similar killing power and, if slightly acid granules are used, they will exert a 3-5 year residual activity. Rainbow Chemical also is marketing a Dursban granule in convenient packets (under the trade name of "Insect Control") for the control of fire ants in similar situations to that for their heptachlor product. There are a number of other companies that also market Dursban and diazion granules. These companies and their products are listed below:

Dursban (chlorpyrifos)
- Ferti-lome, Dursban Fire Ant 10% Granules
- Fords, Fire Ant 2.5 Granules
- Green-light, Fire Ant killer Granules
- Staffels', Ant Granules

Diazinon
- CIBA-GEIGY, Spectracide Fire Ant killer
- Green-light, Diazinon 5G
  Diazinon 14G
  Ant Granules
- High-yield, Imported Fire Ant Control Granules
- Ortho, Fire Ant killer Granules
- Purina, Diazinon - 5%
- Rigo, Diazinon 5% Granules
  Fire Ant Granules
- Vigoro, 5% Diazinon Granules

While all of these products should be effective and preferred over heptachlor containing products, most have not been labeled for use in signal cabinets and their persistance characteristics (which depends on their acidity) have not been compared.

Special or Local Insecticide Applications

A third approach that is available is the use of an insecticide slow release tape or insecticidal paints. A slow release tape is available from Rainbow Chemical called "Insectape" containing propoxur (Baygon). This tape kills crawling insects that walk across it and may prove useful in isolating certain electrical components, such as flashers, from the ants. Some research may be necessary to determine the best placement for the tape, or the use of insecticide containing paints. The tape may have an advantage over insecticidal paint because the tape is obvious and less likely to present a contact skin problem, if handled properly, and the tape provides a longer lasting slow release insecticide formulation. To our knowledge, painting the inside of electrical cabinets with insecticidal paints has not been evaluated or considered. Such paints are available for cockroach control.

IV. PRELIMINARY RECOMMENDATIONS AS A RESULT OF SURVEY

Implementation

Several products are being used by personnel throughout the fire ant infested area of the United States. Most of these products have come into use within the last few years in response to the problem with fire ants. One recommendation would be to obtain data as to what products are being applied, when applied, when ants were again observed in the treated cabinets, and when retreatment occurred. This would help evaluate products already in place. Further, a label might be attached to treated cabinets indicating what the cabinet was treated with and when it was last treated. An example is attached (Figure 1).

It is premature to make any entomological implementation recommendations, but caution should be exercised in the use of long-residual products such as heptachlor which are difficult to replace or clean up if a problem occurs or better products become available.

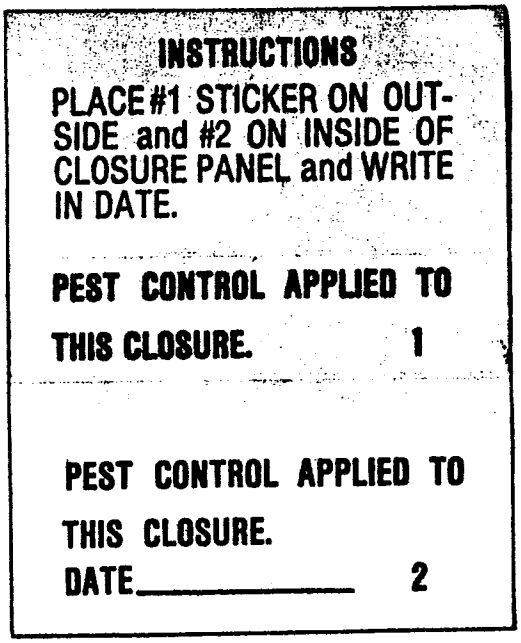

Figure 1. Example of an Adhesive Label For Identifying a Traffic Signal Cabinet That Has Been Treated With a Pest Control Product.

We recommend that the highway department develop a three-stage interm approach to address the problem. We first suggest that a routine inspection of signal cabinets and pull boxes be made preferably in the Spring (late April) and Fall (September). That notes regarding the presence of fire ants and their severity be recorded. Second, we suggest that if ants are found to be a problem, the ants should be removed and the cabinet treated with one of the products suggested below. The product used should be recorded, the method of application, placement of product, date applied and amount applied should also be recorded. Third, that a yellow self-sticking label, which provides a space for and records the type of product used and date applied, should be affixed to the treated cabinets. Fourth, once a treatment application is made, no retreatment should be made unless the ants again appear to become a problem. Periodic records should be maintained as to the effectiveness during the periodic inspections. Further, the maintenance reports should be made available to the highway department and this research project.

In regard to suggested application products; we suggest that granular products containing Dursban or Diazinon, as noted on page 9, be considered along with pyrethrins, such as provided by 797-A. From a research and practical point of view, we additionally suggest that the efficacy of a select group of products be examined. As a minimum, we further examination of:

1. Rainbow's "Insect Control" which is a granular product containing Dursban (chlorpyrifos) at 0.5% and packaged for easy application.

   Address: Rainbow Manufacturing Co.
   P.O. Box 26445
   Birmingham, AL 36226

2. State Chemicals' "797-A powdered insecticide" which is a powder containing pyrethrine and piperonyl butoxide (1 on 10%), which rapidly knock's down and kills the ants, and amorphous silica gel, which is residual and is not a poison but is a dessicant that kills ants. This powder should be applied according to the label. Avoid breathing the dust (suggest a dust mask be used during application). Research is needed to improve on the application method if this product is found to be effective.

   Address: State Chemical Mfg.
   Cleveland, OH 44114

3. Additional products may be considered later.

No specific engineering recommendations can or should be made at this time regarding needed modifications to signal system design or equipment specifications with regard to potential fire ant infestation or risk management of their potential effects. No state or city contacted in the survey was aware of any design change or specification revision that had been made specifically to counter fire ant infestation.

A synthesis of the survey findings regarding engineering aspects of signal design suggests that some consideration of the following items might be beneficial. SDHPT may wish to consider using only solid concrete slabs for cabinet foundations with all conduit cast-in-place. Provision of a spare conduit run to the master pull-box would be desirable for future expansion capabilities. The spare conduit should be capped and sealed at the cabinet and pull box until needed. Additionally, SDHPT may wish to consider sealing the cabinet to the foundation slab in order to reduce weather and insect intrusion of the cabinet interior; however, this action may not necessarily impede fire ants that become attracted to the interior of the cabinet.

Future Research

Available products that may be useful in controlling fire ants in cabinets need to be carefully tested in the field. These include State Chemical's 797-A powered insecticide, Rainbow and other company granular products containing Dursban, and commercial products containing granular Diazion. A comparison of Diazinon or Dursban granular products with Rainbows' "Fire Ant Control" granular product containing heptachlor should be made in regard to residual activity.

The placement of the products, their applications and safety need to be carefully examined and documented.

V. RESEARCH PROGRAM

Observations

During the field survey, fire ants were observed in electrical equipment including traffic signal cabinets. These observations corroborated the testimony and observations of the state and city personnel that the fire ants are often attracted to and are more of a problem in high-voltage equipment and areas. Direct current does not appear to present the same problem. Consequently, laboratory experiments have been programmed to scientifically determine and quantify the electrical attraction relationships to fire ants observed to exist in the signal cabinets.

Equipment

The following laboratory equipment have been obtained to conduct the electrical attraction studies:

1. an audio amplifier
   Carver amplifier, Model 500T, s# 60103121
2. a signal generator
   Wavetek generator, Model 182A, s# M7260409
3. a 500-volt KH power supply
   on loan from Engineering Technology.

Support equipment, components and connections remain to be obtained.

Personnel

We have located, what we believe is, a person experienced with ants and familiar with the fire ant. The person we seek should take leadership of the program regarding the attraction of ants to electrical current. He is also comfortable with electricity and electronic equipment. An offer has been extended and he has indicated a strong interest.