120

MICHIGAN
STATE HIGHWAY DEPARTMENT
Charles M. Ziegler
State Highway Commissioner

MICHIGAN'S EXPERIMENT

in

SNOW AND ICE REMOVAL ON HIGHWAYS BY

RADIANT HEAT

Highway Research Project 36 G-3 (7)
Progress Report No. 1

Research Laboratory
Testing and Research Division
Report 120
January 15, 1949

MICHIGAN'S EXPERIMENT IN SNOW AND ICE REMOVAL ON HIGHWAYS BY RADIANT HEAT

A study of literature will reveal that the removal of snow and ice from pavement surfaces by means of heat has been accomplished successfully on many installations at nominal cost. Heating of the pavement surface is usually accomplished by passing either hot water or low pressure steam through 1-1/4- to 1-1/2-in. wrought iron pipes. The pipes are either embedded in the concrete slab or placed immediately under it if the slab has a comparatively thin cross section. Laboratory tests conducted in 1935 by the Engineering Experiment Station at Michigan State College and a more recent experimental installation made during the winter of 1947-48 by the Detroit Public Lighting Commission produced convincing evidence that the heating of pavement surfaces by electricity to remove snow and ice is feasible and practical at nominal cost.

As a result of the above experimental work, the Michigan State Highway Department realized that this type of snow and ice removal would be ideal for ramps on superhighway intersections. Consequently, during the summer of 1948, the Department authorized the installation of a 1000-ft. trial section on a regular construction project. It was believed that from a practical installation of this type a better knowledge could be acquired relative to cost data and performance of the system under winter conditions.

The site selected for the experiment is on construction project 82-98, C1, route M-102 at the west limits of Ferndale, a suburb of Detroit. At this location, route M-102 is a divided highway with the north roadway a concrete surface and the south roadway a bituminous surface. It is planned to study the relative construction and effectiveness of the method

on two types of highway surfaces, bituminous and concrete. The test area for each type of surface is 500 feet in length and located in the inside lane only, of the two roadways, as shown in Figure 1.

Each installation uses heating elements consisting of 98-ft. lengths of 2- by 2-in. standard concrete sidewalk reinforcing mesh composed of No. 14 gauge galvanized iron wire, 18 inches wide. It was necessary to use this length of heating element because the pavement joints were at 99-ft. intervals. Two heating elements were put in one pavement lane at 6-ft. centers. At the end of each heating element, a 1/4- by 2-in. copper bar and terminal wires were brazed to permit connection to the source of power. See Figure 2. In the concrete pavement the heating elements were placed two inches below the surface. In the bituminous surface the elements were placed between the base and top course. The top course was approximately 1-1/4-in. thick. The heating elements were coated with an insulating varnish to eliminate any possibility of electric shock to persons or animals.

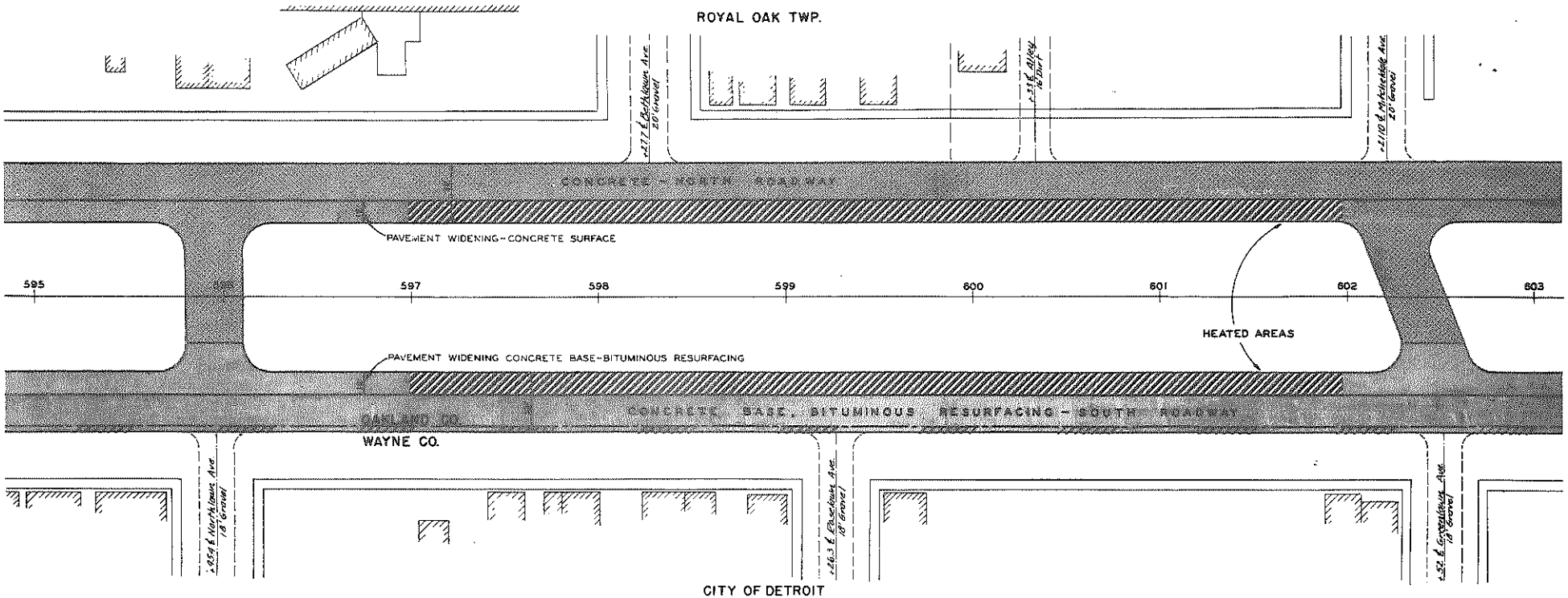
The system has been designed to operate on approximately 50 watts per square foot of heating element. This value was determined from a former experiment by the Detroit Public Lighting Commission to be the most practical for weather and power conditions in Detroit and vicinity. The e.m.f. or electromotive force is kept at 60 volts maximum. Both sides of the roadway are at the same potential and the drop along the roadway is 0.3 volts per foot. A diagrammatic sketch of the electric circuit is shown in Figure 3.

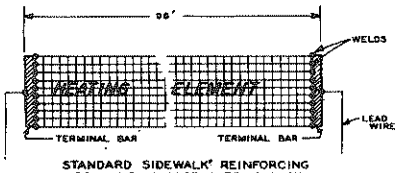
The control system consists of two recording temperature controllers, one for each roadway, and associated relaying. These controllers are

operated by bulbs placed in the pavement halfway between the heating element and pavement surface. When the temperature approaches freezing, the controller energizes the heating elements. After a sufficient rise in temperature, the controller turns off the heating elements. The present settings are 36 degrees F. "ON" and 38 degrees F. "OFF". These settings allow for the temperature gradient which exists between the surface of the roadway and the point below the surface at which the temperature detecter is embedded.

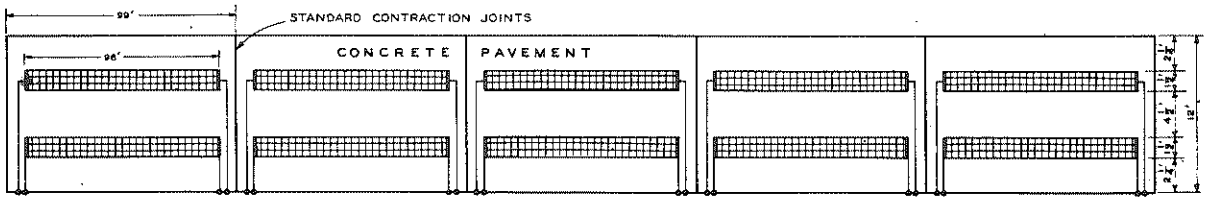
At the present time, the master control for this pavement heating installation is turned on by hand about one hour before a snow storm or ice condition as predicted by the local weather bureau, and is turned off by hand from observation of all conditions, both weather and pavement.

Complete installation costs or operating costs are not available at this time, since minor changes in the electrical equipment are still in progress to improve performance. However, it is estimated that with electric rates at one cent per kilowatt hour, and the system using current only half of the time, operating costs for the 1000-ft. section will be approximately 75 cents an hour.



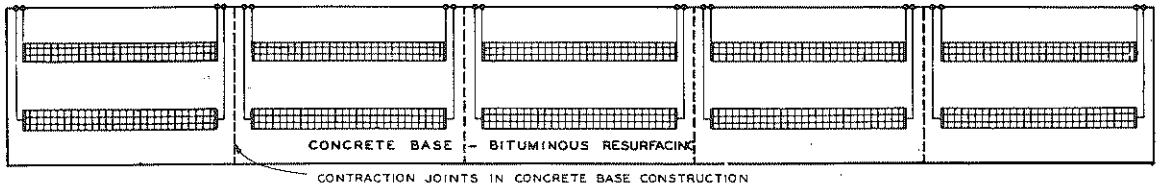


STANDARD SIDEWALK REINFORCING MESH - NO. 14 GAGE WIRE, 2 INCH MESH - HEATING STRIPS 16 INCHES WIDE AND 98 FEET LONG - WIRE AT EACH END OF HEATING STRIP TO BE WELDED TO TERMINAL BARS AS SHOWN.



NORTH ROADWAY WIDENING

SCHEMATIC DIAGRAM OF HEATING GRID LAYOUT



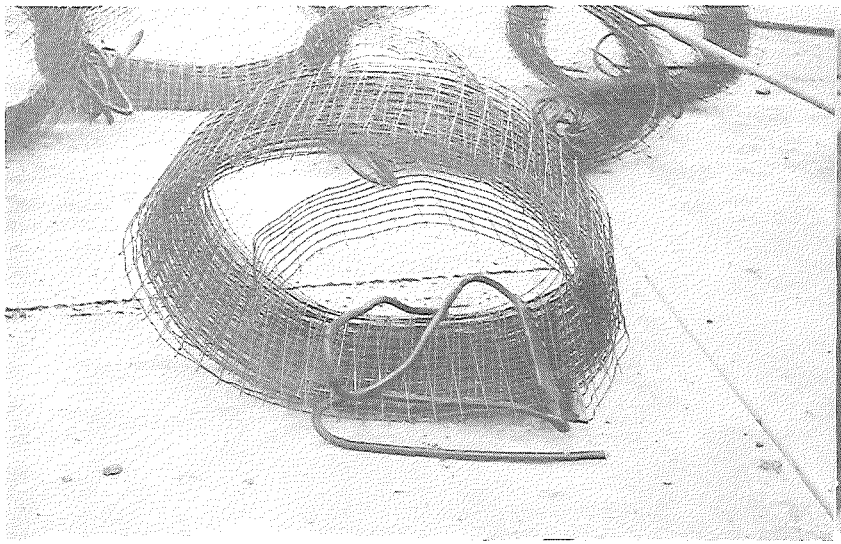
SOUTH ROADWAY WIDENING

EXPERIMENTAL SNOW *and* ICE MELTING SECTION

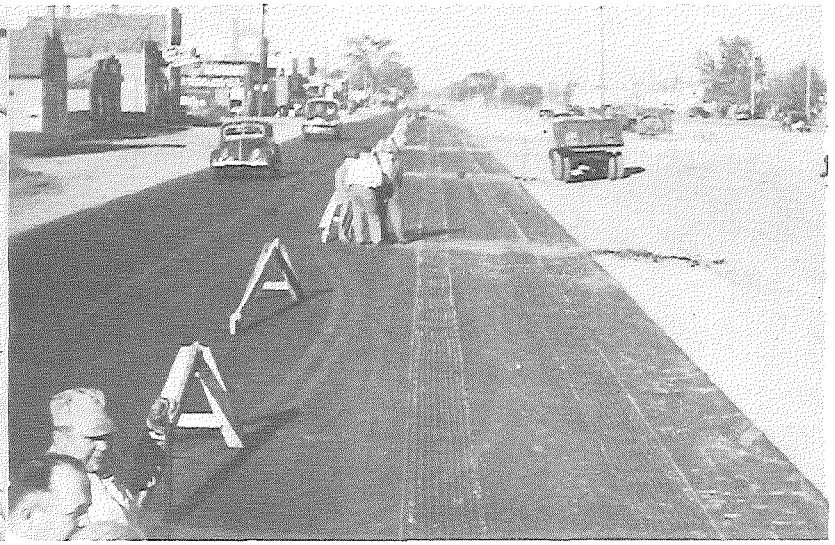
RESEARCH PROJECT 39G-3(7)
CONSTRUCTION PROJECT 82-98 ROUTE 102
DETROIT AND WAYNE COUNTY

MICHIGAN STATE HIGHWAY DEPARTMENT
IN COOPERATION WITH DETROIT PUBLIC LIGHTING COMMISSION

FIGURE 1

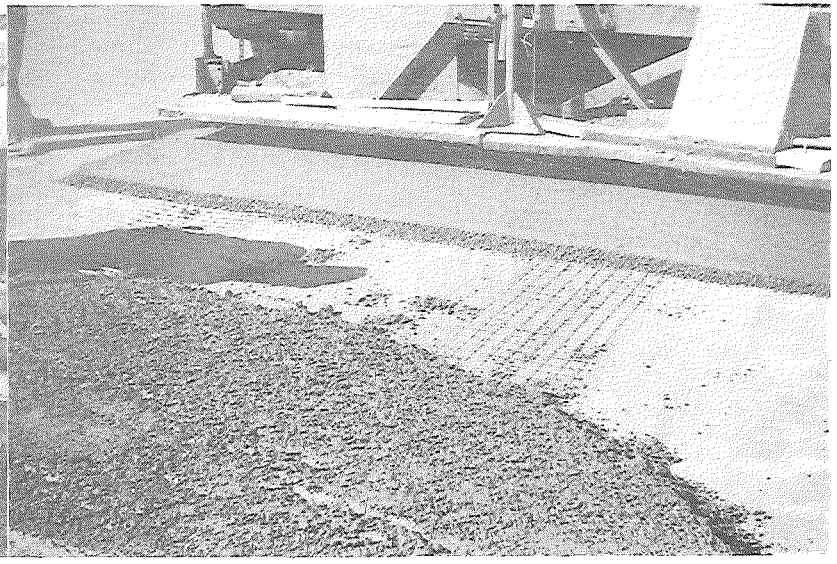


HEATING ELEMENT



IN PLACE IN BITUMINOUS ROADWAY

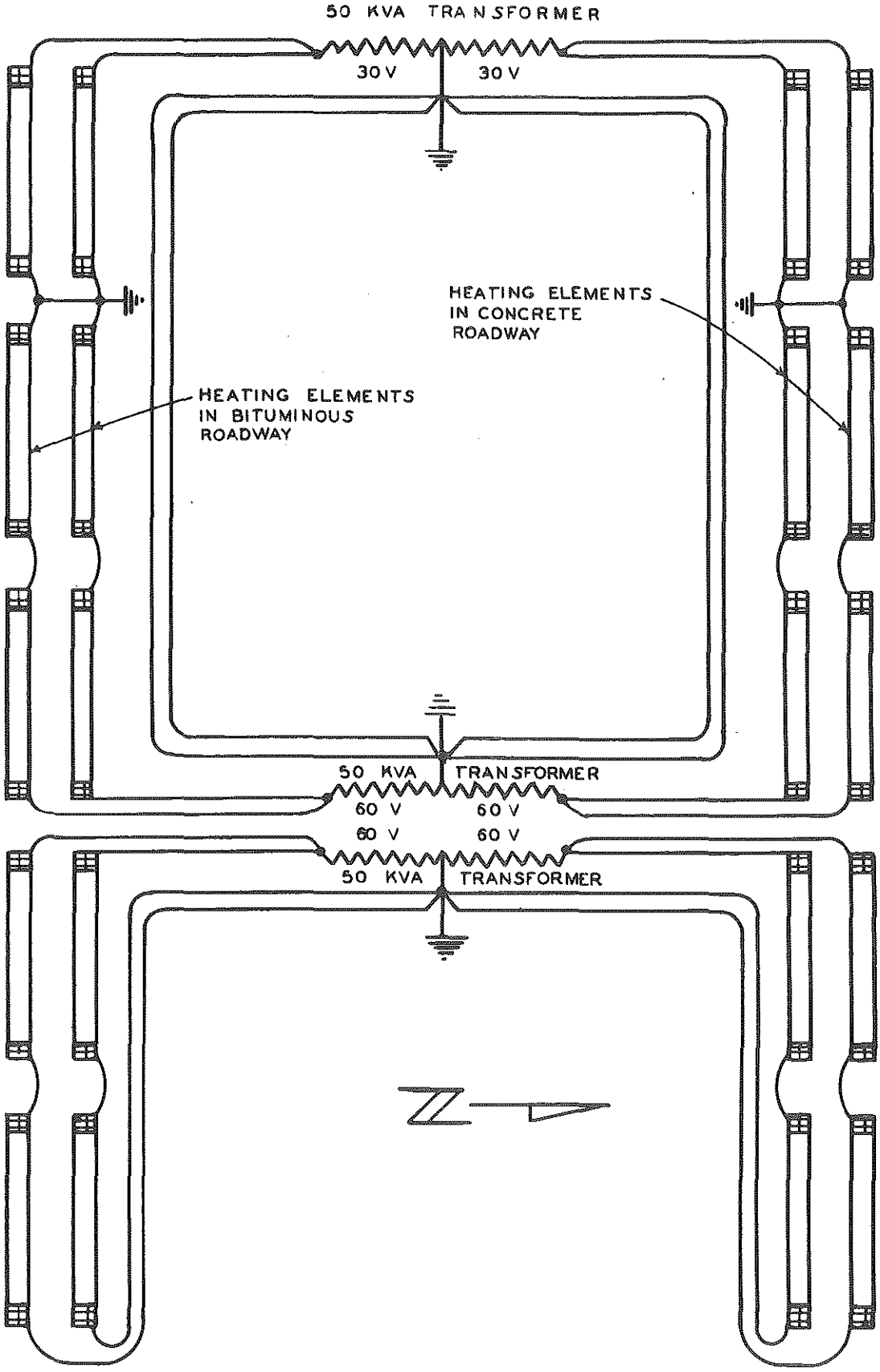
IN CONCRETE ROADWAY



COVERING WITH BITUMINOUS MATERIAL

INSTALLATION of HEATING ELEMENTS

FIGURE 2



CITY OF DETROIT
PUBLIC LIGHTING COMMISSION
8 MILE ROAD PAVEMENT HEATING

F.G.P.

12-30-48

FIGURE 3

FIGURE 4