INSTALLATION REPORT

THE USE OF FABRIC REINFORCED OVERLAYS TO CONTROL REFLECTION CRACKING OF COMPOSITE PAVEMENTS

by

K. H. McGhee
Highway Research Engineer
and
C. S. Hughes
Senior Highway Research Scientist

Virginia Highway Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways and the University of Virginia)

Charlottesville, Virginia

February 1973
VHRC 72-R27

INSTALLATION REPORT

THE USE OF FABRIC REINFORCED OVERLAYS TO CONTROL REFLECTION CRACKING OF COMPOSITE PAVEMENTS

by

K. H. McGhee
and
C. S. Hughes

INTRODUCTION

Transverse joints in rigid pavements and transverse cracks in the surface of flexible pavements commonly reflect through thick bituminous concrete overlays in a short period of time. For the past several years extensive efforts have been made to prevent reflection cracks but they have been only partially successful. One 1971 test installation showing some degree of success involved fabric reinforcement of a $1\frac{1}{2}$-inch thick bituminous overlay in the vicinity of the joints on an old concrete pavement. Joint deflection studies showed that the success or failure of the reinforced overlay was related to the vertical movement of thejoints. Joints showing very small differential deflections of adjoining slabs when traversed by an 18,000 lb. axle load (i.e., the load transfer is approaching 100%) were successfully bridged by the fabric reinforcement. These studies have led to the conclusion that where the vertical motions of joints or cracks are minimized it should be possible to prevent reflection cracking of overlays by use of the fabric reinforcement.

In the present study, fabric reinforcement has been used in an attempt to prevent reflection cracking of two bituminous concrete layers overlying an 8-inch plain (unreinforced, unjointed) concrete base, which is, in turn, underlain by a portland cement stabilized subbase material. On these pavements, it is expected that the extremely rigid base and subbase layers will reduce vertical motion to a minimum. Similar pavements constructed with no overlay reinforcement readily show reflection cracking in the bituminous layers, presumably because of horizontal, thermally induced movements of shrinkage cracks in the concrete base.

EXPERIMENTAL FEATURES

Description

The pavement selected in consultation with Construction Division personnel for the fabric installation is a part of the Pentagon Network portion of Interstate 95 in

Arlington County. The project (0095-000-101, C503) has the design features outlined below.

Surface	— 100 psy bituminous concrete, type S-5
Binder	— 250 psy bituminous concrete, type B-3
Base	— 8 inches plain portland cement concrete
Subbase	— 8 inches cement stabilized subbase material

Plans called for the installation of two reinforcing materials, each on approximately 100 cracks.

Materials

The materials applied were:

(1) Petromat — manufactured by the Phillips Petroleum Co.

(2) Chemstrand (4 oz.) — manufactured by the Monsanto Co.

In addition to the test sections outlined above, one control section of untreated joints was established for comparison purposes.

METHOD OF APPLICATION

Arrangements to install the test sections were made through negotiations with the prime contractor on the project. The materials were installed by the contractor's men with the assistance of Research Council personnel and the materials manufacturer's representatives.

The following method of application was used for both materials:

(1) Utilizing a template for tack control, each crack was tacked for its full length (a 12-foot lane width) and for 18 inches to either side with approximately 0.25 gsy of CAE-2. The distributor and hand spray used to apply the tack leaked badly, resulting in a messy appearance and nonuniform distribution of tack.

(2) The tack was allowed to cure for approximately 1-3 hours before placement of the fabric.

(3) The fabric was laid from one end and broomed into the tack to assure good adhesion. It was noted that the Petromat appeared to absorb the tack better and to adhere more uniformly to the pavement surface than did the Chemstrand.

(4) Since the test sections were not scheduled for an immediate bituminous overlay, all fabric and any excess tack was covered with sand to provide some protection from construction traffic. With the sand application, the Petromat maintained its smooth contact with the pavement surface while the Chemstrand could be seen to wrinkle badly. The wrinkling was thought to result from moisture in the sand and it was expected to disappear upon drying. It was later determined that the wrinkles did not disappear and that the resultant poor bond caused curling and tearing of the Chemstrand when the overlay was applied.

(5) Overlays of bituminous concrete base Type B-3, $2\frac{1}{2}$-inches thick were applied at various dates on the different test sections (Table 1). The overlays were placed with a rubber-tired Cedar Rapids paver. Several problems were associated with placing the overlays and resulted in a substantial loss of fabric. These were:

(a) Some loosely bound material was lost when the pavement was swept to remove the covering sand and construction debris.

(b) Spinning of the paver wheels caused curling and tearing of some loosely bound sections of fabric. This was especially noticeable with the wrinkled Chemstrand. At that time, it was determined that the tack was somewhat soft, and permitted the fabric to shift under the paver wheels. The conditions became worse as the air temperature rose in the afternoon.

(c) On some sections the fabric had been severely damaged or completely destroyed by construction traffic before the overlay could be applied. Records were kept on all sites to provide a basis for comparison between the cracks where reinforcement is intact and cracks on an untreated control section. When all sections had been overlayed there were 64 Petromat and 55 Chemstrand treated cracks for evaluation purposes. The numbers and location of these reinforced cracks are listed in Table 1 and illustrated in the attached Figures — where cross-hatched cracks indicate pre-overlay fabric damage. Note that Figure 6 shows the location of the control section of untreated cracks.

It should also be noted that several originally treated sections of roadway are no longer included in the evaluation because of pre-overlay fabric damage. Research Council records show the exact locations of these sections and cracks in case any questions should arise at a later date.

Table 1

Summary of Fabric Reinforced Cracks

Site	Date Placed	Number of Cracks		Date Overlayed
		Petromat	Monsanto	
1	7/19/72	17	10	7/26/72
2	7/19/72	--	20	7/26/72
3	7/19/72	22	--	10/31/72
4	9/15/72	25	25	9/18/72
TOTAL		64	55	

EVALUATION

Plans have been made to provide instrumentation to measure the longitudinal movements at several cracks or at locations where reflection could be expected to occur under normal conditions. In addition, it is hoped that the vertical movement of several cracks under a moving load can be determined in the spring of 1973. These measurements should provide background for determining the causes of failure if the fabric reinforcement proves to be ineffective.

Periodic inspections of the control and reinforced sections will be conducted until such time as definite conclusions can be drawn. It is expected that within one to two years the success or failure of the fabric reinforcement will be clearly established. At that time, a final report will be issued.

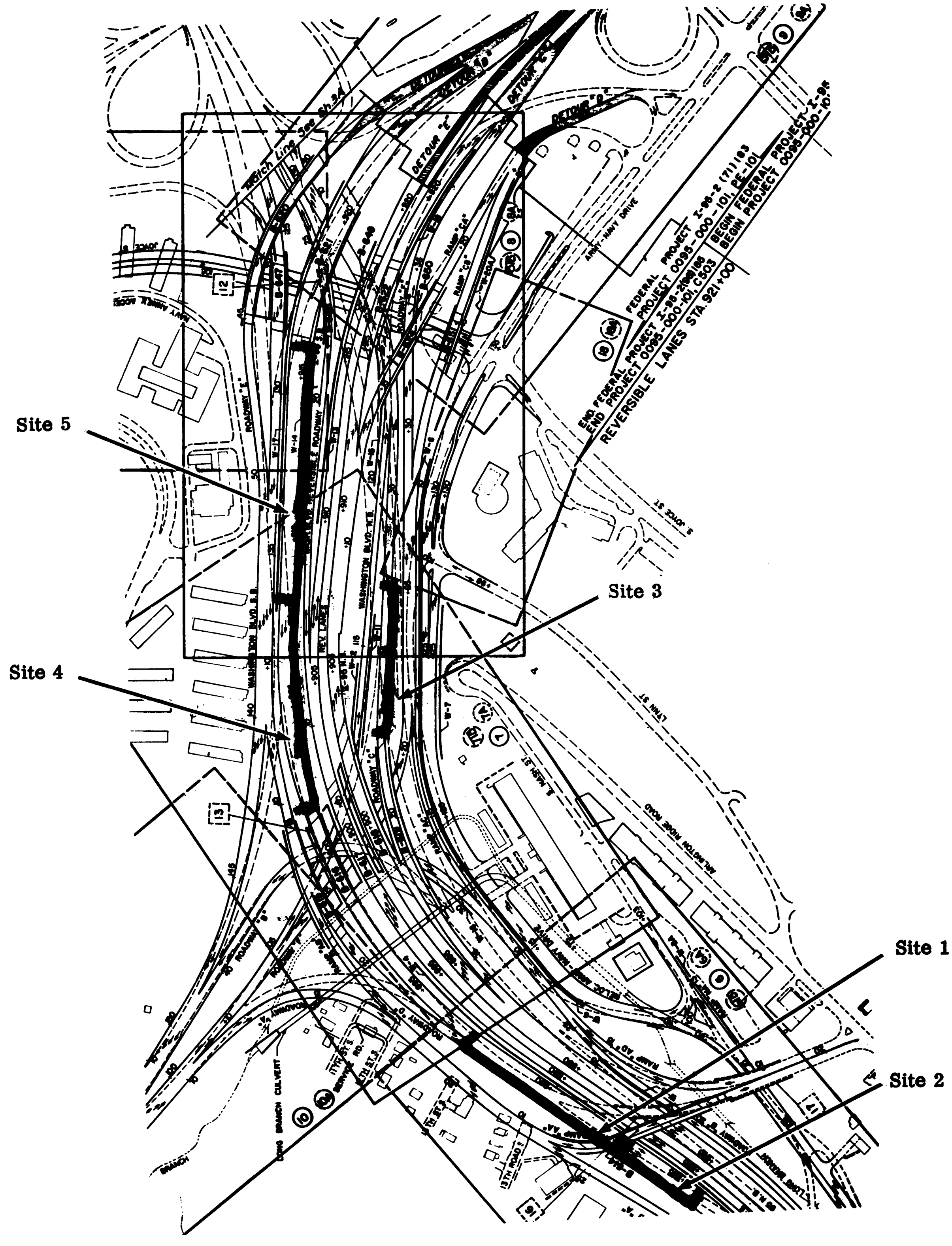
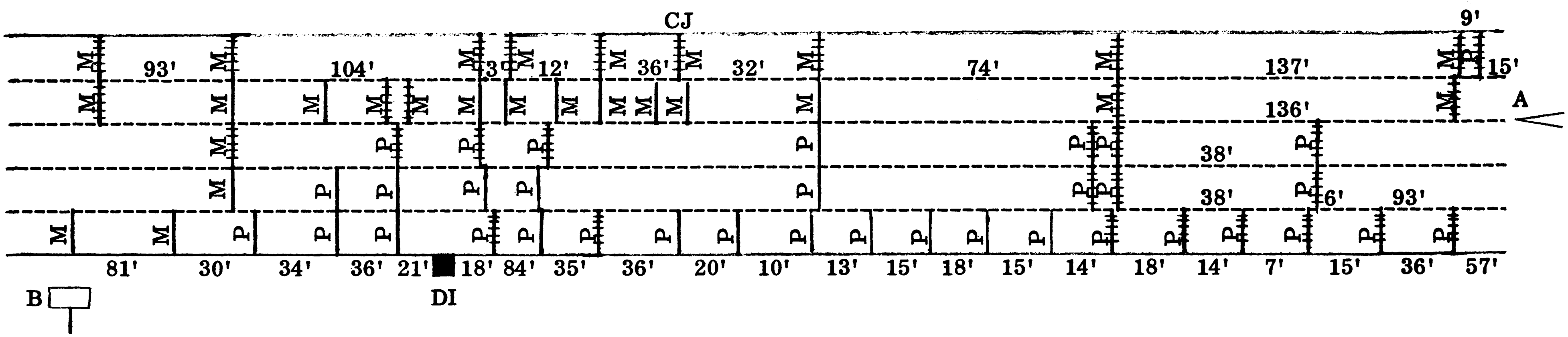


Figure 1. Location of test sites within "Mixing Bowl".

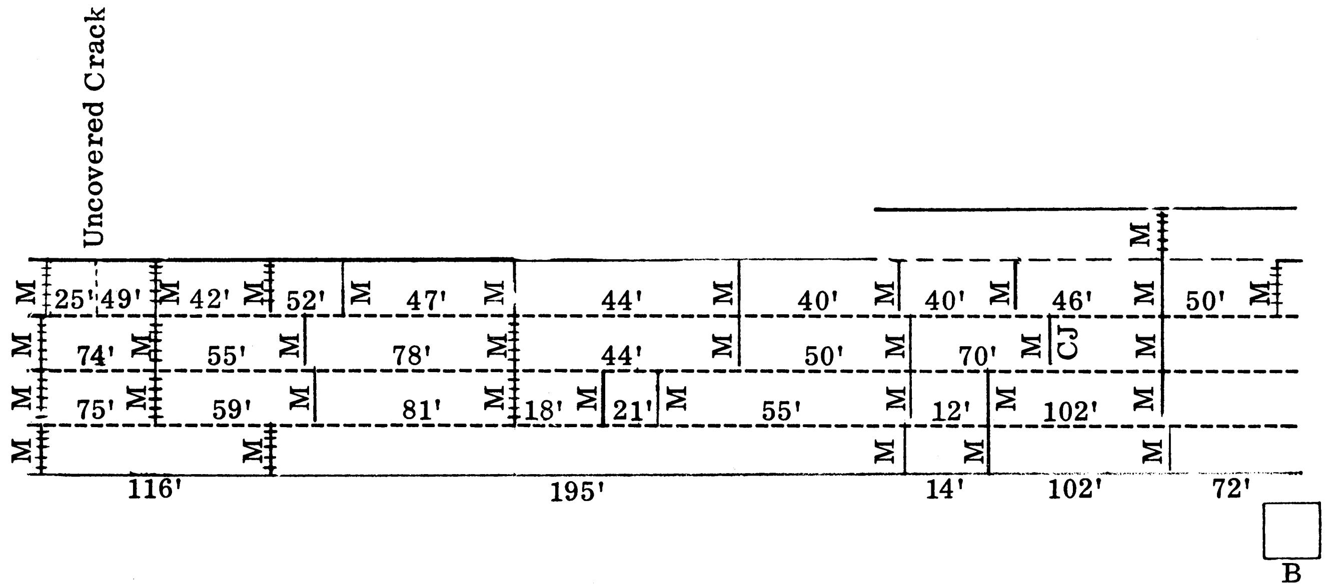


B — Pier beneath Bridge 614 (Roadway A to Ramp AA)

35 Petromat   18 Petromat void = 17
27 Monsanto   17 Monsanto void = 10

All cracks dashed out were damaged prior to application of plant mix and cannot be considered in evaluation.

Figure 2. Site #1 — Southbound I-95. (Not to scale.)



B — Pier beneath Bridge 614 (Roadway A to Ramp AA)

33 Monsanto 13 void = 20

Cracks dashed out damaged by construction and cannot be considered in evaluation.

Figure 3. Site #2 — Southbound I-95. (Not to scale.)

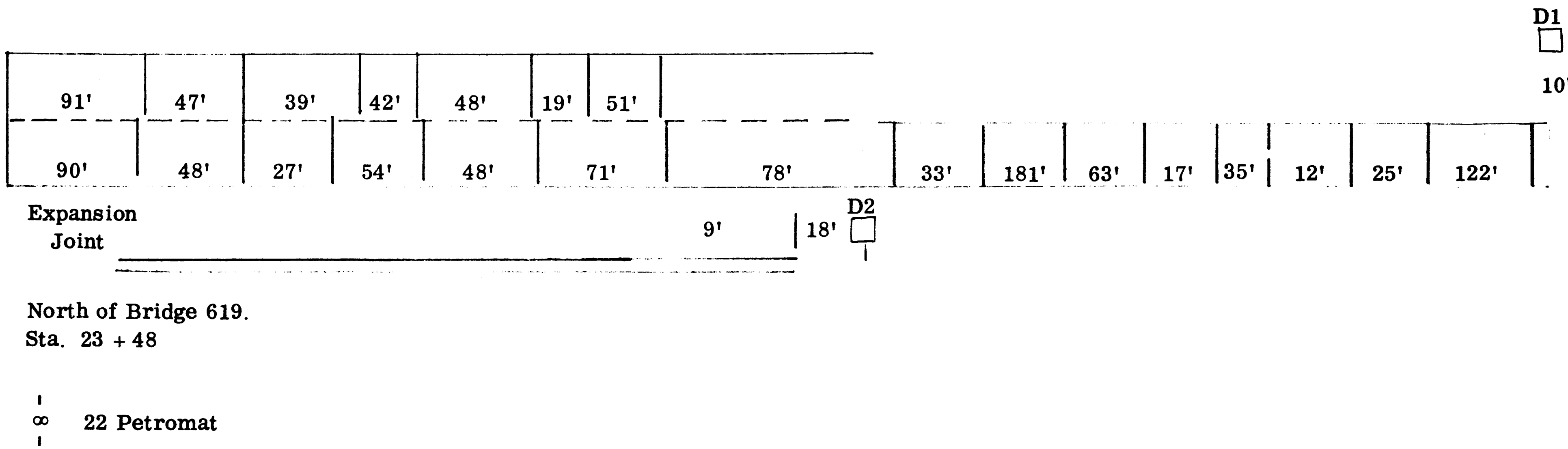
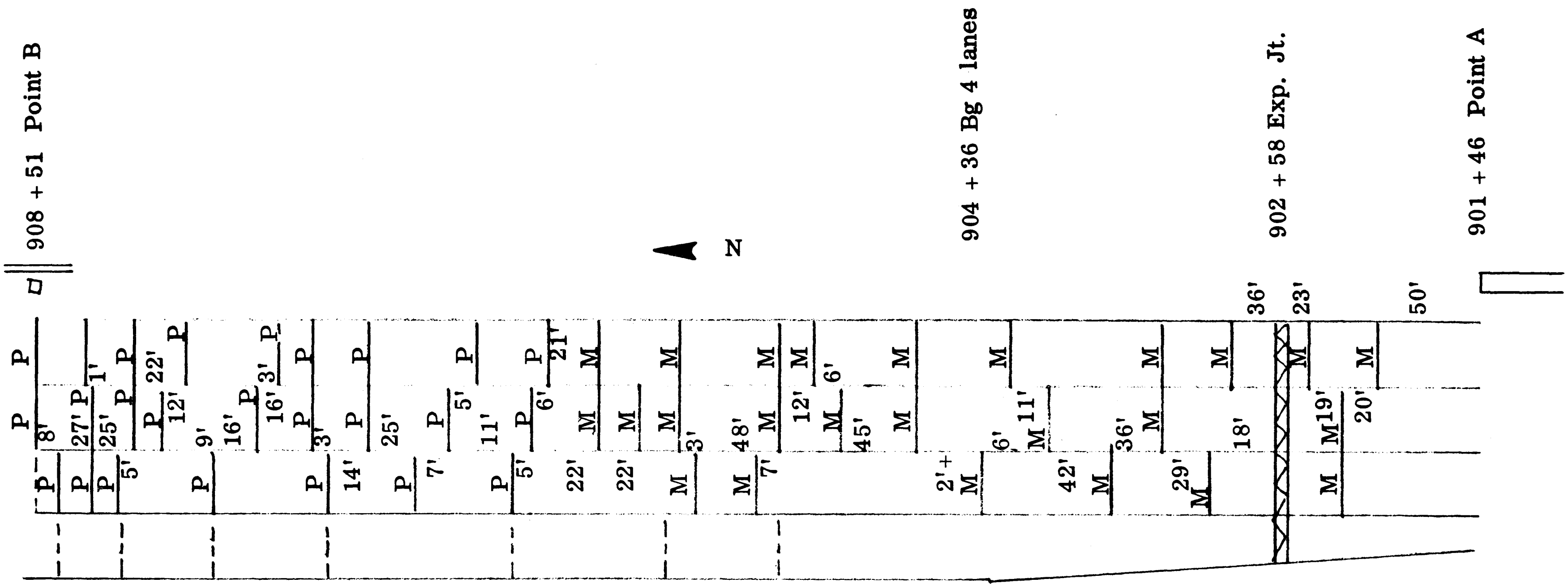


Figure 4. Site 3# — Roadway C northbound. (Not to scale.)



Point A is northeast corner of Bridge 616.

Point B is top of electrical junction box 20' north of beginning of retaining wall right of southbound lane.

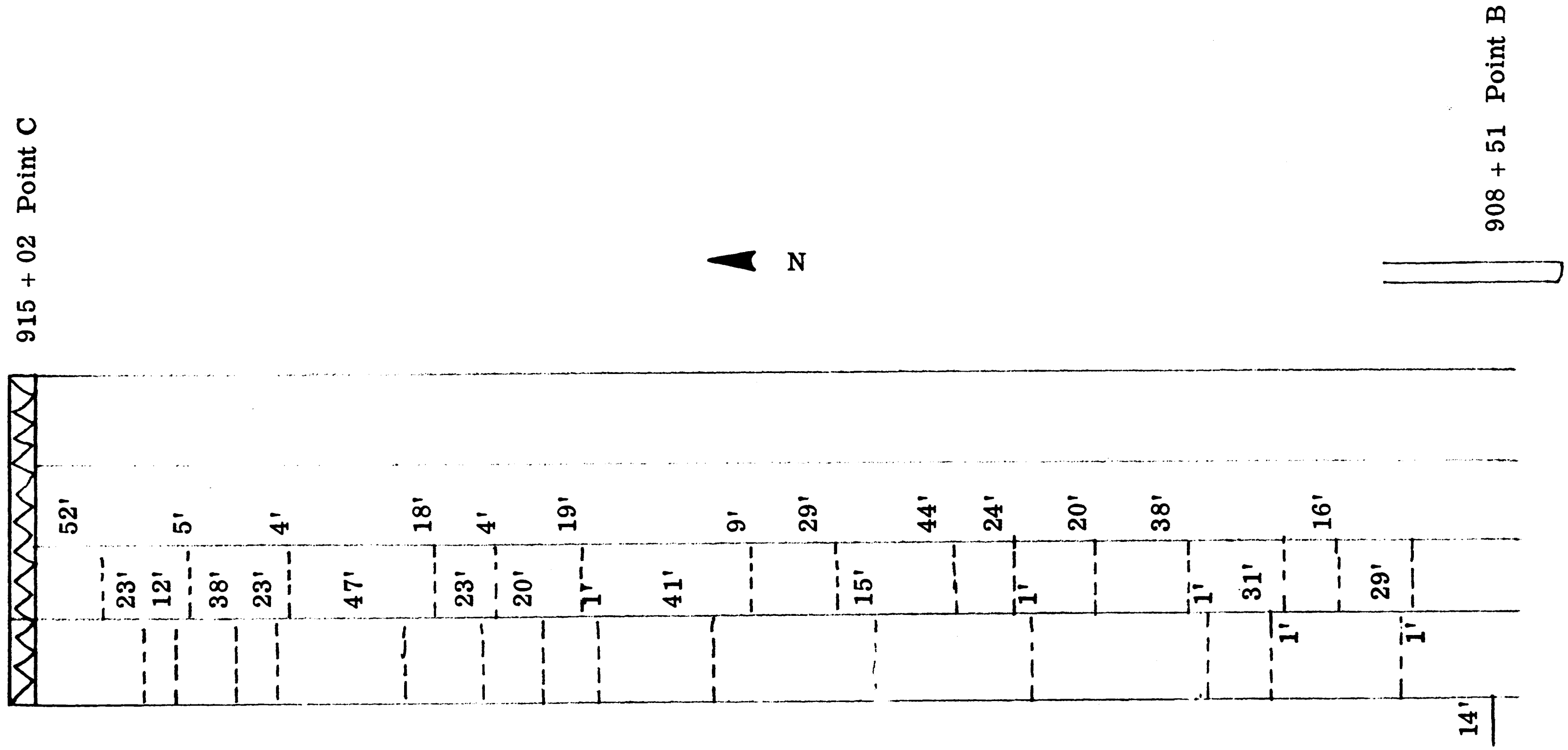
M indicates crack covered with Monsanto. Total = 25

P indicates crack covered with Petromat. Total = 25.

Dashed line indicates uncovered crack. Total = 8.

Figure 5. Site #4 — Southbound I-95. (Not to scale.)

1100



Point B is top of electrical junction box 20' north of beginning of retaining wall right of southbound lane.

Point C is expansion joint south of Bridge 621.

Dashed line indicates uncovered crack. Total cracks = 29

Figure 6. Site #5 — Southbound I-95. (Not to scale.)