

NEW JERSEY DEPARTMENT OF TRANSPORTATION

PORTLAND CEMENT CONCRETE PAVEMENT DAMAGE
DUE TO JOINT INTRUSION AND THERMAL EXPANSION

DIVISION OF RESEARCH AND EVALUATION

Bureau of Structures and Materials

March 1968

ABSTRACT

The scope of this report is to examine the possible causes of pavement damage due to the expansion cycle.

The findings are translated into recommendations for the repair and preventive maintenance of the roadway surfaces.

PORTLAND CEMENT CONCRETE PAVEMENT DAMAGE
DUE TO JOINT INTRUSION AND THERMAL EXPANSION

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1. Introduction	1
2. Inventory of pavement damages for 1966 and 1967	6
3. Investigation of representative damaged sections, with observations	26
4. Recurrences of 1966 blow-ups in 1967	37
5. Conclusion and Recommendations	43

1. INTRODUCTION

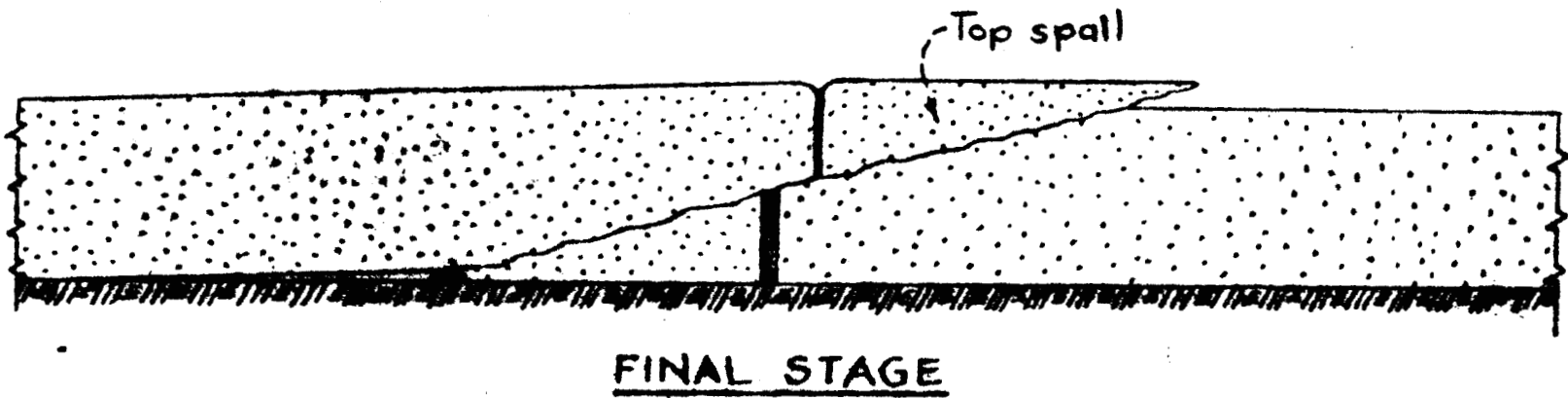
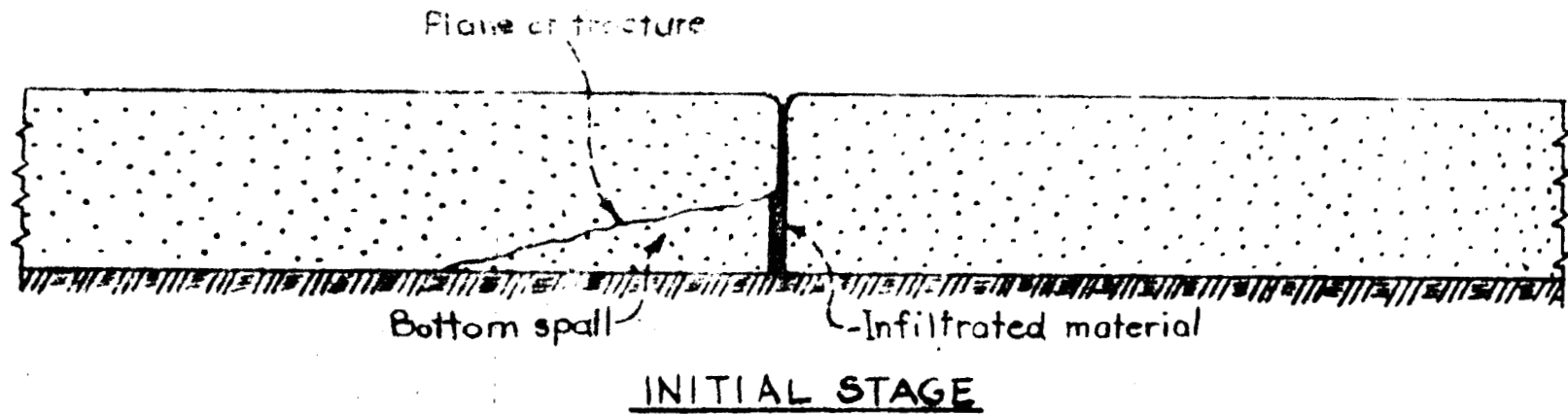
Before proceeding with this study, the following discussion is offered in an attempt to elaborate upon the various types of pavement damages that are most likely to occur.

From the time of construction, concrete pavements are exposed to environmental changes which cause excessive compressive stresses during the expansion cycle. Pavement failures due to the expansion cycle are generally referred to as spalling, rupturing, longitudinal splitting, buckling and "blow-ups"; the latter condition being a complete rupturing or violent shattering of the pavement throughout its full cross section. These failures are believed to be caused jointly by:

- a. the expansion of the pavement,
- b. excessive restraint of the closure of the joints.

Pavement expansion is directly related to the increase of the air and ground temperatures, as well as to compressive stresses throughout the entire pavement. Compressive stresses are greatly increased by the occurrence of slab movements as described in Figure 3.1.

The term slab movement as used in this report refers to the movement or migration of the slab in a horizontal direction with respect to its initially constructed position.



TYPICAL BLOW-UP AT A JOINT

FIG. 11

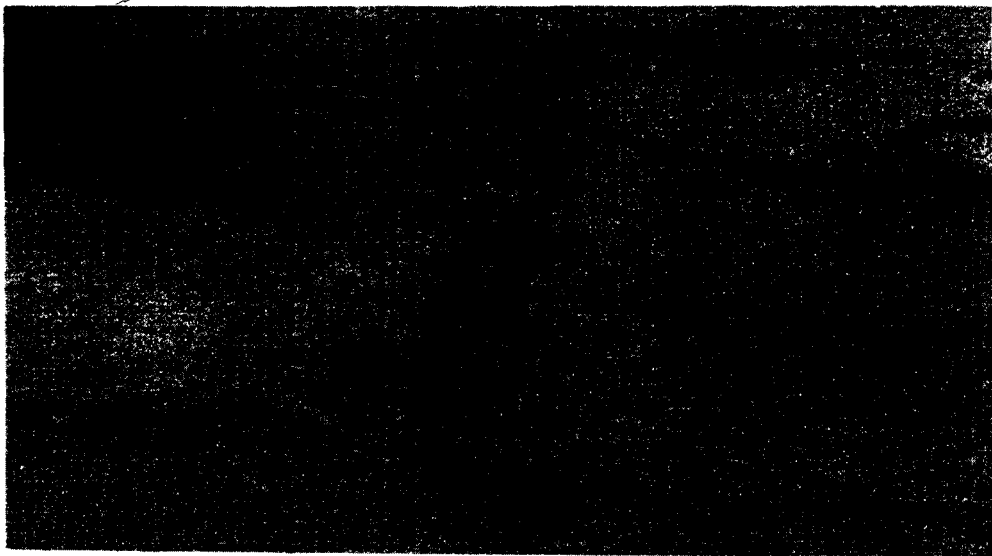
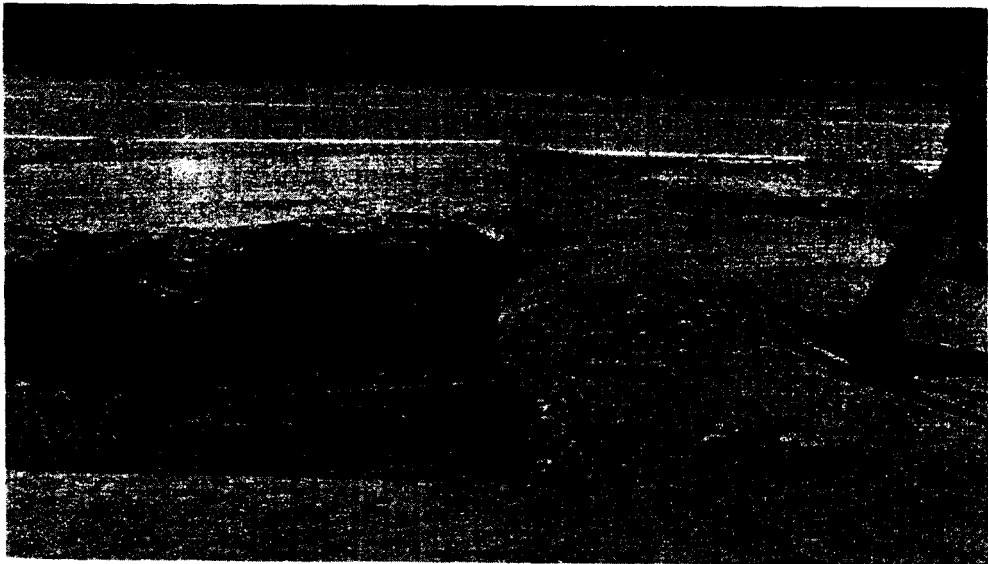


FIGURE 1.2

Joints are installed in concrete pavements to relieve excessive stress. As joints become filled with non-compressible foreign matter, they fail to function during the expansion cycle. The type of failure that results usually depends upon how these materials happen to be distributed within the joint spaces.

"In case of 'blow-ups', large accumulations of foreign non-compressible matter in the joints usually cause, first a rupturing or shearing off at the bottom of the pavement on one side of the joint; this is in turn followed by a shearing off of the top of the pavement on the opposite side of the joint. The result of this happening is a movement of the slab ends towards each other and a raising of one or both slabs".¹ The mechanics of the process are shown in Figure 1.1. Examples of "blow-ups" are shown in Figure 1.2.

An inventory of pavement damage due to blow ups, faulting of joints and cracks is presented in section 2 of this report. The items, listed in numerical order by route numbers, are for the years 1966 and 1967.

Field investigations were conducted during the summer months when pavement failures due to blow ups are most likely to occur.

Section 3 of this report deals with the findings at some typically bad sections. Photographs and typical section diagrams are used to describe the conditions and the

¹Departmental Technical Bulletin Prepared by Mr. William VanBreemen.

possible reasons ^{for} their occurrences.

Further study was thought necessary to examine the recurrence of 1966 blow-ups and other pavement failures in 1967. Attempts are made in section 4 to isolate factors relating to repeated pavement failures within certain sections of the roadway. Suggestions are offered in section 5 for the repair of blow-ups and the possible prevention of their recurrence.

2. INVENTORY OF PAVEMENT DAMAGE FOR 1966

<u>Route & Location</u>	<u>Observations</u>
Rte. 1 N.B. Lane <i>Roadway</i> Parsonage Rd. (Menlo Park)	Numerous large patches before the traffic signal. Cracks and joints recently filled. Slab movement, some settling, (1) very large crack. (see picture p. 27).
Rte. 1 N.B. Lane <i>Roadway</i> .2 mi. North of Parsonage Rd.	Three patches; wide joints, some with filler missing; numerous slab movements.
Rte. 1 N.B. at Parkway entrance	Three patches, numerous cracks and joints with sealer missing, slab movement.
Rte. 1 N.B. No. of Parkway exit, in front of Beth Israel Cemetery	Three patches settling, numerous wide cracks and joints, - sealers missing.
Rte. 1 N.B. Opposite S. Kleins Woodbridge	Three-Four old patches, pavement cracking, some slab upheaval (blow-up), some wide joints filled with foreign particles.
Rte. 1 S.B. Opposite S. Kleins Woodbridge	Three patches; (1) joint badly broken up - other joints w/sealers missing. Section at light very poor.
Rte. 1 S.B. at mile post marker 35, N. of Parkway	Numerous wide joints, 2-3 small <u>patches settling; cracks, slab movement and upheavals.</u> Very poor, old section.
Rte. 1 Parkway overpass	N.B. & S.B. - Some patches, wide joints and slab movement with traffic.
Rte. 1 So. of Parkway	S.B. - Numerous patches and slab upheaval - some cracks; joint - sealers missing.
Rte. 1 Cloverleaf Cemetery Rahway	S.B. - Numerous patches, blow-ups, slab movement with traffic.
Rte. 1 Maintenance Yard Rahway	S.B. & N.B. - Numerous cracks & patches, joints wide and filled with foreign particles.
Rte. 1 Arenal Sunoco Sta. & Esso Sta. Rahway	N.B. - Cracks and blow-ups patched in center lane. One joint after the blow-up is very wide and filled with foreign matter.

<u>Route & Location</u>	<u>Observations</u>
Rte. 1 Kawasaki Motorcycle Rahway	N.B. & S.B. - one blow-up not fixed, numerous cracks.
Rte. 1 So: of Bridge in Carteret	N.B. - Numerous poor joints which could cause blow-ups.
Rte. 1 Green St. Circle Rahway	S.B. - 4 patches across two lanes. No slab movement, but pavement heaving and cracking.
Rte. 1 Front of Texico Station North of Green St. Circle mi. post #38 S.B.	Large patch across two lanes; no slab movement but pavement heaving and cracking.
Rte. 1 Rahway - White Castle	Three large patches - Pavement upheaval - wide cracks & wide joints; old pavement needs work.
Rte. 1 Elizabeth - Anne St. S.B.	Some minor cracking of BC resurfacing at light N.B. & S.B. No blow-ups. Fairly recently resurfaced.
Rte. 1 N.B. & S.B. Opposite Sacred Heart Church Elizabeth	Pavement PCC badly cracked - joint failure and cracks. Upheaval and slab movement - area of blow-up not resurfaced but areas on both sides were recently resurfaced.
Rte. 4 under Rte. 17	PCC - Minor blow-up, slab movement with traffic. Joints cracking with sealers missing.
Rte. 9 Turnpike Exit S.B.	Numerous patches and wide joints, no slab movement.
Rte. 9 Kenny Acres S.B. Woodbridge	Numerous patches and wide joints, no slab movement.
Rte. 9 Congress Inn Woodbridge	Numerous joint failures - others patched. Cracks in slabs as with slab movement.
Rte. 9 Parkway entrance N.B. Lane	Six joints failed; (1) blow-up in left lane. Numerous cracks, joints breaking up.
Rte. 9 North of Parkway N.B. Lane	Practically every joint failed - (1) blow-up.
Rte. 9 2nd Parkway overpass N.B.	Practically every joint failed; some blow-ups.

Route & LocationObservations

Rte. 9 Tile Wholesale
N.B. Lane
Woodbridge

Practically every joint failed,
some blow-ups, patches.

NOTE: Continuous section from Parkway entrance N.B. to Tile Wholesale N.B. & S.B.; had numerous blow ups and almost every joint has failed. Slab movement or shifting in direction of traffic.

Rte. 9 Parkway Adm. Bldg.

S.B. - Joint failure and blow-ups.
Numerous cracks (see note)

Rte. 9 North of Parkway exit

S.B. (see note)

Rte. 9 Parkway Overpass

S.B. (see note)

Rte. 9 Parkway exit

S.B. (see note)

Rte. 9 New Brunswick Avenue

S.B. (see note)

Rte. 9 Majestic Avenue

S.B. (see note)

Rte. 9 Lakewood at Lake
Road

Resurfaced, cracking and upheavals
one blow-up at intersection.

Rte. 9 Lakewood at Pine St.

Resurfaced - Pavement heaving, no
blow-up as yet.

Rte. 9 Sunoco Station and
water works
Lakewood

Resurfaced - Some pavement upheaval,
no blow-up as yet.

Rte. 10 (Section 1401010)
1.9 mi. E. of Ledgewood
Circle

Joints wide - Dowel failures,
slab movement, blow-ups.

Rte. 12 (Section 1001010)
.2 mi. W. of Dvoor's Traffic
Circle Intersection
Route 12 and 523

Old patches breaking up - Numerous
other cracks in concrete. Slab
movement. One blow-up patched.

Rte. 15 (Section 1901000)
N.B. Lane opposite
Sparta Maintenance Yard

Resurfaced. Cracks across the
roadway indicate joints separating
underneath. One blow-up was cut
and patched and looked good.

Rte. 15 (Section 1901000)
S.B. Lane approximately
500' South of Sparta
Maintenance Yard

Resurfaced. Cracks across the road
indicate joint failure underneath.

Route & Location

Observations

Rte. 15 (Section 1901000)
N.B. Lane - Approximately
6 mi. North of Sparta
Maintenance Yard

Resurfaced for approximately 1 mi.
Numerous patches and separating
joints.

Rte. 15 (Section 1901000)
S.B. Lane - Approximately
2.0 mi. North of Sparta
Maintenance Yard

Resurfaced. Joints separating and
cracks across roadway; numerous
patches indicating possible blow-
ups in the past.

Rte. 15 (Section 1902000)
0.3 mi. East of Woodruffs
Sussex Co.

One blow-up patched; slab movement
against the direction of traffic.
Numerous very bad cracks.

Rte. 22 Gladson Esse
Union

Resurfaced, no blow-ups.

Rte. 22 (Section 1801000)
0.15 mi. West of Raritan
River W.B.

Resurfacing. Cracking with slab
movement under BC. Patches could
blow up - Not bad enough to need
immediate attention.

Rte. 22 (Section 1801000)
0.30 mi. West of Raritan
River

Resurfaced. Cracking and settling,
could be joint failure underneath.

Rte. 23 at Jackson Circle
Chequannock

All joints very poor; was patched,
now reopened. No slab movement.

Rte. 23 N.B. - .25 mi.
North of Pompton River
Bridge

Numerous joints recently patched,
others tight.

Rte. 23 - .5 mi. North
of Pompton Bridge

All joints were patched, now
reopening; many are cracked and
wide open.

Rte. 27 200' North of Oak
Tree Rd.

Concrete section between resurfaced
sections. No blow-ups. Bad joints
and cracking.

Rte. 27 Islin - Approach
to Parkway Bridge

No blow-ups, area recently resurfaced

Rte. 27 Metuchen (Boro
Ford)

Resurfaced. Cracks across roadway.
Numerous patches, PCC under BC is
moving.

Rte. 28 (Section 1806000)
200' E. of Gaston Avenue
Somerville

Resurfaced, joint failure and cracks.
Two blow-ups and some slab movement
under BC, 6 joints bad.

Route & Location

Observations

Rte. 29 (Section 1999000)
1 mi. N. of mm 29 Fairview
Rd.

.1 mi. No. mm 29 one large patch;
.1 mi. So. mm 29 roadway breaking
up, one blow-up.

Rte. 33 Hightstown to
Freehold E.B. Lane
mm 15

Resurfaced (in poor condition) -
Numerous patches and blow ups.

mm 16
mm 16.6

Two patches.

mm 16.9

Conc. patches (bad).

mm 17.1

Numerous patches and cracks.

mm 17.5

Pot-holes, cracks, slabs separating.

mm 17.8

Pot-holes, cracks, slabs separating.

mm 18.0

Pavement ok.

mm 19.0

Pavement ok.

mm 20.0

Few patches, otherwise ok.

mm 21.0

Large patch, otherwise ok.

Seal Cracks 21.2

Patches, cracks, .5 mi. of resur-
facing.

mm 22.0

New highway.

Seal Cracks 23.3

Numerous cracks and poor patches.

Seal Cracks, cut at dowel
24.0 at failure, patch

Int. w/527 - Numerous patches &
blow-ups - slab separation - gaps
between lanes.

mm 25.0

Fair section. Poor section at
approach to the Freehold Circle.

Rte. 33 Freehold Circle
to Hightstown W.B. Lane

Circle to mm 26

Some patches.

mm 27

Patches, cracks, 2 blow ups.

mm 25

Patches & cracks.

mm 24

Construction area very poor.

mm 23

Large patches - const. area.

<u>Route & Location</u>	<u>Observations</u>
mm 22	Dual - Excellent shape.
mm 21	Patches, cracks, blow-ups; joints otherwise tight.
mm 20	Large conc. patch, numerous small cracks, patches.
mm 19	Numerous small cracks & patches. <u>joints tight.</u>
No work needed mm 18 No work needed - to 17	Blow-ups patched - joints tight.
mm 16	Small patches (numerous) minor blow-ups. Blow-up at 16.1.
Rte. 33 (Section 1305000) Yellow Brook Rd. E.B.	Intersection just patched.
Rte. 33 (Section 1305000) Yellow Brook Rd. E.B.	Slab movement - intersection recently resurfaced.
Rte. 33 (Section 1305000) 1/4 mi. W. of Howell Rd. W.B. Lane	Four blow-ups recently patched, numerous cracks, poor joints.
Rte. 33 (Section 1305000) 3000' W. of Freehold Maintenance Yard	Four blow-ups recently patched, numerous cracks, poor joints.
Rte. 33 (Section 1305000) At Crow Hill Road W.B. Lane	Numerous slab separations and movements - cracks and blow-ups just past intersection (W.B.).
Rte. 33 (Section 1306000) Anderson's Corner Opposite V. W. Dealer 400' S. of Old Bridge Rd.	The entire section of the roadway has very recently been resurfaced.
<u>Rte. 34 (Section 1221000)</u> <u>Cheesequake</u>	
a. Madison Lumber N.B. & S.B. Lanes, Eagen Rd. to Lumber Co. 400' S. of Old Bridge Rd.	Numerous cracks, patches, slab movement - very poor joints. Slab separating & upheaving - Six blow-ups patched, breaking up.
b. Rte. 34 (Section 1307000) 300' S. of Belmar Blvd. N.B. Lane	Area has been recently resurfaced, some cracks beginning to appear.

Route & Location

Observations

Rte. 35 (Section 1310010)
200' S. Sea Girt Avenue
N.B. & S.B. Lanes

Two blow-ups patched, joints ok -
minor slab movement.

Rte. 41
Tamper Rd.

One minor blow-up across roadway,
two (2) slabs moving in both
directions in S.B. Lane.

Rte. 46 (Section 1409010)
100' E. of Mercer St.
W.B. Lane

Patches re-cracking, minor slab
movement, joints tight.

Rte. 46 (Section 1409010)
E.B. Lane & Birchwood Rd.
Denville

Six slab movements, some cracks -
very poor joints.

Rte. 46 (Section 1409010)
E.B. Lane 200' E. of
Broadway Avenue

Six slab movements, some cracks -
very poor joints.

Rte. 46 (Section 1410020)
Edwards Road to Rte. 159 -
Bloomfield Avenue E.B. &
W.B. Lanes

Joints separating & slabs raising.
This section has been resurfaced.
Slabs seem to be moving underneath
& BC is settling.

Rte. 46 (Section 2108000)
Main Street Hackettstown
0.1 mi. W. of RR

Tight joints, no cracks, no slab
movement - blow-ups have been
patched.

Rte. 46 (Section 2107000)
0.25 mi. E. of Butzville
Intersection

Joints wide, slab movement, two
slabs lifting (blow-ups?).

Rte. 46 (Section 2107000)
2.0 mi. E. of Delaware

Bad cracks - three slabs moved.
Numerous blow-ups (W.B.).

Rte. 46 (Section 2107000)
2 mi. E. of Delaware

Six or more slabs moved - numerous
blow-ups (E.B.).

Rte. 31 (Section 2111000)
Opposite Hills Diner
(S.B. Lane between Hills
& Mozart Avenue)

Slabs cracking; blow-ups patched
(re-cracking), joints wide &
cracking.

Rte. 31 (Section 2111000)
1000' N. of Asbury Int.
(S.B.)

Cracks both lanes, patches S.B.
lanes. One blow-up patched,
slab movement. Joints tight.

Rte. 31 (Section 2111000)
1500' N. of Musconetong
River (S.B.)

One blow-up across the roadway
(patched), some slab movement.

Rte. 31 (Section 2111000)
1000' N. of Rte. 24
Center lane of 3 lanes

One blow-up patched (center
lane). Numerous cracks and slab
movement.

Route & Location

Observations

Rte. 31 (Section 2111000)
0.5 mi. N. of Rte. 24
N.B. Lane

One blow-up patched (center lane). Numerous cracks and slab movements.

Rte. 31 (Section 2111000)
300' S. of Jackson Valley Rd. (W.B.)

One blow-up patched. Joints wide & cracking. Numerous patches in the area.

Rte. 31 (Section 1012000)
.5 mi. N. of Flemington Circle at RR Overpass

Both lanes patched at numerous locations now re-cracking. One blow-up with slab movement.

Rte. 31 (Section 1010000)
N.B. Lane .25 mi N. of Harborton Rd. (1/8 and 1/4 mi. N.)

Patches breaking up at joints, slab separating, joints very poor.

Rte. 70 (E.B.)
Marlton Square, Cropwell Rd. Sinclair Station

Cracks & slab movement. One blow-up (patched).

Rte. 70 (E.B.)
Old Orchard Rd. (E.B.)

Very poor joints, slab movement (continuous), one blow-up patched.

Rte. 70 (W.B.)
Cherry Hill - Markress Rd.

Very poor joints in W. B. Lane.

Rte. 70 (E.B.)
Methodist Church

Joints wide. Minor blow-ups in inside Lane (E.B.).

Rte. 71 (Section 1320000)

a. Brielle - 1000' S. of Brielle Manasquan Boundary

Recently resurfaced. (ok)

b. 2nd Avenue & Rte. 71
W.B. Lane

Recently resurfaced. (ok)

Rte. 73 Maple Shade

Resurfaced. Joints separating and pushing up sealer.

Rte. 73 Fork Landing Rd.

Resurfaced. Joints separating and pushing up sealer.

Rte. 73 Hylton Rd.

Resurfaced. Cracks at joints. One blow-up before intersection.

Rte. 73 Int. w/Church Rd. (E.B.)

Joints badly cracked (were patched, now reopened). Four slabs moved (E.B.). One blow-up at light in center of slab. (50ft. slabs).

Route & LocationObservations

Rte. 73 (Section 0313000
to 0416000)

Numerous bad joints, area being
resurfaced.

Rte. 82 Green Lane

(Numerous joint failures) - No
blow-ups. Wide joints and slab
cracking.

Rte. 82 1313 Morris Avenue

Slab movement with direction of
traffic. Good joints after the
blow-ups. Poor joints before blow-
up (wide, dirty and sealers missing).

Rte. 82 Colonia Avenue

Slab movement with traffic. Joint
failures, wide joints, many patches.

Rte. 82 Norton Avenue

Slab movement with direction of
traffic. Joint failures, wide
joints, many patches.

Rte. 82 1525 Morris Avenue

Slab movement with direction of
traffic. Joint failures, wide
joints, many patches.

Rte. 82 Cranbrook Rd.

No blow-up.

Rte. 88 (Section 1515000)
Vanzele Rd. (W.B.)

Wide joints filled with foreign
particles. Slab movement after
blow-up.

Rte. 88 (Section 1515000)
Curtis Avenue (W.B.)

Unclean wide joints. Slab move-
ment, numerous blow-ups.

Rte. 88 (Section 1515000)
Sullivan Rd. (W.B.)

Unclean wide joints, no sealers.
Some slab movement, one blow-up
patched.

Rte. 88 (Section 1515000)
Barbara PC (W.B.)
Opposite trailer park

Very unclean, wide joints; no
sealers. Some slab movement,
one blow-up patched.

Rte. 94 (Section 1909010)
0.5 mi. (E) of Beaver Run
Rd. E.B. & W.B. Lanes
(Hardyston Township)

Resurfaced, cracks appearing.

Rte. 130 N.B. Lane from
Hightstown overpass to
Cranbury Circle.
mile marker 67
to mile marker 68
" " " 69 at Int.
R. 571
to mile marker 70
Cranbury Circle

one blow-up patched.
one blow-up patched.
patch cracking.

Two patches (ok).

Route & Location

Observations

Rte. 130
N.B. Lanes to mm 74

at mile marker 74
mile marker 74.3
mile marker 74.7
mile marker 74.9
mile marker 75 to 76

Every joint poor. Nine minor blow-ups, numerous patches. One large patch, numerous cracks. Five cracks. One patch. Two large cracks, 1 blow-up. Poor patch at every joint.

Rte. 130 (S.B.)
mm 70
mm 70 - Int. w/571

Large patch at Millstone River. Numerous patches, cracks at every joint, gaps, pavement breaking up past intersection. Numerous patches, gaps, slab movement. Joints very poor. good - Resurfaced.

mm 68

mm 67
67 to Rte. 33

Rte. 130 (S.B.)
mile marker 76
to mile marker 75
to mile marker 74.6

Numerous cracks, patches & blow-ups. Large patch and blow-up at every joint. All joints breaking up. (Very poor section of the road).

to mile marker 74

Rte. 130 (S.B.)
mile marker 74 to 73

mile marker 73 to 72
mile marker 72 to 71

mile marker 71 to 70
(Circle)

Cracks, blow-up, gaps, at every joint. Numerous cracks, holes, poor joints. Numerous blow-ups, holes, cracks & poor patches. All joints poor. Resurfaced southbound only.

Rte. 166
1 mi. N. of Beachwood
Boulevard, N.B. Lane

1000' of slab moving (N). Joints cracked & wide. Some blow-ups filled. (Dowel Failure).

Rte. 166
.1 mi. N. of Beachwood
Boulevard, S.B. Lane

1000' of slab moving (N). Joints cracked & wide. Some blow-ups filled. (Dowel Failure).

Rte. 166
.5 mi. N. of Beachwood
Boulevard (just before
black top)

Numerous cracks N.B. one blow-up, joints poor.

Rte. 166
at Int., Flint Avenue
(Resurfaced)

Black top cracking at the PCC, joints (settling) in both lanes.

Route & Location

Observations

Rte. 168
Mt. Ephraim - 4th Avenue

One blow-up, slab movement.

Rte. 168
Audubon; Marlborough Avenue

Blow-up across all three lanes.
Pavement uplifting; slab movement.

Rte. 168
Fairmount Avenue,
Blackwood

Conc. patches. Two slabs out of alignment (middle lane).

Rte. 168
Old Black Horse Pike
(Blenkefm)

One patch in middle of the road (both lanes). Joints wide, slab movement.

Rte. 202 (Section 1807000)
N.B. Lane, 1.2 mi.
S. of Reading & South
Branch turnoff

N.B. Lane two blow-ups with large patches. Joints cracking & wide. Very poor, 1.2 mi. S. of turnoff. One blow-up at patch, numerous other cracks.

Rte. 202 (Section 1020000)
At intersection w/69
(in Ringoes)

Was patched; re-cracking. Joints separating.

Rte. 206 (Section 1810010)
0.4 S. of New Anwell Rd.

PCC cracking, joint failures. One blow-up patched, slab movement with traffic.

Rte. 206 (Section 1810010)
300' S. of Hillsborough Rd.

(PCC) joint failure and wide joints with cracking. Slab movement with traffic. One blow-up.

Rte. 439 Decker Avenue
Elizabeth

(N.B. & S.B.) blow-ups, patches, slab movement on either side of the blow-ups. Joints filled (O.K.).

Rte. 439 Irvington Avenue
Elizabeth

(N.B. & S.B.) all joints failed. Three blow-ups. Slab movement with traffic, cracks, some slab upheaval.

Rte. 439 Front of Newark
College, Elizabeth

Wide joints, blow in (N.B.) Right Lane, slab movement with traffic.

Rte. 439 Inter. Rte. 82
Elizabeth

Recently resurfaced.

Rte. 439 Union Avenue
Elizabeth

Joint failures and blow-ups. Slab movement with traffic (both lanes).

Route & Location

Observations

Rte. 439 Salm Avenue
Elizabeth

Joint failures and blow-ups. Slab
movement with traffic (both lanes).

Rte. 439 Stanton Avenue
Elizabeth

Joint failures and blow-ups. Slab
movement with traffic (both lanes).

Rte. 439 Cross Avenue
Elizabeth

Joint failures and blow-ups. Slab
movement with traffic (both lanes)

INVENTORY OF PAVEMENT DAMAGE FOR 1967

<u>Route & Location</u>	<u>Observations</u>
Rte. 1 (Section 1202000) 100' S. of Mile marker #27 N.B. Lane	Wide joints, sealer missing, slab movement Type #1. (see typical section).
Rte. 1 (Section 1102020) .02 N. of Milepost #5 N.B. Lane	Resurfacing pushing up thru pavement, no blow-up yet.
Rte. 1 (Section 1102020) 50' N. of Milepost #6 N.B. Lane	Resurfaced. Patches and cracks across roadway.
Rte. 1 (Section 1102020) .2 mi. N. of Milepost #6	Resurfacing, cracking across roadway. Some small patches.
Rte. 1 (Section 1102020) .8 mi. N. of Milepost #7	Resurfacing, cracking across roadway.
Rte. 1, 75 yards N. of Milepost #7	Resurfaced. Some pavement upheaval that may develop into blow-ups at a later date.
Rte. 1 (Section 1201000) 1800' S. of Milepost #19	BC cracking at PCC joints; slab movement.
Rte. 4 Under Rt. 17 Center Lane Eastbound	(PCC) slab movement with traffic Type (1). Wide and dirty joints.
Rte. 9 (Section 1301000) 1500' N. of Milepost #110	(PCC) numerous patches and slab movements. (Type #1) Joints recently resealed. Pavement old and in poor condition. Very heavily travelled roadway.
Rte. 9 (Section 1301000) 1000' S. of Milepost #110	(PCC) slab movement (Type #2). Some upheaval, patches. Joints filled recently.
Rte. 9 (Section 1301000) 1400' S. of Milepost #107	(PCC) joints wide and dirty. Slab movement (Type #1).
Rte. 9 150' S. of Milepost #98	(BC) numerous patches, some cracks at joints.
Rte. 9 (Section 1207000) .5 mi. N. of Milepost #129	*

Route & Location

Observations

Rte. 17
Paramus, Northbound at
Parkway Exit

(PCC) slab movement (Type #2).
Joints are tight and filled.
Some bad cracks with slabs.

Rte. 17
Ridgewood, Left Lane N.B.

(PCC) all joints in left lane are
patched. Slab cracking, no move-
ment.

Rte. 17
Ramsey Left Lane S.B., N.B.

(S.B.) - PCC - joint failure.
Joints are wide and dirty, no slab
movement.

(N.B.) - PCC - patches, joints
before and after patches are
cracking.

Rte. 17
Mahwah, Center Lane, S.B.

PCC - wide joints, joint failure
and cracking, slab upheaval at
blow-up.

Rte. 17
Carlstadt, S. of Division
Avenue, Southbound

Resurfaced, numerous cracks and
upheaval at joints of PCC. Slab
underneath moving.

Rte. 17
Hasbrouck Heights, 100'
before Rte. 46, Center
Lane, N.B.

(PCC) joints very wide & sealers
missing. Numerous cracks, some
patches that could become blow-
ups later.

Rte. 17
150' N. of Rte. 46, 2
lanes, N.B.

(PCC) joints very wide & sealer
missing. Numerous cracks, some
patches that could be blow-ups
later.

Rte. 17
Lodi, Robinson Rd., 3
lanes, S.B.

Resurfaced. Upheaval in 3 lanes,
resurfacing is cracking at PCC
joints.

Rte. 26 (Section 1215000)
Coca Cola Plant, .5 mi. E.
of Rte. 1, N.B. and S.B.

(PCC) slab movement with traffic
(Type #1). Joint sealers missing,
numerous patches.

Rte. 26 (Section 1215000)
Brown Bover, 1 mi. from
Rte. 1

(PCC) slab movement with traffic
(Type #1). Joint sealers missing,
numerous patches.

Rte. 26 (Section 1215000)
Brown Bover

(PCC) slab movement with traffic
(Type #1). Joint sealers missing,
numerous patches.

Rte. 27 (Section 1105000)
18 mi. S. of mm #2

Resurfaced. Area is patched and
there are many cracks. Joints
separating in both lanes. Slab
movement under resurfacing.

Route & LocationObservations

Rte. 29 (Section 1110000)
14 blow ups between 400'
N. of #8 & 1000' S. of #9
North and South Bound

Resurfacing is separating at the
PCC joints and is pushing up.
Patches were apparently blow-ups.
Many cracks.

Rte. 31 (Section 1118000)
Carlton Avenue, Ewing Twp.
S.B.

Resurfaced. One large patch in
S.B. lane, it appears that slabs
under resurfacing are moving.

Rte. 31 (Section 1118000)
.5 mi. N. of Milepost #12

(PCC) large patch and much cracking.
Wide joints and slab movement with
traffic (down hill) (Type #1).

Rte. 31 (Section 1118000)
Approach to R.R. Bridge
N. of Pennington Circle,
S. of Eggomatic

(PCC) patches, slab movement with
traffic (Type #1). Wide and dirty
joints, much cracking.

Rte. 33 (Section 1306000)
600' E. of Milepost #38 W.B.

(PCC) wide joints, slab movement
(Type #1), no blow-ups.

Rte. 33 (Section 1305000)
.2 mi. W. of Milepost #31

(PCC) one blow-up, slab movement
(Type #1), very wide joints.

Rte. 33 (Section 1305000)
.5 mi. E. of Milepost #30

(PCC) blow-up and bad cracks.
Slab movement (Type #2).

Rte. 33 (Section 1305000)
.1 mi. E. of Milepost #28

(PCC) blow-ups no sealers in joints,
joints dirty and cracked.

Rte. 34 (Section 1307000)
.2 mi. N. of Milepost #3

(PCC) blow-ups, wide joints, slab
movement (Type #1), slab upheaval.

Rte. 35 (Section 1311000)
Westside Albany Rd.,
Manasquan

(PCC) large BC patch; wide joints
both sides of patch. slab move-
ment (Type #1).

Rte. 35 (Section 1311010)
Belle Place, Neptune, S.B.

(PCC) numerous bad joints and
patches. Sealer pushing out of
joints. Blow-up at end of moving
slabs (Type #1).

Rte. 35 (Section 1311010)
Munroe Avenue, Neptune S.B.

(PCC) numerous bad joints and
patches. Sealer pushing out of
joints. One blow-up at end of
moving slabs (Type #1).

Rte. 35 (Section 1222010)
Cheesequake, 1/4 mi. N. of
Pirate Ship

Resurfaced. Cracking across road-
way.

Rte. 36 (Section 1315030)
Atlantic Highlands, 3rd
Avenue, E.B.

Resurfaced. PCC under resurfacing
is separating, numerous patches.

Route & Location

Observations

Rte. 36 (Section 1315030)
Atlantic Highlands, Central
Avenue

Resurfacing is cracking and PCC
slabs underneath moving.

Rte. 36 (Section 1315030)
Atlantic Highlands, 7th
Avenue

Resurfacing is cracking and PCC
slabs underneath moving.

Rte. 46
W. of Great Notch Rd.
Right Lane

Resurfaced. Numerous cracks,
two patches in right lane.

Rte. 46
W. of Browertown Rd.
Center Lane

Resurfaced. Numerous cracks,
no blow-ups.

Rte. 46
E. of McBride Avenue
Right Lane

Resurfaced. Numerous cracks,
no blow-ups.

Rte. 46
Eastbound between Notch Rd.
and Valley Rd.

Resurfaced. Numerous cracks and
joints separating. No blow-ups.

Rte. 46
Westbound, 100' W. of Rte.
17, Hasbrouch Heights

(PCC) joints very wide & sealers
missing. Numerous cracks and
patches.

Rte. 70 between Milepost #8
and #9
Medford

(PCC) patch at Locust Avenue.
Patch at Cooper Avenue. Slab
movement (Type #1). Joints are
separating and sealers are missing.

Rte. 70 between Milepost #10
& #11, Elmwood Rd.
Medford

(PCC) blow-ups, slab movement with
traffic (Type #1), joints are tight.

Rte. 70 100 yards W. of
Milepost #11
Medford

(PCC) joints right and have just
been filled. No slab movement
(Type #4).

Rte. 70 between #11 & #12
Medford

(PCC) joints were recently sealed,
(1) blow-up.

Rte. 70 between #12 & #13
Medford

(PCC) pot holes and patches. Slab
movement (Type #1).

Rte. 70 between #13 and
Medford
Medford

(PCC) pot holes and patches, slab
movement (Type #1).

Rte. 70 Entrance to Catholic
School
Medford

(PCC) joints cracking up and
separating. Blow-up in W.B. lane.
No slab movements (Type #4).

Route & LocationObservations

Rte. 71 (Section 1320000) .3 mi. S. of Marker #3	Resurfaced, numerous patches, wide joints, slab movement (Type #1).
Rte. 71 (Section 1320000) .1 mi N. of MMarker #3	(PCC) patches, wide joints, slab movement (Type #1), four slabs involved.
Rte. 71 (Section 1320000) .4 mi. S. of #3	Resurfacing - no blow-ups.
Rte. 88 (Section 1515000) .3 mi. W. of Marker #6	(PCC) patches, cracks in pavement, slab movement (Type #1).
Rte. 88 (Section 1514010) 1200' E. of Marker #2	Resurfaced. Some patches, the concrete underneath is moving.
Rte. 88 (Section 1515000) .1 mi. E. of Marker #7	(PCC) blow-up patched and again breaking up; joints wide and dirty, sealer missing.
Rte 91 (Section 1225000) .5 mi. E. of Rte. #1 Genito Machine & Tool Co.	PCC and resurfacing. Slab cracking and wide joints.
Rte. 91 (Section 1225000) 200' W. of Howe Lane	(PCC) joints very poor, slab movement (Type #1). Slabs heaving.
Rte. 91 (Section 1225000) E. Howe Lane Triangle Cable	(PCC) wide joints, no sealer. Slab movement (Type #1). Two portions w/wide patch.
Rte. 130 (Section 1227001) 500' N. of Marker #70	PCC - very poor joints - wide and dirty - pothole and bad cracks.
Rte. 130 S.B. Lane 500' S. of mm 79	Very bad crack, three blow-ups, pavement rising, joints separating no sealer.
Rte. 130 S.B., mm 79-78	Very poor joints - sealers missing.
Rte. 130 S.B., mm 78	Three blow-ups at joints, sealers missing and dirty.
Rte. 130 N.B., mm 78	Numerous patches & joint failures. Joints very dirty, sealers missing.
Rte. 130 mm 77-76	Numerous joints cracked, very dirty.
Rte. 130 mm 76 N.B. Lane	Numerous blow-ups, all joints very bad.

Route & Location

Observations

Rte. 130 (S.B. Lane)
between mm 72 and 75

Right lane: practically every joint has failed. Old patches breaking up, joint fillers missing, joints very dirty.

Rte. 130 (S.B. Lane)
mm 72 Cranbury cut off

Joints very poor, dirty, sealers missing. Slab movement.

Rte. 130 S.B., mm 72-71

One blow-up; other joints failing, numerous patches breaking up. Practically every joint needs cleaning and sealing - (slab movement).

Rte. 130 S.B., mm 71 to 69
mm 70

Numerous patches, practically every joint dirty, fillers missing. Deep potholes, slab movement.

Rte. 130 S.B.
500' N. of mm 55

Three blow-ups patched, slab movement, numerous dirty unfilled joints.

Rte. 130 S.B.
.1 mi. S. of mm 52

Numerous patches, wide joints, pavement upheaval at joints. Joints very dirty - no fillers.

Rte. 130 N.B.
.1 mi N. of mm 50

One large patch, other minor cracks. Other patches breaking up - numerous joints very dirty - no sealers.

Rte. 130 N.B.
0.9 mi. N. of mm 50 cut off to Florence

One joint failure - two other patches. Joints otherwise recently filled.

Rte. 130 N.B.
.4 mi. N. of mm 51

One patch - new; most joints recently sealed. One joint breaking up.

Rte. 130 N.B.
.4 mi. N. of mm 52

One joint breaking up - others very dirty, fillers missing.

Rte. 206
.9 mi. N. of mm 47

Resurfaced. Bad cracks with pavement upheaval.

Rte. 206
.2 mi. N. of mm 47

Resurfaced. Numerous large patches in N.B. lane. Cracks, some very large.

Rte. 206
.2 mi N. of mm 48

Resurfaced. Pavement upheaval across roadway, slight cracking. No blow-up yet.

Rte. 206
.9 mi. N. of mm 50

Resurfaced. Pavement upheaval may develop into blow-ups.

Route & LocationObservations

Rte. 206 at mm 52	Resurfaced. Roadway badly cracked and breaking up.
Rte. 206 at mm 53	Resurfaced. Roadway in good shape.
Rte. 206 .8 mi. S. of mm 55	Concrete. Numerous patches, joints tight and well sealed.
Rte. 206 .5 mi. S. of mm 55 (N.B. & S.B. Lanes)	Concrete. Numerous cracks, joints tight and well sealed.
Rte. 206 mm 13-14	Resurfaced. Joints separating and dirty. Two blow-ups at Tabernacle Rd. (S.B. lane).
Rte. 206 mm 10-12	Resurfaced. Some large patches South of mm 12. Some minor blow-ups at mm 12. Some other blow-ups and cracks.
Rte. 206 mm 6-8	Resurfaced. Joints separating. Patches & blow-ups South of mm 8. Cracks at R.R. (mm 6-7). Numerous other cracks.
Rte. 206 mm 47	Resurfaced. large patches in S.B. lane. (Resurfacing is cracking).
Rte. 206 .1 mi. S. of mm 48	Resurfaced. Numerous cracks and pavement upheaval. No actual blow-ups yet.
Rte. 206 at mm 48 N.B. and S.B. Lanes	Resurfaced - surface cracking. Some upheaval - no blow-up yet.
Rte. 206 between mm 22 and 23 (N.B. Lane)	One patch at joint breaking up, some dirty unfilled joints.
Rte. 206 Pemberton to Vincetown Rd. (N.B. and S.B.)	Resurfaced. Joints separating, BC cracking at practically every joint. In some cases, conc. shows thru. Slab movement underneath.
Rte. 206 mm 20-21 (N.B.) N. of Buddtown-Vincetown Rd.	Resurfaced. Blow-ups, BC separating at PCC joints. Bad cracks (S.B. lane) - pavement raising at joints.
Rte. 206 Wills Mobile Station	Resurfaced, bad cracks at joints. Blow-ups in both lanes.

Route & Location

Observations

Rte. 206 (State Police)
N. of mm 17

Resurfaced. Bad cracks, joints separating (very poor section).

Rte. 206 between mm 15 & 16

Resurfacing is cracking. Joints seem to be separating. No blow-ups visible.

Rte. 206
Hawkins Rd.

Resurfaced. Bad joints and cracks.

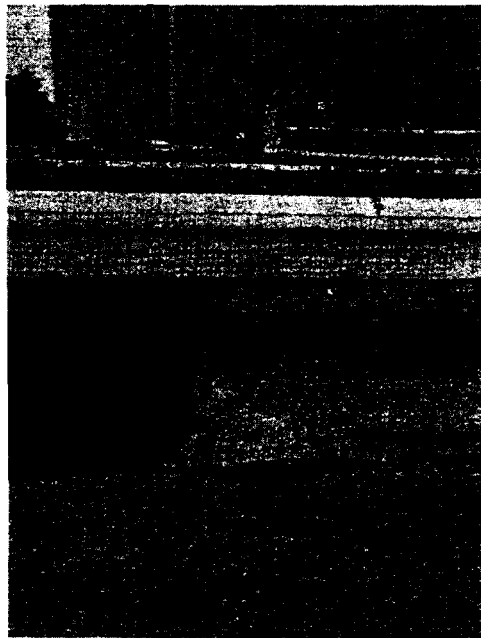
Rte. 206
Medford Lakes Rd.

Resurfaced. Joints separating and dirty. No blow-ups visible.

3.0 Investigation and Observations

A better understanding of the nature of blow-ups may be gained by examining some of the examples and photographs taken at blow-up sites. Typical section diagrams and a discussion of findings are presented at the end of this section.

The photograph below shows a section of the north-bound roadway on Route 1 near the Menlo Park Shopping Center. The large patch on the left in the picture is the result of repair to a previous "blow-up". This patch has again cracked very badly and is settling.



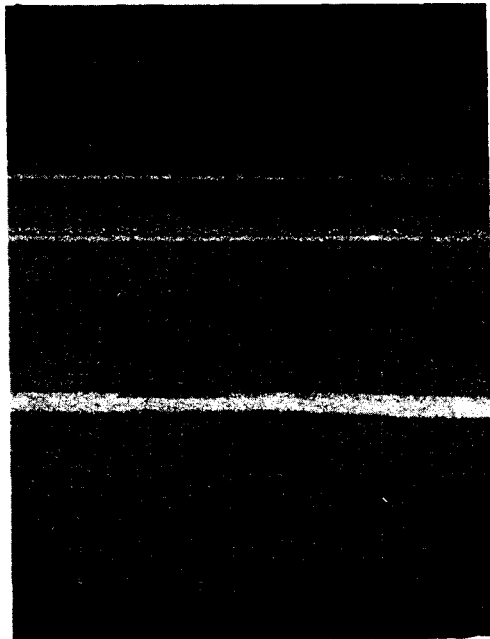
In studying some of the characteristics prevalent in the areas of blow-ups, it was generally found that slab movement and poor joints were common both before and after the section that failed.

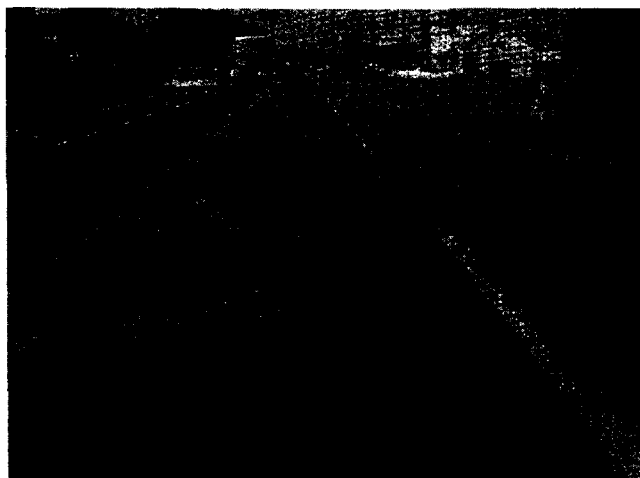


The photograph above shows a typical section on Route 9 where there was considerable slab movement and joints filled with foreign incompressible materials just prior to the section that had failed. This incompressible material in effect will prevent the joints from functioning properly. The lower slab is seen to move to the right with the blow up a few feet to the right at the next joint.

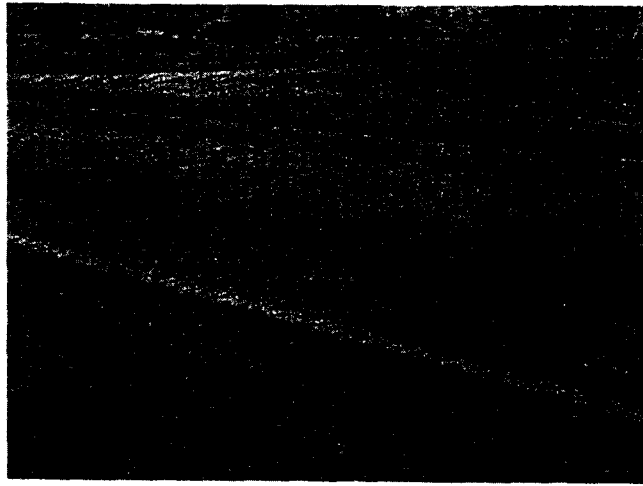
Numerous reports of blow-ups of resurfaced areas were investigated. At many of these locations reflection cracks were found. These cracks would seem to indicate joint malfunction, possibly due to not cleaning the joints prior to resurfacing; see example on previous page. These cracks were always noticed in the vicinity of the blow-ups.

The photograph shown below was taken on Route 29 between milepost 8 and 9. It shows that the resurfacing has cracked at the joints. Notice that in the far lane the crack is a distinct line, whereas, the surface in the nearer lane has cracked and is beginning to push up. This location could very possibly be the beginning of a future blow-up. Many blow-ups were found on this section of Route 29.

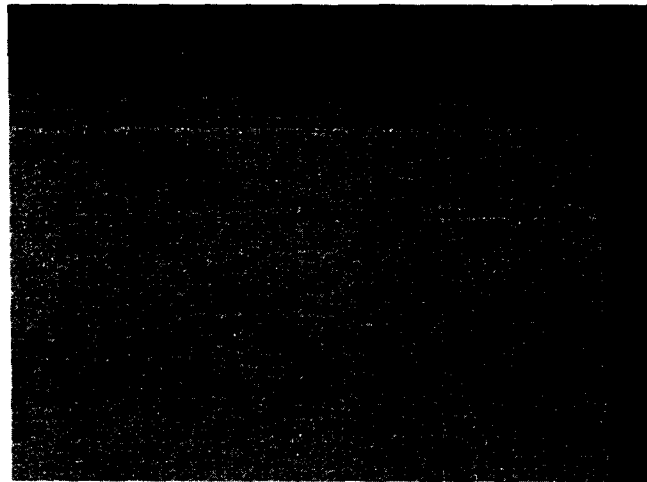




The above photograph was taken on Route 33 (W.B. Lane) entering Hightstown. Blow-ups and poor joints are observed along with scaling of the resurfacing. This section of the roadway was found to rise, indicating possible joint failure and blow-ups of the concrete slabs under the resurfacing.



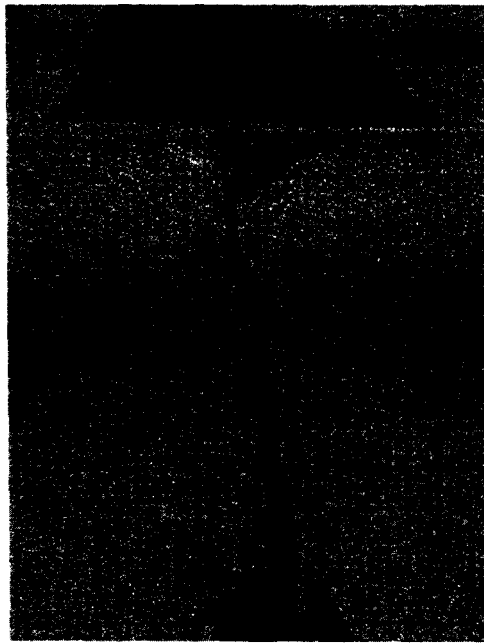
The above photograph, taken on Route 33 in Freehold, shows an experimental concrete patch in an area where blow-ups were numerous. In this case, repeated blow-ups at this point required the replacement of a portion of two concrete slabs; the joint was rebuilt. The patch-work and the joint were found to be in good shape.



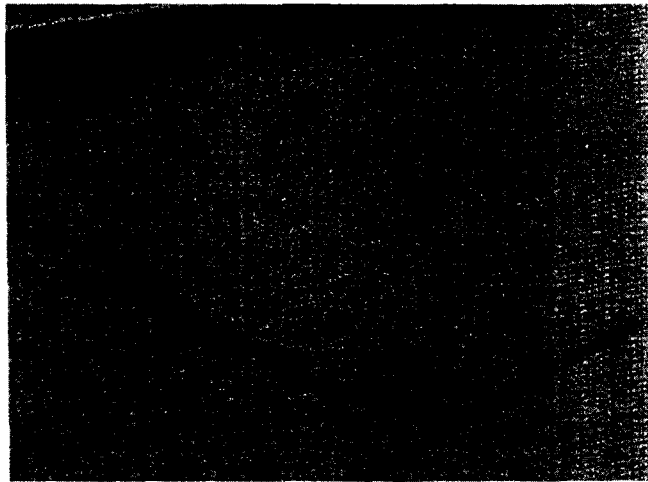
The photograph above shows a typical section at a blow-up on Route 33 between Hightstown and Freehold. The pavement is seen to rise at the crack.


Another road that was found to be in poor condition was Route 88. Numerous sections were investigated and the photograph below is of a representative section. It may be noted that the patch at the top of the picture has been repatched quite recently.

The malfunctioning of this joint (lower lane) has caused the concrete to crack at the bottom of the photograph below and at the center line. The pavement is seen to rise slightly. This section could very possibly be the site of a future blow-up.



A survey of Route 130 showed numerous sections of poor roadway in both the northbound and southbound directions. A representative blow-up section was selected at milepost #79 (S.B. Lane). The photograph below shows a very deep, wide crack and the pavement is seen to rise. Another blow-up was repaired quite recently in the adjacent lane (top of picture).



In order to gain some knowledge of pavement conditions in the general vicinity of the blow-up, some typical sections are presented and discussed ^{later} .

Other examples of recurring blow-ups may be found on Route 130 Southbound, in the vicinity of milepost #72, between Cranbury Circle and Deans. In this section of the roadway, recurring "blow-ups" were found within a few hundred feet and in some instances only 50 to 100 feet apart. This section of the roadway had numerous joint failures, severe pavement cracking and much slab movement. It was noticed that the blow-ups in this section always occurred in the direction of traffic, after the slab movement. This portion of the roadway contains channel drains, that could possibly have corroded and seized, thereby preventing the proper functioning of the joints and causing blow-ups.

Generally, pavement "blow-ups" did not occur on new pavements. In older pavements, the load transfer devices were the most common source of joint failures and the possible cause for blow-ups. When too many load transfer devices fail to function properly, blow-ups are likely to occur at elevated temperatures. Joint failures may result when these load transfer devices corroded or the joints were allowed to fill with foreign particles, preventing the joints from functioning properly.

Some of the most common blow-up sections are shown in Figure 3.1; they are:

1. Slab movement in the direction of traffic, with a blow-up at the end of the movement.
2. Slab movement in both directions, with blow-ups somewhere in the middle of the movement.
3. Slab movement against the direction of traffic, with blow-ups at the end of the movement.
4. No slab movement, but usually joint failures on both sides of the blow-up.

"Blow-ups" were also observed at locations where the concrete roadways had been resurfaced. Concrete slabs under the bituminous concrete were restricted in their movements and the joints were unable to function properly, resulting in the cracking and upheaval of the resurfacing.

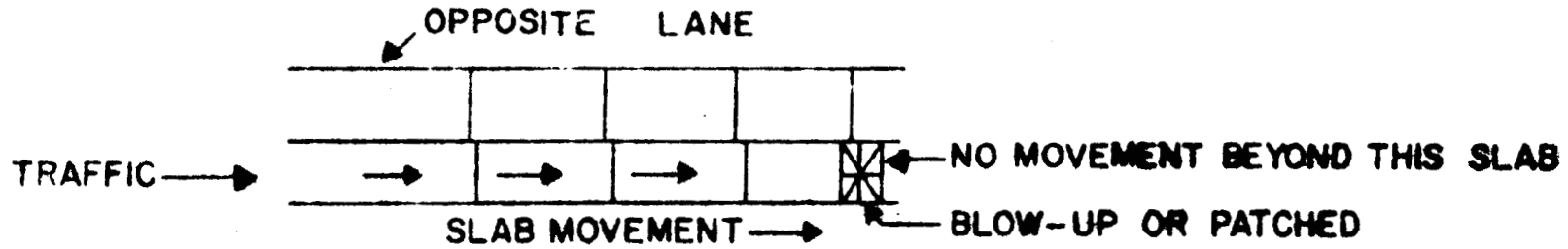
When the non-functioning joints are not repaired, repeated blow-ups may result. A survey of Route 33 shows that this route is plagued with poor joints, patches and blow-ups

TYPICAL SECTIONS AT BLOW-UPS.

TYPE 1

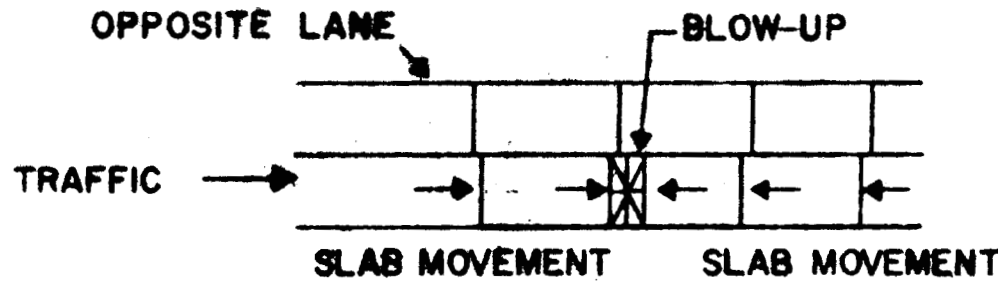
SLAB MOVEMENT IN THE DIRECTION OF TRAFFIC

FIG 3.1



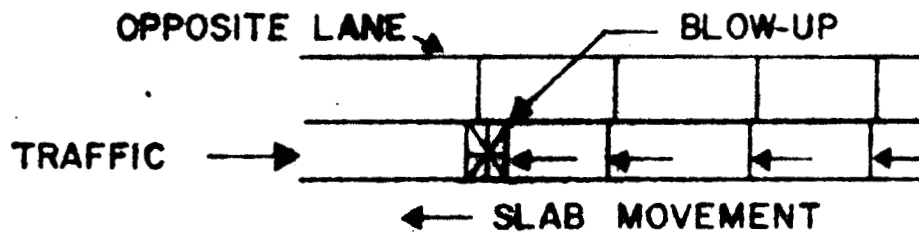
TYPE 2

SLAB MOVEMENT BOTH WAYS AND BLOW BETWEEN.



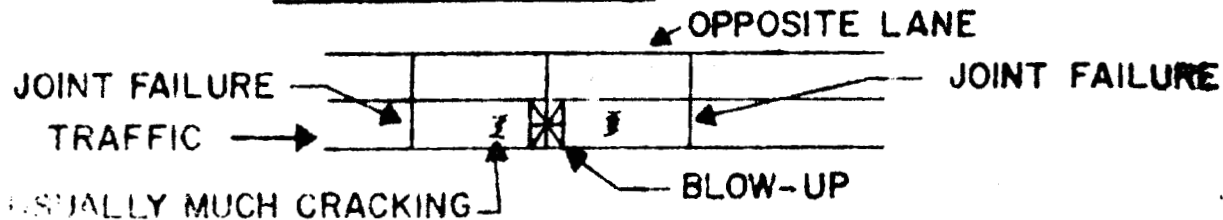
TYPE 3

SLAB MOVEMENT AGAINST TRAFFIC



TYPE 4

NO SLAB MOVEMENT



61
62

It was possible to isolate sections 150 feet to 300 feet apart where repeated blow-ups had occurred. The joints in these sections were found to be unsealed and full of stones and foreign particles.

4.0 Recurrence of 1966 Blow-Ups in 1967

Blow-up recurrences are identified and located by route number, section number, milepost numbers and road names.

A list of the few recurrences studied follows:

Rte. 33

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1305000	1. Yellow Brook Rd. mm 32.5	W.B.
	2. Howell Rd., 1/4 mile West in the W.B. lane mm 30.5	W.B.
	3. Crow Hill Rd., W.B. Lane mm 29.8	W.B.
	4. Freehold Maintenance Yard 3000' W., W.B. Lane	W.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. at milepost #30.8	W.B.
	2. at milepost #30.5	W.B.
	3. at milepost #28.1	W.B.

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1115010	1. at milepost #15	E.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. 600' E. of mm 15	E.B.

Rte. 88

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1515000	1. Sullivan Rd. at 100' E. of mm 7.0	W.B.
	2. 100' E. Barbara Place, milepost 5.7	W.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. at milepost 7.1	W.B.
	2. at milepost 5.7	W.B.

Rte. 130

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
0317010	1. at milepost 47.3	S.B.
	2. at milepost 48.2	S.B.
	3. at milepost 52.4	N.B.
	4. at milepost 52.6	S.B.
	5. at milepost 53.7	S.B.
	6. at milepost 55.4	N.B.
	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
	1. at milepost 50.1	N.B.
	2. at milepost 50.9	N.B.
	3. at milepost 51.4	N.B.
	4. at milepost 51.9	S.B.
	5. at milepost 52.4	N.B.
	6. at milepost 54.7	S.B.

Rte. 130

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1227001	1. Scott's Corner to Cranbury Circle	N.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. 500' N. of milepost 70	N.B.
	2. 200' S. of milepost 76	N.B.
	3. 100' S. of milepost 78	N.B.

Rte. 130

<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1227010	Scott's Corner to Deans	S.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. 500' S. of milepost 79	S.B.
	2. 75' N. of milepost 78	S.B.
	3. 1500' S. of milepost 74	S.B.
	4. 50' N. of milepost 73	S.B.

Rte. 130

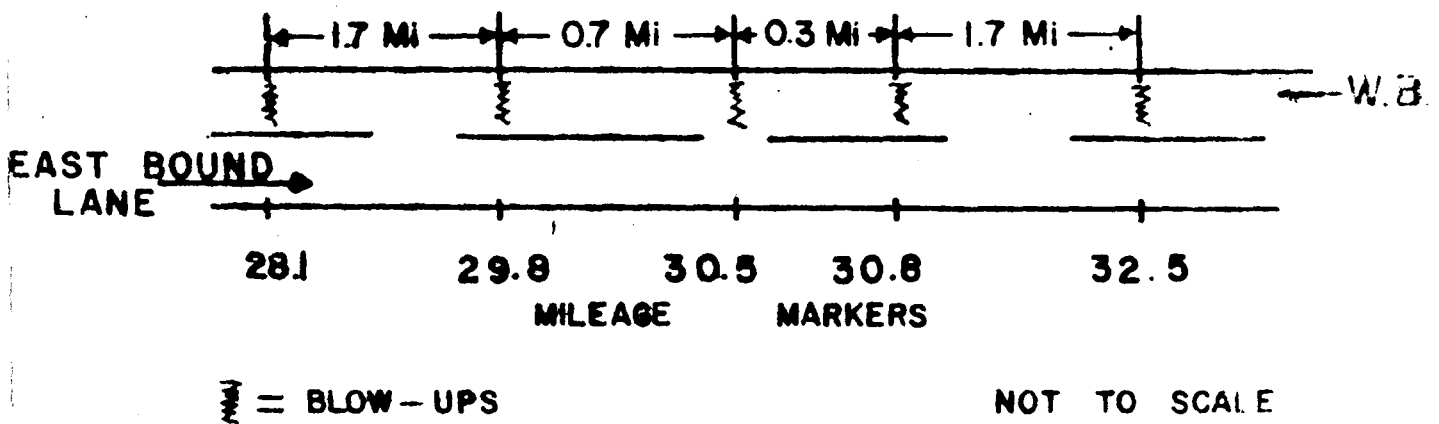
<u>Section Number</u>	<u>Location of 1966 Blow Ups</u>	<u>Lane</u>
1227000	1.-2. Scott's Corner to Cranbury Circle	S.B.
	<u>Location of 1967 Blow Ups</u>	<u>Lane</u>
	1. 2500' S. of milepost 72	S.B.
	2. 4000' S. of milepost 71	S.B.

A few selected examples of recurring blow-ups are discussed below and may be considered as representative samples.

Route 33 Section 1305000

Recurrences of 1966 blow-ups in 1967 may be exemplified in section 1305000 between milepost number 28.1 and milepost number 32.5. A survey of this section indicated numerous joint failures and slab movements both before and after the blow-ups. Slab movement was continuous in the westbound lane from one blow-up to another. Figure 4.1 below, shows the frequency of blow-ups in this section.

FIGURE 4.1

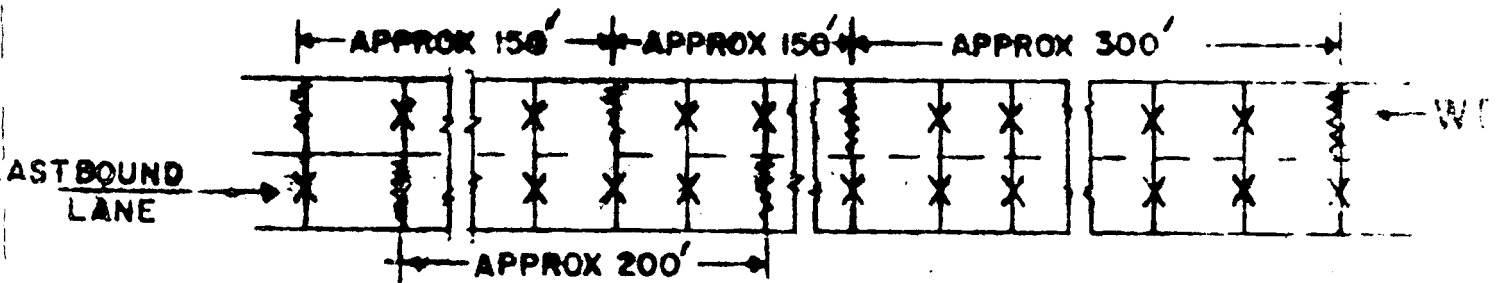


Route 33 Section 1115010

Blow-up recurrences were found in the vicinity of milepost number 15. This area is covered with surface treatments. Blow-ups and joint failures were numerous. Slab movement was noted in both lanes of traffic.

Figure 4.2 below, shows a typical 600 foot section with blow ups and joint failures.

FIGURE 4.2



≡ = BLOW - UPS
X = JOINT FAILURES

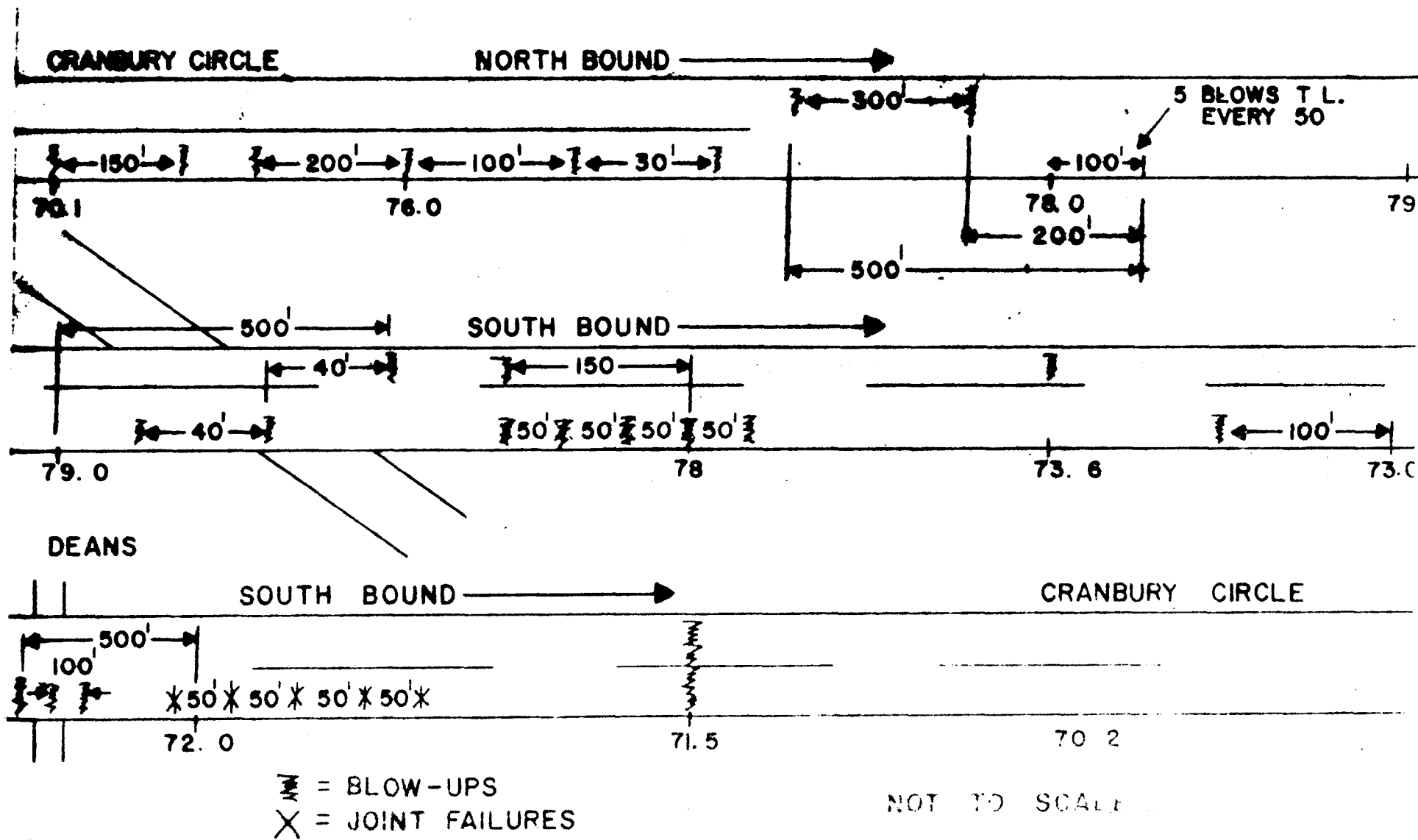
NOT TO SCALE

Route 130, Sections 1227000, 1227001, 1227010

The above mentioned sections are on Route 130, Eastbound and Westbound lanes, ^{between} [REDACTED] Cranbury Circle and Deans. As can be seen from the diagrams in Figure 4.3 many serious blow-ups are located in these sections. Many of these recurrences are 50 feet to 100 feet apart. In some areas practically every slab has some type of serious blow-up or other type of pavement damage. Generally, recurrences are noticed in areas where dirty joints and slab movements are present. These sections of Route 130 between Cranbury Circle and Deans seem to possess all the ingredients for future recurring blow-ups.

FIGURE 4.3

RT 130 SECTION 1227000, 1227001, 1227010



5.0 CONCLUSION AND RECOMMENDATIONS

The findings of this study may be best translated into the following recommendations for the repair and preventive maintenance of blow-ups, joint failures, etc., that will occur on relatively old pavement.

1. More frequent inspection of roadways where older pavements exist, would allow the detection of trouble areas where future blow-ups are likely to occur. Immediate repair of these areas would reduce the possibility of future blow-ups.

2. An established procedure for the proper cleaning of joints filled with large stones and other foreign particles before resurfacing, would permit the joints to function properly, thereby reducing the possibility of joint failure beneath the resurfacing. The joints should also be sealed properly after cleaning.

3. When joints fail to function due to the corrosion of dowels, it may be necessary to cut out the joint and fill it with a more flexible material. It may or may not be necessary to cut out the entire ^{joint} [redacted] or one side of the ^{joint} [redacted] where the most extensive damage occurs. When five or six successive joints fail, it may be advisable to cut out only the joints at the two extremes and retain the remaining slabs to act as one unit.

4. Blow-ups can be repaired in the same manner as joint failures. The blow-ups should be cut to a point where the base and concrete slab are stable. The cut should be filled with a flexible material.

5. Relieving stresses in poor concrete sections of existing roadways may be accomplished by cutting relief sections in the pavement at every fifth or sixth joint. It is recommended that further studies be performed and experimental relief-cut sections be constructed on Routes 33 and 130, and these sections be studied over a period of 2-3 years. Data gathered at this time would be helpful in assessing the merits of relief sections and aid in the maintenance of the existing old concrete roadways.

6. In attempting to seal these cracks, poor joints and blow-ups, some of the newer sealers may be evaluated in these applications. Three of the more promising products available are:

a. "Sealtight", pour-in-place pressure relief joint, manufactured by the W. R. Meadows, Inc. This sealer consists of a compressible base layer and a flexible cap layer. The compressible base layer is made of two separate liquids mixed in the proper amounts and poured into the opening. The resulting foaming action partially fills the opening with a closed-cell material. The pour-in-place flexible cap layer is a tough, extremely flexible substance that is claimed to be resistant to concrete chemicals and vehicular traffic. The manufacturer recommends that the section to be filled be cut to a 4 inch width.

b. "Terraseal 100", which is a black polyurethane rubber caulking compound, manufactured by the Dow Corning Corporation. This material is recommended for use in applications where joint opening due to the expansion and

contraction cycle does not exceed 50% ^{of the constructed depth}. The minimum joint width recommended is 1/8 inch. The recommended caulking thickness ^{depth} should range from 1/8 inch to 5/8 inch. This compound may be used with the standard back-up materials. This compound was used experimentally at a joint on Route 42 at the New Jersey Turnpike overpass in August 1967. An inspection of this joint, 6 months later, indicated that the sealer had filled the joint unevenly and had failed in bond, breaking away from the concrete at the far interface of the joint in the direction of traffic. The overall appearance of this sealer was generally poor when compared to item c. hereafter.

c. Product Research and Chemical Corporation installed a "Rubber Calk 3105" sealant on Route 42, at the north abutment of the New Jersey Turnpike overpass, just north of the installation described above. Prior to installation, the joint was sand blasted to remove all foreign matter. Next the area was treated with P.R.C. #4 primer and allowed to dry 30 minutes. A sponge rubber backing was then placed in the joint to hold the rubber sealant until it had cured and set. The rubber was a two part polyurethane sealant. The mixing and the application were achieved by means of a special and very elaborate machine (only one in existence). This installation was made on August 11, 1966.

An inspection of this joint, 18 months later, indicated that the sealant had filled the joint quite uniformly. The bonding between the sealer and the concrete showed some separation along the far interface of the joint in the direction of traffic. In some instances the sealant had pulled away some pieces of the concrete. However, the overall appearance was considered to be good.