TO:

MAIN OFFICE
REGIONAL OFFICES

SUPERSEDED BY EI 92-021
EFFECTIVE 5/6/1992

ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: BRIDGE DECK EVALUATION PROCEDURE MANUAL

Subject Code: 7.35

Distribution: ☐ Main Office ☐ Regions ☒ Special

APPROVED: E. V. Hannigan
Deputy Chief Engineer (Structures)

Code: EI 75-88

Date: Dec. 9, 1975

Supersedes:
MODIFIES EI 74-098
DATE 10/21/74

Attached is a copy of the Bridge Deck Evaluation Procedure Manual.

This manual describes the procedures that shall be used by the Regions to investigate the condition of bridge decks.

E.I. 74-98 "Procedure for Establishing the Structurally Deficient Bridge Priority List and Bridge R&P Programs" shall be modified as follows:

1. Section II, A.2.b under "Procedure for Establishing Bridge R&P Programs." Replace "(See Appendix A.)" with "(See Bridge Deck Evaluation Procedure Manual)".

2. Delete "(Appendix A will be issued in the future)" from the end of the instruction.

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, NEW YORK

BRIDGE DECK EVALUATION PROCEDURE MANUAL

BY

INVENTORY AND INSPECTION UNIT

STRUCTURES DESIGN AND CONSTRUCTION SUBDIVISION

SEPTEMBER 1975

TABLE OF CONTENTS

	PAGE
SCOPE	iii
GENERAL CORING POLICY INFORMATION	1
TIMING OF CORING OPERATIONS	2
PRELIMINARY DECK INVESTIGATION PROCEDURE	3
GUIDELINES FOR SELECTING CORING PATTERNS	4
PROCEDURE FOR TAKING CORES	5
REPAIRING CORE HOLES	7
CORE REPORTING PROCEDURE	8
DESCRIPTION OF WHAT DETERMINES CASE I PROCEDURE	9
REPORTING CASE I	10
DESCRIPTION OF WHAT DETERMINES CASE II PROCEDURE	11
REPORTING CASE II	11

SCOPE

This manual describes the procedures that shall be used by the Regions to investigate the condition of bridge decks. The term deck in this manual shall be interpreted as the existing structural slab, waterproofing membrane, and wearing courses. For frame bridges, the top of the frame shall be considered to be the deck.

Coring is one method used to determine the conditions of decks. Bridge decks that have separate wearing courses often conceal deterioration in the structural slab. Also, monolithic bridge decks that have insufficient reinforcing cover tend to deteriorate at an accelerated rate. Cores taken in representative areas of the bridge deck provide useful information for evaluating the condition of the concrete.

This manual provides information concerning the following subjects:

1. General Coring Policy Information.
2. Timing of Coring Operations.
3. Preliminary Deck Investigation Procedure.
4. Guidelines For Selecting Coring Patterns.
5. Procedure For Taking Cores.
6. Repairing Core Holes.
7. Core Reporting Procedure.

GENERAL CORING POLICY INFORMATION

All bridges which are planned to be reconstructed must be evaluated with regard to the disposition of the concrete deck. This includes bridges which would be scheduled for only minor contract work as long as deck repair, wearing course removal, or wearing course repair is anticipated. The deck evaluation consists of making field observations, taking deck cores, observing the cores, and preparing deck evaluation reports. A determination may be made to replace a deck based solely on visual observation documented by good quality color photographs of the underside which clearly show that the deck is obviously not salvageable. However, the decision to retain and repair a deck cannot be made without cores.

The deck cores will be taken by the Region. The Region will prepare a deck evaluation report and recommend either replacing the deck or repairing it. When recommending deck replacement, the report is referred to as a Case I report. A Case I report may or may not include cores, but core information should be included if cores are taken. When recommending deck repair, the report is referred to as a Case II report. Core information must be included in all Case II reports. Case II reports are sent to the Materials Bureau for further evaluation, which generally includes testing the cores and sometimes taking additional cores. The Materials Bureau will then prepare a final report with test results and their recommendations.

As a minimum, reports should include descriptions and observations of the deck and substructures, color photographs of the bridge (including the underside), photographs of the cores, plan of core locations, and recommendations.

TIMING OF CORING OPERATIONS

In order to avoid changes in design and details, approved reports should precede the preparation of the preliminary plans for reconstruction projects. Ideally, Region evaluation reports should be submitted to the Structures Subdivision with the Project Proposal and Evaluation Form (Highways) Form TEM 382 as outlined in EI-74-98 or earlier. This provides sufficient time to process the evaluation. Approximately 3½ months is required between receipt of the Region's evaluation and the start of preliminary design.

PRELIMINARY DECK INVESTIGATION PROCEDURE

The preliminary deck investigation includes all work involved up to the coring operation. The work should start with a review of the original or final contract plans (record plans) or any later deck reconstruction plans (removal of the wearing course and structural slab repairs, not just resurfacing). From this review, the type, thickness, and other pertinent information relating to the various parts of the deck may be obtained. Special attention should be given to determining if any utilities have been encased in the deck slab.

The following field work should be done before any coring is started:

1. Identify the bridge and the feature it crosses.
2. Compare the actual bridge with the description taken from the plans and note differences, if they exist.
3. Inspect the bridge components for deterioration.
4. Describe the bridge components that require further investigation.
5. Using color film, photograph the structures, emphasizing the underside of the deck, wearing surfaces, substructures, and approaches, as well as any problem areas. Underside photographs for Case I bridges are imperative.
6. Sketch a plan view of the bridge which includes the physical features such as spans, sidewalks, joints, curb lines, etc. This sketch should locate any utilities on the bridge that may interfere with the extraction of the cores.
7. Establish a coring pattern in conformance with "Guidelines For Selecting Coring Patterns" in this manual. Locate coring pattern on a plan view sketch.
8. Estimate traffic control requirements for extracting the cores.
9. Estimate the total people, equipment and time required to complete the coring operation.

Those responsible for the coring should contact the Highway Maintenance Engineer for further information concerning recent work done to the bridge deck or substructures and to arrange for maintenance of traffic during the coring operation and repair of the core holes upon completion of the coring.

GUIDELINES FOR SELECTING CORING PATTERNS

A coring pattern should represent all the design features comprising a bridge deck, such as different slab thicknesses, wearing surfaces, membranes, etc. In addition, cores should be taken from various locations on the deck, such as along curbs and joints, as well as in the center of the deck.

The coring pattern should always include areas of the deck that exhibit deterioration either on the top or the bottom surface. It is also important that apparently good areas of a deck, if any, receive proper consideration, as well as the bad areas. On monolithic bridge decks that have not been overlayed, sounding the surface of the deck will frequently help in delineating poor and good areas to be included in a coring pattern.

A coring pattern should be selected so that an estimate of the deteriorated areas of the deck can be made. This estimate will assist in making decisions concerning the deck.

Normally, the coring plan should consist of 3 to 6 locations per span depending on conditions. When multiple span bridges are evaluated, consideration should be given to selecting representative spans for coring, where it is feasible. Considerable time and effort can be saved by properly applying this approach. However, each span type should be cored.

When prestressed concrete units are being cored, a careful study of the location in plan and depth of all prestressing strands should be made. Once the strands have been located, a core pattern with restricted depth should be established that will not encounter any prestressing strands.

PROCEDURE FOR TAKING CORES

The cores should be taken with the Regions pavement core drill. Four inch diameter, thin wall, diamond bit core barrels shall be used.

The core should ideally be taken completely through the deck and retrieved from the underside. Where retrieval from the underside is not possible, the core may be broken off near the bottom of the slab. In any case, the core bit should be progressed well into the structural slab.

When coring the top slabs of prestressed concrete box beams, the bit should not be allowed to penetrate through the slab into the box beam void. Also, prestressing strands should not be cored through.

When cores are taken on spans having corrugated steel stay-in-place forms, coring should be discontinued when water is lost through the perforation made in the corrugations by the drill. Loss of drill water will cause the drill bit to overheat.

For locations inaccessible for coring with Region equipment, the Materials Bureau has a portable coring unit that may be scheduled. This is done by making a written request to the Structures Subdivision.

Cores extracted from the bridge deck should be permanently identified by marking the core and putting all sections plus rubble in marked plastic bags. The bag markings should include the Bridge Identification Number (B.I.N.). The cores shall be stored in the Region.

Coring completely through a rubble structural deck can cause surface cave-in which may be hazardous to traffic and require continuous maintenance. If this condition is encountered, subsequent cores may be broken-off short to form a base to hold the core patch. It is generally best to core through the wearing courses and retrieve these before continuing into the structural slab. Coring through cold patch material should be avoided as it becomes gooey and can cover the core and gum up the coring equipment.

The following information should be recorded before moving to the next core location:

1. Exact core location (over beams, through cracks or patch sections) and distances from reference points, such as curbs and joints. These distances shall be shown on the plan sketch.

2. Types of material that make up the core and their respective thicknesses.

3. Condition of wearing courses and structural slab. Any accidental cracking of the core caused by slivers of reinforcement jamming, retrieval techniques, etc., should be noted.

PROCEDURE FOR TAKING CORES (CONTD)

4. Type and condition of the waterproofing material, if any, on top of the structural slab.

5. Total depth of core hole.

6. Total depth of the structural deck.

7. Description of core hole. E.G.: Voids between layers, as well as anything unusual.

REPAIRING CORE HOLES

The core holes shall be repaired as soon as possible after coring is completed. This is important, as failure to repair these holes will accelerate bridge deck deterioration. Non-shrink, fast-curing cement should be used to fill the core hole.

CORE REPORTING PROCEDURE

The course of action concerning the bridge deck shall be determined from information gathered in the field and from inspection of the cores. The appropriate course of action shall follow either the Case I or Case II procedure.

DESCRIPTION OF WHAT DETERMINES CASE I PROCEDURE

A Case I procedure is followed when the Region believes that complete deck replacement is necessary.

Case I slabs have a substantial amount of unsound concrete consisting of rubble, horizontal cracks, etc., which makes the slabs unrepairable. In addition, decks in this condition will usually exhibit visible cracks, spalling, leakage through the deck (wet spots) and efflorescence. An estimate of the area of the deck having unsound concrete as a percentage of the total deck area should be made as an aid in making a replacement decision.

REPORTING CASE I

Each bridge shall be reported separately with sufficient information, including descriptions and photographs to support the conclusion of the Investigator. The Region will be responsible for preparing Case I deck evaluation reports.

The report shall be sent to the Structures Subdivision, The pages of the report should be numbered.

The report should include the following:

1. Color photographs of the underside of deck, wearing srufaces, bridge in elevation, substructures, approaches, and any problem areas.

2. All information relating to the bridge gathered during the preliminary deck investigation.

3. A recommendation based on the evaluation.

In addition, all information described under "Procedure for Taking Cores" in this manual should be included if cores are taken.

This includes core photographs with proper identification of the cores (including BIN number) in the photographs. The photographs must be taken straight on. Balck and white photographs of the cores are acceptable.

The report should be sent to the Structures Subdivision in triplicate. Two reports shall contain original prints of the photographs. The third report may be a photostatic copy of the report. A fourth copy should be kept in the Region's project file. Cores for Case I slabs shall be stored at the Regional Office for three months after receiving written approval for deck replacement from the Structures Subdivision.

Upon concurrence with the Case I recommendation, the Structures Subdivision will notify the Region, by memorandum, of the final determination. If the Structures Subdivision does not concur with the Case I recommendation, the Case II procedure, as described below, is followed.

DESCRIPTION OF WHAT DETERMINES A CASE II PROCEDURE

A Case II procedure is followed when the Region cannot conclude that complete deck replacement is necessary after the preliminary investigation and examination of cores. Cores must be taken for all Case II decks. When the Region concludes that one or more spans are not salvageable but cannot conclude that the other spans should be replaced, the Case II procedure is followed.

Case II structural slabs appear sound but may have localized areas of deterioration. This type of deck may be repairable. When the Region establishes a deck is in the Case II category, a report should be sent in triplicate to the Structures Subdivision, This report should include the reasoning behind the Case II recommendation, a brief description of the bridge, a sketch showing where the cores were extracted, photographs of the extracted cores, and color photographs of the underside of the deck, all in triplicate. The third copy may be a photostatic copy . The core photographs should be properly identified including BIN number. A fourth copy of this report should be kept in the Region's project file.

The cores should be stored in the Region to either be picked-up by the Materials Bureau or sent to the Materials Bureau. The Materials Bureau will notify the Region when they want the cores.

Upon concurrence with the Region's Case II recommendation, the Structures Subdivision will formally request the Materials Bureau to perform a complete deck evaluation.

The Materials Bureau will use the Region's preliminary data supplemented by any additional investigation they feel is necessary. This additional investigation includes core testing and sometimes taking additional cores.

REPORTING CASE II

A preliminary Case II report is submitted to the Structures Subdivision by the Region, as described above.

The final Case II report will be prepared by the Materials Bureau. The report will be similar in structure to the Case I report. The final determination of the disposition of the deck will be made by the Structures Subdivision after receipt of the Case II report from the Materials Bureau.

12

E.I.I.S FILE

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE May 14, 1975

SUBJECT ROUTE 94 BRIDGE OVER LEHEIGH AND HUDSON RAILROAD
BIN 1034840 - SH 154; CHESTER-VAILS GATE
ORANGE COUNTY

FROM F. J. Stark, Design Group, Region 8

TO R. N. Kamp, Structures Subdivision, 6th Floor, Bldg. 5

Based upon visual interpretation of the core samples and site inspection, we recommend replacement of the entire concrete slab.

This bridge is a single span thru plate girder structure 76 feet long with 21 feet of pavement width. The structure was built before 1902, although the exact date of construction cannot be determined because of the absence of record plans in our file. The deck is a reinforced concrete slab approximately 11" thick with an asphalt overlay having many patched areas approximately 1" thick.

Three cores were taken from the structure by Regional forces on April 18, 1975. All were progressed thru the deck and were recovered. One of the cores appears quite sound, one has some rubble and one is mostly rubble. Inspection of the underside of the deck showed wide spread leaching and longitudinal cracking. Reinforcing bars are exposed in places and portions of the encasement concrete has fallen down.

Core descriptions, locations and pictures are attached.

FJS:GW:MJW
Attachments

CORE DESCRIPTION SHEET

CORE #1 - Total Depth 12" - Consists of a 1"± Asphalt Overlay and 11" of Structural Concrete, most of which is rubble.

CORE #2 - Total Depth 12" - Consists of a 1"± Asphalt Overlay and 11" of Structural Concrete, broken into three sections.

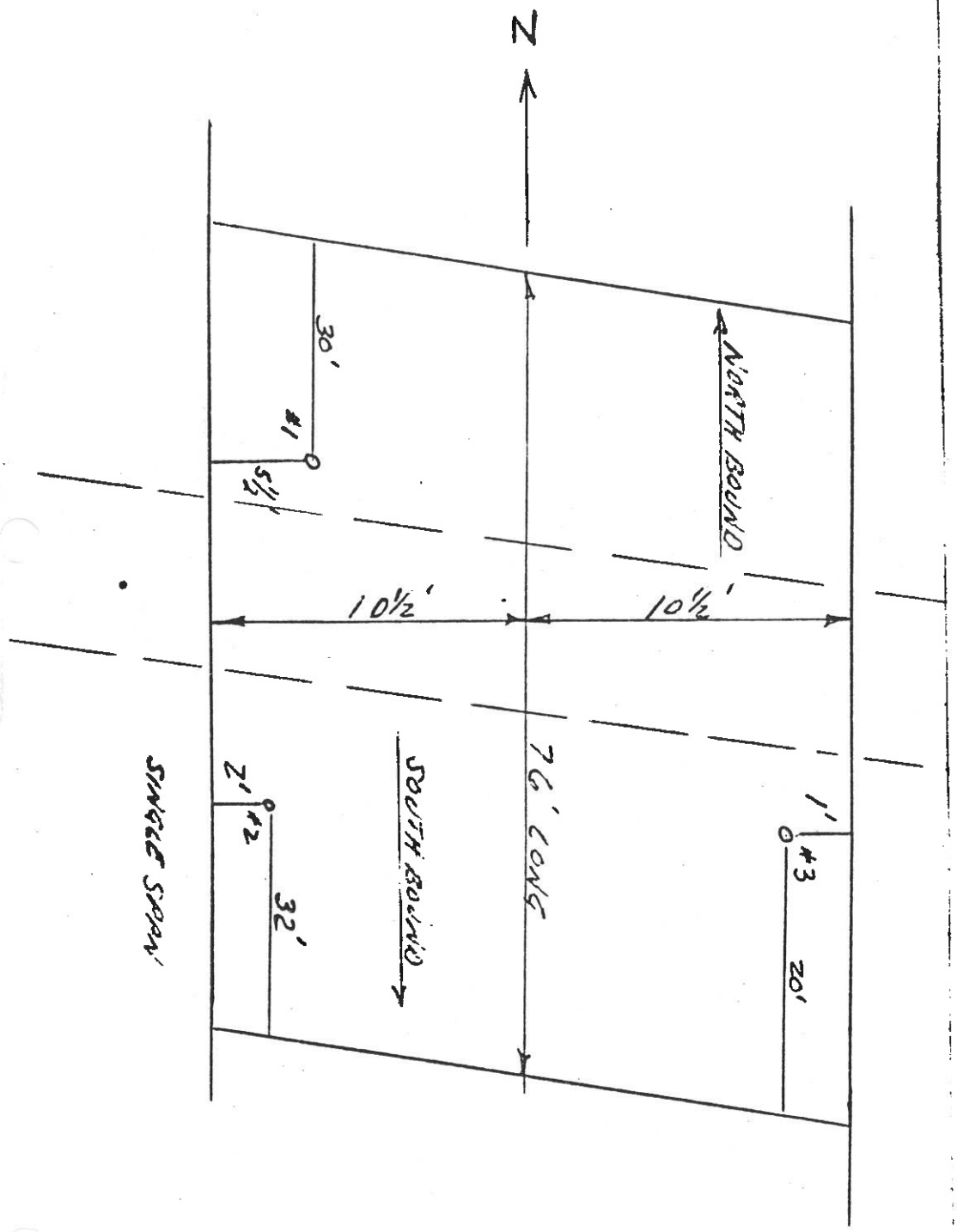
CORE #3 - Total Depth 11½" - Consists of a 1" Asphalt Overlay and 10½" of Structural Concrete, broken into two sections.

B.I.N 1034740

ROUTE 94 RAILROAD BRIDGE

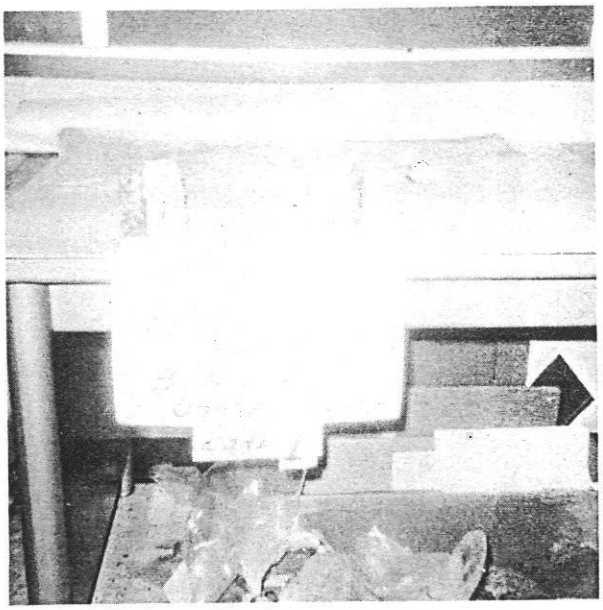
ORANGE COUNTY

14

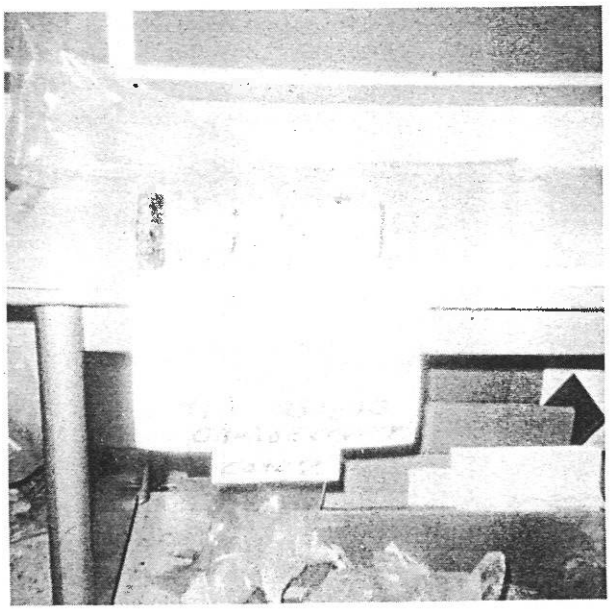


PALISADES INTERSTATE PARKWAY OVER CLOSTER ROAD
REGION 8

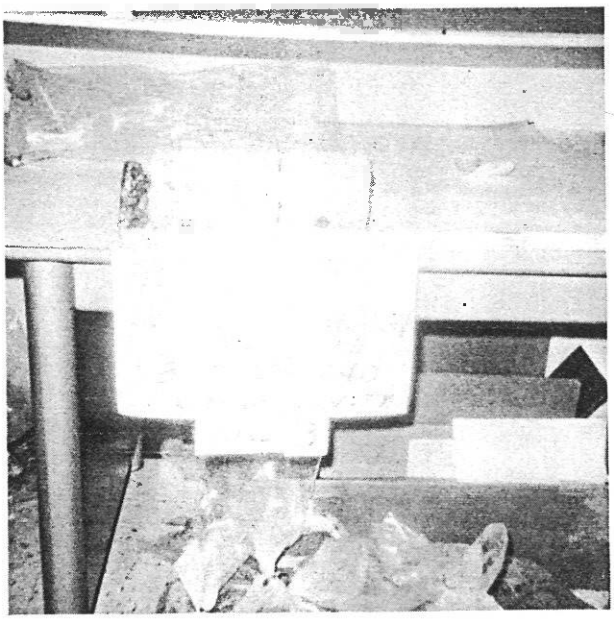
BIN 1034840
ORANGE COUNTY



Core #1



Core #2



Core #3

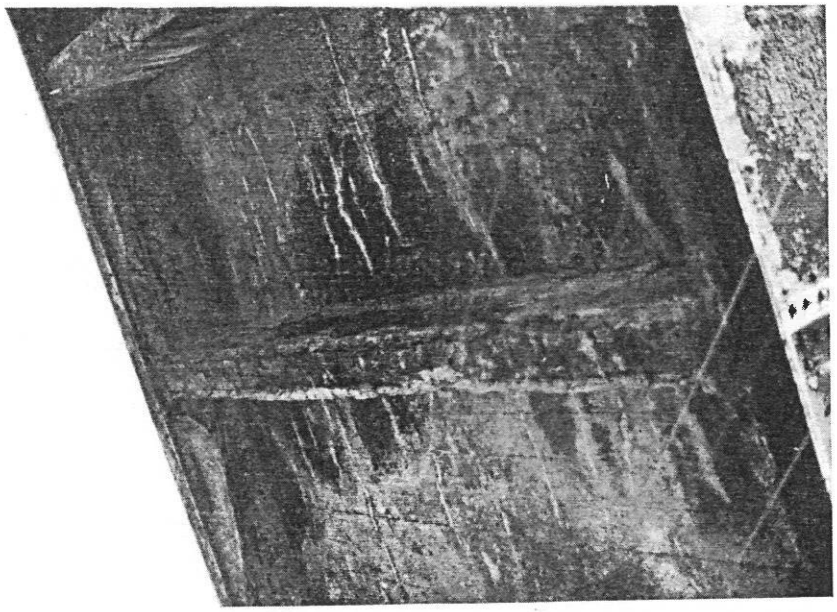
BIN 1034840
ORANGE COUNTY

North Approach

South Approach

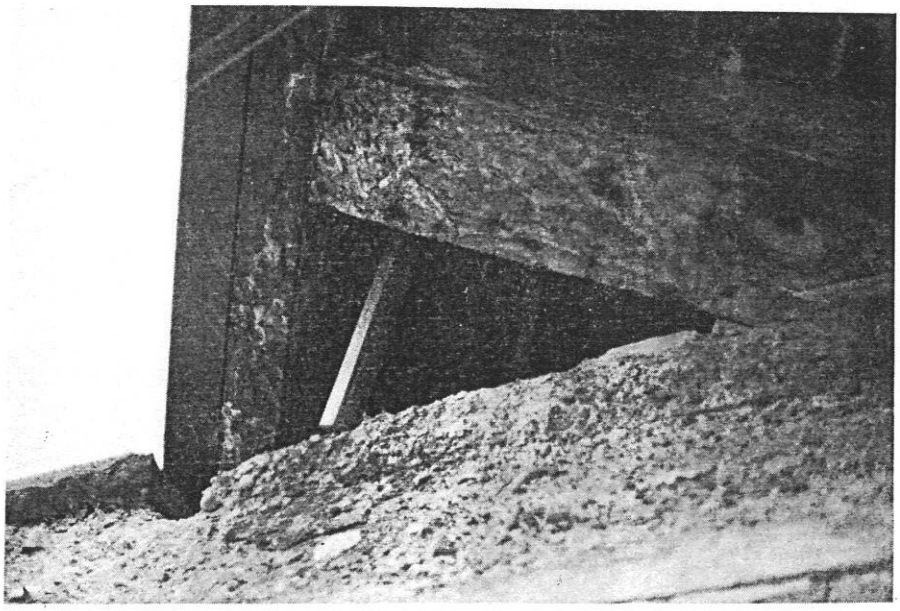
BIN 1034840
ORANGE COUNTY

Looking South

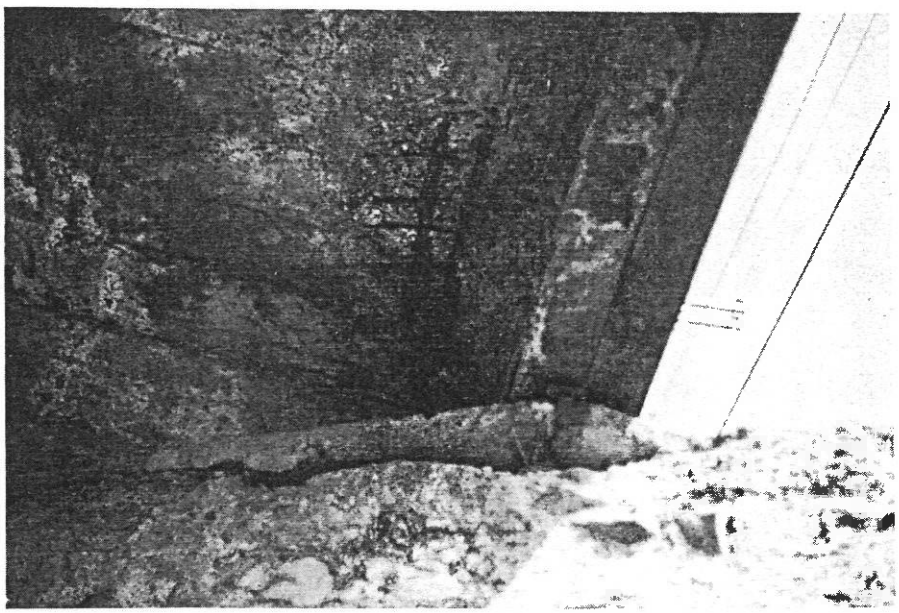


Underside of deck

BIN 1034840
ORANGE COUNTY



North Abutment - West Corner



North Abutment - East Corner

E.I.I.S.
FILE

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE August 27, 1975

SUBJECT EXAMPLE CASE II REPORT - BIN 1012340
PALISADES INTERSTATE PARKWAY OVER
CLOSTER ROAD
ROCKLAND COUNTY

FROM Region Office

TO E. V. Hourigan, Structures Subdivision, 6th Floor, Bldg. 5

This bridge is a 53 feet long, single span, rigid frame with two 12 foot wide lanes for each direction of travel. Curbs and sidewalks are located on each side of the deck and a 34 foot gravel center mall separates the lanes of traffic. This bridge is approximately 20 years old.

The deck consists of a 1 inch asphalt concrete overlay on a 4 inch nominal thickness (actual thickness varies) portland cement wearing slab. The Structural slab is protected by a membrane. The structural slab varies between 1'-4" and 4'-0" in thickness.

Seven cores were taken from the deck. The cores show layered cracking and rubble in the concrete wearing slab. The structural slab cores appear sound and free of cracks.

The asphalt concrete overlay has severe wear in the wheel tracks and the remainder of the pavement looks open textured. Transverse cracks have appeared over both abutments and a longitudinal crack in the deck has reflected through the centerline of the Southbound lanes.

The underside of the deck appears sound except for a longitudinal crack in the Southbound lanes area. Water appears to be passing through this crack as evidenced by leaching appearing on the underside. Heavy leaching is also present on the underside of the deck at the construction joints. The joints are located at the curb lines and in the mall. These leached areas may need repairing.

The curb section adjacent to the sidewalk has deteriorated and the sidewalks have spalled areas.

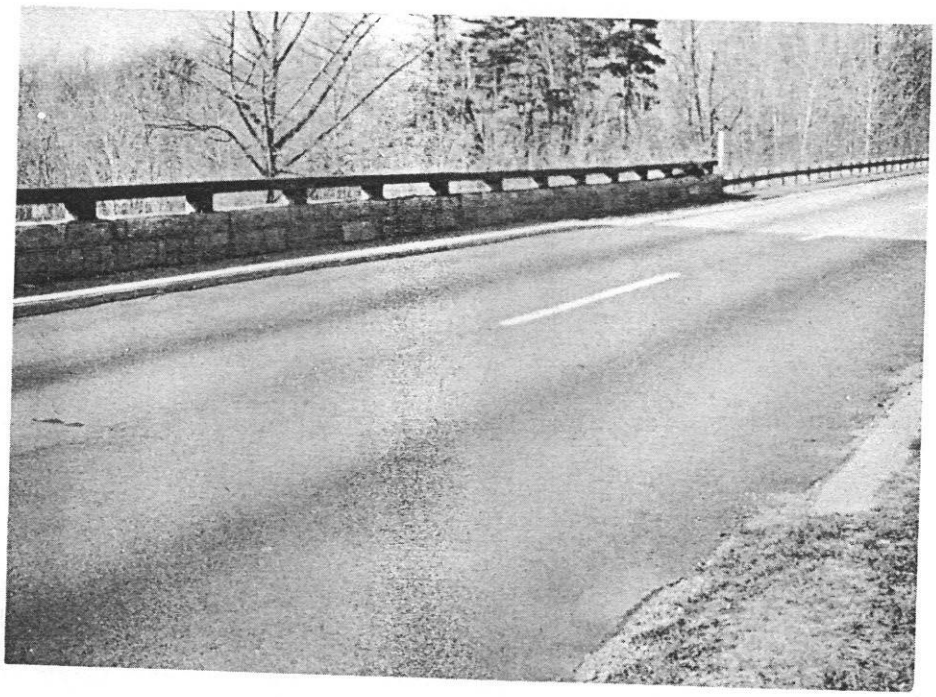
A transverse crack exists in the approach slab on the South end of the Northbound lanes. It appears to be five feet from the abutment. Some pavement settlement has occurred in this area.

Based on our observations, we recommend that the structural deck be retained because of its good condition. The portland cement concrete wearing surfaces, curbs, and sidewalks **are** deteriorated and need to be replaced.

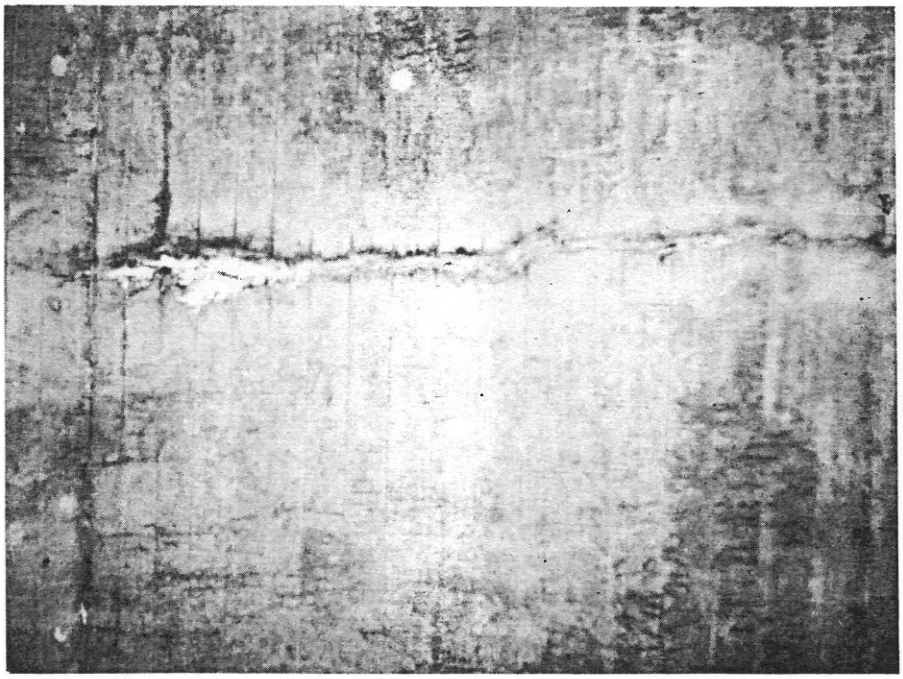
Core locations, descriptions and pictures are attached.

*Attachments

AVR:ACB:GD

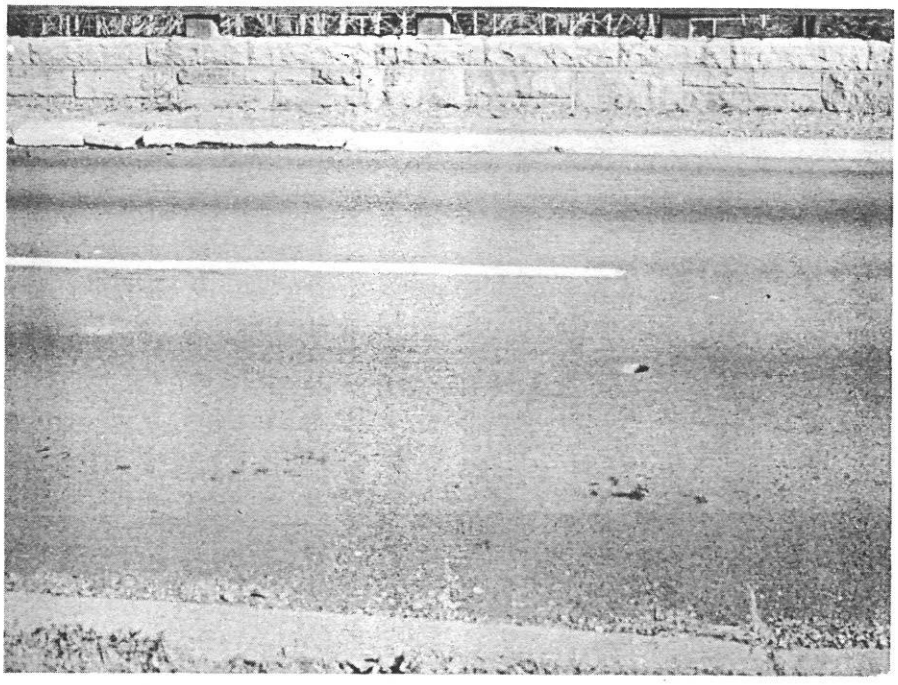


SOUTHBOUND LANE

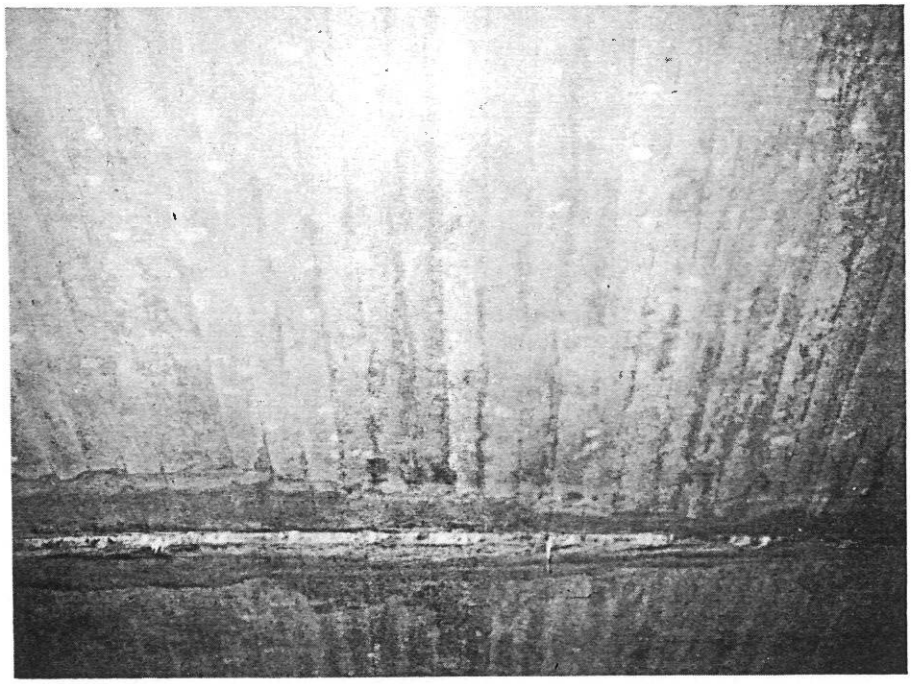


SB LANE, LONGITUDINAL CRACK UNDER CENTERLINE OF ROADWAY

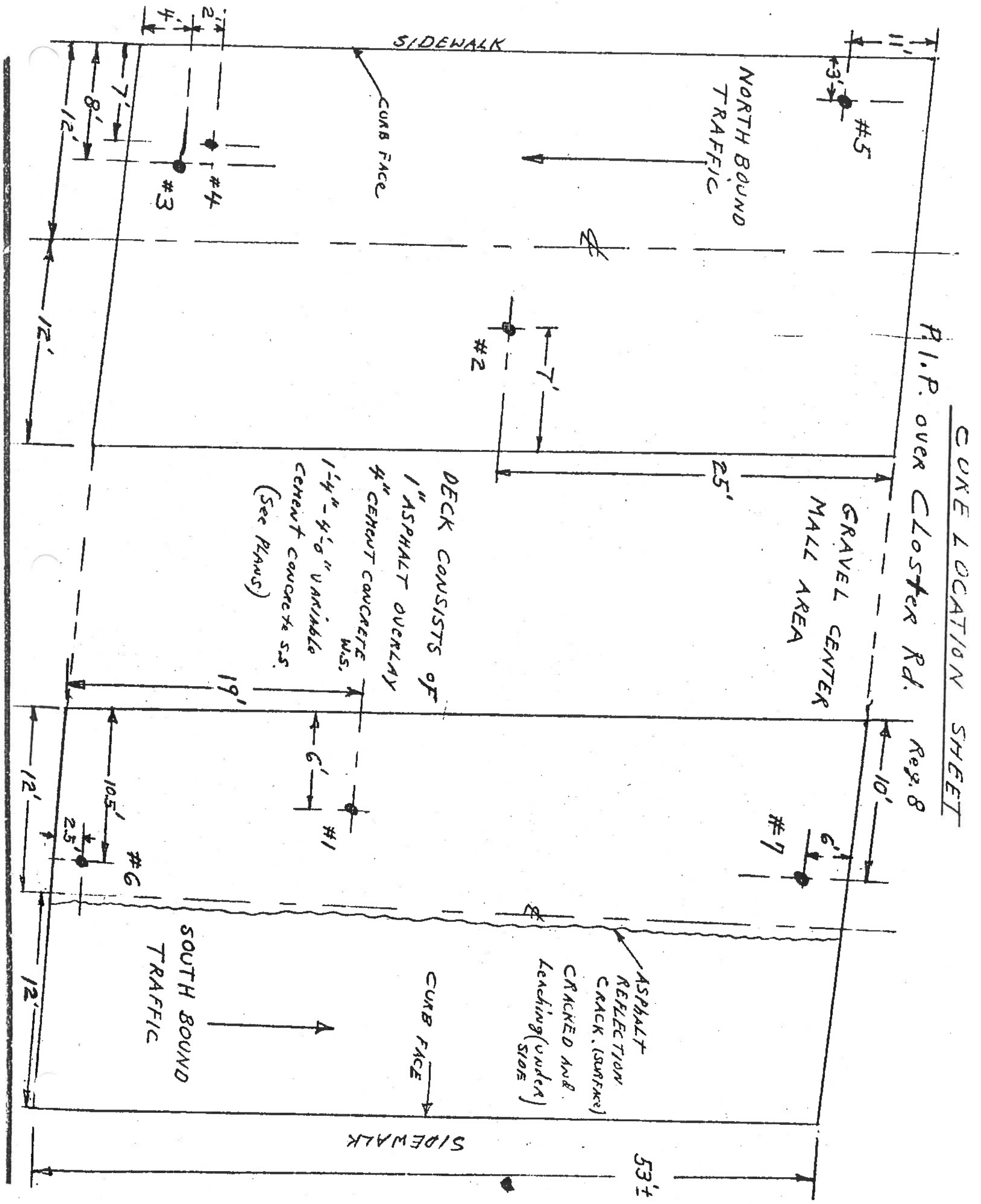
P.I.P. OVER CLOSTER ROAD, REGION 8



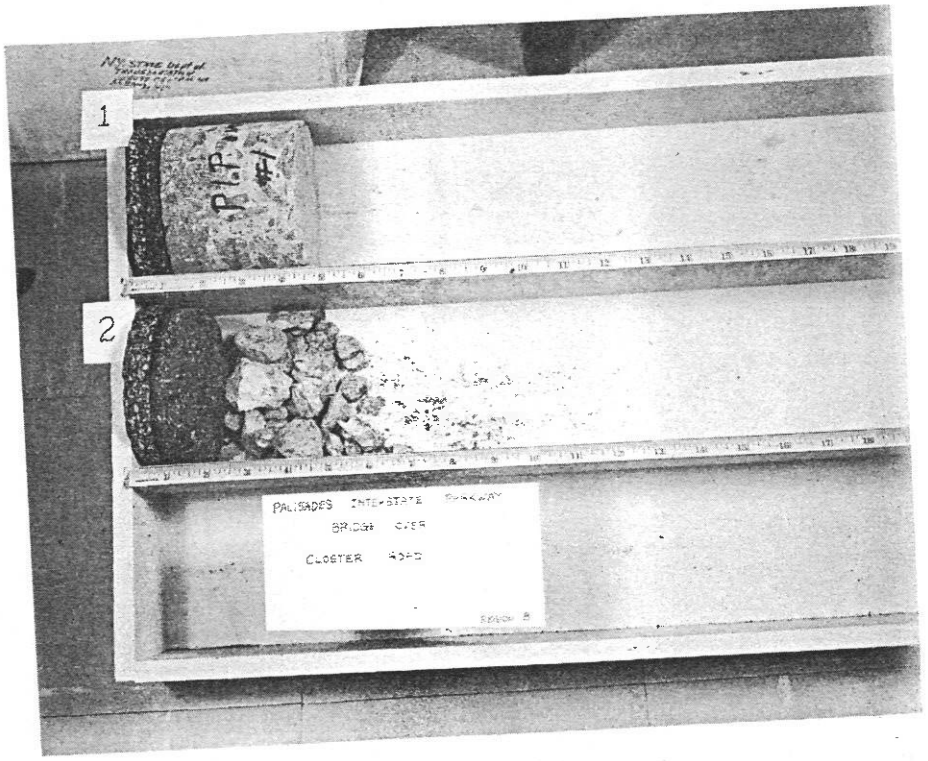
NORTHBOUND LANE



NB LANE, JOINT UNDER INTEGRAL CURB, LEACHED AREA


CORE LOCATION SHEET
P.I.P. over Closter Rd. Reg. 8
SIDEWALK
NORTH BOUND TRAFFIC
CURB FACE
GRAVEL CENTER MALL AREA
DECK CONSISTS OF
1" ASPHALT OVERLAY
4" CEMENT CONCRETE W.S.
1'-4"-4'-0" VARIABLE CEMENT CONCRETE S.S.
(SEE PLANS)
ASPHALT REFLECTION CRACK. (SURFACE)
CRACKED AND Leaching (under side)
SOUTH BOUND TRAFFIC
CURB FACE
SIDEWALK
#1
#2
#3
#4
#5
#6
#7
53'±
25'
19'
12'
12'
12'
12'
10'
10.5'
8'
7'
7'
6'
6'
4'
3'
2'
2.5'
11'

PALISADES INTERSTATE PARKWAY OVER CLOSTER ROAD
REGION 8



25

CORE DESCRIPTIONS

CORE NO. 1

Depth - 4½" - Not through - S.B. Lane.
Overlay - 1" Asphalt Concrete.
Wearing Slab - 3½" Cement Concrete Section In Sound Condition.
No structural slab core was taken.

CORE NO. 2

Depth - 5" - Not through - N.B. Lane.
Overlay - 2" Asphalt Concrete.
Wearing Slab - 3" Cement Concrete Rubble.
No structural slab core was taken.

CORE NO. 3

Depth - 7" - Not through - N.B. Lane.
Overlay - 1" Asphalt Concrete Rubble.
Wearing Slab - 3" Cement Concrete Rubble.
Membrane - Asphalt Impregnated Fabric (De-Bonded).
Structural Slab - 3" Cement Concrete Section free from any cracking or deterioration. Core broke off at heavy re-bar. Also, 7" of the structural core not able to be retrieved from the hole.

CORE NO. 4

Depth - 16½" - Not through - N.B. Lane.
Overlay - 1½" Asphalt Concrete.
Wearing Slab - 3½" - 1" Concrete Section bonded to the overlay, remaining 2½" Cement Concrete Rubble.
Membrane - Worn Away.
Structural Slab - 11½" Cement Concrete In Sound Condition.

CORE NO. 5

Depth - 16" - Not through - N.B. Lane.
Overlay - 2" Asphalt Concrete.
Wearing Slab - 4" Cement Concrete, looks sound. 1" section bonded to the overlay. Also, the 3" section was bonded to the structural slab. The wire mesh was located 2½" from the top of the wearing slab.
Membrane - None visible.
Structural Slab - 10" Cement Concrete In Sound Condition. Re-bar located about 2" from top of the structural portion. No signs of rust.

CORE DESCRIPTIONS (CONTD)

CORE NO. 6

Depth - 9" - Not through - S.B. Lane.
Overlay - 1" Asphalt Concrete.
Wearing Slab - 4" of Cement Concrete In Sound Condition. The wire mesh is located 1 3/4" down from the top of the wearing slab.
Membrane - Worn Away.
Structural Slab - 4" Cement Concrete In Sound Condition. Core broke off at steel.

CORE NO. 7

Depth - 16" - Not through - S.B. Lane.
Overlay - 1" Asphalt Concrete.
Wearing Slab - 3" Cement Concrete With Angular Cracking. The wire mesh is located 1 3/4" from the top of the wearing slab.
Membrane - Worn Away.
Structural Slab - 12" Cement Concrete In Sound Condition. Re-bar is located 9" from the top of the structural slab. No evidence of rust.

AVR:ACB:GD

8/27/75

BRIDGE DECK EVALUATION PROCEDURE MANUAL

RAYMOND T. SCHULER, Commissioner