

MICHIGAN DEPARTMENT OF TRANSPORTATION  
M•DOT

CANTILEVER SIGN STRUCTURE INSPECTION  
Final Report

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Michigan Transportation Commission  
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## EXECUTIVE SUMMARY

In April 1990, following the collapse of two cantilever sign structures, the Michigan Department of Transportation issued an "Action Plan for Cantilever Sign Problem." The Action Plan mandated a yearly inspection cycle for the smaller cantilevers, Types A, B, C, D, E, and I. For the larger cantilevers, Types G and H, a six-month cycle was mandated. This report summarizes the findings of these inspections.

During the initial evaluation of all cantilever sign structures conducted in the spring of 1990, seven were removed from service. Two Type D cantilevers were removed due to improper installation practices. One old Type I was removed due to a rejectable indication found in one of the anchor rods by ultrasonic testing. Four of the larger Type G and Type H cantilevers were also removed. Of these four structures, one Type G was removed due to welding of the anchor nuts. The other three were removed due to rejectable ultrasonic test indications in the anchor bolt. Only one of these four Type G and H cantilevers was the 1982 anchor rod design. The other three were all pre-1982 design in which the eight anchor rods were 1/2-in. smaller in diameter than 1982 design specifications.

The fall 1990 inspection program involved the inspection of the 400 larger Type G and Type H cantilevers. Two were removed due to rejectable ultrasonic test indications in the anchor rods. Both of these were the pre-1982 design. Two other larger cantilevers were removed due to non-conformance to specified standards. In addition, one Type D cantilever with a Type I anchor bolt pattern was discovered to have a deficient anchor rod and was removed.

Three cantilever structures were removed during the spring 1991 evaluation program of in-service cantilevers, and all were the smaller type structures. An old style Type I cantilever and a Type C cantilever were removed due to defective anchor rods. One Type D structure which was installed nine months earlier was removed due to welding of one of the anchor rods during installation.

Based on the results of the three inspection programs, the following recommendations are made:

1. The Maintenance Division should inspect cantilever sign structures and ultrasonically evaluate anchor bolts of these structures on a variable frequency. An inspection interval between one and two years is recommended. This inspection should be done by a contract inspection agency under the general supervision of knowledgeable personnel in the Maintenance Division.
2. A statewide anchor nut tightening program should be instituted by the Maintenance Division using a calibrated hydraulic torque wrench. Loosening of anchor rod nuts should be monitored annually after the tightening program is completed.

3. The Design Division should investigate the consequences of gaps present in the flange plates connecting the horizontal arms to the upright, and determine if modifications in weld size are permissible in order to reduce distortion of the flange plates during fabrication.
4. The Construction Division should monitor more closely the installation of cantilever sign structures during the construction phase.
5. The Traffic and Safety Division, in conjunction with each district, should continue to program projects for replacing outdated, deteriorating, and no longer needed sign cantilever structures.

## INTRODUCTION

The accidental collapse of two cantilever sign structures in early 1990 prompted a statewide inspection of all cantilevers, trusses, and high-mast luminaires. This was a more comprehensive inspection program than that conducted from December 1982 through the spring of 1985. Since 1985, and prior to the 1990 accident, an annual inspection of cantilever sign support anchor rods had been conducted on new sign structures and random structures based on age and prior inspections.

In April 1990, following the collapse of the two cantilever sign structures, the Michigan Department of Transportation issued an "Action Plan for Cantilever Sign Problem - Report to Management." Details of previous inspection programs, including the comprehensive spring 1990 program, can be found in the Action Plan.

The Action Plan mandated a yearly inspection cycle for the smaller cantilevers, Types A, B, C, D, E, and I. For the larger cantilevers, Types G and H, a six-month cycle was mandated. This schedule was recommended for one year to "further gain experience in this problem." This cycle has been completed, with all cantilevers being evaluated in the spring of 1990 and 1991, and in addition, all Type G and H structures being evaluated in the fall of 1990.

## INSPECTION PROGRAMS

### Spring 1990

This was the first comprehensive, statewide inspection program conducted since the 1982 through 1985 intermittent inspection program. It began immediately after the 1990 collapse of the first cantilever structure and was intensified shortly after a second collapse.

A total of 1205 cantilever sign structures were inspected, resulting in seven structures being taken out of service. Specific details concerning each of these cantilever structures can be found in the Appendix.

A summary of the seven cantilevers removed from service is as follows:

1. Two Type D structures were found to contain construction deficiencies and were removed accordingly.
2. One Type I, containing four 1-1/2-in. diameter anchor rods in a square pattern was removed due to a rejectable ultrasonic test indication in an anchor rod.
3. One Type G was removed due to unauthorized welding of the anchor nuts.
4. Two of the larger structures were removed from service due to rejectable ultrasonic test indications in the anchor rods. Two structures, one Type G and one Type H, were of the pre-1982 design containing anchor rods 1/2-in. diameter less than the design standard being used at the time of the 1990 collapses. All failures were in one of the three anchor rods on the side of the base away from traffic, which are subject to high tensile loading and the greatest number of fatigue cycles.
5. One Type H structure utilizing eight 2-1/2-in. diameter anchor rods contained a rejectable indication in one of the front anchor rods closest to traffic. This is an unusual situation, finding a rejectable indication in a front anchor rod that is loaded in compression, and is the only time in any of the evaluation programs where such a case was found.

It should be noted that during the Spring, 1990 inspection program, once the assigned crew found a rejectable indication for any anchor rod, the structure was immediately removed from service (to be conservative) without confirmation of the flaw. Subsequent inspection programs included verification of reported anchor rod failures by an independent inspection team prior to removing the sign structure from service.

#### Fall 1990

This program included the inspection of 251 Type G cantilevers and 149 Type H cantilevers. Four of these structures were removed from service. In addition, one old style Type D (with Type I pattern) was inspected and removed from service. Details for these five structures removed can be found in the Appendix.

The following summary is based on the Fall 1990 findings:

1. One old style Type D was removed due to a rejectable ultrasonic test indication not detected six months earlier.

2. Two structures, one Type G and one Type H were removed from service due to rejectable ultrasonic test indications in the anchor rods not detected during the survey six months earlier. Both were the pre-1982 design, and the primary flaws were located in anchor rods farthest from traffic.
3. One Type G and one Type H structure were removed due to non-conformance to specified standards.

### Spring 1991

This inspection program was the last mandated by the "Action Plan for Cantilever Sign Problem - Report to Management." A total of 1162 structures were inspected statewide resulting in three being removed from service.

Specifics for the three structures removed can be found in the Appendix and the following is a summary of this information:

1. One Type C cantilever, which was not inspected during the previous survey one year earlier, was removed due to a rejectable ultrasonic test indication in one of the anchor rods farthest from traffic.
2. One old style Type D with the Type I base design exhibited ultrasonic test flaws not detected one year earlier, and was removed from service.
3. One Type D cantilever, installed nine months prior to the Fall 1990 inspection program, was removed due to welding of an anchor rod.

### ADDITIONAL FINDINGS

The following is a compilation of other problems encountered during the three inspection programs:

1. Loosening of the anchor rod nuts continues to be a problem. Of the 400 locations evaluated during the Fall of 1990, 133 installations were reported as having one or more loose anchor rod nuts. All loose anchor rod nuts were tightened using a large wrench during the Spring 1990 statewide evaluation program. In the Spring 1991 program 907 of the 1162 locations were found containing loose anchor rod nuts.
2. Gaps ranging from slight to as much as 5/16 in. were observed in the abutting flange plates connecting the horizontal arms to the vertical upright. It is not known if this problem is due to loose flange connections or distortion of the flange plates caused by heat input necessary to weld the connection. (Weld size is larger than conventional weld sizes for these given steel thicknesses.)

3. Several anchor rods did not contain the required full nut engagement, leaving the anchor rod top below the top surface of the nut. This resulted in the anchor rod being too short to ultrasonically test. Partial nut engagement also lowers the holding strength of the anchor rod.
4. In isolated cases, the anchor rod holes in the cantilever sign base were improperly enlarged apparently in the field during installation.
5. Some of the structures were misnumbered or the location description given was wrong. Some cantilever structures were not numbered at all, possibly indicating there were no previous records of these structures existing.
6. Dome and arm caps were reported as missing on several structures.
7. At one location, two circumferential welds were used to fabricate the upright. Only one such weld is allowed by the design standards.
8. Poor or damaged galvanizing due to prolonged exposure was noted at some locations.
9. Due to age, spalling of some concrete bases is occurring.
10. Some anchor rods were field bent to accommodate sign base patterns which did not match the pattern of the anchor rods cast in the concrete base.
11. One location was noted where the anchor rod pattern was rotated  $22\text{-}1/2^\circ$  from the designed standard. This altered the load distribution amongst the anchor rods from that assumed in design.
12. Several locations were found containing notched washers under the anchor bolt nuts not in conformance with design plans or no washers at all.
13. Several anchor rods and nuts were noted as corroding with no galvanizing remaining.
14. At least one cantilever structure was reported as having a utility wire touching the top of the structure.

Reports for the fall 1990 and spring 1991 evaluation programs have been compiled containing specific locations for each of the above problems, and can be obtained by contacting the Structural Services Unit of the Materials and Technology Division.

## SUMMARY

Review of the anchor rod stress range calculations and the results of our inspections indicate that the anchor rods for the cantilever sign structures should be evaluated every one to two years, depending on the standards used. (This is similar to the inspection interval for bridges.) In two isolated cases, calculations indicate a six-month inspection cycle is warranted. However, field data indicate that these calculations may be conservative, and that a longer interval inspection cycle could be used.

Loose anchor rod nuts continue to be a problem; however, the extent is not known since all nuts were supposedly tightened during the initial statewide evaluation using non-calibrated wrenches.

Gaps in the flange plates connecting the horizontal arms to the vertical upright continue to be reported.

Six of the 15 structures were removed due to improper installation practices when installing the anchor rods. Most were welded in some manner. Several other locations were reported with bent anchor rods, enlarged base plate holes, no or non-conforming washers, and the anchor rod pattern rotated 22-1/2° from the planned design.

Several installations remaining in service were designed using outdated standards or are deteriorating due to age.

## RECOMMENDATIONS

### Recommendation No. 1

The Maintenance Division should inspect cantilever sign structures and ultrasonically evaluate anchor rods of these structures on a variable frequency. A maximum inspection interval of two years is recommended for the following structures:

- a. Structures installed after January 1, 1991, that were placed in accordance with the new specifications.
- b. Type C structures with eight 1-1/2-in. diameter anchor rods in a circular pattern (about 113 structures).
- c. Type D structures with eight 1-1/2-in. diameter anchor rods in a circular pattern (about 207 structures).
- d. Type H structures with eight 2-1/2-in. diameter anchor rods in a circular pattern (about 76 structures).

A maximum inspection interval of one year is recommended for all other cantilever sign structures (about 751 structures).



The inspection should be done by a contract inspection agency under the general supervision of knowledgeable personnel in the Maintenance Division.

Recommendation No. 2

A statewide anchor nut tightening program should be instituted by the Maintenance Division using a calibrated hydraulic torque wrench. Loosening of anchor rod nuts should be monitored annually after the tightening program is completed.

Recommendation No. 3

The Design Division should investigate consequences of gaps present in the flange plate connecting the horizontal arms to the upright, and determine if modifications in weld size are necessary to reduce distortion of the flange plates during fabrication.

Recommendation No. 4

The Construction Division should monitor more closely the installation of cantilever sign structures during the construction phase. Continue the program started in 1990 where an inspector from the Materials and Technology Division ultrasonically inspects the anchor rods of all new structures prior to final acceptance. This is a requirement contained in the specification for sign support and light standard anchor bolts.

Recommendation No. 5

The Traffic and Safety Division, in conjunction with each district, should continue to program projects for the replacement of outdated, deteriorating, or no longer needed sign structures.

**APPENDIX**

**Summary of Cantilever Sign Structures  
Removed from Service**

TABLE 1 - STATEWIDE SUMMARY

SPRING 1990 TO SPRING 1991 INSPECTIONS TOTAL REMOVED						
Type	Statewide Total	Deficient Anchor Rods		Installation Defects/Problems	Total	
		Current Design	Old Design			
A	19	0	0	0	0	
B	23	0	0	0	0	
C	183	1	0	0	1	
D	386	0	0	3	3	
E	50	0	0	0	0	
G	251	0	2	2	4	
H	149	1	2	1	4	
I	83	0	3	0	3	
Misc.	3	0	0	0	0	
Total	1147	2	7	6	15	

TABLE 2 - CANTILEVERS REMOVED

<u>Type</u>	<u>Number &amp; Diameter of Anchor Rods</u>	<u>District</u>	<u>When Removed</u>	<u>Design</u>	<u>Reason Removed</u>	<u>Since Last Inspection</u>	<u>Comments</u>
C	8 - 1-1/2 in.	M	Spring 91	Current	No. 2 Deficient	7 yrs	Missed in Spring 90 Program
D	8 - 1-1/2 in.	M	Spring 90	Current	Improper Installation	6 yrs <sup>2</sup>	Defective as constructed
D	8 - 1-1/2 in.	8	Spring 90	Current	Improper Installation	5 yrs <sup>2</sup>	One rod not installed
D	8 - 1-1/2 in.	8	Spring 91	Current	Improper Installation	<sup>3</sup>	5"-6" extension welded on
I	4 - 1-1/2 in.	M	Spring 90	Old	No. 3 Deficient	6 yrs	Square Base
I <sup>1</sup>	4 - 1-1/2 in.	6	Fall 90	Old	No. 3 Deficient	6 mos	Square Base
I <sup>1</sup>	4 - 1-1/2 in.	M	Spring 91	Old	No. 2 Deficient	1 yr	Square Base
G	8 - 1-1/2 in.	M	Spring 90	Old	Improper Installation	3 yrs <sup>2</sup>	Welding on rod nos. 1 & 8
G	8 - 1-1/2 in.	M	Spring 90	Old	No. 8 Deficient	6 yrs	
G	8 - 1-1/2 in.	M	Fall 90	Old	Improper Installation	7 mos	All rods extended 35 in. by welding
G	8 - 1-1/2 in.	M	Fall 90	Old	No. 1 Deficient	7 mos	
H	8 - 2 in.	8	Spring 90	Old	No. 1 Broken	No record	Broken due to fatigue failure
H	8 - 2 in.	8	Fall 90	Old	No. 1 & 5 Deficient	7 mos.	No. 5 deficiency is extremely small
H	8 - 2 in.	6	Fall 90	Old	Improper Installation	No record	Nos. 4, 5, & 6 epoxy extensions
H	8 - 2-1/2 in.	M	Spring 90	Current	No. 6 Deficient	3 yrs	

NOTES:

<sup>1</sup>Two structures designated as Type D contained the Type I pattern of four anchor rods situated in a square base plate. These are shown as Type I in the table.

<sup>2</sup>Deficiency was noted in the previous inspection report.

<sup>3</sup>Installed June 1, 1990.

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 819  
**Location:** I-75 at Allen Road  
**District:** Metro  
**Structure Type:** G  
**Anchor Rod Pattern:** Eight 1 1/2-in. diameter, round

**Date Inspected:** February 5, 1990  
**Findings:** Welding of nuts on the No. 1 and No. 8 anchor rods

**Date Verified:** No need to verify  
**Date Removed from Service:** February 23, 1990  
**Reasons for Removal:** Welding of nuts on the No. 1 and No. 8 anchor rods

**Previous Inspections and Results:** 1987 - Anchor rods No. 1 and No. 8 shown to be broken

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 237  
**Location:** I-96 at Farmington Road, Exit 174  
**District:** Metro  
**Structure Type:** G  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, round

**Date Inspected:** February 26, 1990  
**Findings:** Rejectable indication in anchor rod No. 8

**Date Verified:** Not verified  
**Date Removed from Service:** February 26, 1990  
**Reasons for Removal:** Rejectable indication in anchor rod No. 8

**Previous Inspections and Results:** 1984 - All anchor rods acceptable

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 687  
**Location:** WB US-12, 300 ft West of Birch Street  
**District:** Metro District  
**Structure Type:** H  
**Anchor Rod Pattern:** Eight 2-1/2-in. diameter, round

**Date Inspected:** March 1, 1990  
**Findings:** Rejectable indication in rod No. 6

**Date Verified:** Not verified  
**Date Removed from Service:** March 2, 1990  
**Reasons for Removal:** Rejectable indication in rod No. 6

**Previous Inspections and Results:** 1987 - No defects found

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 17  
**Location:** SB M-53 between 13 Mile Road and 14 Mile Road  
**District:** Metro  
**Structure Type:** Old style I  
**Anchor Rod Pattern:** Four 1-1/2-in. diameter, square

**Date Inspected:** March 8, 1990  
**Findings:** Deficiency in rod No. 3

**Date Verified:** Not verified  
**Date Removed from Service:** March 8, 1990  
**Reasons for Removal:** Deficiency in rod No. 3

**Previous Inspections and Results:** 1984 - All rods acceptable

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 168  
**Location:** EB M-153 at SB M-39  
**District:** Metro  
**Structure Type:** D  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, square

**Date Inspected:** March 8, 1990

**Findings:** Anchor rod No. 8 contained a defect as constructed

**Date Verified:** Not verified

**Date Removed from Service:** March 10, 1990

**Reasons for Removal:** Defect in rod No. 8

**Previous Inspections and Results:** 1984 - Defect in rod No. 8 reported

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 158  
**Location:** NB US-127 South of I-96  
**District:** 8  
**Structure Type:** H  
**Anchor Rod Pattern:** Eight 2-in. diameter, round

**Date Inspected:** February 22, 1990

**Findings:** Rod No. 1 failed due to fatigue

**Date Verified:** No need to verify

**Date Removed from Service:** February 22, 1990

**Reasons for Removal:** Failed rod No. 1

**Previous Inspections and Results:** No records of previous evaluations

**Remarks:** None

**Inspection Program:** Spring 1990  
**Structure Number:** Structure Report No. 576  
**Location:** I-75 at Front Street  
**District:** 8  
**Structure Type:** D  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, round

**Date Inspected:** February 23, 1990

**Findings:** The base was constructed with one less anchor rod than required

**Date Verified:** No need to verify

**Date Removed from Service:** February 25, 1990

**Reasons for Removal:** Missing anchor rod

**Previous Inspections and Results:** 1985 - Missing anchor rod was noted

**Remarks:** None

**Inspection Program:** Fall 1990  
**Structure Number:** 6003  
**Location:** WB US-10 (M-25) at exit ramp to SB I-75  
**District:** 6  
**Structure Type:** Old style Type D (Type I anchor pattern)  
**Anchor Rod Pattern:** Four 1-1/2-in. diameter, square

**Date Inspected:** September 18, 1990

**Findings:** Rejectable indication in rod No. 3, 1-1/2 to 1-3/4 in. below the top of the anchor rod surface

**Date Verified:** Not verified

**Date Removed from Service:** October 18, 1990

**Reasons for Removal:** The cantilever was in such a condition that it probably would have been removed under the construction contract; however, because of the rejectable indication in one anchor rod, and not being able to test another, the cantilever was removed immediately.

**Previous Inspections and Results:** March 9, 1990 - No. 3 was shown to be acceptable.

**Remarks:** Rod No. 4 was too short to be tested ultrasonically.



**Inspection Program:** Fall 1990  
**Structure Number:** 8048  
**Location:** NB US-127 at M-36  
**District:** 8  
**Structure Type:** H  
**Anchor Rod Pattern:** Eight 2-in. diameter, round

**Date Inspected:** October 3, 1990

**Findings:** Rejectable indication in rod No. 1 was noted 2-3/4 in. down from the top of the rod

**Date Verified:** October 4, 1990

**Date Removed from Service:** October 11, 1990

**Reasons for Removal:** Rejectable indication in rod No. 1 and a small flaw was indicted in rod No. 5 noted during verification

**Previous Inspections and Results:** February 22, 1990 - No defects found  
January, 1983 - No defects found

**Remarks:** None

**Inspection Program:** Fall 1990  
**Structure Number:** Unknown  
**Location:** SB I-75 at Dixie Highway  
**District:** 6  
**Structure Type:** H  
**Anchor Rod Pattern:** Eight 2-in. diameter, round

**Date Inspected:** October 4, 1990

**Findings:** Unusual indications were shown for rod Nos. 4, 5, and 6 approximately 1/2 in. down from the top surface. It appeared that these three rods were too short to obtain full nut engagement so short pieces of threaded rods had been epoxied on.

**Date Verified:** No need to verify

**Date Removed from Service:** October 11, 1990

**Reasons for Removal:** Inadequate nut engagement to anchor rod Nos. 4, 5, and 6

**Previous Inspections and Results:** No records of previous evaluations

**Remarks:** None

**Inspection Program:** Fall 1990  
**Structure Number:** 9382  
**Location:** EB I-96 Collector Lanes at Greenfield Road, Exit 184  
**District:** Metro  
**Structure Type:** G  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, round

**Date Inspected:** October 8, 1990

**Findings:** It appeared the sign upright was fabricated 35 to 40 in. too short. The problem was apparently resolved in the field by welding anchor rod extensions and placing a concrete cap around the extended rods, thus raising the foundation height. Ultrasonic testing indicated these apparent welds.

**Date Verified:** No need to verify

**Date Removed from Service:** October 17, 1990

**Reasons for Removal:** All eight anchor rods welded 35 to 40 in. below the top of the concrete foundation, and a footing not in conformance to design standards.

**Previous Inspections and Results:** March 3, 1990 - No rejectable indications

**Remarks:** It is reasonable that defects were not ultrasonically detected during previous evaluations. The UT screen is usually set for detecting flaws down to a depth of 10 in. Because the inspector reported the unusual footing, it was determined to set the UT to measure down to a depth of 40 in..

**Inspection Program:** Fall 1990  
**Structure Number:** 9485  
**Location:** SB M-39 at Rotunda Drive, Exit 5  
**District:** Metro  
**Structure Type:** G  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, round

**Date Inspected:** October 15, 1990

**Findings:** Rejectable indication in rod No. 1 approximately 2 in. down from top of the rod

**Date Verified:** October 17, 1990

**Date Removed from Service:** October 18, 1990

**Reasons for Removal:** Rejectable indication in rod No. 1

**Previous Inspections and Results:** March 2, 1990 - No rejectable indications noted

**Remarks:** The upper portion of rod No. 1 was salvaged and forwarded to the Materials and Technology Laboratory for further evaluation. No evidence of fatigue cracking was found in the laboratory.

**Inspection Program:** Spring 1991  
**Structure Number:** 8185  
**Location:** EB I-94 One Mile in advance of Rawsonville Road, Exit 187  
**District:** 8  
**Structure Type:** D  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, round

**Date Inspected:** March 3, 1991

**Findings:** A deficiency located 5 to 6 in. below the top of the rod in anchor rod No. 7. The salvaged anchor rod clearly indicated the anchor rod had been welded at the location of the rejectable flaw.

**Date Verified:** March 7, 1991

**Date Removed from Service:** March 7, 1991

**Reasons for Removal:** Rejectable indication in rod No. 7

**Previous Inspections and Results:** No previous inspections. The cantilever had been installed on June 1, 1990.

**Remarks:** None

**Inspection Program:** Spring 1991  
**Structure Number:** 9002  
**Location:** NB M-53 at Chicago Road  
**District:** Metro  
**Structure Type:** Old style Type D (Type I anchor rod pattern)  
**Anchor Rod Pattern:** Four 1-1/2-in. diameter, square

**Date Inspected:** March 12, 1991

**Findings:** Rejectable indication in rod No. 2 approximately 2 in. down from the top of the anchor rod

**Date Verified:** March 13, 1991

**Date Removed from Service:** March 14, 1991

**Reasons for Removal:** Rejectable indication in rod No. 2

**Previous Inspections and Results:** March 8, 1990 - All anchor rods acceptable  
January 19, 1984 - All anchor rods acceptable

**Remarks:** The upper portion of the anchor rod was salvaged and forwarded to the Materials and Technology Laboratory for further evaluation. Laboratory evaluation reveal a gouge in the threads.

**Inspection Program:** Spring 1991  
**Structure Number:** 9154  
**Location:** NB Novi Road at EB I-96  
**District:** Metro  
**Structure Type:** C  
**Anchor Rod Pattern:** Eight 1-1/2-in. diameter, base plate pattern not visible

**Date Inspected:** April 22, 1991

**Findings:** A rejectable indication in anchor rod No. 2 approximately 7 in. down from the top surface of the anchor rod.

**Date Verified:** April 23, 1991

**Date Removed from Service:** April 23, 1991

**Reasons for Removal:** Rejectable indication in rod No. 2

**Previous Inspections and Results:** February 9, 1984 - All anchor rods acceptable

**Remarks:** The top portion of the anchor rod was salvaged and forwarded to the Materials and Technology Laboratory for further evaluation. No evidence of fatigue cracking in the top portion was found in the laboratory.