



**WVDOT/DOH Report**

## **Evaluation of Weathering Steel Overhead Sign Structures in West Virginia**

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and

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<b>16. Abstract</b> <p>This report presents the results and findings of the research work aimed at evaluating 82 weathering steel sign structures in Charleston Interstate System in West Virginia. Twenty-six comprehensive inspection forms were developed to objectively evaluate the current condition of the following sign structure types: single and double arm ground mount cantilever structures; bridge superstructure mount cantilever structures; retaining wall mount cantilever structures; retaining wall mount truss structures; two-dimensional and three-dimensional ground mount truss structures; bridge parapet mount truss structures; and bridge frame mount structures. The work included performing extensive field inspection of the elements of each sign structure including the foundations, drainage issues, grout pads, base plates, anchor bolts/nuts/washers, connections between base plates and vertical columns, vertical columns and horizontal chords, connections between vertical columns and horizontal chords, welded splice connections, and attachments. An element condition rating was developed. The element condition rating took into consideration specific rating criteria ranging from severe to good condition. Current condition of each sign structure was then evaluated by an overall condition rating system. The overall condition rating is estimated based on calculating the ratio between the total score of each structure (S) and its maximum possible total score (<math>S_{max}</math>). Following the developed rating methodology presented in the report for the inspected weathering steel sign structures, seven percent were found to be at high risk, 50 percent were at moderate risk, and 43 percent were at low risk. The rating system is intended to assist the WVDOH to make rational decisions on whether there is a need to repair or replace at-risk elements or connections. In-depth evaluations are recommended for the sign structures with the highest risk rating. Further evaluations are recommended for the sign structures with a moderate risk rating to detect any serious defects which may endanger the structure or the traveling public. Normal periodic inspections are recommended for the sign structures with a low risk rating.</p>			
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## **Executive Summary**

Weathering steel sign structures are widely used in interstate highways and at traffic intersections. They are susceptible to fatigue, cracking and lateral buckling under wind loads because of their high span-to-weight ratio and relatively small cross-sectional area. State Departments of Transportation (DOTs) need to consider rational and viable decisions regarding preservation and replacement alternatives of weathering steel sign structures. The decision-making and prioritization of maintenance and replacement plans can be executed more objectively when a representative framework is developed. The ultimate goal of this project is to assist the West Virginia Department of Highways (WVDOH) in managing its weathering steel sign structures inventory through appropriate periodic inspection and evaluation of their current condition. To achieve this goal, the researchers developed an element condition rating system and an overall sign structure inspection framework. This framework was then applied to the WVDOH inventory in its Charleston Interstate System, which includes 82 weathering steel sign structures. Twenty-six comprehensive inspection forms were developed to evaluate the current condition of the inventory, which includes the following sign structure types:

- 1) Type 1.1: Double Armed Ground Mounted Cantilever
- 2) Type 1.2: Single Armed Ground Mounted Cantilever
- 3) Type 2.1: Bridge Superstructure Mounted Cantilever
- 4) Type 2.2: Parapet Wall Mounted Cantilever
- 5) Type 3.1: Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides
- 6) Type 3.2: Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides
- 7) Type 3.3.1: Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides
- 8) Type 3.3.2: Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side
- 9) Type 3.4: Single Chord Ground Mounted Truss
- 10) Type 4: Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection
- 11) Type 5: Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection
- 12) Type 6.1.1: Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns
- 13) Type 6.1.2: Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns

- 14) Type 6.2.1: Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns
- 15) Type 6.2.2: Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns
- 16) Type 6.3: Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns
- 17) Type 6.4: Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns
- 18) Type 6.5: Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns
- 19) Type 6.6: Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns
- 20) Type 7: Retaining Wall Mounted Cantilever
- 21) Type 8: Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside
- 22) Type 9: Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside
- 23) Type 10.1: Bridge Frame Mount - Steel Girder Attached
- 24) Type 10.2: Bridge Frame Mount - Concrete Box Girder Attached
- 25) Type 11.1: Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns
- 26) Type 11.2: Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns

The project included extensive field inspections of the structural elements of the 82 sign structures. Eighty sign structures were successfully inspected. The two remaining structures (Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns) were partially inspected due to the difficulty in accessing some elements of these structures. Below are lists of elements that were inspected:

- Foundation/superstructure bracket
- Drainage issues
- Grout pad under the base plate
- Base plate/mounting plate
- Nuts/washers
- Anchor bolts (using visual inspection and ultrasonic testing)
- Connections between base plate/mounting plate and vertical column
- section loss of the vertical column near the base plate/mounting plate
- Weld lines between vertical columns and supplemental bracing
- Vertical weld lines between tubes constituting the vertical column
- Vertical column, internal and external condition



- Connections between the vertical column and horizontal chords
- Horizontal chords and secondary vertical posts
- Attachments: vertical sign supports, horizontal light arms, vertical sign support to horizontal chord connection bracket, sign panels, electric distribution boxes, conduits, traffic control devices, cameras, etc.

Structural elements of each sign structure were evaluated using an element condition rating system. The element condition rating system includes a sequential rating score (i.e. '0', '1', '2', '3', '4') and an importance weight for each structural element. The overall condition of each sign structure was then evaluated using an overall condition rating system. The overall condition rating is estimated based on the ratio between the total score recorded for each structure ( $S$ ) and its maximum possible total score ( $S_{\max}$ ). Sign structures with ratios between  $0.25 \leq S/S_{\max} < 0.43$  are categorized as "low risk". Sign structures with ratios between  $0.43 \leq S/S_{\max} < 0.62$  are categorized as "moderate risk". Sign structures with ratios between  $0.62 \leq S/S_{\max} < 0.8$  are categorized as "high risk". Sign structures with ratios between  $0.8 \leq S/S_{\max} \leq 1.0$  are categorized as "very high risk". Table 1 shows the overall condition rating for all inspected weathering steel sign structures. The sign structures in Table 1 are sorted in the order of largest to smallest  $S/S_{\max}$  ratio (i.e. highest rating risk to lowest rating risk). Ultrasonic inspection results of anchor/connection bolts and maximum section loss of vertical columns near base plates are also included in Table 1. It can be seen from Table 1 that six structures were found to be at high risk with the  $S/S_{\max}$  ratio ranging from 0.68 to 0.72; 40 structures were at moderate risk with the  $S/S_{\max}$  ratio ranging from 0.44 to 0.63; and 34 structures were at low risk with the  $S/S_{\max}$  ratio ranging from 0.3 to 0.43. Four of the six structures with a high risk rating are structure type #4 ("Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection"). Two other structures with a high risk rating are structure type #3.3.2 ("Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side") and structure type #6.6 ("Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns"). It should be noted that all structures with Ground Mounted Trusses (structure types #4 and #5) and 93 percent of structures with two/three-dimensional overhead trusses (structure types #3.1, 3.2, 3.3.1, 3.3.2) are rated as either moderate or high risk.

The element and overall condition rating systems are intended to assist the WVDOH in making rational decisions on whether there is a need to repair or replace at-risk elements or connections. To detect any serious defects which may endanger the structure or the traveling public, in-depth evaluations are recommended for the sign structures with the highest risk rating. Further evaluations are recommended for the sign structures with a moderate risk rating. Normal periodic inspections are recommended for the sign structures with a low risk rating.

**Table 1** Overall Condition Rating for All Inspected Weathering Steel Sign Structures

Structure Number	Form Number	UT Signal Indication (FSH)	Max. Section Loss (%)	Min. Score ( $S_{min}$ )	Max. Score ( $S_{max}$ )	Total Score (S)	$S/S_{max}$	Rating
01-20-064-57.53	4	NRI	51	46	184	132	0.71739	High risk
01-20-064-57.91	6.6	10%-49%	37	44	176	122	0.69318	High risk
01-20-064-56.33	4	NRI	41	46	184	127	0.69022	High risk
01-20-077-101.84	3.3.2	NRI	41	46	184	126	0.68478	High risk
01-20-064-57.52	4	NRI	39	46	184	126	0.68478	High risk
01-20-064-57.51	4	NRI	25	46	184	125	0.67935	High risk
01-20-079-01.12	4	NRI	29	46	184	115	0.625	Moderate risk
01-20-064-55.00	4	NRI	34	46	184	109	0.59239	Moderate risk
01-20-077-100.12	4	NRI	50	46	184	104	0.56522	Moderate risk
01-20-064-58.30	5	NRI	53	46	184	104	0.56522	Moderate risk
01-20-064-53.72	3.3.1	10%-52%	19	46	184	102	0.55435	Moderate risk
01-20-077-101.63	10.1	NRI	N/A	34	136	75	0.55147	Moderate risk
01-20-060-11.44	3.3.1	10%-40%	26	46	184	100	0.54348	Moderate risk
01-20-60/62-00.39	6.4	NRI	27	47	188	102	0.54255	Moderate risk
01-20-060-12.97	1.2	NRI Can't UT	21	46	184	99	0.53804	Moderate risk
01-20-079-00.68	3.3.1	9%-55%	58	46	184	99	0.53804	Moderate risk
01-20-077-099.58	5	NRI Crack	22	46	184	99	0.53804	Moderate risk
01-20-077-103.38	3.2	NRI	27	46	184	98	0.53261	Moderate risk
01-20-064-53.73	1.2	10%-18%	39	46	184	97	0.52717	Moderate risk
01-20-064-58.27	1.1	NRI	20	46	184	96	0.52174	Moderate risk
01-20-077-102.49	1.1	NRI	31	46	184	95	0.5163	Moderate risk
01-20-077-099.98	4	NRI	30	46	184	95	0.5163	Moderate risk
01-20-064-58.56	11.2	NRI	56	51	204	105	0.51471	Moderate risk
01-20-077-100.39	6.2.1	NRI	24	44	176	90	0.51136	Moderate risk
01-20-064-55.85	1.1	NRI	25	46	184	93	0.50543	Moderate risk
01-20-077-100.22	6.2.2	NRI	41	44	176	88	0.5	Moderate risk
01-20-064-56.04	1.1	NRI	31	46	184	90	0.48913	Moderate risk
01-20-064-54.61	1.2	12%-39%	15	46	184	90	0.48913	Moderate risk
01-20-077-100.72	6.1.2	NRI	17	44	176	85	0.48295	Moderate risk
01-20-60/62-00.22	6.4	NRI	27	44	176	85	0.48295	Moderate risk
01-20-064-55.48	3.3.1	NRI	20	46	184	88	0.47826	Moderate risk
01-20-077-098.57	1.1	NRI	14	46	184	87	0.47283	Moderate risk
01-20-077-100.98	3.1	NRI	10	46	184	87	0.47283	Moderate risk
01-20-077-103.14	3.2	NRI	18	46	184	87	0.47283	Moderate risk
01-20-064-58.55	6.1.1	NRI	16	44	176	81	0.46023	Moderate risk
01-20-077-098.94	8	NRI	5	47	188	86	0.45745	Moderate risk
01-20-077-097.95	1.1	NRI	32	46	184	84	0.45652	Moderate risk
01-20-119-18.46	3.2	NRI	27	46	184	84	0.45652	Moderate risk
01-20-064-55.46	3.3.1	NRI	30	46	184	84	0.45652	Moderate risk
01-20-064-56.50	1.1	NRI	32	46	184	84	0.45652	Moderate risk

Note: UT = Ultrasonic Testing; FSH = Full Screen Height; NRI = Non-Relevant Indication.

**Table 1** Overall Condition Rating for All Inspected Weathering Steel Sign Structures (Cont'd)

Structure Number	Form Number	UT Signal Indication	Max. Section Loss (%)	Min. Score ( $S_{min}$ )	Max. Score ( $S_{max}$ )	Total Score (S)	S/ $S_{max}$	Rating
01-20-077-100.16	6.2.2	NRI	32	44	176	80	0.45455	Moderate risk
01-20-077-101.68	1.2	NRI	29	46	184	83	0.45109	Moderate risk
01-20-077-101.23	3.1	NRI	9	46	184	81	0.44022	Moderate risk
01-20-077-100.08	3.2	NRI	34	46	184	81	0.44022	Moderate risk
01-20-077-102.65	3.2	NRI	19	46	184	81	0.44022	Moderate risk
01-20-064-58.74	2.1	NRI	1	44	176	77	0.4375	Moderate risk
01-20-064-55.12	1.1	NRI	8	46	184	79	0.42935	Low risk
01-20-077-100.90	6.1.1	NRI	4	44	176	75	0.42614	Low risk
01-20-077-100.34	6.2.1	NRI	25	44	176	75	0.42614	Low risk
01-20-077-100.58	6.2.2	NRI	29	44	176	75	0.42614	Low risk
01-20-064-57.87	3.4	NRI	42	43	172	73	0.42442	Low risk
01-20-077-101.58	1.2	NRI	21	46	184	78	0.42391	Low risk
01-20-077-100.88	6.1.1	NRI	31	44	176	74	0.42045	Low risk
01-20-064-57.98	10.2	Can't UT	N/A	39	156	65	0.41667	Low risk
01-20-077-098.29	11.1	NRI	25	54	216	90	0.41667	Low risk
01-20-077-100.09	6.5	NRI	31	47	188	78	0.41489	Low risk
01-20-079-01.57	3.3.1	NRI	15	46	184	76	0.41304	Low risk
01-20-077-101.64	10.1	NRI	N/A	34	136	56	0.41176	Low risk
01-20-064-57.88	1.1	10%-16%	12	46	184	75	0.40761	Low risk
01-20-077-098.45	2.2	NRI	18	41	164	66	0.40244	Low risk
01-20-064-57.83	1.1	12%-13%	7	46	184	74	0.40217	Low risk
01-20-077-097.32	1.1	NRI	24	46	184	74	0.40217	Low risk
01-20-060-13.07	1.2	NRI	17	46	184	74	0.40217	Low risk
01-20-064-57.89	3.4	NRI	30	43	172	68	0.39535	Low risk
01-20-119-19.54	1.2	NRI	7	46	184	71	0.38587	Low risk
01-20-119-19.57	1.2	NRI	25	46	184	71	0.38587	Low risk
01-20-064-58.25	10.2	Can't UT NRI	N/A	39	156	60	0.38462	Low risk
01-20-077-099.10	2.2	NRI	6	41	164	63	0.38415	Low risk
01-20-064-58.10	1.2	NRI	5	46	184	70	0.38043	Low risk
01-20-064-52.40	1.1	10%-31%	15	46	184	69	0.375	Low risk
01-20-064-58.54	1.1	NRI	13	46	184	68	0.36957	Low risk
01-20-060-11.48	1.2	NRI	33	46	184	68	0.36957	Low risk
01-20-064-58.15	10.2	Can't UT	N/A	39	156	57	0.36538	Low risk
01-20-077-100.89	2.1	NRI	1	44	176	64	0.36364	Low risk
01-20-077-100.91	2.1	NRI	3	44	176	63	0.35795	Low risk
01-20-064-57.92	10.2	Can't UT NRI	N/A	39	156	55	0.35256	Low risk
01-20-077-098.76	7	NRI	N/A	24	96	33	0.34375	Low risk
01-20-077-099.30	9	NRI	30	54	216	72	0.33333	Low risk
01-20-077-101.24	1.1	NRI	2	46	184	57	0.30978	Low risk
01-20-064-55.45	1.2	NRI	6	46	184	55	0.29891	Low risk
01-20-064-57.60	6.3							
01-20-064-57.77	6.3							

Note: UT = Ultrasonic Testing; FSH = Full Screen Height; NRI = Non-Relevant Indication.

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## **DISCLAIMER STATEMENT**

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# **CHAPTER 1**

## **INTRODUCTION**



## 1.1 Introduction

The Charleston Interstate System is generally understood to consist of Interstate Route 64 between Exit 54 at Dunbar and the junction of I-64 and I-77 in Charleston; Interstate Route 77 between Exit 95 at MacCorkle Avenue and Exit 106 at Edens Fork; and Interstate Route 79 between its junction with I-77 and Exit 5 at Big Chimney. This area encompasses 82 signs of interest. There are 10 general categories of sign structures. Table 1.1 shows a summary of the general categories and quantity of each structure type, while Table 1.2 lists all specific structure types and quantity.

**Table 1.1** General Categories and Quantity of Each Structure Type

<b>Structure Type</b>	<b>Description</b>	<b>Quantity</b>
1	Ground Mount Cantilever	25
2	Bridge Mount Cantilever	4
3	Ground Mount Trusses (shoulder mounted both sides)	15
4	Ground Mount Trusses (one shoulder mount and one median barrier wall connection)	11
5	Ground Mount Trusses (two shoulder mount and one median barrier wall connection)	2
6	Bridge Mounted Half-Span Trusses	15
7	Retaining Wall Mounted Cantilever	2
8	Half Span with Retaining Wall Mount (both sides)	1
9	Half Span with Shoulder Mount on Outside and Retaining Wall Mount on Inside	1
10	Bridge Frame Mount	6
	<b>Total</b>	<b>82</b>

**Table 1.2** Specific Structure Types and Quantity

<b>Structure Type</b>	<b>Description</b>	<b>Quantity</b>
1.1	Double Armed Ground Mounted Cantilever	14
1.2	Single Armed Ground Mounted Cantilever	11
2.1	Bridge Superstructure Mounted Cantilever	3
2.2	Parapet Wall Mounted Cantilever	2
3.1	Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides	2
3.2	Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides	5
3.3.1	Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides	6
3.3.2	Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side	1
3.4	Single Chord Ground Mounted Truss	2
4	Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	8
5	Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	2
6.1.1	Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns	3
6.1.2	Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns	1
6.2.1	Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns	2
6.2.2	Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns	3
6.3	Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns	2
6.4	Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns	2
6.5	Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns	1
6.6	Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns	1
7	Retaining Wall Mounted Cantilever	1
8	Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside	1
9	Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside	1
10.1	Bridge Frame Mount - Steel Girder Attached	2
10.2	Bridge Frame Mount - Concrete Box Girder Attached	4
11.1	Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns	1
11.2	Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns	1
	<b>Total</b>	<b>82</b>

## **1.2 Problem Statement**

Weathering steel sign structures are widely used in interstate highways and at traffic intersections. They are susceptible to fatigue, cracking, and lateral buckling under wind loads because of their high span-to-weight ratio and relatively small cross-sectional area. State Departments of Transportation (DOTs) need information that enables them to make rational and objective decisions regarding preservation and replacement alternatives of weathering steel sign structures. The decision-making and prioritization of maintenance and replacement plans can be executed objectively and effectively when a representative framework is developed.

## **1.3 Research Objectives**

The ultimate goal of this project is to assist the West Virginia Department of Highways (WVDOH) manage its weathering steel sign structures inventory by developing a systematic inspection and evaluation framework based on a subset of the overall WVDOH sign structure inventory. To achieve this goal, this project was divided into two primary objectives. First, twenty-six comprehensive inspection forms were developed to effectively evaluate the current condition of 82 weathering steel sign structures in the WVDOH Charleston Interstate System. This inventory includes the following sign structural types: single and double arm ground mount cantilever structures, bridge superstructure mount cantilever structures, retaining wall mount cantilever structures, retaining wall mount truss structures, two-dimensional and three-dimensional ground mount truss structures, bridge parapet mount truss structures, and bridge frame mount structures.

Second, data was collected during extensive field inspections and the condition of each sign structure was evaluated. Elements inspected include anchor bolts, footers, connections to bridges or retaining walls, main structural members, secondary structural members, and structural member to structural member connections. A management system was developed such that if a field inspection revealed any serious element or defect that is common to a particular sign type, or a defect or failure of a particular sign structure which may endanger the structure or the traveling public, the WVDOH Project Manager would be notified immediately.

The study outcomes shall be used to develop guidelines to document all structural insufficiencies of the sign structures during the performance of future periodic inspections.

## **1.4 Project Tasks Completed**

### **Task 1: Conduct an extensive literature review to determine findings of other State DOTs**

A literature review was conducted by researching inspection reports, guidelines, and manuals for various sign structures from selected State Departments of Transportation(s) and the Federal Highway Administration.

### **Task 2: Develop a draft inventory and inspection form**

Several drafts of twenty six comprehensive inspection forms were developed to effectively evaluate the current condition of the following sign structural types: single/double armed ground mounted cantilever structures, bridge superstructure/parapet wall mounted cantilever structures, two/three-dimensional overhead truss structures, ground mounted truss structures, bridge mounted half span

truss structures, retaining wall mounted cantilever structures, half span with retaining wall/parapet/shoulder mounted structures, and bridge frame mounted structures.

**Task 3: Refine and finalize Phase I field inspection form and its accompanying instructions and developing a plan for field Inspections**

Twenty-six comprehensive inspection forms for Phase I of this project were finalized. Accompanying instructions for each inspection form were provided. A plan for field inspections of weathering sign structures in Charleston Interstate System was made.

**Task 4: Conduct field inspections to collect pertinent Weathering Steel sign structure information**

Eighty-two sign structures were inspected; of these inspections, 80 were completed successfully. The two remaining sign structures (Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns) were partially inspected due to the difficulty in accessing some elements of these two structures. Pertinent information for each structure was logged on one of the appropriate twenty-six inspection forms. This information included sign structure information (structure number, structure width/height, total number of travel lanes, etc.), foundation, drainage issues, grout pad under base plates, base plates, visual inspection of anchor bolts, nuts/washers, ultrasonic inspection of anchor bolts, connections between base plates and vertical columns, section loss of vertical columns near base plates, weld lines between column vertical members and supplemental bracings, interior/exterior observation of vertical columns, connections between vertical columns and horizontal chords, horizontal chords and secondary vertical posts, and attachments.

**Task 5: Compile a comprehensive electronic inspection inventory that includes a report for each sign structures**

The current condition of each sign structure, including all of its components, has been evaluated. A report for each sign structure has been documented. Data from inspected structures provided by the sub-contractor have been scanned and named as PDFs onto an external hard drive so as to provide electronic copies of these documents. All original paper documents have been neatly organized into folders and labeled accordingly.

**Task 6: Prepare a final report**

A draft of the final report has been prepared to submit to the WVDOH. The report will reflect the directions, comments, and feedback that will be provided by the WVDOH Project Manager. The report will then be modified based on further comments from the WVDOH Project Manager. The revised version of the report will be re-submitted to the WVDOH for final approval.

**Task 7: Develop a "Request for Proposals" (RFP) for conducting future Inspection**

A "Request for Proposals" (RFP) framework for conducting future inspections will be developed.

**Task 8: Plan for Phase II and submission of Phase II Proposal**

After approval of the Phase I final report, the principal investigator will start planning for Phase II tasks and preparing a proposal to reflect the needed tasks. Phase II will focus on structures inspected during Phase I that warrant an in-depth follow-up inspection based on the deficiencies noted. Phase II

will include detailed analyses of existing structure base and arm end connection details to determine the feasibility of reusing these end connections for replacement structures in the future. A program that includes in-depth inspection of potentially deficient structures, including non-destructive testing of base plates, anchor bolts, and connections shall be proposed. Non-destructive testing for the concrete foundations of bridge-mounted sign structures will be recommended if needed. Applicability of findings to other types of sign supports, high mast towers, and signal and lighting poles shall also be considered. Wide dissemination of the project findings through possible presentations in regional/national meetings and conferences shall be included in Phase II. A plan to share the deliverables with the FHWA will be proposed.

#### **Task 9: Subcontract Management**

Management of subcontract has been completed.

### **1.5 Organization of Report**

This section addresses the layout of this report. The report includes six chapters to document the completed tasks and the major findings of the study. Chapter 1 includes an introduction to weathering sign structures and the importance of evaluating their current conditions. The problem statement, research objectives and the completed project tasks are included in Chapter 1. A literature review for sign structures has been included in Chapter 2. Reports, guidelines, and manuals from different states such as Michigan, New York, Virginia, Indiana, and the Federal Highway Administration (FHWA) related to inspection of sign structures are presented in Chapter 2. Chapter 3 presents methodologies for the inspection of sign structures including visual and ultrasonic test inspections. General and component inspection procedures are discussed in Chapter 3. Details of inspections for sign structure components (such as foundations, base plates, anchor bolts/nuts/washers, base plate/vertical column connections, vertical columns and horizontal chords, vertical column/horizontal chord connections, welded splice connections, attachments, etc.) are also explained in Chapter 3. The development of the twenty-six inspection forms is presented. An example of the developed inspection form is given at the end of this chapter. Chapter 4 focuses on development of an element condition rating system using a sequential arithmetic rating score. Chapter 4 also provides the rating criteria and scoring system used to evaluate each structural element of the 26 types of weathering steel overhead sign structures. The overall condition of each sign structure and its inspection results/findings are given in this chapter. Chapter 5 contains the summary and conclusions of the project.

# **CHAPTER 2**

## **LITERATURE REVIEW**

## **2.1 Inspection reports, guidelines, and manuals for sign structures by State Departments of Transportation and Federal Highway Administration**

Michigan DOT (MDOT) performed visual inspections to determine overall condition of 118 sign support structures (82 cantilever and 36 overhead trusses), which was ten percent of the sign supporting structures randomly selected from various districts of the state (MDOT 1989). These structures were visually inspected and deficiencies such as splitting, bending, and cracking of the tubular members were recorded. Welds were checked for cracking and any crack found was recorded and reported to the Maintenance Division. The connecting bolts were thoroughly inspected and the overall condition of each structure was determined. It was concluded that the sign supports in the state of Michigan were in good condition.

New York State DOT (NYSDOT) developed a manual for obtaining inventory data and performing structural condition inspections of overhead sign structures located within New York State (NYSDOT 1999). The manual explains the procedures required to properly document the inventory and inspection data on standard forms, and was supplemented by notes, sketches, and photographs.

Virginia DOT (VDOT) developed a program to inventory and inspect traffic control device structures to provide the Department with the information necessary to determine their physical and functional condition (VDOT 2006). It also provided those individuals performing the inventory and inspection of traffic control device structures with the information necessary to complete their duties both safely and thoroughly. The program included inspection procedures, planning guidelines, a component inspection guide, and maintenance guidelines. Six types of structures were considered: 1) Overhead span sign structures (single-chord, two-chord, tri-chord, and four-chord); 2) Cantilever sign structures (single-chord, two-chord, and four-chord); 3) Bridge parapet mount; 4) Butterfly sign structures; 5) High mast lighting structures; and 6) Camera pole structures.

Purdue University, in cooperation with the Indiana DOT (INDOT) and the Federal Highway Administration (FHWA), conducted a study to evaluate the fatigue behavior of sign structures that are commonly used in the State of Indiana (Li et al. 2006). The study included single mast-arm and double mast-arm cantilever sign structures, box-truss sign structures, tri-chord sign structures, and mono-tube sign structures. The authors developed inspection guidelines that provide information on where to look during an inspection for fatigue damage. They formulated an inspection plan using a crack propagation analysis to evaluate crack growth under the most critical wind conditions. They recommended an inspection period of four years for single and double mast-arm cantilever sign structures and an eight year inspection cycle for box-truss, tri-chord, and mono-tube sign structures.

FHWA provides guidance for the installation, inspection, maintenance, and repair of structural supports for highway signs, luminaires, and traffic signals (FHWA 2005). The

primary purpose of the FHWA document is to provide owners with information that can assist them in managing their inventory, identifying potential problem areas, and ensuring safe and satisfactory performance of these types of ancillary highway structures.



# **CHAPTER 3**

## **INSPECTION**

## **PROCEDURES**

### **3.1 Sign Structure Inspection Method**

A major aim of this project is to develop a systematic method to detect damages in sign structures in the field to prevent sudden structural failures. This process is very important to ensure the safe operation of interstate highways and road systems in West Virginia. During the course of this project, non-destructive testing (NDT) methods were used to evaluate sign structures since they can effectively detect defects in structural components without damaging the material. The following subsections discuss the two primary NDT techniques used to inspect sign structures in this project: visual inspection and ultrasonic testing (UT).

#### **a) Visual Inspection**

Visual inspection is a technique for identifying and inspecting cracks and other defects in sign structures. Visual inspection is the process of examining and evaluating of systems and components. This technique involves using human sensory systems, aided only by such mechanical enhancements to sensory input as magnifiers, dental picks, stethoscopes, and the like. The inspection process may be performed using such behaviors as looking, listening, feeling, smelling, shaking, and twisting (Spencer 1996).

The visual inspection technique has the advantage of being simple and power. However, there are several disadvantages. The results of visual inspection are highly influenced by human factors, including the experience and capabilities of inspection personnel. The size of cracks that can be found is limited by the capability of human eyes. Visual inspection also requires close access to the inspection location. Finally, only surface cracks can be found by visual inspection (Xuejun Li et al 2006). In order minimize these disadvantages, visual inspection can be combined with other inspection techniques such as UT.

#### **b) Ultrasonic Testing (UT) Inspection**

UT inspection uses very short ultrasonic pulse-waves with center frequencies ranging from 0.1-15 MHz and occasionally up to 50 MHz which are launched into materials to detect internal flaws or to characterize materials. The ultrasound waves are introduced into the test object at various surface locations by ultrasonic transducers. These waves travel through the test object and are received by other transducers. If a defect is in the propagation path of the ultrasound waves, the received ultrasound waves will be changed. Interpretation of the reflection and refraction of these ultrasound waves at a particular surface point can provide information about the size and location of defects in the test object (Xuejun Li et al 2006). UT inspection was used in this study to measure section losses at column bases, fractures of connection bolts, and thicknesses of connection members.

### **3.2 Sign Structure Inspection Procedure**

#### **a) General**

The sign structure inspection procedure may vary in some steps, based on the types of sign structures to be inspected, the availability of inspection equipment, and the inspector's professional judgment. But a general inspection procedure is proposed as follows (Zatar et al 2012):

(1) Arrive at inspection site.

(2) Record sign structure information, which includes structure number, structure length (widths and heights), total number travel lanes under structure, year installed, approximate location, county, longitude, latitude, route, milepost, interchange name/number, and any other relevant information

(3) Begin temporary traffic control operations for protection of the inspectors, their equipment, and the public.

(4) Perform inspection and record inspection results for the following components:

- Foundations, condition of the structure's surroundings, and drainage issues
- Grout pads
- Base plates
- Anchor bolts, nuts and washers
- Base plate/vertical structural support connections
- Hand-hole covers
- Inside of vertical structural members near the base of the member
- Drainage of moisture from inside the structure
- Outside of vertical structural members
- Vertical member/horizontal member connections
- Connection bolts
- Cracks
- Horizontal members
- Welded splices in vertical and horizontal members

- Structures with vertical members integrated in median barrier walls
- Attachments, including vertical sign supports, horizontal light arms, vertical sign support to horizontal chord connection bracket, sign panels, electric distribution boxes, conduits, traffic control devices, cameras, etc.

(5) Collect inspected data; evaluate and rate condition of the inspected sign structures.

(6) Remove temporary traffic control and leave inspection site.

### **b) Component Inspection**

This section discusses detailed inspection procedures for sign structure components. For all applicable components, the specific location, width, and length of any cracks should be inspected and logged. Bolt types with known issues will be examined.

#### **• *Foundations, Condition of the Structure Surroundings, and Drainage Issues***

Ground-mounted structure includes investigation of the structure foundations for signs of concrete spalling or cracking and corrosion or deterioration of any exposed reinforcements. For retaining wall mounted structures, this would include the immediate areas of the retaining wall itself near the structures, and where the structures mount to it. For the bridge-mounted structures, this would include signs of warping, cracking, corrosion, and spalling of the steel beams, plates, and concrete piers that the structures are bolted to. For the bridge/parapet wall mounted structures, this would include all components of the bridge superstructure in the immediate vicinity which are bearing the structure loading, such as the parapet wall blisters. There may be some cases where the foundations are on a slope and the soil on the downhill side has washed away from the foundation. Possible drainage issues need to be noted in the inspection report as well.

#### **• *Grout Pads***

Grout pads should be visually inspected for loss of grout, mortar splitting, and mortar spalling. Additionally, the inspector should measure the thickness of grout pads between top of the concrete foundation and the bottom of the leveling nuts.

#### **• *Base Plates***

➤ **Base plate of ground mounted structures:** Scaling or delamination of base plates, particularly the bottom and sides, will be reported. UT will be used to measure thickness of base plates. General overall condition, section loss, visible cracks, surface pitting, and signs of warping/buckling will be reported. Particular attention shall be given to the interface between the bottom outside edge of the base plates and the grout (when present).

➤ **Mounting plate of bridge parapet mounted structures:** The plates that are cast into the concrete will be examined. The level of corrosion/deterioration, signs of warping or

cracking, and signs of separation between the concrete and the plate will be reported. This will include examination of the connection rods/leveling nuts and mounting block bars that are made part of these plates, especially the connection of the rods to the plate.

➤ **Mounting plate mate of bridge parapet mounted structures:** The plate connected to the mounting plate that is cast into the concrete, as well as the connection of the two plates, should be inspected. The plate itself shall be examined in the same manner as the plate it is connected to. Bolted connection will be examined for deterioration/corrosion of the rods, nuts, and washers. Tightness of connections will be checked. Welds for the mounting block bars will be examined for deterioration, and/or cracking.

➤ **Connection plates of bridge mounted structures (steel-to-steel connections):** The plate used to mount the structure to the bridge steel superstructure will be examined. The level of corrosion/deterioration and signs of warping or cracking will be checked. The welding that connects this plate to the sign structure will be examined for deterioration, corrosion, or cracking.

- ***Anchor Bolts, Nuts, and Washers***

Anchor bolts, nuts, and washers should be visually and UT inspected. The level of corrosion/deterioration of the bolts and their nuts/washers, or signs of deterioration at the interface of the bolts and the concrete or steel, will be reported. Nuts, bolts, and washers will be checked for tightness, engagement, cracks, and fractures. Missing components will be reported.

- ***Base Plate/Vertical Structural Support Connections***

Weld connection will be inspected very closely for deterioration/corrosion and/or the presence of cracks. Particular attention will be given to the corners of the vertical uprights for the cantilever structures and the outside faces of the vertical uprights for the structures supported at both ends.

- ***Hand-Hole Covers***

Missing hand-hole covers and other potential locations for water or debris penetration will be noted.

- ***Inside of Vertical Structural Members near the Base of the Member***

Evidence of deterioration, such as scaling that has resulted in any degree of section loss, will be noted.

- ***Drainage of Moisture from Inside the Structure***

Fabrication details related to the facilitation of drainage from inside the structure (including weep holes) will be examined.

- ***Outside of Vertical Structural Members***

Exteriors of vertical structural members will be examined for signs of warping, buckling, deterioration, corrosion, and/or signs of distress, such as the presence of cracks and scaling on the outside face, especially near the base. For cantilever structures, particular care should be paid to the outside corners. Vertical welds for connecting individual tubes which comprise the vertical members will be inspected for evidence of deterioration, cracking, or separation.

- ***Vertical Member/Horizontal Member Connections***

These components are especially critical, some more than others, and warrant close and careful examination.

- ***Horizontal Members***

- **Horizontal members of double arm cantilever structures:** These members will be examined as close as practical for signs of distress, deterioration, or deformation. If possible, the welds connecting the horizontal members with vertical bracing and the end corner welds will be inspected for distress or cracks.

- **Horizontal members of single arm cantilevers:** These may be subject to some level of torsion. These members should be examined for deterioration, distress, or deformation with particular emphasis placed on the corners of the shape. The inside of these members will be examined as much as practically possible.

- **Horizontal members of 2D and 3D frame structures with supports on both ends:** The horizontal members and vertical/horizontal bracing members will be examined for any signs of distress or deformation. Particular attention will be given to the middle third of the span, as this is where the bending stresses could be the highest, especially the front and back of the horizontal members, as well as the bottom faces of the bottom members. The inside of these members will also be examined as much as practically possible.

- **Horizontal members of single-chord structures with supports on both ends:** These members are likely subject to some level of torsion and will be examined for distress or deformation. The highest bending stresses could be in the middle third of the span. Particular attention will be given to the corners of the member, especially at the end thirds of the span where the torsional stresses are expected to be highest. These members also have splice connections on each end near the ends of the span. These splice connections are made with an individual splice plate on each of the four faces of the splice. The outside end of the plate is welded along all three sides to the member. The inside end of the plate is connected to the member by a bolt group. The splice plates will

be checked for signs of deterioration, such as cracks, and for deformation due to bending and torsional stresses. The welds will be checked for deterioration/cracks. The bolts will be examined for their level of deterioration and possibly "sounded" for tightness.

- ***Welded Splices in Vertical and Horizontal Members***

Welded splices in vertical and horizontal members of specific structures will be examined for deterioration or cracks.

- ***Structures with Vertical Members Integrated in Median Barrier Walls***

Inspection of the base connection details for deterioration due to debris buildup is essential. This inspection may require removal of the plates that cover the gaps left in the barrier walls.

- ***Attachments***

The condition of attachments to the horizontal and vertical members, such as vertical sign supports, horizontal light arms, electrical distribution boxes, and their hardware, brackets, and conduits will be examined. Level of deterioration, tightness of connections, damage, and apparent deficiencies will be reported. Attention should be given to face-to-face interfaces between attachments and structural members. These areas will be examined for deterioration and rust build-up.

### **3.3 Development of Sign Structure Inspection Forms**

Twenty-six inspection forms were developed to evaluate the 82 weathering steel sign structures (Table 3.1) found in the WVDOH Charleston Interstate sign structure inventory. Figure 3.1 shows the first two pages of an inspection which used form #4. A full version of inspection form #4 is included in Appendix A. This form includes sixteen main sections and four appendices. The sections in each inspection form vary based on the particular type of sign structure. A general inspection form includes the following sections:

1. Sign structure information
2. Foundation/superstructure bracket
3. Drainage issues
4. Grout pad under the base plate
5. Base plate/mounting plate
6. Visual inspection of anchor bolts
7. Nuts/washers
8. Ultrasonic inspection of anchor bolts
9. Connections between base plate/mounting plate and vertical column

10. Measuring the section loss of the vertical column near the base plate/mounting plate
11. Weld lines between vertical columns and supplemental bracing
12. Vertical weld lines between tubes constituting the vertical column
13. Internal observations of the vertical column
14. External observations of the vertical column
15. Connections between the vertical column and horizontal chords
16. Horizontal chords and secondary vertical posts
17. Attachments

The structure of the following inspection form (Figure 3.1) is based on the inspection procedure discussed in Section 3.2. The order of component inspection in the form progresses from bottom to top of the sign structure. The first section of the inspection form collects basic information about the inspected sign structure. An overall structure key drawing describing all inspection components is presented. Each subsequent section provides lists of check boxes which cover all expected results of component's inspection. Some sections require the inspectors to fill in the UT inspection results of the anchor/connection bolts and plates. Detailed sketches are provided in sections which relate to UT inspections or connections between structural members. The inspectors are only required to tick the check boxes, fill in applicable spaces and write comments or make sketches if they find any deficiencies. This process not only ensures that the inspectors are not missing any inspection items, but also saves time during the inspection process. Finally, detailed inspection guidelines are provided in the appendix of the form to facilitate the inspection process.



**Table 3.1** Details of Twenty Six Developed Inspection Forms

<b>Structure Type</b>	<b>Developed Inspection Form</b>
Double Armed Ground Mounted Cantilever	1.1
Single Armed Ground Mounted Cantilever	1.2
Bridge Superstructure Mounted Cantilever	2.1
Parapet Wall Mounted Cantilever	2.2
Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides	3.1
Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides	3.2
Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides	3.3.1
Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side	3.3.2
Single Chord Ground Mounted Truss	3.4
Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	4
Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	5
Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns	6.1.1
Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns	6.1.2
Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns	6.2.1
Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns	6.2.2
Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns	6.3
Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns	6.4
Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns	6.5
Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns	6.6
Retaining Wall Mounted Cantilever	7
Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside	8
Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside	9
Bridge Frame Mount - Steel Girder Attached	10.1
Bridge Frame Mount - Concrete Box Girder Attached	10.2
Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns	11.1
Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns	11.2



**WVDOT Inspection Form for  
Ground Mounted Trusses - One Shoulder Mount and One Median  
Barrier Wall Connection**

Developed by  
Prof. Wael Zatar  
Marshall University



Inspection Date: _____  Inspection Contractor: _____  _____ _____	Inspector Names: <div style="display: flex; flex-direction: column; align-items: flex-start;"> <div>1) _____</div> <div>2) _____</div> <div>3) _____</div> <div>4) _____</div> <div>5) _____</div> </div>
--	---

*Please completely fill in all the fields of this form and use Appendix C to provide additional details that could not fill in the allocated spaces. For each section of this form, please provide photos' and/or videos' IDs corresponding to the structure number by filling in Appendix D (please use attached sheets if the allocated spaces are insufficient). The photos/videos should simply be named in the format "Structure Number", "Sequential Number" (for example: 01-20-079-00.68\_001, 01-20-079-00.68\_002, etc...).*

SECTION	NOTES AND OBSERVATIONS	
1. Sign Structure Information	<div> <div>Structure Number: _____</div> <div>Structure Length: _____</div> <div style="margin-left: 100px;">           Width - W _____            Height - H (S) _____            Height - H (M) _____         </div> <div>Total Number Travel Lanes Under Structure:</div> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> 2 lanes  <input type="checkbox"/> 5 lanes         </div> <div> <input type="checkbox"/> 3 lanes  <input type="checkbox"/> 6 lanes         </div> <div> <input type="checkbox"/> 4 lanes  <input type="checkbox"/> Other (specify): _____         </div> </div> <div>Year Installed: _____</div> <div>Approximate Location: _____</div> <div>County: _____</div> <div>Longitude: _____</div> <div>Latitude: _____</div> <div>Route #: _____</div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <input type="checkbox"/> East           <input type="checkbox"/> West           <input type="checkbox"/> North           <input type="checkbox"/> South         </div> <div>Milepost (if applicable): _____</div> <div>Interchange Name/Number (if applicable): _____</div> <div>Additional Information: _____</div> <div>_____</div> <div>_____</div> <div>_____</div> </div> <td style="width: 40%; vertical-align: top;"> <div> <div>Structure Key Drawing:</div> <div>Front View</div> </div> <div>Sketch of Sign Legend:</div> <div style="height: 100px;"></div> </td>	<div> <div>Structure Key Drawing:</div> <div>Front View</div> </div> <div>Sketch of Sign Legend:</div> <div style="height: 100px;"></div>
	<p><i>Note 1: If the structure spans lanes traveling in opposite directions, the direction indicated above shall be either North or East, and the face of the structure viewed when traveling in the direction indicated shall be considered the front.</i></p> <p><i>Note 2: Take two photos showing the overall front and back views of the structure.</i></p>	
	Completed by: _____	
2. Foundation	<div>Foundation (At Shoulder):</div> <div> <div>Foundation Covered by Soil?</div> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> No   <input type="checkbox"/> Yes         </div> <div>           If Yes  <input type="checkbox"/> Partially covered  <input type="checkbox"/> Completely covered         </div> </div> </div> <div> <div>Soil Surrounding the Foundation Washed Out?</div> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> No   <input type="checkbox"/> Yes         </div> <div>           If Yes  <input type="checkbox"/> Partially washed out  <input type="checkbox"/> Completely washed out         </div> </div> </div>	

(a) First page of sign structure inspection form #4  
**Figure 3.1** Sample developed inspection form

<b>2. Foundation (Continued)</b>	Concrete Spalling <input type="checkbox"/> No <input type="checkbox"/> Yes	
	If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement?	
	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):	
	Concrete Cracking	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):
	Deterioration	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms):
	Other Defects/Observations	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify):
	<b>Foundation (At Median):</b>	
	Foundation Covered by Soil?	
	<input type="checkbox"/> No <input type="checkbox"/> If Yes <input type="checkbox"/> Partially covered	
	<input type="checkbox"/> Yes <input type="checkbox"/> Completely covered	
<b>3. Drainage Issues</b>	Concrete Spalling <input type="checkbox"/> No <input type="checkbox"/> Yes	
	If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement?	
	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):	
	Concrete Cracking	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):
	Deterioration	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms):
	Other Defects/Observations	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify):
	* Please see the Appendixes A & B	
	<u>Detailed Deficiency Comments:</u>	
	<u>Deficiency Sketches :</u>	
	Note: Take as many photos as required to adequately document each damage or deficiency described above (if applicable).	
Completed by: _____		
Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):		
<u>Detailed Deficiency Comments:</u>		
<u>Deficiency Sketches:</u>		
Note: Take as many photos as needed to adequately document the drainage characteristics of the topography surrounding the structure and each damage or deficiency (if applicable).		
Completed by: _____		

(b) Second page of sign structure inspection form #4  
**Figure 3.1** Sample developed inspection form (Cont'd)

# **CHAPTER 4**

## **INSPECTION**

### **FINDINGS**

#### 4.1 Element Condition Rating

An element (component) condition rating system using a sequential arithmetic rating score (i.e. '0', '1', '2', '3', '4') was used to evaluate each structural element. Table 4.1 shows the element condition rating given in the *Guidelines for the Installation, Inspection, Maintenance and Repair of Structural Supports for Highway Signs, Luminaires, and Traffic Signals* (FHWA 2005).

**Table 4.1** Element Rating Score

Rating Score	Description	Feasible Action
0	Not Applicable	None
1	Element performs intended function with high degree of reliability (Good)	None
2	Element performs intended function with small reduction in reliability (Fair)	Repair element, increase inspection frequency, do nothing
3	Element performs intended function with significant reduction in reliability (Poor)	Repair or replacement of element within specified time frame
4	Element does not perform intended function with any degree of reliability (Severe)	Immediate repair or replacement of element

#### 4.2 Element Rating Criteria and Score

This section provides rating criteria and importance weights used to evaluate each structural element of the 26 types of weathering steel overhead sign structures. Below are typical components in each sign structure and their importance weight (Table 4.2):

**Table 4.2** Typical Components in Each Sign Structure and Their Importance Weight

Component	Importance Weight
Foundations	3
Drainage issues	1
Grout pad under base plate	2
Base plates	5
Anchor/connection bolts, nuts, washers	5
Anchor/connection bolts, ultrasonic inspection	5
Connection between base plate and vertical column	5
Section loss of vertical column near base plate	5
Weld lines between column vertical members and supplemental bracing	3
Exterior of vertical column	3
Connections between vertical column and horizontal chords	3
Horizontal chords and secondary vertical chords	3
Attachments	3

- **Foundations**

***Good condition (Score = 1):*** The element shows no deterioration. There may be efflorescence and/or superficial cracking in the concrete but without effect on strength and/or serviceability.

***Fair condition (Score = 2):*** Minor cracks and spalls may be present in the concrete foundation, but exposed reinforcing rebar shows no evidence of corrosion.

***Poor condition (Score = 3):*** Some delamination and/or spalling may be present in the concrete foundation. Some reinforcing rebar may be exposed. Corrosion of rebar may be present, but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the foundation or the sign structure.

***Severe condition (Score = 4):*** Advanced deterioration is evident. Corrosion of reinforcement and/or loss of concrete section are sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of the foundation and/or the sign structure.

- **Drainage Issues**

***Good condition (Score = 1):*** There are no issues related to the drainage system.

***Fair condition (Score = 2):*** Elements accumulate minor amounts of debris and moisture.

***Poor condition (Score = 3):*** Elements accumulate moderate amounts of debris and moisture.

***Severe condition (Score = 4):*** Elements accumulate high amounts of debris and moisture and are open to flooding and sedimentation.

- **Grout Pad under Base Plate**

***Good condition (Score = 1):*** No grout installed under base plate.

***Fair condition (Score = 2):*** No-to-moderate damage of mortar.

***Poor condition (Score = 3):*** Serious damage of mortar. There is an increased likelihood of accelerated structural anchor deterioration.

***Severe condition (Score = 4):*** Widespread, significant damage of mortar. The functional performance of the grout is significantly reduced. There is a high likelihood of accelerated structural anchor deterioration.

- **Base Plates**

***Good condition (Score = 1):*** No evidence of active corrosion. Surface coating is sound and functioning as intended to protect the metal surface.

***Fair condition (Score = 2):*** Minor surface corrosion is present.

**Poor condition (Score = 3):** Any protective coating has failed. Surface pitting may be present, but any notable section loss due to active corrosion is outside of the anchor bolt circle and does not warrant structural analysis.

**Severe condition (Score = 4):** Corrosion is advanced within the anchor bolt circle. Section loss is sufficient to warrant structural analysis to ascertain the impact on the ultimate strength and/or serviceability of the base plates and/or the sign structure.

- **Anchor/Connection Bolts, Nuts, Washers**

**Case 1: Sign structures with one vertical support (4 anchor/connection bolts per base plate)**

**Good condition (Score = 1):** There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition. If the portions of these elements under the base plate are not accessible for inspection due to the presence of grout, a rating of 2 should be assigned.

**Fair condition (Score = 2):** Minor corrosion of the elements may be present, or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. The elements are fully engaged.

**Poor condition (Score = 3):** Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged. One or more washers are missing.

**Severe condition (Score = 4):** Heavy corrosion of the elements may be present. There is sufficient concern to warrant an analysis to ascertain the corrosion's impact on the strength and/or serviceability of the elements and/or the sign structure. If any anchor bolts are cracked or sheared, or if any anchor nuts are missing or loose, this matter should be reported immediately.

**Case 2: Sign structures with one vertical support (>4 anchor/connection bolts per base plate)**

**Good condition (Score = 1):** There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition. If the portions of these elements under the base plate are not accessible for inspection due to the presence of grout, a rating of 2 should be assigned.

**Fair condition (Score = 2):** Minor corrosion of the elements may be present, or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. The elements are fully engaged. One or more washers are missing.

**Poor condition (Score = 3):** Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged. 20% or less of the anchors are either cracked, sheared, or have a loose or missing nut.

**Severe condition (Score = 4):** Heavy corrosion of the elements may be present. 25% or more of the anchors are either cracked, sheared, or have a loose or missing nut. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.

**Case 3: Sign structures with multiple vertical supports (4 anchor/connection bolts per base plate)**

**Good condition (Score = 1):** There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition. If the portions of these elements under the base plate are not accessible for inspection due to the presence of grout, a rating of 2 should be assigned.

**Fair condition (Score = 2):** Minor corrosion of the elements may be present, or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. One or more anchor nuts are tight but not fully engaged. One or more washers are missing.

**Poor condition (Score = 3):** Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged.

**Severe condition (Score = 4):** Heavy corrosion of the elements may be present. No more than one anchor bolt may be cracked or sheared. No more than one anchor nut may be loose or missing. If the condition is worse, this matter should be reported immediately. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.

**Case 4: Sign structures with multiple vertical supports (>4 anchor/connection bolts per base plate)**

**Good condition (Score = 1):** There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition. If the portions of these elements under the base plate are not accessible for inspection due to the presence of grout, a rating of 2 should be assigned.

**Fair condition (Score = 2):** Minor corrosion of the elements may be present, or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. One or more washers may be missing. No more than two loose anchor nuts, or two tight anchor nuts not fully engaged, may be present.

**Poor condition (Score = 3):** Moderate corrosion of the elements may be present. More than two anchor nuts are tight but not fully engaged. No more than 25% of the anchor nuts may be loose.

**Severe condition (Score = 4):** Heavy corrosion of the elements may be present. 33% or more of the anchors are either cracked, sheared, or have a loose or missing nut. There is sufficient



concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.

- **Ultrasonic Inspection of Anchor/Connection Bolts**

**Good condition (Score = 1):** UT signal indication shows a "Non-Relevant Indication (NRI)" (i.e. there has been no relation to a significant discontinuity), or it shows a signal magnitude ranging from 1% Full Screen High (FSH) to less than 10% FSH.

**Fair condition (Score = 2):** UT signal indication shows a signal magnitude ranging from 10% FSH to less than 30% FSH.

**Poor condition (Score = 3):** UT signal indication shows a signal magnitude ranging from 30% FSH to less than 50% FSH.

**Severe condition (Score = 4):** UT signal indication shows a signal magnitude of more than 50% FSH.

- **Connection between Base Plate and Vertical Column**

**Good condition (Score = 1):** One or two minor weld cracks are present. Cracks are short in length and shallow in depth, and which may be ground out for repair.

**Fair condition (Score = 2):** Several hairline weld cracks are present. There is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the element and/or the sign structure.

**Poor condition (Score = 3):** Several hairline cracks are present and a single crack has visible width, or any other condition that may warrant further analysis to determine the integrity or serviceability of the sign structure.

**Severe condition (Score = 4):** The welded connection has been completely severed. Multiple cracks on the structure have created a condition such that the structure is in imminent danger of collapse.

- **Section Loss of Vertical Column near Base Plate**

**Good condition (Score = 1):** Maximum section loss at any section near the base plate is less than 10%.

**Fair condition (Score = 2):** Maximum section loss at any section near the base plate ranges from 10% to less than 20%.

**Poor condition (Score = 3):** Maximum section loss at any section near the base plate is ranges from 20% to less than 40%.

**Severe condition (Score = 4):** Maximum section loss at any section near the base plate is more than 40%.

- **Weld Lines between Column Vertical Members and Supplemental Bracing**

**Good condition (Score = 1):** One or two minor weld cracks are present. Cracks are short in length and shallow in depth, and which may be ground out for repair.

**Fair condition (Score = 2):** Several hairline weld cracks are present. There is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the element and/or the sign structure.

**Poor condition (Score = 3):** Several hairline cracks are present and a single crack has visible width, or any other condition that may warrant further analysis to determine the integrity and/or serviceability of the sign structure.

**Severe condition (Score = 4):** The welded connection has been completely severed. Multiple cracks on the structure have created a condition such that the structure is in imminent danger of collapse.

- **Exterior of Vertical Column**

**Good condition (Score = 1):** Elements are in new or like-new condition with no significant deficiencies.

**Fair condition (Score = 2):** Minor corrosion with no section loss, minor misalignments, or superficial damage to components is evident.

**Poor condition (Score = 3):** Significant misalignment of components. Moderate corrosion or damage is present to one or more components.

**Severe condition (Score = 4):** Cracks propagating into any chord/post. Major or multiple element defects or section loss are present. Multiple elements meeting these conditions warrant further strength and/or serviceability analysis.

- **Connections between Vertical Column and Horizontal Chords**

**Good condition (Score = 1):** Elements are in new or like-new condition with no significant deficiencies.

**Fair condition (Score = 2):** Minor corrosion with no section loss, minor misalignments, or superficial damage to components is evident.

**Poor condition (Score = 3):** Significant misalignment of components. Moderate corrosion or damage is present to one or more components.

**Severe condition (Score = 4):** Cracks propagating into any chord/post. Major or multiple element defects or section loss are present. Multiple elements meeting these conditions warrant further strength and/or serviceability analysis.

- **Horizontal Chords and Secondary Vertical Posts**

**Good condition (Score = 1):** Elements are in new or like-new condition with no significant deficiencies.

**Fair condition (Score = 2):** Minor corrosion with no section loss, minor misalignments, or superficial damage to components is evident.

**Poor condition (Score = 3):** Significant misalignment of components. Moderate corrosion or damage is present to one or more components.

**Severe condition (Score = 4):** Cracks propagating into any chord/post are evident. Major or multiple element defects or section loss are present. Multiple elements meeting these conditions warrant further strength and/or serviceability analysis.

- **Attachments**

**Good condition (Score = 1):** Elements are fully functional and in new or like-new condition with no significant deficiencies.

**Fair condition (Score = 2):** Minor to moderate damage or deterioration of elements, though elements remain functional.

**Poor condition (Score = 3):** Serious damage or deterioration of elements and the functional performance of the unit is reduced.

**Severe condition (Score = 4):** Any collision damage or deterioration which is significant enough to threaten separation from the sign structure.

### **4.3 Overall Condition Rating**

The overall condition of each sign structure was evaluated using an overall condition rating system. The overall condition rating is estimated based on the ratio between the total score of each structure ( $S$ ) and its maximum possible total score ( $S_{\max}$ ). The maximum possible total score of sign structures varies based on the structural types. Sign structures with ratios ranging from  $0.25 \leq S/S_{\max} < 0.43$  are categorized as “low risk”. Sign structures rated between  $0.43 \leq S/S_{\max} < 0.62$  are categorized as “moderate risk”. Sign structures rated between  $0.62 \leq S/S_{\max} < 0.8$  are categorized as “high risk”. Sign structures rated between  $0.8 \leq S/S_{\max} \leq 1.0$  are categorized as “very high risk” (Table 4.3).

**Table 4.3 Overall Condition Rating**



Overall Condition Rating	$S/S_{\max}$	Description	Feasible Action
Low risk	0.25-0.43	Sign structure performs intended function with high degree of reliability	None
Moderate risk	0.43-0.62	Sign structure performs intended function with small reduction in reliability	Repair element, increase inspection frequency, do nothing
High risk	0.62-0.8	Sign structure performs intended function with significant reduction in reliability	Repair or replacement of element within specified time frame
Very high risk	0.8-1.0	Sign structure does not perform intended function with any degree of reliability	Immediate repair or replacement of element

#### 4.4 Inspection Results and Findings



The condition of each sign structure was evaluated based on the collected field inspection results and the element/overall condition ratings (as discussed in sections 4.2 and 4.3). Table 4.4 shows a sample inspection summary for the inspected weathering steel sign structures. Detailed descriptions of deficiencies of each element (component) and overall summary of structure condition are reported. Each element was rated based on the element rating criteria and score, which was presented in section 4.2. The overall condition of each sign structure was then assessed using the  $S/S_{\max}$  ratio. Table 4.5 shows the overall condition rating for all inspected weathering steel sign structures. The sign structures in Table 4.5 are sorted by order of structure type. Ultrasonic Inspection results of anchor/connection bolts and maximum section loss of vertical columns near base plates are also included in Table 4.5. Numbers of the inspected structures corresponding to their rating risks (i.e. low risk, moderate risk, and high risk) for each structure type are listed in Table 4.6. Tables 4.5 and 4.6 show that 6 structures were found to be at high risk, with  $S/S_{\max}$  ratios ranging from 0.68 to 0.72; 40 structures were at moderate risk with the  $S/S_{\max}$  ratio ranging from 0.44 to 0.63; and 34 structures were at low risk with the  $S/S_{\max}$  ratio ranging from 0.3 to 0.43. Four of six structures with a high rating risk are structure type #4 (Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection). Two other structures with a high rating risk are structure type #3.3.2 (Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side) and structure type #6.6 (Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns). It should be noted that all structures with Ground

Mounted Trusses (structure types #4 and #5) and 93 percent of two/three-dimensional overhead truss structures (structure types #3.1, 3.2, 3.3.1, 3.3.2) were rated as either moderate or high risk.

**Table 4.4** Sample Weathering Sign Structure Inspection Summary

		Inspection Summary for Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection			Prepared by Prof. Wael Zatar Marshall University 
Structure Number: 1-20-64-57.53		Inspector Names:	1) Russ Stewart		
Inspection Date: 12/13/2012; 01/15/2013; 01/19/2013			2) Troy Matthews		
Inspection Contractor: Dennis Corporation			3) Dwight Miller		
<b>Overall Summary of Structure Condition and Recommendations</b> Maximum section loss of 51% was computed in section A-A of the shoulder vertical column. The base under the shoulder column was low and could become buried in debris. Moderate section loss, deterioration/corrosion, and surface pitting of the base plate on median vertical column was observed. Moderate to severe corrosion of weld lines connected the vertical columns and the base plates was reported. Very severe corrosion of the shoulder vertical column near the base plate and in open handhole was recorded. One U-bolt connected the shoulder vertical column and the upper chord was loose. Washers were deteriorating on 80% of bolt connections in the attachments. Total score of this structure is 132 which is high risk based on our category given at the end of the next page.					
Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)	
Foundation	None.	1	3	3	
Drainage Issues	Shoulder base was low and could become buried in debris.	3	1	3	
Grout Pad under Base Plate	Grout pad was present under the base plate at the shoulder column.	2	2	4	
Base Plates	Shoulder column: Minor section loss, deterioration/corrosion, surface pitting, and possible crack of the base plate were reported. Median column: Moderate section loss, deterioration/corrosion, and surface pitting of the base plate were found. Inspectors could not get UT thickness reading for the base plate. The base plate was corroded and pitted and it did not have a flat surface.	4	5	20	
Anchor Bolts, Nuts and Washers	Shoulder column: Minor to moderate corrosion of top nuts/washers was observed. Median column: Minor to moderate deterioration/corrosion of anchor bolts was reported. Moderate deterioration/corrosion of top nuts/washers was observed.	3	5	15	
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5	
Connection between Base Plate and Vertical Column	Shoulder column: Severe corrosion of weld lines 1 and 2 was observed. Median column: Moderate to severe corrosion of weld lines 1 and 2 was reported.	4	5	20	

**Table 4.4** Sample Weathering Sign Structure Inspection Summary (Cont'd)

<div style="display: flex; justify-content: space-between; align-items: center;">  <div style="text-align: center;"> <p>Inspection Summary for</p> <p>Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection</p> </div> <div style="text-align: right;"> <p>Prepared by Prof. Wael Zatar Marshall University</p>  </div> </div>				
Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 51% was computed in section A-A of the shoulder vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	Median column: Corrosion on bottom of weld lines 1 and 2 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column: Minor deterioration of the column was observed. Very severe corrosion of the column near the base plate and in open handhole was reported. Median column: Minor to moderate deterioration/corrosion of the column near the base plate was recorded.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder and median columns: Pack rust between plates/members was observed. One U-bolt connected the shoulder vertical column and the upper chord was loose.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Washers were deteriorating on 80% of bolts.	3	3	9
<b>TOTAL SCORES</b>				<b>132</b>
<p><b>Score Interpretation:</b></p> <p>Maximum Total Score (Very High Risk) = <b>184</b></p> <p>Minimum Total Score (Low Risk) = <b>46</b></p> <p><b>Risk Category:</b></p> <p>Low Risk: <math>46 \leq \text{Total Score} &lt; 80</math></p> <p>Moderate Risk: <math>80 \leq \text{Total Score} &lt; 114</math></p> <p>High Risk: <math>114 \leq \text{Total Score} &lt; 148</math></p> <p>Very High Risk: <math>148 \leq \text{Total Score} \leq 184</math></p>				

**Table 4.5** Overall Condition Rating for Inspected Weathering Steel Sign Structures

Form Number	Structure Number	UT Signal Indication (FSH)	Max. Section Loss (%)	Min. Score ( $S_{min}$ )	Max. Score ( $S_{max}$ )	Total Score (S)	$S/S_{max}$	Rating
1.1	01-20-064-52.40	10%-31%	15	46	184	69	0.375	Low risk
	01-20-064-55.12	NRI	8	46	184	79	0.42935	Low risk
	01-20-064-55.85	NRI	25	46	184	93	0.50543	Moderate risk
	01-20-064-56.04	NRI	31	46	184	90	0.48913	Moderate risk
	01-20-064-56.50	NRI	32	46	184	84	0.45652	Moderate risk
	01-20-064-57.83	12%-13%	7	46	184	74	0.40217	Low risk
	01-20-064-57.88	10%-16%	12	46	184	75	0.40761	Low risk
	01-20-064-58.27	NRI	20	46	184	96	0.52174	Moderate risk
	01-20-064-58.54	NRI	13	46	184	68	0.36957	Low risk
	01-20-077-097.32	NRI	24	46	184	74	0.40217	Low risk
	01-20-077-097.95	NRI	32	46	184	84	0.45652	Moderate risk
	01-20-077-098.57	NRI	14	46	184	87	0.47283	Moderate risk
	01-20-077-101.24	NRI	2	46	184	57	0.30978	Low risk
	01-20-077-102.49	NRI	31	46	184	95	0.5163	Moderate risk
1.2	01-20-060-11.48	NRI	33	46	184	68	0.36957	Low risk
	01-20-060-12.97	NRI Covered bolts	21	46	184	99	0.53804	Moderate risk
	01-20-060-13.07	NRI	17	46	184	74	0.40217	Low risk
	01-20-064-53.73	10%-18%	39	46	184	97	0.52717	Moderate risk
	01-20-064-54.61	12%-39%	15	46	184	90	0.48913	Moderate risk
	01-20-064-55.45	NRI	6	46	184	55	0.29891	Low risk
	01-20-064-58.10	NRI	5	46	184	70	0.38043	Low risk
	01-20-077-101.58	NRI	21	46	184	78	0.42391	Low risk
	01-20-077-101.68	NRI	29	46	184	83	0.45109	Moderate risk
	01-20-119-19.54	NRI	7	46	184	71	0.38587	Low risk
2.1	01-20-064-58.74	NRI	1	44	176	77	0.4375	Moderate risk
	01-20-077-100.89	NRI	1	44	176	64	0.36364	Low risk
	01-20-077-100.91	NRI	3	44	176	63	0.35795	Low risk
2.2	01-20-077-098.45	NRI	18	41	164	66	0.40244	Low risk
	01-20-077-099.10	NRI	6	41	164	63	0.38415	Low risk
3.1	01-20-077-100.98	NRI	10	46	184	87	0.47283	Moderate risk
	01-20-077-101.23	NRI	9	46	184	81	0.44022	Moderate risk
3.2	01-20-077-100.08	NRI	34	46	184	81	0.44022	Moderate risk
	01-20-077-102.65	NRI	19	46	184	81	0.44022	Moderate risk
	01-20-077-103.14	NRI	18	46	184	87	0.47283	Moderate risk
	01-20-077-103.38	NRI	27	46	184	98	0.53261	Moderate risk
	01-20-119-18.46	NRI	27	46	184	84	0.45652	Moderate risk
3.3.1	01-20-060-11.44	10%-40%	26	46	184	100	0.54348	Moderate risk
	01-20-064-53.72	10%-52%	19	46	184	102	0.55435	Moderate risk
	01-20-064-55.46	NRI	30	46	184	84	0.45652	Moderate risk
	01-20-064-55.48	NRI	20	46	184	88	0.47826	Moderate risk

Note: UT = Ultrasonic Testing; FSH = Full Screen Height; NRI = Non-Relevant Indication.

**Table 4.5** Overall Condition Rating for Inspected Weathering Steel Sign Structures (Cont'd)

Form Number	Structure Number	UT Signal Indication	Max. Section Loss (%)	Min. Score (S <sub>min</sub> )	Max. Score (S <sub>max</sub> )	Total Score (S)	S/S <sub>max</sub>	Rating
3.3.1	01-20-079-00.68	9%-55%	58	46	184	99	0.53804	Moderate risk
	01-20-079-01.57	NRI	15	46	184	76	0.41304	Low risk
3.3.2	01-20-077-101.84	NRI	41	46	184	123	0.66848	High risk
3.4	01-20-064-57.87	NRI	42	43	172	73	0.42442	Low risk
	01-20-064-57.89	NRI	30	43	172	68	0.39535	Low risk
4	01-20-064-55.00	NRI	34	46	184	109	0.59239	Moderate risk
	01-20-064-56.33	NRI	41	46	184	124	0.67391	High risk
	01-20-064-57.51	NRI	25	46	184	125	0.67935	High risk
	01-20-064-57.52	NRI	39	46	184	123	0.66848	High risk
	01-20-064-57.53	NRI	51	46	184	132	0.71739	High risk
	01-20-077-099.98	NRI	30	46	184	95	0.5163	Moderate risk
	01-20-077-100.12	NRI	50	46	184	104	0.56522	Moderate risk
	01-20-079-01.12	NRI	29	46	184	112	0.6087	Moderate risk
5	01-20-064-58.30	NRI	53	46	184	104	0.56522	Moderate risk
	01-20-077-099.58	NRI Crack	22	46	184	99	0.53804	Moderate risk
6.1.1	01-20-064-58.55	NRI	16	44	176	81	0.46023	Moderate risk
	01-20-077-100.88	NRI	31	44	176	74	0.42045	Low risk
	01-20-077-100.90	NRI	4	44	176	75	0.42614	Low risk
6.1.2	01-20-077-100.72	NRI	17	44	176	85	0.48295	Moderate risk
6.2.1	01-20-077-100.34	NRI	25	44	176	75	0.42614	Low risk
	01-20-077-100.39	NRI	24	44	176	90	0.51136	Moderate risk
6.2.2	01-20-077-100.16	NRI	32	44	176	80	0.45455	Moderate risk
	01-20-077-100.22	NRI	41	44	176	88	0.5	Moderate risk
	01-20-077-100.58	NRI	29	44	176	75	0.42614	Low risk
6.3	01-20-064-57.60							
	01-20-064-57.77							
6.4	01-20-60/62-00.22	NRI	27	44	176	85	0.48295	Moderate risk
	01-20-60/62-00.39	NRI	27	47	188	102	0.54255	Moderate risk
6.5	01-20-077-100.09	NRI	31	47	188	78	0.41489	Low risk
6.6	01-20-064-57.91	10%-49%	37	44	176	122	0.69318	High risk
7	01-20-077-098.76	NRI	N/A	24	96	33	0.34375	Low risk
8	01-20-077-098.94	NRI	5	47	188	86	0.45745	Moderate risk
9	01-20-077-099.30	NRI	30	54	216	72	0.33333	Low risk
10.1	01-20-077-101.63	NRI	N/A	34	136	75	0.55147	Moderate risk
	01-20-077-101.64	NRI	N/A	34	136	56	0.41176	Low risk
10.2	01-20-064-57.92	Can't UT NRI	N/A	39	156	55	0.35256	Low risk
	01-20-064-57.98	Can't UT	N/A	39	156	65	0.41667	Low risk
	01-20-064-58.15	Can't UT	N/A	39	156	57	0.36538	Low risk
	01-20-064-58.25	Can't UT NRI	N/A	39	156	60	0.38462	Low risk
11.1	01-20-077-098.29	NRI	25	54	216	90	0.41667	Low risk
11.2	01-20-064-58.56	NRI	56	51	204	105	0.51471	Moderate risk

Note: UT = Ultrasonic Testing; FSH = Full Screen Height; NRI = Non-Relevant Indication.



**Table 4.6** Results of Overall Condition Rating for Each Structure Type

Structure type	Form	Number of Inspected Structures			Total Numbers of Inspected Structures
		Low risk	Moderate risk	High risk	
Double Armed Ground Mounted Cantilever	1.1	7	7	0	14
Single Armed Ground Mounted Cantilever	1.2	7	4	0	11
Bridge Superstructure Mounted Cantilever	2.1	2	1	0	3
Parapet Wall Mounted Cantilever	2.2	2	0	0	2
Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides	3.1	0	2	0	2
Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides	3.2	0	5	0	5
Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides	3.3.1	1	5	0	6
Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other	3.3.2	0	0	1	1
Single Chord Ground Mounted Truss	3.4	2	0	0	2
Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	4	0	4	4	8
Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection	5	0	2	0	2
Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns	6.1.1	2	1	0	3
Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns	6.1.2	0	1	0	1
Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns	6.2.1	1	1	0	2
Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns	6.2.2	1	2	0	3
Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns	6.3	N/A	N/A	N/A	0
Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns	6.4	0	2	0	2
Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns	6.5	1	0	0	1
Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column	6.6	0	0	1	1
Retaining Wall Mounted Cantilever	7	1	0	0	1
Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside	8	0	1	0	1
Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside	9	1	0	0	1
Bridge Frame Mount - Steel Girder Attached	10.1	1	1	0	2
Bridge Frame Mount - Concrete Box Girder Attached	10.2	4	0	0	4
Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns	11.1	1	0	0	1
Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns	11.2	0	1	0	1
Total		34	40	6	80

## **4.5 Element Condition Summary for Each Structure Type**

### **Type 1.1: Double Armed Ground Mounted Cantilever**

- Base Plates: There were possibly multiple cracks in the base plates (structure #1-20-64-58.27). Moderate flaking and corrosion/deterioration of bottom of the base plate was observed (structure #01-20-77-102.49).
- Ultrasonic Inspection of Anchor Bolts: Maximum signal strength of 31% full screen height (FSH) was reported for one anchor bolt (structure #01-20-64-52.40).
- Connection between base plate and vertical column: Moderate-to-severe corrosion on all weld lines was reported (structure #01-20-64-58.27).
- Section loss of vertical column near base plate: Maximum section loss was 32% (structures #01-20-064-56.50 and #01-20-077-097.95). Average maximum section loss for all structures of type 1.1 was 13%.
- Exterior of vertical column: Minor-to-severe corrosion of the vertical column was observed (structure #01-20-64-55.85).
- Connections between vertical column and horizontal chords: Minor corrosion of bolts connected between the vertical column and the lower/upper chords was observed. Pack rust between plates/members in the lower chord was reported. The top of the upper chord had a gap between the chord and the splice plate. One bolt was completely loose and the rest were somewhat loose (structure #01-20-77-102.49).
- Horizontal chords and secondary vertical posts: Minor-to-moderate corrosion of the lower chord was observed (structure #01-20-77-102.49).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JBs and the lower chord was reported. One light arm and one light were missing. Impact damage to the electrical distribution boxes and their hardware was recorded (structure #01-20-77-98.57).

### **Type 1.2: Single Armed Ground Mounted Cantilever**

- Drainage Issues: Asphalt blocked the drainage system (structure #01-20-60-12.97).
- Base Plates: Moderate section loss, deterioration, and corrosion of the base plate were observed. Some moderate scaling of rust on the underside of the base plate was reported (structure #01-20-64-54.61).
- Anchor Bolts, Nuts, and Washers: Asphalt covered two anchor bolts. Two top nuts/washers were partially covered and two others were completely covered. Minor-to-moderate corrosion and deterioration of top nuts/washers was observed. Leveling nuts/washers could not be seen due to the covering of asphalt (structure #01-20-60-12.97). One anchor bolt and its nuts/washers have been missing (structure #01-20-64-53.73).

- Ultrasonic Inspection of Anchor Bolts: Maximum signal strength of 39% full screen height (FSH) was reported for anchor bolt #5 (structure #01-20-64-54.61).
- Connection between base plate and vertical column: No weld reinforcement on 2" long of weld lines 2 and 4 was reported (structure #01-20-64-58.10).
- Section Loss of Vertical Column near Base Plate: Maximum section loss was 39% (structure #01-20-064-53.73). Average maximum section loss for all structures of type 1.2 was 20%.
- Vertical weld lines between tubes constituting vertical column: Reinforcement was lost in two areas of weld line 3. One area was 12" long and the other was 14" long. Weld line 4 appears to have been repaired. Some weld areas had one pass and others had 2 passes visible (structure #01-20-60-11.48). Multiple starts/stops in short lengths of weld line 2 were observed. Several areas had 2 passes on weld line 14, while others had 1 pass (structure #01-20-64-53.73). Weld line 2 was deteriorated on 50% of its weld length (structure #01-20-77-101.58). Weld reinforcement has deteriorated on entire length of weld lines 1 and 2; on 50% of the weld length of weld line 3; and on 25% weld length of weld line 4 (structure #01-20-119-19.54). Weld reinforcements have been deteriorated over 90% of the entire length of weld lines 2 and 4 (structure #01-20-119-19.57).
- Exterior of vertical column: Minor-to-severe corrosion of the vertical column was observed (structure #01-20-64-53.73).
- Attachments: One light arm was missing. Horizontal/vertical cracks of bolts connecting the vertical supports and the horizontal light arms were observed. A hole in sign panel was reported (structure #01-20-60-12.97). Crack in weld to the light bar T-bracket was observed (#01-20-60-13.07).

### **Type 2.1: Bridge Superstructure Mounted Cantilever**

- Superstructure connection bracket (SCB) connection plate: Minor-to-moderate corrosion of the SCB connection plate was observed (structure #01-20-064-58.74).
- Section loss of vertical column near base plate: Maximum section loss was 3% (structure #01-20-077-100.91). Average maximum section loss for all structures of type 2.1 was 2%.
- Vertical Weld Lines between Tubes Constituting Vertical Column: Weld lines 2, 3, and 4 were not uniform. Undercut on: (a) 50% length of weld line 2; (b) entire length of weld line 3; (c) a 6" length from the top of weld line #4 was reported (structure #01-20-064-58.74).
- Exterior of vertical column: Minor corrosion of the vertical column was observed. Bulge at top 10" of the vertical column was reported. Upper half of weld line 2 was flushed with outer supports (structure #01-20-064-58.74).

### **Type 2.2: Parapet Wall Mounted Cantilever**

- Section loss of vertical column near base plate: Maximum section loss was 18% (structure #01-20-077-098.45). Average maximum section loss for all structures of type 2.2 was 12%.
- Exterior of Vertical Column: Minor to moderate corrosion of the vertical column was observed (structure #01-20-077-098.45).

### **Type 3.1: Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides**

- Anchor bolts, nuts, and washers: #4 anchor bolt and leveling nut were corroded. #1, 9, and 10 anchor bolts were short. #4 leveling nut was tight to anchor bolt but not to the base plate. #4 washer was completely eroded away (structure #01-20-077-100.98). Six anchor bolts were short. Four of them were covered with another metal/material. Top nuts/washers were not fully engaged since the anchor bolts were short (structure #01-20-077-101.23).
- Section loss of vertical column near base plate: Maximum section loss was 10% (structure #01-20-077-100.98). Average maximum section loss for all structures of type 3.1 was 7%.
- Vertical weld lines between tubes constituting vertical column: Slag was visible in weld lines 1 and 2 near the top chord. Some areas of underfill in weld lines 1, 2, and 3 were reported (structure #01-20-077-100.98). A pinhole was observed in weld line 3. Underfill on 90% length of weld line 4 was reported. Three underfill areas (each area was 6"-9" in length) were observed in weld line 2. Previous repair of weld line 2 was reported (structure #01-20-077-101.23).
- Attachments: Minor to moderate corrosion of the horizontal light arms was observed. Minor corrosion of the vertical sign support to horizontal chord connection bracket was reported. Opening lock on the electrical distribution box was broken (structure #01-20-077-101.23).

### **Type 3.2: Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides**

- Anchor bolts, nuts, and washers: Impact damage to #6 top nut was observed (structure #01-20-077-102.65). Minor to moderate corrosion of leveling nuts/washers was reported (structures #01-20-077-102.65 and #01-20-77-103.38).
- Section loss of vertical column near base plate: Maximum section loss was 34% (structure #01-20-077-100.08). Average maximum section loss for all structures of type 3.2 was 14%.
- Exterior of vertical column: Minor to moderate corrosion of the column was observed. No handhole on the column was reported (structures #01-20-077-100.08,

- #01-20-077-102.65, #01-20-077-103.14, and #01-20-077-103.38). Minor to severe corrosion of the column was reported. Deterioration of the column was reported (1/8" depth at the top of the lower chord on the front side of the column). No hand-hole on the column was reported (structure #01-20-119-18.46).
- Connections between vertical column and horizontal chords: A U-bolt connecting the column and the lower chord was loose. Pack rust between plates/members was observed. Minor corrosion of bolts connected between the columns and the upper chords was reported (structure #01-20-077-100.08).
  - Horizontal chords and secondary vertical posts: Minor corrosion of horizontal chords and secondary vertical posts was observed. 1/8" section loss on the right/back of the upper chord due to pack rust was reported. Section loss on bottom of #4 vertical post was found (structure #01-20-077-103.38).
  - Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. All JB's had significant pack rust under the horizontal chord (structure #01-20-077-103.38). One sign clip was missing. Pack rust between light arm JB's and the lower chord was reported (structure #01-20-119-18.46).

### **Type 3.3.1: Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides**

- Base plates: Possible cracks of the base plate at UT thickness reading locations #4, 5, and 6 were reported (structure #01-20-64-55.46).
- Anchor bolts, nuts, and washers: Five anchor bolts were cut short (structure #01-20-64-53.72). Minor-to-moderate corrosion of leveling nuts/washers was observed (structure #01-20-64-55.48). Four anchor bolts were cut short (structure #01-20-79-01.57).
- Ultrasonic inspection of anchor bolts: Maximum signal strength of 40% full screen height (FSH) was reported for two anchor bolts (structure #01-20-060-11.44). Maximum signal strength of 52% Full Screen Height (FSH) was reported for one anchor bolt (structure #01-20-64-53.72). Maximum signal strength of 55% full screen height (FSH) was reported for one anchor bolt (structure #01-20-79-00.68).
- Section loss of vertical column near base plate: Maximum section loss was 58% (structure #01-20-079-00.68). Average maximum section loss for all structures of type 3.3.1 was 19%.
- Exterior of Vertical Column: Minor to severe corrosion of the column was observed (structure #01-20-64-55.46).
- Connections between vertical column and horizontal chords: Pack rust between plates/members was observed. Two U-bolts were loose on lower chord of the columns (structures #01-20-060-11.44 and #01-20-64-53.72). The inside back L-

shaped plate was bent and the inside front lock-washer was sunk into the bolt hole (structure #01-20-060-11.44). 1/16" undercut on upper chord of the column was reported (structure #01-20-64-53.72).

- Attachments: No washers for bolt connections between sign beam and bracket. Significant pack rust was found between light arm JBs and the lower chord. No washers for bolt connections between sign supports and L-brackets (structure #01-20-060-11.44). A crack in the top of the L-bracket that connects the third sign from right was observed. One L-bracket was bent (structure #01-20-64-53.72). Severe corrosion to conduit nipple was reported (structure #01-20-64-55.48). A bullet hole was found in the left sign panel. Conduit was missing from a damaged light arm; it detached from the hand-hole plate on the lower chord on the left column side. Steel mesh was partially detached from secondary vertical posts. Some deformation and damage to other areas were reported (structure #01-20-79-00.68).

### **Type 3.3.2: Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side**

- Drainage issues: Median mount was accumulating debris and moisture causing corrosion (structure #01-20-077-101.84).
- Base plates: Minor-to-moderate corrosion/deterioration, section loss, and surface pitting of the base plate were reported (structure #01-20-077-101.84).
- Anchor bolts, nuts, and washers: Minor corrosion of anchor bolts and minor deterioration of top nuts/washers was observed. Minor-to-moderate corrosion of top nuts/washers was reported (structure #01-20-077-101.84).
- Section loss of vertical column near base plate: Maximum section loss was 41% (structure #01-20-077-101.84).
- Exterior of vertical column: Hand-hole cover was not in place. Minor-to-severe corrosion of the column was observed (structure #01-20-077-101.84).
- Horizontal chords, secondary vertical posts, and horizontal bracings: Severe corrosion/deterioration in small areas of lower chords (front) was observed. Holes were found on bottom of chord at JBs for light arms. Minor-to-moderate corrosion of lower chords (back) and minor corrosion of upper chords, secondary vertical posts, and horizontal bracings was reported (structure #01-20-077-101.84).
- Attachments: Minor corrosion of horizontal light arms and L-brackets connecting the supports to the chords was observed. Pack rust between light arm JBs and the lower chord was reported. Electrical distribution boxes had sustained impact damage. Conduits were loose under electrical boxes due to impact damage. Horizontal bracing #1 on left vertical column had moderate corrosion on the bottom side (structure #01-20-077-101.84).

### **Type 3.4: Single Chord Ground Mounted Truss**

- Section loss of vertical column near base plate: Maximum section loss was 42% (structure #01-20-064-57.87). Average maximum section loss for all structures of type 3.4 was 31%.
- Exterior of vertical column: Minor to severe corrosion of the columns was reported (structure #01-20-64-57.87).
- Connections between vertical column and horizontal chord: Minor corrosion of the horizontal chord was observed. Surface lamination on top right of the horizontal chord was reported (structure #01-20-64-57.89).
- Splice connections in horizontal chord: Pack rust between plates/members was observed. Minor corrosion of bolts and surface lamination on splice plate #1 was reported (structure #01-20-64-57.89).

### **Type 4: Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection**

- Drainage issues: Shoulder base was low and could become buried in debris (structure #01-20-064-57.53). Median base accumulated road debris and moisture inside barrier plate causing corrosion (structure #01-20-77-100.12). Bottom of the base plate has sedimentation from roadway (structure #01-20-79-01.12).
- Base plates: Minor-to-moderate section loss and deterioration/corrosion of the base plate were observed. Surface pitting of the base plate was reported (structures #01-20-064-55.00, #01-20-064-56.33, #01-20-064-57.51, #01-20-064-57.52). Possible crack and warping/buckling of the base plate were found (structure #01-20-064-57.51). Inspectors could not get UT thickness reading for the base plate because the base plate was corroded and pitted and it did not have a flat surface (structure #01-20-064-57.53).
- Anchor bolts, nuts, and washers: Minor-to-moderate corrosion of nuts/washers was reported (structures #01-20-064-55.00, #01-20-064-56.33, #01-20-064-57.51, #01-20-064-57.53, #01-20-77-100.12). Moderate corrosion of anchor bolts was observed (structure #01-20-77-99.98). Concrete drainage came up flush with bottom of the base plate (structure #01-20-064-57.51). Nine anchor bolts were cut short (structure #01-20-79-01.12).
- Section loss of vertical column near base plate: Maximum section loss was 51% (structure #01-20-064-57.53). Average maximum section loss for all structures of type 4 was 29%.
- Connection between base plate and vertical column: Moderate corrosion of weld lines between the base plate and the median column was observed (structure #01-20-064-55.00). The level of corrosion of weld lines between the base plate and the median

- vertical column ranged from moderate to severe (structures #01-20-064-56.33, #01-20-064-57.51, #01-20-064-57.52, #01-20-064-57.53). Distress of the median column was reported (structure #01-20-064-57.51).
- Exterior of vertical column: Minor-to-severe deterioration and corrosion of the shoulder vertical column was observed (structures #01-20-064-55.00, #01-20-064-56.33, #01-20-064-57.51, #01-20-77-99.98, #01-20-79-01.12). Level of corrosion of the median vertical column near the base plate ranged from moderate to severe (structures #01-20-064-55.00, #01-20-064-57.51). Very severe corrosion of the column near the base plate and in the open hand-hole was reported (structure #01-20-064-57.53).
  - Connections between vertical column and horizontal chords: Pack rust between plates/members was observed. Inside U-bolt at the connections between the shoulder column and the lower chord was broken. Tightness of bolt connection between the median column and the lower chord was lost (structure #01-20-064-56.33). Two U-bolts connected between the vertical column and the lower chord were loose (structure #01-20-064-57.51). One U-bolt connecting the shoulder vertical column and the upper chord was loose (structure #01-20-064-57.53).
  - Attachments: Minor corrosion of vertical sign support to horizontal chord connection bracket was observed. Minor corrosion of horizontal light arms and pack rust between light arm JB's and the lower chord was reported. LB from electrical box and conduit was severely corroded (structure #01-20-064-56.33). Several surface areas of the horizontal chords were delaminated (structure #01-20-064-57.51). Second horizontal light arm from the left was twisted (structure #01-20-064-57.52). Washers were deteriorating on 80% of bolts (structure #01-20-064-57.53). Minor corrosion of horizontal light arms was observed (structure #01-20-79-01.12).

#### **Type 5: Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection**

- Drainage issues: Median mount support base collected debris in cover plate causing corrosion (structure #01-20-77-99.58).
- Base plates: Minor to moderate corrosion of the base plate was reported (structure #01-20-64-58.30).
- Anchor bolts, nuts, and washers: Minor to moderate corrosion of leveling nuts/washers was reported. One anchor bolt had a horizontal crack (structure #01-20-77-99.58).
- Section loss of vertical column near base plate: Maximum section loss was 53% (structure #01-20-064-58.30). Average maximum section loss for all structures of type 5 was 17%.



- Exterior of vertical column: Minor-to-severe corrosion of the median column was observed (structure #01-20-64-58.30). Moderate to severe corrosion of the left shoulder column was reported.
- Connections between vertical column and horizontal chords: Inside U-bolt nut connecting the column and the lower chord was loose. Pack rust between plates/members was reported (structure #01-20-64-58.30).
- Horizontal chords and secondary vertical posts: Pack rust was deteriorating the lower chord approximately 1/8" in depth on back side (structure #01-20-77-99.58).

**Type 6.1.1: Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns**

- Connection between SCB connection plate and vertical column: 1/16" or less undercut on entire length of one weld line on the right column was reported (structure #01-20-77-100.90).
- Section loss of vertical column near base plate: Maximum section loss was 31% (structure #01-20-077-100.88). Average maximum section loss for all structures of type 6.1.1 was 10%.
- Vertical weld lines between tubes constituting vertical column: 24" area of undercut (< 1/16") was observed on top at upper chord on the right column (structure #01-20-64-58.55).
- Exterior of Vertical Column: Minor to moderate corrosion of the left column was observed (structure #01-20-64-58.55).
- Horizontal Chords and Secondary Vertical Posts: Minor corrosion of the horizontal chords was reported. A gauge 3" in length was observed in the lower chord. Slag still present on welds in the lower chord (structure #01-20-64-58.55).

**Type 6.1.2: Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns**

- Connection between SCB connection plate and vertical column: Weld stingers were not fused together for 100% of a weld line on the left column. 1/16" undercut on 75% of an entire weld line on the right column was reported (structure #01-20-77-100.72).
- Section loss of vertical column near base plate: Maximum section loss was 17% (structure #01-20-077-100.72).
- Exterior of vertical column: Minor corrosion of the columns was observed. The left column was warped 3/16" (structure #01-20-77-100.72).
- Attachments: Pack rust between light arm JBs and the lower chord was reported. Connection bracket connecting luminaire track was loose. Conduits were broken (structure #01-20-77-100.72).

#### **Type 6.2.1: Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns**

- SCB connection plates: Minor-to-moderate deterioration/corrosion of the SCB connection plate on the left column was observed (structure #01-20-077-100.39).
- Section loss of vertical column near base plate: Maximum section loss was 25% (structure #01-20-077-100.34). Average maximum section loss for all structures of type 6.2.1 was 14%.
- Exterior of vertical column: Minor-to-moderate corrosion of the left column was observed (structure #01-20-077-100.39).
- Connections between vertical column and horizontal chords: One U-bolt connecting the column and the lower chord was broken. Front face of L-shape plate connecting the column and the upper chord was broken (structure #01-20-77-100.34).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One bolt connecting vertical sign support to horizontal chord connection bracket was loose (structure #01-20-077-100.39).

#### **Type 6.2.2: Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns**

- Section loss of vertical column near base plate: Maximum section loss was 41% (structure #01-20-077-100.22). Average maximum section loss for all structures of type 6.2.2 was 19%.
- Exterior of vertical column: Minor-to-severe corrosion of the right column was reported (structure #01-20-077-100.16).
- Horizontal chords and secondary vertical posts: Minor corrosion of the horizontal chords and secondary vertical posts was reported. End plate was not attached correctly to the right column (structure #01-20-077-100.22).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Two of four bolts connecting the vertical sign support and the upper chord were loose (structure #01-20-077-100.22).

#### **Type 6.4: Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns**

- Drainage issues: Drain holes in bottom of the left vertical column were clogged (structure #01-20-60/62-00.22).
- Section loss of vertical column near base plate: Maximum section loss was 27% for all structures (#01-20-60/62-00.22 and #01-20-60/62-00.39). Average maximum section loss for all structures of type 6.4 was 22%.

- Interior of vertical column: Moderate-to-severe deterioration/corrosion of the right column was reported.
- Exterior of vertical column: Minor-to-severe corrosion of the right column was reported (structures #01-20-60/62-00.22 and #01-20-60/62-00.39).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JBs and the lower chord was reported. Welds on some light arms were cracked or broken (structures #01-20-60/62-00.22 and #01-20-60/62-00.39). One small area of the sign panel was damaged (structure #01-20-60/62-00.22). One sign clip was loose (structure #01-20-60/62-00.39).

**Type 6.5: Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection**

- Section loss of vertical column near base plate: Maximum section loss was 31% (structure #01-20-077-100.09).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JBs and the lower chord was reported. One sign clip was loose (structure #01-20-077-100.09).

**Type 6.6: Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns**

- Concrete support structure: Concrete cracking on back of concrete support (20" long) on the right column side was reported (structure #01-20-064-57.91).
- Concrete superstructure support (CSS) and median connection plates: Minor to moderate corrosion of the CSS/median connection plates was observed (structure #01-20-064-57.91).
- CSS and median connection bolts, nuts, and washers: Minor-to-moderate corrosion of CSS/median bolts/nuts/washers was reported (structure #01-20-064-57.91).
- Ultrasonic inspection of CSS and median connection bolts: Maximum signal strength of 49% full screen height (FSH) was reported for one CSS connection bolt on the right column side (structure #01-20-064-57.91).
- Section loss of vertical column near base plate: Maximum section loss was 37% (structure #01-20-064-57.91).
- Exterior of vertical column: Minor to severe corrosion of the left column was observed (structure #01-20-064-57.91).

- Connections between vertical column and horizontal chords: A total of five U-bolts connecting the left/right column and the lower chord were loose (structure #01-20-064-57.91).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One bolt connected the vertical sign support and the horizontal chord connection bracket was loose (structure #01-20-064-57.91).

#### **Type 7: Retaining Wall Mounted Cantilever**

- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Weld on the center horizontal light arm was broken. Damage to electrical distribution boxes was reported. Center light fixture was broken (structure #01-20-77-98.76).

#### **Type 8: Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside**

- Anchor bolts, nuts, and washers: Minor corrosion of anchor bolts and top/leveling nuts/washers was observed. Some leveling nuts were loose (structure #01-20-077-098.94).
- Section loss of vertical column near base plate: Maximum section loss was 5% (structure #01-20-077-098.94).
- Observations of the retaining wall around the vertical column connections: Concrete cracking in the retaining wall around the vertical column connections was reported (structure #01-20-077-098.94).
- Attachments: Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Four connecting bolts to the light arms were loose or broken (structure #01-20-077-098.94).

#### **Type 9: Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside**

- Section loss of vertical column near base plate: Maximum section loss was 30% (structure #01-20-077-099.30).
- Exterior of vertical column: Minor-to-severe corrosion of the right vertical column was observed. One area of surface delamination (approximately 9" in length) just above the horizontal brace #3 was reported (structure #01-20-077-099.30).

#### **Type 10.1: Bridge Frame Mount - Steel Girder Attached**

- Bridge frame members and attachments: Minor-to-moderate corrosion of horizontal light arms was observed. Pack rust on right horizontal light arm at sign support was reported. Horizontal and transverse braces had a minor corrosion (structure #01-20-77-101.63). Weld connecting the light plate (to which light was attached) and the horizontal light arm was cracked (structure #01-20-77-101.64).
- Condition of concrete in the vicinity of connections between horizontal brace and bridge parapet: 24" long vertical cracks and 1.5" long horizontal cracks under the right parapet connection were observed. 6" long concrete cracking on top of the right parapet connection at bolt #1 was observed (structure #01-20-77-101.63). 3" long concrete cracking was observed below the left parapet connection. Moderate deterioration from spalling and cracking of concrete was reported (structure #01-20-77-101.64).
- Weld connections between the transverse braces and the light arms: Weld connecting diagonal brace and steel girder at left horizontal light arm was broken (structure #01-20-77-101.63).

#### **Type 10.2: Bridge Frame Mount - Concrete Box Girder Attached**

- Bridge frame members and attachments: Minor-to-moderate corrosion of horizontal light arms was observed. Minor corrosion of horizontal braces, angle brackets, and connection plates was reported (structures #01-20-64-57.92 and #01-20-64-58.25). Right horizontal light arm was bent down. Minor-to-moderate corrosion of horizontal braces and connection plates was reported (structure #01-20-64-57.98).
- Connections between horizontal braces and concrete box girder: Minor-to-moderate corrosion of nuts/washers was observed. Some bolts connecting the horizontal braces and the concrete box girder were loose (structures #01-20-64-57.98 and #01-20-64-58.25).

#### **Type 11.1: Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns**

- Section loss of vertical column near base plate: Maximum section loss was 25% (structure #01-20-077-098.29).
- Exterior of vertical column: Minor-to-severe corrosion of the right vertical column was reported (structure #01-20-077-098.29).

#### **Type 11.2: Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns**

- Drainage issues: Drain hole on bottom of the right vertical column was clogged (structure #01-20-064-58.56).

- Anchor bolts, nuts, and washers: Minor corrosion of bolts/nuts/washers was observed. No washers on leveling nuts on the right column side were reported (structure #01-20-064-58.56).
- Section loss of vertical column near base plate: Maximum section loss was 56% (structure #01-20-064-58.56).
- Vertical weld lines between tubes constituting vertical columns: Some weld lines started out as wide stringers and then turned into a weave; these did not appear to tie components together very securely. Most weld lines were concentrated on center plate. One weld line was struck on the right vertical column on several areas (structure #01-20-064-58.56).
- Exterior of vertical column: Minor to very severe corrosion of the right vertical column was reported (structure #01-20-064-58.56).
- Connections between vertical columns and horizontal chords: Connection plate at the lower chord was not secure (structure #01-20-064-58.56).

# **CHAPTER 5**

## **CONCLUSIONS AND RECOMMENDATIONS**

## 5.1 Summary

Twenty-six comprehensive inspection forms were developed to systematically and objectively evaluate the current condition of the 82 sign structures in the WVDOH Charleston Interstate inventory. These structure types include single/double armed mounted cantilever structures, bridge superstructure/parapet wall mounted cantilever structures, two/three-dimensional overhead truss structures, ground mounted truss structures, bridge mounted half span truss structures, retaining wall mounted cantilever structures, half span with retaining wall mounted on outside and parapet wall mounted on inside structures, half span with parapet mounted on inside and shoulder mounted on outside structures, bridge frame mount structures, half span with shoulder mounted on inside, and parapet wall mounted on outside.

The project included performing extensive field inspection of the structural elements of the 82 sign structures. Eighty sign structures were successfully inspected. The two remaining structures (Bridge Mounted Half Span Truss, Type B Column Connection L & R, Open Columns) were partially inspected due to the difficulty in accessing some elements of these two structures.

Structural elements of each sign structure were evaluated using an element condition rating system. A sequential arithmetic rating score (i.e. '0', '1', '2', '3', '4') was used, and an importance weight for each structural element was assigned. The overall condition of each sign structure was then evaluated using an overall condition rating system. The overall condition rating is estimated based on the ratio between the total score of each structure ( $S$ ) and its maximum possible total score ( $S_{\max}$ ). A ratio was used to rate structures since the maximum possible total score of sign structures varies based on each structure's type. Sign structures rated between  $0.25 \leq S/S_{\max} < 0.43$  are categorized as "low risk." Sign structures rated between  $0.43 \leq S/S_{\max} < 0.62$  are categorized as "moderate risk." Sign structures rated between  $0.62 \leq S/S_{\max} < 0.8$  are categorized as "high risk". Sign structures rated between  $0.8 \leq S/S_{\max} \leq 1.0$  are categorized as "very high risk." Following this methodology for the inspected weathering steel sign structures, 7 percent (6 structures) were found to be at high risk with  $S/S_{\max}$  ratios ranging from 0.68 to 0.72; 50 percent (40 structures) were at moderate risk with  $S/S_{\max}$  ratios ranging from 0.44 to 0.63; and 43 percent (34 structures) were at low risk with  $S/S_{\max}$  ratios ranging from 0.3 to 0.43. Four of six structures with a high rating risk are structure type #4 (Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection). Two other structures with a high rating risk are structure type #3.3.2 (Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side) and structure type #6.6 (Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns). It should be noted that all structures with Ground Mounted Trusses (structure types



#4 and #5) and 93 percent of structures with two/three-dimensional overhead truss (structure types #3.1, 3.2, 3.3.1, 3.3.2) are either at a moderate or high rating risk. Below are important findings for each structure type:

**Type 1.1 (Double Armed Ground Mounted Cantilever):** There are 14 structures of this type. Half of them (50%) are rated as low risk. The rest of them are rated as moderate risk. Average maximum section loss near base plate for structure type 1.1 is 13%. Ultrasonic inspection of anchor bolts shows that most of the anchor bolts are in good condition with no significant deficiencies (except anchor bolts in structures #01-20-64-52.40, #01-20-64-57.83, and #01-20-64-57.88, which may have minor to moderate flaws). Major deficiencies for this type are: (1) possible cracks and corrosion/deterioration of the base plates; (2) corrosion on weld lines connecting the base plate and the vertical column; (3) corrosion of the vertical columns; (4) pack rust between plates/members in the lower chord; (5) some bolts connecting the vertical column and the horizontal chords are loose; (6) corrosion of horizontal chords; and (7) pack rust between light arm JB's and the lower chord.

**Type 1.2 (Single Armed Ground Mounted Cantilever):** There are 11 structures of this type. Seven of them (64%) received a low risk rating, while six (36%) are at a moderate risk rating. Average maximum section loss near base plate for structure type 1.2 is 20%. Ultrasonic inspection of anchor bolts shows that most of the anchor bolts are in good condition with no significant deficiencies (except anchor bolts in structures #01-20-64-53.73 and #01-20-64-54.61, which may have minor-to-moderate flaws). Major deficiencies for this type are: (1) section loss and corrosion/deterioration of the base plates; (2) corrosion/missing of anchor bolts/nuts/washers; (3) some weld lines connected the base plate and the vertical column have no weld reinforcements; (4) deterioration of some vertical weld lines between tubes constituting vertical column; (5) corrosion of the vertical column; (6) a missing light arm; and (7) cracks of bolts connecting the vertical supports and the horizontal light arms.

**Type 2.1 (Bridge Superstructure Mounted Cantilever):** There are 3 structures of this type. Two of them (67%) received a low risk rating and one (33%) was received a moderate risk rating. Average maximum section loss near base plate for structure type 2.1 is 2%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) corrosion of superstructure connection bracket (SCB) connection plate; (2) non-uniform/undercut on vertical weld lines between tubes constituting vertical column; and (3) corrosion of the vertical columns.

**Type 2.2 (Parapet Wall Mounted Cantilever):** There are 2 structures of this type and all of them (100%) are at a low rating risk. Average maximum section loss near base plate for structure type 2.2 is 12%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts

are in good condition with no significant deficiencies. A major deficiency for this type is corrosion of the vertical columns.

**Type 3.1 (Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder Mounted on Both Sides):** There are 2 structures of this type and both (100%) received a moderate risk rating. Average maximum section loss near base plate for structure type 3.1 is 7%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) some anchor bolts are corroded and short; (2) some nuts/washers are not fully engaged; (3) some underfill areas in vertical weld lines between tubes constituting vertical column were observed; and (4) horizontal light arms and vertical sign support to horizontal chord connection bracket are corroded.

**Type 3.2 (Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder Mounted on Both Sides):** There are 5 structures of this type and all of them (100%) received a moderate risk rating. Average maximum section loss near base plate for structure type 3.2 is 14%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) impact damage/corrosion of anchor bolt nuts/washers; (2) corrosion/deterioration of the vertical columns; (3) some bolts connected the vertical column and the horizontal chords are loose; (4) pack rust between plates/members; (5) corrosion/section loss of horizontal chords and secondary vertical posts; (6) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; and (7) pack rust between light arm JBs and the lower chord.

**Type 3.3.1 (Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides):** There are 6 structures of this type. One (17%) is rated as low risk. Five of them (83%) received a moderate risk rating. Average maximum section loss near base plate for structure type 3.3.1 is 19%. Ultrasonic inspection of anchor bolts shows that the anchor bolts in 3 structures are in a good shape with no significant deficiencies. The anchor bolts in the other 3 structures (#01-20-64-53.72, #01-20-79-00.68, and #01-20-60-11.44) may have minor-to-severe flaws. Major deficiencies for this type are: (1) possible cracks of the base plates; (2) some anchor bolts are cut short and leveling nuts/washers are corroded; (3) corrosion of the vertical columns; (4) some U-bolts connected the vertical column and the horizontal chords are loose; pack rust between plates/members and bending of L-shaped plates; (5) pack rust between light arm JBs and the lower chord; and (6) missing washers for bolt connections; deformation and damage of sign attachments.

**Type 3.3.2 (Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and Median Barrier Wall Mounted on Other Side):** There is only one structure of this type and is rated as high risk. Maximum section loss near base plate for structure type 3.3.2 is 41%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) corrosion/deterioration, section loss, and surface pitting of the base plates; (2) corrosion of anchor bolts/nuts/washers; (3) corrosion of the vertical columns; (4) corrosion of horizontal chords, secondary vertical posts, and horizontal bracings; (5) corrosion of horizontal light arms and L-brackets connecting the supports to the chords; and (6) pack rust between light arm JBs and the lower chord.

**Type 3.4 (Single Chord Ground Mounted Truss):** There are two structures of this type and both of them are rated as low risk. Average maximum section loss near base plate for structure type 3.4 is 31%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) corrosion of the vertical columns; (2) corrosion and surface lamination of the horizontal chord; and (3) pack rust between plates/members in splice connections in horizontal chord.

**Type 4 (Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection):** There are 8 structures of this type. Half of them received a high risk rating; the rest are rated as moderate risk. Average maximum section loss near base plate for structure type 4 is 29%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) deterioration/corrosion, surface pitting, and possible cracks and warping/buckling of the base plates; (2) anchor bolts/nuts/washers are corroded and some anchor bolts are cut short; (3) corrosion of weld lines connecting the base plate and the vertical column; (4) corrosion/deterioration/distress of the vertical columns; (5) pack rust between plates/members at splice connections between the vertical column and the horizontal chords; (6) some U-bolt connections are loose or broken; (7) delamination in several surface areas of the horizontal chords; (8) corrosion/twist of horizontal light arms; (9) pack rust between light arm JBs and the lower chord; and (10) corrosion of electrical box, conduit, and washers.

**Type 5 (Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection):** There are two structures of this type. Both are rated as moderate risk. Average maximum section loss near base plate for structure type 5 is 17%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good shape condition with no significant deficiencies. Major deficiencies for this structure type include: (1) corrosion of the base plates; (2) corrosion of anchor bolts/nuts/washers and possible cracks of anchor bolts; (3) corrosion of the vertical columns; (4) pack rust between plates/members at splice connections

between the vertical column and the horizontal chords; (5) some U-bolt connections are loose; and (6) deterioration of the horizontal chords.

**Type 6.1.1 (Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Closed Columns):** There are 3 structures of this type. Two of them (67%) received a low rating risk. One (33%) is rated as moderate risk. Average maximum section loss near base plate for structure type 6.1.1 is 10%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) undercut on weld lines between the SCB connection plate and the vertical column; (2) undercut on vertical weld lines between tubes constituting vertical column; (3) corrosion of the vertical columns; and (4) corrosion of the horizontal chords.

**Type 6.1.2 (Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Closed Columns):** There is only one structure of this type. It received a moderate risk rating. Maximum section loss near base plate for structure type 6.1.2 is 17%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) undercut on weld lines between the SCB connection plate and the vertical column; (2) corrosion/warp of the vertical column(s); (3) pack rust between light arm JBs and the lower chord; (4) conduits are broken; and (5) connection brackets connecting luminaire tracks are loose.

**Type 6.2.1 (Bridge Mounted Half Span Truss, Type A Column Connection with Type A SCB L & R, Open Columns):** There are 2 structures of this type. One of them is rated as moderate risk. The other is rated as low risk. Average maximum section loss near base plate for structure type 4 is 14%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) corrosion/deterioration of the SCB connection plates; (2) corrosion of the vertical columns; (3) U-bolt and L-shaped plate connecting the vertical column and the horizontal chords are broken; (4) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; (5) pack rust between light arm JB's and the lower chord; and (6) bolts connecting vertical sign support to horizontal chord bracket are loose.

**Type 6.2.2 (Bridge Mounted Half Span Truss, Type A Column Connection with Type B SCB L & R, Open Columns):** There are 3 structures of this type. Two of them (67%) received a moderate risk rating. One of them (33%) received a low risk rating. Average maximum section loss near base plate for structure type 6.2.2 is 19%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) corrosion of the vertical columns; (2) corrosion of horizontal chords and secondary vertical posts; (3) corrosion of horizontal light

arms and vertical sign support to horizontal chord connection bracket; and (4) some bolts connecting the vertical sign support and the horizontal chord are loose.

**Type 6.4 (Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns):** There are 2 structures of this type and both of them are rated as moderate risk. Average maximum section loss near base plate for structure type 6.4 is 22%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are: (1) drain holes in bottom of the vertical column are clogged; (2) corrosion/deterioration of the vertical columns; (3) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; (4) pack rust between light arm JBs and the lower chord; and (5) welds on some light arms are cracked or broken.

**Type 6.5 (Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection):** There is only one structure of this type and it received a low risk rating. Maximum section loss near base plate for structure type 6.5 is 31%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in a good shape with no significant deficiencies. Major deficiencies for this type are (1) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; and (2) pack rust between light arm JBs and the lower chord.

**Type 6.6 (Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated Median Barrier Column Connection L, Open Columns):** There is only one structure of this type and it is rated as high risk. Maximum section loss near base plate for structure type 6.6 is 37%. Ultrasonic inspection of anchor bolts shows that some anchor bolts may have minor to severe flaws. Major deficiencies for this type are: (1) concrete cracking of concrete support; (2) corrosion of concrete superstructure support (CSS) and median connection plates; (3) corrosion of the CSS/median bolts/nuts/washers; (4) corrosion of the vertical columns; (5) some U-bolts connecting the vertical column and the horizontal chords are loose; (6) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; and (7) pack rust between light arm JBs and the lower chord.

**Type 7 (Retaining Wall Mounted Cantilever):** There is only one structure of this type and it is rated as low risk. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are (1) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; (2) pack rust between light arm JBs and the lower chord; and (3) breaks/damages of electrical distribution boxes, center light fixtures, and welds on the horizontal light arms.

**Type 8 (Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount on Inside):** There is only one structure of this type and it is rated as moderate risk. Maximum section loss near base plate for structure type 8 is 5%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) corrosion of anchor bolts/nuts/washers and loosening of some leveling nuts; (2) concrete cracking in the retaining wall around the vertical column connections; (3) corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket; and (4) some light arm connection bolts are loose/broken.

**Type 9 (Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside):** There is only one structure of this type and it received a low risk rating. Maximum section loss near base plate for structure type 9 is 30%. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are corrosion of the vertical columns and surface delamination of the horizontal braces.

**Type 10.1 (Bridge Frame Mount - Steel Girder Attached):** There are 2 structures of this type. One of them is rated as moderate risk and the other is rated as low risk. Ultrasonic inspection of anchor bolts shows that all the anchor bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) corrosion of horizontal light arms and pack rust on the light arm at sign support; welds connecting the light plates and the horizontal light arms are cracked; (2) cracks, spalling, and deterioration of concrete under the parapet connections; and (3) welds connecting the diagonal braces and the steel girder are broken.

**Type 10.2 (Bridge Frame Mount - Concrete Box Girder Attached):** There are 4 structures of this type and all of them receive a low risk rating. Ultrasonic inspection of anchor bolts for these structures could not be performed since the anchor bolts are too close to I-beam. Major deficiencies for this type are: (1) corrosion of horizontal light arms, horizontal braces, angle brackets, and connection plates; (2) one horizontal light arm is bent down; and (3) corrosion/loose bolt connections between horizontal braces and concrete box girder.

**Type 11.1 (Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Open Type Vertical Columns):** There is only one structure of this type and it received a low risk rating. Maximum section loss near base plate for structure type 11.1 is 25%. Ultrasonic inspection of anchor/connection bolts shows that all the bolts are in a good shape with no significant deficiencies. A major deficiency for this type is corrosion of the vertical columns.

**Type 11.2 (Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns):** There is only one structure of this type and it received a moderate risk rating. Maximum section loss near base plate for structure type 11.2 is 56%. Ultrasonic inspection of anchor/connection bolts shows that all the bolts are in good condition with no significant deficiencies. Major deficiencies for this type are: (1) drain holes on bottom of the column are clogged; (2) corrosion of bolts/nuts/washers and missing washers on leveling nuts; (3) some vertical weld lines between tubes constituting vertical columns do not appear to tie components together very securely; (4) corrosion of the vertical columns; and (5) insecure connection plates at the lower chord at connections between the vertical column and the horizontal chords.

## **5.2 Conclusions and Recommendations**

Based on the results of the element and overall condition ratings for each weathering steel overhead sign structure, it is concluded that the condition of more than half of the weathering steel sign structures in the West Virginia Charleston Interstate System ranges from fair to poor. The rating results presented here are intended to assist the WVDOH in determining whether there is a need to repair or replace at-risk elements or connections. To detect any serious defects which may endanger the structure or the traveling public, in-depth evaluations are recommended for the sign structures with the highest risk rating. Further evaluations are also recommended for the sign structures with moderate risk ratings. Normal periodic inspections are recommended for sign structures with a low risk rating.

## **References**

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- Michigan DOT (1989). *Inspection of Sign Support Structures*. Research Project 83 TI-955, Research Report No. R-1302.
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**APPENDIX A**  
**SAMPLE SIGN**  
**STRUCTURE**  
**INSPECTION FORM**



# WVDOH Inspection Form for Ground Mounted Trusses - One Shoulder Mount and One Median Barrier Wall Connection

Developed by  
Prof. Wael Zatar  
Marshall University



Inspection Date: _____	Inspector Names: 1) _____ 2) _____ 3) _____ 4) _____ 5) _____
Inspection Contractor: _____	
_____	
_____	
_____	

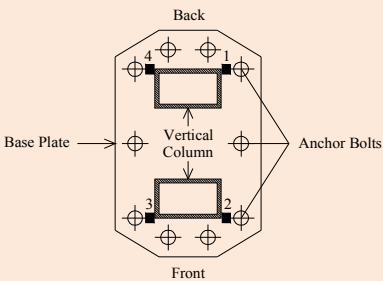
Please completely fill in all the fields of this form and use Appendix C to provide additional details that could not fill in the allocated spaces. For each section of this form, please provide photos' and/or videos' IDs corresponding to the structure number by filling in Appendix D (please use attached sheets if the allocated spaces are insufficient). The photos/videos should simply be named in the format "Structure Number"\_"Sequential Number" (for example: 01-20-079-00.68\_001, 01-20-079-00.68\_002, etc...).

SECTION	NOTES AND OBSERVATIONS
1. Sign Structure Information	<b>Structure Number:</b> _____ <b>Structure Length:</b> _____ <b>Width - W</b> _____ <b>Height - H (S)</b> _____ <b>Height - H (M)</b> _____ <b>Total Number Travel Lanes Under Structure:</b> <input type="checkbox"/> 2 lanes <input type="checkbox"/> 3 lanes <input type="checkbox"/> 4 lanes <input type="checkbox"/> 5 lanes <input type="checkbox"/> 6 lanes <input type="checkbox"/> Other (specify): _____ <b>Year Installed:</b> _____ <b>Approximate Location:</b> _____ <b>County:</b> _____ <b>Longitude:</b> _____ <b>Latitude:</b> _____ <b>Route #:</b> _____ <input type="checkbox"/> East <input type="checkbox"/> West <input type="checkbox"/> North <input type="checkbox"/> South <b>Milepost (if applicable):</b> _____ <b>Interchange Name/Number (if applicable):</b> _____ <b>Additional Information:</b> _____ _____ _____ _____
	<b>Structure Key Drawing:</b> 
	<b>Sketch of Sign Legend:</b> _____ _____ _____ _____
	<b>Note 1:</b> If the structure spans lanes traveling in opposite directions, the direction indicated above shall be either North or East, and the face of the structure viewed when traveling in the direction indicated shall be considered the front.
	<b>Note 2:</b> Take two photos showing the overall front and back views of the structure.
	<b>Completed by:</b> _____
	<b>Foundation (At Shoulder):</b> <b>Foundation Covered by Soil?</b> <input type="checkbox"/> No    If Yes <input type="checkbox"/> Partially covered <input type="checkbox"/> Yes <input type="checkbox"/> Completely covered
	<b>Soil Surrounding the Foundation Washed Out?</b> <input type="checkbox"/> No    If Yes <input type="checkbox"/> Partially washed out <input type="checkbox"/> Yes <input type="checkbox"/> Completely washed out
	<b>2. Foundation</b>

2. Foundation (Continued)	Concrete Spalling <input type="checkbox"/> No <input type="checkbox"/> Yes If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement? <input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):				
	Concrete Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Deterioration <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms): Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):				
	<b>Foundation (At Median):</b> Foundation Covered by Soil? <input type="checkbox"/> No      If Yes <input type="checkbox"/> Partially covered <input type="checkbox"/> Yes <input type="checkbox"/> Completely covered				
	Concrete Spalling <input type="checkbox"/> No <input type="checkbox"/> Yes If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement? <input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):				
	Concrete Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Deterioration <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms): Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):				
	* Please see the Appendixes A & B				
3. Drainage Issues	Detailed Deficiency Comments:		Deficiency Sketches :		
	Note: Take as many photos as required to adequately document each damage or deficiency described above (if applicable).				
	Completed by: _____				
	Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):		Detailed Deficiency Comments:		Deficiency Sketches:
Note: Take as many photos as needed to adequately document the drainage characteristics of the topography surrounding the structure and each damage or deficiency (if applicable).					
Completed by: _____					

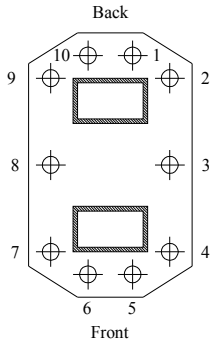
4. Grout Pad under the Base Plate	<b>Grout Pad (At Shoulder):</b>				
	Grout Pad Present?		<input type="checkbox"/> No	<input type="checkbox"/> Yes	
	If Yes, Thickness of the Grout Pad: _____				
	Mortar Splitting *	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Mortar Cracking *	<input type="checkbox"/> No <input type="checkbox"/> Yes
	Mortar Spalling	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Mortar Crushing	<input type="checkbox"/> No <input type="checkbox"/> Yes
	Other Defects/Observations		<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	<b>Grout Pad (At Median):</b>				
	Grout Pad Present?		<input type="checkbox"/> No	<input type="checkbox"/> Yes	
	If Yes, Thickness of the Grout Pad: _____				
	Mortar Splitting *	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Mortar Cracking *	<input type="checkbox"/> No <input type="checkbox"/> Yes
Mortar Spalling	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Mortar Crushing	<input type="checkbox"/> No <input type="checkbox"/> Yes	
Other Defects/Observations		<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
* Please see the Appendix B					
Detailed Deficiency Comments:			Deficiency Sketches:		
Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).					
Completed by: _____					

5. Base Plate	<b>Base Plate (At Shoulder):</b>			
	Locations of Base Plate UT Thickness Readings		Base Plate UT Thickness Readings (in.)	Note
		1		
		2		
		3		
		4		
	Section Loss (Visual Inspection) <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration): Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion): Warping/Buckling <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Surface Pitting <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):			

5. Base Plate (Continued)	<b>Base Plate (At Median):</b>			
	Locations of Base Plate UT Thickness Readings		Base Plate UT Thickness Readings (in.)	Note
		1		
		2		
		3		
		4		
	Section Loss (Visual Inspection) <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration): Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion): Warping/Buckling <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Surface Pitting <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):			
	* Please see the Appendixes A & B			
	Detailed Deficiency Comments:		Deficiency Sketches:	
	Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).			
Completed by: _____				
6. Visual Inspection of Anchor Bolts	<b>Anchor Bolts (At Shoulder):</b>			
	Misalignment <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):			
	Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):			
	Horizontal/Vertical Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):			
	Inclined Shear Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of shear cracks ):			
	Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):			
	Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):			
	<b>Anchor Bolts (At Median):</b>			
	Misalignment <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):			
	Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):			
Horizontal/Vertical Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):				
Inclined Shear Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of shear cracks ):				
Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):				
Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):				
* Please see the Appendixes A & B				

6. Visual Inspection of Anchor Bolts (Continued)	Detailed Deficiency Comments:		Deficiency Sketches:	
	<p><i>Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).</i></p>			
	Completed by: _____			
7. Nuts/Washers	<b>Top Nuts/Washers (At Shoulder):</b>			
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):	
	Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
	Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):	
	Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)	
	(use "ball-peen hammer" method)			
	Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Full Engagement	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	<b>Leveling Nuts/Washers (At Shoulder):</b>			
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):	
	Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
	Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):	
	Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)	
	(use "ball-peen hammer" method)			
	Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Full Engagement	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
	Gap Between Leveling	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Nuts/Washers and			
	the Bottom of the Base Plate			
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	<b>Top Nuts/Washers (At Median):</b>			
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):		
Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):		
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):		
Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)		
(use "ball-peen hammer" method)				
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Full Engagement	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):		
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		

7. Nuts/Washers (Continued)	<b>Leveling Nuts/Washers (At Median):</b> Misalignment <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration): Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion): Tightness <input type="checkbox"/> Tight <input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided) (use "ball-peen hammer" method) Missing <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Full Engagement <input type="checkbox"/> Yes <input type="checkbox"/> No (specify): Gap Between Leveling <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Nuts/Washers and the Bottom of the Base Plate Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):	
	* Please see the Appendixes A & B	
	<u>Detailed Deficiency Comments:</u>          	<u>Deficiency Sketches:</u>          
	Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).	
	Completed by: _____	
	<i>Take one general photo looking at each of the four faces of each of the foundations of the structure. The general photos should include all features of Sections 2, 4, 5, 6 and 7 (foundations, grout pads, base plates, anchor bolts, nuts and washers). If only one of the median cover plates are removed, no photo shall be required of the face with the median cover plate remaining if it is not possible to obtain one.</i>	
8. Ultrasonic Inspection of Anchor Bolts	Inspector Names: _____ Inspection Procedure: _____ Test Method: _____ Test Equipment: _____ Reference Standard: _____ Reference Sensitivity: _____ Transducer Frequency: _____ Calibration Level (dB's): _____ Depth: _____ Scanning Level (dB's): _____	
	<b>Anchor Bolts (At Shoulder):</b>	
	<u>Locations of Anchor Bolts:</u>  <div style="text-align: center;">  </div>	<u>Detailed Deficiency Comments:</u>          

8. Ultrasonic Inspection of Anchor Bolts (Continued)	Bolt No.	Steel Type	Length (in)	Diameter (in)	Signal Indication	Remarks	
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	<b>Anchor Bolts (At Median):</b>						
	Locations of Anchor Bolts:					Detailed Deficiency Comments:	
Bolt No.	Steel Type	Length (in)	Diameter (in)	Signal Indication	Remarks		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

9. Connections between Base Plate and Vertical Column	<b>Weld Lines - Vertical Column (At Shoulder):</b>	
	Locations of Weld Lines:	Detailed Deficiency Comments:



Weld Line 1

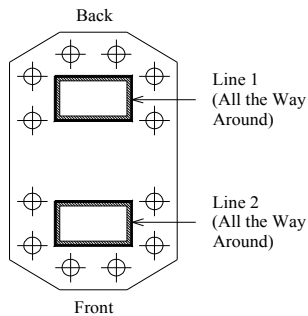
Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 2

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

**Weld Lines - Vertical Column (At Median):**

Locations of Weld Lines:



Detailed Deficiency Comments:

Weld Line 1

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 2

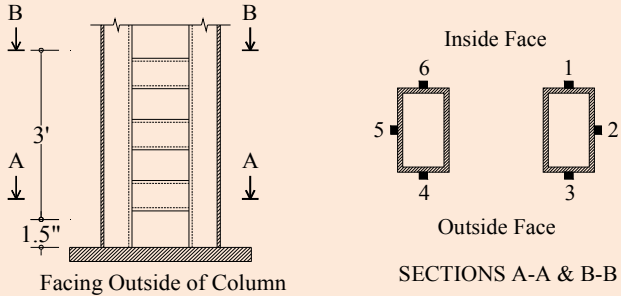
Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

*Note: Take as many photos as required to adequately document each weld line of each foundation and as many photos as required to adequately document each damage or deficiency (if applicable).*

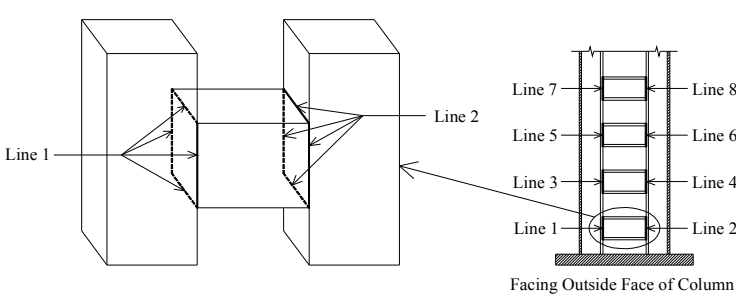
Weld Line		Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
Vertical Column (At Shoulder)	1							
	2							
Vertical Column (At Median)	1							
	2							

*\* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.*

Completed by: \_\_\_\_\_

10. Measuring the Section Loss of the Vertical Column near the Base Plate	Thickness Measurement Locations	UT Thickness Readings (in.)			
		Vertical Column (At Shoulder)		Vertical Column (At Median)	
		Section A-A	Section B-B	Section A-A	Section B-B
	1				
	2				
	3				
	4				
5					
6					
					
<i>Note: Please refer to the detailed procedure for measuring the section loss of the vertical column near the base plate in the Appendix A.</i>					
Completed by: _____					

11. Weld Lines between Column Vertical Members and Supplemental Bracing	Locations of Weld Lines:		Detailed Deficiency Comments:																						
																									
	<p><b>Weld Lines - Vertical Column (At Shoulder):</b></p> <p><u>Weld Line 1</u></p> <table style="width:100%;"> <tr> <td>Misalignment</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>Weld Cracks</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>Weld Size Uniform</td> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No (specify):</td> </tr> <tr> <td>Other Defects/Observations</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> </table> <p><u>Weld Line 2</u></p> <table style="width:100%;"> <tr> <td>Misalignment</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>Weld Cracks</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>Weld Size Uniform</td> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No (specify):</td> </tr> <tr> <td>Other Defects/Observations</td> <td><input type="checkbox"/> No</td> <td><input type="checkbox"/> Yes (specify):</td> </tr> </table>			Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	Other Defects/Observations
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):																							
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):																							
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):																							

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 3

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 4

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 5

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 6

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 7

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 8

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 9

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 10

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 11

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 12

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 13

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 14

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 15

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 16

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

**Weld Lines - Vertical Column (At Median):**

Weld Line 1

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 2

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 3

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 4

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 5

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 6

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Weld Line 7

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 8

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 9

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 10

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 11

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 12

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 13

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 14

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 15

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 16

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

*Note: Take multiple photos as needed to document each vertical weld line of the vertical columns and as many photos as required to adequately document each damage or deficiency (if applicable).*

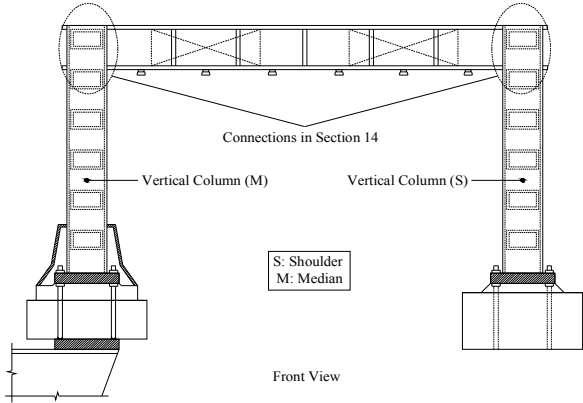
Weld Line		Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
Vertical Column (At Shoulder)	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
Vertical Column (At Median)	1							
	2							
	3							
	4							
	5							
	6							

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)	Vertical Column (At Median)	7							
		8							
		9							
		10							
		11							
		12							
		13							
		14							
		15							
		16							
<p><i>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</i></p> <p>Completed by: _____</p>									
12. Interior Observations of the Vertical Column (Using Camera)	<p><b>Vertical Column (At Shoulder):</b></p> <p>Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p><b>Vertical Column (At Median):</b></p> <p>Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p>								
	<p><i>* Please see the Appendixes A &amp; B</i></p>								
	<p><i>Note: Take as many videos as required to adequately document the condition of the interior of the vertical column.</i></p>								
	<p>Completed by: _____</p>								
	13. Exterior Observations of the Vertical Column	<p><b>Vertical Column (At Shoulder):</b></p> <p>Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Horizontal/Vertical Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):</p> <p>Inclined Shear Cracks <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):</p> <p>Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Warp/Buckling <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p>Distress <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of distress):</p> <p>Handhole Cover in Place <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p>							



13. Exterior Observations of the Vertical Column (Continued)	<b>Vertical Column (At Median):</b>	
	Deterioration *	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):
	Horizontal/Vertical Cracks	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):
	Inclined Shear Cracks	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
	Corrosion *	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):
	Warp/Buckling	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify):
	Distress	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of distress):
	Handhole Cover in Place	<input type="checkbox"/> Yes <input type="checkbox"/> No
	Other Defects/Observations	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify):
	* Please see the Appendixes A & B	
	<u>Detailed Deficiency Comments:</u>      	<u>Deficiency Sketches:</u>      
	<i>Note: Take multiple photos as needed to document each of the outside faces of the vertical column and as many photos as required to adequately document each damage or deficiency (if applicable).</i>	
	Completed by: _____	

14. Connections between the Vertical Column and Horizontal Chords	<u>Locations of Connections:</u> 	<u>Detailed Deficiency Comments:</u>      														
	<b>Connections - Vertical Column (At Shoulder):</b>  <u>Lower Chord</u> <table style="width: 100%;"> <tr> <td style="width: 45%;">Misalignment</td> <td style="width: 10%; text-align: center;"><input type="checkbox"/> No</td> <td style="width: 45%; text-align: center;"><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>L-Shaped Plate Damage</td> <td style="text-align: center;"><input type="checkbox"/> No</td> <td style="text-align: center;"><input type="checkbox"/> Yes (specify):</td> </tr> <tr> <td>U-Bolt Corrosion *</td> <td style="text-align: center;"><input type="checkbox"/> No</td> <td style="text-align: center;"><input type="checkbox"/> Yes (specify level of corrosion):</td> </tr> <tr> <td>U-Bolt Deterioration *</td> <td style="text-align: center;"><input type="checkbox"/> No</td> <td style="text-align: center;"><input type="checkbox"/> Yes (specify level of deterioration):</td> </tr> <tr> <td>Pack Rust Between Plates/Members</td> <td style="text-align: center;"><input type="checkbox"/> No</td> <td style="text-align: center;"><input type="checkbox"/> Yes (specify level of rust):</td> </tr> </table>		Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	L-Shaped Plate Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	U-Bolt Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):	U-Bolt Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):	Pack Rust Between Plates/Members	<input type="checkbox"/> No
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):														
L-Shaped Plate Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):														
U-Bolt Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):														
U-Bolt Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):														
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of rust):														

## 14. Connections between the Vertical Column and Horizontal Chords (Continued)

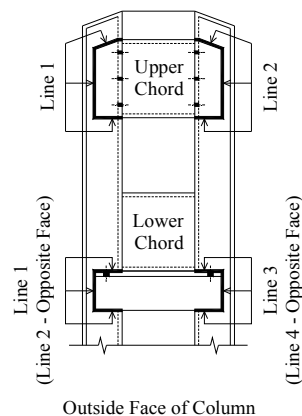
Horizontal/Vertical Cracks of U-Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of U-Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
U-Bolt Tightness (use "ball-peen hammer" method)	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured U-Bolts (visual observation)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Upper Chord</u>		
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
L-Shaped Plate Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Bolt Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of rust):
Horizontal/Vertical Cracks of Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
Bolt Tightness (use "ball-peen hammer" method)	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured Bolts (use "hammer sound" method)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<b>Connections - Vertical Column (At Median):</b>		
<u>Lower Chord</u>		
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
L-Shaped Plate Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
U-Bolt Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
U-Bolt Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of rust):
Horizontal/Vertical Cracks of U-Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of U-Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
U-Bolt Tightness (use "ball-peen hammer" method)	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured U-Bolts (visual observation)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

14. Connections between the Vertical Column and Horizontal Chords (Continued)

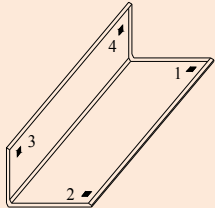
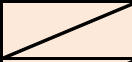

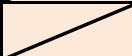
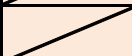
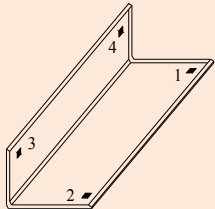
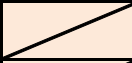

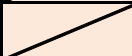
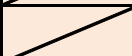
Upper Chord

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
L-Shaped Plate Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Bolt Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of rust):
Horizontal/Vertical Cracks of Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of Bolts	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
Bolt Tightness (use "ball-peen hammer" method)	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured Bolts (use "hammer sound" method)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Locations of Weld Lines:



Deficiency Sketches:

Locations of L-Shaped Plate UT Thickness Readings			L-Shaped Plate UT Thickness Readings (in.)				Note
			Lower Chord		Upper Chord		
			Inside *	Outside *	Inside *	Outside *	
	Vertical Column (At Shoulder)	1					
		2					
		3					
		4					
	Vertical Column (At Median)	1					
		2					
		3					
		4					

\* L-Shaped plates attached at inside/outside face of the vertical columns

14. Connections between the Vertical Column and Horizontal Chords (Continued)	Location		Weld Line	Weld Width (in.)					
				Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *
	Vertical Column (At Shoulder)	Upper Chord	1						
2									
Lower Chord		1							
		2							
		3							
		4							
Vertical Column (At Median)	Upper Chord	1							
		2							
	Lower Chord	1							
		2							
		3							
		4							
<i>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</i>									
Detailed Deficiency Comments:					Deficiency Sketches:				
<p>Note: Take one photo looking at each face of each connection between the vertical column and horizontal chord and as many photos as required to adequately document each damage or deficiency (if applicable).</p>									
Completed by: _____									

15. Horizontal Chords and Secondary Vertical Posts	Locations of Connections:	Detailed Deficiency Comments:
	<p>Connections in Section 15</p> <p>Vertical Column (M)      Vertical Column (S)</p> <p>S: Shoulder M: Median</p> <p>Front View</p>	
<p><u>Lower Chord</u></p> <p>Misalignment      <input type="checkbox"/> No      <input type="checkbox"/> Yes (specify):</p> <p>Corrosion *      <input type="checkbox"/> No      <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Deterioration *      <input type="checkbox"/> No      <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Cracking      <input type="checkbox"/> No      <input type="checkbox"/> Yes (specify dimensions and locations of cracks):</p>		

15. Horizontal Chords and Secondary Vertical Posts (Continued)

Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Upper Chord

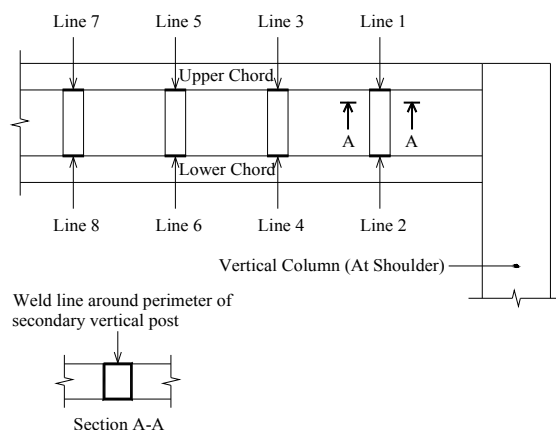
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Secondary Vertical Post

Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

\* Please see the Appendixes A & B

Locations of Weld Lines:



Deficiency Sketches:

	Weld Line	Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
15. Horizontal Chords and Secondary Vertical Posts (Continued)	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
		<i>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</i>						
		<u>Detailed Deficiency Comments:</u>				<u>Deficiency Sketches:</u>		
		<i>Note: Take multiple photos as required of each face of each horizontal chord/secondary post, including the weld lines, and as many photos as required to adequately document each damage or deficiency (if applicable).</i>						
		Completed by: _____						
16. Attachments	<u>Vertical Sign Supports</u>							
	Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):					
	Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):					
	Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):					
	Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):					
	Sagging	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):					

## 16. Attachments (Continued)

Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Horizontal Light Arms</u>		
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Pack Rust Between Light Arm	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of rust):
JB's and the Lower Chord		
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Vertical Sign Support to Horizontal Chord Connection Bracket</u>		
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Sign Panels</u>		
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

## 16. Attachments (Continued)

Bolt Tightness ☐ Tight ☐ Loose

(Visual observation and checking by hand)

Other Defects/Observations ☐ No ☐ Yes (specify):

Electrical Distribution Boxes and Their Hardware

Deformation ☐ No ☐ Yes (specify level of deformation):

Sagging ☐ No ☐ Yes (specify level of sagging):

Missing ☐ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☐ Yes (specify):

Conduits

Deformation ☐ No ☐ Yes (specify level of deformation):

Sagging ☐ No ☐ Yes (specify level of sagging):

Missing ☐ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☐ Yes (specify):

Sign Attachments (Traffic Control Devices, Cameras, etc)

Deformation ☐ No ☐ Yes (specify level of deformation):

Sagging ☐ No ☐ Yes (specify level of sagging):

Missing ☐ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☐ Yes (specify):

Others (Specify):

Deformation ☐ No ☐ Yes (specify level of deformation):

Sagging ☐ No ☐ Yes (specify level of sagging):

Missing ☐ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☐ Yes (specify):

\* Please see the Appendixes A & B

Detailed Deficiency Comments:

Deficiency Sketches:

Note: Take an adequate number of photos to document the attachments and as many photos as required to adequately document each damage or deficiency (if applicable).

Completed by: \_\_\_\_\_



## Appendix A: Inspection Guidelines

### I. Suggested Procedure for Determining Section Loss of Vertical Tubes

1. Remove hand hole cover and visually inspect the inside of the pole.
2. If visible corrosion is observed, especially in the vicinity of the lower end of the column toward the base plate, tap on the exterior of the column to loosen any corrosion particles.
3. At an approximate distance of 3 feet above the base plate, use an electronic thickness device to obtain four readings around the circumference of the column. The minimum of these four numbers may be assumed to be the thickness of the column and should be recorded. The reading obtained is also valid for a two-ply column as the device measures only the outermost thickness. To obtain accurate readings using the device, the inspector will need to grind the irregular weathered surface at measurement locations.
4. At an approximate distance of 1.5 inches above the base plate, obtain eight readings, one at each quarter point along each of the four faces of the column using an electronic thickness device and record the value.
5. If the inspector during the initial visual inspection observes other locations that should be checked for section loss, then additional thickness measurements should then be taken.

### II. Method to Check Tightness of Anchor Rod Nuts

Check that the nut is adequately threaded on the rod. Tap the anchor rod nuts and washers with a ball-peen hammer to check for looseness. The anchor rod nuts must be tight to clamp the base plate to the foundation (or leveling nut). A loose washer will reveal an unclamped anchor rod even if the nut is tight on the anchor rod.




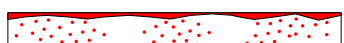

### III. Method to Check Tightness and Integrity of Structural Connection Bolts in the Structure

Check that the nut is adequately threaded on the bolt rod. Tap the bolt nuts and washers with a ball-peen hammer to check for looseness. The bolt nuts must be tight to clamp the structural members. A loose washer will reveal an unclamped bolt rod even if the nut is tight on the bolt rod. The integrity of the bolts themselves should be hammer sounded by tapping the top of the bolt. A dull sound may indicate a fracture in the bolt.

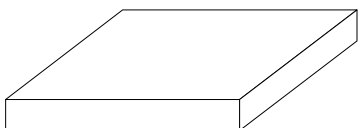
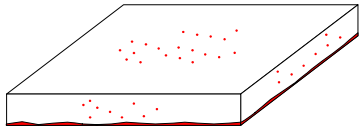
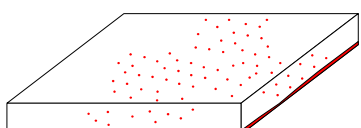
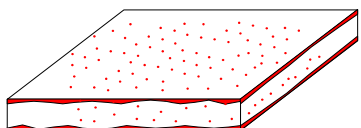
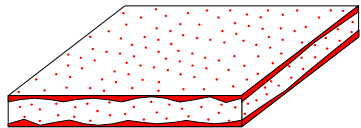
### IV. Determine Weld Size Uniformity

1. Perform visual inspection of weld lines
2. Measure weld width at some sections that the inspector finds to be nonuniform from the visual inspection. The number of readings for each weld line should not be less than 3. If the difference between the largest one and the smallest one is less than 10%, the weld line is assumed to be uniform, otherwise it is nonuniform.

## V. Level of Corrosion/Deterioration of Steel Reinforcements in the Foundation, Anchor Bolts and Structural Connection Bolts

Level of corrosion/deterioration	Commentary	Illustration
0. No corrosion/deterioration	No corrosion/deterioration is observed	
1. Minor corrosion/deterioration	Corrosion/deterioration is observed in a small area that the section loss does not exceed 10%	
2. Moderate corrosion/deterioration	Corrosion/deterioration is observed in a medium area that the section loss is in between 10% and 20%	
3. Severe corrosion/deterioration	Corrosion/deterioration is observed in a large area that the section loss is in between 20% and 40%	
4. Very severe corrosion/deterioration	Corrosion/deterioration is observed in a very large area that the section loss exceeds 40%	

## VI. Level of Corrosion/Deterioration of Steel Members in the Structure

Level of corrosion/deterioration	Commentary	Illustration
0. No corrosion/deterioration	No corrosion/deterioration is observed	
1. Minor corrosion/deterioration	Corrosion/deterioration is observed in a small area that the thickness ratio (minimum thickness/initial thickness) is more than 90%, i.e. the thickness loss does not exceed 10%	
2. Moderate corrosion/deterioration	Corrosion/deterioration is observed in a medium area that the thickness ratio is in between 80% and 90%, i.e. the thickness loss is in between 10% and 20%	
3. Severe corrosion/deterioration	Corrosion/deterioration is observed in a large area that the thickness ratio is in between 60% and 80%, i.e. the thickness loss is in between 20% and 40%	
4. Very severe corrosion/deterioration	Corrosion/deterioration is observed in a very large area that the thickness ratio is less than 60%, i.e. the thickness loss exceeds 40%	

## Appendix B: Terminology

In this form, it is assumed that

1. Corrosion is referring just to the presence of corrosion (rust)
2. Deterioration is referring to measurable, notable section loss
3. Mortar splitting is referring to the complete separation into different parts of the grout pad
4. Mortar cracking is referring to the break without the complete separation into different parts of the grout pad

### Appendix C: Additional Comments and Sketches

(Please use this page to document additional information that you could not get into the previous sections. Please clearly indentify to which section the information is belonging in the form)

Section No.	Additional Comments/Sketches
_____	
_____	
_____	

Section	Additional Comments/Sketches
<div></div>	
<div></div>	
<div></div>	

### Appendix D: Description of Photos/Videos

Completed by \_\_\_\_\_

Structure Number \_\_\_\_\_

Structure Type \_\_\_\_\_

(Description field should have a detailed description of what the photo/video is of, including which face it is of based on the cardinal travel direction)

Photo/Video No.	Section No.	File Name/Path	Detailed Description













**APPENDIX B**  
**SAMPLE COMPLETED**  
**SIGN STRUCTURE**  
**INSPECTION FORM**



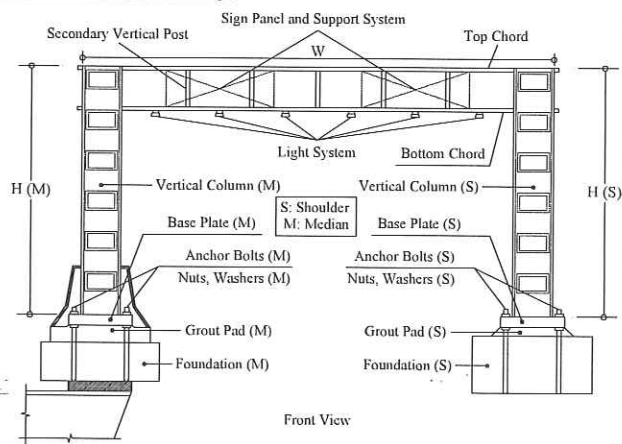
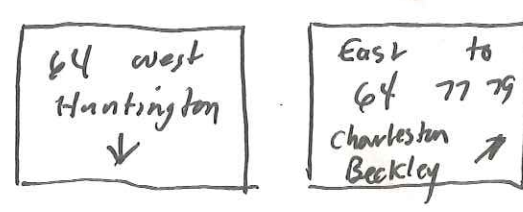
WVDOH Inspection Form for  
Ground Mounted Trusses - One Shoulder Mount and One Median  
Barrier Wall Connection

Developed by  
Prof. Wael Zatar  
Marshall University



Inspection Date: <u>12-13-12, 1-15-13</u> <u>1-19-13</u>	Inspector Names: 1) <u>Russ Stewart</u> 2) <u>Troy Matthews</u> 3) <u>Dwight Miller</u> 4) _____ 5) _____
Inspection Contractor: <u>Dennis Corporation</u>	

Please completely fill in all the fields of this form and use Appendix C to provide additional details that could not fill in the allocated spaces. For each section of this form, please provide photos' and/or videos' IDs corresponding to the structure number by filling in Appendix D (please use attached sheets if the allocated spaces are insufficient). The photos/videos should simply be named in the format "Structure Number"\_"Sequential Number" (for example: 01-20-079-00.68\_001, 01-20-079-00.68\_002, etc...).

SECTION	NOTES AND OBSERVATIONS
1. Sign Structure Information	Structure Number: <u>1-20-64-57.53</u>
	Structure Length: Width - W <u>39.9 ft</u> Height - H (S) <u>31.1 ft</u> Height - H (M) <u>29.9 ft</u>
	Total Number Travel Lanes Under Structure: <input checked="" type="checkbox"/> 2 lanes <input type="checkbox"/> 3 lanes <input type="checkbox"/> 4 lanes <input type="checkbox"/> 5 lanes <input type="checkbox"/> 6 lanes <input type="checkbox"/> Other (specify): _____
	Year Installed: _____
	Approximate Location: <u>Oakwood Rd</u> <u>on Ramp to I-64 E/W</u>
	County: <u>Kanawha</u>
	Longitude: <u>N 38.35297</u>
	Latitude: <u>W 81.64914</u>
	Route #: <u>I-64</u>
	<input checked="" type="checkbox"/> East <input type="checkbox"/> West <input type="checkbox"/> North <input type="checkbox"/> South
Milepost (if applicable): <u>57.53</u>	
Interchange Name/Number (if applicable): _____	
Additional Information: <u>NB Oakwood Rd.</u> <u>Ramps: 2nd structure @</u> <u>split</u>	
<b>Structure Key Drawing:</b> 	
<b>Sketch of Sign Legend:</b> 	
Note 1: If the structure spans lanes traveling in opposite directions, the direction indicated above shall be either North or East, and the face of the structure viewed when traveling in the direction indicated shall be considered the front.	
Note 2: Take two photos showing the overall front and back views of the structure.	
Completed by: <u>RS, TM 1-15-13, 1-19-13</u>	
2. Foundation	<b>Foundation (At Shoulder):</b>
	Foundation Covered by Soil? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Partially covered <input type="checkbox"/> Completely covered Soil Surrounding the Foundation Washed Out? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Partially washed out <input type="checkbox"/> Completely washed out



2. Foundation (Continued)	Concrete Spalling <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
	If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement?	
	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):	
	Concrete Cracking <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
	Deterioration <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms):	
	Other Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):	
	<b>Foundation (At Median):</b>	
	Foundation Covered by Soil?	
	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
	If Yes <input type="checkbox"/> Partially covered <input type="checkbox"/> Completely covered	
3. Drainage Issues	Concrete Spalling <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
	If Yes, Is There Corrosion * or Deterioration * of any Exposed Reinforcement?	
	<input type="checkbox"/> No <input type="checkbox"/> Yes (specify the level of corrosion or deterioration if present):	
	Concrete Cracking <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
	Deterioration <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration in general terms):	
	Other Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):	
	* Please see the Appendixes A & B	
	<u>Detailed Deficiency Comments:</u>	
	<u>Deficiency Sketches :</u>	
	Note: Take as many photos as required to adequately document each damage or deficiency described above (if applicable).	
Completed by: <u>RS 12-13-12 1-15-13</u>		
3. Drainage Issues	Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):	
	<u>Detailed Deficiency Comments:</u>	
	<u>Deficiency Sketches:</u>	
	Shoulder base is low and can become buried in debris	
	Note: Take as many photos as needed to adequately document the drainage characteristics of the topography surrounding the structure and each damage or deficiency (if applicable).	
Completed by: <u>RS 12-13-12</u>		

4. Grout Pad under the Base Plate	<b>Grout Pad (At Shoulder):</b>			
	Grout Pad Present? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes			
	If Yes, Thickness of the Grout Pad: <u>3.5"</u>			
	Mortar Splitting *	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	Mortar Cracking *	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes
	Mortar Spalling	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	Mortar Crushing	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes
	Other Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):			
<b>Grout Pad (At Median):</b>				
Grout Pad Present? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes				
If Yes, Thickness of the Grout Pad: _____				
Mortar Splitting *		<input type="checkbox"/> No <input type="checkbox"/> Yes	Mortar Cracking *	<input type="checkbox"/> No <input type="checkbox"/> Yes
Mortar Spalling		<input type="checkbox"/> No <input type="checkbox"/> Yes	Mortar Crushing	<input type="checkbox"/> No <input type="checkbox"/> Yes
Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):				
* Please see the Appendix B				
Detailed Deficiency Comments:		Deficiency Sketches:		
Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).				
Completed by: <u>RS 12-13-12 1-15-13</u>				

5. Base Plate	<b>Base Plate (At Shoulder):</b>			
	Locations of Base Plate UT Thickness Readings		Base Plate UT Thickness Readings (in.)	Note
		1	2.544	
		2	2.595	
		3	2.573	
		4	2.587 - possible crack @ 1.079"	
	Section Loss (Visual Inspection) <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify): <u>minor</u>			
	Deterioration * <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of deterioration): <u>minor</u>			
	Cracking <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):			
	Corrosion * <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of corrosion): <u>minor</u>			
Warping/Buckling <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):				
Surface Pitting <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify): <u>minor</u>				
Other Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):				



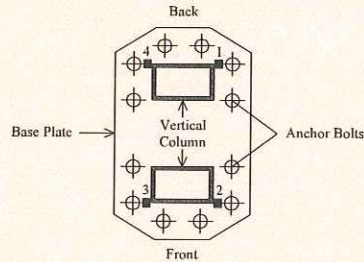
## 5. Base Plate (Continued)

## Base Plate (At Median):

## Locations of Base Plate UT Thickness Readings

Base Plate UT Thickness Readings  
(in.)

## Note



1

?

2

?

3

?

4

?

## Section Loss (Visual Inspection)

☐ No

☒ Yes (specify):

Moderate

## Deterioration \*

☐ No

☒ Yes (specify level of deterioration):

Moderate

## Cracking

☒ No

☐ Yes (specify dimensions and locations of cracks):

## Corrosion \*

☐ No

☒ Yes (specify level of corrosion):

Moderate

## Warping/Buckling

☒ No

☐ Yes (specify):

## Surface Pitting

☐ No

☒ Yes (specify):

moderate

## Other Defects/Observations

☒ No

☐ Yes (specify):

\* Please see the Appendixes A &amp; B

## Detailed Deficiency Comments:

Could not get readings for base plate thickness in median. Baseplate too corroded and pitted to have flat surface.

## Deficiency Sketches:

Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).

Completed by: RS TM 1-15-12, 12-13-12

## 6. Visual Inspection of Anchor Bolts

## Anchor Bolts (At Shoulder):

## Misalignment

☒ No

☐ Yes (specify):

## Deterioration \*

☒ No

☐ Yes (specify level of deterioration):

## Horizontal/Vertical Cracks

☒ No

☐ Yes (specify dimensions and locations of cracks):

## Inclined Shear Cracks

☒ No

☐ Yes (specify dimensions and locations of shear cracks):

## Corrosion \*

☒ No

☐ Yes (specify level of corrosion):

## Other Defects/Observations

☒ No

☐ Yes (specify):

## Anchor Bolts (At Median):

## Misalignment

☒ No

☐ Yes (specify):

## Deterioration \*

☐ No

☒ Yes (specify level of deterioration): minor to moderate

## Horizontal/Vertical Cracks

☒ No

☐ Yes (specify dimensions and locations of cracks):

## Inclined Shear Cracks

☒ No

☐ Yes (specify dimensions and locations of shear cracks):

## Corrosion \*

☐ No

☒ Yes (specify level of corrosion): minor to moderate

## Other Defects/Observations

☒ No

☐ Yes (specify):

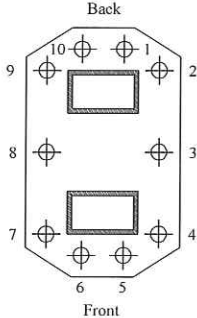
\* Please see the Appendixes A &amp; B



6. Visual Inspection of Anchor Bolts (Continued)	Detailed Deficiency Comments:		Deficiency Sketches:	
	Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).			
	Completed by: <u>RS 12-13-12</u>			

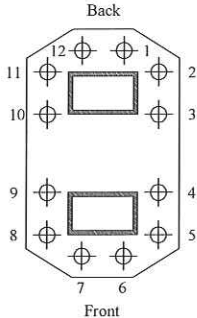
7. Nuts/Washers	<b>Top Nuts/Washers (At Shoulder):</b>			
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):	
	Cracking	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
	Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion):	<u>Minor to Moderate</u>
	Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)	
	(use "ball-peen hammer" method)			
	Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
	Full Engagement	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
<b>Leveling Nuts/Washers (At Shoulder):</b> <u>Grouted</u>				
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Deterioration *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):		
Cracking	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):		
Corrosion *	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):		
Tightness	<input type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)		
(use "ball-peen hammer" method)				
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Full Engagement	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):		
Gap Between Leveling	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Nuts/Washers and the Bottom of the Base Plate				
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
<b>Top Nuts/Washers (At Median):</b>				
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	<u>Moderate</u>	
Deterioration *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of deterioration):		
Cracking	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):		
Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion):	<u>Moderate</u>	
Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided)		
(use "ball-peen hammer" method)				
Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		
Full Engagement	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):		
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):		

7. Nuts/Washers (Continued)	<b>Leveling Nuts/Washers (At Median):</b> Misalignment <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Deterioration* <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration): Cracking <input type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks): Corrosion* <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion): Tightness <input type="checkbox"/> Tight <input type="checkbox"/> Loose (specify number of loose nuts/washers and provide sketch of locations in space provided) (use "ball-peen hammer" method) Missing <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Full Engagement <input type="checkbox"/> Yes <input type="checkbox"/> No (specify): Gap Between Leveling <input type="checkbox"/> No <input type="checkbox"/> Yes (specify): Nuts/Washers and the Bottom of the Base Plate Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):		
	* Please see the Appendixes A & B		
	Detailed Deficiency Comments:		Deficiency Sketches:
	Note: Take as many photos as required to adequately document each damage or deficiency (if applicable).		
Completed by: <u>RS 12-63-12 1-15-13</u>			
Take one general photo looking at each of the four faces of each of the foundations of the structure. The general photos should include all features of Sections 2, 4, 5, 6 and 7 (foundations, grout pads, base plates, anchor bolts, nuts and washers). If only one of the median cover plates are removed, no photo shall be required of the face with the median cover plate remaining if it is not possible to obtain one.			
8. Ultrasonic Inspection of Anchor Bolts	Inspector Names: <u>Russ Stewart Troy Matthew</u> Inspection Procedure: <u>ASTM A-388</u> Test Method: <u>Straight Beam</u> Test Equipment: <u>USN 52 L</u> Reference Standard: <u>II W Type-1</u> Reference Sensitivity: <u>Y8" SDH</u> Transducer Frequency: <u>2.25 MHz / 0.25</u> Calibration Level (dB's): <u>24</u> Depth: <u>10"</u> Scanning Level (dB's): <u>36</u>		
	<b>Anchor Bolts (At Shoulder):</b>		
	Locations of Anchor Bolts:		Detailed Deficiency Comments:
			



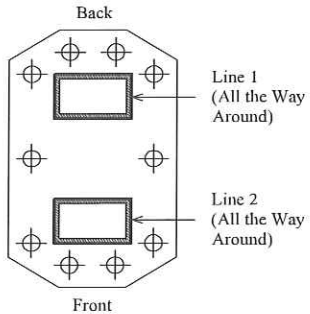
Bolt No.	Steel Type	Length (in)	Diameter (in)	Signal Indication	Remarks
1		65.89	2.25	NRI	
2					
3					
4					
5					
6					
7					
8					
9					
10					

**Anchor Bolts (At Median):**

Locations of Anchor Bolts:	Detailed Deficiency Comments:
	

Bolt No.	Steel Type	Length (in)	Diameter (in)	Signal Indication	Remarks
1		65.99	2.25	NRI	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

**Weld Lines - Vertical Column (At Shoulder):**

Locations of Weld Lines:	Detailed Deficiency Comments:
	

1-19-13

9. Connections between Base Plate and Vertical Column (Continued)

Weld Line 1

Misalignment ☒ No ☐ Yes (specify):

Weld Cracks ☒ No ☐ Yes (specify):

Other Defects/Observations ☒ No ☒ Yes (specify): *Severe Corrosion of weld*

Weld Line 2

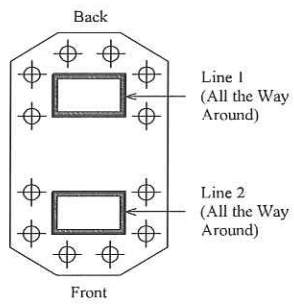
Misalignment ☐ No ☐ Yes (specify):

Weld Cracks ☐ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☐ Yes (specify): *Same as weld 1*

Weld Lines - Vertical Column (At Median):

Locations of Weld Lines:



Detailed Deficiency Comments:

Weld Line 1

Misalignment ☒ No ☐ Yes (specify):

Weld Cracks ☒ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☒ Yes (specify): *Moderate To Severe Corrosion on weld*

Weld Line 2

Misalignment ☒ No ☐ Yes (specify):

Weld Cracks ☒ No ☐ Yes (specify):

Other Defects/Observations ☐ No ☒ Yes (specify): *Same as weld 1*

*Note: Take as many photos as required to adequately document each weld line of each foundation and as many photos as required to adequately document each damage or deficiency (if applicable).*

Weld Line		Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
Vertical Column (At Shoulder)	1							
	2							
Vertical Column (At Median)	1							
	2							

\* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.

Completed by: *RS, JMA 12-13-12*  
*JM 1-15-13 Nodan*



10. Measuring the Section Loss of the Vertical Column near the Base Plate	Thickness Measurement Locations	UT Thickness Readings (in.)			
		Vertical Column (At Shoulder)		Vertical Column (At Median)	
		Section A-A	Section B-B	Section A-A	Section B-B
	1	.419	.493	.394	.483
	2	.432	.490	.432	.489
	3	.424	.490	?	.494
	4	.325	.487	?	.489
5	.256	.495	.250	.487	
6	.247	.484	.351	.480	
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>At Median: could not get readings for 3 and 4 @ A-A</p> </div> <div style="width: 30%; text-align: center;"> <p>Facing Outside of Column</p> </div> <div style="width: 30%; text-align: center;"> <p>1-15-13</p> <p>SECTIONS A-A &amp; B-B</p> </div> </div>					
Note: Please refer to the detailed procedure for measuring the section loss of the vertical column near the base plate in the Appendix A.					
Completed by: <u>RS 12-13-12 1-15-13</u>					

11. Weld Lines between Column Vertical Members and Supplemental Bracing	Locations of Weld Lines:		Detailed Deficiency Comments:
	<p>Facing Outside Face of Column</p>		
	<b>Weld Lines - Vertical Column (At Shoulder):</b>		
	<p><u>Weld Line 1</u></p> <div style="display: flex; justify-content: space-between;"> <div>Misalignment</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Weld Cracks</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Weld Size Uniform</div> <div><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Other Defects/Observations</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div> <p><u>Weld Line 2</u></p> <div style="display: flex; justify-content: space-between;"> <div>Misalignment</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Weld Cracks</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Weld Size Uniform</div> <div><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No (specify):</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Other Defects/Observations</div> <div><input checked="" type="checkbox"/> No    <input type="checkbox"/> Yes (specify):</div> </div>		

## 11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 3

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 4

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 5

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 6

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 7

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 8

Misalignment ☒ No ☐ Yes (specify):  
Weld Cracks ☒ No ☐ Yes (specify):  
Weld Size Uniform ☒ Yes ☐ No (specify):  
Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 9

Misalignment ☐ No ☐ Yes (specify):  
Weld Cracks ☐ No ☐ Yes (specify):  
Weld Size Uniform ☐ Yes ☐ No (specify):  
Other Defects/Observations ☐ No ☐ Yes (specify):



11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)	<u>Weld Line 10</u>		
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 11</u>		
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 12</u>		
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 13</u>		
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 14</u>		
	Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
<u>Weld Line 15</u>			
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
<u>Weld Line 16</u>			
Misalignment	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Cracks	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Size Uniform	<input type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)	<b>Weld Lines - Vertical Column (At Median):</b>		
	<u>Weld Line 1</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify): Corrosion on bottom weld
	<u>Weld Line 2</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify): Same as weld 1
	<u>Weld Line 3</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 4</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 5</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Weld Line 6</u>		
	Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
<u>Weld Line 7</u>			
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	



11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 8

Misalignment ☒ No ☐ Yes (specify):  
 Weld Cracks ☒ No ☐ Yes (specify):  
 Weld Size Uniform ☒ Yes ☐ No (specify):  
 Other Defects/Observations ☒ No ☐ Yes (specify):

Weld Line 9

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 10

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 11

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 12

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 13

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 14

Misalignment ☐ No ☐ Yes (specify):  
 Weld Cracks ☐ No ☐ Yes (specify):  
 Weld Size Uniform ☐ Yes ☐ No (specify):  
 Other Defects/Observations ☐ No ☐ Yes (specify):

11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)

Weld Line 15

Misalignment ☐ No ☐ Yes (specify):

Weld Cracks ☐ No ☐ Yes (specify):

Weld Size Uniform ☐ Yes ☐ No (specify):

Other Defects/Observations ☐ No ☐ Yes (specify):

Weld Line 16

Misalignment ☐ No ☐ Yes (specify):

Weld Cracks ☐ No ☐ Yes (specify):

Weld Size Uniform ☐ Yes ☐ No (specify):

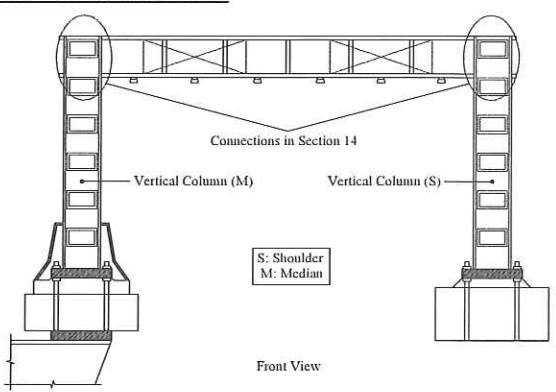
Other Defects/Observations ☐ No ☐ Yes (specify):

*Note: Take multiple photos as needed to document each vertical weld line of the vertical columns and as many photos as required to adequately document each damage or deficiency (if applicable).*

Weld Line		Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
Vertical Column (At Shoulder)	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
Vertical Column (At Median)	1							
	2							
	3							
	4							
	5							
	6							



11. Weld Lines between Column Vertical Members and Supplemental Bracing (Continued)	Vertical Column (At Median)	7								
		8								
		9								
		10								
		11								
		12								
		13								
		14								
		15								
		16								
	<p>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</p> <p>Completed by: <u>TM 1-15-13 Median</u> <u>TM 1-19-13 Shoulder</u></p>									
12. Interior Observations of the Vertical Column (Using Camera)	<p><b>Vertical Column (At Shoulder):</b></p> <p>Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p><b>Vertical Column (At Median):</b></p> <p>Deterioration * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Corrosion * <input type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</p> <p>Other Defects/Observations <input type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p>* Please see the Appendixes A &amp; B</p> <p>Note: Take as many videos as required to adequately document the condition of the interior of the vertical column.</p> <p>Completed by: _____</p>									
	13. Exterior Observations of the Vertical Column	<p><b>Vertical Column (At Shoulder):</b></p> <p>Deterioration * <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of deterioration): <u>Minor</u></p> <p>Horizontal/Vertical Cracks <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):</p> <p>Inclined Shear Cracks <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):</p> <p>Corrosion * <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of corrosion): <u>Very severe @ bottom</u></p> <p>Warp/Buckling <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p>Distress <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of distress):</p> <p>Handhole Cover in Place <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <u>Very severe corrosion @ open hand hole</u></p> <p>Other Defects/Observations <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify): <u>Vertical Column base</u></p>								

13. Exterior Observations of the Vertical Column (Continued)	<b>Vertical Column (At Median):</b>		
	Deterioration *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of deterioration): @ base plate minor to moderate
	Horizontal/Vertical Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
	Inclined Shear Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
	Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion): minor to moderate
	Warp/Buckling	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Distress	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
	Handhole Cover in Place	<input type="checkbox"/> Yes	<input type="checkbox"/> No N/A
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
* Please see the Appendixes A & B			
	Detailed Deficiency Comments:		Deficiency Sketches:
	At base of vertical column where handhole cover is missing there is very severe corrosion. #s 4, 5, and 6 in sect. A-A (shoulder) ↑		
Note: Take multiple photos as needed to document each of the outside faces of the vertical column and as many photos as required to adequately document each damage or deficiency (if applicable).			
Completed by: <u>RS 12-13-12</u>			
14. Connections between the Vertical Column and Horizontal Chords	<b>Locations of Connections:</b>		<b>Detailed Deficiency Comments:</b>
			
	<b>Connections - Vertical Column (At Shoulder):</b> <b>Lower Chord</b> Misalignment <span style="float: right;"><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):</span> L-Shaped Plate Damage <span style="float: right;"><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):</span> U-Bolt Corrosion * <span style="float: right;"><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of corrosion):</span> U-Bolt Deterioration * <span style="float: right;"><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</span> Pack Rust Between Plates/Members <span style="float: right;"><input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of rust):</span>		



## 14. Connections between the Vertical Column and Horizontal Chords (Continued)

Horizontal/Vertical Cracks of U-Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of U-Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
U-Bolt Tightness (use "ball-peen hammer" method)	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured U-Bolts (visual observation)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Upper Chord</u>		
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
L-Shaped Plate Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Corrosion *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Bolt Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of rust):
Horizontal/Vertical Cracks of Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
Bolt Tightness (use "ball-peen hammer" method)	<input type="checkbox"/> Tight	<input checked="" type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space) <i>1 Loose on front side</i>
Fractured Bolts (use "hammer sound" method)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<b>Connections - Vertical Column (At Median):</b>		
<u>Lower Chord</u>		
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
L-Shaped Plate Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
U-Bolt Corrosion *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
U-Bolt Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of rust):
Horizontal/Vertical Cracks of U-Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Inclined Shear Cracks of U-Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):
U-Bolt Tightness (use "ball-peen hammer" method)	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)
Fractured U-Bolts (visual observation)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):



14. Connections between the Vertical Column and Horizontal Chords (Continued)

Upper Chord			
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
L-Shaped Plate Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Bolt Corrosion *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):	
Bolt Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):	
Pack Rust Between Plates/Members	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of rust):	
Horizontal/Vertical Cracks of Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):	
Inclined Shear Cracks of Bolts	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of shear cracks):	
Bolt Tightness (use "ball-peen hammer" method)	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose (specify number of loose bolts and provide sketch of locations in space)	
Fractured Bolts (use "hammer sound" method)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify number of fractured bolts and provide sketch of locations in space provided)	
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):	
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	

Locations of Weld Lines:	Deficiency Sketches:

Locations of L-Shaped Plate UT Thickness Readings			L-Shaped Plate UT Thickness Readings (in.)				Note	
			Lower Chord		Upper Chord			
			Inside *	Outside *	Front Inside *	Back Outside *		
	Vertical Column (At Shoulder)	1				.510	.512	
		2				.512	.508	
		3				.518	.515	
		4				.517	.519	
	Vertical Column (At Median)	1				.510	.512	
		2				.512	.513	
		3				.516	.515	
		4				.519	.516	

\* L-Shaped plates attached at inside/outside face of the vertical columns

14. Connections between the Vertical Column and Horizontal Chords (Continued)	Location		Weld Line	Weld Width (in.)					
				Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *
	Vertical Column (At Shoulder)	Upper Chord	1						
2									
Lower Chord		1							
		2							
		3							
		4							
Vertical Column (At Median)	Upper Chord	1							
		2							
	Lower Chord	1							
		2							
		3							
		4							
<p>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</p>									
Detailed Deficiency Comments:					Deficiency Sketches:				
<p>Note: Take one photo looking at each face of each connection between the vertical column and horizontal chord and as many photos as required to adequately document each damage or deficiency (if applicable).</p>									
<p>Completed by: <u>TN 1-15-13 Median</u> <u>TN 1-19-13 Shoulder</u></p>									

15. Horizontal Chords and Secondary Vertical Posts	Locations of Connections:	Detailed Deficiency Comments:
	<p>Connections in Section 15</p> <p>Vertical Column (M)</p> <p>Vertical Column (S)</p> <p>S: Shoulder M: Median</p> <p>Front View</p>	
<p><u>Lower Chord</u></p> <p>Misalignment <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify):</p> <p>Corrosion * <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (specify level of corrosion): <u>minor</u></p> <p>Deterioration * <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify level of deterioration):</p> <p>Cracking <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify dimensions and locations of cracks):</p>		



15. Horizontal Chords and Secondary Vertical Posts (Continued)

Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Upper Chord

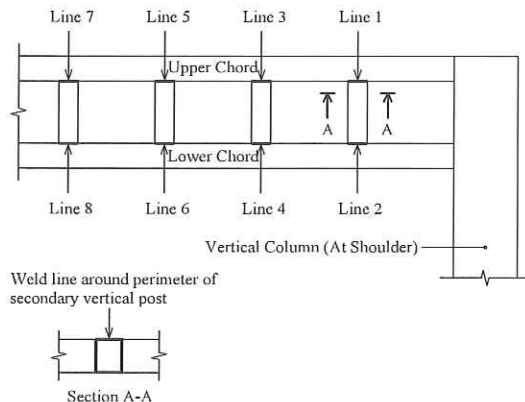
Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion): <i>MINOR</i>
Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Cracking	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

Secondary Vertical Post

Misalignment	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion): <i>MINOR</i>
Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Cracking	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify dimensions and locations of cracks):
Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Distress	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of distress):
Section Loss (Visual Inspection)	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):

\* Please see the Appendixes A & B

Locations of Weld Lines:



Deficiency Sketches:



	Weld Line	Weld Width (in.)						Note
		Section 1 *	Section 2 *	Section 3 *	Section 4 *	Section 5 *	Section 6 *	
15. Horizontal Chords and Secondary Vertical Posts (Continued)	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
		<p>* Measure weld width at some sections that the inspector finds to be non-uniform from the visual inspection. The number of readings for each weld line should not be less than 3. Please refer to Appendix A for the steps of determining weld size uniformity.</p>						
		Detailed Deficiency Comments:				Deficiency Sketches:		
		<p>Note: Take multiple photos as required of each face of each horizontal chord/secondary post, including the weld lines, and as many photos as required to adequately document each damage or deficiency (if applicable).</p>						
		Completed by: <u>JM 1-15-13</u>						
16. Attachments	<u>Vertical Sign Supports</u>							
	Corrosion *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):					
	Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):					
	Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):					
	Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):					
	Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):					

Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Horizontal Light Arms</u>		
Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion): <i>Minor</i>
Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Pack Rust Between Light Arm	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of rust):
JB's and the Lower Chord		
Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
<u>Vertical Sign Support to Horizontal Chord Connection Bracket</u>		
Corrosion *	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify level of corrosion): <i>Minor</i>
Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Bolt Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose
(Visual observation and checking by hand)		
Weld Cracks	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
Weld Size Uniform	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No (specify):
Other Defects/Observations	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes (specify): <i>washers are deteriorating on 80% of B&amp;S</i>
<u>Sign Panels</u>		
Corrosion *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of corrosion):
Deterioration *	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deterioration):
Damage	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of damage):
Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):



16. Attachments (Continued)	Bolt Tightness	<input checked="" type="checkbox"/> Tight	<input type="checkbox"/> Loose
	(Visual observation and checking by hand)		
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Electrical Distribution Boxes and Their Hardware</u>		
	Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
	Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
	Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Conduits</u>		
	Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
	Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
	Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Sign Attachments (Traffic Control Devices, Cameras, etc)</u>		
	Deformation	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
	Sagging	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):
	Missing	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	Other Defects/Observations	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (specify):
	<u>Others (Specify):</u>		
	Deformation	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of deformation):
Sagging	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify level of sagging):	
Missing	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
Other Defects/Observations	<input type="checkbox"/> No	<input type="checkbox"/> Yes (specify):	
* Please see the Appendixes A & B			
<u>Detailed Deficiency Comments:</u>		<u>Deficiency Sketches:</u>	
<p>Note: Take an adequate number of photos to document the attachments and as many photos as required to adequately document each damage or deficiency (if applicable).</p> <p>Completed by: <u>JM 1-15-13 Median</u>  <u>JM.E.S 1-19-13 Shoulder</u></p>			

## Appendix A: Inspection Guidelines

### I. Suggested Procedure for Determining Section Loss of Vertical Tubes

1. Remove hand hole cover and visually inspect the inside of the pole.
2. If visible corrosion is observed, especially in the vicinity of the lower end of the column toward the base plate, tap on the exterior of the column to loosen any corrosion particles.
3. At an approximate distance of 3 feet above the base plate, use an electronic thickness device to obtain four readings around the circumference of the column. The minimum of these four numbers may be assumed to be the thickness of the column and should be recorded. The reading obtained is also valid for a two-ply column as the device measures only the outermost thickness. To obtain accurate readings using the device, the inspector will need to grind the irregular weathered surface at measurement locations.
4. At an approximate distance of 1.5 inches above the base plate, obtain eight readings, one at each quarter point along each of the four faces of the column using an electronic thickness device and record the value.
5. If the inspector during the initial visual inspection observes other locations that should be checked for section loss, then additional thickness measurements should then be taken.

### II. Method to Check Tightness of Anchor Rod Nuts

Check that the nut is adequately threaded on the rod. Tap the anchor rod nuts and washers with a ball-peen hammer to check for looseness. The anchor rod nuts must be tight to clamp the base plate to the foundation (or leveling nut). A loose washer will reveal an unclamped anchor rod even if the nut is tight on the anchor rod.

### III. Method to Check Tightness and Integrity of Structural Connection Bolts in the Structure






Check that the nut is adequately threaded on the bolt rod. Tap the bolt nuts and washers with a ball-peen hammer to check for looseness. The bolt nuts must be tight to clamp the structural members. A loose washer will reveal an unclamped bolt rod even if the nut is tight on the bolt rod. The integrity of the bolts themselves should be hammer sounded by tapping the top of the bolt. A dull sound may indicate a fracture in the bolt.

### IV. Determine Weld Size Uniformity

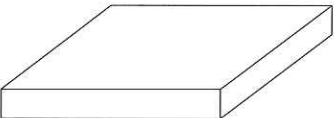
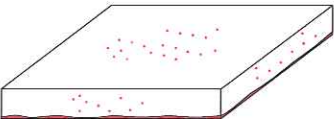
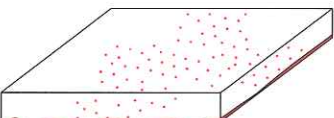
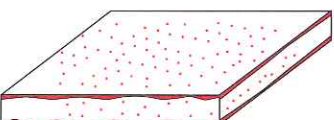
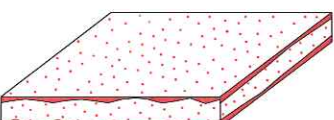
1. Perform visual inspection of weld lines
2. Measure weld width at some sections that the inspector finds to be nonuniform from the visual inspection. The number of readings for each weld line should not be less than 3. If the difference between the largest one and the smallest one is less than 10%, the weld line is assumed to be uniform, otherwise it is nonuniform.



# V. Level of Corrosion/Deterioration of Steel Reinforcements in the Foundation, Anchor Bolts and Structural Connection Bolts

Level of corrosion/deterioration	Commentary	Illustration
0. No corrosion/deterioration	No corrosion/deterioration is observed	
1. Minor corrosion/deterioration	Corrosion/deterioration is observed in a small area that the section loss does not exceed 10%	
2. Moderate corrosion/deterioration	Corrosion/deterioration is observed in a medium area that the section loss is in between 10% and 20%	
3. Severe corrosion/deterioration	Corrosion/deterioration is observed in a large area that the section loss is in between 20% and 40%	
4. Very severe corrosion/deterioration	Corrosion/deterioration is observed in a very large area that the section loss exceeds 40%	

# VI. Level of Corrosion/Deterioration of Steel Members in the Structure

Level of corrosion/deterioration	Commentary	Illustration
0. No corrosion/deterioration	No corrosion/deterioration is observed	
1. Minor corrosion/deterioration	Corrosion/deterioration is observed in a small area that the thickness ratio (minimum thickness/initial thickness) is more than 90%, i.e. the thickness loss does not exceed 10%	
2. Moderate corrosion/deterioration	Corrosion/deterioration is observed in a medium area that the thickness ratio is in between 80% and 90%, i.e. the thickness loss is in between 10% and 20%	
3. Severe corrosion/deterioration	Corrosion/deterioration is observed in a large area that the thickness ratio is in between 60% and 80%, i.e. the thickness loss is in between 20% and 40%	
4. Very severe corrosion/deterioration	Corrosion/deterioration is observed in a very large area that the thickness ratio is less than 60%, i.e. the thickness loss exceeds 40%	

## Appendix B: Terminology

In this form, it is assumed that

1. Corrosion is referring just to the presence of corrosion (rust)
2. Deterioration is referring to measurable, notable section loss
3. Mortar splitting is referring to the complete separation into different parts of the grout pad
4. Mortar cracking is referring to the break without the complete separation into different parts of the grout pad

### Appendix C: Additional Comments and Sketches

(Please use this page to document additional information that you could not get into the previous sections. Please clearly identify to which section the information is belonging in the form)

Section No.	Additional Comments/Sketches
<div style="border-bottom: 1px solid black; width: 50%; margin-bottom: 10px;"></div>	<p>Photos:</p> <p>Shoulder base:      135-7785 to 135-7803</p> <p>                                 641 to 659</p> <p>                                 12-13-12      14:38 to 14:40</p>
<div style="border-bottom: 1px solid black; width: 50%; margin-bottom: 10px;"></div>	<p>Photos:      134-6717 to 134-6732</p> <p>Median      14:21 to 14:24</p> <p>1-15-13</p> <p>                                 136-8532 to 136-8556</p> <p>                                 12:07      12:25</p>
<div style="border-bottom: 1px solid black; width: 50%; margin-bottom: 10px;"></div>	<p>1-19-13      136-8919 to 136-8950</p> <p>                                 8:25 to 8:59</p>



Appendix D: Description of Photos/Videos			
Completed by	Russ Stewart	Structure Number	1-20-64-57.53
		Structure Type	4
(Description field should have a detailed description of what the photo/video is of, including which face it is of based on the cardinal travel direction)			
Photo/Video No.	Section No.	File Name/Path	Detailed Description
IMG 6717-6724		1-20-64-57.53 - Median Column	Front and Back Overview
IMG 6725-6732		"	Median Base Connection
IMG 8532-8539		"	Lower chord Connection
IMG 8540-8547		"	Upper Chord Connection
IMG 8549		"	Light Arm Assembly
IMG 8550-8554		"	Broken Washer for Vertical Sign Support
IMG 8555-8556		"	J.B. Pack Rust - Light Arms
IMG 7785-7800		1-20-64-57.53 - Shoulder Column	Base plate and Vertical connections
IMG 7801-7803		"	Hand hole view
IMG 8919-8923		"	Front and Back Overview
IMG 8924-8932		"	Lower Chord Connection
IMG 8933-8940		"	Upper Chord Connection
IMG 8941		"	Broken Washer - Vertical Sign Support
IMG 8942		"	Horz. Chord handhole cover
IMG 8943		"	J.B. Pack Rust
IMG 8944-8948		"	Base plate weld corrosion
IMG 8949-8950		"	Hand hole



**APPENDIX C**  
**SIGN STRUCTURE**  
**INSPECTION**  
**SUMMARY**



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-52.40	Inspector Names:	1) Russ Stewart
Inspection Date: 10/09/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 15% was computed in section A-A of the vertical column. Minor corrosion of the vertical column above the base plate welds was observed. Total score of this structure is 69 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	Minor corrosion and deterioration of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 31% Full Screen Height (FSH) was reported for anchor bolt #2.	3	5	15
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of 15% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting the Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column above the base plate welds was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	None.	1	3	3
TOTAL SCORES				69

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-55.12	Inspector Names:	1) Russ Stewart
Inspection Date: 10/22/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 8% was computed in section A-A of the vertical column. Total score of this structure is 79 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plates	Minor surface pitting of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of 8% was computed in section A-A of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting the Vertical Column	Weld lines 8 and 9 was not uniform.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed. 1/16" gauge just below the upper chord was reported.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the upper/lower chords was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported. LB from the electrical box was corroded.	3	3	9
TOTAL SCORES				79

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-55.85	Inspector Names:	1) Russ Stewart
Inspection Date: 10/24/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 25% was computed in section A-A of the vertical column. Weld lines 1-4 between tubes constituting the vertical column were not uniform. Minor to severe corrosion of the vertical column was observed. One horizontal light arm has been missing. Total score of this structure is 93 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	Minor to moderate corrosion and deterioration of leveling nuts/washers was observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of 25% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting the Vertical Column	Weld lines 1-4 were not uniform.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to severe corrosion of the vertical column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the lower/upper chords and the vertical column was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One horizontal light arm has been missing. LB was corroded.	3	3	9
TOTAL SCORES				93

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-56.04	Inspector Names:	1) Russ Stewart
Inspection Date: 10/16/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 31% was computed in section A-A of the vertical column. Concrete spalling of the foundation was observed. Moderate corrosion of the vertical column under the bottom splice plate was reported. Total score of this structure is 90 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Concrete spalling of the foundation was observed.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plates	There were possibly some cracks in the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5





# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of 31% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting the Vertical Column	Holes were observed in weld lines 2 and 4.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Moderate corrosion of the vertical column under the bottom splice plate was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the lower chord was observed. Pack rust between plates/members in the lower chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported. LB connection to junction box was corroded.	3	3	9
TOTAL SCORES				90

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-56.50  
Inspection Date: 10/24/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 32% was computed in section A-A of the vertical column. Minor to severe corrosion of the vertical column was observed. Total score of this structure is 84 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	Minor surface corrosion of top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of 32% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting the Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to severe corrosion of the vertical column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the lower/upper chords and the vertical column was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed.	2	3	6
TOTAL SCORES				84

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.83	Inspector Names:	1) Russ Stewart
Inspection Date: 10/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 7% was computed in sections A-A and B-B of the vertical column. Anchor bolts #1 and #12 were slightly cut short. Minor corrosion and deterioration of the vertical column was observed. Top on the upper chord in the connection between the vertical column and the horizontal chords had a gap between the upper chord and the splice plate. One bolt was completely loose and the rest were somewhat loose. Total score of this structure is 74 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	Anchor bolts #1 and #12 were slightly cut short. Minor corrosion of 2 anchor bolts and leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 13% Full Screen Height (FSH) was reported for anchor bolt #6.	2	5	10
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 7% was computed in sections A-A and B-B of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the lower/upper chords was observed. Pack rust between plates/members in the lower chord was reported. Top on the upper chord had a gap between the chord and the splice plate. One bolt was completely loose and the rest were somewhat loose.	4	3	12
Horizontal Chords and Secondary Vertical Posts	A gauge in front the upper chord near the splice plate was observed.	2	3	6
Attachments	Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				74

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.88	Inspector Names:	1) Russ Stewart
Inspection Date: 10/12/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 12% was computed in section A-A of the vertical column. Minor corrosion of the vertical column was observed. One loose bolt/nut at top of the upper chord in the connection between the vertical column and the upper chord was reported. Total score of this structure is 75 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	There were possibly some cracks in the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Minor surface corrosion of top/leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 16% Full Screen Height (FSH) was reported for anchor bolt #11.	2	5	10
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 12% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed. Surface pitting on outside of the vertical column between the upper and lower chord was reported.	2	3	6
Connections between Vertical Column and Horizontal Chords	One loose bolt/nut at top of the upper chord in the connection between the vertical column and the upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	Pack rust between light arm JB's and the lower chord was observed. Misaligned bolt to L-bracket at the vertical sign support to horizontal chord connection bracket was reported to be tight.	2	3	6
TOTAL SCORES				75

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





## Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.27	Inspector Names:	1) Russ Stewart
Inspection Date: 10/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 20% was computed in section A-A of the vertical column. Minor corrosion and deterioration of the vertical column was observed. Moderate to severe corrosion on all weld lines between the vertical column and the base plate was reported. Total score of this structure is 96 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	The foundation was partially covered by soil. No deficiencies were reported.	1	3	3
Drainage Issues	Bottom of the sign structure is smothered in mulch for a flower bed.	2	1	2
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	There were possibly multiple cracks in the base plate.	3	5	15
Anchor Bolts, Nuts and Washers	Some minor corrosion to top of anchor bolts was observed. Where bottom of the sign structure was once buried in mulch, there was a lot of corrosion and deterioration on the surface of nuts and the base plate.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Moderate to severe corrosion on all weld lines was reported.	4	5	20



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 20% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion and deterioration of the vertical column was observed. There were a lot of rust that needed to be removed to do UT scans.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the lower/upper chords was observed. Pack rust between plates/members in the lower chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				96

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.54	Inspector Names:	1) Russ Stewart
Inspection Date: 11/14/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 13% was computed in section A-A of the vertical column. Minor to moderate corrosion and deterioration of leveling nuts/washers was observed. Total score of this structure is 68 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	Minor to moderate corrosion and deterioration of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 13% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the upper/lower chords was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Middle light bar has been removed. Electrical box door was open.	2	3	6
TOTAL SCORES				68

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-97.32	Inspector Names:	1) Russ Stewart
Inspection Date: 10/11/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 24% was computed in section A-A of the vertical column. Some minor surface pitting, corrosion, and section loss of the base plate was reported. Minor corrosion of the vertical column above the base plate welds was observed. Total score of this structure is 74 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	The foundation was partially covered by soil. No deficiencies were reported.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Some minor surface pitting and corrosion on the base plate resulting in minor section loss of the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Weld line 1 had minor corrosion present. Reinforcement has been starting to deteriorate.	2	5	10



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 24% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column above the base plate welds was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	None.	1	3	3
TOTAL SCORES				74

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-97.95	Inspector Names:	1) Russ Stewart
Inspection Date: 11/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 32% was computed in section A-A of the vertical column. Minor to severe corrosion of the vertical column was observed. Total score of this structure is 84 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of top/leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5





# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 32% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to severe corrosion of the vertical column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	Pack rust between plates/members at the connections between the vertical column and the horizontal chords was observed. Minor corrosion of bolts connected between the upper chord and the vertical column was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				84

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-98.57	Inspector Names:	1) Russ Stewart
Inspection Date: 11/29/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 14% was computed in section A-A of the vertical column. Minor to moderate corrosion of the vertical column was observed. One light arm and one light were missing. Impact damage of the electrical distribution boxes and their hardware was reported. Total score of this structure is 87 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of anchor bolts and top/leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Minor corrosion of weld line 3 was observed.	2	5	10



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 14% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	Weld line 2 had several areas of stitch welds present.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to moderate corrosion of the vertical column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the upper chord was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One light arm and one light were missing. Impact damage of the electrical distribution boxes and their hardwares was recorded.	3	3	9
TOTAL SCORES				87

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.24	Inspector Names:	1) Russ Stewart
Inspection Date: 10/24/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 2% was computed in section B-B of the vertical column. Minor corrosion of the vertical column was observed. Total score of this structure is 57 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Grout pad was present under the base plate. Grout pad thickness is 4 inches. Mortar cracking (probably from impact) was observed.	2	2	4
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 2% was computed in section B-B of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed. 1/16" section loss behind the old electrical box was reported.	2	3	6
Connections between Vertical Column and Horizontal Chords	The horizontal chord welded to the vertical column. Inspectors could not take thickness readings of splice plates since they was inside the vertical column. No other deficiencies were reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	Minor to moderate corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				57

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-102.49  
Inspection Date: 10/16/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 31% was computed in section A-A of the vertical column. Concrete spalling of the foundation was observed. Moderate flaking and corrosion/deterioration of bottom of the base plate were found. Moderate corrosion of the vertical column near the base plate and under bottom of the splice plate was reported. Total score of this structure is 95 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	The foundation was partially covered by soil. Concrete spalling was observed.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Moderate flaking and corrosion/deterioration of bottom of the base plate were observed.	3	5	15
Anchor Bolts, Nuts and Washers	Minor corrosion and deterioration of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Double Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 31% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Moderate corrosion of the vertical column near the base plate and under bottom of the splice plate was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Moderate corrosion of bolts connected between the vertical column and the lower chord was observed. Pack rust between plates/members in the lower chord was reported.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor to moderate corrosion of the lower chord was observed.	3	3	9
Attachments	Minor corrosion of horizontal light arms and conduit was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>95</b>

## Score Interpretation:

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60-11.48  
Inspection Date: 10/11/2012; 10/12/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 33% was computed in section A-A of the vertical column. Reinforcement was lost in two areas of vertical weld line 3 between tubes constituting the vertical column. One area was 12" long and the other was 14" long. Vertical weld line 4 appears to have been repaired. Some weld areas had one pass and others had 2 passes visible. Total score of this structure is 68 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 33% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	Reinforcement was lost in two areas of weld line 3. One area was 12" long and the other was 14" long. Weld line 4 appears to have been repaired. Some weld areas had one pass and others had 2 passes visible.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	A small hole was observed at the bottom of the vertical column near the base plate. A lot of debris inside the vertical column were reported when handhole cover was removed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	Conduit pulled loose from electrical box. Weatherhead pulled loose from conduit. Lights were on. No photocell was present.	2	3	6
TOTAL SCORES				68

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60-12.97  
Inspection Date: 10/09/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 21% was computed in section A-A of the vertical column. Moderate corrosion and deterioration of the vertical column were observed. Total score of this structure is 99 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	The foundation was completely covered by asphalt.	2	3	6
Drainage Issues	Asphalt blocked the drainage system.	4	1	4
Grout Pad under Base Plate	Inspectors could not see if the grout pad was present due to asphalt covering the base plate.	1	2	2
Base Plate	The base plate was partially covered by asphalt. Only thickness measurements in locations 2 and 3 were reported. There were possibly some cracks in the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Asphalt covered anchor bolts #1 and #4. Two top nuts/washers were partially covered and two others were completely covered. Minor to moderate corrosion and deterioration of top nuts/washers were observed. Leveling nuts/washers could not be seen due to the covering of asphalt.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Two of total four anchor bolts had no flaws and the rest two anchor bolts were covered by pavement.	2	5	10
Connection between Base Plate and Vertical Column	Base plate welds were covered by asphalt and inspectors were unable to inspect weld lines 1, 2, and 4.	2	5	10



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 21% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Moderate corrosion and deterioration of the vertical column were observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	One light arm was missing. Horizontal/vertical cracks of bolts connecting the vertical supports and the horizontal light arms was observed. A hole in sign panel was reported.	3	3	9
TOTAL SCORES				99

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60-13.07  
Inspection Date: 10/09/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 17% was computed in section A-A of the vertical column. Minor to moderate corrosion of the vertical column were observed. The upper handhole cover and electrical weatherhead were loose. Total score of this structure is 74 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	The foundation was partially covered by soil. No deficiencies were reported.	1	3	3
Drainage Issues	Drainage system was partially buried by debris from road.	2	1	2
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	Moderate corrosion and deterioration of leveling nuts/washers were observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 17% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to moderate corrosion of the vertical column were observed. The upper handhole cover and electrical weatherhead were loose.	3	3	9
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	Crack in weld to Tee bracket for light bar was observed.	3	3	9
TOTAL SCORES				74

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-53.73	Inspector Names:	1) Russ Stewart
Inspection Date: 11/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 39% was computed in section A-A of the vertical column. One anchor bolt (# 8) and its nuts/washers have been missing. Multiple starts/stops in short lengths of weld line 2 between tubes constituting the vertical column were observed. Minor to severe corrosion of the vertical column was reported. Total score of this structure is 97 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	One anchor bolt (# 8) and its nuts/washers have been missing.	4	5	20
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 18% Full Screen Height (FSH) was reported for anchor bolt #5.	2	5	10
Connection between Base Plate and Vertical Column	None.	1	5	5





# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 39% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	Multiple starts/stops in short lengths of weld line 2 were observed. Several areas had 2 passes on weld line 14, while others had 1 pass.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to severe corrosion of the vertical column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	The connection between the vertical column and the horizontal arm was slightly misaligned.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal light arm was observed.	2	3	6
Attachments	None.	1	3	3
TOTAL SCORES				97

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-54.61	Inspector Names:	1) Russ Stewart
Inspection Date: 11/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 15% was computed in sections A-A and B-B of the vertical column. Moderate section loss, deterioration, and corrosion of the base plate was observed. Some moderate scaling of rust on underside of the base plate was reported. Total score of this structure is 90 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Moderate section loss, deterioration, and corrosion of the base plate was observed. Some moderate scaling of rust on underside of the base plate was reported.	3	5	15
Anchor Bolts, Nuts and Washers	Minor corrosion of top nuts/washers and moderate deterioration/corrosion of leveling nuts/washers were observed. Anchor bolts below the nuts had moderate deterioration and corrosion.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 39% Full Screen Height (FSH) was reported for anchor bolt #5.	3	5	15
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 15% was computed in sections A-A and B-B of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion and deterioration of bolts connected between the vertical column and the horizontal chord was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	2	3	6
Attachments	None.	1	3	3
TOTAL SCORES				90

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-55.45  
Inspection Date: 12/14/2012; 01/07/2013  
Inspection Contractor: Dennis Corporation

Inspector Names: 1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 6% was computed in section A-A of the vertical column. Minor corrosion of the vertical column were observed. Total score of this structure is 55 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 6% was computed in section A-A of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor of the vertical column were observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal light arm was observed.	2	3	6
Attachments	Conduit line was broken.	2	3	6

## TOTAL SCORES

55

### Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

### Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.10	Inspector Names:	1) Russ Stewart
Inspection Date: 10/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 5% was computed in sections A-A and B-B of the vertical column. No weld reinforcement on 2" long of two weld lines between the vertical column and the base plate was reported. Total score of this structure is 70 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	No weld reinforcement on 2" long of weld lines 2 and 4 was reported.	3	5	15



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 5% was computed in sections A-A and B-B of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Horizontal light arm was misaligned out to the front top of 0.25".	2	3	6
Attachments	A hole in conduit on the right light arm was observed.	2	3	6
TOTAL SCORES				70

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.58	Inspector Names:	1) Russ Stewart
Inspection Date: 10/10/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 21% was computed in section A-A of the vertical column. There were some moderate corrosion and deterioration on leveling nuts. Weld line 2 between tubes constituting the vertical column was deteriorated on 50% of its weld length. Total score of this structure is 78 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad is present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	There were some moderate corrosion and deterioration on leveling nuts.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 21% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Line between Tubes Constituting Vertical Column	Weld line 2 was deteriorated on 50% of its weld length.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	None.	1	3	3
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the vertical column and the horizontal light arm was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal light arm was observed.	2	3	6
Attachments	None.	1	3	3
TOTAL SCORES				78

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.68	Inspector Names:	1) Russ Stewart
Inspection Date: 10/10/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 29% was computed in section A-A of the vertical column. Minor to moderate corrosion of anchor bolts and the vertical column was observed. Total score of this structure is 83 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad is present under the base plate.	1	2	2
Base Plate	There were possibly some cracks in the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Minor to moderate corrosion of anchor bolts was observed. Minor corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 29% was computed in section A-A of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to moderate corrosion of the vertical column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolt nuts connected between the vertical column and the horizontal light arm was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal light arm was observed.	2	3	6
Attachments	None.	1	3	3
TOTAL SCORES				83

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-119-19.54	Inspector Names:	1) Russ Stewart
Inspection Date: 10/10/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 7% was computed in section A-A of the vertical column. Weld reinforcement has deteriorated on entire length of weld lines 1 and 2 between tubes constituting the vertical column. Minor corrosion of the vertical column was observed. Total score of this structure is 71 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Concrete spalling and surface deterioration of exposed concrete were observed.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad is present under the base plate.	1	2	2
Base Plate	Corrosion and section loss of the base plate were reported. There were possibly some cracks in the base plate.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion and deterioration of leveling nuts/washers was reported.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 7% was computed in section A-A of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	Weld reinforcement has deteriorated on entire length of weld lines 1 and 2; on 50% weld length of weld line 3; and on 25% weld length of weld line 4.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal light arm was observed.	2	3	6
Attachments	None.	1	3	3
TOTAL SCORES				71

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-119-19.57  
Inspection Date: 10/10/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 25% was computed in section B-B of the vertical column. Minor to moderate corrosion of the vertical column were observed. Weld reinforcements have been deteriorated over 90% of entire length of weld lines between tubes constituting the vertical column (weld lines 2 and 4). Total score of this structure is 71 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	No grout pad was present under the base plate.	1	2	2
Base Plate	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5





# Inspection Summary for Single Armed Ground Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 25% was computed in section B-B of the vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	Weld reinforcements have been deteriorated over 90% of entire length of weld lines 2 and 4.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to moderate corrosion of the vertical column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected the vertical column and the horizontal chord was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	None.	1	3	3
Attachments	None.	1	3	3
TOTAL SCORES				71

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.74	Inspector Names:	1) Russ Stewart
Inspection Date: 01/14/2013; 01/24/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 1% was computed in section A-A of the vertical column. Minor to moderate corrosion of the SCB connection plate was observed. Three vertical weld lines between tubes constituting the vertical column were not uniform. Bulge at top 10" of the vertical column was reported. Upper half of weld line 2 was flushed with outer supports. Total score of this structure is 77 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	None.	1	1	1
SCB Connection Plate	Minor to moderate corrosion of the SCB connection plate was observed.	3	5	15
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between SCB Connection Plate and Vertical Column	Minor corrosion of weld line 4 was observed.	2	5	10



# Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near SCB Connection Plate	Maximum section loss of 1% was computed in section A-A of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	Weld lines 2, 3, and 4 were not uniform. Undercut on: (a) 50% length of weld line 2; (b) entire length of weld line 3; (c) 6" long from top of weld line 4 was reported.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed. Bulge at top 10" of the vertical column was reported. Upper half of weld line 2 was flushed with outer supports.	3	3	9
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Conduit rusted a bridge construction.	2	3	6
TOTAL SCORES				77

## Score Interpretation:

Maximum Total Score (Very High Risk) = 176

Minimum Total Score (Low Risk) = 44

## Risk Category:

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



## Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-100.89  
Inspection Date: 12/03/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 1% was computed in section A-A of the vertical column. Minor corrosion of the vertical column was observed. Total score of this structure is 64 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	No report.	2	1	2
SCB Connection Plate	Minor corrosion of the SCB connection plate was observed.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between SCB Connection Plate and Vertical Column	None.	2	5	10



# Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near SCB Connection Plate	Maximum section loss of 1% was computed in section A-A of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				64

## Score Interpretation:

Maximum Total Score (Very High Risk) = 176

Minimum Total Score (Low Risk) = 44

## Risk Category:

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



# Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-100.91  
Inspection Date: 12/03/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 3% was computed in sections A-A and B-B of the vertical column. Minor corrosion of the vertical column was observed. Total score of this structure is 63 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	None.	1	1	1
SCB Connection Plate	Minor corrosion of the SCB connection plate was observed.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between SCB Connection Plate and Vertical Column	None.	2	5	10



# Inspection Summary for Bridge Superstructure Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near SCB Connection Plate	Maximum section loss of 3% was computed in sections A-A and B-B of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				63

## Score Interpretation:

Maximum Total Score (Very High Risk) = 176

Minimum Total Score (Low Risk) = 44

## Risk Category:

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$





## Inspection Summary for Parapet Wall Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-98.45	Inspector Names:	1) Russ Stewart
Inspection Date: 11/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 18% was computed in section A-A of the vertical column. Minor to moderate corrosion of the vertical column was observed. Total score of this structure is 66 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Drainage Issues	None.	1	1	1
Mounting Plate	Minor corrosion of the mounting plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between Mounting Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Parapet Wall Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Mounting Plate	Maximum section loss of 18% was computed in section A-A of the vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor to moderate corrosion of the vertical column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the upper/lower chords and the vertical column was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				66

## Score Interpretation:

Maximum Total Score (Very High Risk) = 164

Minimum Total Score (Low Risk) = 41

## Risk Category:

Low Risk:  $41 \leq \text{Total Score} < 71$

Moderate Risk:  $71 \leq \text{Total Score} < 101$

High Risk:  $101 \leq \text{Total Score} < 131$

Very High Risk:  $131 \leq \text{Total Score} \leq 164$



# Inspection Summary for Parapet Wall Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-99.10  
Inspection Date: 11/29/2012; 12/04/2012  
Inspection Contractor: Dennis Corporation

Inspector Names: 1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 6% was computed in section B-B of the vertical column. Minor corrosion of the vertical column was observed. Total score of this structure is 63 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Drainage Issues	None.	1	1	1
Mounting Plate	Minor corrosion of the mounting plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Minor corrosion of top nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between Mounting Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Parapet Wall Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Section Loss of Vertical Column near Mounting Plate	Maximum section loss of 6% was computed in section B-B of the vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Minor corrosion of the vertical column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Minor corrosion of bolts connected between the upper chord and the vertical column was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
TOTAL SCORES				63

## Score Interpretation:

Maximum Total Score (Very High Risk) = 164

Minimum Total Score (Low Risk) = 41

## Risk Category:

Low Risk:  $41 \leq \text{Total Score} < 71$

Moderate Risk:  $71 \leq \text{Total Score} < 101$

High Risk:  $101 \leq \text{Total Score} < 131$

Very High Risk:  $131 \leq \text{Total Score} \leq 164$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.98	Inspector Names:	1) Russ Stewart
Inspection Date: 12/06/2012; 12/19/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 10% was computed in section A-A of the right vertical column. Some anchor bolts and leveling nuts were corroded and short. One leveling nut was tight to the anchor bolt but not to the base plate. Some areas of underfill in weld lines between tubes constituting the right vertical column were reported. Minor corrosion of the left and right vertical column was observed. Total score of this structure is 87 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	Left column side: Concrete spalling in was observed.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Left/right column sides: No grout pads were present under the base plates.	1	2	2
Base Plates	Right column side: Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Right column side: #4 anchor bolt and leveling nut were corroded. #1, 9, and 10 anchor bolts were short. #4 leveling nut was tight to anchor bolt but not to the base plate. #4 washer was completely eroded away.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 10% was computed in section A-A of the right vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	Left column side: Slag were visible in weld lines 1 and 2 near the top chord. Right column side: Some areas of underfill in weld lines 1, 2, and 3 were reported.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor corrosion of the column was observed. Right column side: No handhole in the column was reported.	2	3	6
Connections between Vertical Column and Horizontal Chords	Right column side: No weld on front side of the connections was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. 0.1" in gauge on top of the lower chord was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>87</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-101.23  
 Inspection Date: 11/13/2012; 12/19/2012; 01/18/2013  
 Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 9% was computed in section A-A of the right vertical column. Six anchor bolts on the left vertical column were short. Four of them were covered with another metal/material. Underfill on 90% length of a weld line between tubes constituting the left vertical column was reported. Total score of this structure is 81 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Left column side: foundation was partially covered by soil. No deficiencies were reported.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Left column side: Grout pad was present under the base plate. Mortar cracking under the base plate was observed.	2	2	4
Base Plates	Right column side: Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Six anchor bolts were short. Four of them were covered with another metal/material. Top nuts/washers were not fully engaged since the anchor bolts were short.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5





Inspection Summary for  
**Two-Dimensional Overhead Truss, Closed Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 9% was computed in section A-A of the right vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column	Left column side: A pinhole was observed in weld line 3. Underfill on 90% length of weld line 4 was reported. Right column side: Three underfill areas (each area was 6"-9" in length) was observed in weld line 2. Previous repair of weld line 2 was reported.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Minor corrosion of the columns was observed. No handholes were present.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor to moderate corrosion of horizontal light arms was observed. Minor corrosion of vertical sign support to horizontal chord connection bracket was reported. Open-lock of the electrical distribution boxes was broken.	3	3	9
<b>TOTAL SCORES</b>				<b>81</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.08  
 Inspection Date: 11/15/2012; 11/16/2012  
 Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 34% was computed in section A-A of the left vertical column. Minor to moderate corrosion of the right vertical column was observed. A U-bolt connected between the left vertical column and the lower chord was loose. Total score of this structure is 81 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Left/right column sides: Grout pads were present under the base plates. Right column side: Grout pad was partially removed on outside face.	2	2	4
Base Plates	Left/right column sides: Minor corrosion of the base plates was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Right column side: Only three leveling nuts exposed from the removed grout.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 34% was computed in section A-A of the left vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: No report. Right column side: Minor to moderate corrosion of the column was observed. No handhole on the column was reported.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left column side: A U-bolt connected between the column and the lower chord was loose. Left/right column sides: Pack rust between plates/members was observed. Minor corrosion of bolts connected between the columns and the upper chords was reported.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. Deterioration of the lower chord (> 1/16") was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>81</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-102.65	Inspector Names:	1) Russ Stewart
Inspection Date: 10/23/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 19% was computed in section A-A of the left vertical column. Impact damage to #6 top nut of the left vertical column was observed. Minor to moderate corrosion of leveling nuts/washers of the right column was reported. Total score of this structure is 81 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Right column side: Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Impact damage to #6 top nut was observed. Right column side: Minor to moderate corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 19% was computed in section A-A of the left vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to moderate corrosion of the column was observed. Handhole cover was not in place. Right column side: No handhole on the column was reported.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Minor corrosion of bolts connected between the columns and the upper chords was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported. LB and conduit between electrical boxes were corroded.	2	3	6
<b>TOTAL SCORES</b>				<b>81</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-103.14	Inspector Names:	1) Russ Stewart
Inspection Date: 10/17/2012; 01/24/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 18% was computed in section A-A of the left vertical column. Minor to moderate corrosion of the left vertical column was observed. Total score of this structure is 87 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	Left column side: Concrete spalling was reported.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Left/right column sides: Minor corrosion of the base plates was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Right column side: Minor corrosion of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Right column side: Minor pitting of weld lines 1 and 2 was observed.	2	5	10



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 18% was computed in section A-A of the left vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting Vertical Column	Left column side: 3/16" corrosion was observed at toe of weld lines 7 and 8 on outside face of horizontal braces. Right column side: All weld lines had minor corrosion on bottom welds of horizontal braces.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to moderate corrosion of the column was reported. Minor corrosion was observed behind old electrical box. A gauge was found at bottom of the column near the base plate. Right column side: Minor corrosion of the column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was reported. Right column side: Minor corrosion of bolts connected between the column and the upper chord was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. No malfunction of electrical box was found but there was an impact damage to side of the box.	2	3	6
<b>TOTAL SCORES</b>				<b>87</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-103.38  
 Inspection Date: 10/17/2012  
 Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 27% was computed in section A-A of the left vertical column. Minor to moderate corrosion of the left vertical column was observed. Minor to moderate deterioration and corrosion of leveling nuts/washers on the right vertical column was reported. 1/4" section loss of the right column on top of the lower chord was found. Section loss was observed on bottom of a vertical post. All JB's had a lot of pack rust under the horizontal chord. Total score of this structure is 98 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	Right column side: Concrete spalling was reported.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Right column side: Minor section loss and corrosion of the base plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Minor corrosion of leveling nuts/washers was observed. Right column side: Minor corrosion of top nuts/washers was observed. Minor to moderate deterioration and corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 27% was computed in section A-A of the left vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	Left column side: A hole was observed in weld line 8 at bottom-front conner. Right column side: Minor corrosion was observed in all weld lines on bottom of the horizontal support.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to moderate corrosion of the column was observed. Right column side: Minor corrosion of the column was observed. 1/4" section loss of the column on top of the lower chord was reported.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Minor corrosion of bolts connected between the columns and the upper chords was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. 1/8" section loss on the upper chord on right/back from pack rust was reported. A section loss on bottom of #4 vertical post was found.	3	3	9
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. All JB's had a lot of pack rust under the horizontal chord.	3	3	9
<b>TOTAL SCORES</b>				<b>98</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-119-18.46	Inspector Names:	1) Russ Stewart
Inspection Date: 10/23/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 27% was computed in section A-A of the left vertical column. Minor to severe corrosion of the left vertical column was observed. Deterioration of the right column was reported (1/8" depth at top of the lower chord on the front side of the column). One sign clip was missing. Total score of this structure is 84 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Right column side: Grout pad was present under the base plate	2	2	4
Base Plates	Right column side: Possible crack of the base plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Two-Dimensional Overhead Truss, Open Type Column Design, Shoulder  
 Mounted on Both Sides**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 27% was computed in section A-A of the left vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting Vertical Column	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to severe corrosion of the column was observed. Right column side: Deterioration of the column was reported (1/8" depth at top of the lower chord on the front side of the column). No handhole on the column was reported. Minor corrosion of the column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Minor corrosion of bolts connected between the columns and the upper chords was observed. Pack rust between plates/members was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords was observed.	2	3	6
Attachments	Minor corrosion of vertical sign supports, horizontal light arms, and vertical sign support to horizontal chord connection bracket was observed. One sign clip was missing. Pack rust between light arm JB's and the lower chord was reported.	3	3	9
<b>TOTAL SCORES</b>				<b>84</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60-11.44	Inspector Names:	1) Russ Stewart
Inspection Date: 10/11/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 26% was computed in section A-A of the right vertical column. Two U-bolts connected between the left/right vertical column and the lower chords were loose. Inside back L-shaped plate was bent and inside front lock washer was sunk into bolt hole in the lower chord of the left column. A lot of pack rust between light arm JB's and the lower chord were observed. Total score of this structure is 100 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Right column side: Minor corrosion and possible cracks of the base plate were reported.	2	5	10
Anchor Bolts, Nuts and Washers	Left/right column sides: Minor corrosion of leveling nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 40% Full Screen Height (FSH) was reported for anchor bolt #15 (left column) and anchor bolt #3 (right column).	3	5	15
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides**

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 26% was computed in section A-A of the right vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: No handhole on this column was present. Right column side: Minor corrosion of the column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was observed. One U-bolt was loose on lower chord of the left column and one U-bolt was loose on lower chord of the right column. Left column side (lower chord): Inside back L-shaped plate was bent and inside front lock washer was sunk into bolt hole.	4	3	12
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Minor corrosion of horizontal chords was reported.	2	3	6
Attachments	No washers for bolt connections between sign beam and bracket. A lot of pack rust between light arm JB's and the lower chord. No washers for bolt connections between sign supports and L-brackets.	4	3	12

**TOTAL SCORES**

**100**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-53.72	Inspector Names:	1) Russ Stewart
Inspection Date: 10/12/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 19% was computed in section A-A of the right vertical column. Five anchor bolts were cut short. Two U-bolts connected between the right vertical column and the lower chord were loose and 1/16" undercut on upper chord of the column was reported. Crack in top of L-bracket that connects the third sign from right was observed. One L-bracket was bent. Total score of this structure is 102 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Left column side: Possible crack of the base plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Five anchor bolts were cut short. Minor corrosion of leveling nuts/washers was observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 52% Full Screen Height (FSH) was reported for anchor bolt #12 (right column).	4	5	20
Connection between Base Plate and Vertical Column	None.	1	5	5





Inspection Summary for  
**Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides**

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 19% was computed in section A-A of the right vertical column.	2	5	10
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Minor corrosion of the columns was observed. Left column side: No handhole on this column was present. Right column side: Surface pitting of the column was reported.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was observed. Right column side: Two U-bolts were loose on lower chord of the column. and 1/16" undercut on upper chord of the column was reported.	4	3	12
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Hole in weld on lower chord was reported.	2	3	6
Attachments	Pack rust between light arm JB's and the lower chord was reported. Crack in top of L-bracket that connects the third sign from right was observed. One L-bracket was bent.	3	3	9

**TOTAL SCORES**

**102**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-55.46	Inspector Names:	1) Russ Stewart
Inspection Date: 12/14/2012; 01/07/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 30% was computed in section A-A of the right vertical column. Possible cracks of the base plate were reported. Minor to severe corrosion of the right column was observed. Total score of this structure is 84 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Right column side: Possible cracks of the base plate at UT thickness reading locations #4, 5, and 6 were reported.	3	5	15
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 30% was computed in section A-A of the right vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to moderate corrosion of the column was reported. Right column side: Minor to severe corrosion of the column was observed.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was reported.	2	3	6
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Minor corrosion of horizontal chords, secondary vertical posts, and horizontal bracings was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and L-brackets connecting the supports to the chords was observed. Pack rust between light arm JB's and the lower chord was reported. One of six light plate welds were cracked.	2	3	6
<b>TOTAL SCORES</b>				<b>84</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-55.48	Inspector Names:	1) Russ Stewart
Inspection Date: 10/16/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 20% was computed in section A-A of the right vertical column. Minor to moderate corrosion of leveling nuts/washers was observed. Pack rust between light arm JB's and the lower chord and severe corrosion to conduit nipple was reported. Total score of this structure is 88 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Right column side: Grout pad was present. Mortar for grout pad was eroding around base plate and some corrosion were exposed on leveling nuts.	2	2	4
Base Plates	Right column side: Possible cracks of the base plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Right column side: Minor to moderate corrosion of leveling nuts/washers was observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 20% was computed in section A-A of the right vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Handhole covers were not in place. Minor corrosion of the columns were observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was observed.	2	3	6
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Minor corrosion of horizontal chords, secondary vertical posts and horizontal bracings was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and L-brackets connecting the supports to the chords was observed. Pack rust between light arm JB's and the lower chord and severe corrosion to conduit nipple was reported.	3	3	9
<b>TOTAL SCORES</b>				<b>88</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-79-0.68	Inspector Names: 1) Russ Stewart
Inspection Date: 10/17/2012; 10/19/2012	2) Troy Matthews
Inspection Contractor: Dennis Corporation	3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 58% was computed in section A-A of the left vertical column. Minor corrosion of the left/right vertical columns was reported. Conduit was missing from damaged light arm. It detached from the handhole plate on the lower chord on the left column side. Total score of this structure is 99 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	Left column side: Top nuts #7 and #16 were loose.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Maximum signal strength of 55% Full Screen Height (FSH) was reported for anchor bolt #12 (left column).	4	5	20
Connection between Base Plate and Vertical Column	None.	1	5	5



# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 58% was computed in section A-A of the left vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Minor corrosion of the columns was reported. Left column side: Handhole cover was not in place. A gauge with 1/8" in depth was observed in front of the column in outface side. Right column side: No handhole on this column was present. Impact damage to outside of the column was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was reported. Right column side: An U-bolt connected between the upper chord and the column was loose.	2	3	6
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Minor corrosion of horizontal chords, secondary vertical posts, and horizontal bracings was reported.	2	3	6
Attachments	Right horizontal light arm had impact damage. Pack rust between light arm JB's and the lower chord was observed. L-brackets connecting the supports and the chords had a minor corrosion. A bullet hole was found in left sign panel. Conduit was missing from damaged light arm. It detached from the handhole plate on the lower chord on the left column side. Steel mesh was partially detached from secondary vertical posts. Some deformation and damage to other areas were reported.	4	3	12
TOTAL SCORES				99

## Score Interpretation:

Maximum Total Score (Very High Risk) = 184

Minimum Total Score (Low Risk) = 46

## Risk Category:

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





# Inspection Summary for Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-79-1.57	Inspector Names:	1) Russ Stewart
Inspection Date: 10/19/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Maximum section loss of 15% was computed in section A-A of the right vertical column. Some anchor bolts were cut short and damage from mower of a bolt was found. Minor corrosion of the vertical columns was reported. Total score of this structure is 76 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	Left column side: Concrete spalling was reported.	2	3	6
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	Left column side: Minor corrosion of top/leveling nuts/washers was reported. Right column side: Anchor bolts #1, 4, 5, and 16 were cut short. Damage from mower on bolt #9.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
Three-Dimensional Overhead Truss, Shoulder Mounted on Both Sides

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 15% was computed in section A-A of the right vertical column.	2	5	10
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Minor corrosion of the columns was reported. Left column side: No handhole was present on the column.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left/right column sides: Pack rust between plates/members was reported. Right column side: Weld was not uniform on back of L-bracket.	2	3	6
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Minor corrosion of horizontal chords was reported. Lower chord was corroded at spacer plate.	2	3	6
Attachments	Minor corrosion of horizontal light arms and L-brackets connecting the supports to the chords was observed. Photocell was corroded at base. Corrosion of LB connection to electrical box was reported.	2	3	6

**TOTAL SCORES**

**76**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and  
Median Barrier Wall Mounted on Other Side**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.84	Inspector Names:	1) Russ Stewart
Inspection Date: 12/6/2012; 1/18/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 41% was computed in section A-A of the shoulder vertical column. Minor to moderate corrosion/deterioration, section loss, and surface pitting of base plate on median column was reported. Minor to very severe corrosion of shoulder vertical column was observed. Minor to moderate corrosion of median vertical column was reported. Electrical distribution boxes were damaged due to impact. Conduits were loose under electrical boxes due to impact damage. Horizontal bracing #1 on left vertical column had a moderate corrosion on bottom side. Total score of this structure is 126 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Shoulder column side: Concrete spalling at conner of the foundation was reported.	2	3	6
Drainage Issues	Median mount was accumulating debris and moisture causing corrosion.	3	1	3
Grout Pad under Base Plate	Median column side: Grout pad was present.	2	2	4
Base Plates	Shoulder column side: Minor corrosion of the base plate was observed. Median column side: Minor to moderate corrosion/deterioration, section loss, and surface pitting of the base plate was reported.	3	5	15
Anchor Bolts, Nuts and Washers	Shoulder column side: Minor corrosion of top and leveling nuts/washers was observed. Median column side: Minor corrosion of anchor bolts and minor deterioration of top nuts/washers was observed. Minor to moderate corrosion of top nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column side: Minor corrosion of weld line 2 was observed. Median column side: Minor corrosion of weld lines 1 and 2 was reported.	2	5	10



Inspection Summary for  
**Three-Dimensional Overhead Truss, Shoulder Mounted on One Side and  
Median Barrier Wall Mounted on Other Side**

Prepared by  
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Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 41% was computed in section A-A of the shoulder vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column side: Handhole cover was not in place. Minor to very severe corrosion of the column was observed. Median column side: No handhole cover was present. Minor to moderate corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder/median column sides: Pack rust between plates/members was observed.	3	3	9
Horizontal Chords, Secondary Vertical Posts and Horizontal Bracings	Severe corrosion/deterioration in small areas of lower chords (front) was observed. Holes was found on bottom of chord at JB's for light arms. Minor to moderate corrosion of lower chords (back) and minor corrosion of upper chords, secondary vertical posts, and horizontal bracings were reported.	4	3	12
Attachments	Minor corrosion of horizontal light arms and L-brackets connecting the supports to the chords was observed. Pack rust between light arm JB's and the lower chord was reported. Electrical distribution boxes were damaged due to impact. Conduits were loose under electrical boxes due to impact damage. Horizontal bracing #1 on left vertical column had a moderate corrosion on bottom side.	4	3	12
<b>TOTAL SCORES</b>				<b>126</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



## Inspection Summary for Single Chord Ground Mounted Truss

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.87	Inspector Names:	1) Russ Stewart
Inspection Date: 10/22/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 42% was computed in section A-A of the left vertical column. Minor to severe corrosion of left and right vertical columns was reported. Total score of this structure is 73 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5



# Inspection Summary for Single Chord Ground Mounted Truss

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connection between Base Plate and Vertical Column	None.	1	5	5
Section Loss of Vertical Column near Base Plate	Maximum section loss of 42% was computed in section A-A of the left vertical column.	4	5	20
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column sides: Minor to severe corrosion of the columns was reported. Right column side: No handhole was present.	4	3	12
Connections between Vertical Column and Horizontal Chord	Minor corrosion of the horizontal chord was observed.	2	3	6
Splice Connections in Horizontal Chord	Minor bolt corrosion of the left splice connections was reported.	2	3	6
Attachments	None.	1	3	3

## TOTAL SCORES

73

### Score Interpretation:

Maximum Total Score (Very High Risk) = 172

Minimum Total Score (Low Risk) = 43

### Risk Category:

Low Risk:  $43 \leq \text{Total Score} < 75$

Moderate Risk:  $75 \leq \text{Total Score} < 107$

High Risk:  $107 \leq \text{Total Score} < 139$

Very High Risk:  $139 \leq \text{Total Score} \leq 172$



## Inspection Summary for Single Chord Ground Mounted Truss

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.89	Inspector Names:	1) Russ Stewart
Inspection Date: 10/15/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Maximum section loss of 30% was computed in section A-A of both left and right vertical columns. Surface lamination on top right of the horizontal chord and surface lamination on splice plate #1 (in right splice connections) was reported. Total score of this structure is 68 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plates	None.	1	5	5
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5





# Inspection Summary for Single Chord Ground Mounted Truss

Prepared by  
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Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connection between Base Plate and Vertical Column	None.	1	5	5
Section Loss of Vertical Column near Base Plate	Maximum section loss of 30% was computed in section A-A of both left and right vertical columns.	3	5	15
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: No handhole was present.	2	3	6
Connections between Vertical Column and Horizontal Chord	Minor corrosion of the horizontal chord was observed. Surface lamination on top right of the horizontal chord was reported.	3	3	9
Splice Connections in Horizontal Chord	Left splice connections: Pack rust between plates/members was observed. Right splice connections: Minor corrosion of bolts and surface lamination on splice plate #1 was reported.	3	3	9
Attachments	None.	1	3	3

## TOTAL SCORES

68

### Score Interpretation:

Maximum Total Score (Very High Risk) = 172

Minimum Total Score (Low Risk) = 43

### Risk Category:

Low Risk:  $43 \leq \text{Total Score} < 75$

Moderate Risk:  $75 \leq \text{Total Score} < 107$

High Risk:  $107 \leq \text{Total Score} < 139$

Very High Risk:  $139 \leq \text{Total Score} \leq 172$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-55.00	Inspector Names:	1) Russ Stewart
Inspection Date: 10/24/2012; 01/15/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 34% was computed in section A-A of the shoulder vertical column. Minor to moderate section loss and deterioration/corrosion of the base plate on the median column side were observed. Minor to moderate corrosion of leveling nuts/washers on the median column side was reported. Moderate corrosion of weld lines between the base plate and the median column was recorded. Level of deterioration and corrosion of the shoulder vertical column was from minor to severe. Level of corrosion of the median vertical column was from moderate to severe. Total score of this structure is 109 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Median column side: Foundation was partially covered by soil. Concrete spalling was not observed in the foundation and there were no sign of corrosion/deterioration of reinforcements.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Median column side: Grout pad was present under the base plate. Grout pad thickness was 0.2 inch. There was no sign of mortar splitting, spalling, cracking, or crushing.	2	2	4
Base Plates	Median column side: Minor to moderate section loss and deterioration/corrosion of the base plate were observed. Surface pitting of the base plate was reported.	3	5	15
Anchor Bolts, Nuts and Washers	Median column side: Minor corrosion of anchor bolts was observed. Shoulder column side: Minor to moderate corrosion of leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Median column side: Moderate corrosion of weld lines between the base plate and the median column was observed.	3	5	15



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 34% was computed in section A-A of the shoulder vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	Median column side: Minor corrosion of weld lines 1 and 2 between the median column and the supplemental bracing was observed.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column side: Minor to severe deterioration and corrosion of the shoulder vertical column was observed. Median column side: Level of corrosion of the median vertical column near the base plate was from moderate to severe.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder/median column sides: Pack rust between plates/members was observed. Level of corrosion of the bolt connection between the shoulder/median vertical columns and the upper chord was minor.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Guide rail to light arm bracket was loose. Retractable cable was off of roller guide.	2	3	6

**TOTAL SCORES**

**109**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-56-33	Inspector Names:	1) Russ Stewart
Inspection Date: 10/22/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 41% was computed in section A-A of the shoulder vertical column. Level of corrosion of weld lines between the base plate and the median vertical column was from moderate to severe. Minor to severe deterioration and corrosion of the shoulder vertical column was observed. Inside U-bolt at the connections between the shoulder vertical column and the lower chord was broken. LB from electrical box and conduit was severely corroded. Total score of this structure is 127 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Shoulder column side: Foundation was partially covered by soil. Concrete spalling was observed in the foundation but there were no sign of corrosion/deterioration of reinforcements.	2	3	6
Drainage Issues	Shoulder column side: Base of the vertical column and concrete foundation are level with bottom of roadside drainage and are open to flooding and sedimentation.	2	1	2
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Shoulder/median column sides: Minor section loss and deterioration of base plates were observed. Level of corrosion of the base plates were from minor to moderate. Surface pitting of the base plates were reported.	3	5	15
Anchor Bolts, Nuts and Washers	Shoulder column side: Moderate corrosion of top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported. Median column side: Minor corrosion of anchor bolts was observed. Level of corrosion of top nuts/washers was from minor to moderate.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column side: Minor corrosion of weld lines between the base plate and the shoulder vertical column was observed. Median column side: Level of corrosion of weld lines between the base plate and the median vertical column was from moderate to severe.	4	5	20



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 41% was computed in section A-A of the shoulder vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column side: Minor to severe deterioration and corrosion of the shoulder vertical column was observed. There was a lot of corrosion and deterioration for the first 0 to 4 inches from top of the base plate of the column. Median column side: Level of corrosion of the median vertical column was from minor to moderate.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder/median column sides: Pack rust between plates/members was observed. Shoulder column side: Inside U-bolt at the connections between the shoulder column and the lower chord was broken. Minor corrosion of bolts connected between the shoulder column and the upper chord was reported. Median column side: Tightness of bolt connection between the median column and the lower chord was lost.	4	3	12
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of vertical sign support to horizontal chord connection bracket was observed. Minor corrosion of horizontal light arms and pack rust between light arm JB's and the lower chord was reported. LB from electrical box and conduit was severely corroded.	3	3	9
<b>TOTAL SCORES</b>				<b>127</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-57.51	Inspector Names:	1) Russ Stewart
Inspection Date: 12/13/2012; 01/09/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 25% was computed in section A-A of the shoulder and median vertical columns. Minor to moderate corrosion of the base plate on the median column was observed. Section loss, deterioration, warping/buckling, surface pitting, and possible crack of the base plate on the median column were reported. Moderate to severe corrosion of weld lines 1 and 2 connected the median vertical column and the base plate was recorded. Moderate to severe corrosion of the median vertical column was noted. Deterioration of the base plate and distress of the median vertical column were informed. Two U-bolts connected between the median vertical column and the lower chord were loose. Several surface areas of the horizontal chords were delaminated. Total score of this structure is 125 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Shoulder column: Inspectors gave question mark for the grout pad under the base plate of this column. Median column: Grout pad was present under the base plate of this column. No damage was reported.	2	2	4
Base Plates	Shoulder column: Minor corrosion and possible crack of the base plate were reported. Median column: Minor to moderate corrosion of the base plate was observed. Section loss, deterioration, warping/buckling, surface pitting, and possible crack of the base plate were reported.	4	5	20
Anchor Bolts, Nuts and Washers	Shoulder column: Concrete drainage basin came up flush with bottom of the base plate. Median column: Minor corrosion of anchor bolts was observed. Minor to moderate corrosion and deterioration of top nuts/washers were reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Median column: Moderate to severe corrosion of weld lines 1 and 2 was reported.	4	5	20



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 25% was computed in section A-A of the shoulder and median vertical columns.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	Median column: Corrosion on bottom of weld lines 1 and 2 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column: Minor to severe corrosion of the column was observed. Median column: Moderate to severe corrosion of the column was observed. Deterioration of the base plate and distress of the column were reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder column: Pack rust between plates/members was observed. Median column: Pack rust between plates/members was reported. Two U-bolts connected between the vertical column and the lower chord were loose.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Several surface areas of the horizontal chords were delaminated. Minor corrosion of the horizontal chords and secondary vertical chords was reported.	3	3	9
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>125</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$





Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-57.52	Inspector Names: 1) Russ Stewart
Inspection Date: 12/13/2012; 01/15/2013	2) Troy Matthews
Inspection Contractor: Dennis Corporation	3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 39% was computed in section A-A of the shoulder vertical column. The foundation under the shoulder column was corroded severely. The shoulder foundation was low and covered by soil. Soil had been removed earlier and drainage pathway was dug. Minor to severe section loss, deterioration/corrosion, and surface pitting of the base plates were reported. Moderate to severe corrosion of weld lines connected the vertical columns and the base plates was reported. Minor to moderate corrosion of the shoulder and median vertical columns was observed. Pack rust caused deterioration on the upper chord. Second horizontal light arm from left was twisted. Total score of this structure is 126 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	Shoulder column: The foundation was partially covered by soil.	2	3	6
Drainage Issues	Shoulder column: The foundation was low. Soil had been removed earlier and drainage pathway was dug.	2	1	2
Grout Pad under Base Plate	Shoulder and Median columns: Grout pads were present under the base plates.	2	2	4
Base Plates	Shoulder column: Moderate section loss and deterioration/corrosion of the base plate were observed. Severe surface pitting of the base plate was reported. Median column: Minor to moderate section loss, deterioration/corrosion, and surface pitting of the base plate were reported.	4	5	20
Anchor Bolts, Nuts and Washers	Shoulder column: Moderate corrosion of anchor bolts was observed. Minor to moderate corrosion of top nuts/washers was reported. Median column: Moderate deterioration/corrosion of top nuts/washers was recorded.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column: Severe corrosion of weld lines 1 and 2 was observed. Median column: Moderate to severe corrosion of weld lines 1 and 2 was reported.	4	5	20





Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 39% was computed in section A-A of the shoulder vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	Median column: Corrosion on bottom of weld lines 1 and 2 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder and median columns: Minor to moderate corrosion of the columns was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Shoulder and median columns: Pack rust between plates/members was observed. Pack rust caused deterioration on the upper chord.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported. Minor deterioration of the upper chord, caused by the pack rust, was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Second horizontal light arm from left was twisted.	3	3	9
<b>TOTAL SCORES</b>				<b>126</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-57.53	Inspector Names:	1) Russ Stewart
Inspection Date: 12/13/2012; 01/15/2013; 01/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 51% was computed in section A-A of the shoulder vertical column. The base under the shoulder column was low and could become buried in debris. Moderate section loss, deterioration/corrosion, and surface pitting of the base plate on median vertical column was observed. Moderate to severe corrosion of weld lines connected the vertical columns and the base plates was reported. Very severe corrosion of the shoulder vertical column near the base plate and in open handhole was recorded. One U-bolt connected the shoulder vertical column and the upper chord was loose. Washers were deteriorating on 80% of bolt connections in the attachments. Total score of this structure is 132 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	Shoulder base was low and could become buried in debris.	3	1	3
Grout Pad under Base Plate	Grout pad was present under the base plate at the shoulder column.	2	2	4
Base Plates	Shoulder column: Minor section loss, deterioration/corrosion, surface pitting, and possible crack of the base plate were reported. Median column: Moderate section loss, deterioration/corrosion, and surface pitting of the base plate were found. Inspectors could not get UT thickness reading for the base plate. The base plate was corroded and pitted and it did not have a flat surface.	4	5	20
Anchor Bolts, Nuts and Washers	Shoulder column: Minor to moderate corrosion of top nuts/washers was observed. Median column: Minor to moderate deterioration/corrosion of anchor bolts was reported. Moderate deterioration/corrosion of top nuts/washers was observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column: Severe corrosion of weld lines 1 and 2 was observed. Median column: Moderate to severe corrosion of weld lines 1 and 2 was reported.	4	5	20



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 51% was computed in section A-A of the shoulder vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	Median column: Corrosion on bottom of weld lines 1 and 2 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column: Minor deterioration of the column was observed. Very severe corrosion of the column near the base plate and in open handhole was reported. Median column: Minor to moderate deterioration/corrosion of the column near the base plate was recorded.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder and median columns: Pack rust between plates/members was observed. One U-bolt connected the shoulder vertical column and the upper chord was loose.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Washers were deteriorating on 80% of bolts.	3	3	9
<b>TOTAL SCORES</b>				<b>132</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-99.98	Inspector Names:	1) Russ Stewart
Inspection Date: 01/10/2013; 01/17/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 30% was computed in section A-A of the shoulder vertical column. Moderate corrosion of anchor bolts on the median column side was observed. Minor to severe corrosion of the shoulder vertical column was reported. Total score of this structure is 95 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Foundation	Median column side: Foundation was completely covered by soil. Concrete spalling was not observed in the foundation and there were no sign of corrosion/deterioration of reinforcements.	1	3	3
Drainage Issues	Median barrier plate accumulates debris and moisture causing corrosion.	2	1	2
Grout Pad under Base Plate	Shoulder/median column sides: No grout pads were present under the base plates.	1	2	2
Base Plates	Median column side: Corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Median column side: Moderate corrosion of anchor bolts was observed. Minor to moderate corrosion of top and leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Median column side: Minor corrosion of weld lines between the base plate and the median column was observed.	2	5	10



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
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 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near Base Plate	Maximum section loss of 30% was computed in section A-A of the shoulder vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column side: Minor to severe corrosion of the shoulder vertical column was observed. Median column side: Minor corrosion of the median vertical column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder/median column side: Pack rust between plates/members was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed.	2	3	6
<b>TOTAL SCORES</b>				<b>95</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.12	Inspector Names:	1) Russ Stewart
Inspection Date: 12/04/2012; 01/10/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 50% was computed in section B-B of the median vertical column. Median base accumulated road debris and moisture inside barrier plate causing corrosion. Minor to moderate corrosion of the base plate on the median vertical column was reported. Minor to moderate corrosion of the columns was observed. Total score of this structure is 104 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	Median base accumulated road debris and moisture inside barrier plate causing corrosion.	4	1	4
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Median column: Minor section loss and deterioration of the base plate was observed. Minor to moderate corrosion of the base plate was reported.	3	5	15
Anchor Bolts, Nuts and Washers	Median column: Minor to moderate corrosion of top and leveling nuts/washers was reported.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column: Undercut on the base plate (approximately 1/16" depth) on inside weld line 1 was observed. Median column: Minor corrosion of weld lines 1 and 2 was reported.	2	5	10



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 50% was computed in section B-B of the median vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder and median columns: Minor to moderate corrosion of the columns was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Shoulder and median columns: Pack rust between plates/members was observed. Minor corrosion of bolts connected the columns and the upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord and a small hole in left sign panel were reported.	2	3	6
<b>TOTAL SCORES</b>				<b>104</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-79-1.12	Inspector Names:	1) Russ Stewart
Inspection Date: 10/23/2012; 01/17/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 29% was computed in section A-A of the shoulder vertical column. Bottom of the base plate on shoulder column has sedimentation from roadway. Nine anchor bolts on shoulder column were cut short and minor to moderate corrosion of leveling nuts/washers on shoulder column was reported. Minor to moderate corrosion of weld lines 1 and 2 connected between median column and base plate was observed. Minor to severe corrosion of the shoulder column, moderate corrosion of horizontal light arms, and bullet holes on sign panels were reported. Total score of this structure is 115 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	Shoulder column: Bottom of the base plate has sedimentation from roadway.	3	1	3
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Shoulder column: Minor surface corrosion and surface pitting of the base plate were observed. Median column: Minor section loss, deterioration/corrosion, and surface pitting of the base plate were reported.	2	5	10
Anchor Bolts, Nuts and Washers	Shoulder column: 9 anchor bolts were cut short. Minor corrosion of top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported. Median column: Minor deterioration/corrosion of top nuts/washers was observed. Inspectors could not see and inspect leveling nuts/washers.	4	5	20
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Shoulder column: Minor corrosion of weld lines 1 and 2 was observed. Median column: Minor to moderate corrosion of weld lines 1 and 2 was reported.	3	5	15





Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
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 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 29% was computed in section A-A of the shoulder vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	Shoulder column: Minor corrosion of weld lines 7 and 8 was observed. Median column: None.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Shoulder column: Minor to severe corrosion of the column was observed. Median column: Minor to moderate corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Shoulder column: Pack rust between plates/members was observed. Minor corrosion of bolt connections in upper chord was reported. Median column: Pack rust between plates/members in upper chord was observed.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords was observed. 1/8" gauge on front of upper chord approximately 5 ft from shoulder column was reported.	2	3	6
Attachments	Moderate corrosion of horizontal light arms and minor corrosion of vertical sign support to horizontal chord connection bracket were observed. Bullet holes on sign panels were reported. LB was corroded.	3	3	9
<b>TOTAL SCORES</b>				<b>115</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-58.30	Inspector Names:	1) Russ Stewart
Inspection Date: 11/14/2012; 01/18/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 53% was computed in section A-A of the median vertical column. Minor to moderate corrosion of the base plate on the median vertical column was observed. Minor to very severe corrosion of the median vertical column was reported. Inside U-bolt nut connected the left shoulder column and the lower chord was loose. Total score of this structure is 104 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	Grout pads were present under the base plates of left and right shoulder vertical column.	2	2	4
Base Plates	Left shoulder column: Minor corrosion of the base plate from being partially buried was observed. Median column: Minor section loss and surface pitting of the base plate was reported. Minor to moderate corrosion of the base plate was recorded.	3	5	15
Anchor Bolts, Nuts and Washers	Left shoulder column: Minor corrosion of top nuts/washers was observed. Median column: Minor corrosion of anchor bolts and minor corrosion/deterioration of top nuts/washers were reported.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Median column: Minor corrosion of weld lines 1 and 2 was reported.	2	5	10



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 53% was computed in section A-A of the median vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left and right shoulder columns: Minor corrosion of the columns was observed. Median column: Minor to very severe corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left shoulder column: Inside U-bolt nut connected the column and the lower chord was loose. Minor corrosion of bolt connected the column and the upper chord was reported. Median and right shoulder columns: Minor corrosion of bolts connected the columns and the upper chords was observed. Median column: Pack rust between plates/members was recorded.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>104</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-99.58	Inspector Names:	1) Russ Stewart
Inspection Date: 11/14/2012; 01/17/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 22% was computed in section A-A of the shoulder vertical column. Median mount support base collected debris in cover plate causing corrosion. Minor to moderate corrosion of leveling nuts/washers on the median vertical column base was reported. Anchor bolt #12 on the median column had a horizontal crack. Moderate to severe corrosion of the left shoulder vertical column was recorded. Total score of this structure is 99 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	Median mount support base collected debris in cover plate causing corrosion.	3	1	3
Grout Pad under Base Plate	None.	1	2	2
Base Plates	Left shoulder column: Minor corrosion of the base plate was observed. Median column: Minor section loss and corrosion of the base plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Median column: Minor corrosion of anchor bolts and top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported. Anchor bolt #12 had a horizontal crack.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Vertical Column	Median column: Minor corrosion of weld lines 1 and 2 was reported.	2	5	10



Inspection Summary for  
**Ground Mounted Trusses - One Shoulder Mount and One Median Barrier  
 Wall Connection**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the Base Plate	Maximum section loss of approximately 22% was computed in section A-A of the shoulder vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracing	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left shoulder column: Moderate to severe corrosion of the column was observed. Median column: Minor to moderate corrosion of the column was reported. Right shoulder column: Minor corrosion of the column was recorded.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left/right shoulder and median columns: Pack rust between plates/members was observed. Left shoulder and median columns: Minor corrosion of bolts connected the vertical columns and the upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported. Pack rust was deteriorating the lower chord approximately 1/8" in depth on back side.	3	3	9
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Two of twelve sign clips on right vertical sign were loose.	2	3	6
<b>TOTAL SCORES</b>				<b>99</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **184**

Minimum Total Score (Low Risk) = **46**

**Risk Category:**

Low Risk:  $46 \leq \text{Total Score} < 80$

Moderate Risk:  $80 \leq \text{Total Score} < 114$

High Risk:  $114 \leq \text{Total Score} < 148$

Very High Risk:  $148 \leq \text{Total Score} \leq 184$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
SCB L & R, Closed Columns**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.55

Inspection Date: 11/29/2012; 12/05/2012; 01/14/2013

Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart

2) Troy Matthews

3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 16% was computed in section B-B of the left vertical column. Minor to moderate corrosion of the left vertical column was observed. Total score of this structure is 81 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	Right column: Minor corrosion of the column, where the paint coat failed, was observed.	2	3	6
Drainage Issues	None.	1	1	1
SCB Connection Plates	Left and right columns: Minor corrosion of the SCB connection plates was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 16% was computed in section B-B of the left vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting the Vertical Column	Left column: Inspection results were not reported. Right column: 24" area of undercut (< 1/16") was observed on top at upper chord.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left column: Minor to moderate corrosion of the column was observed. Right column: Minor corrosion of the column was reported.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left column: 1/8" deep gauge 31" above the lower chord in the inside face was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords was reported. A gauge 3" in length was observed in the lower chord. A slag still presented on welds in the lower chord.	3	3	9
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Minor and partial peeling lettering for "50 MPH" were recorded.	2	3	6
<b>TOTAL SCORES</b>				<b>81</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
SCB L & R, Closed Columns**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-100.88  
Inspection Date: 12/03/2012; 12/05/2013  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 31% was computed in section A-A of the right vertical column. Minor corrosion of the left and right vertical columns was observed. Total score of this structure is 74 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	None.	1	1	1
SCB Connection Plates	Left and right columns: Minor corrosion of the SCB connection plates was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5





Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 31% was computed in section A-A of the right vertical column.	3	5	15
Vertical Weld Lines between Tubes Constituting the Vertical Column	Left column: One pinhole in weld line 1 was observed. Right column: Three areas of UF/Lof on lower chord and one area of UF/Lof above lower chord were reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left column: Slag still presented on welds in upper and lower chords.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported. Old attachment weld on vertical post #4 was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>74</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.90	Inspector Names:	1) Russ Stewart
Inspection Date: 11/13/2012; 01/18/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 4% was computed in section A-A of the left vertical column. 1/16" or less undercut on entire length of a weld line connected the SCB connection plate and the right vertical column was reported. Minor corrosion of the columns was observed. Total score of this structure is 75 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	Left and right columns: Minor corrosion of the columns was observed.	2	3	6
Drainage Issues	Inspection results were not reported.	2	1	2
SCB Connection Plates	Left and right columns: Minor corrosion of the SCB connection plates was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	Left column: Inspection results were not reported. Right column: 1/16" or less undercut on entire length of weld line 3 was reported.	3	5	15



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 4% was computed in section A-A of the left vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting the Vertical Column	Left column: Undercut on 50% of weld line 1 was observed. A pin hole in area of underfill (approximately 5" long) was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported. Old attachment weld on vertical post #5 was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Electrical distribution boxes were opened and lock was broken.	2	3	6
<b>TOTAL SCORES</b>				<b>75</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.72	Inspector Names: 1) Russ Stewart
Inspection Date: 11/27/2012; 12/05/2012; 01/10/2013	2) Troy Matthews
Inspection Contractor: Dennis Corporation	3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 17% was computed in section A-A of the left vertical column. Weld stingers were not fused together for 100% of a weld line between the SCB connection plate and the left vertical column. Minor corrosion of the left and right vertical columns was observed. The left vertical column was warp 3/16" (75" from the column base). Connection bracket connecting luminare track was loose. Conduits were broken. Total score of this structure is 85 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	None.	1	1	1
SCB Connection Plates	Left and right columns: Minor corrosion of the SCB connection plates was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	Left column: Weld stingers were not fused together for 100% of weld line 1. Right column: 1/16" undercut on 75% of entire weld line 1 was reported.	3	5	15



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Closed Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 17% was computed in section A-A of the left vertical column.	2	5	10
Vertical Weld Lines between Tubes Constituting the Vertical Column	Left column: One pinhole in weld line 1 was observed. Right column: An underfill area (<12") on bottom of weld line 1 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed. Left column: The column was warp 3/16" (75" from the column base).	3	3	9
Connections between Vertical Column and Horizontal Chords	None.	1	3	3
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Connection bracket connecting luminare track was loose. Conduits were broken.	4	3	12
<b>TOTAL SCORES</b>				<b>85</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.34  
 Inspection Date: 11/16/12; 11/28/12; 1/8/13; 1/10/13  
 Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 25% was computed in section A-A of the left vertical column. Minor corrosion of the left and right vertical columns was observed. One U-bolt connected the left and right vertical columns and the lower chords was broken. Front face of L-shape plate connected the right vertical column and the upper chord was damaged. Total score of this structure is 75 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	Inspection results were not reported.	2	1	2
SCB Connection Plates	Left column: Minor corrosion of the SCB connection plate was observed.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 25% was computed in section A-A of the left vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed. Right column: Small dent was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left and right columns: One U-bolt connected the column and the lower chord was broken. Right column: Front face of L-shape plate connected the column and the upper chord was broken. Minor corrosion of bolts connected the column and the upper chord was reported.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>75</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.39	Inspector Names: 1) Russ Stewart
Inspection Date: 11/28/2012; 01/10/2013; 01/14/2013	2) Troy Matthews
Inspection Contractor: Dennis Corporation	3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 24% was computed in section A-A of the left vertical column. Minor to moderate deterioration/corrosion of the SCB connection plate on the left vertical column was observed. Minor to moderate corrosion of the left vertical column was reported. One bolt connected vertical sign support to horizontal chord connection bracket was loose. Total score of this structure is 90 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	Left column: Minor corrosion of the SCB was observed.	2	3	6
Drainage Issues	None.	1	1	1
SCB Connection Plates	Left column: Minor to moderate deterioration/corrosion of the SCB connection plate was observed. Right column: Minor corrosion of the SCB connection plate was reported.	3	5	15
SCB Connection Bolts, Nuts and Washers	Left column: Bolt B3 was corroding from drain hole.	2	5	10
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5





Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type A  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 24% was computed in section A-A of the left vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left column: Minor to moderate corrosion of the column was observed.	3	3	9
Connections between Vertical Column and Horizontal Chords	Right column: Pack rust between plates/members in upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One bolt connected vertical sign support to horizontal chord connection bracket was loose.	3	3	9
<b>TOTAL SCORES</b>				<b>90</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.16	Inspector Names:	1) Russ Stewart
Inspection Date: 11/16/2012; 01/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 32% was computed in section A-A of the right vertical column. Minor to severe corrosion of the right vertical column was reported. Total score of this structure is 80 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	Left and right columns: Weld lines 9, 10, and 11 did not exist. Right column: Minor corrosion of the SCB was reported.	2	3	6
Drainage Issues	None.	1	1	1
SCB Connection Plates	Left and right columns: Corrosion of the SCB connection plates was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 32% was computed in section A-A of the right vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left column: Minor corrosion of the column was observed. Right column: Minor to severe corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left column: Pack rust between plates/members in the lower chord was observed. Minor corrosion of bolts connected the column and the upper chord was reported. Right column: Pack rust between plates/members in the upper and lower chords was recorded.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>80</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.22  
 Inspection Date: 11/16/2012; 12/04/2012; 01/08/2013  
 Inspection Contractor: Dennis Corporation

Inspector Names:

1) Russ Stewart
2) Troy Matthews
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 41% was computed in section A-A of the right vertical column. Minor corrosion of the left and right vertical columns was observed. End plate was not attached correctly to the right vertical column. Two of four bolts connected the vertical sign support and the upper chord was loose. Total score of this structure is 88 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	None.	1	3	3
Drainage Issues	Inspection results were not reported.	2	1	2
SCB Connection Plates	Right column: Corrosion of the SCB connection plate was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	Right column: Corrosion of weld line 2 from drain was reported.	2	5	10



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 41% was computed in section A-A of the right vertical column.	4	5	20
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left column: Pack rust between plates/members in the upper and lower chords was observed. Right column: Pack rust between plates/members in the lower chord was reported. Minor corrosion of bolts connected the column and the upper chord was recorded.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported. End plate was not attached correctly to the right column.	3	3	9
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Two of four bolts connected the vertical sign support and the upper chord was loose.	3	3	9
<b>TOTAL SCORES</b>				<b>88</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.58	Inspector Names:	1) Russ Stewart
Inspection Date: 11/28/2012; 12/05/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 29% was computed in section A-A of the left vertical column. Minor corrosion of the left and right vertical columns was observed. Total score of this structure is 75 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Superstructure Connection Bracket (SCB)	Left column: Minor corrosion of the SCB at drain hole was reported.	2	3	6
Drainage Issues	Inspection results were not reported.	2	1	2
SCB Connection Plates	Left and right columns: Minor corrosion of the SCB connection plates was observed.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type A Column Connection with Type B  
 SCB L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 29% was computed in section A-A of the left vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed. Left column: One of three drain holes was plugged causing corrosion of the column.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left column: Pack rust between plates/members in the lower chord was observed. Right column: Pack rust between plates/members in the upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed.	2	3	6

**TOTAL SCORES**

**75**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60.62-0.22  
Inspection Date: 11/27/2012; 01/07/2013  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 27% was computed in section A-A of the right vertical column. Drain holes in bottom of the left vertical column were clogged. Minor to severe corrosion of the right vertical column was reported. Weld on light arm #3 was cracked on front. Weld on light arm #4 was cracked on rear. One small area of the sign panel was damaged. Total score of this structure is 85 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Drainage Issues	Drain holes in bottom of the left vertical column were clogged.	3	1	3
Mounting Plate	Left and right columns: Minor corrosion of the plate was observed. One of three drain holes were plugged up causing corrosion.	2	5	10
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Mounting Plate and Vertical Column	None.	1	5	5
Section Loss of Vertical Column near the Mounting Plate	Maximum section loss of approximately 27% was computed in section A-A of the right vertical column.	3	5	15





Inspection Summary for  
**Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Vertical Weld Lines between Tubes Constituting the Vertical Column near the Column Base	None.	1	3	3
Supplemental Bracing Members and Their Welds	Left and right columns: Minor corrosion of supplemental bracing members was observed.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left column: Minor corrosion of the column was observed. Right column: Minor to severe corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left and right columns: Pack rust between plates/members was observed. Minor corrosion of bolts connected the vertical columns and the upper chords was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Weld on light arm #3 was cracked on front. Weld on light arm #4 was cracked on rear. One small area of the sign panel was damaged.	3	3	9
<b>TOTAL SCORES</b>				<b>85</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-60.62-0.39  
Inspection Date: 01/07/2013  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 27% was computed in section A-A of the left vertical column. Drain holes in bottom of the left vertical column were clogged. Minor to severe corrosion of the left vertical column was observed. Moderate to severe deterioration/corrosion of the right vertical column was reported. One sign clip was loose. Weld on light arm #3 was cracked on rear. Weld on light arm #2 was broken on front. Total score of this structure is 102 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Drainage Issues	Inspection Results were not reported.	3	1	3
Mounting Plate	Left and right columns: Minor corrosion of the plates was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Left and right columns: Minor corrosion of leveling nuts/washers was reported.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Mounting Plate and Vertical Column	None.	1	5	5
Section Loss of Vertical Column near the Mounting Plate	Maximum section loss of approximately 27% was computed in section A-A of the left vertical column.	3	5	15



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type C Column Connection L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Vertical Weld Lines between Tubes Constituting the Vertical Column near the Column Base	None.	1	3	3
Supplemental Bracing Members and Their Welds	Left and right columns: Minor corrosion of supplemental bracing members was observed.	2	3	6
Interior of Vertical Column	Left column: Minor corrosion of the column was observed. Right column: Moderate to severe deterioration/corrosion of the column was reported.	4	3	12
Exterior Observation of Vertical Column	Left column: Minor to severe corrosion of the column was observed. 1/16" deep gauge on the column just below the upper chord was reported. Right column: Minor corrosion of the column was recorded.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left and right columns: Pack rust between plates/members was observed. Minor corrosion of bolts connected the vertical columns and the upper chords was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One sign clip was loose. Weld on light arm #3 was cracked on rear. Weld on light arm #2 was broken on front.	3	3	9
<b>TOTAL SCORES</b>				<b>102</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **188**

Minimum Total Score (Low Risk) = **47**

**Risk Category:**

Low Risk:  $47 \leq \text{Total Score} < 82$

Moderate Risk:  $82 \leq \text{Total Score} < 117$

High Risk:  $117 \leq \text{Total Score} < 152$

Very High Risk:  $152 \leq \text{Total Score} \leq 188$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-100.09	Inspector Names:	1) Russ Stewart
Inspection Date: 01/09/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 31% was computed in section A-A of the right vertical column. Minor corrosion of left and right vertical columns was reported. One sign clip was loose. Total score of this structure is 78 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Superstructure Connection Bracket (SCB)	Left column: Minor corrosion of the column was observed. The column was deteriorated (<1/16") at bottom of the SCB connection plate.	2	3	6
Drainage Issues	Inspection results were not reported.	2	1	2
SCB Connection Plates	Left and right vertical column: Minor corrosion of the columns was reported.	2	5	10
SCB Connection Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of SCB Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between SCB Connection Plate and Vertical Column	None.	1	5	5
Vertical Weld Lines between Tubes Constituting Vertical Column near SCB Connection Plate	None.	1	3	3



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type D Column Connection L & R, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Column near the SCB Connection Plate	Maximum section loss of approximately 31% was computed in section A-A of the right vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior Observation of Vertical Column	Left and right columns: Minor corrosion of the columns was observed.	2	3	6
Connections between Vertical Column and Horizontal Chords	Left and right columns: Pack rust between plates/members in the lower chord was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of the horizontal chords and secondary vertical posts was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One sign clip was loose.	3	3	9
<b>TOTAL SCORES</b>				<b>78</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **188**

Minimum Total Score (Low Risk) = **47**

**Risk Category:**

Low Risk:  $47 \leq \text{Total Score} < 82$

Moderate Risk:  $82 \leq \text{Total Score} < 117$

High Risk:  $117 \leq \text{Total Score} < 152$

Very High Risk:  $152 \leq \text{Total Score} \leq 188$



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated  
 Median Barrier Column Connection L, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-57.91	Inspector Names:	1) Russ Stewart
Inspection Date: 12/04/2012; 01/18/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 37% was computed in section A-A of the left vertical column. Concrete cracking on back of concrete support (20" long) on right column side was observed. Minor to moderate corrosion of the CSS/Median connection plates on left vertical column side and moderate corrosion of the CSS/Median connection plates on right vertical column side was reported. Minor to moderate corrosion of median bolt nuts/washers on left column side was noted. Moderate corrosion of CSS connection bolts on right column side and minor to severe corrosion of the left vertical column were recorded. All four U-bolts connected the right vertical column and the lower chord was loose. One bolt connected the vertical sign support and the horizontal chord connection bracket was loose. Total score of this structure is 122 which is high risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Concrete Support Structure	Right column side: Concrete cracking on back of concrete support (20" long) was reported.	3	3	9
Drainage Issues	None.	1	1	1
Concrete Superstructure Support (CSS) and Median Connection Plates	Left column side: Minor to moderate corrosion of the CSS/Median connection plates was observed. Right column side: Moderate corrosion of the CSS/Median connection plates was reported.	3	5	15
CSS and Median Connection Bolts, Nuts, and Washers	Left column side: Minor corrosion of median connection bolts was observed. Minor to moderate corrosion of median bolt nuts/washers was reported. Right column side: Moderate corrosion of CSS connection bolts was recorded. Minor corrosion of CSS connection bolt nuts/washers was noted.	3	5	15
Ultrasonic Inspection of CSS and Median Connection Bolts	Maximum signal strength of 49% Full Screen Height (FSH) was reported for CSS connection bolt #3 (right column).	3	5	15
Connections between CSS/Median Connection Plates and Vertical Columns	Left column side: Minor corrosion of weld lines 1 and 2 was reported.	2	5	10



Inspection Summary for  
**Bridge Mounted Half Span Truss, Type E Column Connection R, Elevated  
 Median Barrier Column Connection L, Open Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Columns near CSS/Median Connection Plates	Maximum section loss of approximately 37% was computed in section A-A of the left vertical column.	3	5	15
Weld Lines between Column Vertical Members and Supplemental Bracings	None.	1	3	3
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor to severe corrosion of the column was observed. Right column side: Minor corrosion of the column was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left column side: One U-bolt connected the column and the lower chord was loose on inside face. Right column side: All four U-bolts connected the column and the lower chord was loose.	4	3	12
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. One bolt connected the vertical sign support and the horizontal chord connection bracket was loose.	3	3	9
<b>TOTAL SCORES</b>				<b>122</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **176**

Minimum Total Score (Low Risk) = **44**

**Risk Category:**

Low Risk:  $44 \leq \text{Total Score} < 77$

Moderate Risk:  $77 \leq \text{Total Score} < 110$

High Risk:  $110 \leq \text{Total Score} < 143$

Very High Risk:  $143 \leq \text{Total Score} \leq 176$



## Inspection Summary for Retaining Wall Mounted Cantilever

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-98.76	Inspector Names:	1) Russ Stewart
Inspection Date: 12/05/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Minor corrosion of horizontal chords and secondary vertical posts was observed. Foreign objects in lower chords were damaged. Weld on the center horizontal light arm was broken. Damages of electrical distribution boxes were reported. Center light fixture was broken. Total score of this structure is 33 which is low risk based on our category given at the end of this page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Condition of Concrete in the Vicinity of Connections between Retaining Wall and Horizontal Chords	None.	1	3	3
Connections between the Retaining Wall and Horizontal Chords	None.	1	5	5
Nuts/Washers	None	1	5	5
Ultrasonic Inspection of Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. Foreign objects in lower chords were damaged.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. Weld on the center horizontal light arm was broken. Damages of electrical distribution boxes were reported. Center light fixture was broken.	3	3	9
<b>TOTAL SCORES</b>				<b>33</b>

### Score Interpretation:

Maximum Total Score (Very High Risk) = **96**  
Minimum Total Score (Low Risk) = **24**

### Risk Category:

Low Risk:  $24 \leq \text{Total Score} < 42$   
Moderate Risk:  $42 \leq \text{Total Score} < 60$   
High Risk:  $60 \leq \text{Total Score} < 78$   
Very High Risk:  $78 \leq \text{Total Score} \leq 96$





Inspection Summary for  
**Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount  
on Inside**

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-98.94	Inspector Names:	1) Russ Stewart
Inspection Date: 1/8/2013; 1/17/2013; 1/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum average section loss of 5% was computed in section A-A of the right vertical column. Leveling nuts #1 and #4 on top connection and leveling nut #1 on bottom connection on the right column side were loose. Concrete cracking in the retaining wall around the vertical column connections was reported. Four connecting bolts to the light arms were loose or broken. Total score of this structure is 86 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Drainage Issues	None.	1	1	1
Mounting Plates	Left/right column side: Minor corrosion of the mounting plates was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Minor corrosion of anchor bolts and top/leveling nuts/washers was observed. Right column side: Minor corrosion of anchor bolts and top/leveling nuts/washers on top connection was reported. Leveling nuts #1 and #4 on top connection and leveling nut #1 on bottom connection were loose.	3	5	15
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between Vertical Column and Mounting Plate	None.	1	5	5
Section Loss of Vertical Column near the Mounting Plate	Maximum average section loss of 5% was computed in section A-A of the right vertical column.	1	5	5
Vertical Weld Lines between Tubes Constituting the Vertical Column near the Column Base	None.	1	3	3



Inspection Summary for  
**Half Span with Retaining Wall Mount on Outside and Parapet Wall Mount  
on Inside**

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Supplemental Bracing Members and Their Welds.	Left/right column side: Minor corrosion of supplemental bracing members was observed. Right column side: 1/16" undercut on front faces of weld lines #1 and #2 was reported.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left/right column side: Minor corrosion of the vertical columns was observed.	2	3	6
Observations of the Retaining Wall around the Vertical Column Connections	Concrete cracking in the retaining wall around the vertical column connections was reported.	3	3	9
Connections between Vertical Column and Horizontal Chords	Left/right column side: Minor corrosion of bolts connected the vertical columns and the upper chords was observed. Left column side: Pack rust between plates/members on the upper chord was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. 22" area of small gauges was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Four connecting bolts to the light arms were loose or broken.	3	3	9

**TOTAL SCORES**

**86**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **188**

Minimum Total Score (Low Risk) = **47**

**Risk Category:**

Low Risk:  $47 \leq \text{Total Score} < 82$

Moderate Risk:  $82 \leq \text{Total Score} < 117$

High Risk:  $117 \leq \text{Total Score} < 152$

Very High Risk:  $152 \leq \text{Total Score} \leq 188$



Inspection Summary for  
**Half Span with Parapet Mounted on Inside and Shoulder Mounted on Outside**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-99.30	Inspector Names:	1) Russ Stewart
Inspection Date: 12/6/2012; 1/17/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum average section loss of 30% was computed in section A-A of the right vertical column. Minor to severe corrosion of the right vertical column was observed. One area of surface delamination (approximately 9" in length) of the right column just above the horizontal brace #3 was reported. Total score of this structure is 72 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under the Base Plate	None.	1	2	2
Base Plate and Mounting Plate	Right column side: Minor corrosion of the mounting plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	Right column side: #3 washer was deteriorating and moderately corroding.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Left Vertical Column and Mounting Plate	None.	1	5	5
Connection between Base Plate and Right Vertical Column	None.	1	5	5
Section Loss of Vertical Columns	Maximum average section loss of 30% was computed in section A-A of the right vertical column.	3	5	15



Inspection Summary for  
**Half Span with Parapet Mounted on Inside and Shoulder Mounted on  
 Outside**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Vertical Weld Lines between Tubes Constituting the Vertical Column near the Column Base (Left Side Column)	None.	1	3	3
Supplemental Bracing Members and Their Welds.	Left/right column side: Minor corrosion of supplemental bracing members was observed.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Column	Left column side: Minor corrosion of the left vertical column was observed. Small dents on the column above the column base were reported. Right column side: Minor to severe corrosion of the right vertical column was observed. One area of surface delamination (approximately 9" in length) just above the horizontal brace #3 was reported.	4	3	12
Connections between Vertical Column and Horizontal Chords	Left/right column side: Pack rust between plates/members in the upper chords was reported.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6

**TOTAL SCORES**

**72**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **216**

Minimum Total Score (Low Risk) = **54**

**Risk Category:**

Low Risk:  $54 \leq \text{Total Score} < 94$

Moderate Risk:  $94 \leq \text{Total Score} < 134$

High Risk:  $134 \leq \text{Total Score} < 174$

Very High Risk:  $174 \leq \text{Total Score} \leq 216$



# Inspection Summary for Bridge Frame Mount - Steel Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.63  
Inspection Date: 11/13/2012  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Minor to moderate corrosion of horizontal light arms was observed. 5" long concrete cracking on top of the left parapet connection at bolt #4 was reported. There were 24" long vertical cracks and 1.5" long horizontal cracks under the right parapet connection. 6" long concrete cracking on top of the right parapet connection at bolt #1 was recorded. Weld connected diagonal brace and steel girder at left horizontal light arm was broken. Total score of this structure is 75 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Bridge Frame Members and Attachments	Minor to moderate corrosion of horizontal light arms was observed. Pack rust on right horizontal light arm at sign support was reported. Horizontal and transverse braces had a minor corrosion.	3	3	9
Condition of Concrete in the Vicinity of Connections between Horizontal Brace and Bridge Parapet	Left parapet: 5" long concrete cracking on top of the left parapet connection at bolt #4 was observed. Right parapet: 24" long vertical cracks and 1.5" long horizontal cracks under the right parapet connection were observed. 6" long concrete cracking on top of the right parapet connection at bolt #1 was observed.	4	3	12
Connections between the Horizontal Braces and the Bridge Parapet	Minor corrosion of bolts and nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between the Horizontal Braces and the Vertical Sign Supports	Minor corrosion of bolts and nuts/washers was reported.	2	5	10



Inspection Summary for  
Bridge Frame Mount - Steel Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between the Vertical Sign Supports and the Horizontal Light Arms	Minor corrosion of bolts was observed.	2	5	10
Connections between the Horizontal Light Arms and the Steel Girder	Minor corrosion of bolts was observed.	2	5	10
Weld Connections between the Transverse Braces and the Light Arms	Weld connected diagonal brace and steel girder at left horizontal light arm was broken.	3	3	9
<b>TOTAL SCORES</b>				<b>75</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **136**

Minimum Total Score (Low Risk) = **34**

**Risk Category:**

Low Risk:  $34 \leq \text{Total Score} < 59$

Moderate Risk:  $59 \leq \text{Total Score} < 84$

High Risk:  $84 \leq \text{Total Score} < 109$

Very High Risk:  $109 \leq \text{Total Score} \leq 136$



## Inspection Summary for Bridge Frame Mount - Steel Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-77-101.64	Inspector Names:	1) Russ Stewart
Inspection Date: 11/13/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

### Overall Summary of Structure Condition and Recommendations

Weld connected the light plate (plate where light was attached on) and the horizontal light arm was cracked. 3" long concrete cracking was observed below the left parapet connection. Moderate deterioration from spalling and cracking of concrete was reported. Total score of this structure is 56 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Bridge Frame Members and Attachments	Minor corrosion of vertical sign supports, horizontal braces, and transverse braces was observed. Minor corrosion and deterioration of horizontal light arms was reported. Weld connected the light plate (plate where light was attached on) and the horizontal light arm was cracked.	3	3	9
Condition of Concrete in the Vicinity of Connections between Horizontal Brace and Bridge Parapet	3" long concrete cracking was observed below the left parapet connection. Moderate deterioration from spalling and cracking of concrete was reported.	3	3	9
Connections between the Horizontal Braces and the Bridge Parapet	Minor corrosion of bolts and nuts/washers was observed.	2	5	10
Ultrasonic Inspection of Anchor Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connections between the Horizontal Braces and the Vertical Sign Supports	Minor corrosion of bolts and nuts/washers was reported.	2	5	10



Inspection Summary for  
Bridge Frame Mount - Steel Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between the Vertical Sign Supports and the Horizontal Light Arms	None.	1	5	5
Connections between the Horizontal Light Arms and the Steel Girder	None.	1	5	5
Weld Connections between the Transverse Braces and the Light Arms	None.	1	3	3
<b>TOTAL SCORES</b>				<b>56</b>

<b>Score Interpretation:</b>	
Maximum Total Score (Very High Risk) =	<b>136</b>
Minimum Total Score (Low Risk) =	<b>34</b>
<b>Risk Category:</b>	
Low Risk:	$34 \leq \text{Total Score} < 59$
Moderate Risk:	$59 \leq \text{Total Score} < 84$
High Risk:	$84 \leq \text{Total Score} < 109$
Very High Risk:	$109 \leq \text{Total Score} \leq 136$





# Inspection Summary for Bridge Frame Mount - Concrete Box Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.92  
Inspection Date: 01/14/2013  
Inspection Contractor: Dennis Corporation

Inspector Names:  
1) Russ Stewart  
2) Troy Matthews  
3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Minor to moderate corrosion of horizontal light arms was observed. Minor corrosion of nuts/washers connected the vertical sign supports and the bridge parapet was reported. Total score of this structure is 55 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Bridge Frame Members and Attachments	Minor to moderate corrosion of horizontal light arms was observed. Minor corrosion of horizontal braces, angle brackets, and connection plates was reported.	3	3	9
Condition of Concrete in the Vicinity of Connections between Vertical Sign Supports and Bridge Parapet	None.	1	3	3
Condition of Concrete in the Vicinity of Connection between Horizontal Braces and Concrete Box Girder	None.	1	3	3
Connections between Vertical Sign Supports and Bridge Parapet	Minor corrosion of nuts/washers connected the vertical sign supports and the bridge parapet was reported.	2	5	10
Ultrasonic Inspection of Anchor Bolts Connecting Vertical Sign Supports to Bridge Parapet	Inspectors could not do UT inspections because the bolts were too long.	2	5	10



Inspection Summary for  
**Bridge Frame Mount - Concrete Box Girder Attached**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between Vertical Sign Supports and Horizontal Light Arms	None.	1	5	5
Connections between Horizontal Braces and Vertical Sign Supports	None.	1	5	5
Connections between Horizontal Braces and Concrete Box Girder	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts Connecting Horizontal Braces to Concrete Box Girder	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
<b>TOTAL SCORES</b>				<b>55</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **156**

Minimum Total Score (Low Risk) = **39**

**Risk Category:**

Low Risk:  $39 \leq \text{Total Score} < 68$

Moderate Risk:  $68 \leq \text{Total Score} < 97$

High Risk:  $97 \leq \text{Total Score} < 126$

Very High Risk:  $126 \leq \text{Total Score} \leq 156$



# Inspection Summary for Bridge Frame Mount - Concrete Box Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-57.98	Inspector Names:	1) Russ Stewart
Inspection Date: 01/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Right horizontal light arm was bent down. Minor to moderate corrosion of horizontal braces and connection plates was reported. Minor to moderate corrosion of nuts/washers was observed. Three of eight nuts (one on left side and two on right side) were loose. Total score of this structure is 65 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Bridge Frame Members and Attachments	Minor corrosion of horizontal light arms and angle brackets was observed. Right horizontal light arm was bent down. Minor to moderate corrosion of horizontal braces and connection plates was reported.	3	3	9
Condition of Concrete in the Vicinity of Connections between Vertical Sign Supports and Bridge Parapet	None.	1	3	3
Condition of Concrete in the Vicinity of Connection between Horizontal Braces and Concrete Box Girder	None.	1	3	3
Connections between Vertical Sign Supports and Bridge Parapet	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts Connecting Vertical Sign Supports to Bridge Parapet	Inspectors could not do UT inspections because the bolts were too close to the vertical sign support.	2	5	10



Inspection Summary for  
**Bridge Frame Mount - Concrete Box Girder Attached**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between Vertical Sign Supports and Horizontal Light Arms	None.	1	5	5
Connections between Horizontal Braces and Vertical Sign Supports	None.	1	5	5
Connections between Horizontal Braces and Concrete Box Girder	Minor to moderate corrosion of nuts/washers was observed. Three of eight nuts (one on left side and two on right side) were loose.	3	5	15
Ultrasonic Inspection of Anchor Bolts Connecting Horizontal Braces to Concrete Box Girder	Inspectors could not do UT inspections for the bolts.	2	5	10
<b>TOTAL SCORES</b>				<b>65</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **156**

Minimum Total Score (Low Risk) = **39**

**Risk Category:**

Low Risk:  $39 \leq \text{Total Score} < 68$

Moderate Risk:  $68 \leq \text{Total Score} < 97$

High Risk:  $97 \leq \text{Total Score} < 126$

Very High Risk:  $126 \leq \text{Total Score} \leq 156$



# Inspection Summary for Bridge Frame Mount - Concrete Box Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.15	Inspector Names:	1) Russ Stewart
Inspection Date: 01/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

One of eight bolts connected the right horizontal brace and the concrete box girder was loose. Total score of this structure is 57 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Bridge Frame Members and Attachments	Minor corrosion of horizontal light arms, horizontal braces, angle brackets, and connection plates was reported.	2	3	6
Condition of Concrete in the Vicinity of Connections between Vertical Sign Supports and Bridge Parapet	None.	1	3	3
Condition of Concrete in the Vicinity of Connection between Horizontal Braces and Concrete Box Girder	None.	1	3	3
Connections between Vertical Sign Supports and Bridge Parapet	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts Connecting Vertical Sign Supports to Bridge Parapet	Inspectors could not do UT inspections because the bolts were too close to I-beam.	2	5	10



Inspection Summary for  
**Bridge Frame Mount - Concrete Box Girder Attached**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between Vertical Sign Supports and Horizontal Light Arms	None.	1	5	5
Connections between Horizontal Braces and Vertical Sign Supports	None.	1	5	5
Connections between Horizontal Braces and Concrete Box Girder	One of eight bolts connected the right horizontal brace and the concrete box girder was loose.	2	5	10
Ultrasonic Inspection of Anchor Bolts Connecting Horizontal Braces to Concrete Box Girder	Inspectors could not do UT inspections for the bolts.	2	5	10
<b>TOTAL SCORES</b>				<b>57</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **156**

Minimum Total Score (Low Risk) = **39**

**Risk Category:**

Low Risk:  $39 \leq \text{Total Score} < 68$

Moderate Risk:  $68 \leq \text{Total Score} < 97$

High Risk:  $97 \leq \text{Total Score} < 126$

Very High Risk:  $126 \leq \text{Total Score} \leq 156$



# Inspection Summary for Bridge Frame Mount - Concrete Box Girder Attached

Prepared by  
Prof. Wael Zatar  
Marshall University



Structure Number: 1-20-64-58.25	Inspector Names:	1) Russ Stewart
Inspection Date: 12/19/2012; 01/19/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

## Overall Summary of Structure Condition and Recommendations

Minor to moderate corrosion of horizontal braces and connection plates was reported. Four of eight bolts connected the horizontal braces and the concrete box girder were loose (two on the left side and two on the right side). Total score of this structure is 60 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Bridge Frame Members and Attachments	Minor corrosion of horizontal light arms and angle brackets was observed. Minor to moderate corrosion of horizontal braces and connection plates was reported.	3	3	9
Condition of Concrete in the Vicinity of Connections between Vertical Sign Supports and Bridge Parapet	None.	1	3	3
Condition of Concrete in the Vicinity of Connection between Horizontal Braces and Concrete Box Girder	None.	1	3	3
Connections between Vertical Sign Supports and Bridge Parapet	None.	1	5	5
Ultrasonic Inspection of Anchor Bolts Connecting Vertical Sign Supports to Bridge Parapet	Inspectors could not do UT inspections because the bolts were too close to I-beam.	2	5	10



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Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Connections between Vertical Sign Supports and Horizontal Light Arms	None.	1	5	5
Connections between Horizontal Braces and Vertical Sign Supports	None.	1	5	5
Connections between Horizontal Braces and Concrete Box Girder	Four of eight bolts connected the horizontal braces and the concrete box girder were loose (two on the left side and two on the right side). Minor corrosion of weld connection was observed.	3	5	15
Ultrasonic Inspection of Anchor Bolts Connecting Horizontal Braces to Concrete Box Girder	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
<b>TOTAL SCORES</b>				<b>60</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **156**

Minimum Total Score (Low Risk) = **39**

**Risk Category:**

Low Risk:  $39 \leq \text{Total Score} < 68$

Moderate Risk:  $68 \leq \text{Total Score} < 97$

High Risk:  $97 \leq \text{Total Score} < 126$

Very High Risk:  $126 \leq \text{Total Score} \leq 156$





Inspection Summary for  
**Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on  
 Outside, Open Type Vertical Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-77-98.29	Inspector Names:	1) Russ Stewart
Inspection Date: 11/15/2012; 1/17/2013		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum average section loss of 25% was computed in section A-A of the right vertical column. Minor to severe corrosion of the right vertical column was reported. Total score of this structure is 90 which is low risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	None.	1	1	1
Grout Pad under Base Plate	None.	1	2	2
Base Plate and Mounting Plate	Minor corrosion of the base plate was observed.	2	5	10
Anchor Bolts, Nuts and Washers	None.	1	5	5
Ultrasonic Inspection of Anchor and Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Left Vertical Column	Minor corrosion of weld lines 1 and 2 connected the base plate and the left vertical column was reported.	2	5	10
Connection between Right Vertical Column and Mounting Plate	None.	1	5	5
Section Loss of Vertical Columns	Maximum average section loss of 25% was computed in section A-A of the right vertical column.	3	5	15



Inspection Summary for  
**Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on  
 Outside, Open Type Vertical Columns**

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 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Vertical Weld Lines between Tubes Constituting the Right Vertical Column near the Column Base	None.	1	3	3
Supplemental Bracing Members and Their Welds	Left/right column sides: Minor corrosion of supplemental bracing members was observed.	2	3	6
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Columns	Left column side: Minor to moderate corrosion of the left vertical column at the column base was observed. Right column side: Minor to severe corrosion of the right vertical column was reported.	4	3	12
Connections between Vertical Columns and Horizontal Chords	Left/right column sides: Pack rust between plates/members was reported. Minor corrosion of bolts connected the upper chord and the right vertical column was observed.	2	3	6
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed. 1/8" deep gauge on upper front of the upper chord was reported.	2	3	6
Attachments	Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6
<b>TOTAL SCORES</b>				<b>90</b>

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **216**

Minimum Total Score (Low Risk) = **54**

**Risk Category:**

Low Risk:  $54 \leq \text{Total Score} < 94$

Moderate Risk:  $94 \leq \text{Total Score} < 134$

High Risk:  $134 \leq \text{Total Score} < 174$

Very High Risk:  $174 \leq \text{Total Score} \leq 216$



Inspection Summary for  
**Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on Outside, Closed Type Vertical Columns**

Prepared by  
 Prof. Wael Zatar  
 Marshall University



Structure Number: 1-20-64-58.56	Inspector Names:	1) Russ Stewart
Inspection Date: 11/12/2012		2) Troy Matthews
Inspection Contractor: Dennis Corporation		3) Dwight Miller

**Overall Summary of Structure Condition and Recommendations**

Maximum section loss of 56% was computed in section A-A of the right vertical column. Mount support concrete base was below the road deck and soil collected under the base plate. Drain hole on bottom of the right vertical column was clogged. No washers on leveling nuts was reported. Weld line 1, connected between tubes constituting the left vertical column, did not appear to tie components together very securely. It was more concentrated on centerplate. Minor to very severe corrosion of the right vertical column was reported. Inspection plate at the lower chord was not secure. Total score of this structure is 105 which is moderate risk based on our category given at the end of the next page.

Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R x W)
Foundation	None.	1	3	3
Drainage Issues	Left column side: Mount support concrete base was below the road deck and soil collected under the base plate. Right column side: Drain hole on bottom of the right vertical column was clogged.	3	1	3
Grout Pad under Base Plate	None.	1	2	2
Base Plate and Mounting Plate	Left column side: Minor section loss and corrosion of the base plate was observed. Right column side: Minor corrosion and surface pitting of the mounting plate was reported.	2	5	10
Anchor Bolts, Nuts and Washers	Left column side: Minor corrosion of leveling nuts/washers was observed. Right column side: Minor corrosion of bolts and top/leveling nuts/washers was observed. No washers on leveling nuts was reported.	3	5	15
Ultrasonic Inspection of Anchor and Connection Bolts	Non-Relevant Indication (NRI): An indication that has no relation to a significant discontinuity.	1	5	5
Connection between Base Plate and Left Vertical Column	None.	1	5	5
Connection between Right Vertical Column and Mounting Plate	None.	1	5	5



Inspection Summary for  
**Half-Span with Shoulder Mounted on Inside and Parapet Wall Mounted on  
 Outside, Closed Type Vertical Columns**

Prepared by  
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 Marshall University



Component	Description of Deficiencies	Component Rating (R)	Component Importance Weight (W)	Component Score (S = R × W)
Section Loss of Vertical Columns	Maximum section loss of 56% was computed in section A-A of the right vertical column.	4	5	20
Vertical Weld Lines between Tubes Constituting Vertical Columns	Left column side: Weld line 1 started out as wide stringer then turned into a weave (1/16" undercut). It did not appear to tie components together very securely. It was more concentrated on centerplate. Weld line 2 was struck on the right vertical column on several areas. Right column side: Weld line 3 (between the upper and the lower chord) started out as a stringer then turned into a weave.	3	3	9
Interior of Vertical Column	N/A.	0	0	0
Exterior of Vertical Columns	Left column side: Minor corrosion of the left vertical column was observed. No handhole cover was presented on this column. Right column side: Minor to very severe corrosion of the right vertical column was reported. Inside handhole cover was off and outside handhole cover was on.	4	3	12
Connections between Vertical Columns and Horizontal Chords	Left column side: Connection plate at the lower chord was not secure.	3	3	9
Horizontal Chords and Secondary Vertical Posts	Minor corrosion of horizontal chords and secondary vertical posts was observed.	2	3	6
Attachments	Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported.	2	3	6

**TOTAL SCORES**

**105**

**Score Interpretation:**

Maximum Total Score (Very High Risk) = **204**

Minimum Total Score (Low Risk) = **51**

**Risk Category:**

Low Risk:  $51 \leq \text{Total Score} < 89$

Moderate Risk:  $89 \leq \text{Total Score} < 127$

High Risk:  $127 \leq \text{Total Score} < 165$

Very High Risk:  $165 \leq \text{Total Score} \leq 204$

**APPENDIX D**

**INSPECTION RATING**

**CRITERIA AND SCORE**

COMPONENT	RATING CRITERIA and SCORE				Component Importance Weight
	1 (Good)	2 (Fair)	3 (Poor)	4 (Severe)	
Foundation	The element shows no deterioration. There may be efflorescence and/or superficial cracking in the concrete but without affect on strength and/or serviceability.	Minor cracks and spalls may be present in the concrete foundation but there is no evidence of corrosion of exposed reinforcing rebar.	Some delaminations and/or spalls may be present in the concrete foundation and some reinforcing rebars may be exposed. Corrosion of rebar may be present but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the foundation or the sign structure.	Advanced deterioration. Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of the foundation and/or the sign structure.	3
Drainage Issues	None	Elements accumulates minor debris and moisture	Elements accumulates moderate debris and moisture	Elements accumulates high debris and moisture and are open to flooding and sedimentation	1
Grout Pad under Base Plate	No grout installed under base plate	No damage to moderate damage of mortar	Serious damage of mortar. Increased likelihood of accelerated structural anchor deterioration.	Widespread significant damage of mortar. The functional performance of the grout is significantly reduced. High likelihood of accelerated structural anchor deterioration.	2
Base Plates	No evidence of active corrosion. Surface coating is sound and functioning as intended to protect the metal surface.	Minor surface corrosion is present.	Any protective coating has failed. Surface pitting may be present but any notable section loss due to active corrosion is outside of the anchor bolt circle and does not warrant structural analysis.	Corrosion is advanced within the anchor bolt circle. Section loss is sufficient to warrant structural analysis to ascertain the impact on the ultimate strength and/or serviceability of the base plates and/or the sign structure.	5

COMPONENT		RATING CRITERIA and SCORE				Component Importance Weight
		1 (Good)	2 (Fair)	3 (Poor)	4 (Severe)	
Anchor Bolts (ABs), Nuts, Washers	One vertical support (4 ABs/base plate)	There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition.  If the portions of these elements under the base plate are not accessible for inspection due to the presence of grout, a rating of 2 should be assigned.	Minor corrosion of the elements may be present or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. The element are fully engaged.	Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged. One or more washers are missing.	Heavy corrosion of the elements may be present. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure. If any anchor bolts are cracked or sheared, or if any anchor nuts are missing or loose, this matter should be reported immediately.	5
	One vertical support (> 4 ABs/base plate)		Minor corrosion of the elements may be present or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. The element are fully engaged. One or more washers are missing.	Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged. 20% or less of the anchors are either cracked, sheared, or have a loose or missing nut.	Heavy corrosion of the elements may be present. 25% or more of the anchors are either cracked, sheared, or have a loose or missing nut. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.	
	Multiple vertical supports (4 ABs/base plate)		Minor corrosion of the elements may be present or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. One or more anchor nuts are tight but not fully engaged. One or more washers are missing.	Moderate corrosion of the elements may be present. One or more anchor nuts are tight but not fully engaged.	Heavy corrosion of the elements may be present. No more than one anchor bolt may be cracked or sheared. No more than one anchor nut may be loose or missing. If the condition is worse, this matter should be reported immediately. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.	
	Multiple vertical supports (> 4 ABs/base plate)		Minor corrosion of the elements may be present or the portions of these elements under the base plate are not accessible for inspection due to the presence of grout. One or more washers may be missing. No more than two loose anchor nuts or two tight anchor nuts but not fully engaged may be present.	Moderate corrosion of the elements may be present. More than two anchor nuts are tight but not fully engaged. No more than 25% of the anchor nuts may be loose.	Heavy corrosion of the elements may be present. 33% or more of the anchors are either cracked, sheared, or have a loose or missing nut. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.	

COMPONENT	RATING CRITERIA and SCORE				Component Importance Weight
	1 (Good)	2 (Fair)	3 (Poor)	4 (Severe)	
Ultrasonic Inspection of Anchor/Connection Bolts	UT signal indication shows a "Non-Relevant Indication (NRI)" (i.e. there has been no relation to a significant discontinuity) or it shows a signal magnitude ranging from 1% Full Screen High (FSH) to less than 10% FSH.	UT signal indication shows a signal magnitude ranging from 10% FSH to less than 30% FSH.	UT signal indication shows a signal magnitude ranging from 30% FSH to less than 50% FSH.	UT signal indication shows a signal magnitude more than 50% FSH.	5
Connection between Base Plate and Vertical Column	One or two minor weld crack are present. Cracks that are short in length and shallow in depth, which may be grinded out for repair.	Several hairline weld cracks are present. There is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the element and/or the sign structure.	Several hairline cracks are present and a single crack has visible width. Any condition where there is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.	The welded connection has been completely severed. Multiple cracks on structure have created a condition such that the structure is in imminent danger of collapse.	5
Section Loss of Vertical Column near Base Plate	<10%	10-20%	20-40%	>40%	5
Weld Lines between Column Vertical Members and Supplemental Bracing	One or two minor weld crack are present. Cracks that are short in length and shallow in depth, which may be grinded out for repair.	Several hairline weld cracks are present. There is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the element and/or the sign structure.	Several hairline cracks are present and a single crack has visible width. Any condition where there is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the elements and/or the sign structure.	The welded connection has been completely severed. Multiple cracks on structure have created a condition such that the structure is in imminent danger of collapse.	3
Exterior of Vertical Column	Elements are in new or like-new condition with no significant deficiencies.	Minor corrosion with no section loss, minor misalignments, or superficial damage to components may be observed.	Significant misalignment of components. Moderate corrosion or damage is present to one or more components.	Cracks propagating into any chord/post. Major or multiple element defects or section loss are present. Multiple elements warrant ultimate strength and/or serviceability analysis.	3






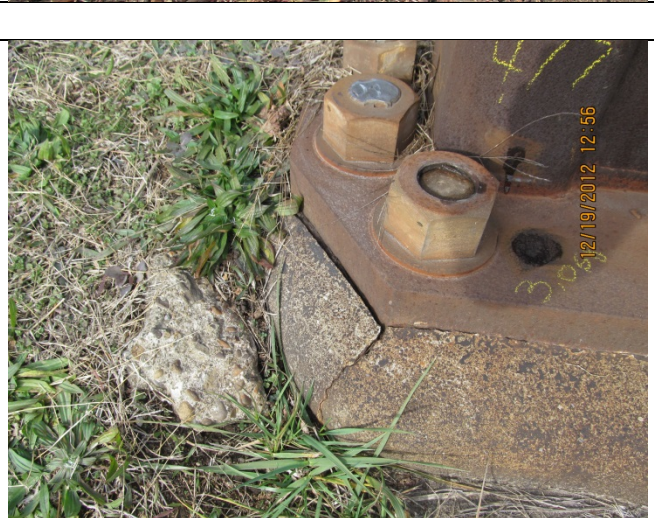
COMPONENT	RATING CRITERIA and SCORE				Component Importance Weight
	1 (Good)	2 (Fair)	3 (Poor)	4 (Severe)	
Connections between Vertical Column and Horizontal Chords	Elements are in new or like-new condition with no significant deficiencies.	Minor corrosion with no section loss, minor misalignments, or superficial damage to components may be observed.	Significant misalignment of components. Moderate corrosion or damage is present to one or more components.	Cracks propagating into any chord/post. Major or multiple element defects or section loss are present. Multiple elements warrant ultimate strength and/or serviceability analysis.	3
Horizontal Chords and Secondary Vertical Posts	Elements are in new or like-new condition with no significant deficiencies.	Minor corrosion with no section loss, minor misalignments, or superficial damage to components may be observed.	Significant misalignment of components. Moderate corrosion or damage is present to one or more components.	Cracks propagating into any chord/post. Major or multiple element defects or section loss are present. Multiple elements warrant ultimate strength and/or serviceability analysis.	3
Attachments	Elements are fully functional and in new or like-new condition with no significant deficiencies	Minor to moderate damage or deterioration of elements, however elements remain functional	Serious damage or deterioration of elements and the functional performance of the unit is reduced	Any collision damage or deterioration which is significant enough to threaten separation from the sign structure	3
<b>Score Interpretation:</b> Maximum Total Score (Very High Risk) = <b>184</b> Minimum Total Score (Low Risk) = <b>46</b> <b>Risk Category:</b> Low Risk: $46 \leq \text{Total Score} < 80$ Moderate Risk: $80 \leq \text{Total Score} < 114$ High Risk: $114 \leq \text{Total Score} < 148$ Very High Risk: $148 \leq \text{Total Score} \leq 184$					

# **APPENDIX E**

## **SAMPLE ELEMENT**


### **RATING**

Foundation	Description
	<p>No deficiencies were found in the foundation. This element was rated as 1 (Structure #01-20-64-55.45 - type 1.2).</p>
	<p>Concrete spalling of the foundation under the left vertical column was observed. This element was rated as 2 (Structure #01-20-77-100.98 - type 3.1).</p>




Grout Pad under Base Plate	Description
	<p>No grout pad was present under the base plate. This element was rated as 1 (Structure #01-20-64-55.85 - type 1.1).</p>
	<p>Mortar cracking of the grout pad under the base plate at the left vertical column was observed. This element was rated as 2 (Structure #01-20-77-101.23 - type 3.1).</p>




Base Plates	Description
	<p>No deficiencies were found in the base plate. This element was rated as 1 (Structure #01-20-64-56.50 - type 1.1).</p>
	<p>Minor corrosion of the base plates on the left/right vertical columns was observed. This element was rated as 2 (Structure #01-20-77-100.08 - type 3.2).</p>
	<p>Minor section loss and surface pitting of the base plate on the median vertical column was reported. Minor to moderate corrosion of the base plate was observed. This element was rated as 3 (Structure #01-20-64-58.30 - type 5).</p>




Base Plates (Cont'd)	Description
	<p>Moderate section loss and deterioration/corrosion of the base plate at the shoulder vertical column were observed. Severe surface pitting of the base plate was reported. This element was rated as 4 (Structure #01-20-64-57.52 - type 4).</p>




Anchor Bolts, Nuts, and Washers	Description
	<p>No deficiencies of the anchor bolts, nuts, and washers were found. This element was rated as 1 (Structure #01-20-77-101.24 - type 1.1).</p>
	<p>Two anchor bolts were slightly cut short. Minor corrosion of two anchor bolts and leveling nuts/washers was observed. This element was rated as 2 (Structure #01-20-64-57.83 - type 1.1).</p>
	<p>Minor to moderate corrosion and deterioration of leveling nuts/washers was observed. This element was rated as 3 (Structure #01-20-64-55.85 - type 1.1).</p>



Anchor Bolts, Nuts, and Washers (Cont'd)	Description
	<p>Nine anchor bolts on the shoulder vertical column were cut short. Minor corrosion of top nuts/washers was observed. Minor to moderate corrosion of leveling nuts/washers was reported. This element was rated as 4 (Structure #01-20-79-01.12 - type 4).</p>






Connection between Base Plate and Vertical Column	Description
	<p>No deficiencies of the connection between the base plate and the vertical column were found. This element was rated as 1 (Structure #01-20-64-52.40 - type 1.1).</p>
	<p>Minor corrosion of weld line 1 connected between the base plate and the vertical column was observed. Weld reinforcement had been starting to deteriorate. This element was rated as 2 (Structure #01-20-77-97.32 - type 1.1).</p>
	<p>Minor to moderate corrosion of weld lines 1 and 2 connected between the base plate and the median vertical column was observed. This element was rated as 3 (Structure #01-20-79-01.12 - type 4).</p>




Connection between Base Plate and Vertical Column (Cont'd)	Description
	<p>Severe corrosion of weld lines connected between the base plate and the shoulder vertical column was observed. This element was rated as 4 (Structure #01-20-64-57.52 - type 4).</p>







Weld Lines between Column Vertical Members and Supplemental Bracing	Description
	<p>No deficiencies of the weld lines between the column vertical members and the supplemental bracing were found. This element was rated as 1 (Structure #01-20-60-11.44 - type 3.3.1).</p>
	<p>Corrosion on bottom of the weld lines connected between the median vertical column and the supplemental bracing was observed. This element was rated as 2 (Structure #01-20-64-57.52 - type 4).</p>

Exterior of Vertical Column	Description
	<p>Minor corrosion of the vertical column was observed. This element was rated as 2 (Structure #01-20-64-52.40 - type 1.1).</p>
	<p>Moderate corrosion of the vertical column under the bottom splice plate was observed. This element was rated as 3 (Structure #01-20-64-56.04 - type 1.1).</p>
	<p>Handhole cover at the shoulder vertical column was not in place. Minor to very severe corrosion of the shoulder column was observed. This element was rated as 4 (Structure #01-20-77-101.84 - type 3.3.2).</p>



Connections between Vertical Column and Horizontal Chords	Description
	<p>No deficiencies of the connections between the vertical column and the horizontal chord were found. This element was rated as 1 (Structure #01-20-64-52.40 - type 1.1).</p>
	<p>Minor corrosion of bolts connected between the lower chord and the vertical column was observed. Pack rust between plates/members was reported. This element was rated as 2 (Structure #01-20-64-55.85 - type 1.1).</p>
	<p>Pack rust between plates/members was observed. One U-bolt connected the shoulder vertical column and the upper chord was loose. This element was rated as 3 (Structure #01-20-64-57.53 - type 4).</p>


Connections between Vertical Column and Horizontal Chords (Cont'd)	Description
	<p>Minor corrosion of bolts connected between the vertical column and the lower chord was observed. Severe pack rust between plates/members in the lower chord was reported. One bolt was completely loose and the rest were somewhat loose. This element was rated as 4 (Structure #01-20-64-57.83 - type 1.1).</p>

Horizontal Chords and Secondary Vertical Posts	Description
	<p>No deficiencies of the horizontal chords and secondary vertical posts were found. This element was rated as 1 (Structure #01-20-64-57.88 - type 1.1).</p>
	<p>Minor corrosion of horizontal chords and secondary vertical posts was observed. This element was rated as 2 (Structure #01-20-64-58.54 - type 1.1).</p>
	<p>Minor to moderate corrosion of the lower chord was observed. This element was rated as 3 (Structure #01-20-77-102.49 - type 1.1).</p>



Attachments	Description
	<p>No deficiencies of the attachments were found. This element was rated as 1 (Structure #01-20-77-97.32 - type 1.1).</p>
	<p>Minor corrosion of horizontal light arms and vertical sign support to horizontal chord connection bracket was observed. Pack rust between light arm JB's and the lower chord was reported. This element was rated as 2 (Structure #01-20-77-97.95 - type 1.1).</p>
	<p>Minor corrosion of horizontal light arms was observed. Pack rust between light arm JB's and the lower chord was reported. LB from the electrical box was corroded. This element was rated as 3 (Structure #01-20-64-55.12 - type 1.1).</p>



Attachments (Cont'd)	Description
 <p>The top photograph shows a highway interchange with overhead signs. The left sign is green with white text, indicating 'I-77 NORTH' and 'Parkersburg' with a left-turn arrow. The right sign is green with white text, indicating 'TO SOUTH' and 'I-64 I-77 Charleston' with a right-turn arrow. The background shows a steep, rocky hillside. A timestamp '10/19/2012 09:20' is visible in the bottom right corner of the photo.</p> <p>The bottom photograph is a close-up of the steel structure supporting the signs. It shows a horizontal steel arm and vertical posts. There is significant rust and corrosion on the steel, particularly on the horizontal arm. A timestamp '10/19/2012 10:13' is visible in the bottom right corner of the photo.</p>	<p>Right horizontal light arm had impact damage. Pack rust between light arm JB's and the lower chord was observed. L-brackets connecting the supports and the chords had a minor corrosion. Steel mesh was partially detached from secondary vertical posts. Some deformation and damage to other areas were reported. This element was rated as 4 (Structure #01-20-79-00.68 - type 3.3.1).</p>

**APPENDIX F**  
**MAXIMUM SECTION**  
**LOSS NEAR BASE**  
**PLATE**

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-064-52.40	1.1	Column	Section A-A	0.5	0.468	0.426	0.468	0.423	0.491	0.459	0.461	15
			Section B-B	0.458	0.458	0.472	0.453					9
01-20-064-55.12	1.1	Column	Section A-A	0.476	0.48	0.477	0.474	0.458	0.461	0.478	0.471	8
			Section B-B	0.472	0.472	0.467	0.47					7
01-20-064-55.85	1.1	Column	Section A-A	0.496	0.493	0.472	0.491	0.375	0.392	0.486	0.469	25
			Section B-B	0.48	0.492	0.468	0.488					6
01-20-064-56.04	1.1	Column	Section A-A	0.463	0.483	0.476	0.489	0.345	0.358	0.485	0.478	31
			Section B-B	0.489	0.493	0.472	0.486					6
01-20-064-56.50	1.1	Column	Section A-A	0.487	0.493	0.462	0.473	0.361	0.341	0.473	0.479	32
			Section B-B	0.48	0.469	0.465	0.47					7
01-20-064-57.83	1.1	Column	Section A-A	0.476	0.471	0.469	0.499	0.478	0.465	0.487	0.474	7
			Section B-B	0.465	0.488	0.478	0.485					7
01-20-064-57.88	1.1	Column	Section A-A	0.474	0.439	0.475	0.47	0.483	0.493	0.473	0.475	12
			Section B-B	0.456	0.458	0.465	0.452					10
01-20-064-58.27	1.1	Column	Section A-A	0.458	0.452	0.401	0.428	0.475	0.486	0.478	0.439	20
			Section B-B	0.481	0.485	0.48	0.489					4
01-20-064-58.54	1.1	Column	Section A-A	0.488	0.489	0.484	0.498	0.437	0.454	0.489	0.48	13
			Section B-B	0.482	0.479	0.471	0.485					6
01-20-077-097.32	1.1	Column	Section A-A	0.43	0.491	0.475	0.471	0.386	0.382	0.475	0.478	24
			Section B-B	0.496	0.473	0.492	0.476					5
01-20-077-097.95	1.1	Column	Section A-A	0.45	0.426	0.468	0.47	0.341	0.346	0.474	0.473	32
			Section B-B	0.464	0.47	0.462	0.473					8
01-20-077-098.57	1.1	Column	Section A-A	0.459	0.476	0.475	0.476	0.433	0.43	0.472	0.476	14
			Section B-B	0.487	0.478	0.463	0.476					7
01-20-077-101.24	1.1	Column	Section A-A	0.766	0.77	0.496	0.493	0.731	0.699	0.494	0.506	1
			Section B-B	0.781	0.499	0.736	0.491					2
01-20-077-102.49	1.1	Column	Section A-A	0.412	0.466	0.478	0.485	0.39	0.344	0.503	0.49	31
			Section B-B	0.468	0.478	0.466	0.482					7
01-20-060-11.48	1.2	Column	Section A-A	0.453	0.464	0.454	0.468	0.47	0.456	0.35	0.334	33
			Section B-B	0.459	0.456	0.458	0.461					9
01-20-060-12.97	1.2	Column	Section A-A	0.485	0.486	0.492	0.488	0.483	0.484	0.472	0.397	21
			Section B-B	0.489	0.476	0.488	0.47					6

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-060-13.07	1.2	Column	Section A-A	0.478	0.474	0.47	0.47	0.471	0.475	0.427	0.416	17
			Section B-B	0.476	0.469	0.469	0.465					7
01-20-064-53.73	1.2	Column	Section A-A	0.454	0.456	0.422	0.478	0.303	0.351	0.437	0.464	39
			Section B-B	0.447	0.475	0.452	0.433					13
01-20-064-54.61	1.2	Column	Section A-A	0.457	0.462	0.476	0.442	0.425	0.443	0.441	0.474	15
			Section B-B	0.444	0.426	0.456	0.462					15
01-20-064-55.45	1.2	Column	Section A-A	0.506	0.499	0.473	0.496	0.493	0.494	0.474	0.472	6
			Section B-B	0.498	0.473	0.499	0.478					5
01-20-064-58.10	1.2	Column	Section A-A	0.481	0.491	0.476	0.488	0.485	0.483	0.48	0.484	5
			Section B-B	0.484	0.475	0.481	0.478					5
01-20-077-101.58	1.2	Column	Section A-A	0.489	0.492	0.5	0.504	0.5	0.503	0.394	0.446	21
			Section B-B	0.498	0.474	0.505	0.475					5
01-20-077-101.68	1.2	Column	Section A-A	0.487	0.484	0.489	0.481	0.482	0.485	0.449	0.357	29
			Section B-B	0.487	0.454	0.48	0.458					9
01-20-119-19.54	1.2	Column	Section A-A	0.488	0.489	0.503	0.498	0.504	0.485	0.512	0.463	7
			Section B-B	0.487	0.512	0.506	0.506					3
01-20-119-19.57	1.2	Column	Section A-A	0.499	0.496	0.487	0.488	0.49	0.493	0.453	0.48	9
			Section B-B	0.501	0.373	0.485	0.474					25
01-20-064-58.74	2.1	Column	Section A-A	0.496	0.749	0.494						1
			Section B-B	0.51	0.757	0.499						0
01-20-077-100.89	2.1	Column	Section A-A	0.496	0.787	0.498						1
			Section B-B	0.502	0.783	0.502						0
01-20-077-100.91	2.1	Column	Section A-A	0.485	0.782	0.49						3
			Section B-B	0.484	0.784	0.496						3
01-20-077-098.45	2.2	Column	Section A-A	0.447	0.483	0.452	0.481	0.408				18
			Section B-B	0.476	0.495	0.479	0.494	0.467	0.478	0.49	0.474	7
01-20-077-099.10	2.2	Column	Section A-A	0.485	0.491	0.491	0.49	0.483				3
			Section B-B	0.477	0.479	0.501	0.483	0.481	0.472	0.487	0.478	6
01-20-077-100.98	3.1	Left Column	Section A-A	0.481	0.503	0.47	0.486	0.491	0.491	0.486	0.494	6
			Section B-B	0.483	0.486	0.488	0.522	0.483	0.493	0.481	0.511	4
		Right Column	Section A-A	0.47	0.468	0.48	0.451	0.477	0.481	0.458	0.479	10
			Section B-B	0.483	0.484	0.481	0.506	0.481	0.48	0.48	0.513	4

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-077-101.23	3.1	Left Column	Section A-A	0.487	0.498	0.482	0.506	0.477	0.506	0.493	0.525	5
			Section B-B	0.488	0.493	0.488	0.528	0.487	0.507	0.483	0.522	3
		Right Column	Section A-A	0.491	0.478	0.504	0.519	0.496	0.494	0.457	0.537	9
			Section B-B	0.498	0.489	0.494	0.53	0.5	0.506	0.497	0.54	2
01-20-077-100.08	3.2	Left Column	Section A-A	0.48	0.526	0.469	0.332	0.399	0.37			34
			Section B-B	0.476	0.473	0.468	0.482	0.492	0.491			6
		Right Column	Section A-A	0.478	0.528	0.47	0.495	0.535	0.498			6
			Section B-B	0.476	0.47	0.476	0.482	0.488	0.49			6
01-20-077-102.65	3.2	Left Column	Section A-A	0.504	0.496	0.5	0.406	0.42	0.462			19
			Section B-B	0.491	0.485	0.492	0.519	0.52	0.514			3
		Right Column	Section A-A	0.505	0.516	0.515	0.517	0.507	0.513			-1
			Section B-B	0.515	0.511	0.517	0.52	0.515	0.511			-2
01-20-077-103.14	3.2	Left Column	Section A-A	0.498	0.495	0.503	0.463	0.408	0.416			18
			Section B-B	0.498	0.496	0.496	0.511	0.502	0.522			1
		Right Column	Section A-A	0.457	0.465	0.456	0.449	0.435	0.492			13
			Section B-B	0.444	0.446	0.451	0.461	0.439	0.442			12
01-20-077-103.38	3.2	Left Column	Section A-A	0.452	0.439	0.435	0.365	0.403	0.401			27
			Section B-B	0.455	0.435	0.427	0.491	0.484	0.49			15
		Right Column	Section A-A	0.519	0.525	0.533	0.529	0.526	0.537			-4
			Section B-B	0.553	0.521	0.524	0.524	0.524	0.521			-4
01-20-119-18.46	3.2	Left Column	Section A-A	0.494	0.492	0.49	0.363	0.409	0.475			27
			Section B-B	0.495	0.492	0.491	0.489	0.487	0.494			3
		Right Column	Section A-A	0.489	0.484	0.481	0.481	0.478	0.487			4
			Section B-B	0.482	0.479	0.483	0.48	0.48	0.481			4
01-20-060-11.44	3.3.1	Left Column	Section A-A	0.456	0.439	0.494	0.437	0.439	0.492			13
			Section B-B	0.457	0.448	0.481	0.467	0.448	0.467			10
		Right Column	Section A-A	0.45	0.467	0.394	0.378	0.372	0.434			26
			Section B-B	0.452	0.459	0.454	0.453	0.423	0.44			15
01-20-064-53.72	3.3.1	Left Column	Section A-A	0.482	0.485	0.457	0.443	0.449	0.49			11
			Section B-B	0.492	0.488	0.462	0.457	0.456	0.494			9
		Right Column	Section A-A	0.452	0.461	0.434	0.405	0.421	0.47			19
			Section B-B	0.455	0.451	0.454	0.454	0.438	0.456			12

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-064-55.46	3.3.1	Left Column	Section A-A	0.434	0.489	0.436	0.439	0.429	0.472			14
			Section B-B	0.492	0.489	0.498	0.488	0.484	0.471			6
		Right Column	Section A-A	0.494	0.491	0.414	0.358	0.348	0.484			30
			Section B-B	0.496	0.493	0.474	0.473	0.474	0.489			5
01-20-064-55.48	3.3.1	Left Column	Section A-A	0.429	0.453	0.454	0.45	0.453	0.458			14
			Section B-B	0.47	0.472	0.489	0.486	0.489	0.476			6
		Right Column	Section A-A	0.506	0.507	0.437	0.407	0.398	0.508			20
			Section B-B	0.504	0.506	0.513	0.508	0.511	0.507			-1
01-20-079-00.68	3.3.1	Left Column	Section A-A	0.487	0.211	0.414	0.462	0.418	0.489			58
			Section B-B	0.483	0.477	0.475	0.479	0.474	0.49			5
		Right Column	Section A-A	0.484	0.495	0.497	0.487	0.495	0.477			5
			Section B-B	0.481	0.48	0.486	0.485	0.489	0.476			5
01-20-079-01.57	3.3.1	Left Column	Section A-A	0.483	0.481	0.494	0.484	0.488	0.485			4
			Section B-B	0.486	0.482	0.491	0.485	0.484	0.484			4
		Right Column	Section A-A	0.443	0.457	0.499	0.488	0.482	0.423			15
			Section B-B	0.472	0.478	0.48	0.483	0.48	0.476			6
01-20-077-101.84	3.3.2	Left Column	Section A-A	0.471	0.477	0.36	0.299	0.294	0.467			41
			Section B-B	0.476	0.468	0.507	0.497	0.511	0.466			7
		Right Column	Section A-A	0.462	0.434	0.429	0.443	0.448	0.453			14
			Section B-B	0.482	0.483	0.479	0.474	0.471	0.47			6
01-20-064-57.87	3.4	Left Column	Section A-A	0.322	0.291	0.366	0.391					42
			Section B-B	0.446	0.403	0.419	0.463					19
		Right Column	Section A-A	0.394	0.406	0.412	0.404					21
			Section B-B	0.424	0.439	0.442	0.453					15
01-20-064-57.89	3.4	Left Column	Section A-A	0.348	0.363	0.389	0.405					30
			Section B-B	0.463	0.45	0.459	0.464					10
		Right Column	Section A-A	0.42	0.348	0.427	0.419					30
			Section B-B	0.467	0.453	0.448	0.46					10
01-20-064-55.00	4	Left Column	Section A-A	0.496	0.485	0.492	0.387	0.352	0.331			34
			Section B-B	0.493	0.487	0.488	0.49	0.487	0.496			3
		Right Column	Section A-A	0.428	0.444	0.444	0.444	0.485	0.465			14
			Section B-B	0.485	0.48	0.489	0.489	0.486	0.49			4

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-064-56.33	4	Left Column	Section A-A	0.487	0.425	0.407	0.394	0.385	0.341	0.418	0.295	41
			Section B-B	0.481	0.484	0.481	0.475	0.474	0.478			5
		Right Column	Section A-A	n/a	0.473	0.465	0.468	0.47	n/a			7
			Section B-B	0.489	0.487	0.49	0.489	0.488	0.486			3
01-20-064-57.51	4	Left Column	Section A-A	0.494	0.491	0.497	0.396	0.373	0.389			25
			Section B-B	0.487	0.487	0.495	0.486	0.481	0.48			4
		Right Column	Section A-A	n/a	0.376	0.376	0.425	0.483	n/a			25
			Section B-B	0.489	0.485	0.488	0.484	0.476	0.483			5
01-20-064-57.52	4	Left Column	Section A-A	0.479	0.441	0.483	0.303	0.352	0.345			39
			Section B-B	0.49	0.488	0.492	0.484	0.474	0.484			5
		Right Column	Section A-A	0.413	0.413	n/a	n/a	0.45	0.453			17
			Section B-B	0.483	0.485	0.485	0.491	0.485	0.488			3
01-20-064-57.53	4	Left Column	Section A-A	0.419	0.432	0.426	0.325	0.256	0.247			51
			Section B-B	0.493	0.49	0.49	0.487	0.495	0.484			3
		Right Column	Section A-A	0.394	0.432	n/a	n/a	0.25	0.351			50
			Section B-B	0.483	0.489	0.494	0.489	0.487	0.48			4
01-20-077-099.98	4	Left Column	Section A-A	0.489	0.498	0.497	0.402	0.407	0.351			30
			Section B-B	0.485	0.496	0.489	0.503	0.492	0.496			3
		Right Column	Section A-A	0.463	0.496	0.502	0.469	0.424	0.474			15
			Section B-B	0.577	0.524	0.522	0.485	0.481	0.488			4
01-20-077-100.12	4	Left Column	Section A-A	0.48	0.481	0.484	0.453	0.442	0.433			13
			Section B-B	0.482	0.48	0.481	0.523	0.512	0.523			4
		Right Column	Section A-A	0.557	0.539	0.502	0.478	0.481	0.535			4
			Section B-B	0.542	0.25	0.543	0.486	0.503	0.493			50
01-20-079-01.12	4	Left Column	Section A-A	0.365	0.353	0.406	0.496	0.478	0.498			29
			Section B-B	0.493	0.466	0.494	0.489	0.49	0.49			7
		Right Column	Section A-A	0.417	0.439	n/a	n/a	0.469	0.463	0.421	0.409	18
			Section B-B	0.49	0.492	0.493	0.496	0.5	0.493			2



Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-064-58.30	5	Left Column	Section A-A	0.494	0.495	0.497	0.5	0.498	0.496			1
			Section B-B	0.497	0.491	0.491	0.494	0.492	0.497			2
		Median Column	Section A-A	0.432	0.452	0.456	0.251	0.274	0.236	0.383	0.419	53
			Section B-B	0.475	0.482	0.48	0.476	0.483	0.474			5
		Right Column	Section A-A	0.478	0.469	0.473	0.484	0.484	0.484			6
			Section B-B	0.473	0.478	0.478	0.485	0.482	0.476			5
01-20-077-099.58	5	Left Column	Section A-A	0.518	0.515	0.517	0.397	0.429	0.389			22
			Section B-B	0.512	0.513	0.519	0.517	0.502	0.508			0
		Median Column	Section A-A	n/a	0.422	0.462	0.494	0.47	n/a			16
			Section B-B	0.476	0.476	0.475	0.475	0.48	0.472			6
		Right Column	Section A-A	0.554	0.548	0.552	0.5	0.49	0.502			2
			Section B-B	0.546	0.542	0.545	0.492	0.491	0.496			2
01-20-064-58.55	6.1.1	Left Column	Section A-A	0.483	0.478	0.508	0.478	0.48				4
			Section B-B	0.492	0.482	0.489	0.506	0.485	0.482	0.492	0.42	16
		Right Column	Section A-A	0.491	0.473	0.503	0.49	0.498				5
			Section B-B	0.49	0.482	0.483	0.507	0.499	0.492	0.499	0.517	4
01-20-077-100.88	6.1.1	Left Column	Section A-A	0.49	0.487	0.511	0.481	0.482				4
			Section B-B	0.49	0.485	0.492	0.526	0.49	0.492	0.493	0.527	3
		Right Column	Section A-A	0.397	0.345	0.511	0.493	0.495				31
			Section B-B	0.491	0.506	0.49	0.518	0.491	0.492	0.49	0.48	4
01-20-077-100.90	6.1.1	Left Column	Section A-A	0.494	0.496	0.525	0.481	n/a				4
			Section B-B	0.492	0.493	0.494	0.526	0.501	0.502	0.501	0.522	2
		Right Column	Section A-A	0.502	0.499	0.52	0.497	0.5				1
			Section B-B	0.502	0.502	0.51	0.53	0.5	0.5	0.498	0.521	0
01-20-077-100.72	6.1.2	Left Column	Section A-A	0.477	0.479	0.413	0.469	0.468				17
			Section B-B	0.493	0.496	0.486	0.509	0.482	0.475	0.489	0.468	6
		Right Column	Section A-A	0.492	0.494	0.517	0.491	0.496				2
			Section B-B	0.487	0.49	0.493	0.515	0.486	0.491	0.494	0.522	3
01-20-077-100.34	6.2.1	Left Column	Section A-A	0.495	0.488	0.409	0.376					25
			Section B-B	0.49	0.484	0.489	0.478	0.47	0.437			13
		Right Column	Section A-A	0.483	0.488	0.481	0.483					4
			Section B-B	0.487	0.485	0.495	0.482	0.481	0.485			4



Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-077-100.39	6.2.1	Left Column	Section A-A	0.485	0.479	0.379	0.389					24
			Section B-B	0.486	0.488	0.486	0.483	0.453	0.461			9
		Right Column	Section A-A	0.489	0.483	0.489	0.495					3
			Section B-B	0.489	0.482	0.484	0.492	0.5	0.493			4
01-20-077-100.16	6.2.2	Left Column	Section A-A	0.487	0.495	0.488	0.489					3
			Section B-B	0.494	0.49	0.488	0.489	0.489	0.485			3
		Right Column	Section A-A	0.474	0.481	0.339	0.378					32
			Section B-B	0.487	0.488	0.487	0.483	0.491	0.485			3
01-20-077-100.22	6.2.2	Left Column	Section A-A	0.477	0.481	0.48	0.46					8
			Section B-B	0.482	0.485	0.488	0.485	0.489	0.488			4
		Right Column	Section A-A	0.487	0.487	0.295	0.353					41
			Section B-B	0.49	0.491	0.491	0.485	0.485	0.493			3
01-20-077-100.58	6.2.2	Left Column	Section A-A	0.492	0.49	0.394	0.354					29
			Section B-B	0.5	0.487	0.494	0.492	0.491	0.479			4
		Right Column	Section A-A	0.495	0.491	0.49	0.489					2
			Section B-B	0.494	0.493	0.491	0.492	0.485	0.492			3
01-20-064-57.60	6.3	Left Column	Section A-A	n/a	n/a	n/a	n/a	n/a	n/a			
			Section B-B	n/a	n/a	n/a	n/a	n/a	n/a			
01-20-064-57.77	6.3	Right Column	Section A-A	n/a	n/a	n/a	n/a	n/a	n/a			
			Section B-B	n/a	n/a	n/a	n/a	n/a	n/a			
01-20-60/62-00.22	6.4	Left Column	Section A-A	0.489	0.484	0.448	0.426	0.425				15
			Section B-B	0.491	0.486	0.489	0.48	0.482	0.481			4
		Right Column	Section A-A	0.374	0.378	0.363	0.408	0.496				27
			Section B-B	0.488	0.492	0.486	0.473	0.44	0.47			12
01-20-60/62-00.39	6.4	Left Column	Section A-A	0.457	0.363	0.381	0.504					27
			Section B-B	0.48	0.488	0.486	0.477	0.456	0.474			9
		Right Column	Section A-A	0.465	0.45	0.406	0.424					19
			Section B-B	0.479	0.488	0.484	0.481	0.475	0.48			5
01-20-077-100.09	6.5	Left Column	Section A-A	0.509	0.489	0.495	0.512	0.367	0.449	0.363	0.404	27
			Section B-B	0.488	0.489	0.501	0.493	0.491	0.495	0.49	0.481	4
		Right Column	Section A-A	0.487	0.498	0.489	0.536	0.343	0.348	0.367	0.373	31
			Section B-B	0.488	0.487	0.496	0.492	0.496	0.496	0.494	0.502	3

Structure No.	Structure Type	Vertical Member	Cross Section	Thickness Measurement Locations (Thickness Unit: Inch)								Section Loss (%)
				1	2	3	4	5	6	7	8	
01-20-064-57.91	6.6	Left Column	Section A-A	0.439	0.465	n/a	n/a	0.315	0.336			37
			Section B-B	0.482	0.481	0.489	0.479	0.47	0.484			6
		Right Column	Section A-A	0.483	0.478	0.485	0.483	0.482	0.481			4
			Section B-B	0.485	0.478	0.48	0.485	0.476	0.478			5
01-20-077-098.76	7	n/a										
01-20-077-098.94	8	Left Column	Section A-A	0.487	0.482	0.481	0.483					4
			Section B-B	0.494	0.49	0.482	0.484	0.482	0.487			4
		Right Column	Section A-A	0.473	0.476	0.485	0.51					5
			Section B-B	n/a	0.492	0.487	0.487	0.502	n/a			3
01-20-077-099.30	9	Left Column	Section A-A	0.47	0.476	0.489	0.49					6
			Section B-B	0.481	0.483	0.489	0.496	0.492	0.491			4
		Right Column	Section A-A	0.491	0.487	0.49	0.351	0.349	0.4			30
			Section B-B	0.486	0.494	0.491	0.481	0.489	0.479			4
01-20-077-101.63	10.1	n/a										
01-20-077-101.64	10.1	n/a										
01-20-064-57.92	10.2	n/a										
01-20-064-57.98	10.2	n/a										
01-20-064-58.15	10.2	n/a										
01-20-064-58.25	10.2	n/a										
01-20-077-098.29	11.1	Left Column	Section A-A	0.488	0.483	0.42	0.424	0.489	0.486			16
			Section B-B	0.485	0.5	0.48	0.485	0.484	0.485			4
		Right Column	Section A-A	0.489	0.483	0.376	0.391					25
			Section B-B	0.503	0.482	0.483	0.487	0.476	0.474			5
01-20-064-58.56	11.2	Left Column	Section A-A	0.515	0.498	0.502	0.493	0.453	0.481	0.493	0.512	9
			Section B-B	0.489	0.484	0.49	0.506	0.487	0.483	0.482	0.514	4
		Right Column	Section A-A	0.497	0.382	0.434	0.431	0.222				56
			Section B-B	0.484	0.498	0.487	0.519	0.483	0.485	0.27	0.509	46