

April 10, 2023  
Project No.: 20234746.001A

Mr. Karl Kranz  
The Maryland Zoo in Baltimore  
1876 Mansion House Drive  
Baltimore, MD 21217  
p: 443.552.3350  
c: 717.825.0948

Subject: Marsh Aviary Boardwalk – Structural Condition Assessment

Dear Mr. Kranz:

At your request, on March 22, 2023, Century Engineering, LLC (CE) performed a condition assessment of the existing Boardwalk, located in the Marsh Aviary Exhibit of the Maryland Zoo in Baltimore, MD. The purpose of our visit was to visually observe the physical condition of existing structural elements of the boardwalk. Our professional services were performed in accordance with our proposal dated December 20, 2022.

#### DESCRIPTION

The Marsh Aviary Boardwalk is located within the aviary exhibit, looping around the man-made waterways (Photo 1). The boardwalk consists of 2x10 PT beams spaced at 20", spanning between (2)3x10 + (2)2x10 (side members) built-up PT wood girders spaced up to 8'-0"±. The wood girders bear on concrete pier foundations, the girders are attached to the piers with bent steel plate connections. The 6x6 PT handrail posts typically are located at each end of the built-up wood girders. The handrail posts extend down between the two side 2x10 members of the built-up girder and are through bolted, the (2)3x10 members stop short, abutting the posts. The fencing consists of rope mesh strewn between steel bars that are attached to the wood rails / posts.

#### OBSERVATIONS

Due to limited access from waterways, enclosed areas and/or height restrictions of accessible areas, the entirety of the boardwalk framing could not be observed.

Construction drawings prepared by CLR Design were used for reference. See attached for marked-up plans indicating specific observations of handrail / framing deficiencies.

The following findings / deficiencies were observed:

1. 2x composite decking appears to be in good condition (Photo 2).
2. Overall handrail is weathered, but solid. The top rail is covered with a continuous piece of composite material that is buckling in several locations (Photo 3).
3. There are several handrail posts that are deteriorated, with up to 100% section loss (Photo 4). These locations are noted on the attached plans.
4. There are several areas with deteriorated joists. White fungus was observed on the sides of several joists. These locations are noted on the attached plans (Photo 5).

5. There are several locations where the outer, side 2x10 members of the built-up wood girders are rotted with up to 100% section loss (Photo 6-7). These locations are noted on the attached plans. Typically the interior (2)3x10 members appear to be in good condition.
6. Jambs that support hinges for steel framed gates exhibit damage and, per staff's accounts, have to continually be adjusted. Due to excessive weight of the gates, the attachment points of the hinges are damaged, causing the gates to sag and become out of plumb (Photo 8).
7. Joist hangers appear to be in good condition overall.
8. Heavy steel connections appear to be in good condition.
9. Concrete piers appear to be in good condition.

**RECOMMENDATIONS**

There are several areas of concern with the handrail posts and boardwalk framing. A more in-depth investigation is recommended. This will require that the composite decking be removed, in order to expose questionable framing members. Further deterioration may be discovered once the questionable are is exposed.

CE recommends the following:

1. Replace buckled composite handrail topping. Consider leaving gaps for expansion per manufacturer's recommendations.
2. Handrail posts with section loss shall be removed and replaced with 6x6 PT posts, reattach handrail.
3. Deteriorated joists shall be removed and replaced with 2x10 PT joists.
4. 2x10 girder side members that are deteriorated shall be removed and replaced with new 2x10 members. Joist and handrail post connections will need to be reinstalled. Joist connectors will likely need to be replaced.
5. Heavy steel connections will have to be reconnected where side members of girders are to be replaced. Interior 3x10 members will need to be observed once exterior, deteriorated 2x10 members are removed.

Thank you for the opportunity to perform these services for you. Please contact us if you have any questions or if we can be of service to you in any way.

Sincerely,

**CENTURY ENGINEERING, LLC, A KLEINFELDER COMPANY**

Gary W. Swift  
Senior Engineer  
Building Structures Division

Gregory S. Holland  
Vice President  
Building Structures Division



Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 32548, Expiration Date 06-22-2024



Photo 1 – Exhibit photo



Photo 2 – Composite decking

**CENTURY ENGINEERING, LLC, A KLEINFELDER COMPANY**  
10710 Gilroy Road, Hunt Valley, MD 21031 p | 443.589.2400 f | 443.589.2401



Photo 3 – Buckled composite railing topping material



Photo 4 – Deterioration of 6x6 PT handrail post at base connection



Photo 5 – Mold observed on the sides of rotted 2x10 joists



Photo 6 – Rotted 2x10 side members of built-up wood girder



Photo 7 – Rotted 2x10 side members of built-up wood girder w/embedded ice pick

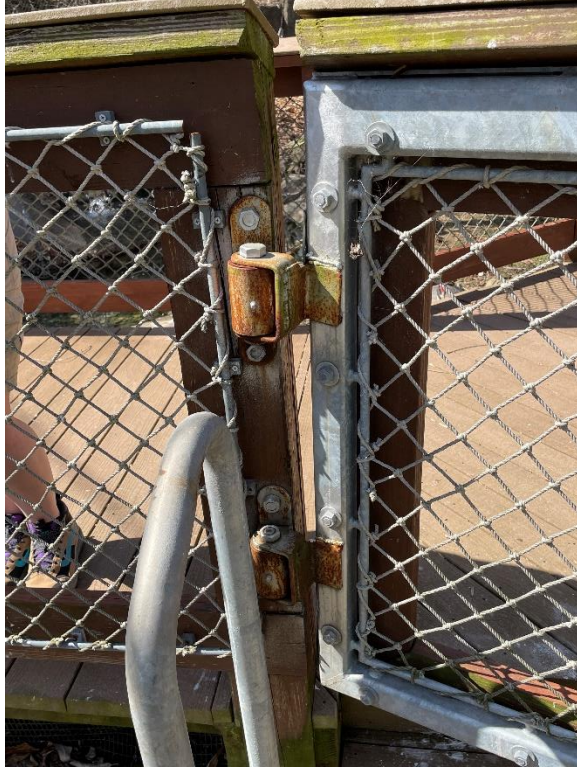
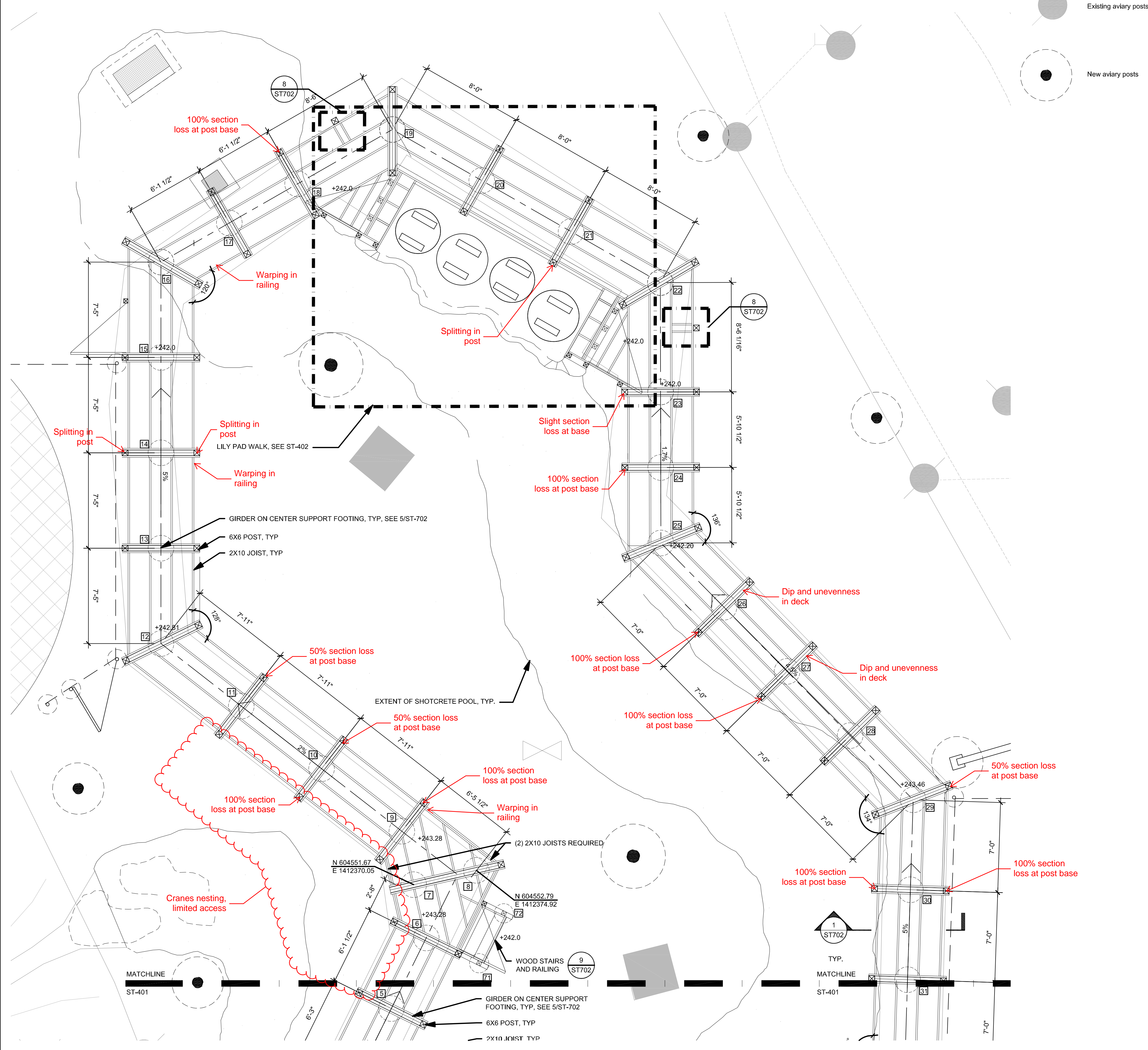
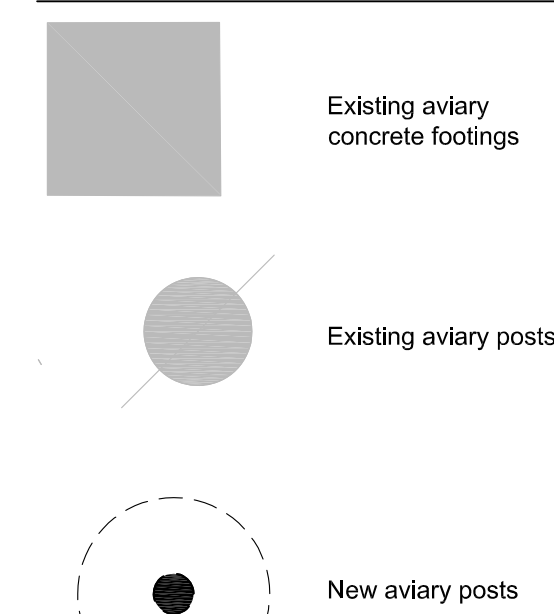


Photo 8 – Damaged jambs at gate connections

Legend



BOARDWALK PIER SCHEDULE

PIER NO.	AREA	DIAMETER	DEPTH BELOW FINISH GRADE	DETAIL	TOP OF PIER ELEVATION	REMARKS
1	Interior Aviary Boardwalk	24" dia.	4' depth	5/ST-702	244.10	
2	Interior Aviary Boardwalk	24" dia.	4' depth	5/ST-702	243.70	
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THE MARYLAND ZOO  
IN BALTIMORE

Marsh Aviary  
Renovation

**clr** ARCHITECTURE  
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EXHIBIT DESIGN  
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Seal:

Revisions	Date
Schematic Design Drawings	11.30.2012
95% CD Set	03.01.2013

Boardwalk  
Layout Plan North

Sheet Title

Project No.: 10013

Project Manager: JS

Drawn: MF Checked: MB

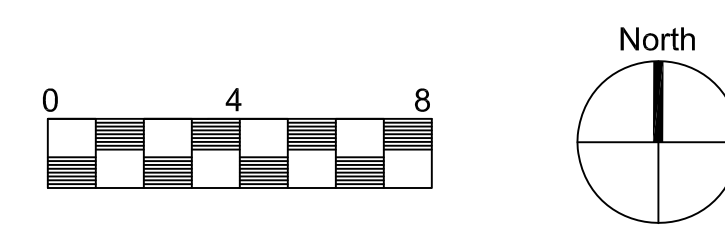
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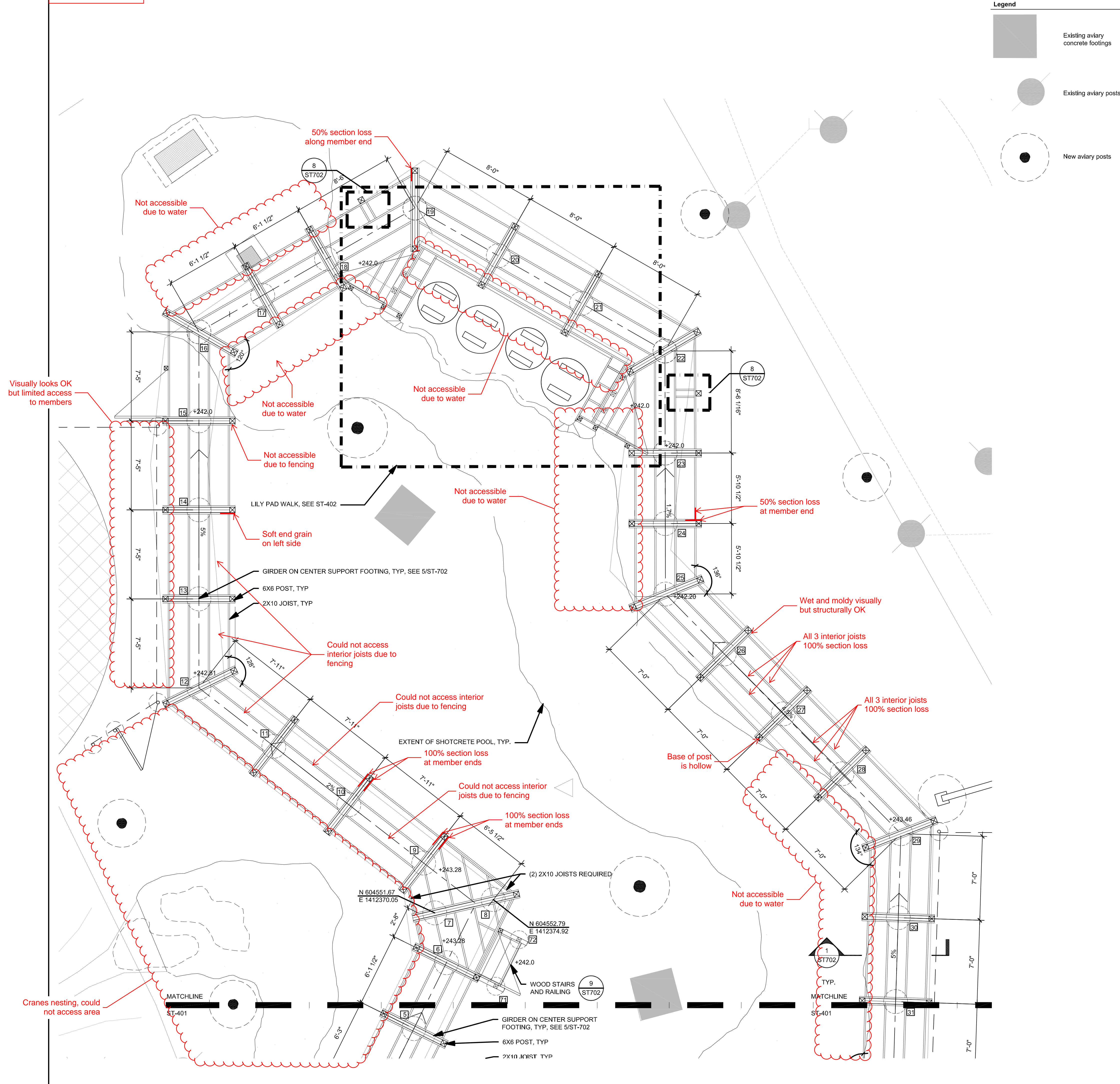
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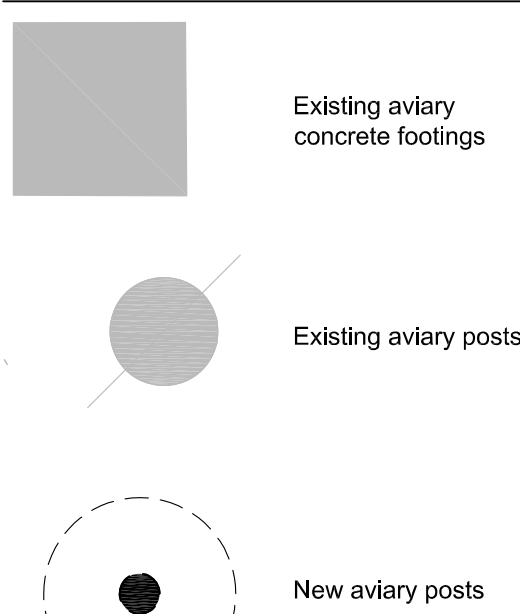
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Notes:  
See ST-410 for exhibit grading information.





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833 Chestnut Street, Suite 1000  
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95% CD Set	03.01.2013

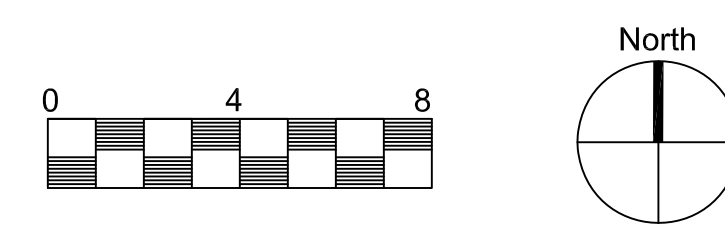
Boardwalk  
Layout Plan North

Sheet Title

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Project Manager:	JS
Drawn:	MF
Checked:	MB
Scale:	As Noted
Date:	03.01.2013
Drawing No.:	



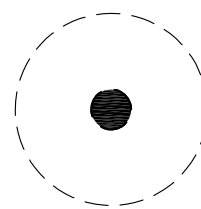
ST400

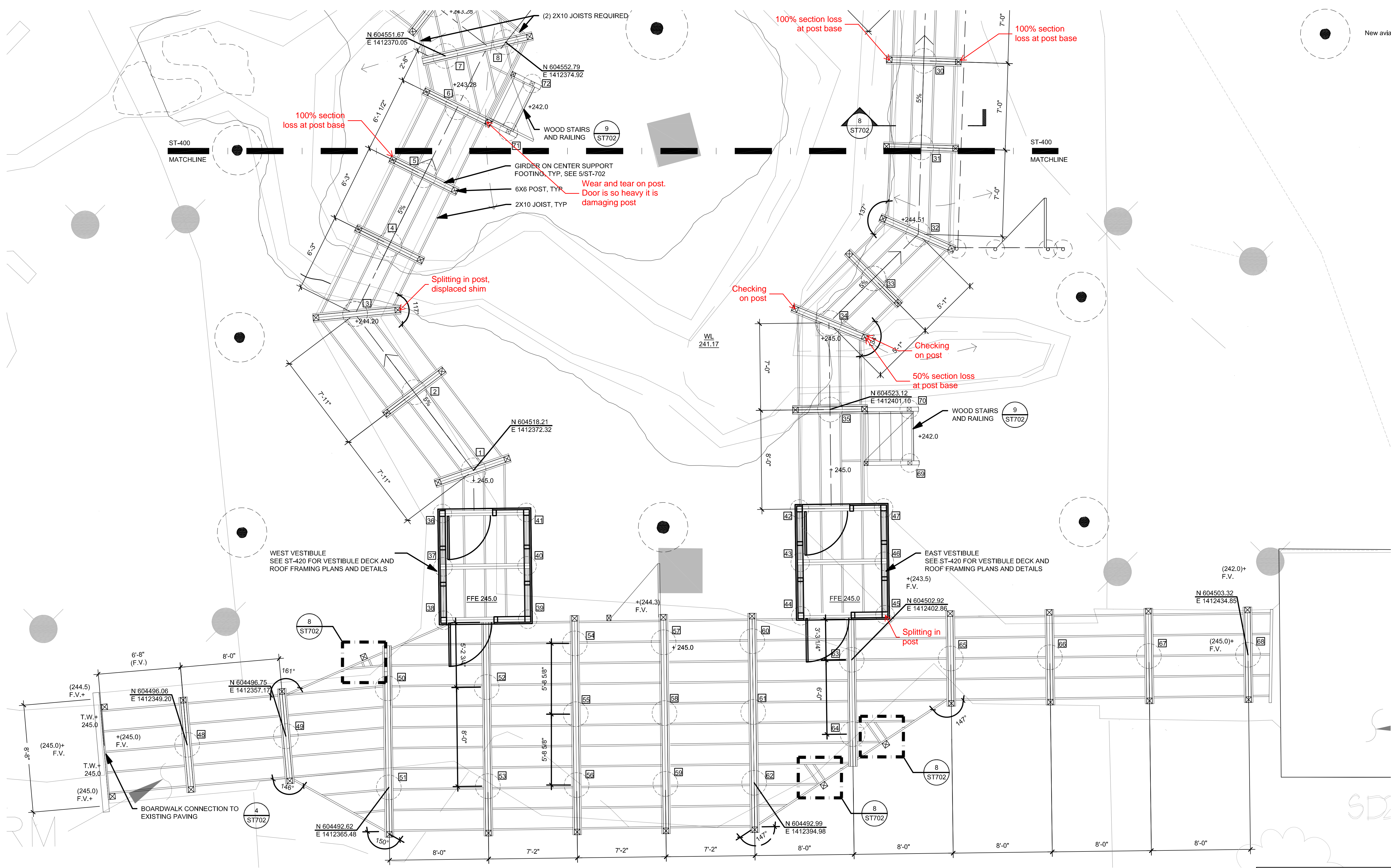
Notes:  
See ST-410 for exhibit grading information.





**Legend**

-  Existing aviary concrete footings
-  Existing aviary posts
-  New aviary posts



THE MARYLAND ZOO  
IN BALTIMORE

## Marsh Aviary Renovation

**clr** ARCHITECTURE  
LANDSCAPE ARCHITECTURE  
EXHIBIT DESIGN

833 Chestnut Street, Suite 1000  
Philadelphia, PA 19107  
Phone: 215.564.0250 Fax: 215.564.1154

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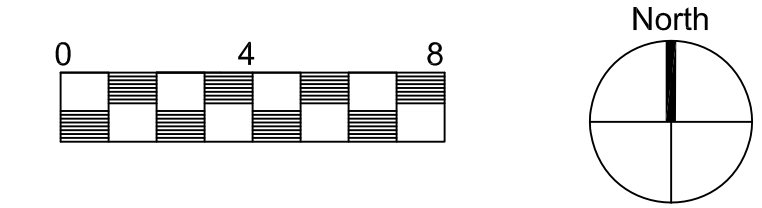
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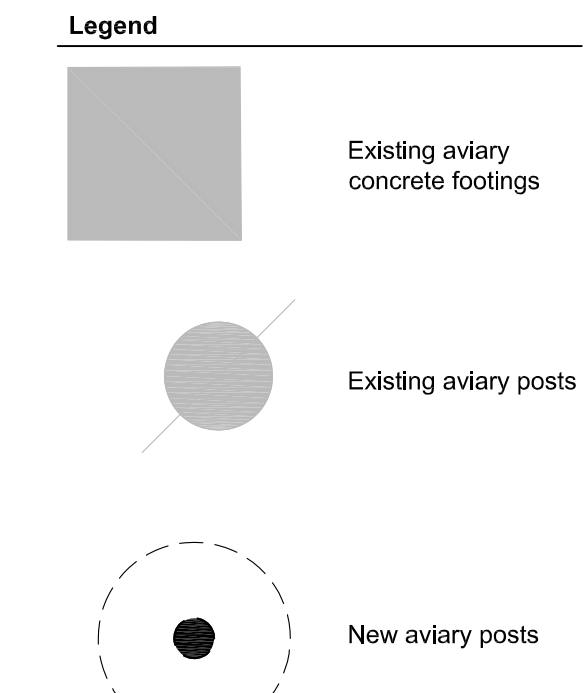
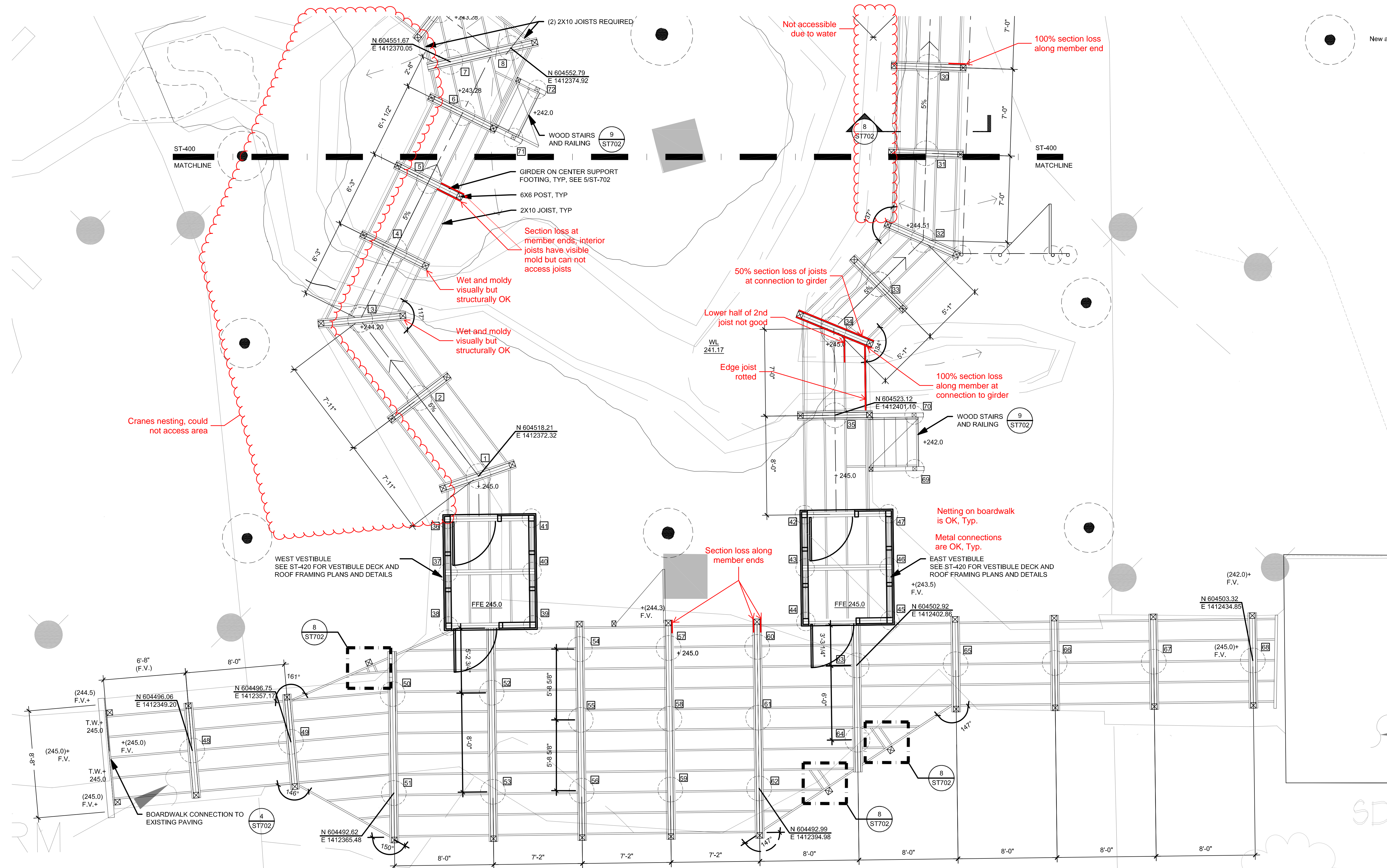
## Boardwalk Layout Plan South

Sheet Title	Project No.: 10013
Project Manager: JS	Drawn: MF Checked: MB
Scale: As Noted	Date: 03.01.2013
Drawing No.	

Notes:  
1. See ST-410 for exhibit grading information.  
2. See ST-400 for Boardwalk Pier Schedule.



**ST401**



THE MARYLAND ZOO  
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## Marsh Aviary Renovation

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833 Chestnut Street, Suite 1000  
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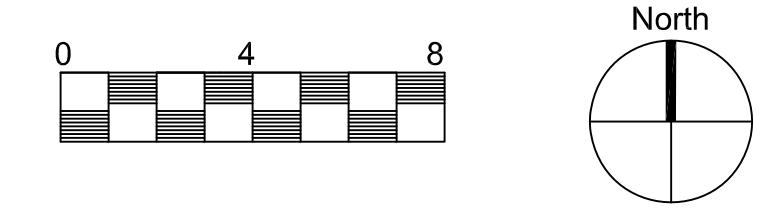
Seal:

Revisions	Date
Schematic Design Drawings	11.30.2012
95% CD Set	03.01.2013

## Boardwalk Layout Plan South

Sheet Title	Project No.: 10013
Project Manager: JS	Drawn: MF Checked: MB
Scale: As Noted	Date: 03.01.2013
Drawing No.	

Notes:  
1. See ST-410 for exhibit grading information.  
2. See ST-400 for Boardwalk Pier Schedule.



**ST401**