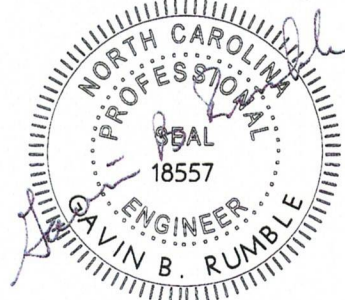Certificate of Professional Services
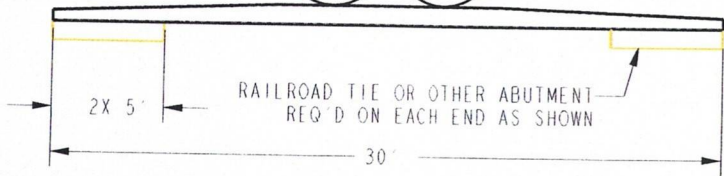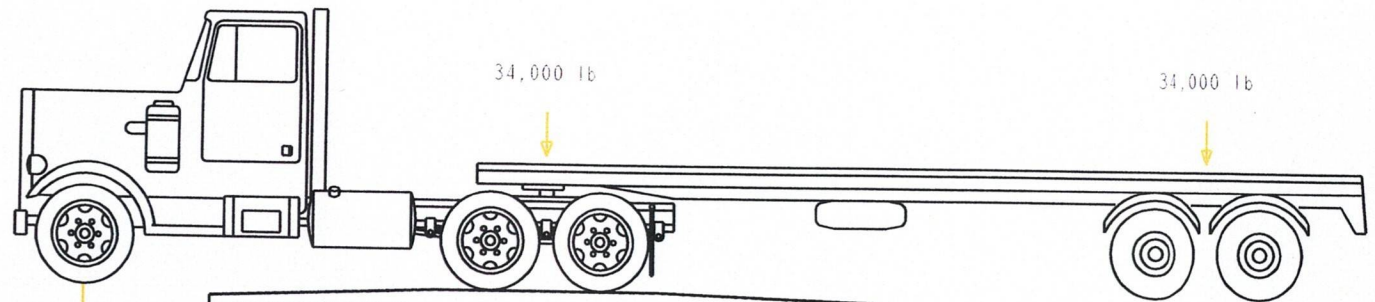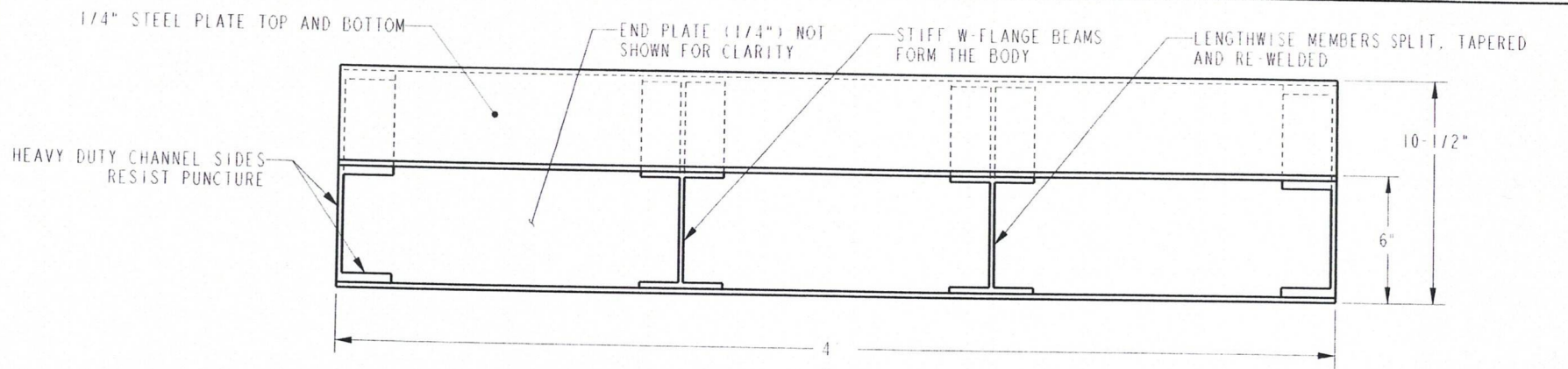
for

Mast Equipment, LLC

Analysis of 202211-3001 & 3002
30 Ft & 40 Ft Logging Bridge Planks

This report was prepared by the undersigned
Licensed Professional Engineer.

_____
Gavin B. Rumble, PE
Mechanical Engineer

Solid Engineering & Design

1/4" STEEL PLATE TOP AND BOTTOM

END PLATE (1/4") NOT SHOWN FOR CLARITY

STIFF W-FLANGE BEAMS FORM THE BODY

LENGTHWISE MEMBERS SPLIT, TAPERED AND RE-WELDED

HEAVY DUTY CHANNEL SIDES RESIST PUNCTURE

10-1/2"

6"

4'

34,000 lb

34,000 lb

12,000 lb

2X 5'

RAILROAD TIE OR OTHER ABUTMENT REQ'D ON EACH END AS SHOWN

30'

NOTES:

1. FOR TEMPORARY USE ONLY.
2. NOT TO BE USED ON PUBLIC ROADWAYS.
3. THIS BRIDGE DEVICE SHALL NOT BE USED WHERE BRIDGE FAILURE WOULD ENDANGER THE OPERATOR OR BYSTANDERS.
4. LOW VEHICLE SPEED AND APPROACH PREPARATION ARE CRITICAL TO SUCCESSFUL DEPLOYMENT.
5. CAPACITY SHOWN IS FOR TWO IDENTICAL UNITS AND IS BASED ON DOT MAXIMUM AXLE LOADING.
5. BRIDGE STRENGTH HAS BEEN VERIFIED UP TO 40,000 LBS WHEN LOADED AS SHOWN.
6. BRIDGE DESIGN AS PROVIDED BY MAST EQUIPMENT LLC HAS BEEN INSPECTED AND VERIFIED BY SOLID ENGINEERING.
7. FIELD CONDITIONS MAY VARY, THERE-FORE MAST LLC AND Se DO NOT PROVIDE WARRANTY AGAINST MIS-USE OR OTHER CONDITIONS WHICH COULD DEGRADE THE STRENGTH OR LIFE OF BRIDGE.

NORTH CAROLINA
PROFESSIONAL
SEAL
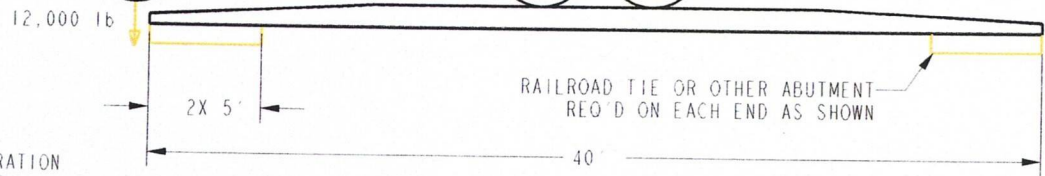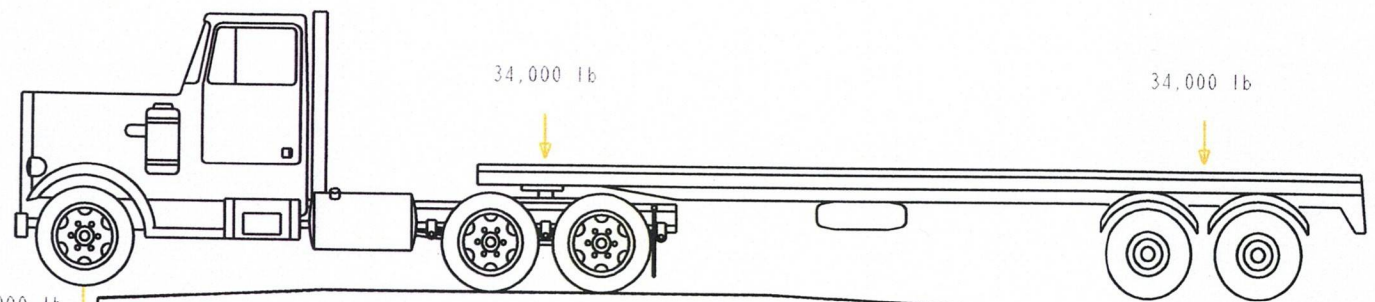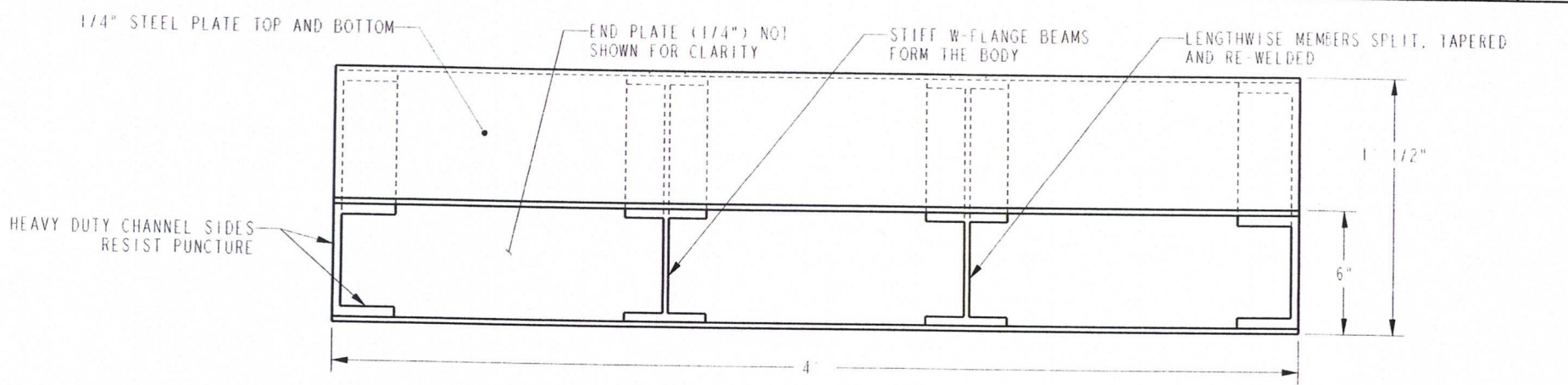18557
ENGINEER
GAVIN B. RUMBLE

03-JAN-2023

Solid Engineering & Design
Se Means Strength

105 S. Salisbury St   Lexington, NC   (336) 224-2312

TITLE: CAPACITY, 30' X 4' STEEL BRIDGE
TWO IDENTICAL UNITS REQUIRED

STANDARD TOLERANCES	
.X	± .1
.XX	± .01
.XXX	± .005
ANGULAR	± 1°
FRACTIONAL DIMS	± 1/64

INCHES UNLESS OTHERWISE SPEC D

APPROVALS

REVISIONS					
	A	SEALED AND ISSUED	1/3/23	GBR	-
	REV	DESCRIPTION	DATE	BY	APPR

DRAWING BY:	GBR	12/13/22
CHECKED BY:	IRM	12/22/22
APPROVED BY:		

ANGLE PROJECTION

SIZE	DRAWING NO.	REV
B	202211-3001	A

SCALE: 1/64   Pro/E

CLIENT   MAST EQPMT LLC

SHEET 1 OF 1

1/4" STEEL PLATE TOP AND BOTTOM

END PLATE (1/4") NOT
SHOWN FOR CLARITY

STIFF W-FLANGE BEAMS
FORM THE BODY

LENGTHWISE MEMBERS SPLIT, TAPERED
AND RE-WELDED

HEAVY DUTY CHANNEL SIDES
RESIST PUNCTURE

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34,000 lb

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03-JAN-2023

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   STRENGTH OR LIFE OF BRIDGE.

STANDARD TOLERANCES	
.X	± 1
.XX	± 01
.XXX	± 005
ANGULAR	± 1°
FRACTIONAL DIMS	± 1/64

INCHES UNLESS OTHERWISE SPEC'D

Se Solid Engineering & Design
Se Means Strength

105 S. Salisbury St   Lexington, NC   (336) 224-2312

TITLE: CAPACITY, 40' X 4' STEEL BRIDGE
TWO IDENTICAL UNITS REQUIRED

REVISIONS					
	A	SEALED AND ISSUED	1/3/23	GBR	-
	REV	DESCRIPTION	DATE	BY	APPR

APPROVALS

DRAWING BY:	GBR	12/13/22	
CHECKED BY:	IRM	12/22/22	
APPROVED BY:			

ANGLE PROJECTION

SIZE	DRAWING NO.	REV
B	202211-3002	A

SCALE: 1/64   Pro/E

CLIENT   MAST EQPMT LLC

SHEET 1 OF 1

NORTH CAROLINA PROFESSIONAL ENGINEER
SEAL 18557
GAVIN B. RUMBLE

Mast Equipment, LLC

Analysis of 30 Ft & 40 Ft Logging Bridge Planks
(Se Drawings 202211-3001 & 3002)

Solid Engineering & Design

Introduction:

Solid Engineering & Design (*Se*) has been engaged by Mast Equipment, LLC (**Client**) to analyze and certify drawings depicting their 30 ft and 40 ft logging bridge planks. An FEA study and associated calculations of the bridge planks were prepared based on field measurements of the current 30 ft design at the South Boston location on 12-Sept-2022. The following report reflects *Se's* findings during this study and represents our best efforts and diligence. *Se* is not responsible for any malfunctions during the manufacture and/or use of the products studied in this investigation.
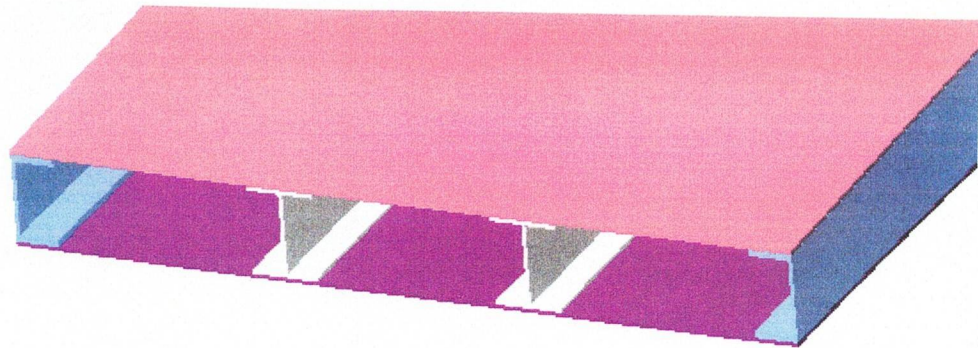
Assumptions:

Figure 1: Solid Model (end plates not shown)

Based on **Client** specifications, it was determined that this device would be modeled as a simple beam (simple supports at each end) with a maximum vertical load of 106,340 lbs representing the articulated heavy-lift tractor demonstration pictured below in Figure 2.

Figure 2: Demonstration w/30 ft bridge planks

The demonstration included railroad tie abutments extending 5 ft from each end as described in the product literature. *Se* personnel witnessed this demonstration and measured the maximum deflection of the 30 ft bridged to be approximately 7/8" under load. We witnessed no indicators which would be present if the bridge planks were overloaded and subject to failure.
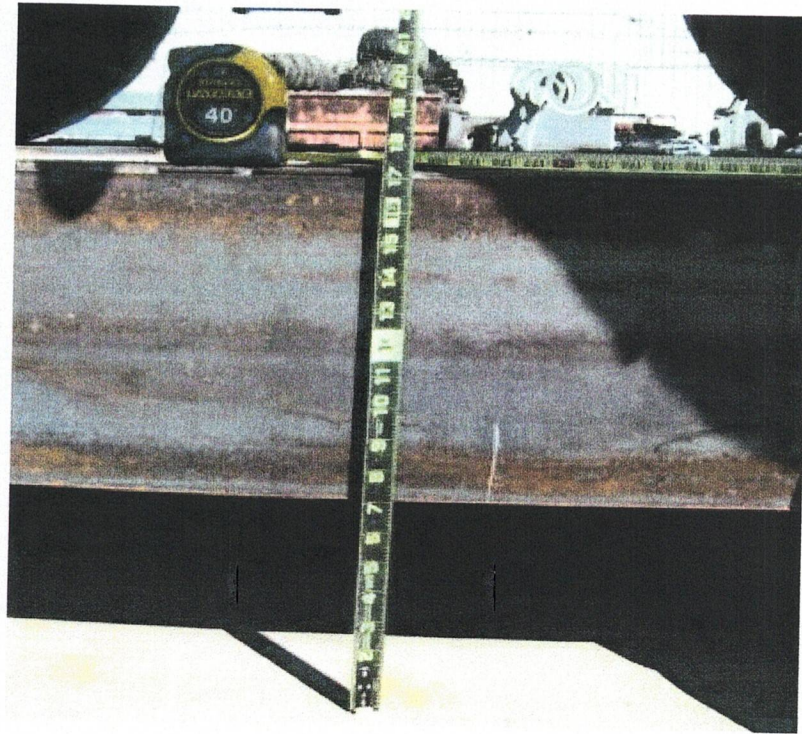
Solid Engineering & Design

Figure 3: Deflection of 30 ft bridge planks

Discussion:

Modeled as four uniform loads of 26,585 lbs as seen in Figure 4, the bridge planks clearly demonstrated the ability to carry the tractor load and the theoretical deflection was within the margin of error for a computer model.
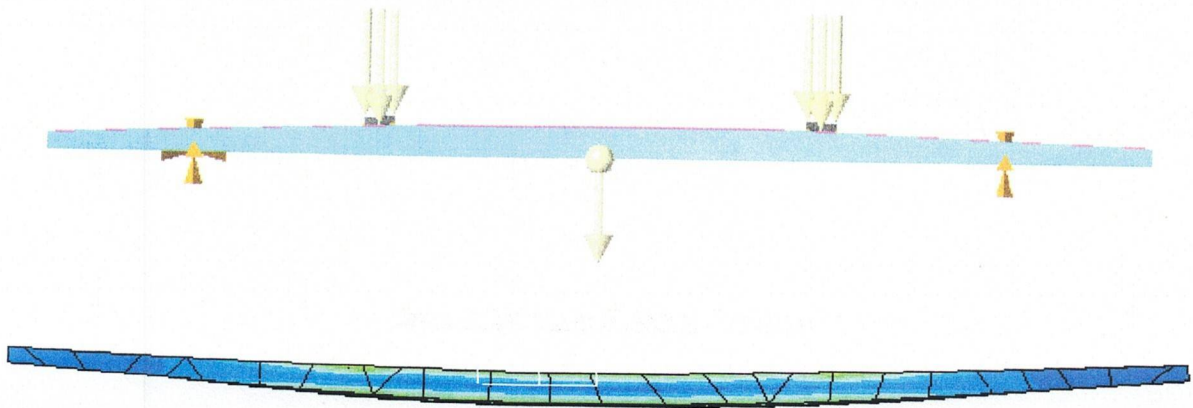

Figure 4: Analysis of 30 ft bridge planks - demonstration

Solid Engineering & Design

Our final study was based on the maximum wheel axle loading allowed by DOT standards which state that the tandem axle at the back of the semi-tractor and the tandem axle at the back of the trailer may exert no more than 34,000 lbs onto the roadway. This scenario was modeled as shown in Figure 5.
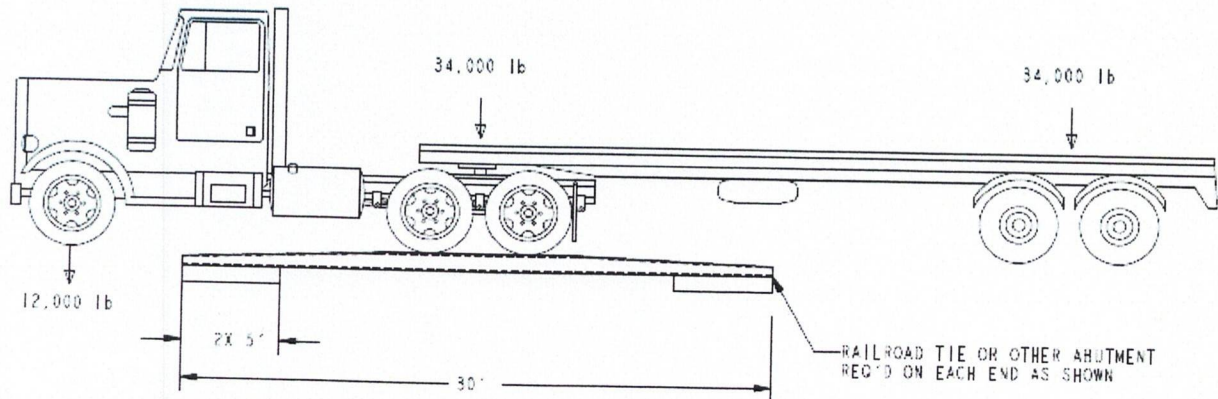

Figure 5: Typical DOT Semi Rig Axle Loads

To allow for field variables, this load case was increased to 40,000 lbs with the tandem axles 5 ft apart. When this boundary condition and the constraints shown were applied to the model, as expected, the 30 ft plank model which already supported the entire weight of the articulated tractor exhibited acceptable stresses and deflections. The maximum allowable stress range for the stress plot below is 18,000 psi which is 50% of the yield strength of the materials used in the body components and welds. The images in Figure 6 below, for comparison, are the results of the articulated tractor loading (top) and the semi rig loading (bottom). Dark blue areas exhibit lower stresses, greens and yellows are higher stresses, and red would be excessive stress. Similar results were achieved for the 40 ft planks which are built with heavier members (as shown on drawing 202211-3002).
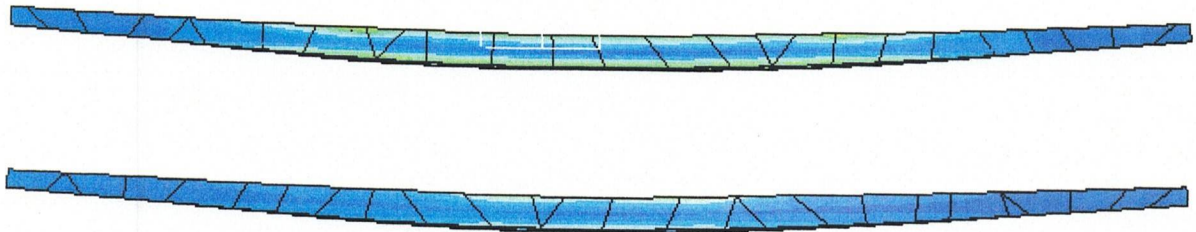

Figure 6: Stress Analysis results for both load cases

Conclusions:

As designed, and as shown on *Se* drawings 202211-3001 and 202211-3002, the Mast Steel Bridge Planks, when properly sited and loaded, can safely support the maximum weight (34,000 lbs) of the tandem axles of a properly loaded semi-tractor/trailer. This conclusion is based on the calculated stress in the product not exceeding the allowable limits as determined by *Se* in compliance with accepted engineering standards. This product is NOT to be used in situations or conditions where bridge failure would endanger the operators and/or bystanders.

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