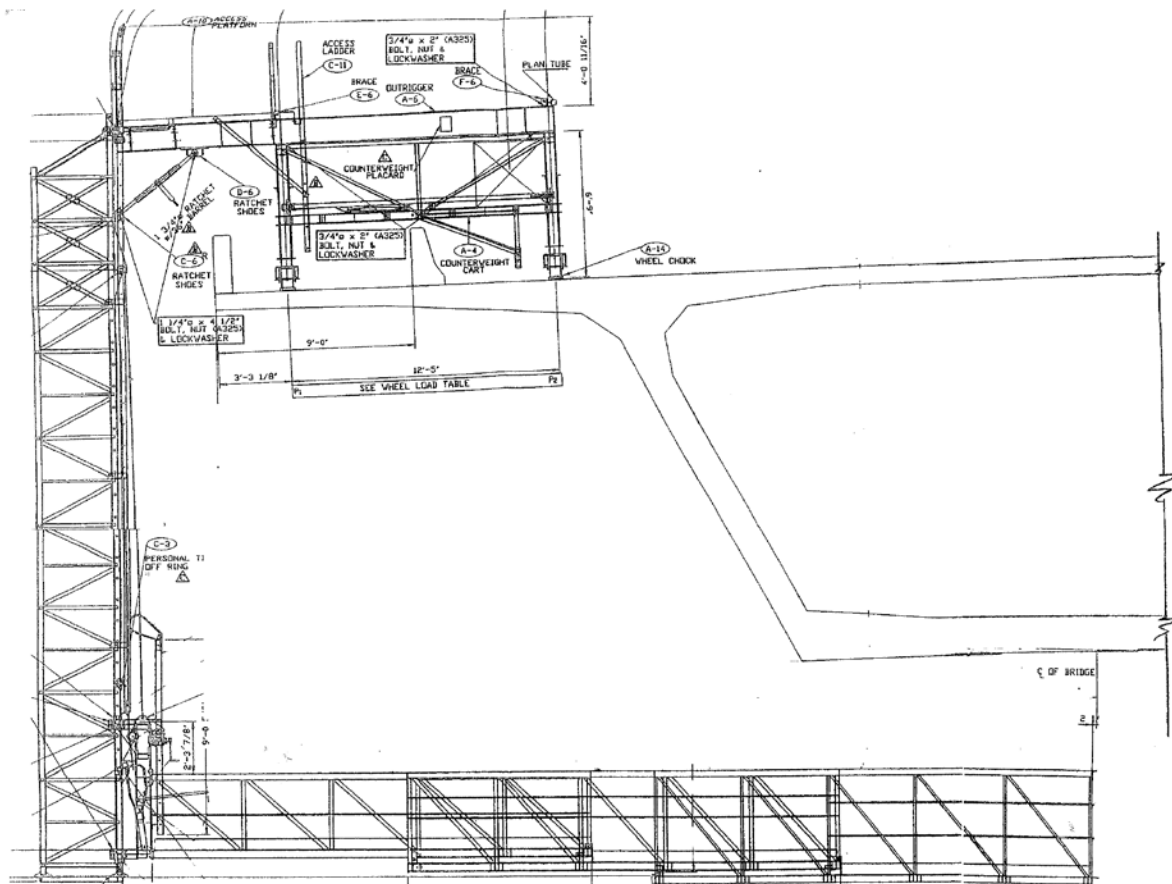


Investigation of the July 23, 2003, Collapse of Custom Cantilever Finishing Platform in Panama City, FL

U.S. Department of Labor
Occupational Safety and Health Administration
Directorate of Construction

December 2003



REPORT

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Report Prepared by
Mohammad Ayub, PE
Dinesh Shah, PE

REPORT

Introduction

The Directorate of Construction, OSHA National Office, was requested to provide assistance in the investigation and causal determination of the July 23, 2003 fatal collapse of a scaffold at the construction site of the Hathaway Bridge in Panama City, FL. The scaffold was located on the westbound bridge under construction. A structural engineer from the Office of Engineering, Directorate of Construction, OSHA National office visited the incident site on August 26, 2003 and on subsequent dates. Each time, he was accompanied by the Compliance Officer from the Jacksonville OSHA Area Office.

Background

The incident occurred in the morning hours of July 23, 2003 as a work crew of four employees was placing grout bags and other materials on the cantilever section of the scaffold. The scaffold was custom-designed for the project by United Form Services, Inc., of Neodesha, KS and was known as Custom Cantilever Style Finishing Work Platform'. As the grout bags were placed on the cantilever section of the scaffold, the scaffold suddenly failed, causing the four employees to slip and fall into the water. One employee was killed but the other three survived with varying degrees of injuries. Figures 4, 5 and 6 show a similar scaffold not involved in the incident.

Granite Construction Company, the general contractor of the bridge under construction, contracted with United Forms Services (UFS) to design, fabricate, deliver and erect a custom-designed finishing platform for the bridge. UFS designed the scaffold which was later fabricated by Young's Welding of Chanute, KS. Two such platforms were delivered, assembled and erected at the site under direct supervision of UFS. UFS designed the scaffold for a rated load of 2,000 pounds, including the weight of workers, equipment, etc.

UFS drawings E1 thru E6 of November, 2002 bearing the signature of a professional engineer provided the details of structural steel framing of the scaffold. The framing consisted of a 44' long cantilever platform, 6' wide. The cantilever platform was supported by a 36' high vertical truss, also 6' wide. The truss at the top was supported by two outrigger beams spaced at 6' on centers, and supported by two wheel struts spaced at 12' on center on top of the bridge, see Figure 1. To counteract the effects of the cantilever, counterweights were placed on outrigger beams above the bridge floor. 1 3/4" diameter steel braces were provided to transfer the loads at each corner, see Figure 1 and 2. The braces at each end were connected by ratchet shoes, see Figure 4 and 5. The upper ratchet shoe was connected to a 6 x 3/8 x 1'-3" steel plate, see Figure 6. The steel plate was connected to the bottom flange of the outrigger beams using A325 bolts. As discussed earlier, the cantilever platform was designed for a total live load of 2,000 pounds uniformly distributed over the cantilever span, including the weights of all employees and all other miscellaneous weights (Figure 2, 3 and 7).

Field observation of the collapsed scaffold indicated that the critical failure occurred at the 3/8" connection plate of the ratchets to the bottom flange of the outrigger beams.

Structural Analysis

We conducted independent structural analyses to determine the causal factors that could have contributed to the collapse of the scaffold under the loads placed on it immediately before the incident. The following loads were considered in the analysis:

26 bags of grout left over from the previous day x 50.5 lb each	= 1,300 pounds
68 bags of grout lowered on the morning of the incident	= 3,400 pounds
Less 5 bags of grout that was placed in the access hole	= (250 pounds)
3 Men x 150 pounds	= 450 pounds
1 Man x 200 pounds	= 200 pounds
4 buckets of tools x 50 pounds	= 200 pounds
5 five gallon buckets of water x 40 pounds	= 200 pounds
4 wood frames x 40 pounds	= 160 pounds
 Approximate total weight	 = 6,000 pounds

UFS rated the platform for a maximum load of 2,000 pounds. This was specifically included in the general notes of their contract drawings (Figure 3) that “Design load on this work platform is 8 men anywhere on the platform or 2000 pounds distributed at 50 pounds per square foot.” UFS also stated elsewhere on the drawing that “2000 pound total live load on the buggy includes the load on the work platform, access platform and ladders (impact is not included). The magnitude of the load placed on the scaffold on the day of the incident was clearly far greater than the rated capacity of the scaffold. A load of approximately 6,000 pounds was placed on the scaffold that had a rated capacity of only 2,000 pounds. In fact at the time of the incident, workers were continuing to place additional loads on the scaffold until it collapsed.

OSHA requires that all scaffolds and components be designed for their dead loads and for four times the intended load without failure. UFS’s drawings stated that the design for the scaffold met OSHA requirements. Our structural analysis, however, indicated that the scaffold did not meet the requirements of the OSHA standard. The 3/8" ratchet connecting plate was overstressed over 200 % under four times the intended load. The scaffold could not support its dead load and four times the rated load, (i.e, 4 x 2000 pounds = 8,000 pounds) without failure. If the scaffold was properly designed and fabricated to meet the OSHA standard, the placement of 6000 pounds on the scaffold would not have caused the scaffold to collapse. The collapse should not have occurred until the load reached 8,000 pounds.

Conclusions

1. The contractor placed loads on the scaffold well in excess of its rated capacity of 2,000 pounds. At the time of the incident, approximately 6000 pounds were placed on the platform. In addition, loads were not evenly placed over the length of the scaffold, as required by the manufacturer. 29CFR 1926.451(f)(1) was violated.
2. The structural design of the scaffold was flawed. The scaffold did not meet OSHA's requirement that it support four times the intended load without failure. If the scaffold was designed to meet OSHA's requirements, the scaffold would not have collapsed until the load reached 8,000 pounds. 29CFR 1926.45 l(a)(1) was violated.
3. Both the above factors contributed to the collapse.
4. Wind was not considered a causal factor in the collapse.

CAUTION
 THE COUNTERWEIGHT MUST BE IN PLACE BEFORE LOWERING THE BRIGGS. THE CONTRACTOR IS TO FURNISH THE COUNTERWEIGHT IS A BLOCK OF CONCRETE 4'-0" X 4'-0" X 5'-0" LONG, WEIGHING 10,000 LBS. THE CONTRACTOR IS TO FINISH THE CONCRETE COUNTERWEIGHT WITH SUFFICIENT REINFORCING TO SUPPORT THE COUNTERWEIGHT TO THE CART TO PREVENT MOVEMENT IN ALL DIRECTIONS TO PREVENT OVERTURNING.

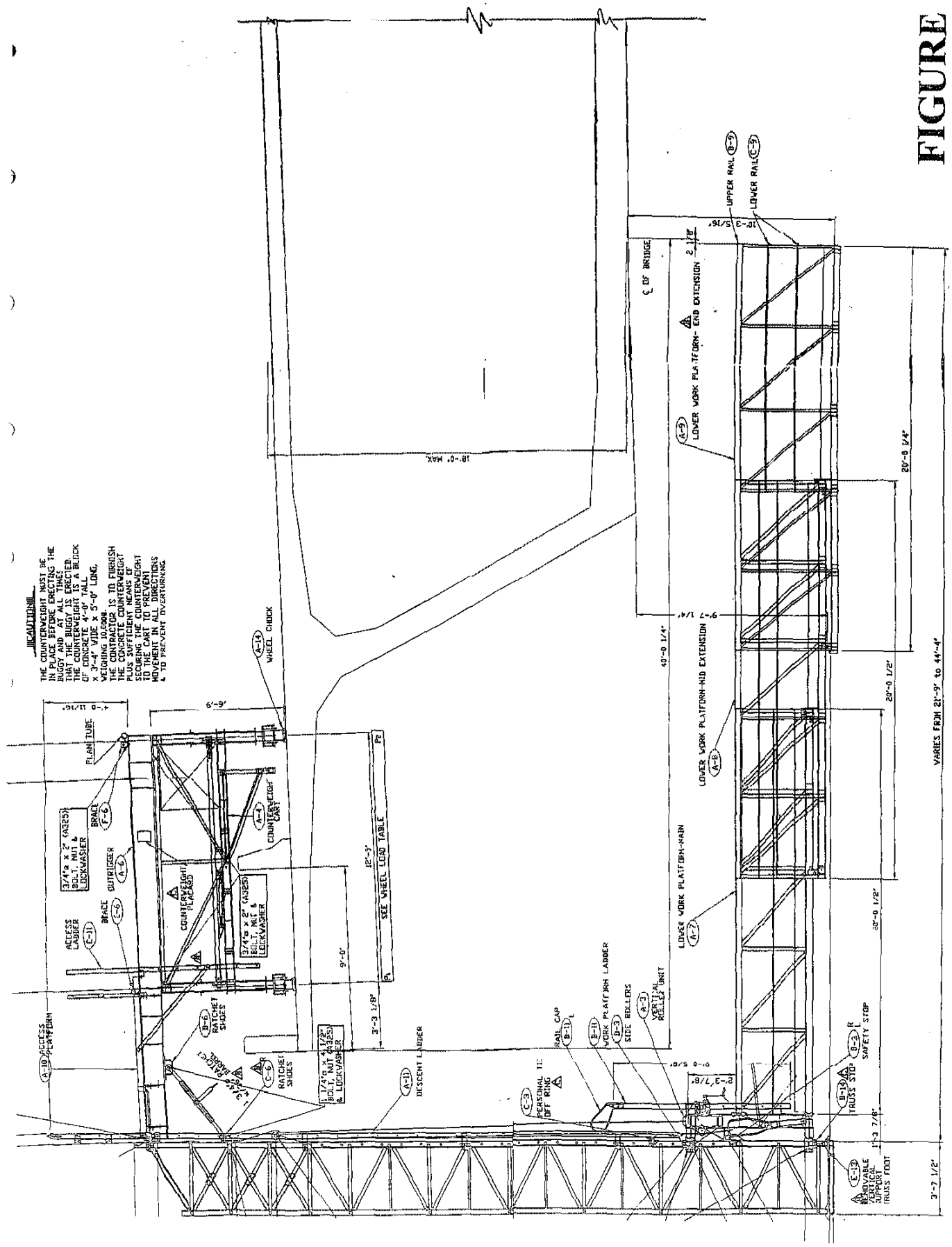
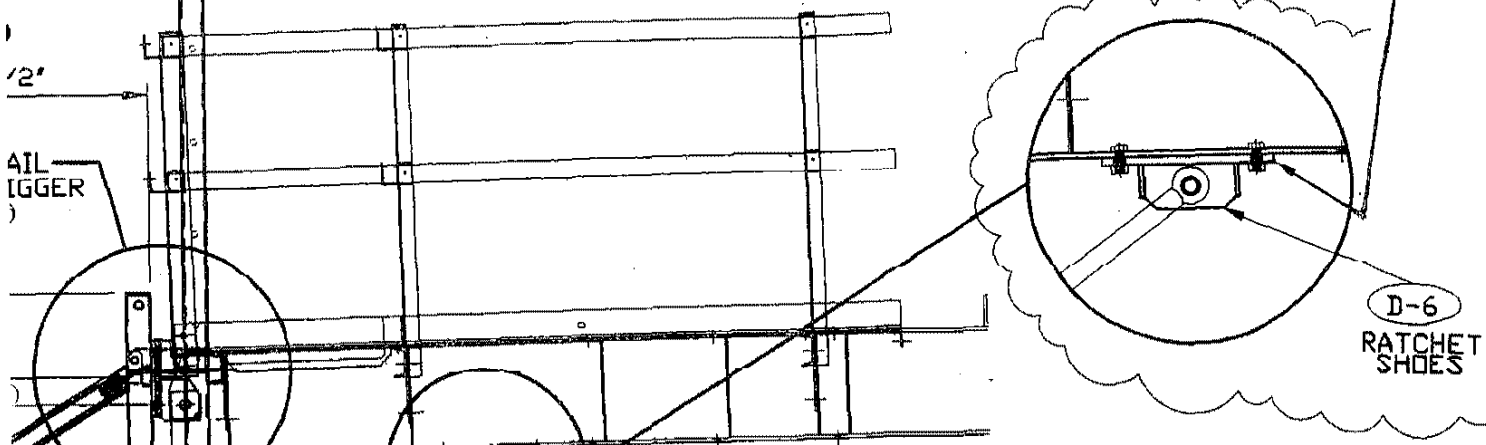


FIGURE 1

ELEVATION
 CUSTOM CANTILEVER STYLE FINISHING WORK PLATFORM

VARIES FROM 21'-9" TO 44'-4"

$\frac{3}{8}$ " THICK PLATE USED IN LIEU OF $\frac{3}{4}$ "



- RATCHET ALLOWS THE BUGGY TO BE FOR SUPER-ELEVATION.
- ADJUST RATCHETS ONLY WITH THE LOWER PLATFORM IN THE RETRACTED POSITION.
- SET VERTICAL SUPPORT TRUSS 1% FROM PLUMB AS SHOWN TO COMPENSATE FOR DEFLECTION OF THE LOWER PLATFORM WHEN EXTENDED

FIGURE 2

7/8"φ × 2 1/2" BOLT (A325)
w/ HARD WASHER ON SLOT SIDE
AND LOCK WASHER ON NUT SIDE

RATCHET SHOE
C-6 R

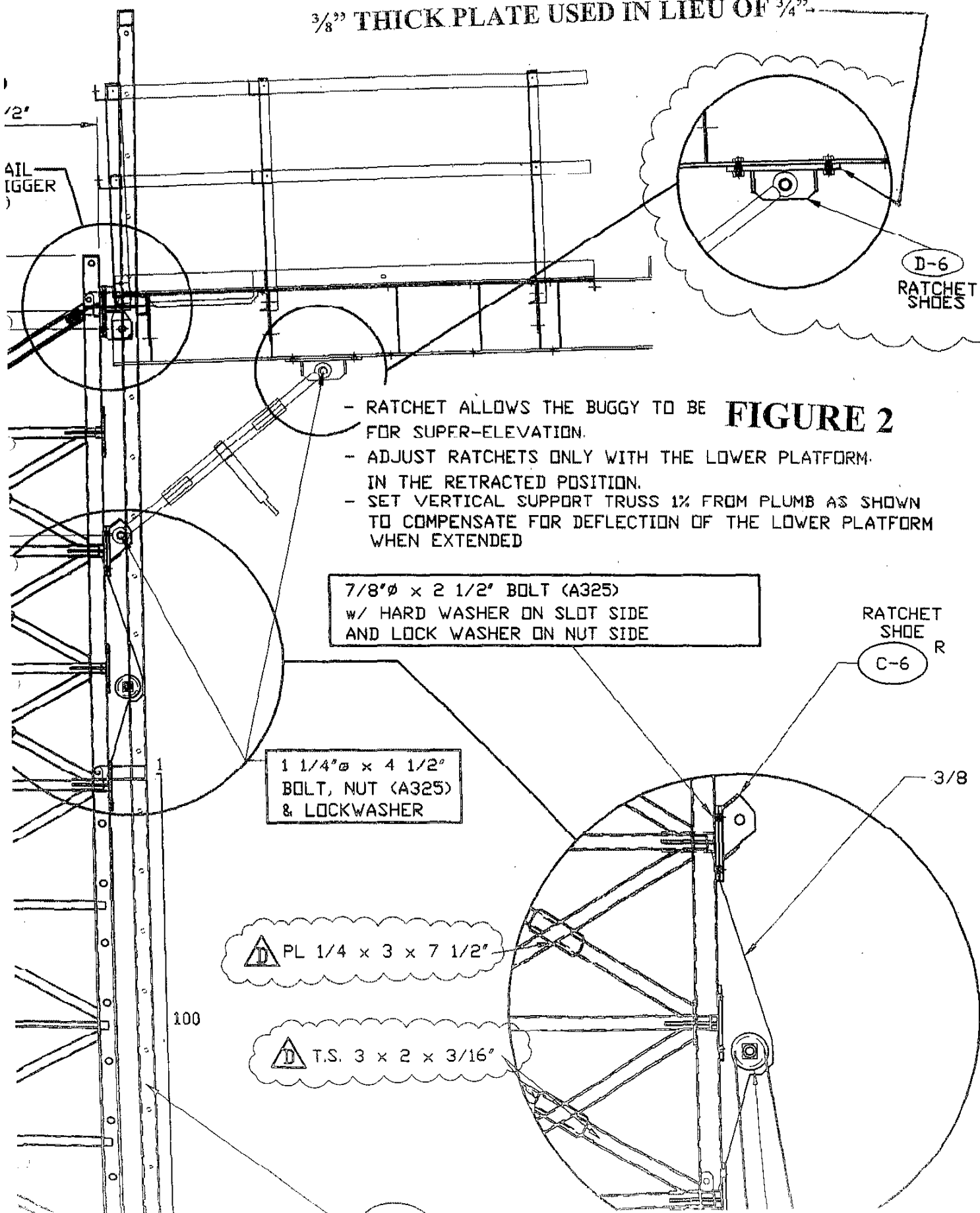
1 1/4"φ × 4 1/2" BOLT, NUT (A325) & LOCKWASHER

3/8 P

PL 1/4 × 3 × 7 1/2"

T.S. 3 × 2 × 3/16"

100



APPLICATION SAFETY NOTES

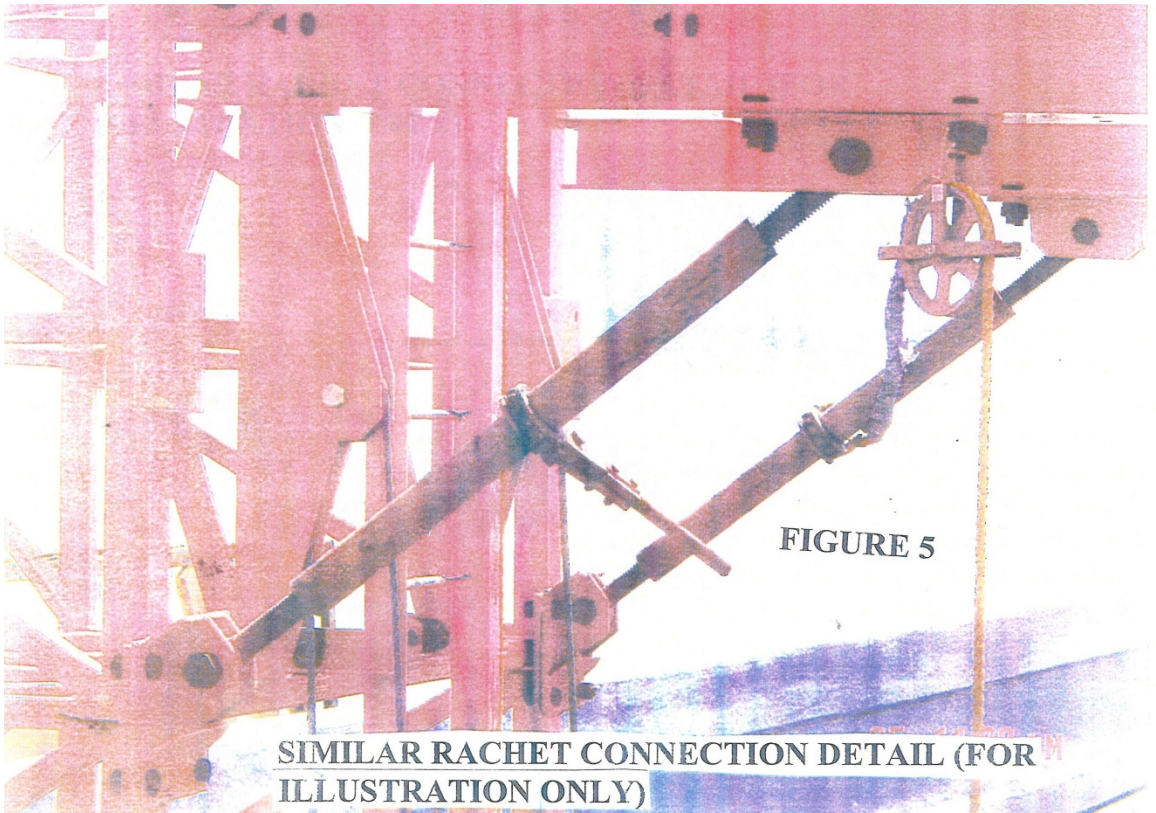
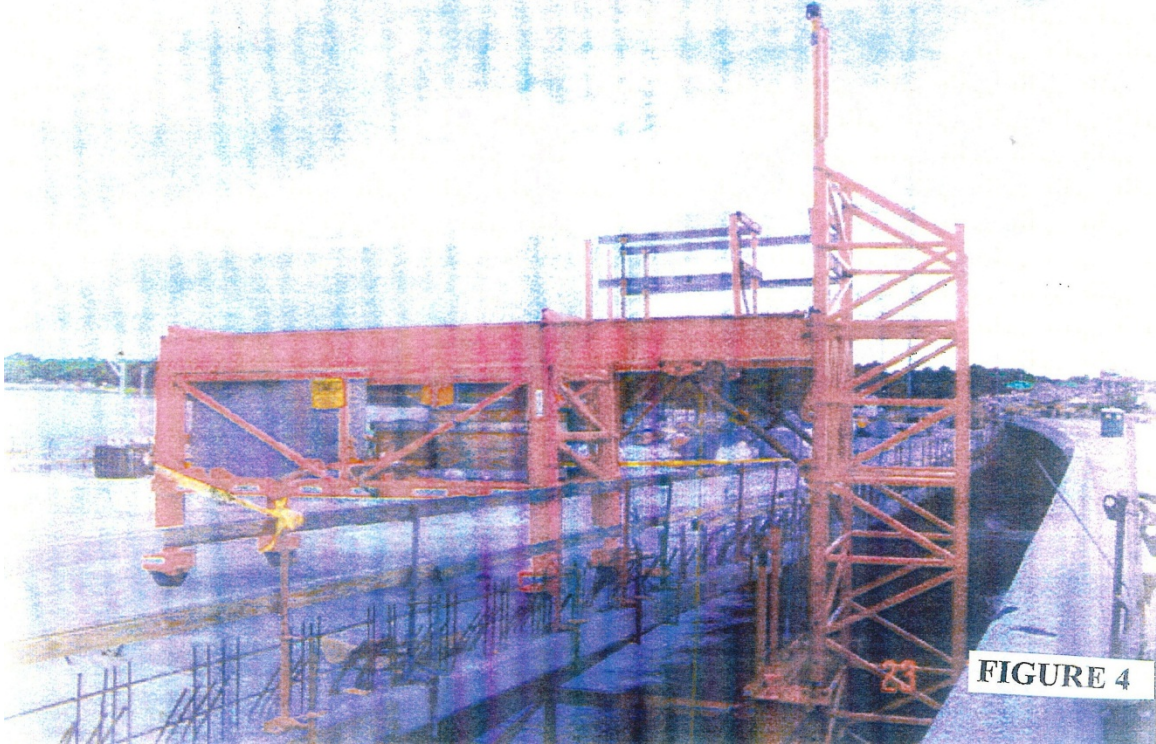
1. DESIGN LOAD ON THIS WORK PLATFORM IS 8 MEN ANYWHERE ON THE PLATFORM OR 2000# DISTRIBUTED AT 50 P.S.F.
2. CLEAR THE WORK PLATFORM OF ALL DEBRIS BEFORE RETRACTING.
3. CHECK ALL BOLTS AND RETORQUE THE NUTS ON THE CAM FOLLOWERS MONTHLY TO INSURE THEY REMAIN TIGHT.
4. DO NOT ALTER THIS EQUIPMENT OR THE APPLICATION OF THIS EQUIPMENT WITHOUT WRITTEN PERMISSION FROM UNITED FORM SERVICES, INC.
5. THE BUGGY SHOULD BE STAYED TO THE BRIDGE IF WIND IS ANTICIPATED TO EXCEED 50 MPH.
6. THE COUNTERWEIGHT CART IS FOR USE ON CONCRETE BRIDGE DECKS ONLY. MOVE VERY SLOWLY WHEN ADVANCING DOWN THE BRIDGE. DO NOT TOW ON PUBLIC ROADS.
7. MAKE CERTAIN THE PLATFORM IS NOT IN DANGER OF COMING IN CONTACT WITH POWER LINES. GROUND BUGGY IF USED NEAR POWER LINES TO DISSIPATE INDUCED CURRENT.
- ⚠ 9. CHECK ALL CABLES, CABLE CLAMPS, PULLEYS AND NUTS ON THE PULLEYS FOR WEAR PERIODICALLY AND BEFORE RE-ERECTING. REPLACE AS REQUIRED. THE CABLE CLAMPS CAN BE INSPECTED FROM THE VERTICAL SUPPORT TRUSS WHEN THE PLATFORM IS RETRACTED. THE END SHEAVES CAN ONLY BE INSPECTED IF THE FINISHING PLATFORM IS DISASSEMBLED OR BY REMOVING A PIECE OF PLYWOOD DECKING.
- ⚠ 10. LUBRICATE THE PULLEYS & WHEELS BEFORE RE-ERECTING THE WORK PLATFORM.
- ⚠ 11. LUBRICATE THE GRIPHOIST WINCHES AND THE THERN WINCHES ACCORDING TO THE MANUFACTURERS RECOMMENDATIONS IN THEIR OWNERS MANUALS.
- ⚠ 12. CHECK ALL MOVING PARTS PERIODICALLY AND AT RE-ERECTION FOR ABNORMAL WEAR.
- ⚠ 13. THE E-3 SAFETY LOCK PINS AS SHOWN IN THE SAFETY LOCK PIN DETAIL ON DRAWING E-5 AND THE 3/8" x 2" QUICK RELEASE PINS SHOWN IN SECTION A-4 & SECTION B-4 ON DRAWING E-4 MUST ALL BE IN PLACE BEFORE OCCUPYING THE WORK PLATFORM.

DESIGN NOTES :

1. DESIGN & CONSTRUCTION IS IN COMPLIANCE WITH THE AMERICAN NATIONAL STANDARD FOR CONSTRUCTION AND DEMOLITION OPERATIONS - SCAFFOLDING - SAFETY REQUIREMENTS (ANSI A10.8) AND THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION PART 1926, SUBPART L, SECTION 1926.451.
2. THE 2000# TOTAL LIVE LOAD ON THE BUGGY, INCLUDES THE LOAD ON THE WORK PLATFORM, ACCESS PLATFORM & LADDERS. (IMPACT IS NOT INCLUDED)
3. THE DESIGN LIVE LOAD FOR THE ACCESS PLATFORM IS 25 P.S.F.
4. THE DESIGN LIVE LOAD FOR EACH LADDER IS TWO MEN.
5. THE RATED LIVE LOAD OF THE WOOD DECKING IS 50 P.S.F.
6. SAFETY FACTOR ON LIVE LOAD IS 4:1 STRESSED TO YIELDING OR BUCKLING AND 4:1 TO OVERTURNING.
7. STEEL IS ASTM A-36 OR ASTM A-500 GD. B.
8. BOLTS ARE ASTM A325 UNLESS NOTED.
- ⚠ 9. USE A LOCK WASHER UNDER ALL NUTS EXCEPT THE NYLOCK NUTS.
10. STEEL COMPONENTS ARE SANDBLASTED, PRIMED AND PAINTED WITH ORANGE ENAMEL.

FIGURE 3

SIMILAR SCAFFOLD (FOR ILLUSTRATION ONLY)



SIMILAR RACHET CONNECTION DETAIL (FOR ILLUSTRATION ONLY)

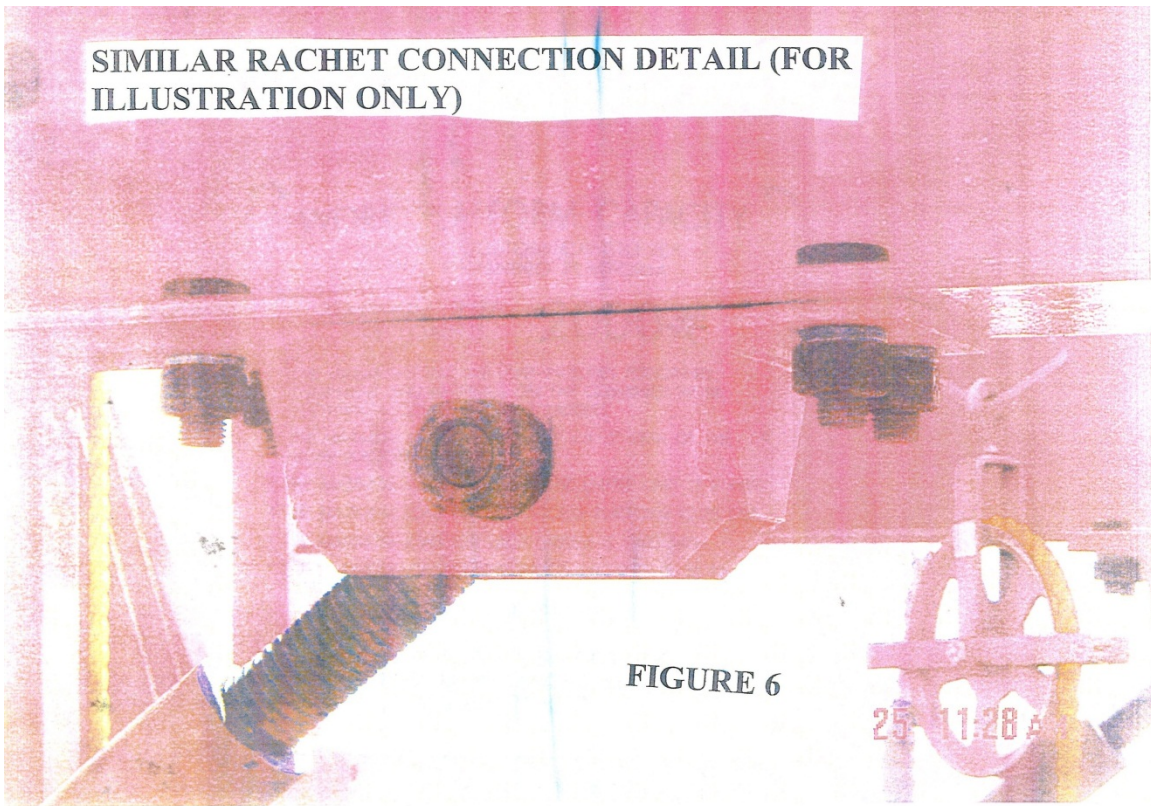


FIGURE 6

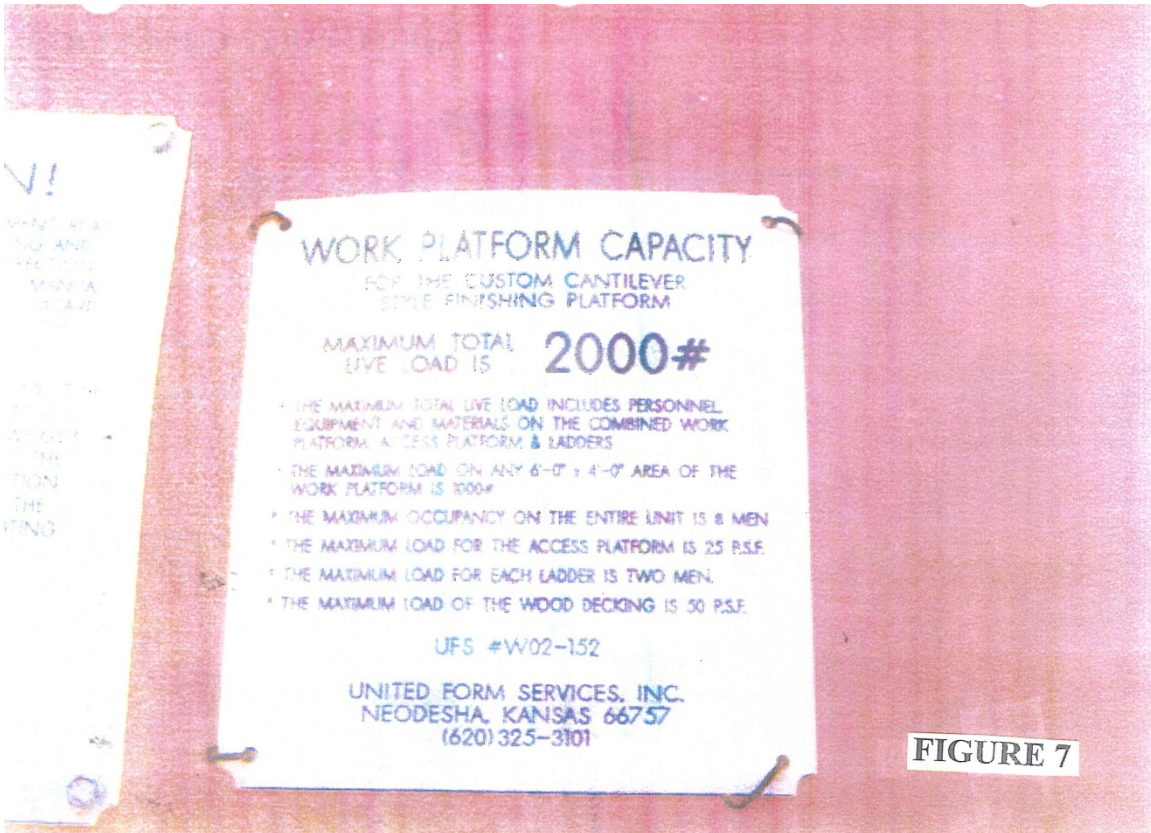


FIGURE 7

COLLAPSED STRUCTURE



COLLAPSED STRUCTURE



COLLAPSED STRUCTURE

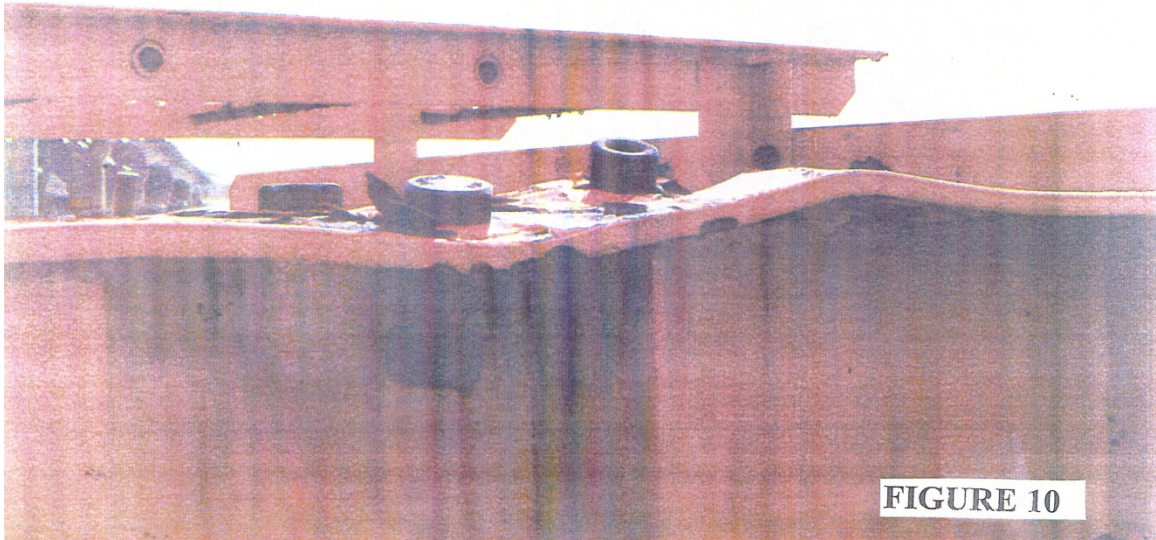
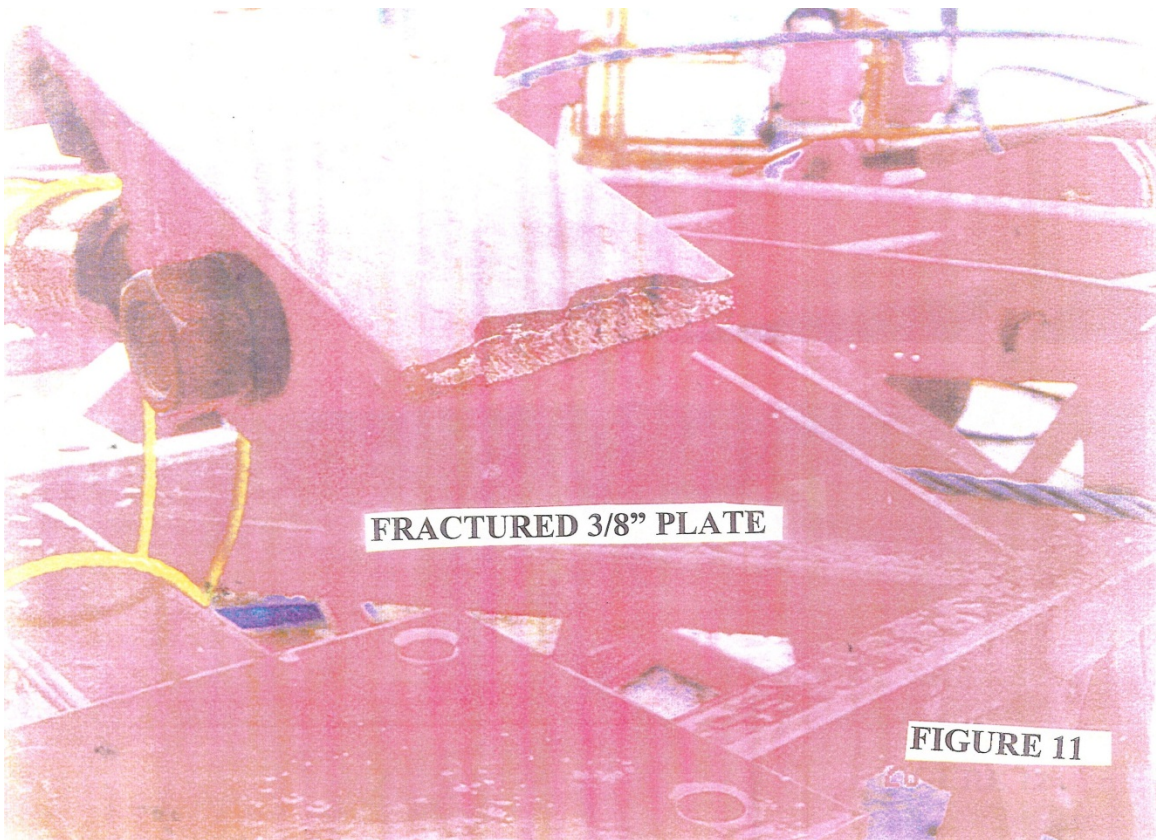


FIGURE 10



FRACTURED 3/8" PLATE

FIGURE 11

FRACTURED 3/8" PLATE

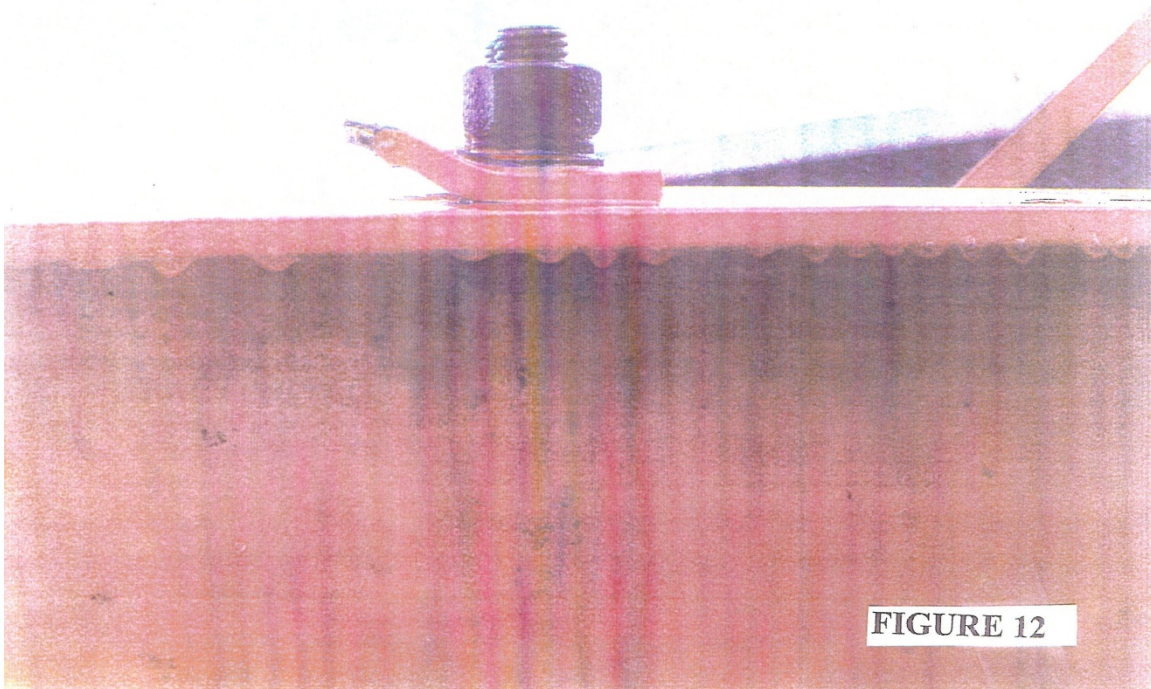
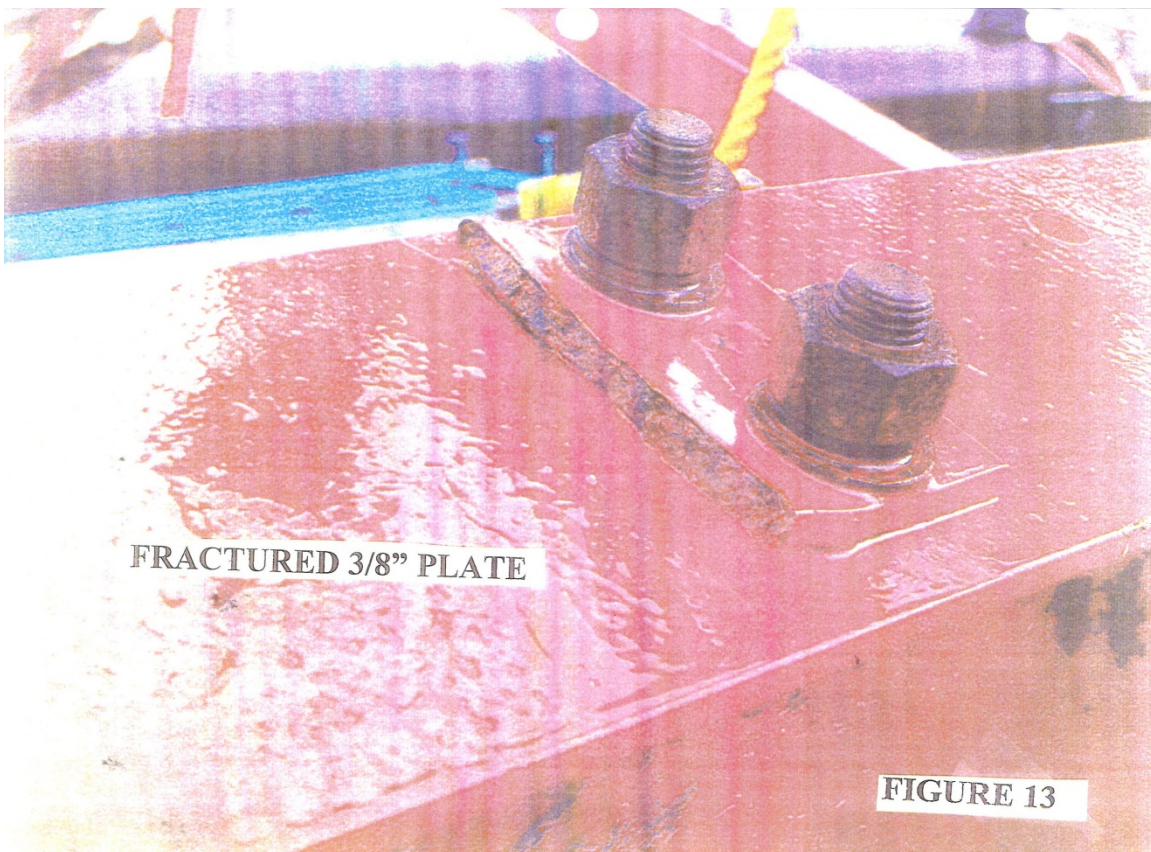


FIGURE 12



FRACTURED 3/8" PLATE

FIGURE 13