

Investigation of the April 19, 2018, Communication Tower Collapse in Fordland, Missouri.

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

October 2018



Report

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Executive Summary

On April 19, 2018, an incident occurred in Fordland, Missouri where one employee was killed. The project involved the reinforcement of the KOZK 1,891-foot-tall guyed communication tower along Highway FF just north of Fordland, Missouri. The location of the tower is shown in Figure 1 (905 State Highway FF Fordland, MO 65602). The tower was initially designed and erected by Kline in 1971. Currently, Missouri State University (MSU) contracted Tower Consultants, Inc. (TCI) to design the required structural modifications necessary to support the transmission line replacement. TCI's scope of work involved creating construction documents, reviewing submittal drawings, observing the construction process including producing progress reports and assisting MSU in the bidding and contractor selection process. MSU selected Steve Lemay, LLC (Lemay) to serve as the contractor.

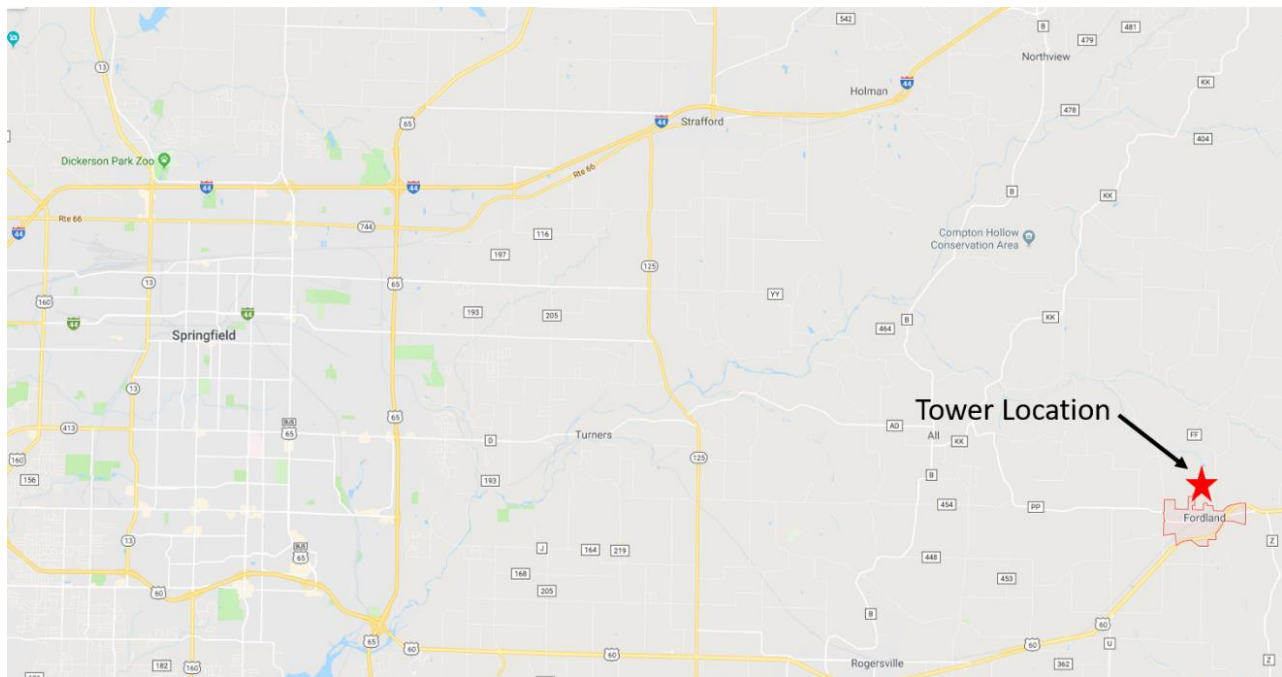


Figure 1. Project Location

The Occupational Safety and Health Administration's (OSHA) Regional Administrator, Region VII, asked the Directorate of Construction (DOC) in OSHA's National Office in Washington, D.C., to provide technical and engineering assistance to the OSHA Kansas City Area Office in its investigation of the tower collapse in Fordland, MO. At your request an engineer from DOC, Dr. Bryan Ewing, P.E., accompanied by Chester Ray, visited the incident site on April 23, 2018 and August 1, 2018. We also reviewed photographic evidence, witness interviews, construction documents, industry standards and engineering reports in preparation of this report. Attached is our report. After reviewing the documents and conducting independent structural analysis, we conclude the following:

- 1) TCI's suggested diagonal replacement procedure was flawed in that it compromised the effectiveness of the integrated surrounding braces and the load bearing capacity of the

tower legs. A single diagonal brace could not be removed without affecting the integrity of the redundant brace because the braces share two common bolts at the diagonal/redundant connection.

- 2) The cause of the communication tower collapse was the weakening of the compressive strength of the tower legs by removing the bolts at the connection of the diagonals to the horizontal redundant. The compromised redundant effectively doubled the unbraced length of the tower leg which reduced the compressive capacity of the tower leg.
- 3) Lemay used an undersized come-a-long while removing the diagonal braces.
- 4) Lemay failed to provide the design of the required temporary frame for diagonal replacement above or below a guy level. TCI failed to confirm the use/design of a temporary frame as TCI is required to approve the adequacy of the temporary frame prior to diagonal replacement according to TCI's construction documentation.

Introduction

The 1,891-foot-tall guyed communication tower is constructed of 10-foot wide triangular sections. The legs of the tower consisted of 63 sections of solid round steel ranging in diameter from 4½" to 3¼" that were approximately 30 feet long. The lower 34 leg sections were constructed from high strength alloy steel with a design yield strength of 95 ksi. The design yield strength of the remaining leg sections was 47 ksi. The legs are connected by numerous angle struts, solid rod diagonals and horizontal redundants as shown in Figure 2. Although Figure 2 only shows one side, all three sides of the tower are similar. The angle struts consisted of double back-to-back A36 grade steel angles. The sizes of the angles vary and were either L3x2x¼ or L2½x2x¼. The solid rod diagonals were fabricated from A36 grade steel and vary in diameter from ¾" to 1¼". The horizontal redundants were 1¾" diameter solid A36 steel rods. The horizontal redundants were narrowed at its mid-span to accommodate the splice plates of the crossing diagonals. Both diagonals and the redundant were secured to each other with two through bolts. Note that Figure 2 shows the recommended split pipe reinforcement of the tower legs, but these split pipe reinforcements were not in place at the time of the incident. The 30-foot tower leg sections were field spliced together with six A325 bolts through factory fabricated flange plates at each end of the leg. The tower was stabilized by nine levels of guy wires. Each level had three guy lines (1 for each of the principal triangular directions of the tower). The diameter of the guy lines varied from 1–1/16" to 1–9/16" with a range of initial tensile forces between ±15 kips to ±33 kips depending on the temperature. A typical cross section of the tower and tower elevation are shown in Figures 3 and 4, respectively.

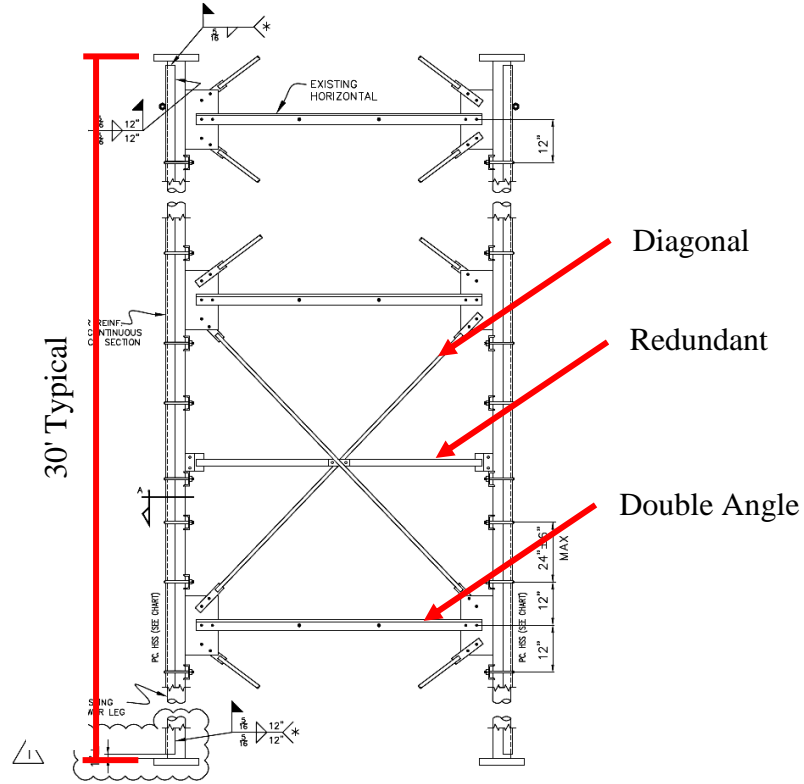


Figure 2. Typical Bracing Elevation of Tower Legs

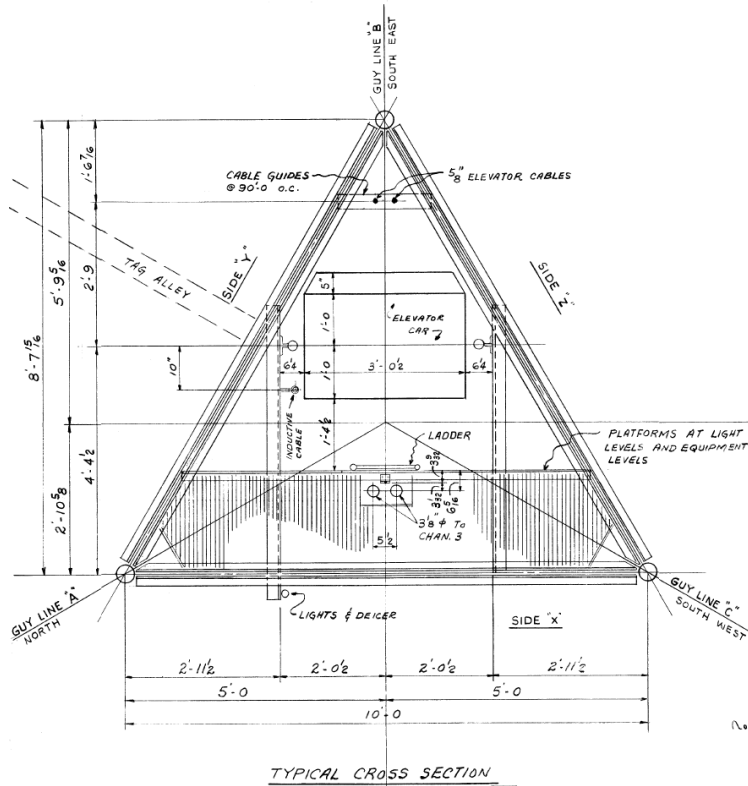


Figure 3. Typical Tower Cross Section

Investigation of the April 19, 2018, Communication Tower Collapse in Fordland, Missouri

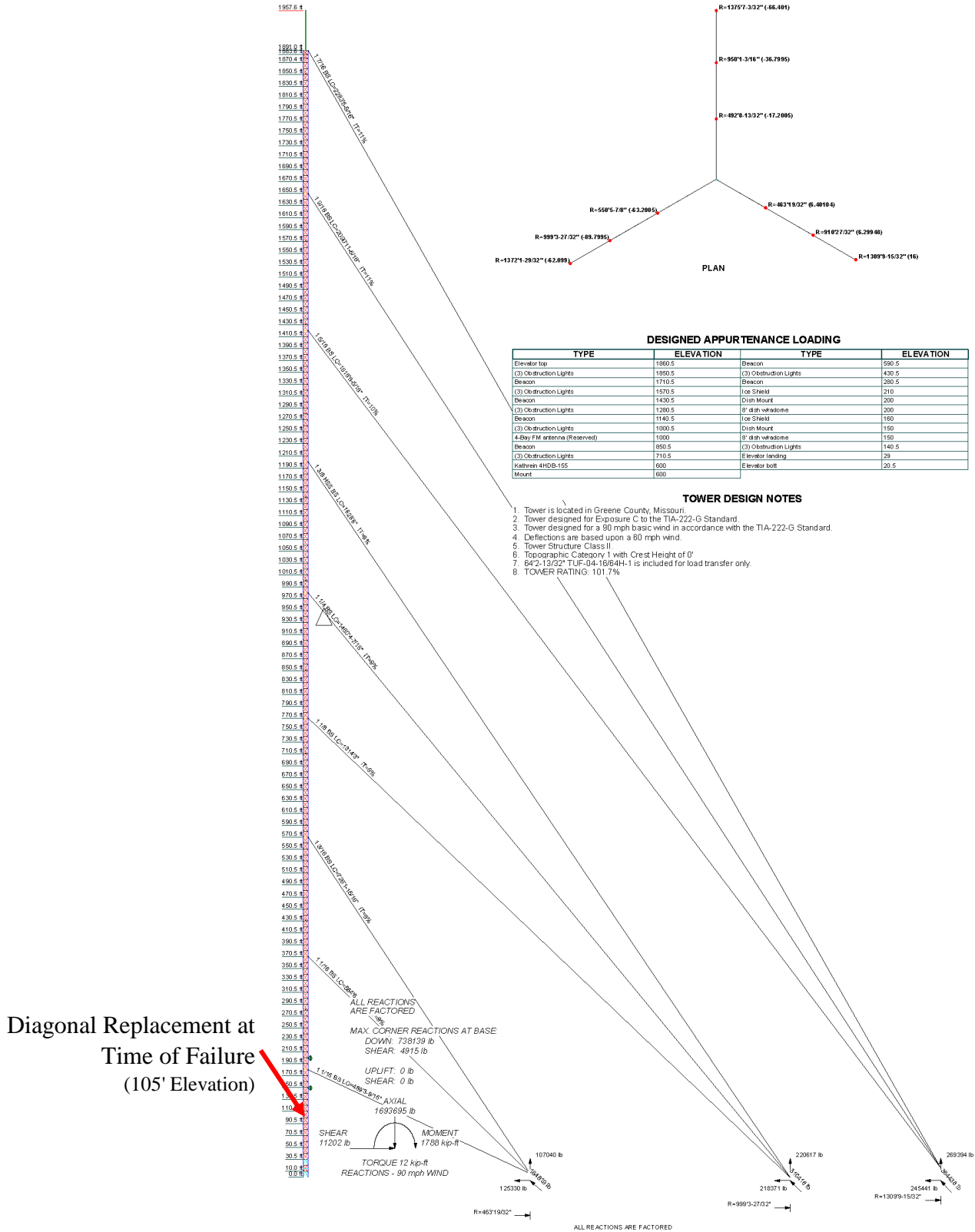


Figure 4. Tower Elevation (TCI Structural Analysis Report Appendix E-1)

TCI's May 19, 2017 structural analysis of the communication tower concluded that structural modifications were necessary for the tower to comply with the wind and ice loading requirements of ANSI/TIA-222-G. TCI recommended to replace one level of guy wires, reinforce 34 tower leg sections, replace 25 bays of diagonals and reinforce one level of horizontal struts. Lemay was contracted to perform the recommended structural modifications.

Incident Description

On April 19, 2018 at 9:33 AM, according to security camera surveillance footage, the KOZK communication tower collapsed resulting in the fatality of one worker and non-life-threatening injuries to four others. Lemay was performing structural modifications to the tower at the time of the collapse. An image of the resulting debris is shown in Figure 5. The contractor was replacing diagonals at the 105-foot level of the 1891-foot tall communication tower when the tower started to collapse. According to witness statements, the foreman of the five-man crew instructed the other employees on the tower to descend when audible structural distresses indicated the loss of structural integrity of the tower. The other employees on the tower managed to reach the ground and retreat from the falling debris. The foreman, however, decided to remain on the tower to discern and rectify the cause of the audible structural distresses and was struck and killed by the falling structure.



Figure 5. Collapsed Communication Tower (Google Image Search)



Figure 6 Top Section of Collapsed Communication Tower

Lemay arrived on-site on Monday, April 16, 2018 to begin working on the structural modifications to the communication tower the next day. The first two days involved preparation of the materials and tools and laying down and painting diagonals. Work on the tower was originally going to take place on Wednesday, but high winds caused the crew to delay work on the tower for another day. The crew began replacing diagonals on Thursday, April 19, 2018. They began replacing the diagonals at the 105' elevation. According to witness statements, the six replacement diagonals, the necessary equipment and the foreman were raised in a man-basket. One employee remained on the ground and the remaining employees went to assist with the replacement of diagonals. Two of the diagonals did not fit and were returned to the staging area on the ground so that the bolt holes could be bored out to facilitate their installation. The crew completed the diagonal replacement on two of the three sides and started work on the third. Witnesses stated they began hearing unusual sounds above them and the foreman instructed the other crew members to descend the tower as quickly as possible. The crew members made it off the tower before the collapse. However, the foreman did not, resulting in the lone fatality of the incident.

Observations of Collapsed Tower

As shown in Figure 5, it appears that as the tower began to collapse onto itself, the tower initially fell in the southern direction. Then the tower tilted and fell over itself back in a northern direction. As the top tiers of the tower fell, they remained essentially intact. As shown in Figure

6, all the guy wires disengaged from their anchor points and whipped about slashing through tree limbs and fencing. The man-basket, original and new diagonals and tools, including two come-a-longs were buried under the wreckage. The tower section from 90' to 120' was recovered and stored on-site for further observation. This tower section is shown in Figures 7 to 10. The slings and diagonals were found at the 105' tower elevation as shown in Figure 11. Several wires of the sling used for the come-a-long attachment to the tower panel point was severed and others were bird-nesting. A total of six bolted connections were missing. Two bolts were missing at the connection point between the two diagonals and the redundant horizontal bar. Two more bolts were missing from each gusset plate at the connection between the tower legs at the 100' elevation of the diagonals (see Figure 11). This was consistent with witness statements that the crew was working on the final third bay of diagonals at the 105' elevation at the time of the incident. The redundant bar and the tower leg appeared to have buckled.



Figure 7. Recovered Section of the Tower 90'-120'



Figure 9. Bent Redundant Member at 105' Tower Elevation



Figure 8. Bent Tower Leg from the Recovered Section



Figure 10. New bolts Installed on Two Diagonals at 100' Tower Elevation

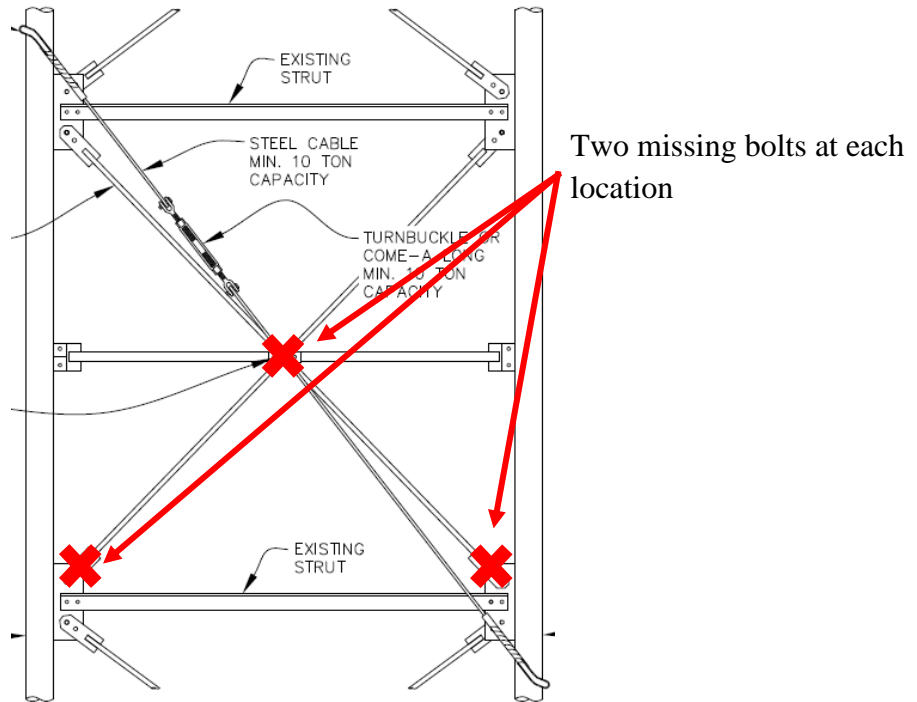


Figure 11. Missing bolts at the 105' Tower Elevation

Structural Analysis and Discussion

A guyed communication tower is a slender structure that relies on the guy wires to minimize flexural stresses generated by lateral loads, including wind, earthquake, etc. The tensioned guy wires were attached to the structure at various locations along the height of the tower. The compressive gravity loads, arising from its own weight, weight of the antennas and other equipment and resultant vertical loads of the guy wires, are supported by the axial strength of the tower. One of the characteristics of a structural member that affects its compressive strength is the unbraced length of the member. Therefore, it is critical that the tower legs are adequately braced while renovations or structural modifications are underway. Bracing must be in place to ensure the compressive stability of the tower legs and the lateral stability of the tower itself. The compressive capacity of a structural member is inversely proportional to the unbraced length. Typically, as the unbraced length of a member is increased, the compressive capacity of the member is reduced.

A representative section of the 105' tower elevation is shown in Figure 12. Figure 12 is a photograph of one of the tower bays of the top section of the tower that remained essentially intact after the collapse. The tower legs are braced by the diagonal rod members and the horizontal (appears vertical in the photograph as the tower is on its side) redundant. The typical tower bay is 10' wide by 10' tall. Therefore, this configuration of the bracing members creates unbraced lengths of five feet for the tower legs and redundant. The diagonals and the redundant were connected with two bolts at their mid-span as shown in Figure 13.



Figure 12. Representative Section from the Top of the Tower



Figure 13. Bolted Connection between Diagonals and Redundant Horizontal

TCI's erection drawings states that the diagonals must be replaced one at a time. However, in order to replace a diagonal, the two bolts on each end of the diagonal and the two bolts at the diagonal's mid-span must be removed. The removal of the bolts at the mid-span, however, results in doubling the unbraced length of the tower legs and redundant from five to ten feet.

This doubling of the unbraced length creates three problems for the redundant member. First, the redundant member exceeds the allowable slenderness ratio for main compression members other than leg members and for secondary members (200 and 250 respectively) as outlined in ANSI/TIA-222-G. The resultant slenderness ratio of the redundant member without the bolted connection at its mid-span is 274. Second, the unfactored compressive resistance is reduced from 32 kips to 8 kips. This 75% reduction of compressive strength created the third problem for the redundant member. The redundant no longer satisfied the ANSI/TIA-222-G requirement for minimum bracing resistance for the tower legs. ANSI/TIA-222-G requires that the strength of the brace is at least 1.5% of the axial design compressive force of the supported member. Therefore, the unbraced length of the tower legs has doubled to ten feet.

The ANSI/TIA-222-G design strength of the tower legs was reduced by 68% due to the doubling of the unbraced length. The tower legs require a minimum bracing resistance of approximately 13 kips. However, the horizontal redundant member is only capable of providing 8 kips. The resultant unfactored design strength of the tower legs reduces from 865 kips to 279 kips. The total dead load from the guy wires and the weight of the tower above the 105-foot elevation is 316 kips. Furthermore, any incidental wind load would increase the compressive load on some of the tower legs. The overstressing of the tower legs could have been a reason for why some of the diagonals did not fit and required re-boring of the bolt holes.

The diagonal replacement procedure is described on sheet E-5 of TCI's erection drawings document and is partially shown in Figure 14. The diagonal replacement procedure requires the use of a come-a-long to eliminate the tensile forces in the diagonal to facilitate the removal of the diagonal. TCI requires the use of a come-a-long with a ten-ton capacity. However, Lemay used a come-a-long device (Griphoist/Tirfor® T-532D) with a rated working load of 8,000 pounds (4 tons). An identical model come-a-long used on-site is shown in Figure 15. The come-a-long used on the tower is shown in Figure 16 while in the debris field and which was recovered later is shown in Figure 17.

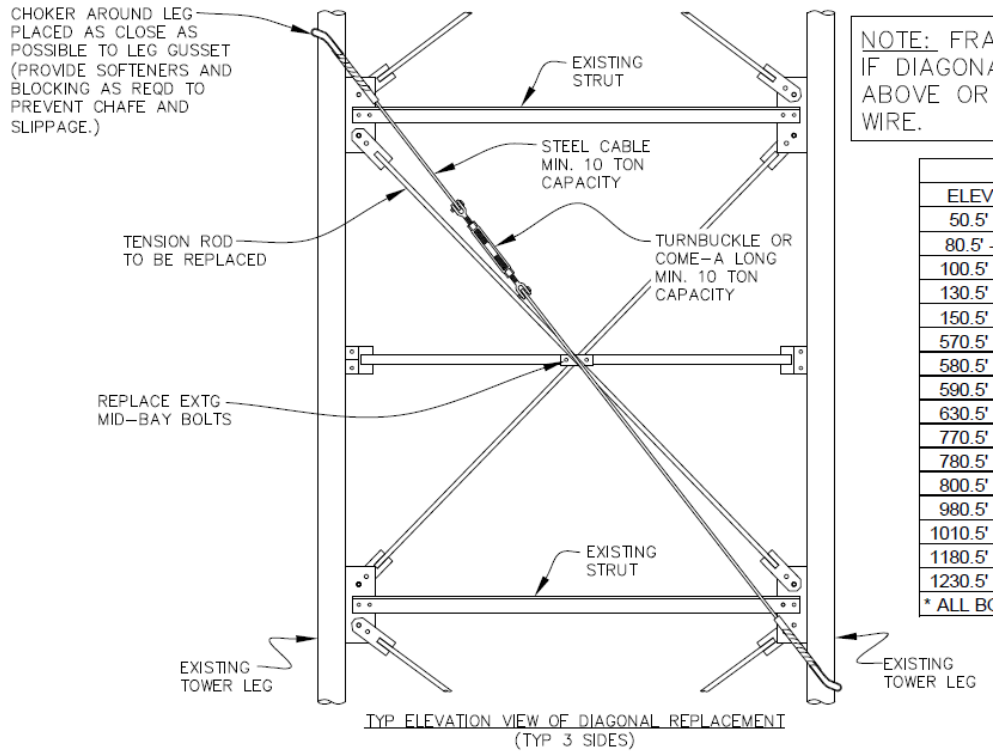


Figure 14. TCI Diagonal Replacement (E-5)



Figure 15. Lemay Come-a-long Used On-site



Figure 16. T-532D Come-a-long in Debris



Figure 17. T-532D Come-a-long Salvage from Debris

TCI's erection drawings document requires the use of a temporary frame when a diagonal is replaced above or below a guy wire location. Furthermore, TCI requires that the frame, provided by Lemay, be approved by TCI. During an interview with TCI engineering staff, TCI stated that they had no communications with Lemay about the use or design of a temporary frame. Lemay should have submitted a temporary frame design to TCI since diagonals required replacement

above guy wire levels 3, 4 and 5. Reciprocally, TCI should have requested a temporary frame design from Lemay since TCI's diagonal replacement procedure requires them to approve the frame. The notes from sheet E-5 of TCI's erection documents is shown in Figure 18. The lack of the temporary frame design did not contribute to the collapse of the communication tower, because at the time of the incident Lemay was not working on a bay that required a temporary frame.

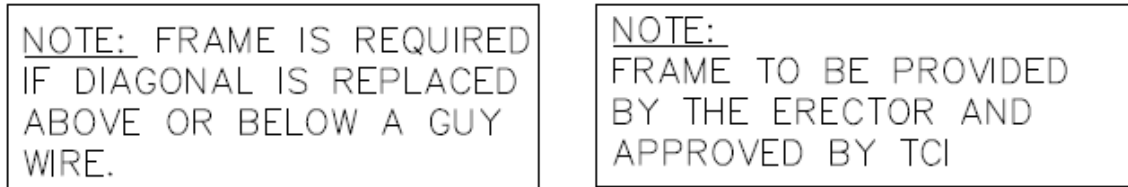


Figure 18. TCI Temporary Frame Requirements (E-5)

Conclusion

Based upon the above, we conclude that:

- 1) TCI's suggested diagonal replacement procedure was flawed in that it compromised the effectiveness of the integrated surrounding braces and the load bearing capacity of the tower legs. A single diagonal brace could not be removed without affecting the integrity of the redundant brace because the braces share two common bolts at the diagonal/redundant connection.
- 2) The cause of the communication tower collapse was the weakening of the compressive strength of the tower legs by removing the bolts at the connection of the diagonals to the horizontal redundant. The compromised redundant effectively doubled the unbraced length of the tower leg which reduced the compressive capacity of the tower leg.
- 3) Lemay used an undersized come-a-long while removing the diagonal braces.
- 4) Lemay failed to provide the design of the required temporary frame for diagonal replacement above or below a guy level. TCI failed to confirm the use/design of a temporary frame as TCI is required to approve the adequacy of the temporary frame prior to diagonal replacement according to TCI's construction documentation.

Appendix A

ERECTION DRAWINGS
(PREPARED BY TCI)

REINFORCE TOWER, KOZK

PROJECT NO.: 180830-027
MISSOURI STATE UNIVERSITY
1891.0-FT GUYED TOWER
KOZK FORDLAND
905 STATE HIGHWAY FF
FORDLAND, MISSOURI 65602
(37°10'11.0"N, 92°56'31.0"W)
(WEBSTER COUNTY)

PROJECT INFORMATION	SHEET INDEX
<p>APPLICANT: MISSOURI STATE UNIVERSITY 901 S NATIONAL AVENUE FORDLAND, MISSOURI 65602 PH: 417-836-5101</p> <p>LAND OWNER: MISSOURI STATE UNIVERSITY EMERGENCY CONTACT: BRETT MOORE MISSOURI STATE UNIVERSITY PH: 417-836-5804</p> <p>JURISDICTION: WEBSTER COUNTY, MISSOURI</p>	<p>T-1 = TITLE SHEET G-1 = GENERAL NOTES G-2 = MODIFICATION DESCRIPTION E-1 = TOWER ELEVATION DRAWING E-2 = TOWER ELEVATION DRAWING E-3 = TOWER ELEVATION DRAWING E-4 = CROSS SECTION E-5 = DIAGONAL REPLACEMENT E-6 (REV 01) = SPLIT PIPE REINFORCING E-7 = HORIZONTAL REINFORCEMENT E-8 = GUY WIRE REPLACEMENT E-9 = TENSION CHART E-10 = POST MODIFICATION CHECKLIST</p>
<p>CONTRACTOR LIST</p> <p>TOWER CONTRACTOR: Tower Consultants, Inc. 15 Barry Ct. Springfield, MO 65812 (417) 497-8468</p>	<p>LEGEND</p> <p>A ▲ = DETAIL ▼ = SECTION □ = CENTERLINE □ = RATE □ = PROPERTY LINE ▲ = TENSION</p>
<p>PROJECT DESCRIPTION</p> <p>MISSOURI STATE UNIVERSITY IS PROPORING TO PERFORM A TOWER MODIFICATION IN ORDER TO COMPLY WITH MISSOURIA-222-G STANDARD WITH PROPOSED LOADING ON THE EXISTING 1891.0-FT GUYED TOWER.</p>	<p>TOWER DESIGNED FOR A WIND SPEED OF 90-MPH WITH NO ICE & 30-MPH WITH 1" OF RADIAL ICE PER EIA/TIA-222-G STANDARD.</p>

VICINITY MAP

**KOZK
1891.0-FT GUYED
TOWER**

KOZK

SPRINGFIELD, MO

1891.0 GUYED TOWER

ERECTION DRAWINGS


INDEX

Category: **T-1**

GENERAL NOTES

- GENERAL**
1. ALL METHODS, MATERIALS, AND WORKMANSHIP SHALL FOLLOW THE DICTATES OF GOOD CONSTRUCTION PRACTICE.
 2. ALL WORK INDICATED ON THESE DRAWINGS SHALL BE PERFORMED BY QUALIFIED CONTRACTORS WITH A MINIMUM OF 10 YEARS EXPERIENCE IN TOWER AND FOUNDATION CONSTRUCTION.
 3. ALL DIMENSIONS, MATERIALS, AND DETAILS OF THE EXISTING STRUCTURES ARE INCLUDED FOR INFORMATION ONLY. CONTRACTOR SHALL FIELD VERIFY ALL RELEVANT INFORMATION PRIOR TO CONSTRUCTION OR FABRICATION AND NOTIFY THE ENGINEER OF RECORD IMMEDIATELY OF ANY VARIANCE OR DISCREPANCIES. ALL NEW WORK SHALL ACCOMMODATE EXISTING CONDITIONS. DETAILS NOT SPECIFICALLY SHOWN ON THE DRAWINGS SHALL FOLLOW SIMILAR DETAILS FOR THIS JOB.
 4. DIMENSIONS AND ELEVATIONS GIVEN FOR THE NEW CONSTRUCTION MUST ALSO BE VERIFIED BY THE CONTRACTOR PRIOR TO FABRICATION AND ERECTION TO ASSURE PROPER FIT AND ALIGNMENT OF THE STRUCTURAL COMPONENTS IN ACCORDANCE WITH THE INTENT OF THE CONTRACT DOCUMENTS.
 5. ANY SUBSTITUTIONS MUST CONFORM TO THE REQUIREMENTS OF THESE NOTES AND SPECIFICATIONS AND SHOULD BE SIMILAR TO THOSE SHOWN. ALL SUBSTITUTIONS SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
 6. ANY MANUFACTURED DESIGN ELEMENTS MUST CONFORM TO THE REQUIREMENTS OF THESE NOTES AND SPECIFICATIONS AND BE APPROVED BY THE ENGINEER OF RECORD PRIOR TO FABRICATION. THE WORK SHALL BE PERFORMED IN THE STATE WHERE THE WORK IS BEING PERFORMED. IF REQUIRED, CONTRACTOR TO PREPARE PERMIT DRAWING SET SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE WHERE THE WORK IS BEING PERFORMED. ALL PERMITS, LICENSES, APPROVALS AND OTHER REQUIREMENTS FOR CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
 7. ALL WORK SHALL BE DONE IN ACCORDANCE WITH LOCAL CODES AND SAFETY REGULATIONS.
 8. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND EXECUTION OF ALL MISCELLANEOUS SHORING, BRACING, TEMPORARY SUPPORTS, ETC. NECESSARY TO PROVIDE A COMPLETE AND STABLE STRUCTURE AS SHOWN ON THESE DRAWINGS. ALL INSTALLATION PROCEDURES, SAFEGUARDS AND MEANS AND METHODS OF CONSTRUCTION ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
 9. A DETAILED RIGGING PLAN SHALL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE OWNER FOR APPROVAL. THE RIGGING PLAN SHALL INCLUDE AS A MINIMUM: BRIEF TOWER DESCRIPTION, HOIST MODEL AND CAPACITY, DATA, WIRE ROPE SIZE AND CONSTRUCTION, SHEARLOCK DIAMETER AND CAPACITY, CHOKER SIZE AND CAPACITY, RIGGING DETAILS TO THE TOWER, PLANNED LIFT HEIGHTS, WIN POLE SIZE AND CAPACITY AND A DETAILED LOCKING NET RIGGING COMPONENTS.
- APPLICABLE CODES AND STANDARDS**
1. AISC/AIA/EA: STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES.
 2. IBC: INTERNATIONAL BUILDING CODE, LATEST EDITION.
 3. ASTM: STANDARDS FOR BUILDING CODES, LATEST EDITION.
 4. ACI 318: AMERICAN CONCRETE INSTITUTE, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, LATEST EDITION.
 5. ACI 315: AMERICAN CONCRETE INSTITUTE, DETAILS AND DETAILING OF CONCRETE REINFORCEMENT, LATEST EDITION.
 6. CSRI: CONCRETE STEEL REINFORCING INSTITUTE, MANUAL OF STANDARD PRACTICE, LATEST EDITION.
 7. AWS: AMERICAN WELDING SOCIETY, STRUCTURAL WELDING CODE, LATEST EDITION.
- STEEL AND FABRICATION**
1. ALL STEEL FABRICATION TO BE DONE BY AN AISC-CERTIFIED FABRICATION FACILITY IN ACCORDANCE WITH THE LATEST EDITION OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION.
 2. ALL STEEL TO BE ASTM A572 OR 50 (60KSI MIN YIELD STRENGTH) U.N.O.; BOLTS TO BE ASTM A325 WITH ANCO LOCKNUTS U.N.O.
 3. ALL MATERIAL TO BE HOT DIPPED GALVANIZED PER ASTM A123 OR ASTM A153.
 4. BOLT HOLE DIAMETER SHALL NOT BE MORE THAN 1/8" LARGER THAN NOMINAL BOLT DIAMETER AND SHALL BE PUNCHED OR DRILLED U.N.O.
- WELDING**
1. ALL WELDING TO BE PERFORMED BY AWS CERTIFIED WELDERS AND CONDUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE AWS WELDING CODE. ALL WELDS TO BE INSPECTED FOR STRUCTURAL SOUNDNESS AND DOCUMENTED.
 2. ALL ELECTRODES TO BE E70 LOW HYDROGEN TYPE.
 3. MINIMUM WELD SIZE TO BE 0.3125 INCH FILLET WELDS UNLESS NOTED OTHERWISE ON THE DRAWINGS.
 4. ALL WELDED CONNECTIONS TO BE SEAL WELDED FOR GALVANIZING.

- FIELD INSTALLATION**
- FINISHED SURFACE THAT ARE SCRATCHED OR DAMAGED SHALL BE REPAIRED USING A ZINC RICH TWO PART EPOXY SUCH AS CARBOLINE 15 OR EQUIVALENT.**
2. A480 BOLTS SHALL BE SPRAY PAINTED WITH A COAT OF COLD GALVANIZING PRIOR TO INSTALLATION FOLLOWED BY A COAT OF A ZINC RICH TWO PART EPOXY SUCH AS CARBOLINE 15 OR EQUIVALENT AFTER INSTALLATION.
 3. HARDWARE INTERFERING WITH THE INSTALLATION OF REINFORCING MATERIAL SHALL BE TEMPORARILY MOVED AND REINSTALLED AFTER THE COMPLETION OF THE WORK.
 4. WHEN FIELD WELDING IS REQUIRED THE STEEL SHALL BE CLEANED OF ALL PAINT AND GALVANIZING TO A BARE METAL, AS SPECIFIED PER AWS D1.1. PREHEATING AND POST HEATING MAY BE REQUIRED.
 5. WELDED AREAS ARE TO BE TOUCHED UP USING A ZINC RICH TWO PART EPOXY SUCH AS CARBOLINE 15 OR EQUIVALENT.
- TIGHTENING OF BOLTS AND NUTS**
1. ALL HIGH STRENGTH BOLTS TO BE TIGHTENED TO THE SNUG TIGHT CONDITION AS SPECIFIED IN THE CURRENT EDITION OF THE AISC SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A480 BOLTS. BOLTS REQUIRING FULL PRETENSION TO BE TIGHTENED BY "THE TURN OF THE NUT METHOD" U.N.O.
- FOUNDATIONS**
1. CONTRACTOR SHALL VERIFY THE LOCATION OF UNDERGROUND UTILITIES IN THE AREA WHERE THE WORK IS TO BE PERFORMED.
 2. DRILLED SHAFT INSTALLED IN ACCORDANCE WITH ACI-308 (LATEST EDITION).
- CONCRETE**
1. ALL CONCRETE FOR FOUNDATIONS SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI, AFTER 28 DAYS.
 2. THE CONCRETE MIX SHALL NOT CONTAIN LESS THAN 51 SACKS OF CEMENT (ASTM C 150 TYPE II) PER CUBIC YARD.
 3. THE CONCRETE SHALL HAVE A MAXIMUM AGGREGATE SIZE OF 1/2".
 4. THE CONCRETE MIX SHALL PRODUCE A MAXIMUM SLUMP OF 5" ±1".
 5. THE CONCRETE MIX SHALL HAVE A TOTAL AIR CONTENT OF 5%, WITH A TOLERANCE OF PLUS OR MINUS 1.5%. AIR-ENTRAINING ADMIXTURES SHALL CONFORM TO ASTM C 260.
 6. THE CONCRETE MIX SHALL HAVE A MAXIMUM WATER-CEMENT RATIO OF 0.45. WATER REDUCING OR ACCELERATING ADMIXTURES SHALL CONFORM TO ASTM C 494.
 7. THE CONCRETE SHALL NOT CONTAIN CALCIUM CHLORIDE OR ANY OTHER ADMIXTURE CONTAINING CHLORIDE OTHER THAN NATURAL IMPURITIES.
 8. FORM WORK SHALL CONFORM TO ACI 318 (LATEST EDITION) SPECIFICATIONS.
 9. ALL CONCRETE SHALL BE PLACED IN A MONOLITHIC POUR UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
 10. PROVIDE CHAMFERS AT ALL EXPOSED CORNERS OF CONCRETE.
 11. CONCRETE WORK UNDER EXTREME WEATHER CONDITIONS SHALL CONFORM TO ACI 318 (LATEST EDITION) SPECIFICATIONS.
- STEEL REINFORCEMENT (REBAR)**
1. ALL REINFORCING STEEL TO BE GRADE 60 DEFORMED BILLET STEEL PER ASTM A615.
 2. REINFORCEMENT SHALL BE FABRICATED AND PLACED IN ACCORDANCE WITH THE ACI 315 AND CSRI SUPPORT REINFORCING AS REQUIRED BY CSRI TO PREVENT DISPLACEMENT UPON CONCRETE POURING.
 3. MAINTAIN ALL CLEARANCES NOTED ON THE DRAWINGS. WHERE NO DIMENSIONS ARE NOTED, USE THE ACI RECOMMENDED CLEARANCES.
 4. FOR CONCRETE POURED AGAINST SOIL, THE MINIMUM COVER FOR ALL REINFORCING BARS SHALL BE 3".
 5. TIE BARS SECURELY WITH #16 ANNEALED WIRE AND SUPPORT AS REQUIRED.
 6. ALL WELDED WIRE FABRIC TO BE PER ASTM A185. ALL BARS AND WIRE SHALL BE FREE OF RUST, MILL SCALE, DIRT, OR OTHER FOREIGN MATERIAL PRIOR TO CASTING CONCRETE.
 7. PROVIDE MINIMUM LAP SPLICES OF 36 BARS DIAMETERS UNLESS NOTED OTHERWISE.
 8. FIELD BENDING OF REINFORCEMENT BARS IS NOT PERMITTED. DO NOT WELD REINFORCING BARS.

No.	0	Date	11/3/17	By	WEB	Revision	RELEASED FOR JOB USE
				KOZK 1891-0 GUYED TOWER SPRINGFIELD, MO GENERAL NOTES			
ICI INDUSTRIAL CONSTRUCTION, INC. 4800 W. STATE ST., SUITE 200 OMAHA, NE 68102 TEL: 402-426-0881 FAX: 402-426-0882 WWW.ICI-CORP.COM				Sheet No.: Project No.: 17,289,002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17			

MODIFICATION DESCRIPTION:

1. THIS DRAWING IS FOR JOB USE.
2. UPGRADES APPLY TO ALL THREE FACES OF THE TOWER.
3. A TEMPORARY BRACE MUST BE INSTALLED THAT IS OF EQUIVALENT OR GREATER CAPACITY THAN THE MEMBER BEING REPLACED. THE TEMPORARY BRACE SHALL BE PLACED ADJACENT TO THE MEMBER BEING REPLACED SUCH THAT IT WILL TAKE THE LOAD AFTER THE EXISTING MEMBER IS REMOVED.
A TEMPORARY FRAME IS REQUIRED ABOVE AND BELOW GUY LEVELS DURING DIAGONAL REPLACEMENT.
4. REPLACE THE EXISTING SOLID ROD DIAGONAL MEMBERS WITH A NEW HIGHER CAPACITY MEMBER AT THE FOLLOWING LOCATIONS (SEE E-5):

50.5' - 60.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
60.5' - 100.5'	1" S.R., ASTM A572-50, 3/4" A490X BOLTS
100.5' - 110.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
130.5' - 160.5'	7/8" S.R., ASTM A572-50, 5/8" A325X BOLTS
570.5' - 590.5'	1 1/4" S.R., ASTM A572-50, 3/4" A490X BOLTS
590.5' - 630.5'	1" S.R., ASTM A572-50, 3/4" A490X BOLTS
630.5' - 650.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
770.5' - 800.5'	1" S.R., ASTM A572-50, 3/4" A325X BOLTS
800.5' - 830.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
980.5' - 990.5'	1" S.R., ASTM A572-50, 3/4" A325X BOLTS
1010.5' - 1020.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
1180.5' - 1190.5'	1" S.R., ASTM A572-50, 3/4" A325X BOLTS
1230.5' - 1240.5'	7/8" S.R., ASTM A572-50, 3/4" A325X BOLTS
5. REINFORCE THE EXISTING LEGS BY ADDING SPLIT PIPE REINFORCING AT THE FOLLOWING LOCATIONS (SEE E-6)

0.0' - 60.5'	(2 SECTIONS) HALF HSS 5.5" O.D. x 0.5" WALL, FY=50KSI MIN.
60.5' - 150.5'	(3 SECTIONS) HALF HSS 5.25" O.D. x 0.5" WALL, FY=50KSI MIN.
150.5' - 210.5'	(2 SECTIONS) HALF HSS 5.5" O.D. x 0.5" WALL, FY=50KSI MIN.
210.5' - 390.5'	(6 SECTIONS) HALF HSS 5.25" O.D. x 0.5" WALL, FY=50KSI MIN.
390.5' - 420.5'	(1 SECTION) HALF HSS 5.125" O.D. x 0.5" WALL, FY=50KSI MIN.
420.5' - 450.5'	(1 SECTION) HALF HSS 5.25" O.D. x 0.5" WALL, FY=50KSI MIN.
450.5' - 600.5'	(5 SECTIONS) HALF HSS 5.125" O.D. x 0.5" WALL, FY=50KSI MIN.
600.5' - 810.5'	(7 SECTIONS) HALF HSS 4.875" O.D. x 0.5" WALL, FY=50KSI MIN.
810.5' - 1020.5'	(7 SECTIONS) HALF HSS 4.75" O.D. x 0.5" WALL, FY=50KSI MIN.
6. REINFORCE THE EXISTING DOUBLE ANGLE HORIZONTAL MEMBERS BY ADDING A SINGLE ANGLE MEMBER BETWEEN THE DOUBLE ANGLES AT THE FOLLOWING LOCATIONS (SEE E-7):

590.5'	(1 LEVEL) L3 1/2"x2 1/2"x3/8" 3/4" A325X BOLTS
--------	--

7. REPLACE GUY LEVEL 6 AND ADJUST THE GUY WIRE INITIAL TENSION USING THE TANGENT INTERCEPT METHOD TO THE VALUES LISTED IN THE CHART BELOW. REUSE EXISTING GROUNDING AND HFD (SEE E-8 & E-9):

EXISTING GUY PROPERTIES		RECOMMENDED GUY PROPERTIES	
GUY LEVEL	GUY ANCHOR	GUY ANCHOR	% OF U.L. TENSION
6"	Outer Anchor	Outer Anchor	11.0%
6"	Inner Anchor	Inner Anchor	11.0%
12"	Outer Anchor	Outer Anchor	11.0%
12"	Inner Anchor	Inner Anchor	11.0%
18"	Outer Anchor	Outer Anchor	11.0%
18"	Inner Anchor	Inner Anchor	11.0%
24"	Outer Anchor	Outer Anchor	11.0%
24"	Inner Anchor	Inner Anchor	11.0%
30"	Outer Anchor	Outer Anchor	11.0%
30"	Inner Anchor	Inner Anchor	11.0%
36"	Outer Anchor	Outer Anchor	11.0%
36"	Inner Anchor	Inner Anchor	11.0%

- NOTE: VALUES SHOWN ABOVE ARE VALID AT 60 DEGREES FAHRENHEIT; A P&T CHART WITH TEMPERATURE CORRECTIONS WILL BE REQUIRED FOR FIELD ADJUSTMENTS
8. ALL MATERIAL SHALL BE HOT DIP GALVANIZED IN ACCORDANCE TO ASTM SPECIFICATIONS.
 9. ALL REINFORCING MATERIAL SHALL BE PAINTED IN THE FIELD TO MATCH THE EXISTING COLOR SCHEME OF THE TOWER.
 10. THE MODIFICATION MATERIAL AND INSTALLATION DRAWINGS CONTAINED HEREIN ARE BASED ON THE ASSUMPTION THAT THE TOWER HAS BEEN PROPERLY INSTALLED AND MAINTAINED, INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
 - A. PROPER ALIGNMENT AND PLUMBNESS.
 - B. CORRECT GUY TENSIONS.
 - C. CORRECT BOLT TIGHTNESS.
 - D. NO SIGNIFICANT DETEIORATION OR DAMAGE TO ANY COMPONENT.

11. ALL MATERIAL REQUIRED BY SHEETS E-1 THROUGH E-8 FURNISHED TO CONTRACTOR BY TCI. FOR PRICING PLEASE CONTACT:


RON DOZSA
425-778-5169

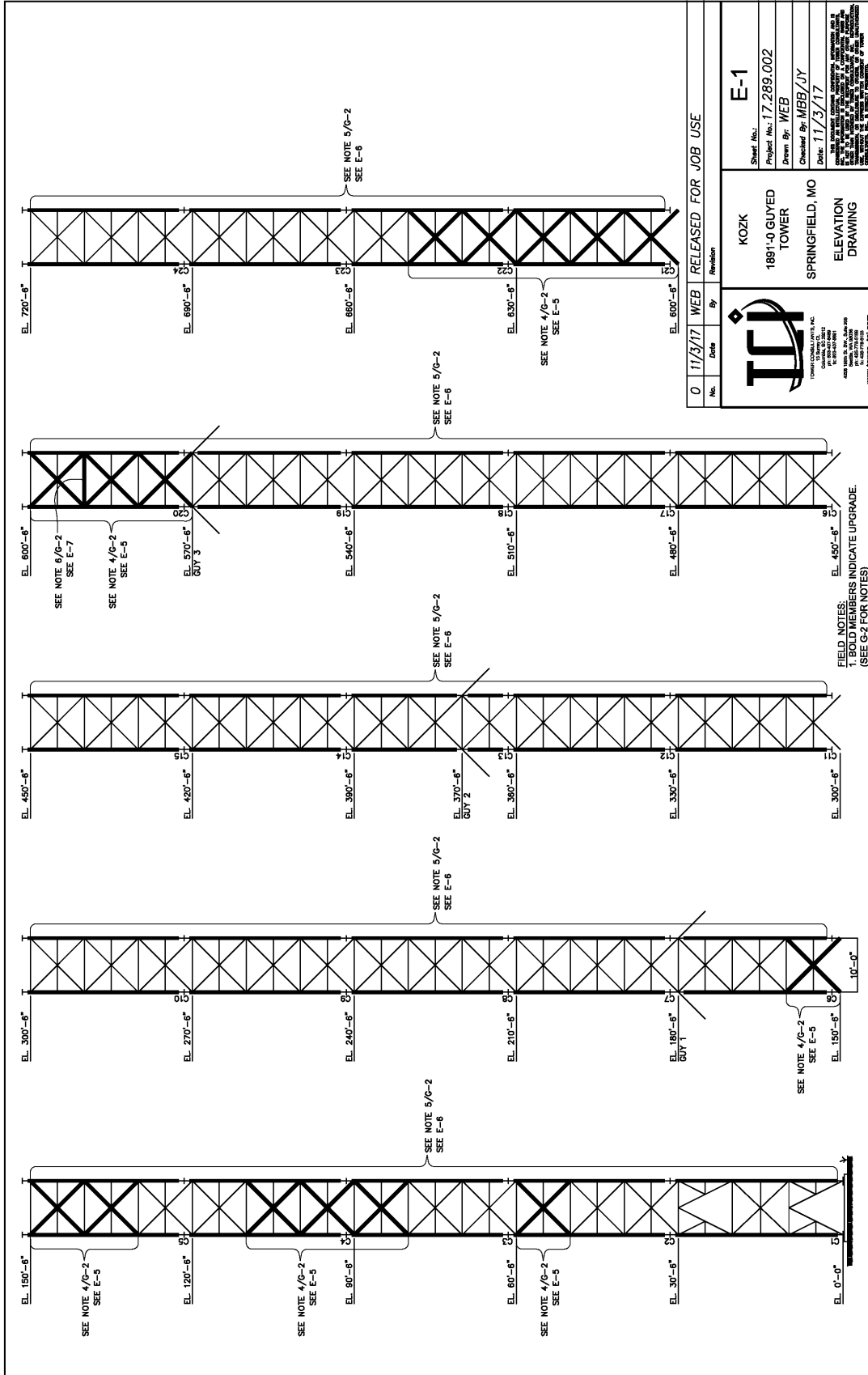
DESIGN INFORMATION:

1. THIS DRAWING PACKAGE IS BASED ON TOWER CONSULTANTS ANALYSIS REPORT 17.289.001, DATED MAY 19, 2017.
2. THE TOWER IS DESIGNED FOR THE EXISTING AND PROPOSED LOADING AS LISTED IN THE REPORT REFERENCED ABOVE.


ANTENNA WORK:

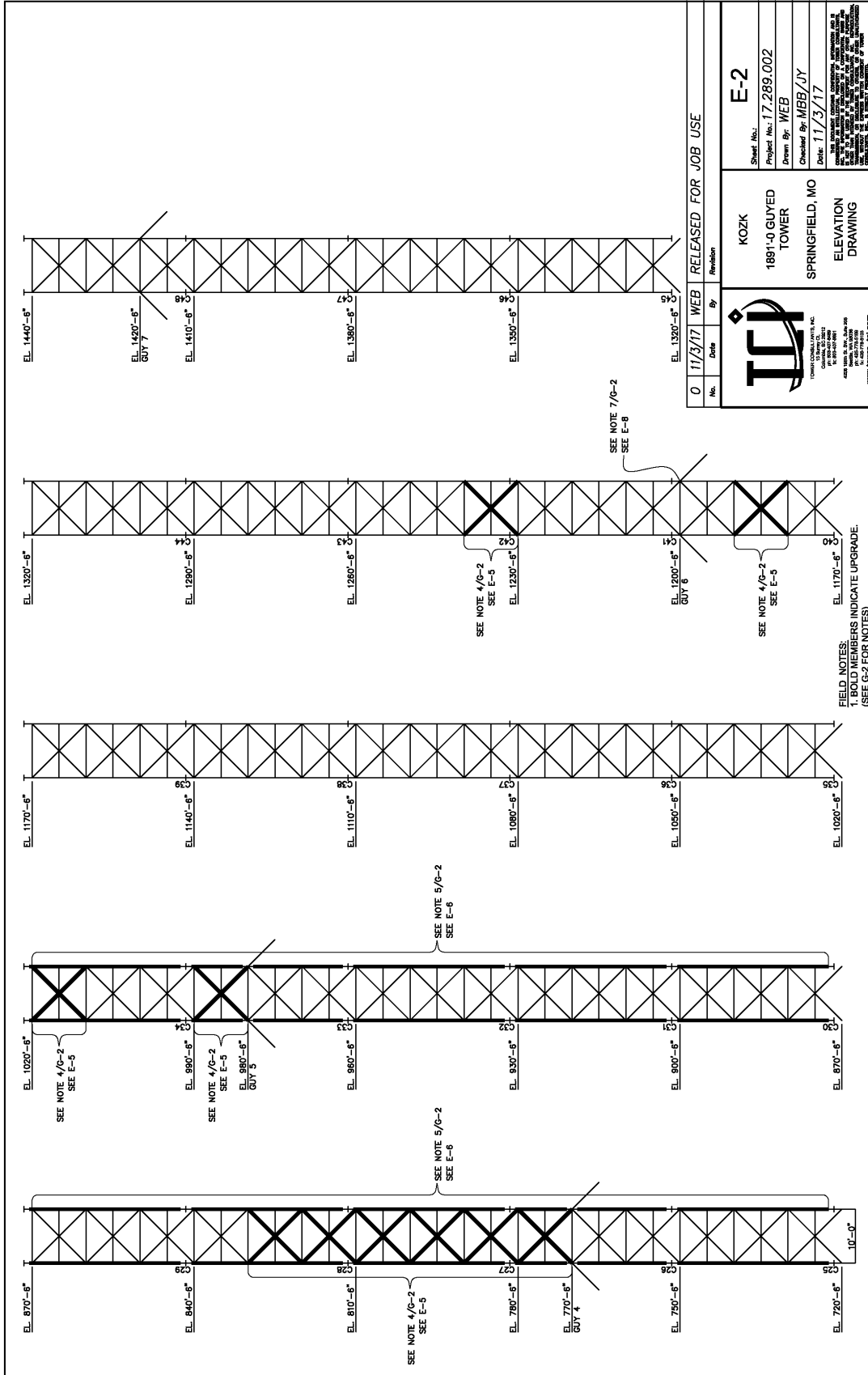
1. REMOVE THE FOLLOWING LINES (SEE CROSS SECTION ON E-4):
 - 0' - TOP 6 1/8" RIGID LINE
2. INSTALL THE FOLLOWING LINES (SEE CROSS SECTION ON E-4):
 - 0' - TOP 6 1/8" RIGID LINE

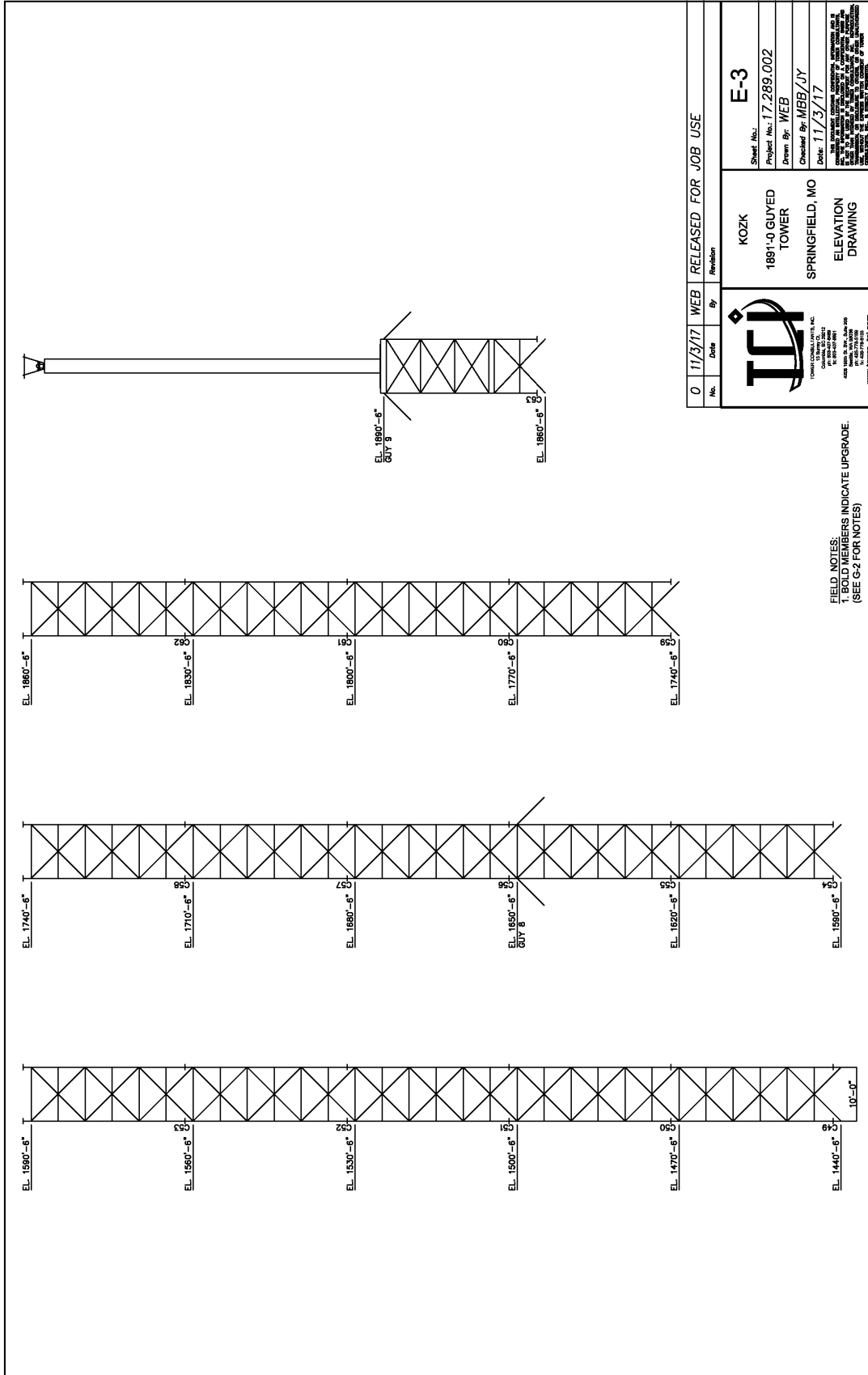
0	11/3/17	WEB	By	Revision	RELEASED FOR JOB USE
No.	Date				
 <p>TCI TOWER CONSULTANTS, INC. 1000 N. W. 10th St. Ocala, FL 32107 Tel: 352-237-8881 Fax: 352-237-8882 www.tower-consultants.com</p>			Sheet No.: G-2 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17		
			KOZAK 1891-Q GUYED TOWER SPRINGFIELD, MO MODIFICATION DESCRIPTION		




No.	Date	By	Revision
0	11/3/17	WEB	RELEASED FOR JOB USE

 TOWER JOINTS, INC. 4800 W. 116th St., Suite 200 Overland Park, MO 66204 Tel: 913-241-8881 Fax: 913-241-8882 www.tji.com	KOZIK 1891-Q GUYED TOWER SPRINGFIELD, MO ELEVATION DRAWING	Sheet No.: E-1 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
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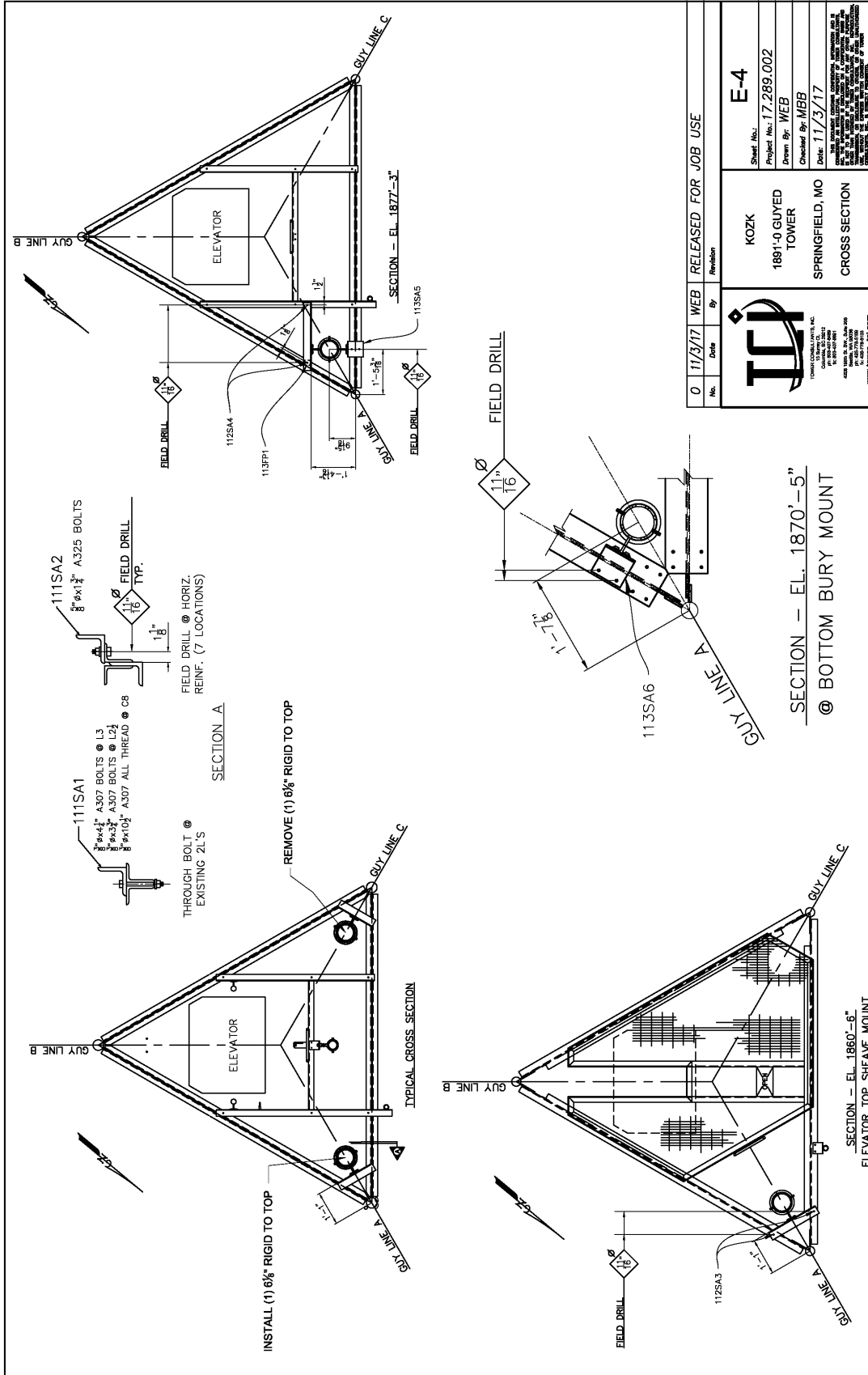




No.	Date	By	Revision
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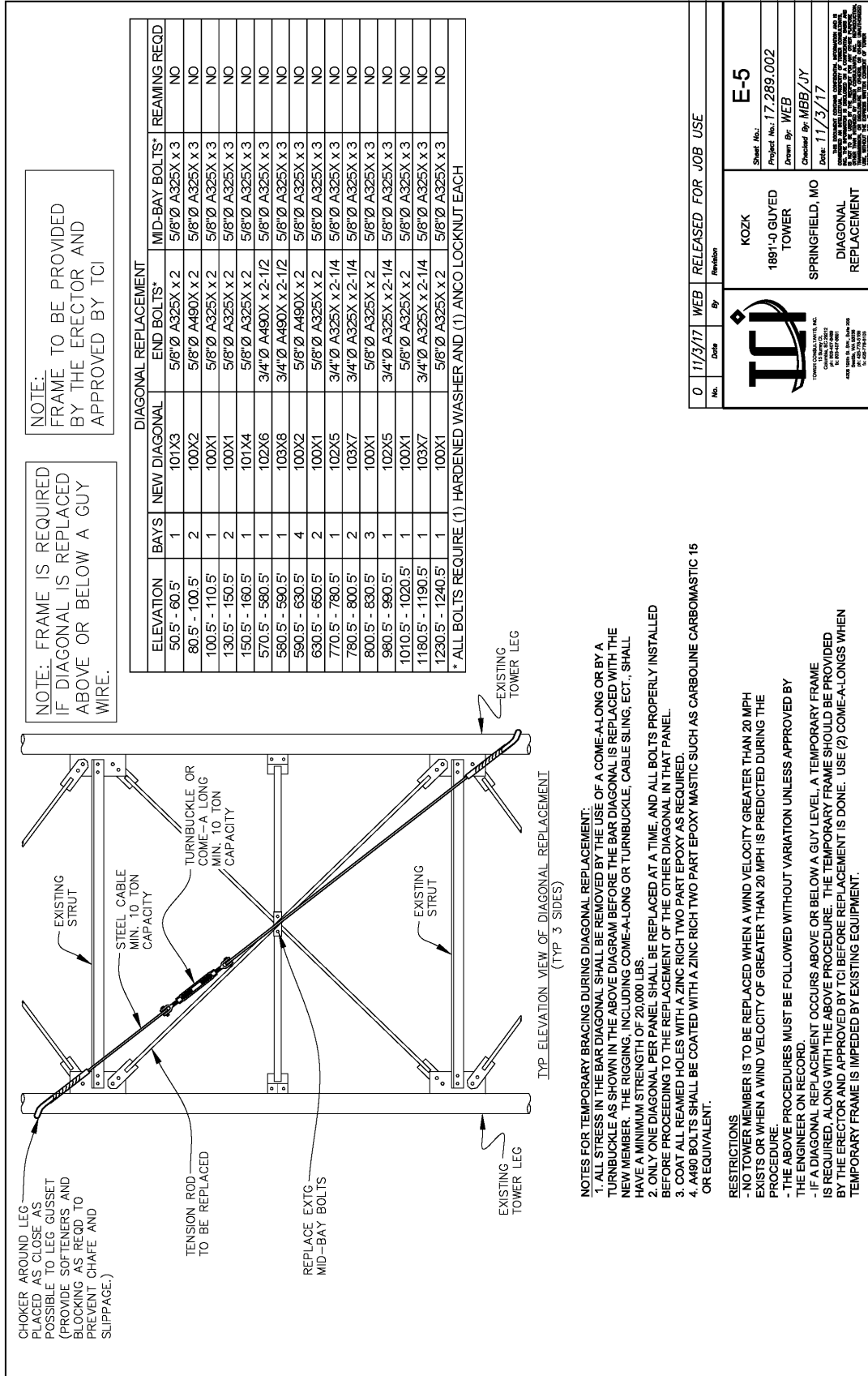
 TOWER COMMUNICATIONS, INC. 4800 W. 11th St., Suite 200 Tulsa, Oklahoma 74116 Tel: 918-437-8881 Fax: 918-437-7318 www.tower.com	KOZIK 1891'-0 GUYED TOWER SPRINGFIELD, MO ELEVATION DRAWING	Sheet No.: E-3 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
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FIELD NOTES:
 1. BOLD MEMBERS INDICATE UPGRADE.
 (SEE G-2 FOR NOTES)



No.	Date	By	Revision
0	11/3/17	WEB	RELEASED FOR JOB USE

	Sheet No.:	E-4
	Project No.:	17.289.002
	Drawn By:	WEB
	Checked By:	MBB
Date:		11/3/17
KOSK 1891-0 GUYED TOWER SPRINGFIELD, MO CROSS SECTION		www.kosk.com 488 Main St., Suite 200 Springfield, MO 65802 Tel: 417-832-0881 Fax: 417-832-0882 www.kosk.com



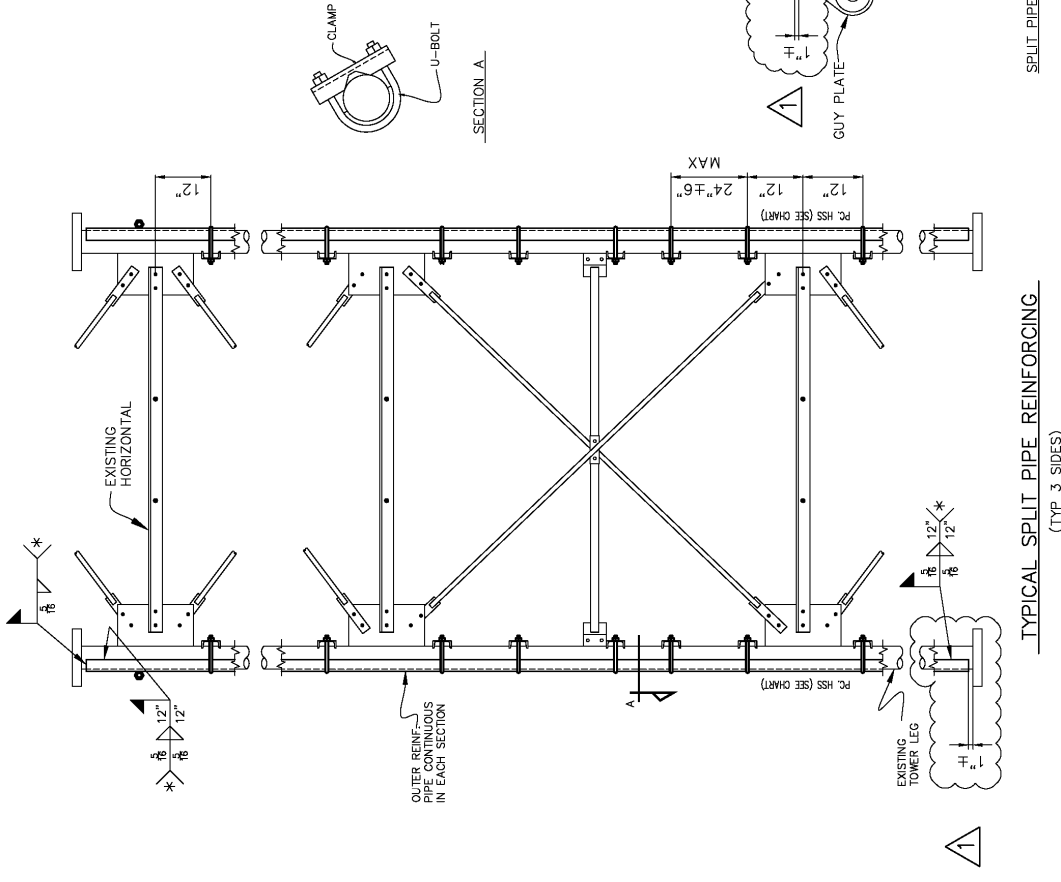
No.	Date	Revision
0	11/3/17	WEB RELEASED FOR JOB USE

TCI
TOWER CONSTRUCTION, INC.
1000 W. STATE ST.
SPRINGFIELD, MO 65702
TEL: 417-862-8881
FAX: 417-862-8882
WWW.TCI-CORP.COM

KOZK
1891-Q GUYED TOWER
SPRINGFIELD, MO
DIAGONAL REPLACEMENT

Sheet No.:	E-5
Project No.:	17.289.002
Drawn By:	WEB
Checked By:	MBB/JY
Date:	11/3/17

SPLIT PIPE REINFORCING PIPE				
ELEVATION	SECTIONS	REINFORCING PIPE	U-BOLTS	CLAMP
0.0' - 30.5'	1	105M6	108UB60 (C/C 6-3/4")	108M19
30.5' - 60.5'	1	105M1	108UB60 (C/C 6-3/4")	108M19
60.5' - 90.5'	1	107M15	108UB60 (C/C 6-3/4")	108M19
90.5' - 150.5'	2	105M2	108UB60 (C/C 6-3/4")	108M19
150.5' - 180.5'	1	106M7	108UB60 (C/C 6-3/4")	108M19
180.5' - 210.5'	1	105M1	108UB60 (C/C 6-3/4")	108M19
210.5' - 270.5'	2	105M2	108UB60 (C/C 6-3/4")	108M19
270.5' - 300.5'	1	107M15	108UB60 (C/C 6-3/4")	108M19
300.5' - 360.5'	2	105M2	108UB60 (C/C 6-3/4")	108M19
360.5' - 390.5'	1	106M8, 106M9	108UB60 (C/C 6-3/4")	108M19
390.5' - 420.5'	1	105M3	108UB60 (C/C 6-3/4")	108M19
420.5' - 450.5'	1	105M2	108UB60 (C/C 6-3/4")	108M19
450.5' - 480.5'	1	107M16	108UB60 (C/C 6-3/4")	108M19
480.5' - 540.5'	2	105M3	108UB60 (C/C 6-3/4")	108M19
540.5' - 570.5'	1	106M10	108UB60 (C/C 6-3/4")	108M19
570.5' - 600.5'	1	105M3	108UB60 (C/C 6-3/4")	108M19
600.5' - 660.5'	2	105M4	108UB50 (C/C 5-3/4")	108M20
660.5' - 690.5'	1	107M17	108UB50 (C/C 5-3/4")	108M20
690.5' - 750.5'	2	105M4	108UB50 (C/C 5-3/4")	108M20
750.5' - 780.5'	1	106M11, 106M12	108UB50 (C/C 5-3/4")	108M20
780.5' - 810.5'	1	105M4	108UB50 (C/C 5-3/4")	108M20
810.5' - 870.5'	2	105M5	108UB50 (C/C 5-3/4")	108M20
870.5' - 900.5'	1	107M18	108UB50 (C/C 5-3/4")	108M20
900.5' - 960.5'	2	105M5	108UB50 (C/C 5-3/4")	108M20
960.5' - 990.5'	1	107M13, 107M14	108UB50 (C/C 5-3/4")	108M20
990.5' - 1020.5'	1	105M5	108UB50 (C/C 5-3/4")	108M20



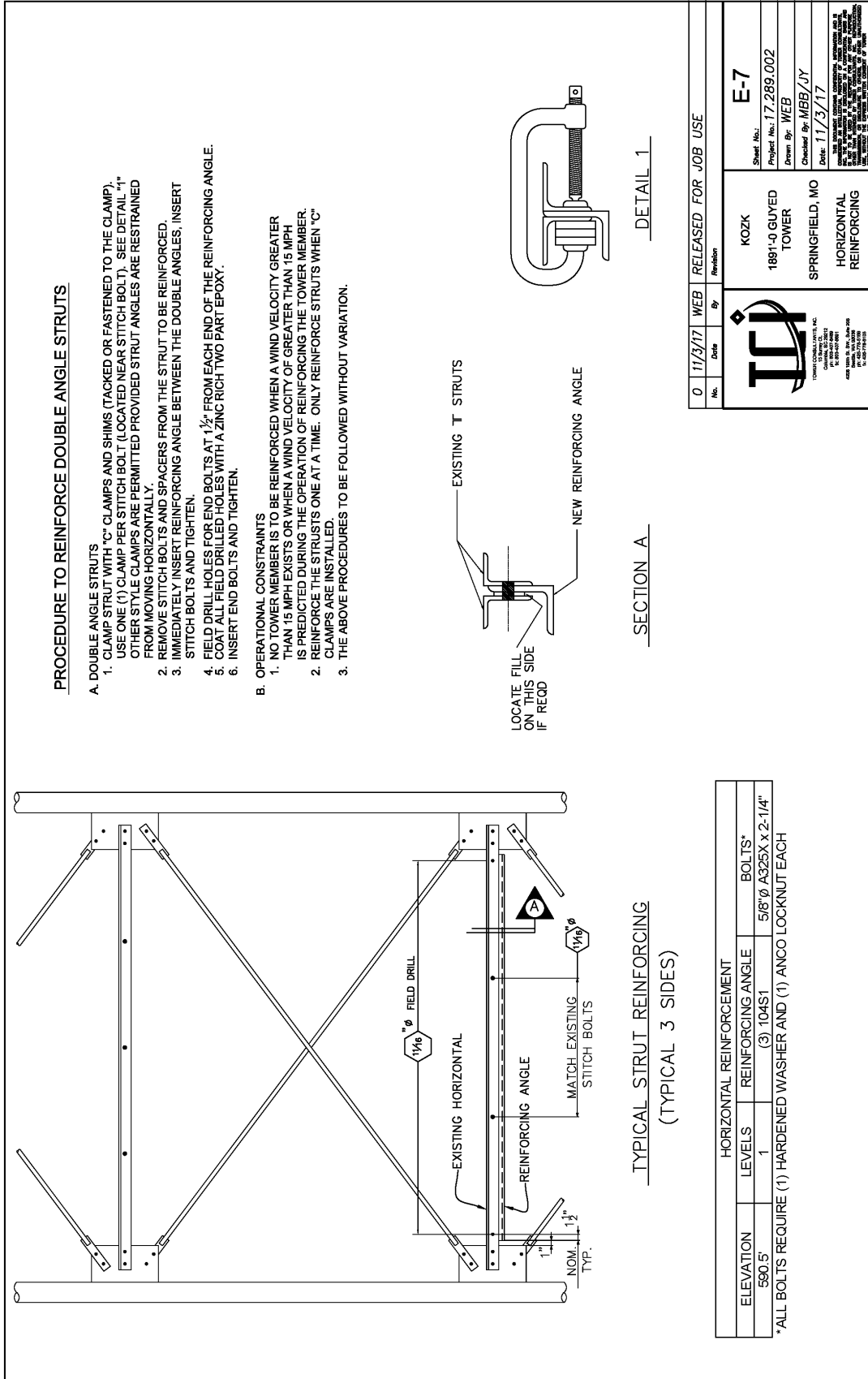
*APPLY HEAVY COAT OF ZINC RICH TWO PART EPOXY PAINT AFTER WELDING

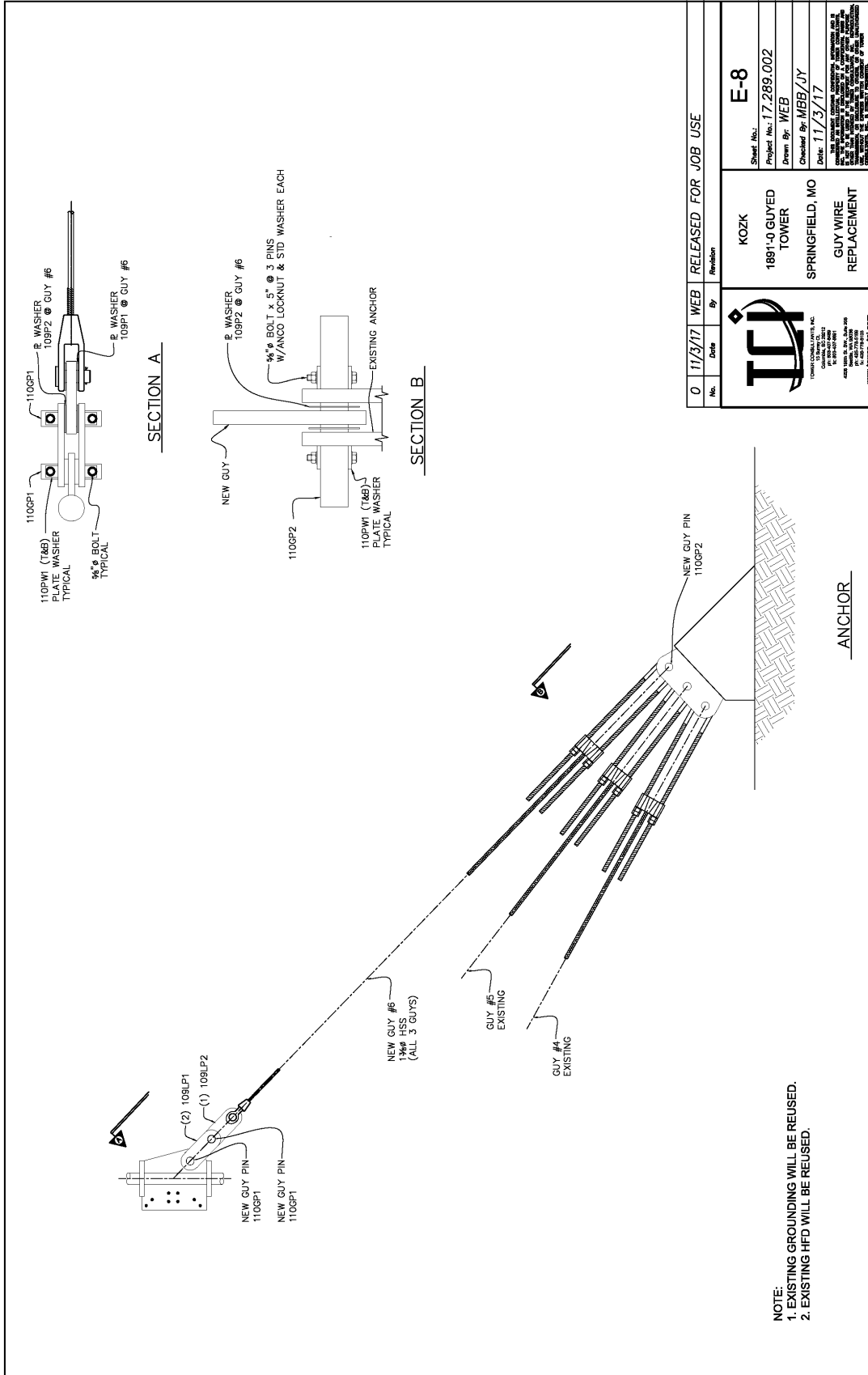
No.	Date	By	Revision
1	1/17/18	WEB	REVISED SPLIT PIPE CLEARANCE
0	11/3/17	WEB	RELEASED FOR JOB USE

Sheet No.: **E-6**
 Project No.: 17.289.002
 Drawn By: WEB
 Checked By: MBB/JY
 Date: 11/3/17
 KOZAK
 1891-Q GUYED TOWER
 SPRINGFIELD, MO
 SPLIT PIPE REINFORCING


SPLIT PIPE REIN. @ GUY PLATES

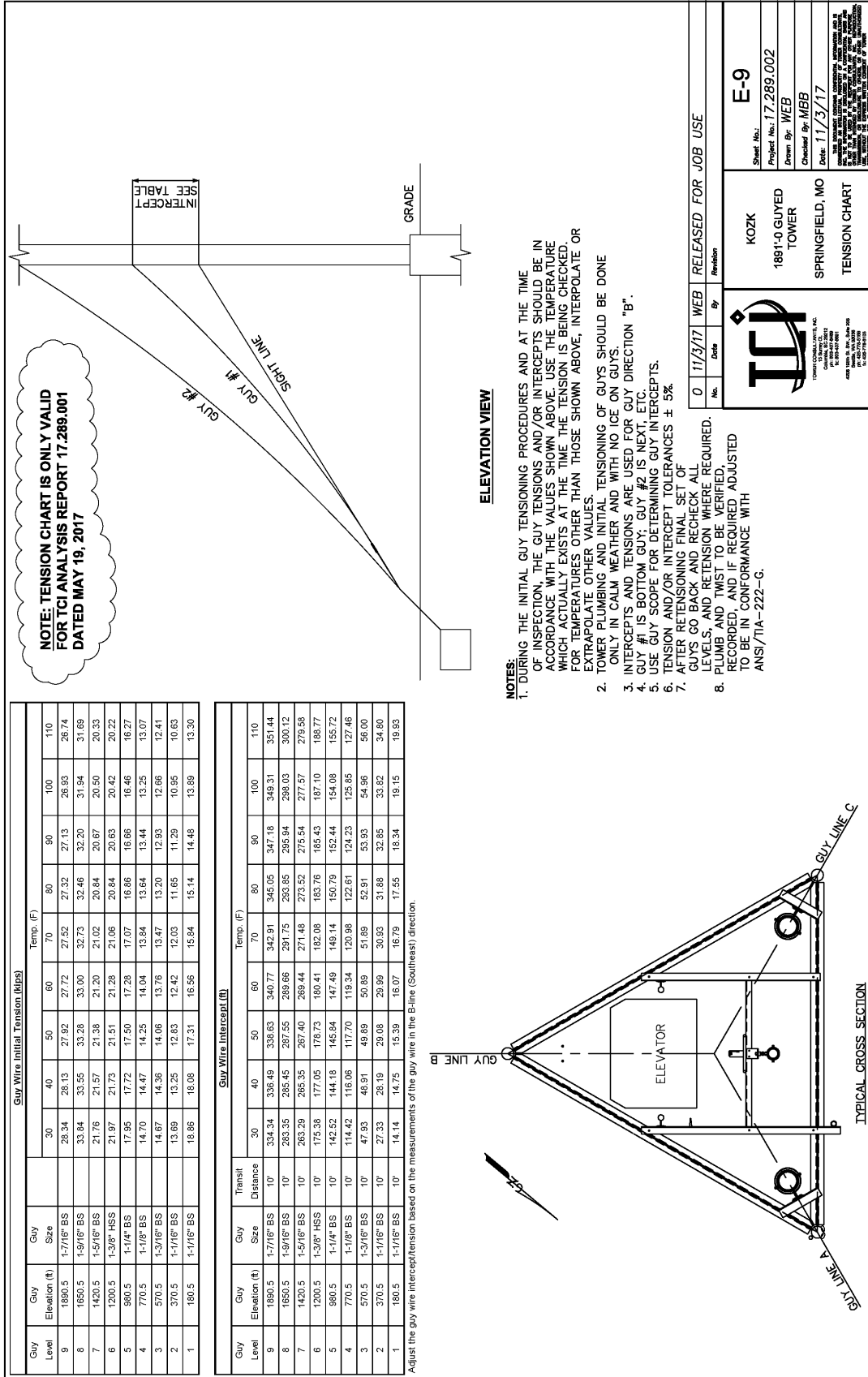
TYPICAL SPLIT PIPE REINFORCING (TYP 3 SIDES)





No.	Date	By	Revision
0	11/3/17	WEB	RELEASED FOR JOB USE

 TOWER CONSULTANTS, INC. 4800 W. 120th St., Suite 200 Overland Park, MO 66209 Phone: 913.241.2200 Fax: 913.241.2201 www.towerinc.com	KOZK 1891-Q GUYED TOWER SPRINGFIELD, MO GUY WIRE REPLACEMENT	Sheet No.: E-8 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
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POST-MODIFICATION CHECKLIST		BRIEF DESCRIPTION (SEE ENG-SOW-10007)
REQUIRED SECTION	REPORT ITEM	
PRE-CONSTRUCTION		
X	6.1.1 MI CHECKLIST DRAWING	THIS CHECKLIST SHALL BE INCLUDED IN THE MI REPORT
NA	6.1.2 EIR APPROVED SHOP DRAWINGS	FABRICATION DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW. THE CONTRACTOR SHALL PROVIDE THE APPROVED SHOP DRAWINGS TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.1.3 FABRICATION INSPECTION	INSPECTION SHALL BE CONDUCTED IN ACCORDANCE WITH INDUSTRY STANDARDS AND THE CONTRACT DOCUMENTS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.1.4 FABRICATOR CERTIFIED WELD INSPECTION	DRAWINGS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	6.1.5 MATERIAL TEST REPORT (MTR)	MATERIAL CERTIFICATION SHALL BE PROVIDED FOR ALL STEEL WITH A YIELD STRENGTH GREATER THAN 36 KS AND THIS DOCUMENTATION SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.1.6 FABRICATOR NDE INSPECTION	INSPECTION SHALL BE PROVIDED FOR ALL STEEL STRUCTURES (AS NOTED ON THESE DRAWINGS) IS REQUIRED AND A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.1.7 NDE REPORT OF MONOPOLE BASE PAINT (AS REQUIRED)	INSPECTION SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	6.1.8 PACKING SLIPS	THE MATERIAL SHIPPING LIST SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
CONSTRUCTION		
X	6.2.1 CONSTRUCTION INSPECTIONS	LETTER FROM THE GENERAL CONTRACTOR STATING THAT THE WORKMANSHIP WAS OBSERVED AND THE MI INSPECTOR'S COMMENTS AND RECOMMENDATIONS ARE INCLUDED IN THE MI REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.2.2 FOUNDATION INSPECTIONS	VISUAL OBSERVATION OF THE EXCAVATION AND BEAR SHALL BE PERFORMED BEFORE PLACING THE CONCRETE. A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.2.3 CONCRETE COMP. STRENGTH AND SLUMP TESTS	TESTS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.2.4 POST INSTALLED ANCHOR ROD VERIFICATION	POST INSTALLED ANCHOR ROD VERIFICATION SHALL BE PERFORMED BY ACCORDANCE WITH STANDARD INDUSTRY PRACTICES FOR INCLUSION IN THE MI REPORT.
NA	6.2.5 BASE PLATE GROUT VERIFICATION	INSPECTION THAT DETERMINES THAT THE GROUT WAS INSTALLED IN ACCORDANCE WITH STANDARD INDUSTRY PRACTICES FOR INCLUSION IN THE MI REPORT.
NA	6.2.6 CONTRACTOR'S CERTIFIED WELD INSPECTION	WELDS AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.2.7 EARTHWORK: LIFT AND DENSITY	INSPECTION SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	6.2.8 ON SITE GALT GALVANIZING VERIFICATION	VERIFYING THAT ANY ON-SITE GALT GALVANIZING WAS APPLIED IN ACCORDANCE WITH STANDARD INDUSTRY PRACTICES FOR INCLUSION IN THE MI REPORT.
X	6.2.9 BUY WIRE TENSION REPORT	THE GENERAL CONTRACTOR SHALL PROVIDE A REPORT TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	6.2.10 GC AS-BUILT DOCUMENTS	THE GENERAL CONTRACTOR SHALL SUBMIT A COPY OF THE CONTRACT DRAWINGS AND AS-BUILT DOCUMENTS TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT. THE MI INSPECTOR SHALL OBSERVE AND REPORT ANY DISCREPANCIES BETWEEN THE CONTRACTORS REDLINE DRAWING AND THE ACTUAL COMPLETED INSTALLATION.
POST-CONSTRUCTION		
X	6.3.1 MI INSPECTOR REDLINE OR RECORD DRAWINGS	THE MI INSPECTOR SHALL OBSERVE AND REPORT ANY DISCREPANCIES BETWEEN THE CONTRACTORS REDLINE DRAWING AND THE ACTUAL COMPLETED INSTALLATION.
NA	6.3.2 POST INSTALLED ANCHOR ROD FULL-SCALE TESTING	TESTING SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	6.3.3 PHOTOGRAPHS	PHOTOGRAPHS SHALL BE SUBMITTED TO THE MI WHICH DOCUMENT PHASES OF THE CONSTRUCTION. THE PHOTOS SHALL BE DATED IN A MANNER THAT EASILY IDENTIFIES THE EXACT LOCATION OF THE PHOTO.

NOTE: X DENOTES A DOCUMENT NEEDED FOR THE MI REPORT. NA DENOTES A DOCUMENT THAT IS NOT REQUIRED FOR THE MI REPORT.

MODIFICATION INSPECTION NOTES:

GENERAL: MODIFICATION INSPECTION (MI) IS A VISUAL INSPECTION OF TOWER MODIFICATIONS AND A REVIEW OF CONSTRUCTION INSPECTIONS AND OTHER REPORTS TO ENSURE THE MODIFICATIONS AND CORRECTIVE ACTIONS ARE IN ACCORDANCE WITH THE ORIGINAL DESIGN AND THE MODIFICATION DRAWINGS, AS DESIGNED BY THE ENGINEER OF RECORD (EOR). THE MI IS TO CONFIRM MODIFICATION CONSTRUCTION AND WORKMANSHIP ONLY AND IS NOT A REVIEW OF THE MODIFICATION DESIGN ITSELF. ANY DISCREPANCIES SHOULD BE REPORTED TO THE EOR IMMEDIATELY. THE MI INSPECTOR SHALL BE RESPONSIBLE FOR ENSURING THAT THE MODIFICATION DESIGN IS IN ACCORDANCE WITH INDUSTRY STANDARDS AND THE CONTRACT DOCUMENTS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.

ALL MI'S SHALL BE CONDUCTED BY A TOWER CONSULTANT, INC. (TCI) ENGINEERING OR ENGINEERING SERVICE VENDOR (ESV) THAT IS APPROVED TO PERFORM ELEVATED WORK. TO ENSURE THAT THE REQUIREMENTS OF THE MI ARE MET, IT IS VITAL THAT THE GENERAL CONTRACTOR (GC) AND THE MI INSPECTOR BEGIN COMMUNICATING AND COORDINATING EARLY IN THE PROJECT. THE MI INSPECTOR SHALL BE PROACTIVE IN REACHING OUT TO THE OTHER PARTY.

THE MI INSPECTOR IS REQUIRED TO CONTACT THE GC AS SOON AS RECEIVING A PO FOR THE MI TO, AT A MINIMUM:

- REVIEW THE GC'S SCHEDULE TO CONDUCT ON-SITE INSPECTIONS, INCLUDING FOUNDATION INSPECTIONS
- WORK WITH THE GC TO DEVELOP A SCHEDULE TO CONDUCT ON-SITE INSPECTIONS
- THE MI INSPECTOR IS RESPONSIBLE FOR COLLECTING ALL GENERAL CONTRACTOR (GC) INSPECTION AND TEST REPORTS, REVIEWING THE DOCUMENTS FOR ADHERENCE TO THE CONTRACT AND SPECIFICATIONS, CONDUCTING THE IN-FIELD INSPECTIONS, AND SUBMITTING THE REPORT TO OWN.
- IT IS SUGGESTED THAT THE GC PROVIDE A MINIMUM OF 5 BUSINESS DAYS NOTICE, EFFICIENCY AND EFFECTIVENESS OF DELIVERING A MI REPORT.
- THE GC AND MI INSPECTOR COORDINATE CLOSELY THROUGHOUT THE ENTIRE PROJECT. ANY CHANGES TO THE SCHEDULE, MODIFICATIONS, OR RE-ENGINEERING OPERATIONS SHALL BE APPROVED BY THE EOR AND THE MI INSPECTOR.
- THE FOUNDATION INSPECTIONS TO ALLOW FOUNDATION AND MI INSPECTORS TO COMPLY WITH ONE SITE VISIT.
- THE MI INSPECTOR ON-SITE DURING THE MI TO HAVE ANY DISCREPANCIES CORRECTED DURING THE INITIAL MI. THEREFORE, THE GC MUST CHOOSE TO COORDINATE WITH THE MI EARLY IN THE PROJECT TO ENSURE ALL CONSTRUCTION PHASES ARE AT THEIR DISPOSEL WHEN THE MI INSPECTOR IS ON SITE.

VERIFICATION INSPECTIONS SHALL BE HELD TO THE SAME SPECIFICATIONS AND REQUIREMENTS IN THE CONTRACT DOCUMENTS.

VERIFICATION INSPECTION MAY BE CONDUCTED BY AN INDEPENDENT ASSY FIRM AFTER A MODIFICATION PROJECT IS COMPLETED, AS MARKED BY THE DATE OF AN ACCEPTED PROJECT OR TOWER AS-BUILT REPORT FOR THE ORIGINAL PROJECT.

THE GC AND THE MI INSPECTOR THE FOLLOWING PHOTOGRAPHS, AT A MINIMUM, ARE TO BE TAKEN AND INCLUDED IN THE MI REPORT:

- PRE-CONSTRUCTION GENERAL SITE CONDITION
- FOUNDATION MODIFICATIONS
- PHOTOGRAPHS DURING THE REINFORCEMENT MODIFICATION CONSTRUCTION/DIRECTION
- FAST CONSTRUCTION PHOTOGRAPHS
- FINAL INFELD CONDITION

PHOTOS OF ELEVATED MODIFICATIONS TAKEN FROM THE GROUND SHALL BE CONSIDERED INADEQUATE.

CONSTRUCTION OR DELAYS IN SCHEDULED MI, WHICH THE MI WILL BE CONDUCTED, AND OTHER PARTY CANCELS OR DELAYS TO WHICH THE MI WILL BE RESPONSIBLE FOR ANY COSTS, FEES, LOSS OF PROFITS AND/OR OTHER PENALTIES RELATED TO THE PROJECT. LOCAL AND STATE REGULATIONS SHALL BE OBSERVED AND ENFORCED TO DO THIS CORRECTLY FOR A THIRD PARTY. MI EXCEPTIONS MAY BE MADE IN THE EVENT THAT THE CONTRACTOR'S SAFETY OR THE SAFETY OF THE PARTIES INVOLVED.


CONSTRUCTION OF ELEVATED MI:

- THE MODIFICATION INSTALLATION WOULD FAIL THE MI (CALLED M1), THE GC SHALL WORK WITH CUSTOMER TO COORDINATE A REBARATION PLAN IN ONE OF TWO WAYS:
- CORRECT FAILING ISSUES TO COMPLY WITH THE SPECIFICATIONS CONTAINED IN THE CONTRACT DOCUMENTS.
- ON WITH THE CUSTOMERS APPROVAL, THE GC MAY WORK WITH THE EOR TO RE-ANALYZE THE MODIFICATION/REINFORCEMENT USING THE AS-BUILT CONDITION.

VERIFICATION INSPECTIONS:

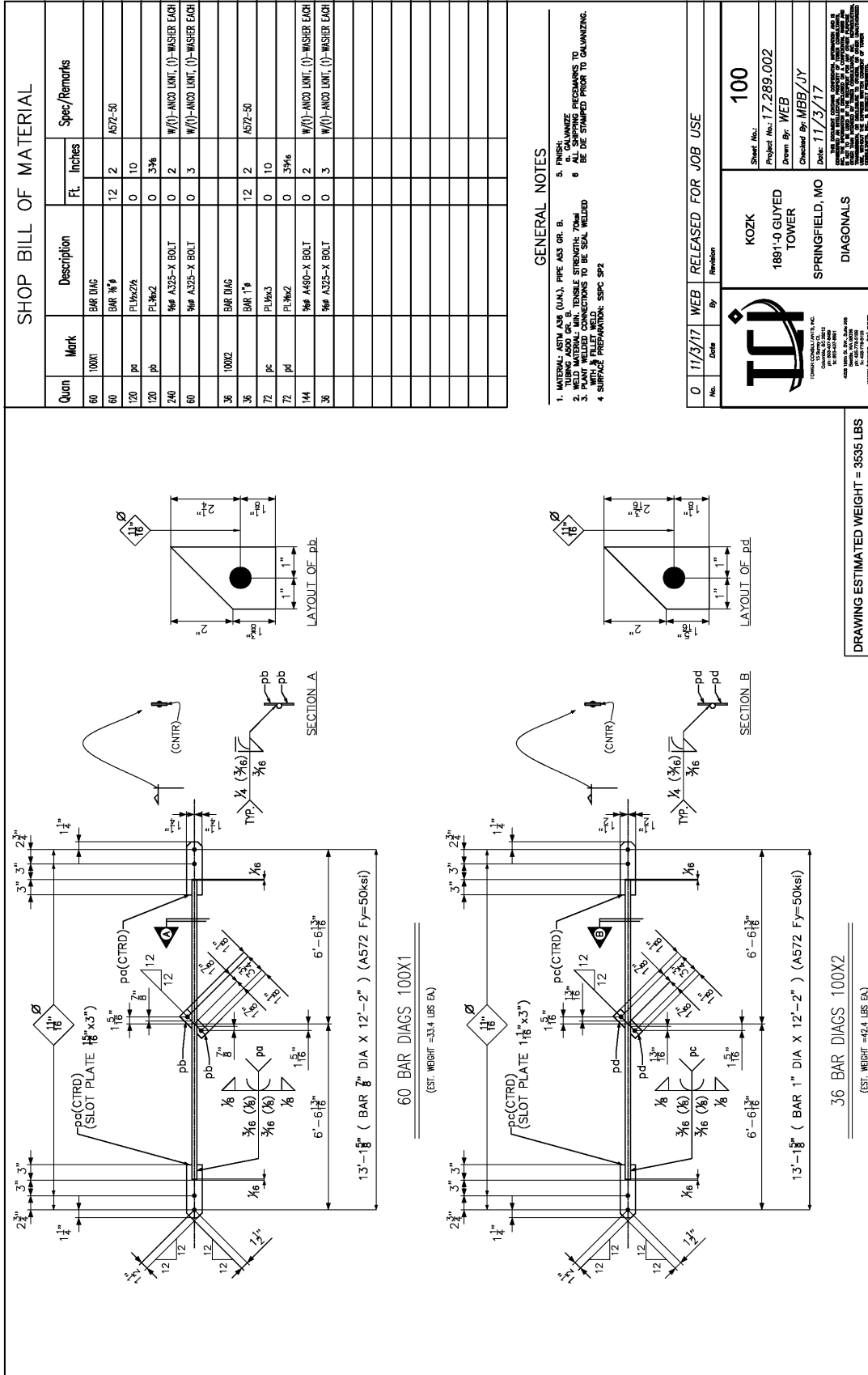
- TO RESOLVE THE RIGHT TO CONDUCT A MI VERIFICATION INSPECTION TO VERIFY THE MODIFICATION PROJECT'S COMPLETION, THE MI INSPECTOR(S) OR TOWER MODIFICATION PROJECTS.
- ALL VERIFICATION INSPECTIONS SHALL BE HELD TO THE SAME SPECIFICATIONS AND REQUIREMENTS IN THE CONTRACT DOCUMENTS.
- VERIFICATION INSPECTION MAY BE CONDUCTED BY AN INDEPENDENT ASSY FIRM AFTER A MODIFICATION PROJECT IS COMPLETED, AS MARKED BY THE DATE OF AN ACCEPTED PROJECT OR TOWER AS-BUILT REPORT FOR THE ORIGINAL PROJECT.
- THE GC AND THE MI INSPECTOR THE FOLLOWING PHOTOGRAPHS, AT A MINIMUM, ARE TO BE TAKEN AND INCLUDED IN THE MI REPORT:
- PRE-CONSTRUCTION GENERAL SITE CONDITION
- FOUNDATION MODIFICATIONS
- PHOTOGRAPHS DURING THE REINFORCEMENT MODIFICATION CONSTRUCTION/DIRECTION
- FAST CONSTRUCTION PHOTOGRAPHS
- FINAL INFELD CONDITION

PHOTOS OF ELEVATED MODIFICATIONS TAKEN FROM THE GROUND SHALL BE CONSIDERED INADEQUATE.

0 11/3/17 WEB RELEASE FOR JOB USE		Revision	
No.	Date	By	Revision
 <p>TCI TOWER CONSULTANT, INC. 3850 STATE ST. SUITE 300 SPRINGFIELD, MO 65702 TEL: 417-832-8881 FAX: 417-832-8882 WWW.TOWER-CONSULTANT.COM</p>		<p>E-10</p> <p>Sheet No.: Project No.: 17,289,002 Drawn By: WEB Checked By: MBB Date: 11/3/17</p>	
<p>KOZIK 1881.0 GUINED TOWER SPRINGFIELD, MO</p>		<p>POST MODIFICATION CHECKLIST</p>	

Appendix B

FABRICATION DRAWINGS
(PREPARED BY TCI)




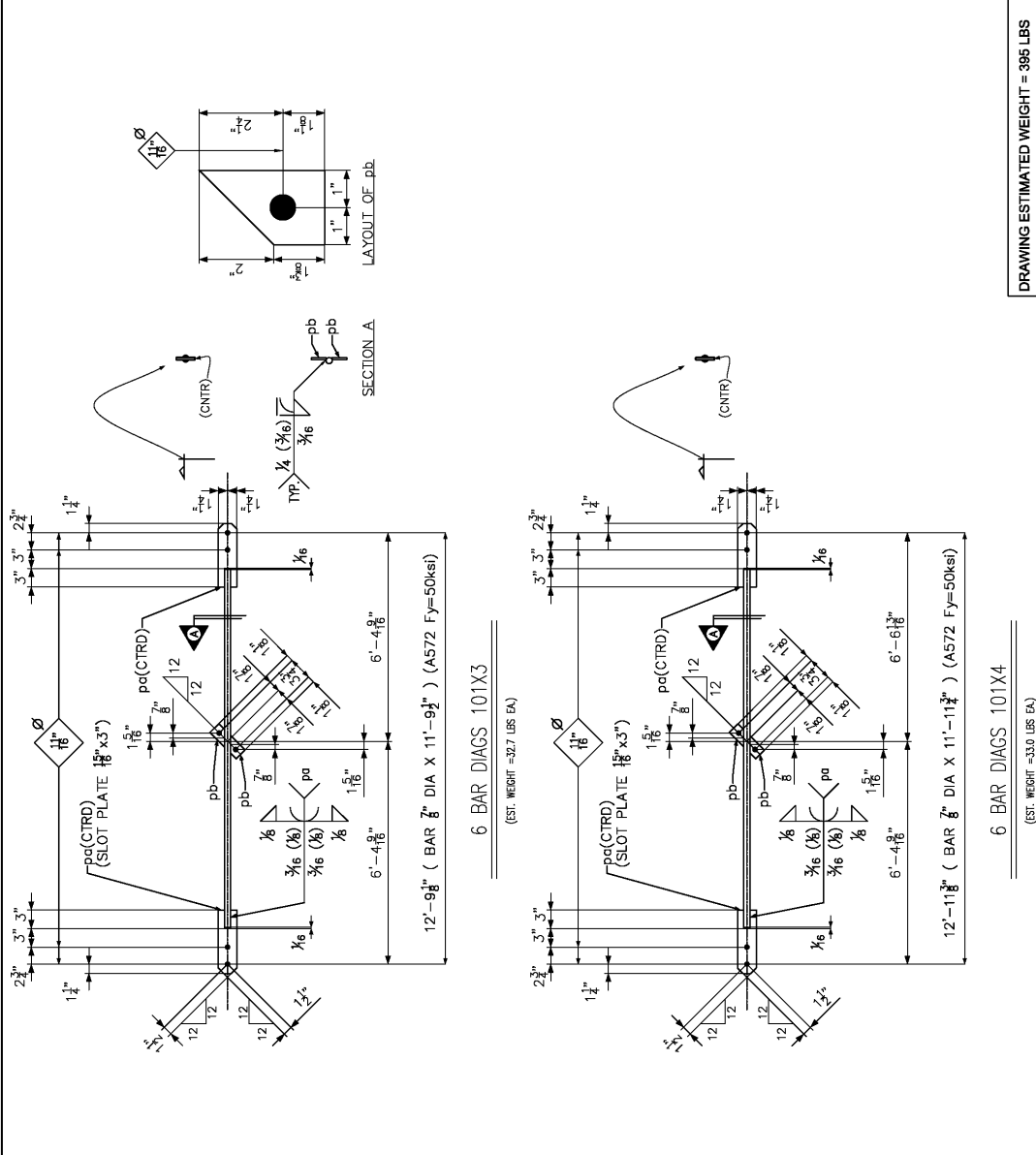
SHOP BILL OF MATERIAL				
Quan	Mark	Description	Spec/Remarks	
			Ft.	Inches
6	101X3	BAR DIAG		
6		BAR $\frac{7}{8}$ " ϕ	11	9 1/2" A572-50
12	pb	PL $\frac{1}{2}$ "x2 1/2"	0	10
12	pb	PL $\frac{3}{8}$ "x2	0	3 3/4"
24		$\frac{3}{8}$ " A325-X BOLT	0	2 W/(1)-ANCO LMIT, (1)-WASER EACH
6		$\frac{3}{8}$ " A325-X BOLT	0	3 W/(1)-ANCO LMIT, (1)-WASER EACH
6	101Y4	BAR DIAG		
6		BAR $\frac{7}{8}$ " ϕ	11	11 3/4" A572-50
12	pb	PL $\frac{1}{2}$ "x2 1/2"	0	10
12	pb	PL $\frac{3}{8}$ "x2	0	3 3/4"
24		$\frac{3}{8}$ " A325-X BOLT	0	2 W/(1)-ANCO LMIT, (1)-WASER EACH
6		$\frac{3}{8}$ " A325-X BOLT	0	3 W/(1)-ANCO LMIT, (1)-WASER EACH

GENERAL NOTES

1. MATERIAL ASTM A572 (U.S.), PIPE A53 GR. B.
2. WELD MATERIAL: E70T18, TENSILE STRENGTH: 70ksi
3. PAINT & WELD CONNECTIONS TO BE SEALED
4. SURFACE PREPARATION: SPFC SP2
5. FINISH GALVANIZE
6. ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision	RELEASED FOR JOB USE
0	11/3/17	WEB		

 <p>TJI TRUSS JOINT INDUSTRIES, INC. 4800 W. 116th St., Suite 900 Overland Park, MO 66204 Tel: 913-241-8800 Fax: 913-241-8810 www.tji.com</p>	<p>Sheet No.: 101 Project No.: 17-289-002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17</p>
<p>KOZK 1891-0 GUYED TOWER SPRINGFIELD, MO</p>	<p>DIAGONALS</p>




DRAWING ESTIMATED WEIGHT = 395 LBS

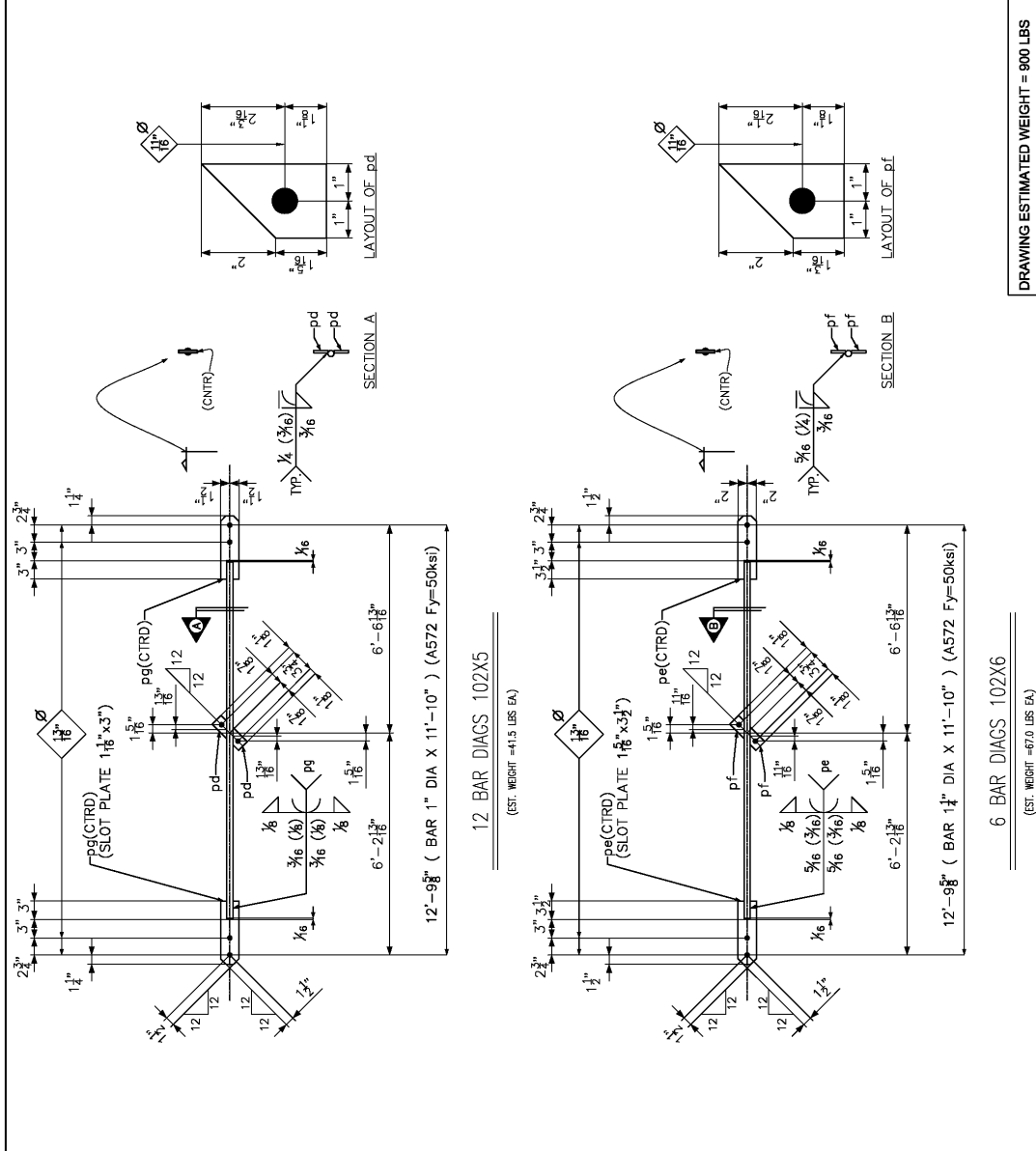
SHOP BILL OF MATERIAL				
Quan	Mark	Description	Spec/Remarks	
			Ft.	Inches
12	1025	BAR DIAG		
12		BAR 1"φ	11	A572-50
24	pg	PL 1/8x3	0	10
24	pd	PL 3/8x2	0	3/8"
48		3/8" A325-X BOLT	0	2 1/4"
12		3/8" A325-X BOLT	0	3"
6	1026	BAR DIAG		
6		BAR 1 1/4"φ	11	A572-50
12	pe	PL 3/8x4	0	10 3/4"
12	pf	PL 3/8x2	0	3 3/4"
24		3/8" A490-X BOLT	0	2 1/4"
6		3/8" A325-X BOLT	0	3"

GENERAL NOTES

1. MATERIAL ASTM A572 (U.S.), PIPE A53 GR. B.
2. WELD MATERIAL: E7018, TENSILE STRENGTH: 70ksi
3. PLANT WELDED CONNECTIONS TO BE SEA WELDED
4. SURFACE PREPARATION: SPFC SP2
5. FINISH GALVANIZE
6. ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision
0	11/3/17	WEB	RELEASED FOR JOB USE

 <p>TOWER GUYWIRE INDUSTRIES, INC. 4800 W. 11th St., Suite 200 Columbia, MO 65204 Tel: 620-779-8100 Fax: 620-779-8101 www.towerguywire.com</p>	KOZK 1891-0 GUYED TOWER SPRINGFIELD, MO DIAGONALS	Sheet No.: 102 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
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SHOP BILL OF MATERIAL				
Quan	Mark	Description	Spec./Remarks	
			Ft.	Inches
18	103X7	BAR DIAG		
18		BAR 1 1/2"	12	2 A572-50
36	pg	PL 1/2x3	0	10
36	pd	PL 3/8x2	0	3/8x6
72		3/8" A325-X BOLT	0	2 1/4 W/(1)-ANCO LMIT, (1)-WASER EACH
18		3/8" A325-X BOLT	0	3 W/(1)-ANCO LMIT, (1)-WASER EACH
6	103X8	BAR DIAG		
6		BAR 1 1/2"	12	2 A572-50
12	pe	PL 3/8x4	0	10 3/4
12	pf	PL 3/8x2	0	3/8x6
24		3/8" A325-X BOLT	0	2 1/4 W/(1)-ANCO LMIT, (1)-WASER EACH
6		3/8" A325-X BOLT	0	3 W/(1)-ANCO LMIT, (1)-WASER EACH

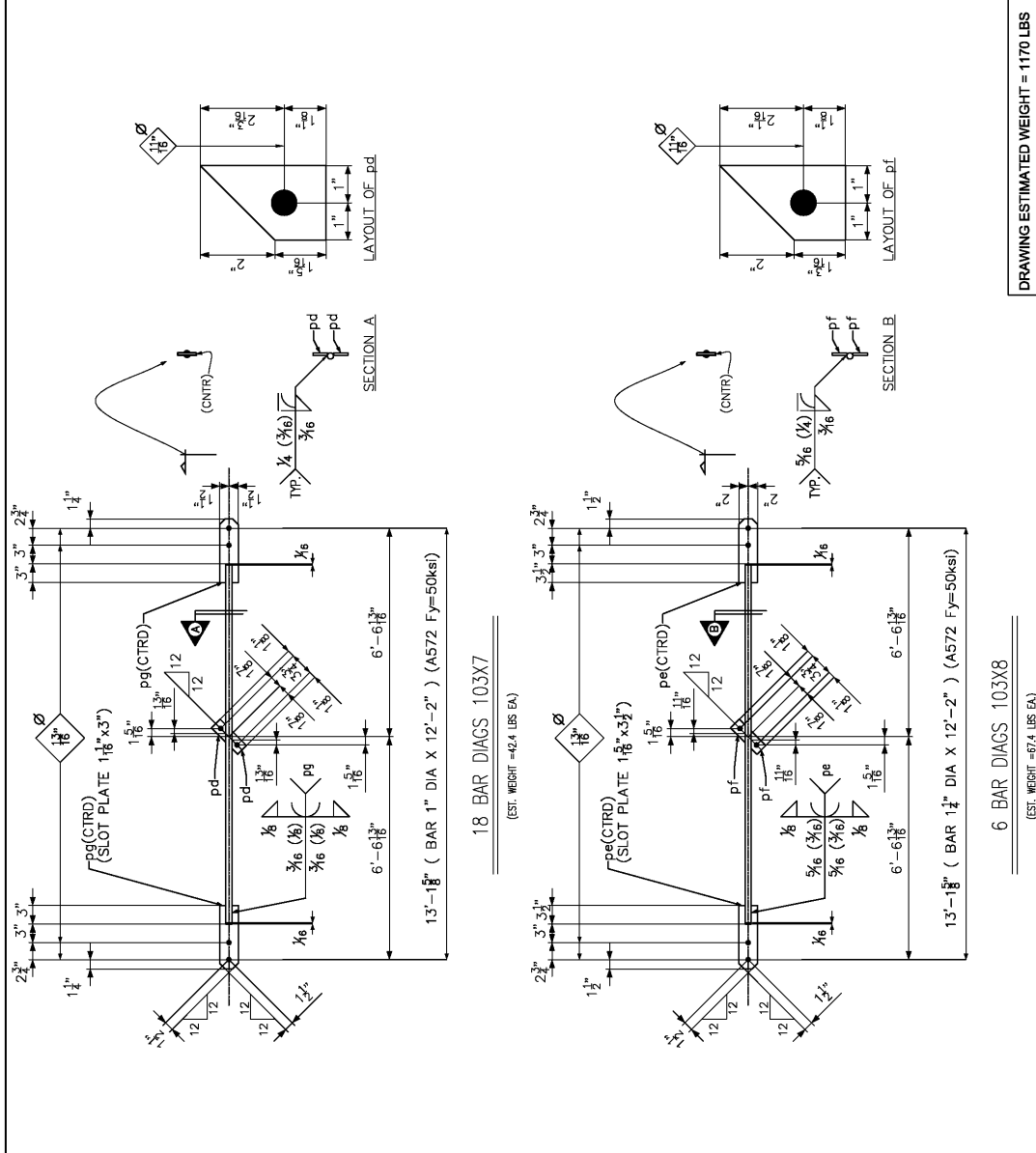
GENERAL NOTES

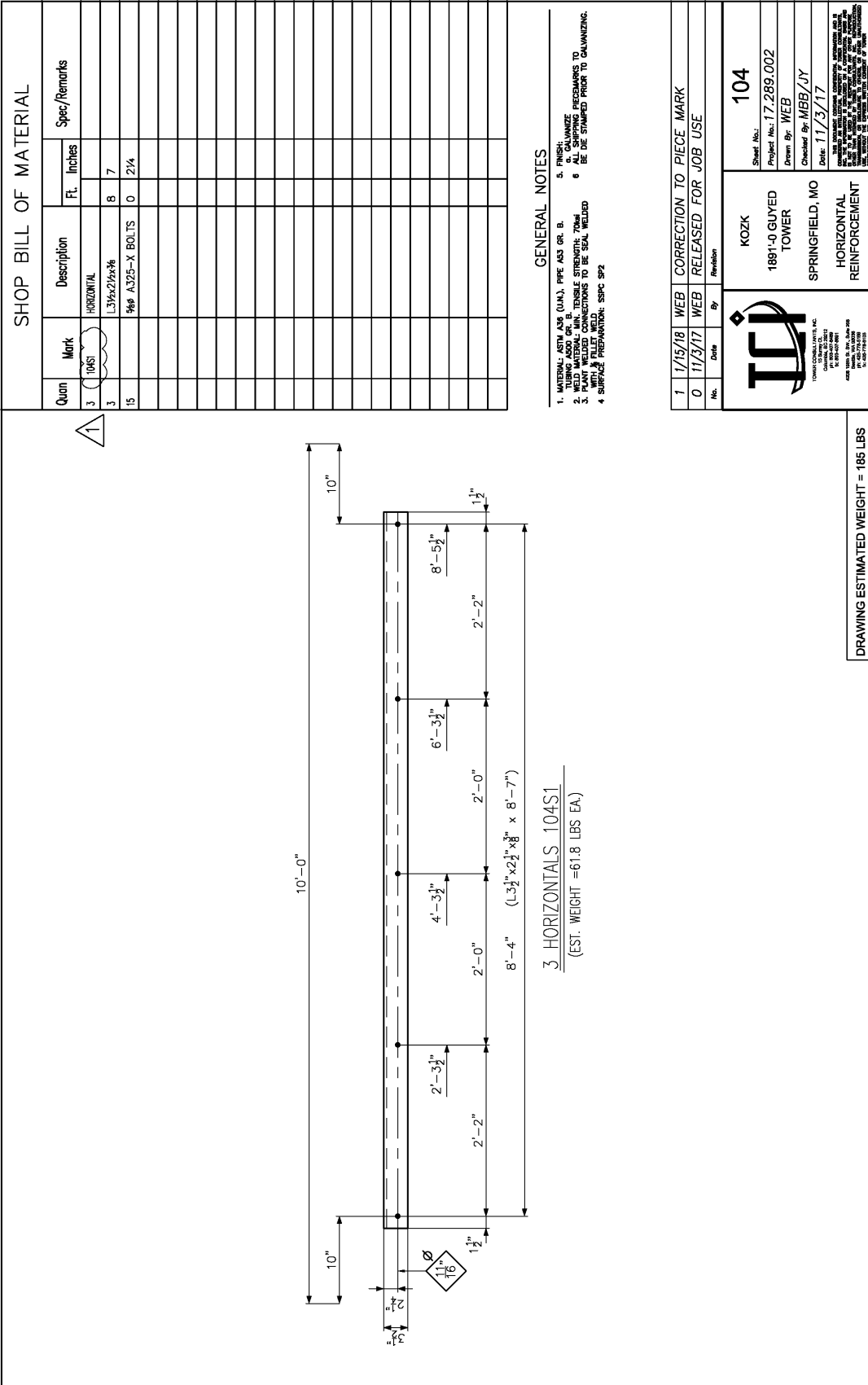
1. MATERIAL ASTM A36 (U.S.), PIPE A53 GR. B.
2. WELD MATERIAL: E7018, TENSILE STRENGTH: 70ksi
3. ALL WELDED CONNECTIONS TO BE SEA WELDED
4. SURFACE PREPARATION: SPFC SP2
5. FINISH GALVANIZE
6. ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision
0	11/3/17	WEB	RELEASED FOR JOB USE

Sheet No.	103
Project No.	17.289.002
Drawn By	WEB
Checked By	MBB/JY
Date	11/3/17

1891-0 GUYED TOWER
SPRINGFIELD, MO
DIAGONALS





SHOP BILL OF MATERIAL

Quan	Mark	Description	Ft. Inches		Spec./Remarks
			Ft.	Inches	
3	104S1	HORIZONTAL	8	7	
		.L3/4x2 1/4x6	0	2 1/4	
		9# A325-X BOLTS			
15					

GENERAL NOTES

- MATERIAL ASTM A36 (U.S.), PIPE ASD GR. B.
- FRINGE SURROUND
- WELD MATERIAL: MIN. TENSILE STRENGTH: 70ksi
- PLANT WELDED CONNECTIONS TO BE SEA WELDED
- ALL SHIPPING REQUIREMENTS TO BE USED PRIOR TO GALVANIZING.
- SURFACE PREPARATION: SPS-3

1	1/15/18	WEB	CORRECTION TO PIECE MARK
0	1/3/17	WEB	RELEASED FOR JOB USE
No.	Date	By	Revision

TIC
TOWER CONSTRUCTION, INC.
4800 STATE ST. SUITE 100
FORDLAND, MO 65652
TEL: 656-6260
FAX: 656-6281
WWW.TOWERCONSTRUCTION.COM

Sheet No. **104**
Project No: 17.289.002
Drawn By: WEB
Checked By: MBB/JY
Date: 11/3/17

1891-0 GUYED TOWER
SPRINGFIELD, MO
HORIZONTAL REINFORCEMENT

DRAWING ESTIMATED WEIGHT = 185 LBS

SHOP BILL OF MATERIAL				
Quan	Mark	Description	Spec/Remarks	
			Ft.	Inches
6	10SM1	SPLIT PIPE		
6		PC. HSS 5.5" O.D. x 0.5" WALL	29	6 1/4 (F=50ksi MIN)
6	10M	1" HWY HEX NUT		
21	10SM2	SPLIT PIPE		
21		PC. HSS 5.5" O.D. x 0.5" WALL	29	6 1/4 (F=50ksi MIN)
21	10M	1" HWY HEX NUT		
12	10SM3	SPLIT PIPE		
12		PC. HSS 5.125" O.D. x 0.5" WALL	29	6 1/4 (F=50ksi MIN)
12	10M	1" HWY HEX NUT		
15	10SM4	SPLIT PIPE		
15		PC. HSS 4.875" O.D. x 0.5" WALL	29	6 1/4 (F=50ksi MIN)
15	10M	1" HWY HEX NUT		
15	10SM5	SPLIT PIPE		
15		PC. HSS 4.75" O.D. x 0.5" WALL	29	6 1/4 (F=50ksi MIN)
15	10M	1" HWY HEX NUT		
3	10SM6	SPLIT PIPE		
3		PC. HSS 5.5" O.D. x 0.5" WALL	30	3/4 (F=50ksi MIN)
3	10M	1" HWY HEX NUT		


DRAWING ESTIMATED WEIGHT = 25905 LBS

GENERAL NOTES

1. MATERIALS: ASTM A513 (U.S.), PIPE ASS. OR. B.
2. FINISH: GALVANNEAL
3. TUBING: ABOVE OR. B.
4. GALVANNEAL: GALVANNEAL
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100. GALVANNEAL: GALVANNEAL

SHOP BILL OF MATERIAL			
Quan	Mark	Description	Spec/Remarks
			Ft. Inches
3	106M7	SPLIT PIPE	
		PC. HSS 5.5" O.D. x 0.5" WALL	27 3/4 F=50ksi MN
3	106M8	SPLIT PIPE	
		PC. HSS 5.25" O.D. x 0.5" WALL	7 3/4 F=50ksi MN
3	106M9	SPLIT PIPE	
		PC. HSS 5.25" O.D. x 0.5" WALL	20 3/4 F=50ksi MN
3	106M10	SPLIT PIPE	
		PC. HSS 5.125" O.D. x 0.5" WALL	26 11/16 F=50ksi MN
3	106M11	SPLIT PIPE	
		PC. HSS 4.875" O.D. x 0.5" WALL	17 2/4 F=50ksi MN
3	106M12	SPLIT PIPE	
		PC. HSS 4.875" O.D. x 0.5" WALL	10 2/4 F=50ksi MN

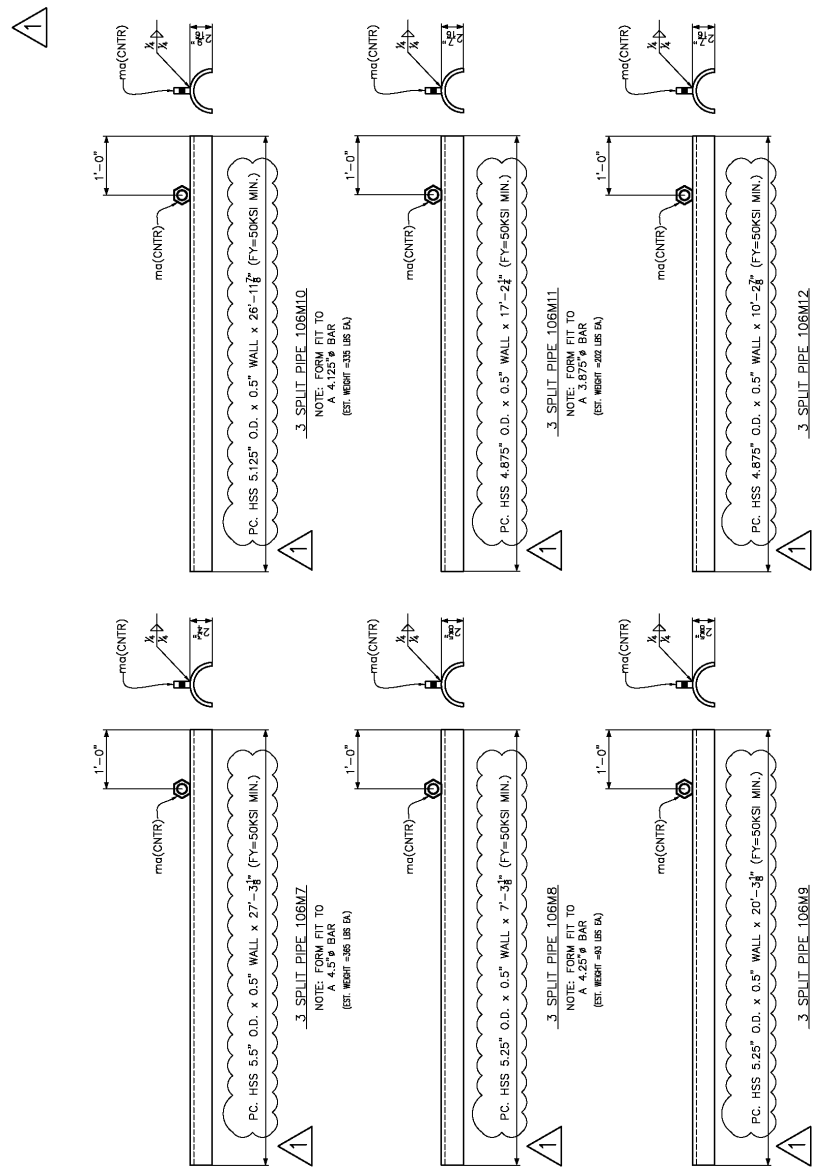
No.	Date	By	Revision
1	1/17/18	WEB	REVISED SPLIT PIPE LENGTH
0	11/3/17	WEB	RELEASED FOR JOB USE

 <p>TECHNICAL CONSTRUCTION, INC. 4800 STATE ST. SUITE 200 SPRINGFIELD, MO 65707 PHONE: 417-865-0800 FAX: 417-865-0801 WWW.TCI-CORP.COM</p>	KOZK 1891'-0" GUYED TOWER SPRINGFIELD, MO SPLIT PIPE REINFORCING	Sheet No.: Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
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DRAWING ESTIMATED WEIGHT = 4125 LBS

GENERAL NOTES

- MATERIAL: ASTM A516 (U.S.), PIPE ASS. OR. B.
- TUBING ABOVE OR. B. GALVANIZE
- WELD METAL SHALL BE STRENGTH 70MPa
- WELD METAL SHALL BE STRENGTH 70MPa WITH A WELT WELD
- SURFACE PREPARATION: SSPC SP2
- FINISH: 5. GALVANIZE
- ALL DIMENSIONS SHALL BE AS SHOWN UNLESS OTHERWISE NOTED
- BE PREPARED PRIOR TO GALVANIZING.



SHOP BILL OF MATERIAL			
Quan	Mark	Description	Spec./Remarks
			Fe. Inches
3	107M13	SPLIT PIPE	
3		PC. HSS 4.75" O.D. x 0.5" WALL	1 1/4" F _y =50ksi MN
3	17a	1" HWY HEX NUT	
3	107M14	SPLIT PIPE	
3		PC. HSS 4.75" O.D. x 0.5" WALL	2 7/8" F _y =50ksi MN
3	17a	1" HWY HEX NUT	
6	107M15	SPLIT PIPE	
6		PC. HSS 5.125" O.D. x 0.5" WALL	2 7/8" F _y =50ksi MN
6	17a	1" HWY HEX NUT	
3	107M16	SPLIT PIPE	
3		PC. HSS 5.125" O.D. x 0.5" WALL	2 7/8" F _y =50ksi MN
3	17a	1" HWY HEX NUT	
3	107M17	SPLIT PIPE	
3		PC. HSS 4.875" O.D. x 0.5" WALL	2 7/8" F _y =50ksi MN
3	17a	1" HWY HEX NUT	
3	107M18	SPLIT PIPE	
3		PC. HSS 4.75" O.D. x 0.5" WALL	2 7/8" F _y =50ksi MN
3	17a	1" HWY HEX NUT	

GENERAL NOTES

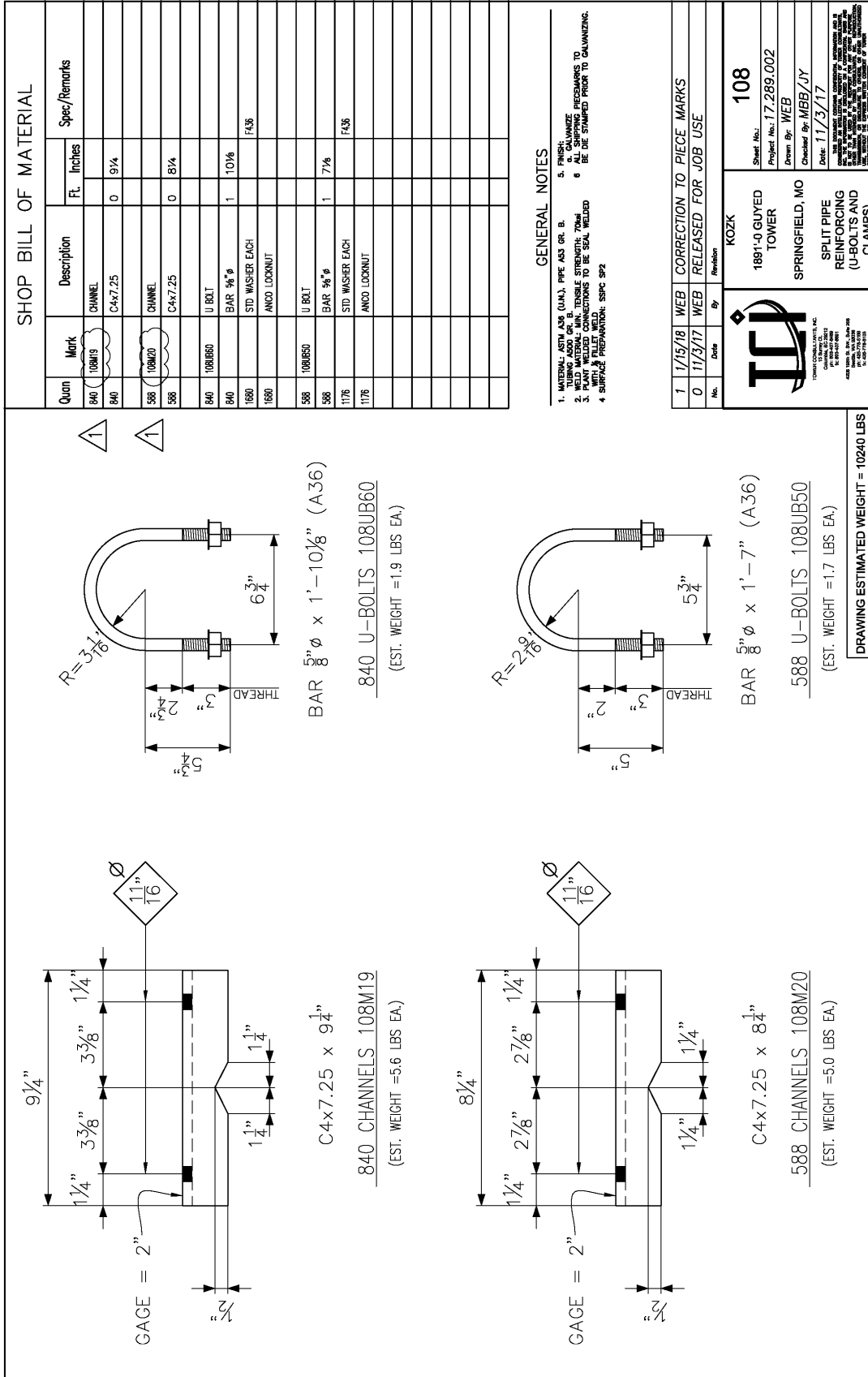
- MATERIAL: ASTM A58 (U.S.A.), PIPE ASS. OR. B.
- TUBING: ASTM A58 (U.S.A.), PIPE ASS. OR. B.
- WELD: ALL WELDS SHALL BE FULL PENETRATION BUTT JOINTS TO BE FULL PENETRATION WELDED WITH A WELDED WELD.
- SURFACE PREPARATION: SSPC SP2
- FINISH: GALVANIZE
- GALVANIZE
- ALL DIMENSIONS SHALL BE AS SHOWN UNLESS OTHERWISE NOTED.
- BE THE STANDARDS PRIOR TO QUANTIFYING.

No.	Date	By	Revision
1	1/17/18	WEB	REVISED SPLIT PIPE LENGTH
0	11/3/17	WEB	RELEASED FOR JOB USE

ICCI
INTERNATIONAL CONSTRUCTION CONSULTANTS, INC.
 4800 W. 120th St., Suite 100
 Overland Park, KS 66209
 Tel: 913-241-8800
 Fax: 913-241-8801
 www.icci.com

Sheet No.: **107**
 Project No.: **17-289-002**
 Drawn By: **WEB**
 Checked By: **MBB/JY**
 Date: **11/3/17**

DRAWING ESTIMATED WEIGHT = 5935 LBS




SHOP BILL OF MATERIAL

Quan	Mark	Description	Spec/Remarks	
			Ft.	Inches
840	108M19	CHANNEL		
840		C4x7.25	0	9 1/4
588	108M20	CHANNEL		
588		C4x7.25	0	8 1/4
840	108UB60	U BOLT		
840		BAR 5/8" Ø	1	10 1/8
1680		STD WASHER EACH		F436
1680		ANCO LOCKNUT		
588	108UB50	U BOLT		
588		BAR 5/8" Ø	1	7 1/4
1176		STD WASHER EACH		F436
1176		ANCO LOCKNUT		

GENERAL NOTES

- MATERIAL ASTM A36 (UN.), PIPE AS3 GR. B.
- WELD MATERIAL: E70T1, MIN. TENSILE STRENGTH: 70KSI
- PLANT WELDED CONNECTIONS TO BE SEAL WELDED
- SURFACE PREPARATION: SSPC SP2
- FRISO GALVANIZE
- ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision
1	1/15/18	WEB	CORRECTION TO PIECE MARKS
0	11/3/17	WEB	RELEASED FOR JOB USE



IJI
 INDUSTRIAL JOINERS, INC.
 4000 W. 11th St., Suite 900
 Oklahoma City, OK 73112
 (405) 241-4333
 www.ijioverseas.com

KOZK
 1881-U GUYED TOWER
 SPRINGFIELD, MO

Sheet No.: **108**
 Project No.: **17.289.002**
 Drawn By: **WEB**
 Checked By: **MBB/JY**
 Date: **11/3/17**


SPLIT PIPE REINFORCING (U-BOLTS AND CLAMPS)

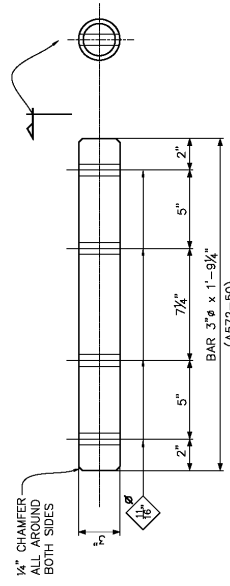
SHOP BILL OF MATERIAL				
Quan	Mark	Description	Spec/Remarks	
			Ft.	Inches
6	110GP1	BAR 3/8	0	11 1/8" A572-50
12		3/8" A325-X BOLT	0	5 W/(1)-ANOD LMIT, (1)-WASHER EACH
3	110GP2	BAR 3/8	1	9 1/4" A572-50
6		3/8" A325-X BOLT	0	5 W/(1)-ANOD LMIT, (1)-WASHER EACH
80	110PW1	PLATE WASHER		
80		PL 3/8x2 1/2	0	2 1/2" A36

GENERAL NOTES

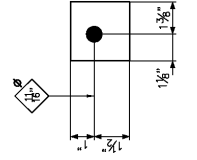
1. MATERIAL: ASTM A36 (U.S.), PIPE AND GR. B.
2. WELD MATERIAL: E7018, TENSILE STRENGTH: 70ksi
3. PLANT WELDED CONNECTIONS TO BE SEAL WELDED
4. SURFACE PREPARATION: SSPC SP2
5. FINISH: GALVANIZE
6. ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision	Released For Job Use
0	11/3/17	WEB		

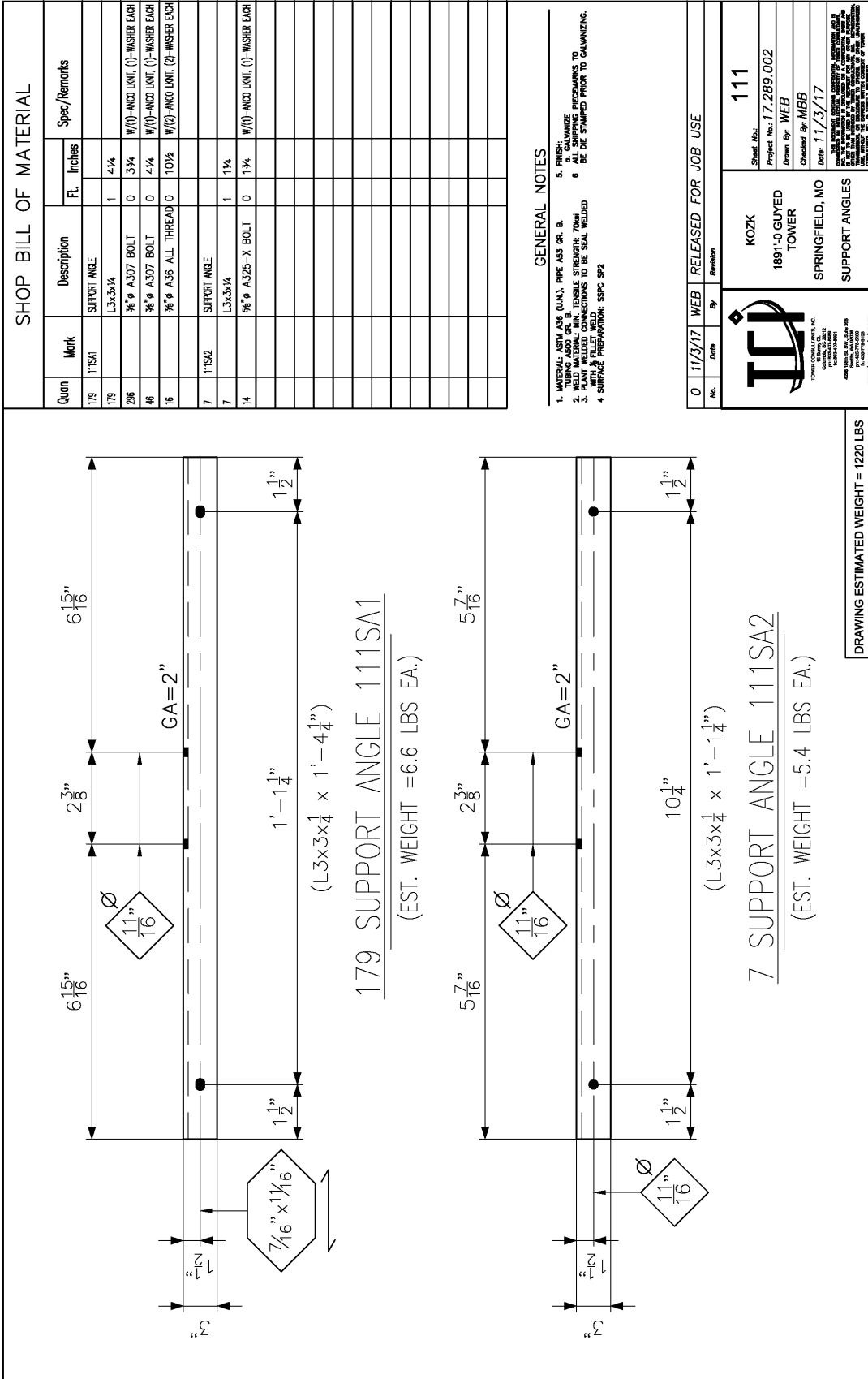
 <p>TOWER GUYEYE, INC. 4800 STATE ST., SUITE 200 SPRINGFIELD, MO 65703 TEL: 417-862-8881 FAX: 417-862-8882 WWW.TOWERGUYEYE.COM</p>	SHEET NO. 110 PROJECT NO. 17-289-002 DRAWN BY: WEB CHECKED BY: MBB/JY DATE: 11/3/17
KOZK 1891-0 GUYED TOWER SPRINGFIELD, MO GUY PINS	



3 PINS 110GP2
 (EST. WEIGHT = 22.6 LBS EA)
 (CUT #6 ANCHOR END)



DRAWING ESTIMATED WEIGHT = 320 LBS



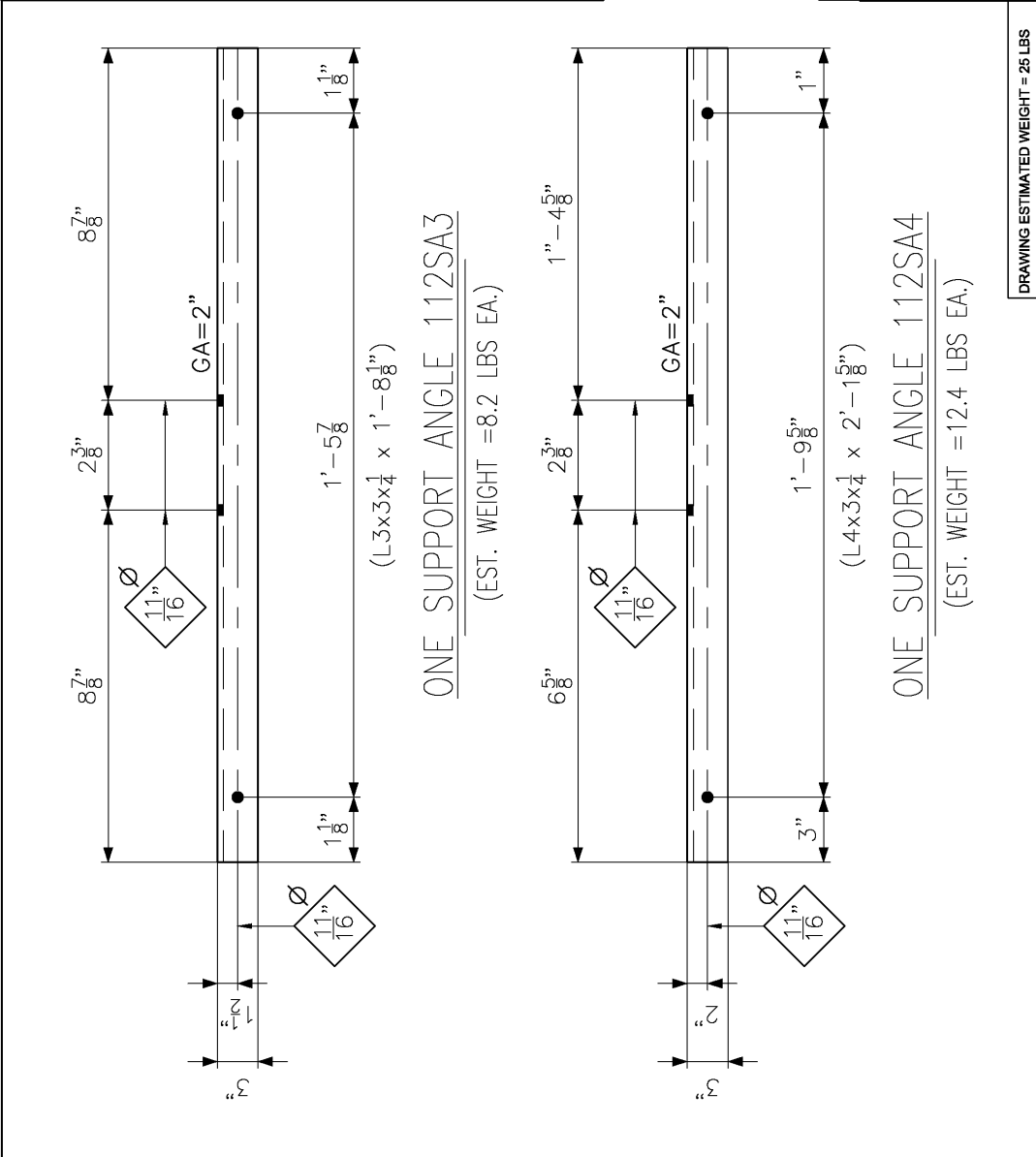
SHOP BILL OF MATERIAL				
Quan	Mark	Description	Fe. Inches	Spec./Remarks
ONE	112SA3	SUPPORT ANGLE L3x3x¼	1	8 1/8"
ONE		¾" A.325-X BOLT	0	2 3/8"
ONE	112SA4	SUPPORT ANGLE L4x3x¼	2	1 9/8"
ONE		¾" A.325-X BOLT	0	2

GENERAL NOTES

1. MATERIAL ASTM A36 (U.N.), PIPE ASST. GR. B.
2. WELD MATERIAL: E70T18, TENSILE STRENGTH: 70ksi
3. PAINT: WELDED CONNECTIONS TO BE SEAL WELDED
4. SURFACE PREPARATION: SPFC SP2
5. FINISH: GALVANNEAL
6. ALL SHIPPING RECEIPTS TO BE STAMPED PRIOR TO GALVANIZING.

No.	Date	By	Revision	RELEASED FOR JOB USE
0	11/3/17	WEB		

ICI	Project No.: 17.289.002	Sheet No.: 112
INTEGRATED CONSTRUCTION SERVICES, INC.	Drawn By: WEB	
4800 STATE ST., SUITE 200 SPRINGFIELD, MO 65712 TEL: 417-865-8881 WWW.ICISERVICESTRONG.COM	Checked By: MBB	
	Date: 11/3/17	



DRAWING ESTIMATED WEIGHT = 25 LBS

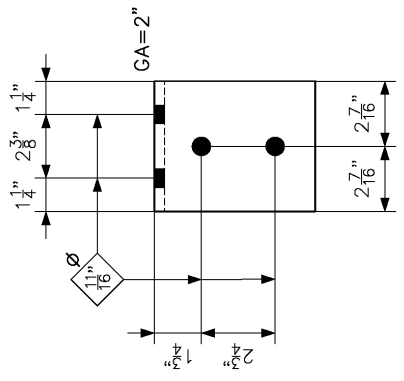
SHOP BILL OF MATERIAL				
Quan	Mark	Description	Ft.	Spec/Remarks
				Inches
ONE	113SA5	SUPPORT ANGLE		
ONE	L6x4x $\frac{3}{8}$		0	4/16
2		$\frac{3}{8}$ " A.325-X BOLT	0	2
				W/(-) AND LMIT, (-) WASHER EACH
ONE	113SA6	SUPPORT ANGLE		
ONE	L6x4x $\frac{3}{8}$		0	6/16
2		$\frac{3}{8}$ " A.325-X BOLT	0	2
				W/(-) AND LMIT, (-) WASHER EACH
ONE	113FP1	FILL PLATE		
ONE	PL $\frac{1}{4}$ x2		0	2

GENERAL NOTES

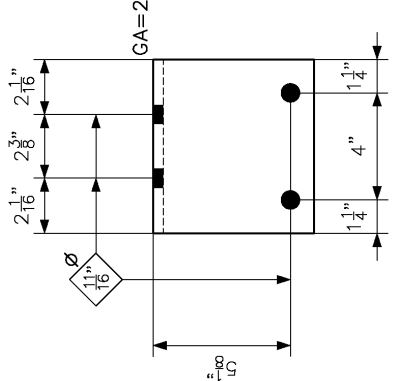
1. MATERIAL ASTM A36 (U.N.), PIPE A53 GR. B.
2. WELD MATERIAL: E60, TENSILE STRENGTH: 70ksi
3. PLANT WELDED CONNECTIONS TO BE SEAL WELDED
4. SURFACE PREPARATION: SPFC SP2
5. FINISH GALVANIZE
6. ALL SHIPPING REQUIREMENTS TO BE STAMPED PRIOR TO GALVANIZING.

<p>TRUST INSULATION CONSTRUCTION</p> <p>4858 HARRIS BLVD., SUITE 200 CHICAGO, IL 60631 TEL: 847-974-9100 FAX: 847-974-9101 WWW.TIC-USA.COM</p>	<p>0 11/3/17</p>	<p>WEB</p>	<p>RELEASED FOR JOB USE</p>
	<p>No.</p>	<p>Date</p>	<p>Revision</p>

<p>TRUST INSULATION CONSTRUCTION</p> <p>4858 HARRIS BLVD., SUITE 200 CHICAGO, IL 60631 TEL: 847-974-9100 FAX: 847-974-9101 WWW.TIC-USA.COM</p>	<p>113</p> <p>Project No.: 17.289.002</p> <p>Drawn By: WEB</p> <p>Checked By: MBB</p> <p>Date: 11/3/17</p>
<p>KOZK</p> <p>1891-0 CUYED TOWER</p> <p>SPRINGFIELD, MO</p> <p>SUPPORT ANGLES</p>	

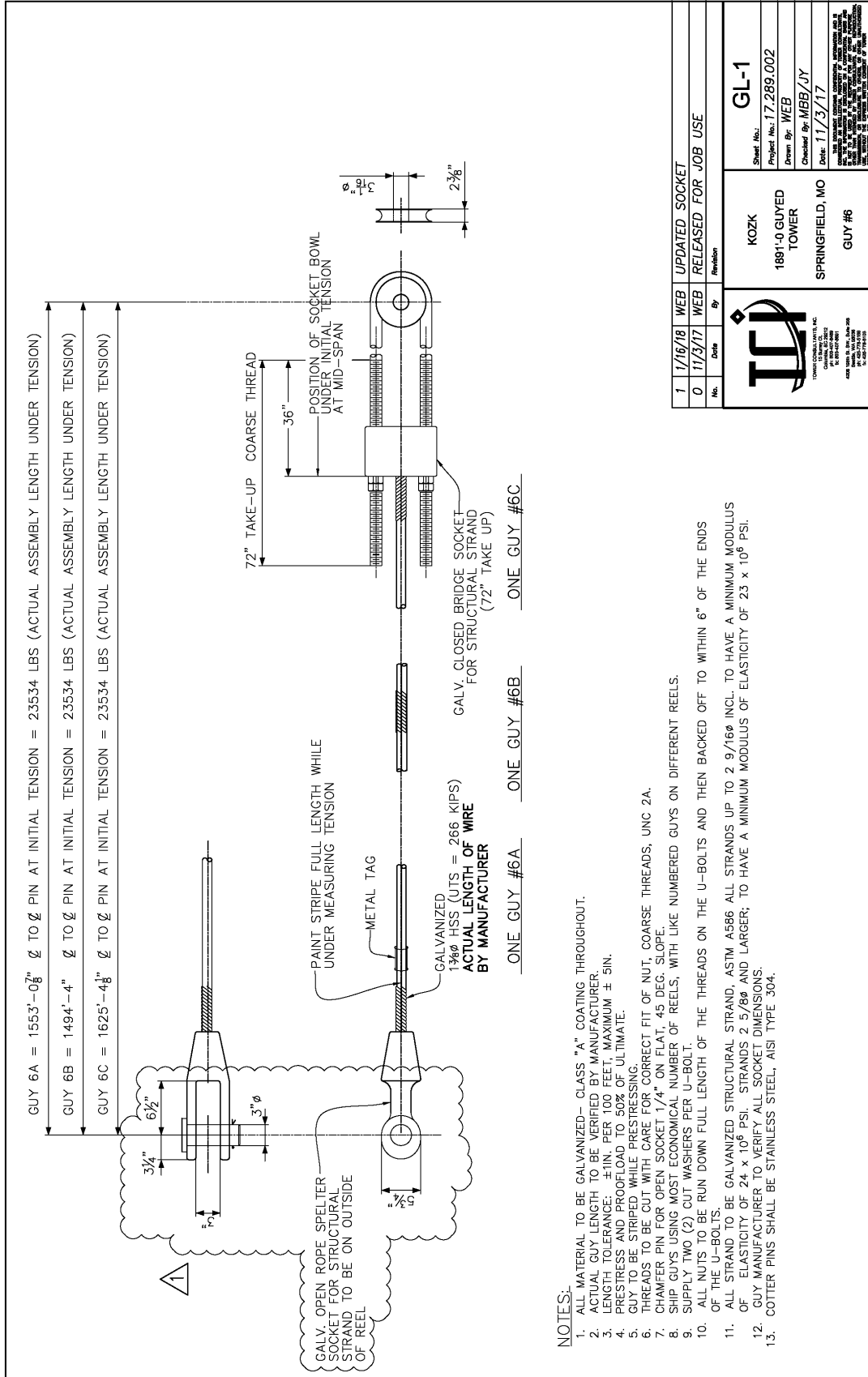


ONE SUPPORT ANGLE 113SA5
 (EST. WEIGHT = 5.0 LBS EA.)




ONE SUPPORT ANGLE 113SA6
 (EST. WEIGHT = 6.7 LBS EA.)

DRAWING ESTIMATED WEIGHT = 15 LBS



No.	Date	By	Revision
1	1/16/18	WEB	UPDATED SOCKET
0	11/3/17	WEB	RELEASED FOR JOB USE

 TGI TOWER GUYS, INC. 4800 W. STATE ST., SUITE 200 SPRINGFIELD, MO 65803 TEL: 417-865-0881 FAX: 417-865-0882 WWW.TOWERGUYS.COM	KOKZ 1891-0 GUYED TOWER SPRINGFIELD, MO GUY #6	Sheet No.: GL-1 Project No.: 17.289.002 Drawn By: WEB Checked By: MBB/JY Date: 11/3/17
--	--	--

- NOTES:**
1. ALL MATERIAL TO BE GALVANIZED- CLASS "A" COATING THROUGHOUT.
 2. ACTUAL GUY LENGTH TO BE VERIFIED BY MANUFACTURER.
 3. LENGTH TOLERANCE: ±1IN. PER 100 FEET, MAXIMUM ± 5IN.
 4. PRESTRESS AND PROOFLOAD TO 50% OF ULTIMATE.
 5. GUY TO BE STRIPED WHILE PRESTRESSING.
 6. THREADS TO BE CUT WITH CARE FOR CORRECT FIT OF NUT, COARSE THREADS, UNC 2A.
 7. CHAMFER PIN FOR OPEN SOCKET 1/4" ON FLAT, 45 DEG. SLOPE.
 8. SHIP GUYS USING MOST ECONOMICAL NUMBER OF REELS, WITH LIKE NUMBERED GUYS ON DIFFERENT REELS.
 9. SUPPLY TWO (2) CUT WASHERS PER U-BOLT.
 10. ALL NUTS TO BE RUN DOWN FULL LENGTH OF THE THREADS ON THE U-BOLTS AND THEN BACKED OFF TO WITHIN 6" OF THE ENDS OF THE U-BOLTS.
 11. ALL STRAND TO BE GALVANIZED STRUCTURAL STRAND, ASTM A586 ALL STRANDS UP TO 2 9/16" INCL. TO HAVE A MINIMUM MODULUS OF ELASTICITY OF 24 x 10⁶ PSI. STRANDS 2 5/8" AND LARGER; TO HAVE A MINIMUM MODULUS OF ELASTICITY OF 23 x 10⁶ PSI.
 12. GUY MANUFACTURER TO VERIFY ALL SOCKET DIMENSIONS.
 13. COTTER PINS SHALL BE STAINLESS STEEL, AISI TYPE 304.

Appendix C

PHOTOGRAPHS
(APRIL 23, 2018)



Figure C- 1



Figure C- 2



Figure C- 3



Figure C- 4



Figure C- 5

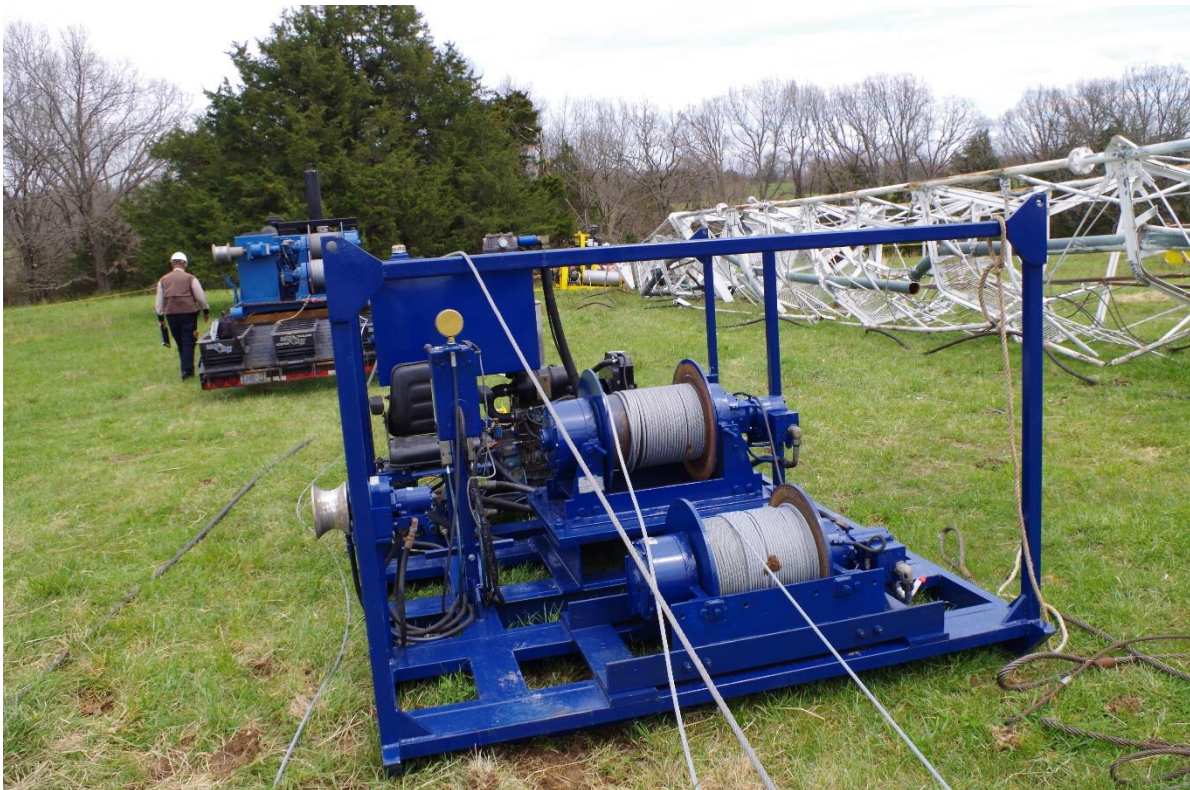


Figure C- 6



Figure C- 7



Figure C- 8



Figure C- 9



Figure C- 10



Figure C- 11



Figure C- 12



Figure C- 13



Figure C- 14

Appendix D

PHOTOGRAPHS
(AUGUST 1, 2018)



Figure D- 1



Figure D- 2



Figure D- 3



Figure D- 4



Figure D- 5



Figure D- 6



Figure D- 7



Figure D- 8



Figure D- 9



Figure D- 10



Figure D- 11



Figure D- 12