Bridge Factors Factual Report Attachment 60 – FDOT General Use Permit

Miami, FL

HWY18MH009

(97 pages)

GENERAL USE PERMIT

Date: 12/12/2017 Permit No.: 2017-K-690-095

Name of Applicant or Authorized Agent: DWIGHT DEMPSEY

Entity (if applicable): Munilla Construction Management (MCM)

(If entity, furnish contact information for responsible representative)

Address: 424 North Calhoun Street Zip Code: 32301

City/State: Tallahassee, Florida Telephone No.: (850) 224-7400 ext. ____

Email Address: ddempsey@figgbridge.com

Activity / Project Site

County: Miami-Dade State Road: SR 90 Section: 120, 000

From Mile Post: 6.407 to Mile Post: 7.070

Construction Proposed or Underway: Yes ☐ No ☐ FM Project No.: ____

Name of Municipality if Work is within Limits: ____

Description of Work Activity:
Plan to move the precast concrete pedestrian bridge main span from the staging area to the final position over SW 8th Street. The precast concrete main span weighs 950 tons and will be precast in the staging area that is located directly to the south of the pedestrian bridge location. Self-propelled modular transporters will be used to move the precast main span to its final position.

General Provisions

1. Attach any pertinent plans or drawings.
2. Attach notification letters sent to any Utilities both aerial and underground that will be potentially impacted.
3. The designated FDOT Engineer shall be notified 48 hours prior to beginning of work. Contact George Delanoval at 3056407246.
4. All work, materials and equipment shall be subject to inspection and approval by FDOT. Applicants certification of work at completion is required.
5. The permittee shall be responsible to place and display safety devices and proper maintenance of traffic in accordance with the latest version of the Department's Design Standards, index series 600, or an alternative plan signed and sealed by a professional Engineer and attached with the permit.
6. All FDOT property shall be restored to its original condition. Any damage to FDOT property as a result of this work shall be repaired and restored in a manner acceptable to the FDOT at the sole expense of the permittee.

Special Provisions

SEE ATTACHMENTS
WORK WITHIN THE F.D.O.T. RIGHT OF WAY SHALL
CONFORM TO CURRENT F.D.O.T. STANDARDS AND SPECIFICATIONS
PERMIT APPROVAL IN NO WAY CONSTITUTES THAT THE PERMITTED HAS AN APPROVED LANE CLOSURE. PLEASE COORDINATE A PRE-CONSTRUCTION MEETING WITH FDOT FIELD INSPECTOR.

Conditions

1. In the event the permittee fails to meet any of the requirements of this permit by the FDOT, the permitted activity must cease until brought into compliance. If compliance can not be met, then the permit will be rendered void and said work shall be removed from the right of way at no cost to the FDOT.
2. Work shall commence within 14 days of permit approval.
   Work shall be completed by 4/1/2018.
   (Date)
3. The rights and privileges herein set out are granted only to the extent of the State's right, title and interest in the land to be entered upon and used by the permittee, and the permittee will, at all times, and to the extent permitted by law, assume all risk of and indemnify, defend and save harmless the State of Florida and the FDOT from and against any and all loss, damage, cost or expense arising in any manner on account of the exercise or attempted exercises by said permittee of the aforesaid rights and privileges.

Applicant

I hereby agree to comply with all terms and conditions set forth and described in this permit.

DWIGHT DEMPSEY, Regional Director	DWIGHT DEMPSEY	12/12/2017
Printed or Typed Name and Title	Signature	Date

FDOT

Approved By:	Ali Al-Said	Ali Al-Said	2/5/2018
	Print Designated Engineer	Signature	Date
	DISTRICT PERMIT ENGINEER		
	Title		

WORK WITHIN THE

F.D.O.T.

RIGHT OF WAY SHALL CONFORM TO CURRENT F.D.O.T. STANDARDS AND SPECIFICATIONS

6201 SW 70th Street 2nd Floor
Miami, Florida 33143
[redacted]

Submittal #000400-5.A
000400 - DIVISION 2 - CONCRETE STRUCTURES

Project: 2015-711 - FIU - UCPP - DB Pedestrian Bridge
SW 109 Avenue & SW 8th Street
Miami, Florida 33174
[redacted]

SPMT Bridge Movement Plan

SPEC SECTION:	000400 - DIVISION 2 - CONCRETE STRUCTURES	**CREATED BY:**	
STATUS:	Open	**DATE CREATED:**	09/06/2017
ISSUE DATE:	09/06/2017	**REVISION:**	A
RESPONSIBLE CONTRACTOR:	Bamhart Crane & Rigging	**RECEIVED FROM:**	
RECEIVED DATE:	//	**OWNER JOB NO.:**	BT-904
FINAL DUE DATE:	09/22/2017	**DAYS ELAPSED:**	
TYPE:	SD-02 Shop Drawings	**MCM JOB NO.:**	**2015-711**
PRIORITY:			

APPROVERS: Erika Hango **(FIGG Bridge Engineers)**, Jose Morales **(Bolton Perez & Associates)**

BALL IN COURT:
Erika Hango **(FIGG Bridge Engineers)**

DISTRIBUTION:
Alan Ruiz **(MCM)**, Rodrigo Isaza **(MCM)**, Ernesto Hernandez **(MCM)**, Manuel Feliciano **(FIGG Bridge Engineers)**, Dwight Dempsey **(FIGG Bridge Engineers)**, Daniela Delgado **(MCM)**

DESCRIPTION:
Transport Shoring & Bracing Details
Travel Path Layout
Initial Staging & Lift Details
Final Set Location & Elevation Details
Travel Path & Mating Details
Transport Configuration Details
Transport Structural Equipment Details
Goldhofer Stability Calculation Summary
Gantry and Shoring Analysis
Design Parameters
Procedure

ATTACHMENTS:

SUBMITTAL WORKFLOW

#	NAME	SUBMITTER/ APPROVER	SENT DATE	DUE DATE	RETURNED DATE	RESPONSE	COMMENTS
1	Erika Hango	Approver		9/15/2017		Pending	
2	Jose Morales	Approver		9/22/2017		Pending	

SHOP DRAWING REVIEW

X FOR INFORMATION ONLY ______ ACCEPTED ______ ACCEPTED AS NOTED
______ ACCEPTED AS NOTED & RESUBMIT ______ NOT ACCEPTED

This review is only for general conformance with design intent of the project and general compliance with the information given in the contract documents. Review, corrections or comments made concerning the shop drawings during this review do not relieve the contractor from compliance with requirements of the drawings and specifications, nor relieve the contractor of contractual responsibility for any error or deviation from contract requirements. The contractor is responsible for confirming and correlating all quantities, dimensions and structural capabilities - Selecting fabrication processes and techniques of construction - Coordinating his work with that of all other trades - and performing his work in a safe and satisfactory manner.

FIGG BRIDGE ENGINEERS, INC. By: EDL Date: 9/18/17

Submittal #000400-5.A
000400 - DIVISION 2 - CONCRETE STRUCTURES

ENGINEERS & GENERAL CONTRACTORS

Review is for general conformance with the Contract Documents. Comments shall not be construed as relieving the supplier/subcontractor from strict compliance with such documents. The supplier/subcontractor remain responsible for details and accuracy, for complying with standards of the industry regarding fabrication, assembly, erection and installation procedures.

- [x] REVIEWED
- [ ] REVISE & RESUBMIT
- [ ] REVIEWED AS NOTED
- [ ] REJECTED

By: Alan Ruiz   Date: 9-6-2017

BY   DATE   COPIES TO

BARNHART Minds Over Matter	University City Prosperity Project – FIU Pedestrian Bridge Design Parameters	Document: PR1575-DP1.0
		Revision: A
		Approval Date: 06/28/2017

1.0 SCOPE

This document serves to set forth the design parameters that Barnhart Crane & Rigging, Co. Inc. (Barnhart) will utilize in the design and analysis of the equipment to be used during the lift, move, and set evolutions for the University City Prosperity Project – FIU Pedestrian Bridge. The intent of this document is to integrate and clarify the design requirements for Barnhart's scope related to the performance of the project for Munilla Construction Management, LLC (MCM – i.e., the "Customer").

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1.0 SCOPE 1

2.0 CONTENTS 1

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3.0 Applicable Codes & Standards

3.1. Structural Components:

3.1.1. Structural Steel – AISC "Manual of Steel Construction" 14th Edition (AISC 14th Ed.) Analysis is based on Allowable Strength Design (Reference AISC 14th Ed. Section B4).

3.1.2. Structural Welding – AWS D1.1:2015.

3.2. Structural Loadings:

3.2.1. Loads & Load Combinations – "Minimum Design Loads for Buildings and Other Structures" ASCE 7-10 Section 2.4.1 as applicable and specific to project as modified per ASCE 37-14 defined in 3.2.2 below.

3.2.2. Loads on Temporary Structures – "Design Loads on Structures During Construction" ASCE 37-14.

3.3. Self-Propelled Modular Transporter (SPMT):

3.3.1. "Platform Trailer Standard Operating Procedure" – SOP-006 (Latest Revision) – Barnhart Crane & Rigging, Inc.

3.3.2. "Load Securement for Road Transports Standard Operating Procedure" – SOP-005 (Latest Revision) – Barnhart Crane & Rigging, Inc.

3.4. Pull Up Gantry Systems:

3.4.1. "Pull Up Gantry (PUG) Standard Operating Procedure" – SOP-012 (Latest Revision) – Barnhart Crane & Rigging, Inc.

3.5. Pull Up Gantry Systems:

3.5.1. "Cribbing Standards" Standard Operating Procedures - SOP - 002 (Latest Revision) – Barnhart Crane & Rigging, Inc.

4.0 Design Loads

4.1. Lifting and Transport Loads:

4.1.1. Vertical rigging and transport loads are based on the actual weight of the piece being handled as provided to Barnhart by the Customer. Additional vertical impact factors are not considered in the analysis of the SPMT and support equipment due to the slow and controlled movement.

4.1.2. The maximum Transport Weight of the bridge section to be lifted and moved as part of Barnhart's scope of work for this project is 950 Tons (1,900 Kips), as indicated in the Figg RFC Superstructure Plans (Sheet B-37).

4.1.3. Lifting system, structural components and transport equipment will be selected and analyzed based on the loads as stated in 4.1.1 & 4.1.2 per the appropriate design code.

4.1.4. The capacity of the lifting system, structural components and transport equipment will be considered to be the published capacity (safe working load) as provided by the manufacturer.

4.1.5. Vertical live loads will not be present on the bridge deck during transport operations and are not considered in this analysis.

4.2. Wind Loads:

4.2.1. Wind load analyses for the SPMT and support equipment will be performed per the basic provisions of ASCE 7-10. Wind load analyses will be evaluated along each major horizontal axis of the SPMT Support Apparatus (Longitudinal and Transverse) in conjunction with other applicable loads.

4.2.2. The maximum wind speed is developed using the basic wind speed of 166 MPH (Risk Category II) and reducing the basic wind speed by a factor of 0.75 given in ASCE 37-14 Section 6.2.1 for construction periods less than 6 weeks. Based on these criteria, wind loading will be modeled based on the following parameters:

4.2.2.1. The SPMT and support equipment will be modeled with wind loadings at the following velocities (V):

4.2.2.1.1. V = 125 MPH (166 MPH * 0.75) for SPMT equipment in "loaded/non-operating" condition.

4.2.2.1.2. V = 30 MPH for SPMT equipment in "loaded/operating" condition.

4.2.2.2. Wind load development per ASCE 7-10, Chapter 29.

4.2.2.3. Structural support assemblies considered "Rigid" with gust effect factor, G=0.85.

4.2.2.4. Exposure Category = C.

4.2.2.5. The Risk Category shall be II for all environmental loads, during construction, as per ASCE 37-14 Section 6.1.

4.2.2.6. Topographic factor, K_{zt} = 1.0

4.2.2.7. Wind directionality factor, K_d = 1.0

4.2.2.8. Velocity pressure exposure coefficient, k_h = 1.04 (h = 40)

4.2.2.9. Force coefficient, C_f = 1.6 (ϵ = 0.5, wind perpendicular to bridge);

4.2.2.10. Force Coefficient, C_f = 1.0 (wind parallel to bridge).

4.2.3. Additional operational wind load restrictions may be placed on the structure by BCR engineering if deemed necessary based on final calculations and design.

4.3. Transport Acceleration Loads:

4.3.1. Transport acceleration load analyses for the SPMT and support equipment will be performed using a maximum transport acceleration force equal to five percent of the total bridge and shoring equipment dead load. The five percent acceleration force used in this analysis covers the accelerations due to starting, stopping, and turning of the transporters during transport operations.

4.3.2. Transport acceleration forces will be evaluated independently along the Longitudinal and Transverse horizontal axis of the SPMT, in conjunction with other applicable loads, and applied at the CG of the superstructure assembly.

4.3.3. Based on the Bridge Travel Weight of 1,900 kips, a transport acceleration force of at least 95 kips will be considered in the Longitudinal and Transverse SPMT axes.

4.3.4. Transport acceleration forces are considered to act simultaneously with the wind forces resulting from a 30 MPH wind event in the analysis of the SPMT Support Apparatus.

4.3.5. Per section 4.1.1, no additional vertical impact factor is considered in the analysis of the SPMT and support equipment.

4.4. Alignment tolerance:

4.4.1. Final set alignment of bridge span will be within ±5/8”. No obstructions including wing walls, supports or other structures will interfere with setting or the bridge or travel path of the platform trailers.

4.5. Seismic Loads:

4.5.1. Due to the short-term duration of the project as well as the physical location of the project being in Miami, Florida; seismic loads are specifically excluded in this analysis.

4.6. Miscellaneous Loads:

4.6.1. Barnhart understands that the maximum Bridge Travel Weight listed in Section 4.1.2 includes all miscellaneous gravity loads for the bridge sections included in Barnhart’s scope of work for this project. The effects of any additional bridge section loads that are not included in the maximum Bridge Travel Weight listed in section 4.1.2 would need to be determined and could lead to additional costs.

4.6.2. No load testing of the SPMT, support equipment, or any other Barnhart supplied equipment, is included in the scope of this project – either on-site or offsite. Any requirements for load testing will be handled as a change-order to the contract.

4.7. Ground Loadings:

4.7.1. In general, short-term ground loadings imparted to the ground by rigging equipment, transporters, etc. are not limited by long-term settlement criteria (as are other building and structure foundations designed to stay in service for many years under the imposed loadings). Therefore, the ground loadings should be considered as “temporary short-term” loadings for the purpose of geotechnical evaluations of the loads and should be compared to soil bearing capacity values with appropriately scaled factors of safety (provided by Customer).

4.7.2. Average nominal ground loadings will be calculated beneath the nominal area of bearing surfaces for the transport configurations. Transient / variable short term loadings (primarily from wind-load effects) will not be considered to govern design of load spreading systems unless the magnitude of such loadings is deemed critical to be considered the overall system performance by Barnhart engineering. contract.

4.8. Coefficients of Static Friction:

4.8.1. For the purpose of design, analysis, and determination of loadings in the jacking systems, moving equipment, and rigging and anchorage hardware components where friction is considered (except for structural bolted connections which are governed by AISC provisions), the following minimum static coefficients of friction (ms) will be used in Barnhart calculations:

4.8.1.1. Wood on Steel = 0.20
4.8.1.2. Wood on Concrete = 0.60
4.8.1.3. Wood on Wood = 0.30
4.8.1.4. Steel on Steel (Wet) = 0.20
4.8.1.5. Steel on Concrete = 0.45
4.8.1.6. Nylatron or Teflon on Steel = 0.12

5.0 SOFTWARE

5.1. Barnhart may elect to utilize the following software to perform structural calculations and analyses for the project (as applicable):

5.1.1. MathCAD 14 (or latest release)

5.1.2. RISA-3D v. 10.0 (or latest release)

5.1.3. Autodesk Simulation 2011 (or latest release)

5.1.4. Microsoft Excel 2013 (or latest release)

***** END OF DOCUMENT *****

BARNHART Minds Over Matter	Transporter Stability Analysis Munilla Construction Management UCPP – FIU Pedestrian Bridge	Number: PR1575-EC1.0 Revision: B Date: 9/1/2017

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Appendix D - Wind Loads Calculations

APPLICABLE CODES, STANDARDS, AND REFERENCE DOCUMENTS

a. Refer to Document PR1575-DP1.0 Design Parameters for all applicable codes used in developing this calculation package.

2. Calculations Performed & Cases Considered

a. **PR1575-EC1.1 – "Goldhofer Stability Analysis"** – RISA-3D model of the Goldhofer Transporter Zoning.

I. **Case 1** – Unloaded Transport System

II. **Case 2** – Loaded Transport System

III. **Case 3** – Loaded Transport System – 30 MPH Wind & 5% Accel. Load

IV. **Case 4** – Loaded Transport System – 125 MPH Wind (Not Traveling)

b. **PR1575-EC1.2 – "Goldhofer Overload & Tilting Limits"** – Analysis of hydraulic zone capacity and crossfall limits

I. Using the same RISA-3D model as PR1575-EC1.1, the hydraulic overload limit of the transporter we determined by rotating the model about the X and Y axis until the capacity of a single hydraulic zone was reached.

3. Loads

a. **Dead Loads** – Dead loads include the weight of the transporters and shoring and lifting equipment atop the Goldhofer trailers, as well as the bracing between the trailers.

b. **Live Loads** – The maximum weight of the bridge span, as indicated in the Figg RFC Superstructure Plans (Sheet B-37) will be considered as 1,900K. No additional vertical impact factors are considered in the analysis.

I. **5% Global Transport Load -** The Global transport load is taken as 5% of the total Dead Load + Live Load and is applied at the center of gravity location in the +X, +Y and -Y direction. This factor accounts for acceleration forces due to starting, stopping, and turning of the transporters during transport operations.

c. **Wind Loads**

I. **Wind Speeds for Design**

1. **Non-Operational (Loaded) – 125 MPH.** If sustained winds greater than 125 m.p.h. are predicted to occur, bridge span shall be set back to shoring structure (provided by others).

2. **Operational (Loaded) – 30 MPH.** Wind load was applied at the center of gravity, acting in the same direction as the global transport loads. If sustained winds greater than 30 m.p.h. are predicted to occur, contact Barnhart engineering for countermeasures.

II. Refer to Document PR1575-DP1.0 Design Parameters (Sec. 4.2) for detailed wind load parameters used in developing this calculation package.

4. **Supporting Structure:** This RISA model was used only to analyze the loadings to the hydraulic system of the transporter. All members in the system are considered "RIGID" and are not analyzed. Separate calculations were performed to analyze the structural capacity of the trailer spine beam (PR1575-EC1.2) and lifting/structural equipment (PR1575-EC2.0).

5. **RISA-3D Calculation Format:**

a. **PR1575-EC1.0 – "Goldhofer Stability Analysis"**

I. **RISA Report –** This report includes the inputs and design result for cases 1 through 4. The Global X direction is positive towards the south end (Bent 1). Wind loads and side loads are considered to act in the +X, +Y and -Y directions (whichever is most unfavorable).

II. **Plots & Figures**

1. **Figure SK-1 – Iso View - Node & Member Map:** Corresponds to an overall view of the zoning geometry and each node/member location.

2. **Figures SK-2 through SK-11– Load Combination Loads:** Iso views of the applied forces for each of the Load Combinations

6. **Discussion of Results**

a. **Basic Load Cases (BLC) Used**

BLC No.	*BLC Description*	*Category*
1	DL	DL
2	LL	LL
3	LL Offset Forward	LL
4	LL Offset Rearward	LL
5	Xport Force (X Direction)	None
6	Xport Force (Y Direction)	None
7	Wind Load (X Direction)	WLX
8	Wind Load (Y Direction)	WLY

b. Load Combinations (LC) Used

LC No.	*Description*	*BLC*	*Factor*	*BLC*	*Factor*	*BLC*	*Factor*	*BLC*	*Factor*
Case 1 - Unloaded									
1	DL	1	1						
Case 2 - Loaded									
2	DL+LL	1	1	2	1				
3	DL + LL_F	1	1	3	1				
4	DL + LL_R	1	1	4	1				
Case 3 - Loaded (5% Accel Load & 30 MPH Wind)									
5	DL + LL_F + XportX + WLX	1	1	3	1	5	1	7	1
6	DL + LL_F + XportY + WLY	1	1	3	1	6	1	8	1
7	DL + LL_R + Xport-Y + WL-Y	1	1	4	1	6	-1	8	-1
Case 4 - Loaded (125 MPH Wind)									
8	DL + LL_F + WLX 125	1	1	3	1	7	17.36		
9	DL + LL_F + WLY 125	1	1	3	1	8	17.36		
10	DL + LL_R + WL-Y 125	1	1	4	1	8	-17.36		

c. Operational conditions for transporting the bridge span (Case 3) assumes the weight of the bridge + support equipment weight + 5% acceleration load + 30 MPH wind load all acting simultaneously and in the most unfavorable direction.

d. Non-operational condition for supporting bridge span in high winds (Case 4) assumes the weight of the bridge + support equipment weight + 125 MPH wind load all acting simultaneously and in the most unfavorable direction. The wind load is scaled up to 125 MPH by applying the following factor: [(125/30)^2]=17.36.

e. The maximum calculated loading on the pool and side zone are shown in Table 1. Goldhofer specifications state that at 0.6 MPH transport speed, each axle line has a gross capacity of 40t. The transport arrangement will be hydraulically zoned in a 3-point global zoning configuration, as shown on drawing PR1575-T1.0. All hydraulic zones are within their design capacity per Goldhofer specifications. Additional limitations include maximum travel speeds of 0.6 mph, and stopping all travel if necessary to level or raise the load.

Table 1 – PR1575-EC1.0 – Summary of Max Loading on Hydraulic zones.

Zone	Unit	Envelope Value	Load Combination	Capacity	Maximum % Capacity
Pool Zone	K	1,113.9	7	1,410.6	79%
Side Zone	K	940.6	6	1,410.6	67%

f. The hydraulic overload limit was determined to be 11.0 degrees, at this angle the pool zone could become overloaded during the worst case loading. The tilting limit of the transport arrangement is calculated as the arctangent of the distance from the cg to the edge of the stability triangle over the cg height; Φ_TL=atan(9'-10"/26'-10.5") = 20.1 degrees (Ref. dwg PR1575-T1.0). Both the hydraulic and tilting limit are within the requirements for standard operating procedures.

Appendix A:

PR1575-EC1.1 - RISA-3D Report

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	Yes
Maximum Iteration Number for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Z
Global Member Orientation Plane	XY
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 13th(360-05): ASD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 13th(360-05): ASD
Cold Formed Steel Code	AISI S100-07: ASD
Wood Code	AF&PA NDS-05/08: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-11
Masonry Code	ACI 530-08: ASD
Aluminum Code	AA ADM1-05: ASD - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

Global, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct Z	.02
Ct X	.02
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	3
R X	3
Ct Exp. Z	.75
Ct Exp. X	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	GEN1A	RE4X4	Beam	gen_Conc3NW	16	21.333	21.333	31.573
2	RIGID		None	RIGID	1e+6	1e+6	1e+6	1e+6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	SIDEZONE2	51	9.8423	0.	0	
2	SIDEZONE1	-44	9.8423	0.	0	
3	POOLZONE	0	-19.6848	0	0	
4	N1	0	0	0	0	
5	CG_REAR	1	-1	24.125	0	
6	CG_FORWARD	1	1.	24.125	0	
7	CG	0.	-0.	24.125	0	
8	PP1	-44	-35.5208	0	0	
9	PP2	51	-35.5208	0	0	
10	N2	-44	0	0	0	
11	N3	51	0	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	SIDEZONE2	Reaction	Reaction	CS10000				
2	SIDEZONE1	Reaction	Reaction	CS10000				
3	POOLZONE			CS10000				

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	SIDEZON...	PP1			RIGID	None	None	RIGID	Typical
2	M2	SIDEZON...	PP2			RIGID	None	None	RIGID	Typical
3	M3	POOLZONE	N2			RIGID	None	None	RIGID	Typical

Company	: Barnhart		Sept 1, 2017
Designer	: DLT		4:17 PM
Job Number	: PR1575-EC1.1	Transporter Zone Analysis	Checked By: JJE

Member Primary Data (Continued)

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
4	M4	POOLZONE	N3			RIGID	None	None	RIGID	Typical
5	M5	N2	N3			RIGID	None	None	RIGID	Typical
6	M6	CG	N1			RIGID	None	None	RIGID	Typical
7	M7	CG_FOR...	N1			RIGID	None	None	RIGID	Typical
8	M8	CG_REAR	N1			RIGID	None	None	RIGID	Typical

Joint Loads and Enforced Displacements (BLC 1 : DL)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N2	L	Z	-125.212
2	N3	L	Z	-125.212
3	PP1	L	Z	-32
4	PP2	L	Z	-32
5	N2	L	Z	-213.408
6	N3	L	Z	-213.408

Joint Loads and Enforced Displacements (BLC 2 : LL)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 3 : LL Offset Forward)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG_FORWARD	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 4 : LL Offset Rearward)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG_REAR	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 5 : Xport Force (X Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	X	107.521

Joint Loads and Enforced Displacements (BLC 6 : Xport Force (Y Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Y	107.521

Joint Loads and Enforced Displacements (BLC 7 : Wind Load (X Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	X	.324

Joint Loads and Enforced Displacements (BLC 8 : Wind Load (Y Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Y	4.813

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Member)	Surface(...
1	DL	DL			-1	6				
2	LL	LL				1				
3	LL Offset Forward	LL				1				
4	LL Offset Rearward	LL				1				
5	Xport Force (X Dire...	None				1				
6	Xport Force (Y Dire...	None				1				

Basic Load Cases (Continued)

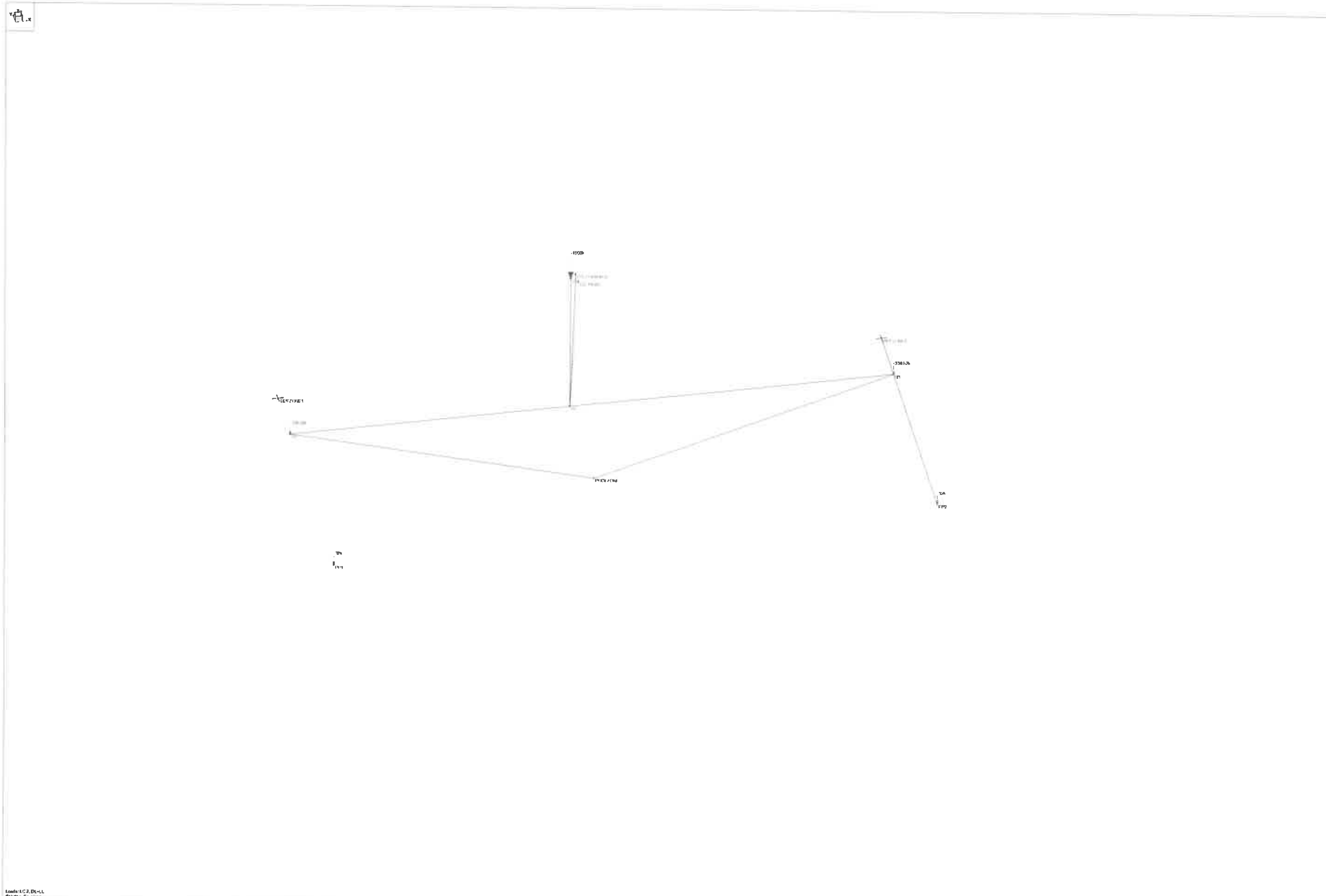
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Member)	Surface(...
7	Wind Load (X Direct...	WLX				1				
8	Wind Load (Y Direct...	WLY				1				

Load Combinations

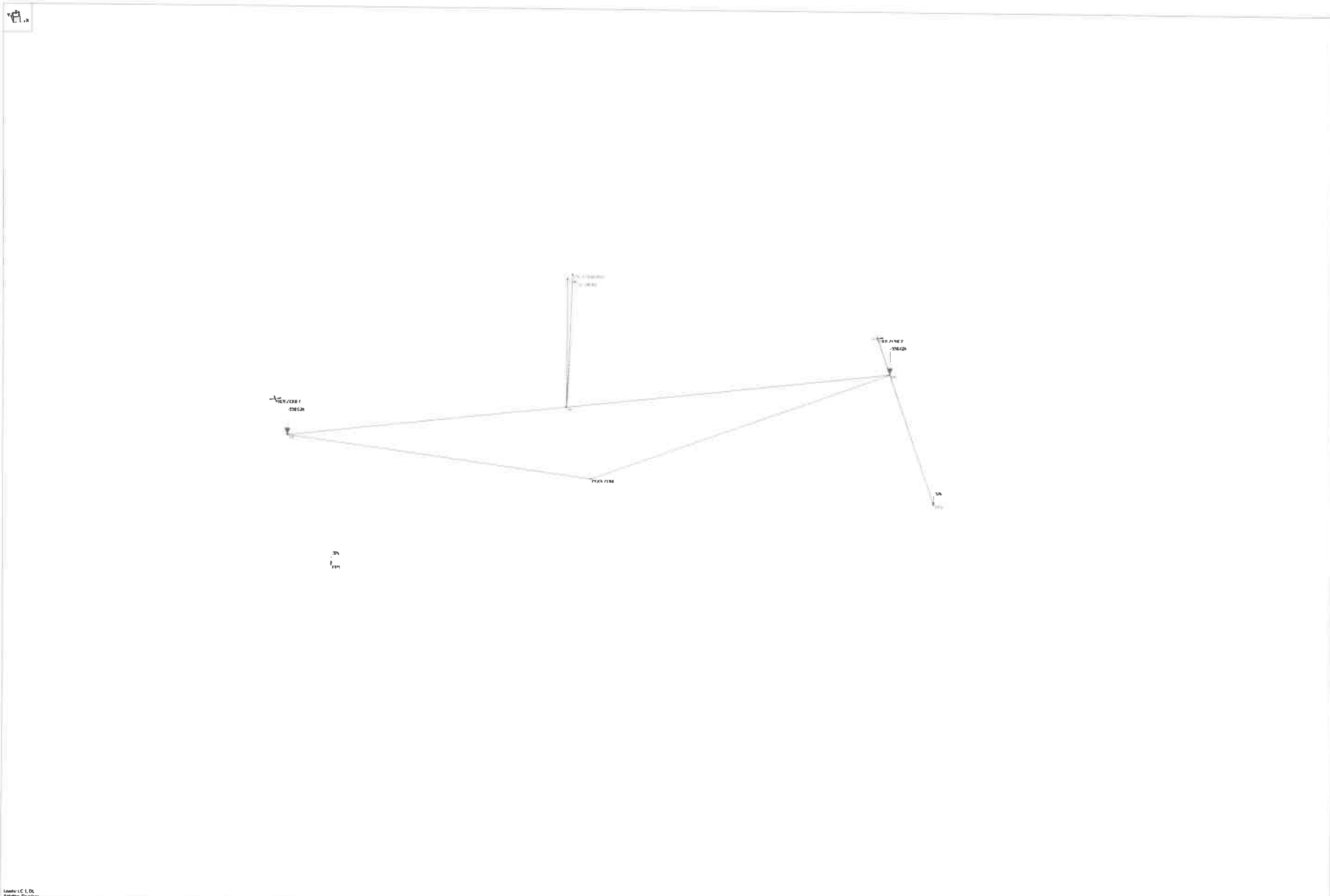
	Description	So...	PDelta	S...	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac...
1	DL	Yes	Y		1	1														
2	DL+LL	Yes	Y		1	1	2	1												
3	DL + LL_F	Yes	Y		1	1	3	1												
4	DL + LL_R	Yes	Y		1	1	4	1												
5	DL + LL_F + XportX + WLX	Yes	Y		1	1	3	1	5	1	7	1								
6	DL + LL_F + XportY + WLY	Yes	Y		1	1	3	1	6	1	8	1								
7	DL + LL_R + Xport-Y + WL-Y	Yes	Y		1	1	4	1	6	-1	8	-1								
8	DL + LL_F + WLX 125	Yes	Y		1	1	3	1	7	17....										
9	DL + LL_F + WLY 125	Yes	Y		1	1	3	1	8	17....										
10	DL + LL_R + WL-Y 125	Yes	Y		1	1	4	1	8	-17...										

Envelope Joint Reactions

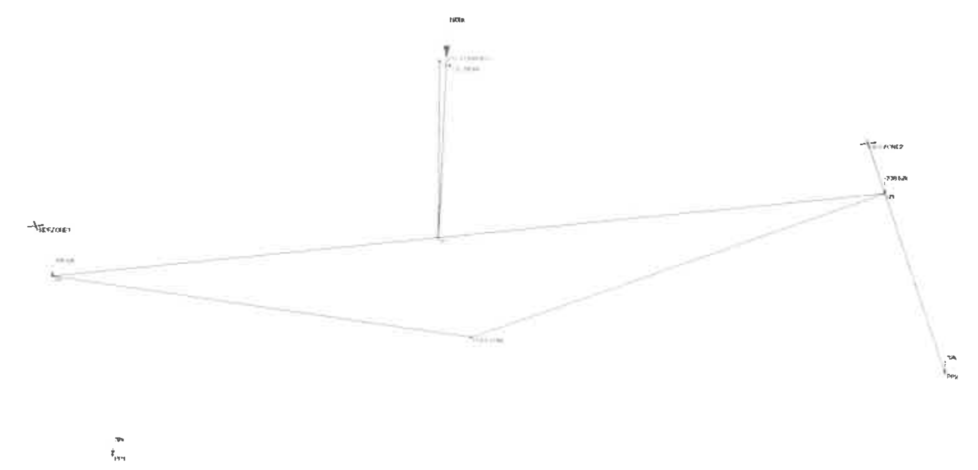
	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	SIDEZONE2	max	101.497	7	52.034	7	899.604	6	0	1	0	1	0	1
2		min	-101.496	6	-52.031	6	220.525	1	0	1	0	1	0	1
3	SIDEZONE1	max	101.496	6	60.3	7	940.563	6	0	1	0	1	0	1
4		min	-101.497	7	-60.303	6	196.646	1	0	1	0	1	0	1
5	POOLZONE	max	0	1	0	1	1113.949	7	0	1	0	1	0	1
6		min	0	1	0	1	324.07	1	0	1	0	1	0	1
7	Totals:	max	0	7	112.334	7	2641.24	6						
8		min	-107.845	5	-112.334	6	741.24	1						



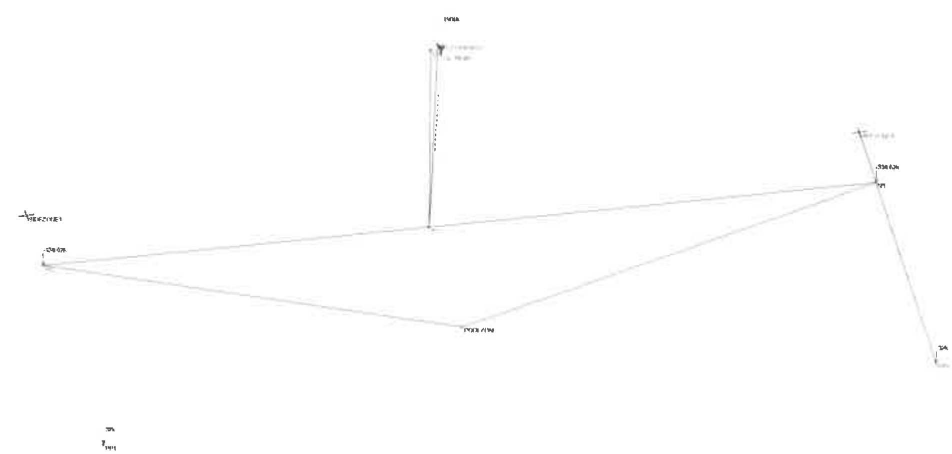
Barnhart	Transporter Zone Analysis	SK - 2
DLT	LC2	Sept 1, 2017 at 4:18 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



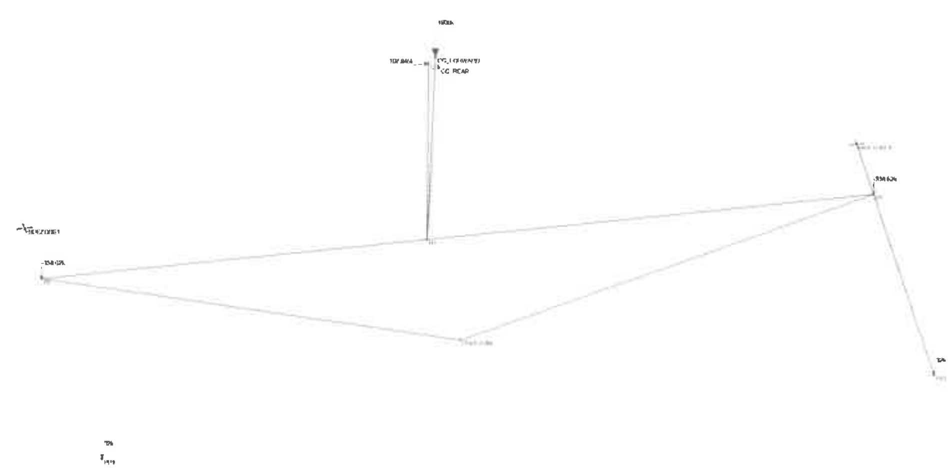
Barnhart	Transporter Zone Analysis	SK - 1
DLT	LC1	Sept 1, 2017 at 4:18 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



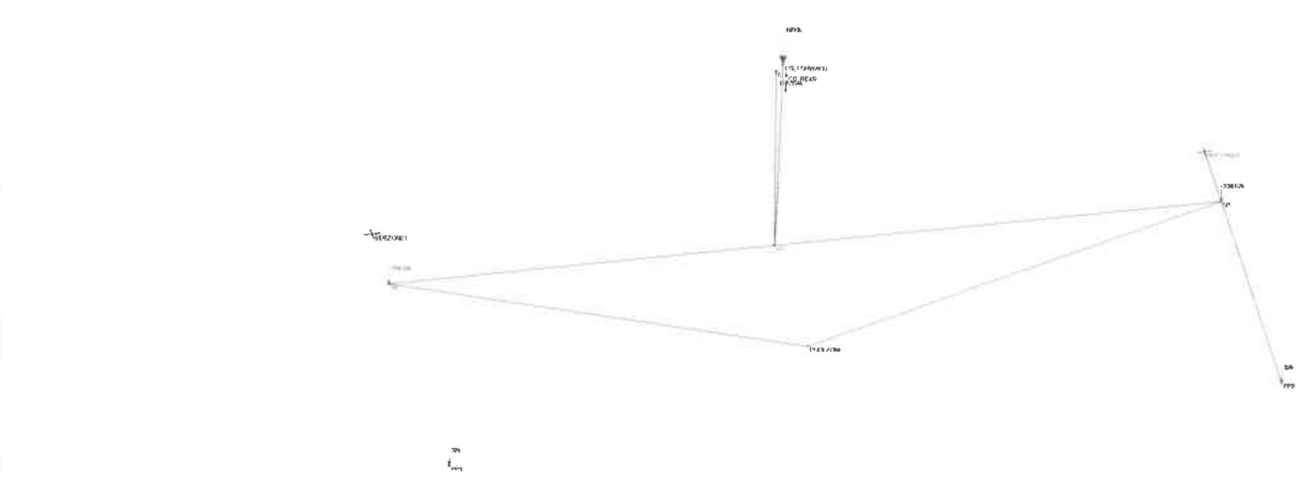
Barnhart	Transporter Zone Analysis	SK - 3
DLT		Sept 1, 2017 at 4:19 PM
PR1575-EC1.1	LC3	PR1575-EC1.1 RISA Goldhofer Rev01.r3d



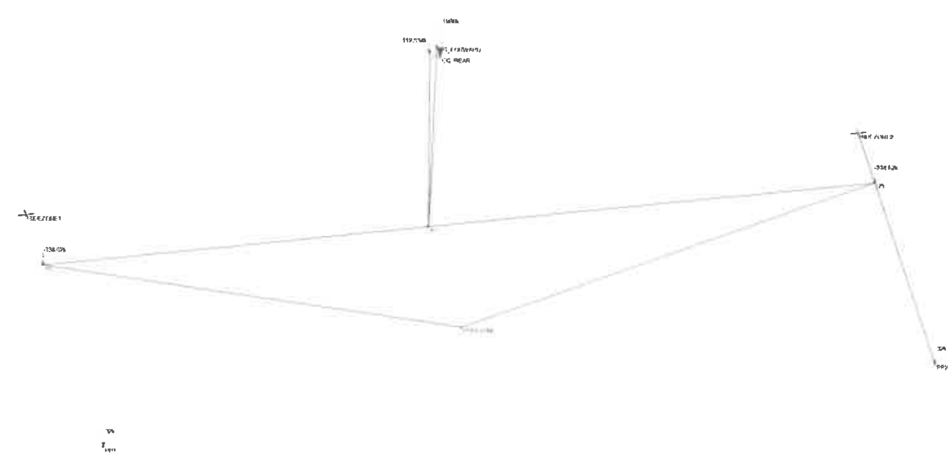
Barnhart	Transporter Zone Analysis	SK - 4
DLT	LC4	Sept 1, 2017 at 4:19 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



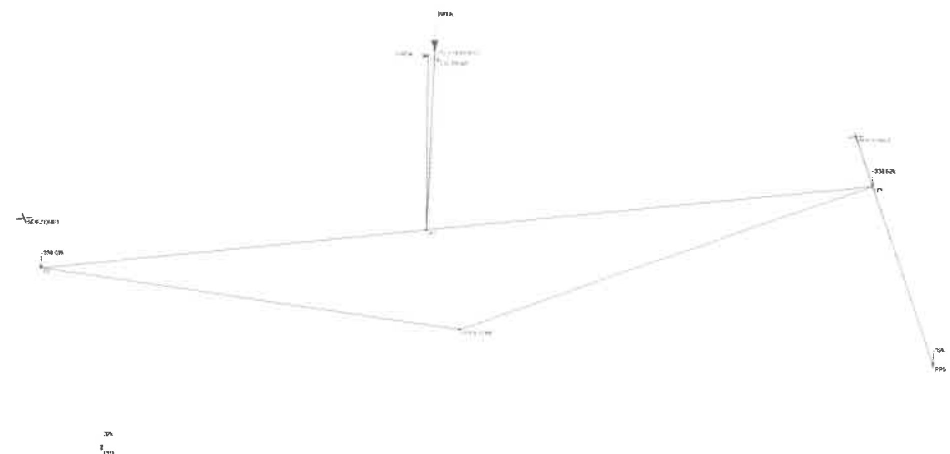
Barnhart	Transporter Zone Analysis	SK - 5
DLT	LC5	Sept 1, 2017 at 4:20 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



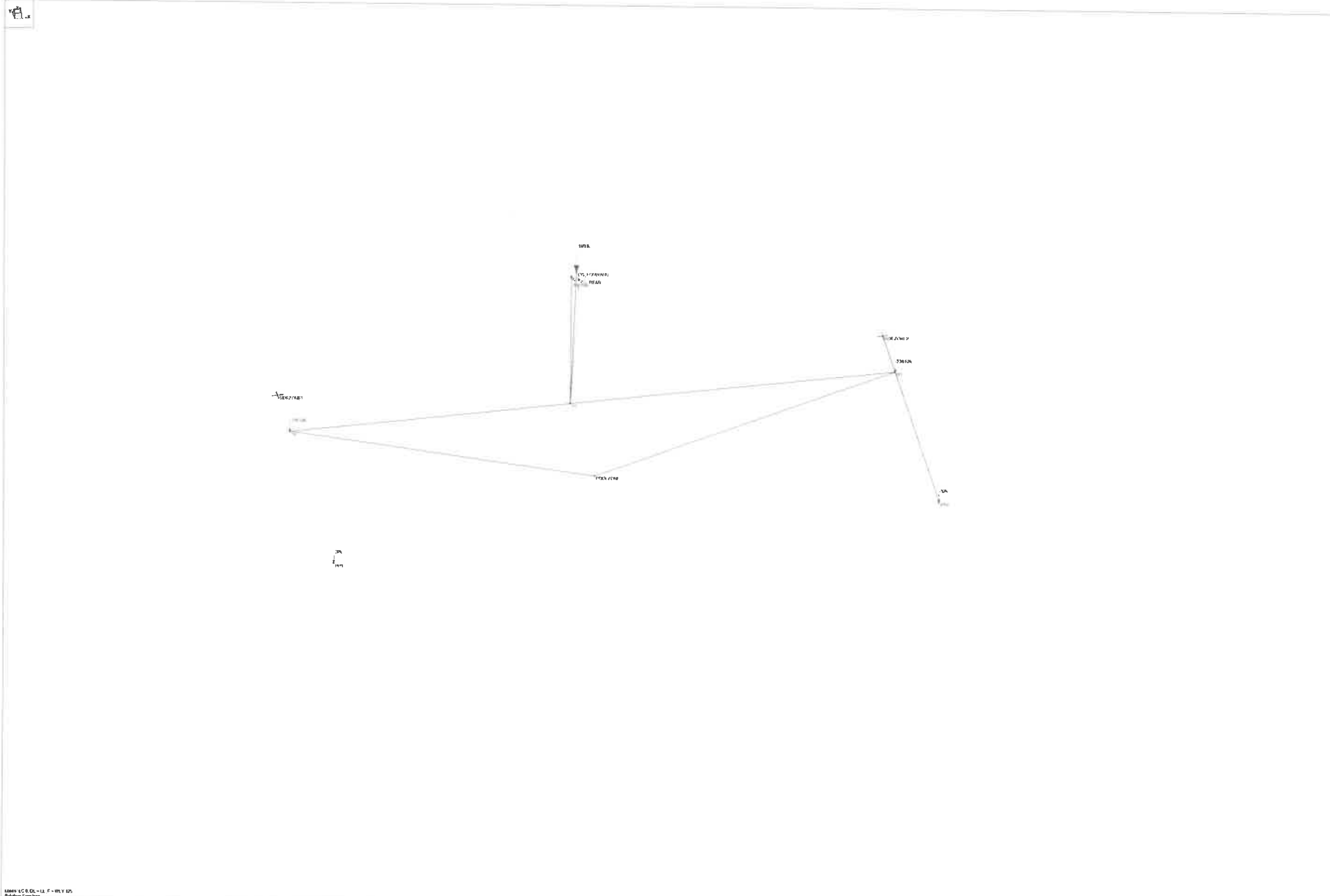
Barnhart	Transporter Zone Analysis	SK - 6
DLT	LC6	Sept 1, 2017 at 4:20 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



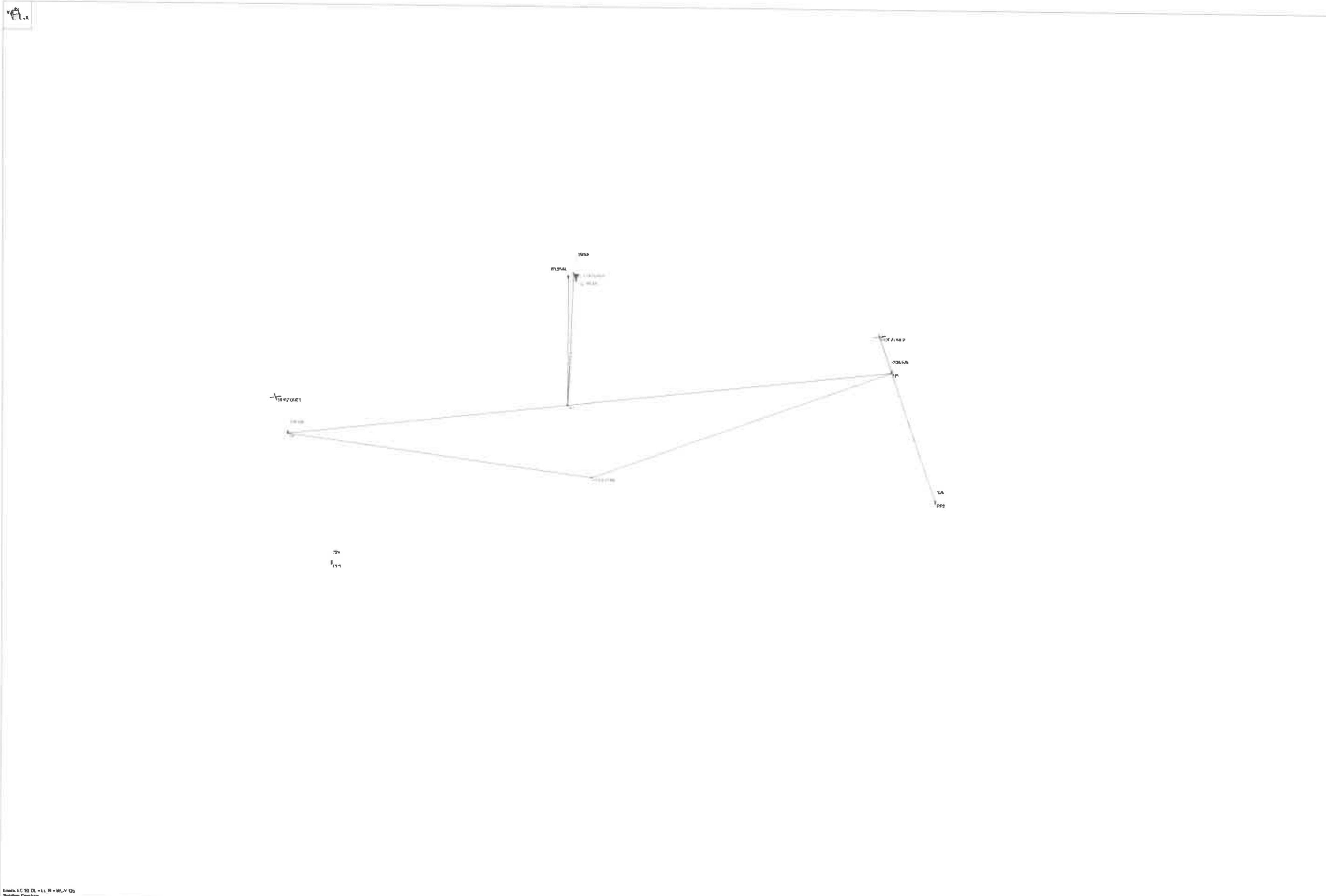
Barnhart	Transporter Zone Analysis	SK - 7
DLT	LC7	Sept 1, 2017 at 4:20 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



Barnhart	Transporter Zone Analysis	SK - 8
DLT	LC8	Sept 1, 2017 at 4:20 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d



Barnhart	Transporter Zone Analysis	SK - 9
DLT		Sept 1, 2017 at 4:21 PM
PR1575-EC1.1	LC9	PR1575-EC1.1 RISA Goldhofer Rev01.r3d



Barnhart	Transporter Zone Analysis	SK - 10
DLT	LC10	Sept 1, 2017 at 4:21 PM
PR1575-EC1.1		PR1575-EC1.1 RISA Goldhofer Rev01.r3d

Appendix B:

PR1575-EC1.2 – RISA Hydraulic Overload Analysis

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	Yes
Maximum Iteration Number for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Z
Global Member Orientation Plane	XY
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 13th(360-05): ASD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 13th(360-05): ASD
Cold Formed Steel Code	AISI S100-07: ASD
Wood Code	AF&PA NDS-05/08: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-11
Masonry Code	ACI 530-08: ASD
Aluminum Code	AA ADM1-05: ASD - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

Global, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct Z	.02
Ct X	.02
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	3
R X	3
Ct Exp. Z	.75
Ct Exp. X	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	GEN1A	RE4X4	Beam	gen_Conc3NW	16	21.333	21.333	31.573
2	RIGID		None	RIGID	1e+6	1e+6	1e+6	1e+6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	SIDEZONE2	51	9.661469	1.877999	0	
2	SIDEZONE1	-44	9.661469	1.877999	0	
3	POOLZONE	0	-19.323135	-3.756037	0	
4	N1	0	0	0	0	
5	CG_REAR	1	-5.584894	23.490947	0	
6	CG_FORWARD	1	-3.62164	23.872565	0	
7	CG	0.	-4.603267	23.681756	0	
8	PP1	-44	-34.868183	-6.777688	0	
9	PP2	51	-34.868183	-6.777688	0	
10	N2	-44	0	0	0	
11	N3	51	0	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	SIDEZONE2	Reaction	Reaction	CS10000				
2	SIDEZONE1	Reaction	Reaction	CS10000				
3	POOLZONE			CS10000				

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	SIDEZON...	PP1			RIGID	None	None	RIGID	Typical
2	M2	SIDEZON...	PP2			RIGID	None	None	RIGID	Typical
3	M3	POOLZONE	N2			RIGID	None	None	RIGID	Typical

Member Primary Data (Continued)

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
4	M4	POOLZONE	N3			RIGID	None	None	RIGID	Typical
5	M5	N2	N3			RIGID	None	None	RIGID	Typical
6	M6	CG	N1			RIGID	None	None	RIGID	Typical
7	M7	CG_FOR...	N1			RIGID	None	None	RIGID	Typical
8	M8	CG_REAR	N1			RIGID	None	None	RIGID	Typical

Joint Loads and Enforced Displacements (BLC 1 : DL)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N2	L	Z	-125.212
2	N3	L	Z	-125.212
3	PP1	L	Z	-32
4	PP2	L	Z	-32
5	N2	L	Z	-213.408
6	N3	L	Z	-213.408

Joint Loads and Enforced Displacements (BLC 2 : LL)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 3 : LL Offset Forward)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG_FORWARD	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 4 : LL Offset Rearward)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG_REAR	L	Z	-1900

Joint Loads and Enforced Displacements (BLC 5 : Xport Force (X Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	X	107.521

Joint Loads and Enforced Displacements (BLC 6 : Xport Force (Y Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Y	107.521

Joint Loads and Enforced Displacements (BLC 7 : Wind Load (X Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	X	.324

Joint Loads and Enforced Displacements (BLC 8 : Wind Load (Y Direction))

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	CG	L	Y	4.813

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Member)	Surface(...
1	DL	DL			-1	6				
2	LL	LL				1				
3	LL Offset Forward	LL				1				
4	LL Offset Rearward	LL				1				
5	Xport Force (X Dire...	None				1				
6	Xport Force (Y Dire...	None				1				

Basic Load Cases (Continued)

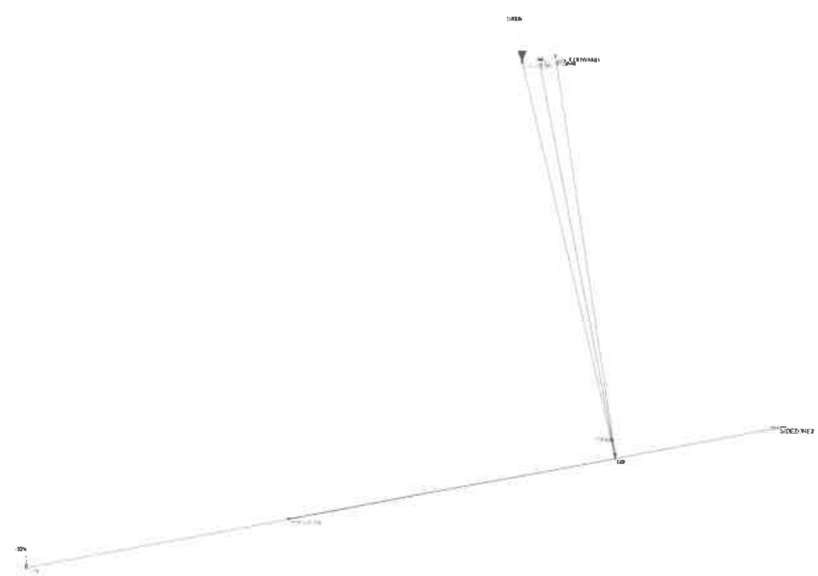
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Member)	Surface(...
7	Wind Load (X Direct...	WLX				1				
8	Wind Load (Y Direct...	WLY				1				

Load Combinations

	Description	So...	PDelta	S...	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac...
1	DL	Yes	Y		1	1														
2	DL+LL	Yes	Y		1	1	2	1												
3	DL + LL_F	Yes	Y		1	1	3	1												
4	DL + LL_R	Yes	Y		1	1	4	1												
5	DL + LL_F + XportX + WLX	Yes	Y		1	1	3	1	5	1	7	1								
6	DL + LL_F + XportY + WLY	Yes	Y		1	1	3	1	6	1	8	1								
7	DL + LL_R + Xport-Y + WL-Y	Yes	Y		1	1	4	1	6	-1	8	-1								
8	DL + LL_F + WLX 125	Yes	Y		1	1	3	1	7	17....										
9	DL + LL_F + WLY 125	Yes	Y		1	1	3	1	8	17....										
10	DL + LL_R + WL-Y 125	Yes	Y		1	1	4	1	8	-17....										

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	SIDEZONE2	max	428.225	7	52.039	7	756.181	6	0	1	0	1	0	1
2		min	-.042	1	-52.024	6	220.526	1	0	1	0	1	0	1
3	SIDEZONE1	max	.042	1	60.295	7	774.318	6	0	1	0	1	0	1
4		min	-428.225	7	-60.31	6	196.648	1	0	1	0	1	0	1
5	POOLZONE	max	0	1	0	1	1409.008	7	0	1	0	1	0	1
6		min	0	1	0	1	324.066	1	0	1	0	1	0	1
7	Totals:	max	0	1	112.334	7	2641.24	6						
8		min	-107.845	5	-112.334	6	741.24	1						



Barnhart	Transporter Overload Analysis	SK - 11
KCA	OVERLOAD GRAPHIC	Sept 1, 2017 at 4:27 PM
PR1575-EC1.1		PR1575-EC1.2 Goldhofer OL Limit Rev01.r3d

Appendix C:

PR1575-EC1.2 – Goldhofer EasyLOAD

easyLOAD³
Version 3.0.4 (Build 205)

Goldhofer

Master data

Index number :	229
Type :	PST/SL E
Parallel combination :	P(1 + 1)
Designation :	PSTe2-12
Vehicle number :	
Truck registration number :	

Basic data of the trailer / semitrailer

Deadweight :	101.074 kg	
Centre of gravity :	9.746 mm	
Deadweight distribution	(based on the initial setting and the support circuit setting)	
	Front support circuit	**Rear support circuit**
	(4 Axle lines)	(8 Axle lines)
	4x 6.327 kg = 25.310 kg	8x 9.471 kg = 75.764 kg
Minimum length :	21.950 mm	
Extendable maximum by :	0 mm	
Maximum length :	21.950 mm	

Initial setting

Extension step :	0 / 0
Extended by :	0 mm
Overall length, trailer / semitrailer :	21.950 mm
Coupling length a :	0 mm
Coupling length b :	21.950 mm
Coupling length c (rear overhang) :	0 mm
Gross combination length a + b + c :	21.950 mm

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Sitz- und Registergericht: Memmingen, HRB 10871
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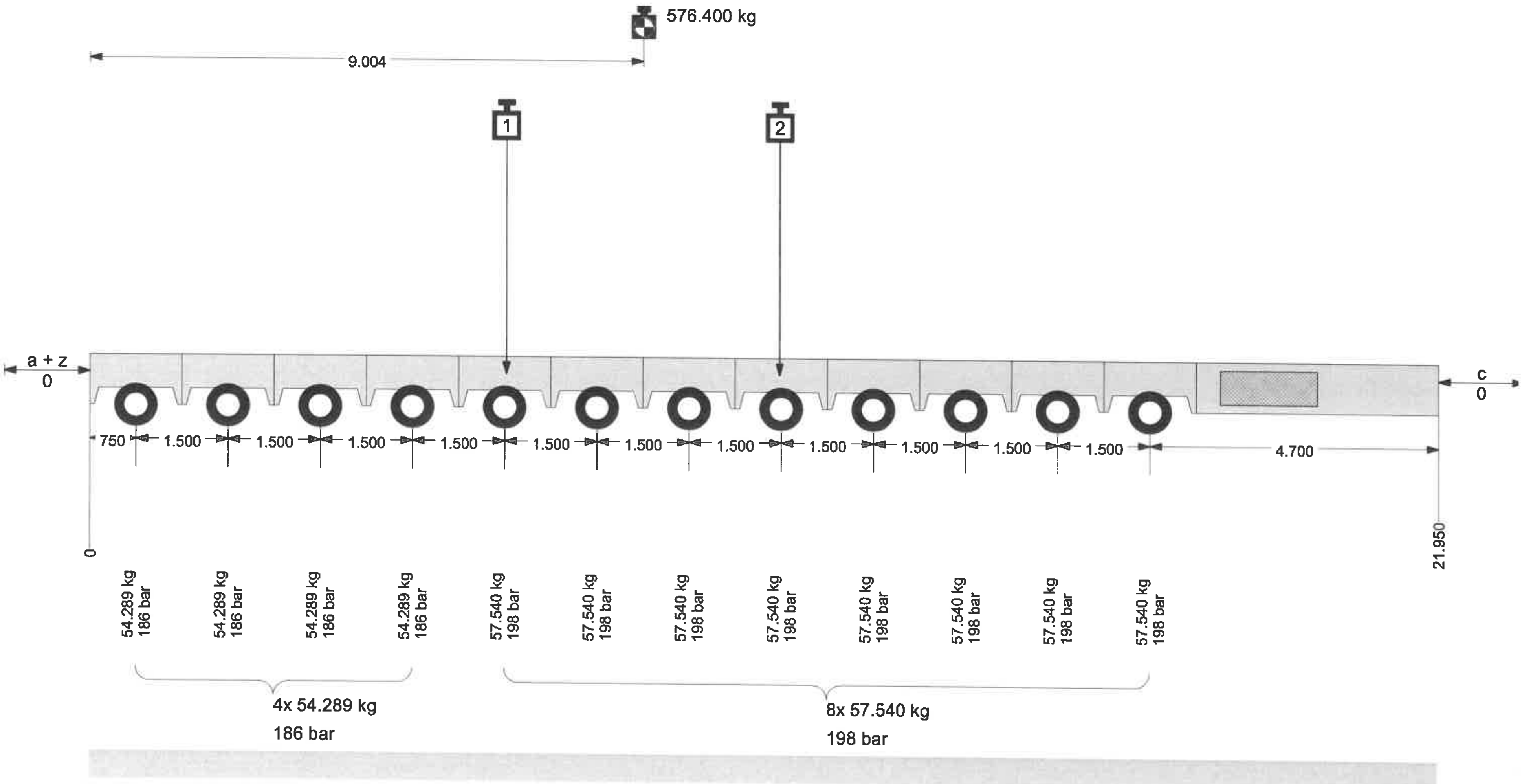
9/1/2017 4:45:12 PM
PID:00041 - DongleID: 10-1054255

easyLOAD³
Version 3.0.4 (Build 205)

Goldhofer

Drawing of trailer / semitrailer

Graphics and positions (in mm) based on the initial setting of the vehicle



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9/1/2017 4:45:12 PM
PID:00041 - DongleID: 10-1054255

easyLOAD³
Version 3.0.4 (Build 205)

Goldhofer

Distributed payload

Positions based on the initial setting of the trailer/semitrailer

	Payload share (kg)	Position (mm)
1	288.200	6.782
2	288.200	11.227

Load situation

All data (=results) are based on the evaluations carried out in the initial setting

Deadweight, tractor unit :	0 kg
Deadweight, trailer / semitrailer :	101.074 kg
Deadweight, centre of gravity :	9.746 mm
Payload, total :	576.400 kg
Payload, centre of gravity :	9.004 mm
Total weight (Trailer / semitrailer + Payload) :	677.474 kg
Overall centre of gravity (Trailer / semitrailer + Payload) :	9.115 mm
Gross combination weight (Tractor unit + Trailer / semitrailer + Payload) :	677.474 kg
Axle load front	4 x 54.289 kg = 217.15
Axle load rear	8 x 57.540 kg = 460.31

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9/1/2017 4:45:12 PM
PID:00041 - DongleID: 10-1054255

Modules used

Index no. :	Identification no. :	Vehicle no. :	Deadweight :	Truck registration number :	Designation :
11738 [12x]	---	WG0PST06060060223, WG0PST06170060216, WG0PST06160060215, WG0PST04270060224, WG0PST04470060225, WG0PST06570060218, WG0PST06780060318, WG0PST06980060319, WG0PST06980060322, WG0PST06780060321, WG0PST06890060412, WG0PST06X90060413, WG0PST06790060417, WG0PST04590060415, WG0PST06590060416, WG0PST04290060419, WG0PST06790060420, WG0PST06990060421, WG0PST06M70060219, WG0PST06370060220	7.850 kg		Bogie
11684	513658	60222-00	6.873 kg		Powerpack

easy LOAD³
Version 3.0.4 (Build 205)

Goldhofer

Driveability

Evaluation of load and driveability based on the loading situation described in the initial setting

Highest bending load : 55 %

tilting and overload limit :

c.o.g. height above ground: 7.560 mm

Tilting limit 8,3° | 14,6%

Overload limit 3,9° | 6,8%

The tilting limit results factor in a safety margin of 0%.

A	A	A	A	B	B	B	B	B	B	B	B
A	A	A	A	B	B	B	B	B	B	B	B
A	A	A	A	C	C	C	C	C	C	C	C
A	A	A	A	C	C	C	C	C	C	C	C

The trailer/semitrailer is driveable under these conditions.

easyLOAD³
Version 3.0.4 (Build 205)

Goldhofer

Master data

Index number :	229
Type :	PST/SL E
Parallel combination :	P(1 + 1)
Designation :	PSTe2-12
Vehicle number :	
Truck registration number :	

Basic data of the trailer / semitrailer

Deadweight :	101.074 kg	
Centre of gravity :	9.746 mm	
Deadweight distribution	(based on the initial setting and the support circuit setting)	
	Front support circuit	**Rear support circuit**
	(4 Axle lines)	(8 Axle lines)
	4x 6.327 kg = 25.310 kg	8x 9.471 kg = 75.764 kg
Minimum length :	21.950 mm	
Extendable maximum by :	0 mm	
Maximum length :	21.950 mm	

Initial setting

Extension step :	0 / 0
Extended by :	0 mm
Overall length, trailer / semitrailer :	21.950 mm
Coupling length a :	0 mm
Coupling length b :	21.950 mm
Coupling length c (rear overhang) :	0 mm
Gross combination length a + b + c :	21.950 mm

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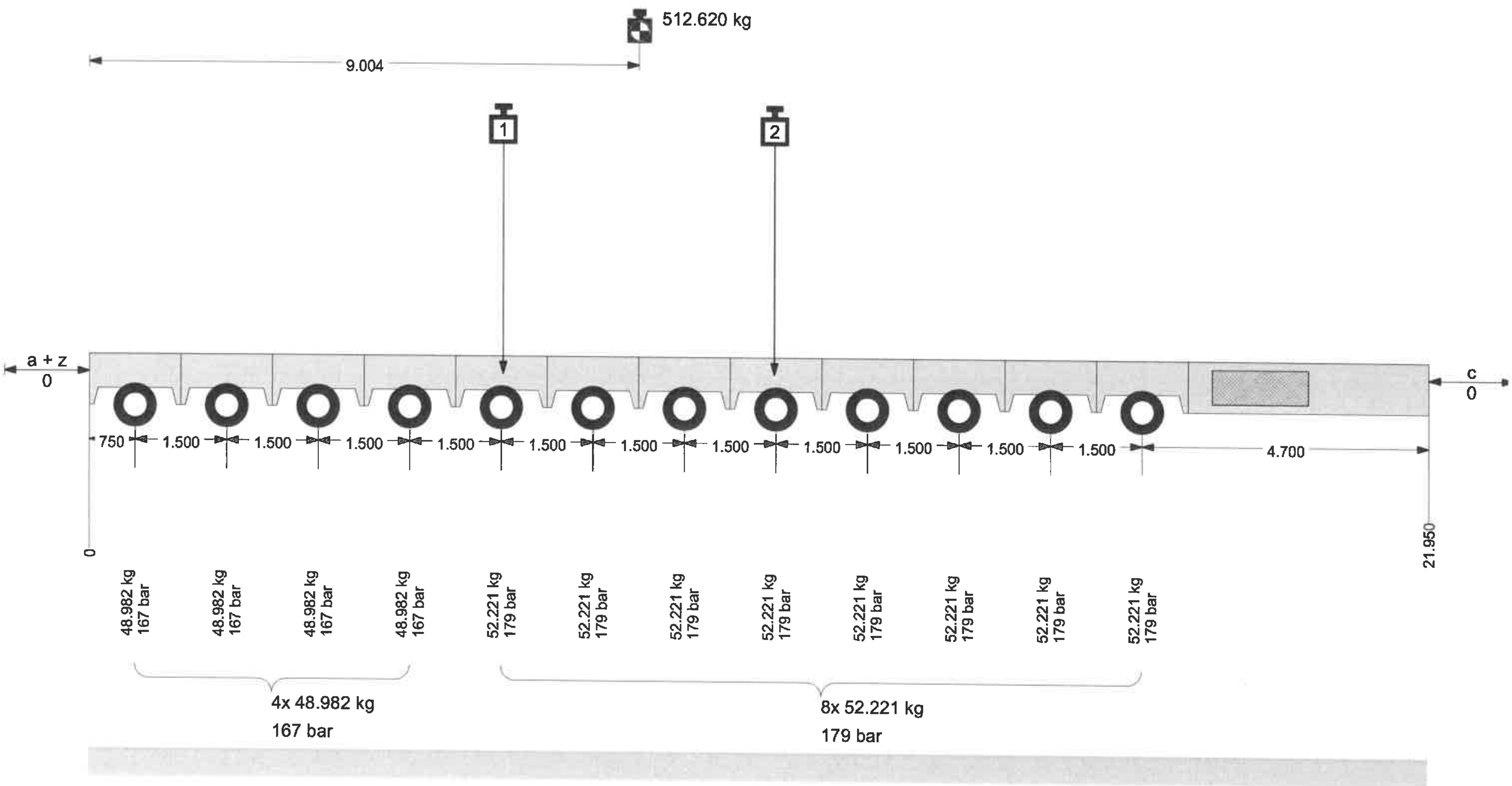
Drawing of trailer / semitrailer

Graphics and positions (in mm) based on the initial setting of the vehicle



Goldhofer Aktiengesellschaft ··· Donaustraße 95 ··· D-87700 Memmingen ··· Phone +49 (0) 8331 / 15-0 ··· Fax +49 (0) 8331 / 15-239
Sitz- und Registergericht: Memmingen, HRB 10871
Die **TÜV SÜD Automotive GmbH** bestätigt in ihrem Technischen Bericht GM76131T (V1.0, 14.04.2010), dass bei bestimmungsgemäßem Gebrauch der easyLOAD Software die Integrität der berechneten Werte gewährleistet ist.

9/1/2017 4:47:00 PM 2
PID:00042 - DongleID: 10-1054255

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Distributed payload

Positions based on the initial setting of the trailer/semitrailer

	Payload share (kg)	Position (mm)
1	256.310	6.782
2	256.310	11.227

Load situation

All data (=results) are based on the evaluations carried out in the initial setting

Deadweight, tractor unit :	0 kg
Deadweight, trailer / semitrailer :	101.074 kg
Deadweight, centre of gravity :	9.746 mm
Payload, total :	512.620 kg
Payload, centre of gravity :	9.004 mm
Total weight (Trailer / semitrailer + Payload) :	613.694 kg
Overall centre of gravity (Trailer / semitrailer + Payload) :	9.127 mm
Gross combination weight (Tractor unit + Trailer / semitrailer + Payload) :	613.694 kg
Axle load front	4 x 48.982 kg = 195.92
Axle load rear	8 x 52.221 kg = 417.76

easy LOAD³
Version 3.0.4 (Build 205)

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Modules used

Index no. :	Identification no. :	Vehicle no. :	Deadweight :	Truck registration number :	Designation :
11738 [12x]	---	WG0PST06060060223, WG0PST06170060216, WG0PST06160060215, WG0PST04270060224, WG0PST04470060225, WG0PST06570060218, WG0PST06780060318, WG0PST06980060319, WG0PST06980060322, WG0PST06780060321, WG0PST06890060412, WG0PST06X90060413, WG0PST06790060417, WG0PST04590060415, WG0PST06590060416, WG0PST04290060419, WG0PST06790060420, WG0PST06990060421, WG0PST06M70060219, WG0PST06370060220	7.850 kg		Bogie
11684	513658	60222-00	6.873 kg		Powerpack

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Driveability

Evaluation of load and driveability based on the loading situation described in the initial setting

Highest bending load : 55 %

tilting and overload limit :

c.o.g. height above ground: 7.560 mm

Tilting limit 8,3° | 14,6%

Overload limit 5,4° | 9,5%

The tilting limit results factor in a safety margin of 0%.

A	A	A	A	B	B	B	B	B	B	B	B
A	A	A	A	B	B	B	B	B	B	B	B
A	A	A	A	C	C	C	C	C	C	C	C
A	A	A	A	C	C	C	C	C	C	C	C

The trailer/semitrailer is driveable under these conditions.

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Sitz- und Registergericht: Memmingen, HRB 10871
9/1/2017 4:47:00 PM
PID:00042 - DongleID: 10-1054255
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Appendix D:

PR1575-EC4.0 – Wind Load Calculation

Wind Load Calculations
for
UCPP - FIU Pedestrian Bridge Span

PR1575-EC4.0

Rev A

Rev A - Issued for Review

Objective:

Determine the wind loads applied to the FIU Pedestrian Bridge Main span.

Task:

1. Calculate wind load in the X directions (parallel to span)
2. Calculate wind load in the Y directions (perpendicular to span)

Parameters/Assumptions:

1. Refer to Barnhart Design Parameters document for wind load design details

References:

1. Bridge Span Dims & Weight per FIGG Project ID 434688-1-58-01, Sheet B-37.
2. Bridge Span 3D Model Received 5/1/2017.
3. Barnhart Design Parameters - PR1575-DP1.0
4. ASCE 7-10 - Minimum Design Loads for Buildings and Other Structures

Given:

$V_{op} := 30$ *Operational Wind Speed in MPH (Per Ref 3)*

$G := 0.85$ *Gust effect factor (Per Ref 3)*

$k_{zt} := 1.0$ *Topographic factor (Per Ref 3)*

$k_d := 1.0$ *Wind Directionality factor (Per Ref 3)*

$k_h := 1.04$ *Velocity Pressure Exposure Coef. (Per Ref 3)*

$C_{f\_per} := 1.6$ *Force Coef. - Perpendicular (Y Direction) (Per Ref 3)*

$C_{f\_par} := 1.04$ *Force Coef. - Parallel (X Direction) (Per Ref 3)*

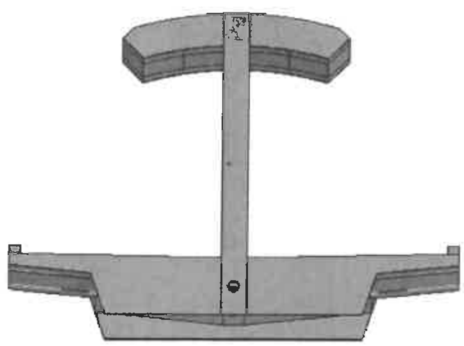
Velocity Pressure (Per ASCE 7-10):

$$q_z := 0.00256 \frac{lb}{ft^2} \cdot k_h \cdot k_{zt} \cdot k_d \cdot V_{op}^2 = 2.396 \cdot \frac{lb}{ft^2}$$ *Ref 3, Eqn 29.3-1*

MCM - FIU Pedestrian Bridge Wind Load Calculation Doc #: PR1575-EC4.0 Rev. A	BARNHART Minds Over Matter	By: DLT Date: 6/29/2017 Chk: JJE

Wind Force - X Direction (Parallel to Span):

End View of Bridge Span:



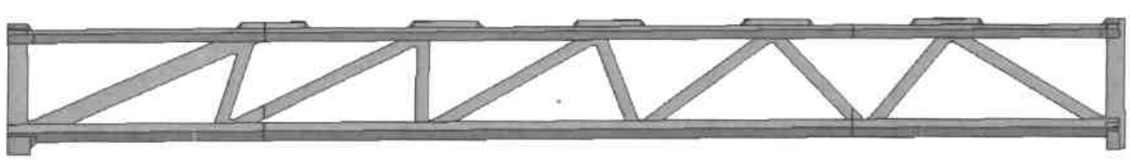
The projected area of the bridge was determined using the area feature in AutoCAD on the 3D model provided by the customer *(Ref. 2)*

$A_{par} := 153ft^2$ *Projected Area Parallel to Bridge (X Direction)*

$F_{Wx} := q_z \cdot G \cdot C_{f\_par} \cdot A_{par} = 324.1 \cdot lb$ *Ref 3, Eqn 29.3-1*

Wind Force - Y Direction (Perpendicular to Span):

Elevation View of Bridge Span:



The projected area of the bridge was determined using the area feature in AutoCAD on the 3D model provided by the customer *(Ref. 2)*

$A_{per} := 1477ft^2$ *Projected Area Parallel to Bridge (X Direction)*

$F_{Wy} := q_z \cdot G \cdot C_{f\_per} \cdot A_{per} = 4813.2 \cdot lb$ *Ref 3, Eqn 29.3-1*

*****END OF CALCULATION*****

Shoring Calculations
for
UCPP - FIU Pedestrian Bridge Span

PR1575-EC2.0

Rev B

Rev B - Issued for Review

Shoring Calculations
for
UCPP - FIU Pedestrian Bridge Span

PR1575-EC2.0

Rev B

Rev B - Issued for Review

MCM - FIU Pedestrian Bridge
Shoring Analysis
Doc #: PR1575-EC2.0
Rev. A

BARNHART
Minds Over Matter

By: DLT
Date: 9/1/2017
Chk:

Objective:

Verify the capacity shoring/lifting equipment used to transport and set the FIU Pedestrian Bridge Main span.

Task:

1. Verify shoring has adequate capacity to support load.

Parameters/Assumptions:

1. Center of Gravity of Span is centered +/- 1' between on the shoring arrangement

References:

1. Bridge Span Dims & Weight per FIGG Project ID 434688-1-58-01, Sheet B-37.
2. Bridge Span CG Location per E-mail received from customer 5/9/2017
3. Barnhart Drawings PR1575-L1.0-L1.3 - Layout Details.
4. Barnhart Drawings PR1575-T1.0 & T1.1 - Transport Details.
5. Barnhart Calculation PR1575-EC1.0 - Transporter Stability Calc
6. 24in Wide Slide Beam Calculation - EP253-EC1.0, Rev00.

Given:

$tonne := 2.204kip$

$Wt_{span} := 1900kip$ *Weight of Bridge Span*

$Wt_{shoring} := 250.425kip$ *Total Weight of Shoring (Per Ref 4)*

$S_y := 107.5kip$ *Maximum Side Load From PR1575-EC1.0 (Ref 5)*

$D_1 := 51ft$ Distance from South Trailer to CG of Bridge

$D_2 := 95ft$ Distance between Trailers

Verify Capacity of Shoring Arrangement:

During transport, the bridge span will be supported by a shoring arrangement consisting of Barnhart custom beams, gantries and stands. The bridge span will be supported at four locations by Barnhart 24" wide slide beams. Two beams each end of the bridge span. Each support location has wood wedge mats on top of the slide beams to maintain contact along the angled bottom side of the bridge. Each slide beam rests on top of two Barnhart Pull-Up Gantries (with dead section and rocker plate), which are set atop 42" tall shoring stands.

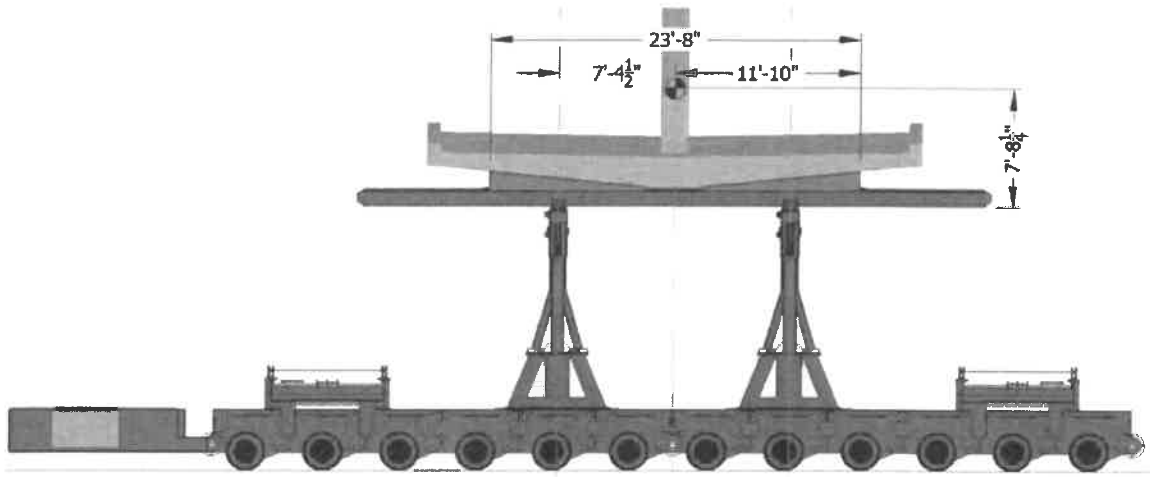
24" Wide Slide Beams

The upper portion of the shoring arrangement consists of Barnhart custom 24" wide slide beams. The beams are positioned atop Barnhart Pull-Up Gantries. Atop each beams are two wooden mats that are in contact and support the bridge span, positioned directly about the gantries. Therefore, bending or shear in the beams is negligible. The weight of the bridge span (1900 kip) is resting on a total of (8) wedge mats and (4) beams resulting in a vertical load of 237.5 kips applied at the same location as the underlying support location (i.e. beams are not subjected to flexural or shear stresses). Since the "web yielding" limit of a single beam is 1088 kips, the beams have enough capacity to carry the load. *(Per Ref 4)*

MCM - FIU Pedestrian Bridge Shoring Analysis Doc #: PR1575-EC2.0 Rev. A	BARNHART Minds Over Matter	By: DLT Date: 9/1/2017 Chk:

Pull-Up Gantries

Barnhart's Pull-Up Gantries are designed to carry a vertical load of 350 Kips with the main stage fully stroked (60" stroke), and 250 Kips when used with the dead section insert and rocking plate. The controlling factors for the dead section capacity are bending stresses in the rocker plate and the tube pin hole bearing capacity. Worst case loadings to the gantries occur when the 5% acceleration load + wind load is applied to the system in the Y direction. Based on the location of the System CG and the side loads determined in Barnhart Calculation PR1575-EC1.0 *(Ref 5)*, the worst case loading to any gantry is as follows:



$$P_{gantry} := \left(\frac{Wt_{span} \cdot \frac{D_1}{D_2}}{4} + \frac{10.35kip}{2} + 0.605kip \right) + \left(\frac{S_y \cdot 7.708ft}{14.75ft \cdot 4} \right) = 274.824 \cdot kip$$

$Cap_{gantry} := 350kip$ *Capacity of Gantry up to 60" Stroker (Per Spec Sheet EP29-SP1.20)*

$$\frac{P_{gantry}}{Cap_{gantry}} = 79 \cdot \%$$

$Cap_{dead} := 275kip$ *Capacity of Dead Section & Rocker - Job specific calculation attached for 5' extension and shimmed below base (Per Spec Sheet EP29-SP1.1)*

$$\frac{P_{gantry}}{Cap_{dead}} = 100 \cdot \%$$

The calculation shows the potential for marginal overloading on the dead section if worst case conditions are met (5% Acceleration loads + 30 MPH wind loads acting in the Y direction). The marginal overloading of the gantry does not constitute a failure because the overloads are transient and temporary.

Furthermore, the dead section will not be extended and will bear on the main stage bearing plate in addition to being pinned to the main stagine top section. The slide beams are positions such that a 1" thick diaphram is directly in line with the gantry. Exceeding the capacity in this scenario means the rocking plate may become marginally overstressed in bending, but once the transporter has stopped, the additional load from acceleration or deceleration will have dissipated. Without the transport loads applied, the gantries are within the design capacity. This potential overload condition will be mitigated in the field by monitoring pressure gauges, limiting travel speeds to 0.6 mph, traveling with the gantries at the minimum required stroke, and stopping all travel when operating (raising or lowering) gantries.

42in Shoring Stands

A Barnhart shoring stand is positioned beneath each gantry on the deck of the Goldhofer trailers. Worst case loading to the stands occur in the same scenario as stated above for the gantries and is equal to the worst case loading for the gantries plus the dead weight of the gantry. The following values were determined for a single stand.

$P_{stand} := P_{gantry} + 6.98\text{kip} = 281.804 \cdot \text{kip}$

$Cap_{stand} := 500\text{kip}$ *Capacity of Gantry (Per Spec Sheet EP29-SP1.2)*

$$\frac{P_{stand}}{Cap_{stand}} = 56 \cdot \%$$

*****END OF CALCULATION*****

Attachment 1

Barnhart Specification Sheets

Attachment 2

24in Wide Slide Beam Calculation - EP253-EC1.0

PUG Dead Section Equipment # EP29 Document # EP29-EC2.0 REV. 00	BARNHART Minds Over Matter	By: KCA 9/1/2017 Page 1 of 6 Chk: JJE Rev.: 00

EP29 - 60in Pull Up Gantry Dead Section Calculations

EP29-EC2.0

Revision 01
For PR1575

Document Page Count:

EP29-EC2.0 - 60in Pull Up Gantry Dead Section Calculations (Rev.00)	**6**
EP29-RO1.0 - RISA-3D Structural Analysis of Dead Section (Rev.00)	**2**
Total Page Count	**8**

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Parameters and Assumptions	3
Constants	3
Design Loads	3
Steel Properties	3
Structural Analysis	4
Attachments	6

Task:

Check dead section for specific loading of 275 kips - shim below base to prevent pin loading during transport.

Parameters:

1. Design plates and connections per AISC 13th Edition.
2. Design main tube member per ASME B30-1-2011.

Constants:

$k := 1000 \cdot lb$ $\quad psi := 1\frac{lb}{in^2}$ $\quad ksi := 1\frac{k}{in^2}$ $\quad g := 32.2\frac{ft}{sec^2}$ $\quad E := 29000 \cdot ksi$

Design Loads:

$P_{dead} := 275k$ (dead section req'd capacity)

$P_s \geq 1.5\%$ dead section side load (ASME B30.1-2011)

$P_L \geq 1.5\%$ dead section longitudinal load (ASME B30.1-2011)

Hot Rolled Steel Properties:

$F_{y36} := 36 \cdot ksi$ $\quad F_{u36} := 58 \cdot ksi$

$F_{y46} := 46ksi$ $\quad F_{u50} := 65 \cdot ksi$

$F_{y50} := 50 \cdot ksi$ $\quad F_{u100} := 110 \cdot ksi$

$F_{y100} := 100 \cdot ksi$

Cold Roll Steel Properties:

$F_{y1018} := 54 \cdot ksi$

$F_{y1045} := 77 \cdot ksi$

$F_{y4142} := 100 \cdot ksi$

Weld Filler Properties:

$F_{E70} := 70 \cdot ksi$

$F_{E90} := 90 \cdot ksi$

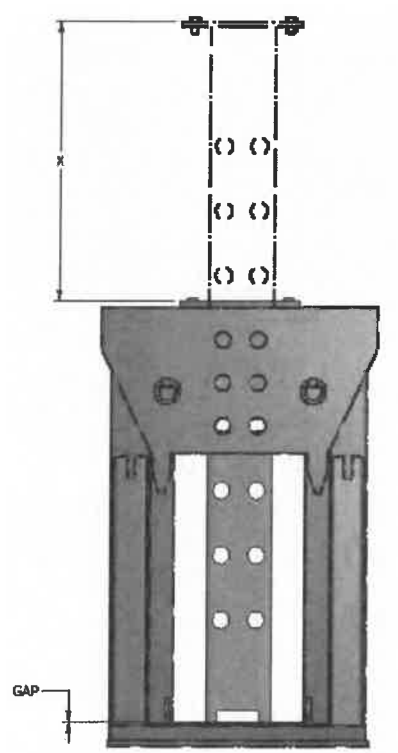


Figure 1: 60in Pull Up Gantry w/ Dead

Section

Main Tube (HSS 12x12x5/8) Analysis

$A_{gross} := 24in^2$ (gross cross sectional area of tube) $t_{wall} := 0.581in$ (tube design wall thickness)

$d_{holes} := 3in$ (hole ϕ) $n_{holes} := 4$ (# holes at cross section) $\Omega_c := 1.67$

$A_{tube\_holes} := d_{holes} \cdot t_{wall} \cdot n_{holes} = 6.97 \cdot in^2$ (area of slotted holes)

$A_{net} := A_{gross} - A_{tube\_holes} = 17.03 \cdot in^2$ (gross area of tube minus slotted hole area)

- Compression (accounting for loss of area from holes)

$L := 60in$ (estimated available length of dead section) $r := 4.62in$ (HSS12x12x5/8 properties)

$K := 2.1$ (per AISC Table C-C2.2 p. 16.1-240. One end of tube fully fixed, opposite end fully free)

$$\frac{K \cdot L}{r} = 27.27$$

$$F_e := \frac{\pi^2 \cdot E}{\left(\frac{K \cdot L}{r}\right)^2} = 384.8 \cdot ksi \quad > \quad F_{e\_allow} := 0.44F_{y46} = 20.24 \cdot ksi$$

therefore: $F_{cr} := \left(0.658^{\frac{F_{y46}}{F_e}}\right) \cdot F_{y46} = 43.76 \cdot ksi$ (AISC E3-2)

$P_n := F_{cr} \cdot A_{net} = 745.06 \cdot k$ (AISC E3-1)

$$\frac{P_n}{\Omega_c} = 446.14 \cdot k \quad > \quad P_{dead} = 275 \cdot k$$ OK

- Combined Loading

$P_{dead} = 275 \cdot k$ $P_s := P_{dead} \cdot 1.5\% = 4.13 \cdot k$ $P_L := P_s = 4.13 \cdot k$

** See Attachment 1 for RISA-3D Analysis **

AISC Code Check = .653 < 1.000
OK

- Bearing in tube wall

$t_{wall} = 0.58 \cdot in$ $\quad d_{pin} := 2.875in$ $\quad \Omega_b := 2$

$A_{pb} := t_{wall} \cdot d_{pin} = 1.67 \cdot in^2$

$R_n := \dfrac{1.8 \cdot F_{y46} \cdot A_{pb}}{\Omega_b}$ (AISC J7-1)

$R_n = 69.15 \cdot k$ (per hole)

$P_{bearing} := R_n \cdot n_{holes} = 276.61 \cdot k$ $>$ $P_{dead} = 275 \cdot k$ <u>OK</u>

<u>Pin Shear</u>

$d_{pin} := 2.875in$ $\quad d_{pinhole} := 1.625in$ $\quad \Omega_v := 1.67$

$A_{pin} := \pi \left(\dfrac{d_{pin}}{2}\right)^2 = 6.49 \cdot in^2$ $\quad A_{pinhole} := \pi \left(\dfrac{d_{pinhole}}{2}\right)^2 = 2.07 \cdot in^2$

$A_{total} := A_{pin} - A_{pinhole} = 4.42 \cdot in^2$

$V_{npin} := R_n = 69.15 \cdot k$ (per pin shear plane, 4 shear planes total)

$F_{ymin} := \dfrac{V_{npin} \cdot \Omega_v}{0.6 \cdot A_{total}} = 43.57 \cdot ksi$ *** use minimum 1018 pin material (F_y = 54 ksi) ***

<u>Summary</u>

$P_{max} := P_{bearing} = 276.61 \cdot k$

Per RISA-3D, 275k load with 1.5% side/longtitudinal load at 5ft - Code Check 0.653<1.00 = <u>OK</u>

Pull Up Gantry Dead Section Capacity = 275 kip @ < 5ft extended

**** E N D O F C A L C U L A T I O N ****

ATTACHMENT 1:
EP29-RO1.0 - RISA-3D STRUCTURAL ANALYSIS OF PULL UP GANTRY DEAD SECTION EXTENDED 5FT

Attachment 2

24in Wide Slide Beam Calculation - EP253-EC1.0

Company :
Designer : Jordan Terry
Job Number :

Max Column Length check

Sept 1, 2017
1:22 PM
Checked By: KDR

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	Yes
Maximum Iteration Number for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 13th(360-05): ASD
Cold Formed Steel Code	AISI S100-07: ASD
Wood Code	AF&PA NDS-05/08: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-11
Masonry Code	ACI 530-08: ASD
Aluminum Code	AA ADM1-05: ASD - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

Company	:		Sept 1, 2017
Designer	: Jordan Terry		1:22 PM
Job Number	:	Max Column Length check	Checked By: KDR

Global, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct Z	.02
Ct X	.02
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	3
R X	3
Ct Exp. Z	.75
Ct Exp. X	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	GEN1A	RE4X4	Beam	gen_Conc3NW	16	21.333	21.333	31.573
2	RIGID		None	RIGID	1e+6	1e+6	1e+6	1e+6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	10	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N2			HSS12x12x10	Column	SquareTube	A500 Gr.46	Typical

Joint Loads and Enforced Displacements (BLC 1 : Vertical)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N2	L	Y	-275

Joint Loads and Enforced Displacements (BLC 2 : Sideload)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N2	L	X	4.13

Company	:		Sept 1, 2017
Designer	: Jordan Terry		1:22 PM
Job Number	:	Max Column Length check	Checked By: KDR

Basic Load Cases

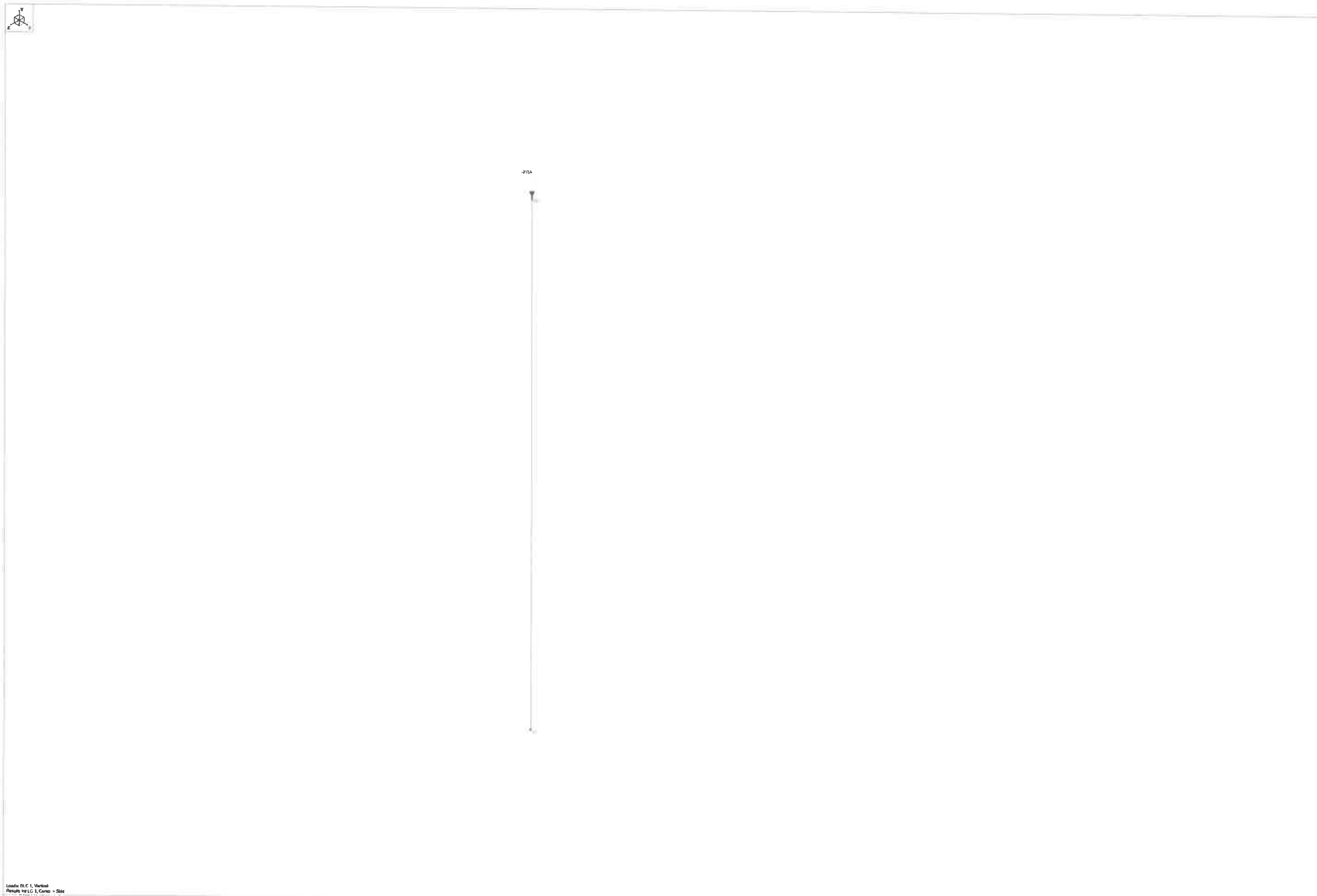
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Member)	Surface(...
1	Vertical	LL		-1		1				
2	Sideload	LL				1				

Load Combinations

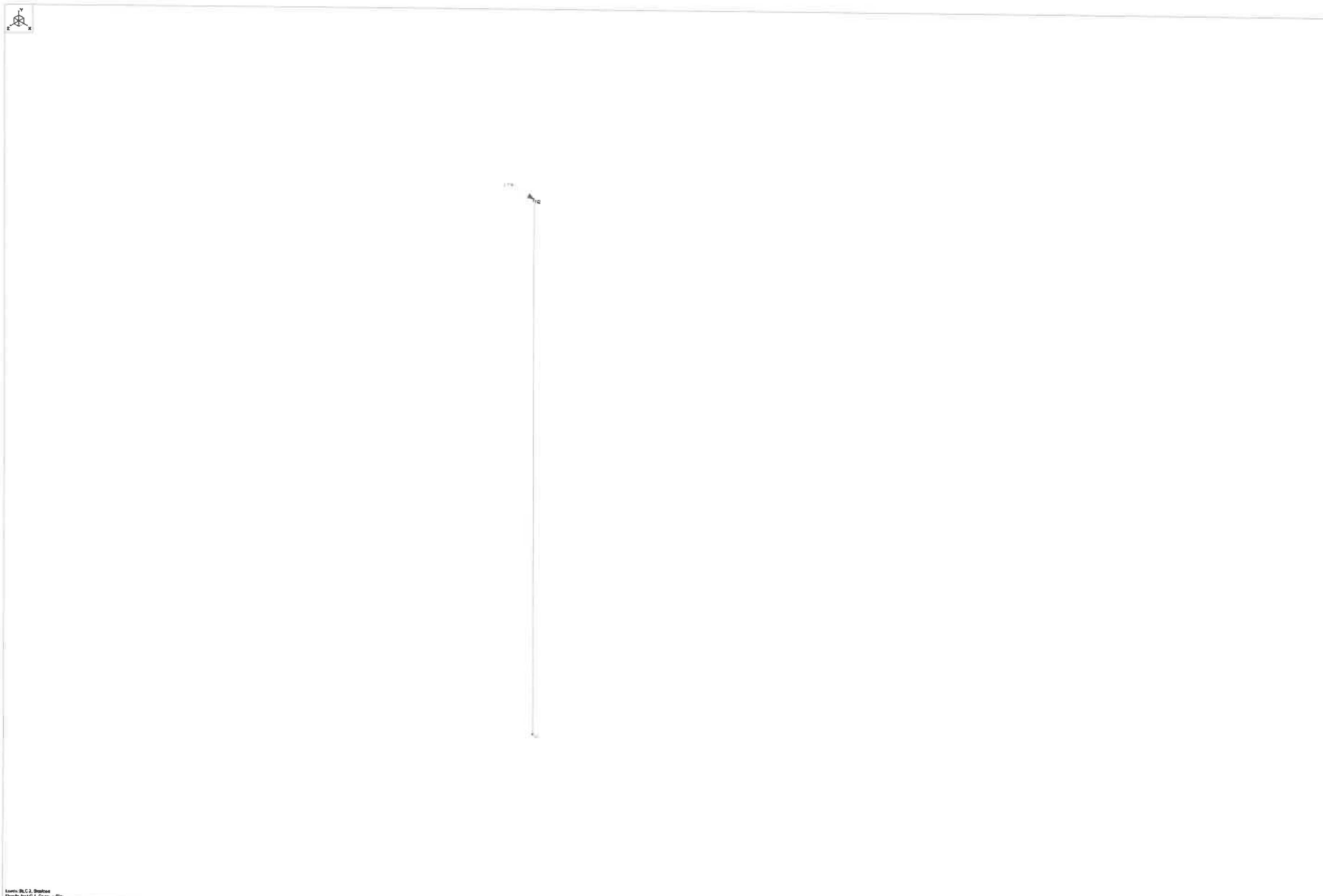
	Description	So...	PDelta	S...	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac...
1	Comp. + Side	Yes	Y		1	1	2	1												
2	Compression Only	Yes	Y		1	1														

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	-4.13	275.875	0	0	0	49.699
2	1	Totals:	-4.13	275.875	0			
3	1	COG (ft):	X: 0	Y: 9.984	Z: 0			



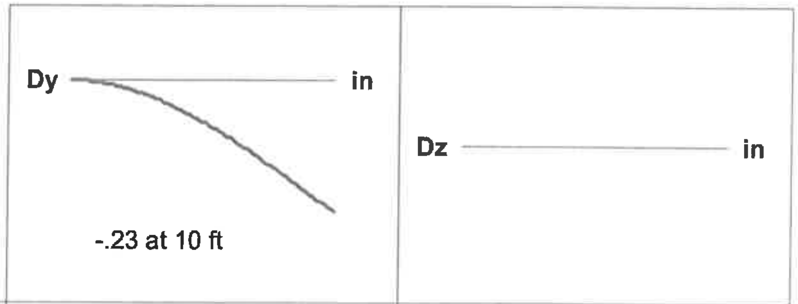
Jordan Terry	Max Column Length check Vertical Load	SK - 1
		Sept 1, 2017 at 1:27 PM
		PUG Dead Section 5ftColumn Length.r3d

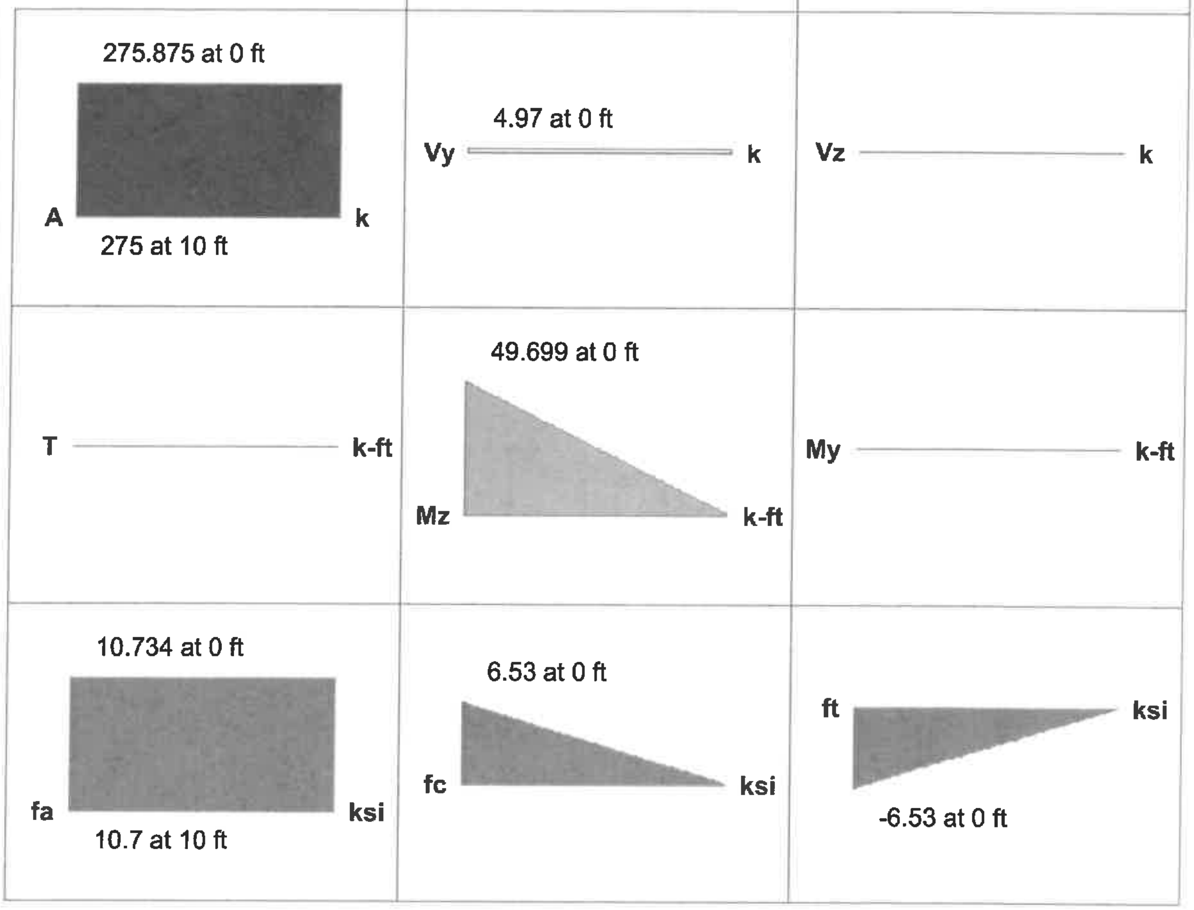


Jordan Terry	Max Column Length check Side Load	SK - 2 Sept 1, 2017 at 1:28 PM PUG Dead Section 5ftColumn Length.r3d

Column: ***M1***

Shape: **HSS12x12x10**
Material: **A500 Gr.46**
Length: **10 ft**
I Joint: **N1**
J Joint: **N2**
LC 1: Comp. + Side
Code Check: **0.653 (bending)**
Report Based On 97 Sections





AISC 14th(360-10): ASD Code Check

Direct Analysis Method

Max Bending Check	**0.653**	Max Shear Check	**0.025 (y)**
Location	**0 ft**	Location	**0 ft**
Equation	**H1-1a**	Max Defl Ratio	**L/523**
Bending Flange	**Compact**	Compression Flange	**Non-Slender**
Bending Web	**Compact**	Compression Web	**Non-Slender**

Fy	**46 ksi**
Pnc/om	**579.388 k**
Pnt/om	**707.904 k**
Mny/om	**250.2 k-ft**
Mnz/om	**250.2 k-ft**
Vny/om	**196.979 k**
Vnz/om	**196.979 k**
Tn/om	**207.633 k-ft**
Cb	**1.667**

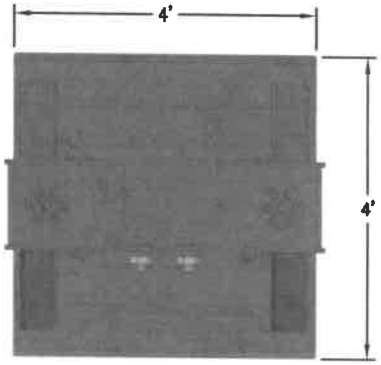
	y-y	z-z
Lb	**10 ft**	**10 ft**
KL/r	**54.573**	**54.573**

L Comp Flange	**10 ft**
Warp Length	**NC**
L-torque	**10 ft**
Tau_b	**1**

Attachment 1

Barnhart Specification Sheets

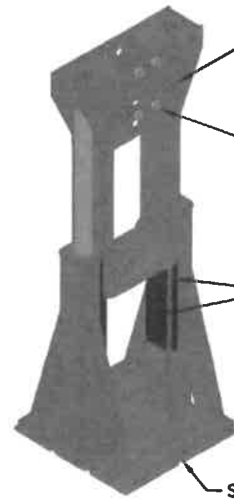
X:\QPulse4\Docs\Eng. Doc\Equipment Folders\Equipment Packages\EP29 – 60in Stroke Pull Up Gantry\Drawings\Autocad\EP29–SPM1.0–1.3.dwg   Aug 25, 2016 – 8:58am   jtyler



TOP VIEW FOOTPRINT

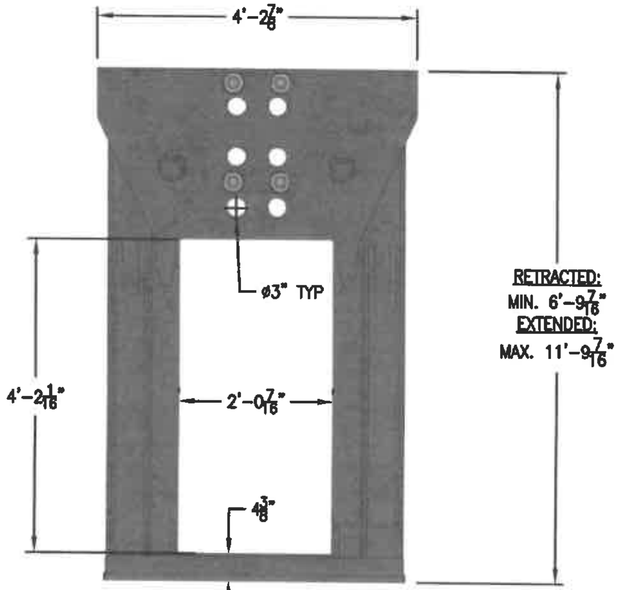
N.T.S.

Doc. #	SP-306
Rev. #	06
Page #	1 OF 4



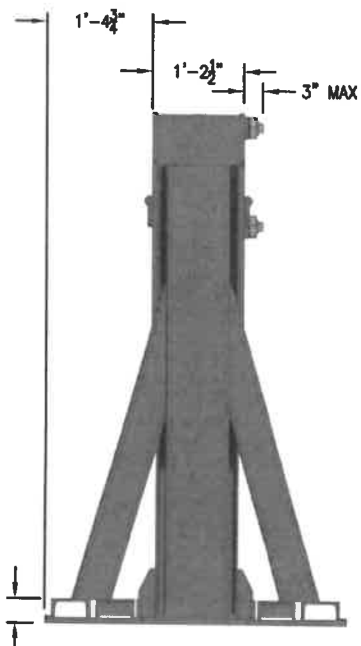
OPERATING PRESSURE (PSI)	*CAPACITY PER GANTRY (US TONS)	**PRESSURE UNDER BASE (PSF)
500	17	2399
1000	33	4473
1500	50	6547
2000	66	8621
2500	83	10695
3000	100	12769
3500	116	14843
4000	133	16917
4500	149	18990
5000	166	21064
5500	183	23138
6000	199	25212
6500	216	27286
7000	232	29360
***7500	250	31575

*Ensure Capacity at Height not Exceeded
**Assumes equal loading w/ 4' x 4' base
**Includes Weight of Gantry
***Maximum Operating Pressure



FRONT VIEW (RETRACTED)

N.T.S.



SIDE VIEW

N.T.S.

SPECIFICATIONS

WEIGHT: 5200 LBS EACH
MAX OPERATING PRESSURE: 7500 PSI
CYLINDER ERA: 33.183 in^2 PER CYL.
66.366 in^2 PER UNIT
MAX STROKE: 60in
HYD. OIL: ►13.6 gal FOR 60in STROKE

CAPACITY: 250 TON/LEG UP TO 36in. STROKE
175 TON/LEG UP TO 60in. STROKE*

REFERENCE ONLY

GENERAL NOTES

1. MONITOR PRESSURE ON INDIVIDUAL GANTRIES WHILE RAISING AND LOWERING LOADS, EACH UNIT HAS PRESSURE GAUGE AT BASE.
2. HOLDING VALVE INSTALLED ON EACH GANTRY SEE EP29-SP1.3 FOR SPECIFICATIONS AND PLUMBING SCHEMATIC.
* HIGHER CAPACITIES POSSIBLE WITH BCR ENGINEERING APPROVAL
► INCLUDES 10% EXTRA OIL VOLUME

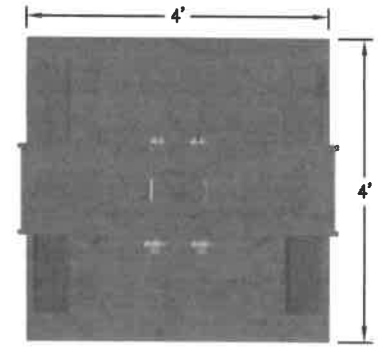
REV #	REVISIONS	DATE	REV. BY	CHK BY:
06	ADDED 2ND STAGE/DEAD SECTION FIT NOTE	3/21/16	JCT	KDR
07	CORRECTED OVERALL HEIGHT DIMS	7/11/16	JCT	JZB

BARNHART CRANE AND RIGGING
SPECIFICATION SHEET 1 OF 4
BARNHART Minds Over Matter

SCALE	DATE	DRAFTED BY:	APPROVED BY:
N.T.S	04/24/10	SPB	KDR

DWG NUMBER: EP29-SP1.0
REV NUMBER: 07
60in PULL UP GANTRY

X:\QPulse4\Docs\Eng. Doc\Equipment Folders\Equipment Packages\EP29 – 60in Stroke Pull Up Gantry\Drawings\Autocad\EP29-SPM1.0-1.3.dwg Aug 25, 2016 – 8:58am jtyler



FOOTPRINT

N.T.S.

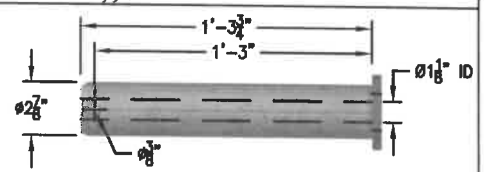
SPECIFICATIONS W/ DEAD SECTION

WEIGHT: 5900 LBS EACH
(ROCKING PLATE ASSEMBLY ADDS 280 LBS)

CAPACITY OF DEAD SECTION:
- 125 TON/LEG–CONTACT BCR ENG FOR HIGHER CAPACITIES.
- ADDT'L LENGTH AVAILABLE AT THE FOLLOWING INCREMENTS: Y = 0, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 52.

CAPACITY OF ROCKING PLATE ASSEMBLY:
- 125 TON/LEG

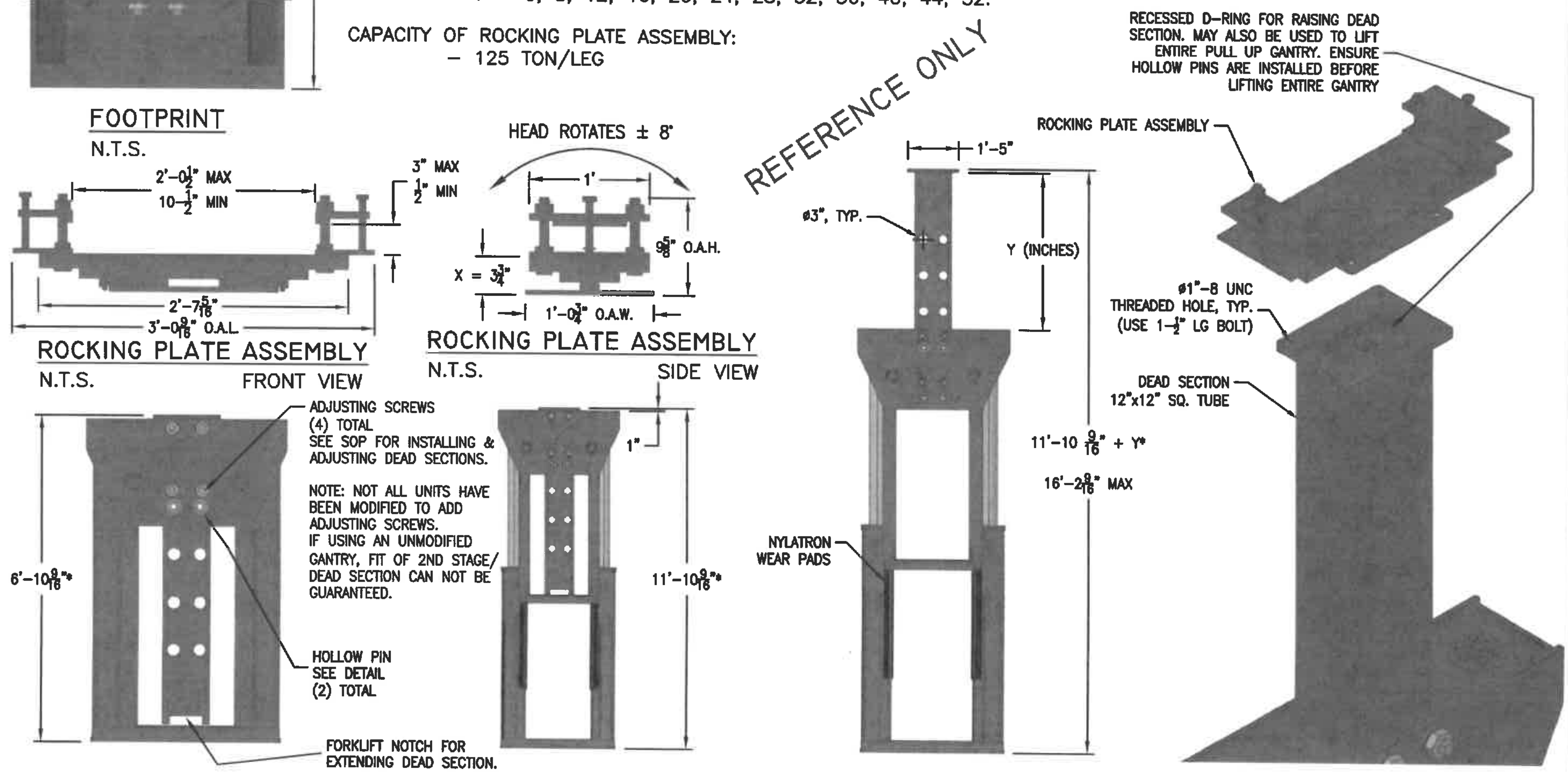
Doc. #	SP-306
Rev. #	06
Page #	2 OF 4



HOLLOW PIN

N.T.S. 54 KSI

REFERENCE ONLY



ROCKING PLATE ASSEMBLY
N.T.S. FRONT VIEW

ROCKING PLATE ASSEMBLY
N.T.S. SIDE VIEW

FRONT
N.T.S. (RETRACTED)

FRONT
N.T.S. (EXTENDED)

FRONT
N.T.S. (DEAD SECTION EXT)

DEAD SECTION
N.T.S.

GENERAL NOTES
1. STANDARD 60in PULL UP GANTRY PACKAGE INCLUDES DEAD SECTION.
2. IF ADDITIONAL AND/OR LONGER DEAD SECTIONS ARE NEEDED, CONTACT ENGINEERING.
3. CAPACITIES WITH DEAD SECTION OR OPERATIONAL SECOND STAGE ARE AS NOTED ON THIS SHEET; OR OTHERWISE DETERMINED BY ENGINEERING.
* ADD X DIMENSION IF ROCKING PLATE ASSEMBLY IS USED.

REV #	REVISIONS	DATE	REV. BY	CHK BY:
06	ADDED 2ND STAGE/DEAD SECTION FIT NOTE	3/21/16	JCT	KDR
07	CORRECTED OVERALL HEIGHT DIMS	7/11/16	JCT	JZB

BARNHART CRANE AND RIGGING

SPECIFICATION SHEET 2 OF 4

BARNHART
Minds Over Matter

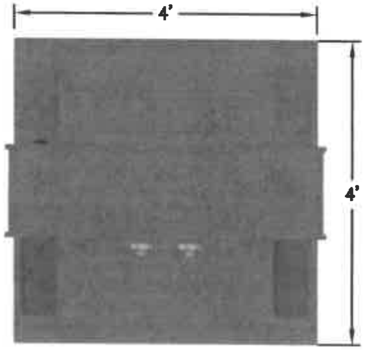
SCALE	DATE	DRAFTED BY:	APPROVED BY:
N.T.S	04/24/10	SPB	KDR

DWG NUMBER: EP29-SP1.1

REV NUMBER: 07

60in PUG W/ DEAD SECTION

X:\QPulse4\Docs\Eng. Doc\Equipment Folders\Equipment Packages\EP29 – 60in Stroke Pull Up Gantry\Drawings\Autocad\EP29-SPM1.0-1.3.dwg Aug 25, 2016 – 8:59am jtyler



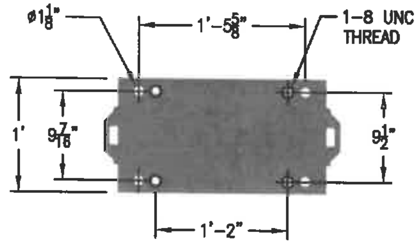
FOOTPRINT
N.T.S.

Doc. #	SP-306
Rev. #	06
Page #	3 OF 4

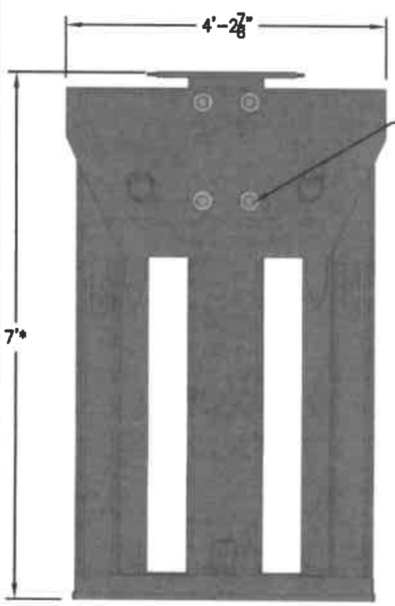
SPECIFICATIONS W/ OPTIONAL 2ND STAGE INSERT

WEIGHT: 6700 LBS EACH
(ROCKING PLATE ASSEMBLY ADDS 280 LBS)
MAX OPERATING PRESSURE: 7500 PSI
CYLINDER ERA: 33.183 in²
MAX STROKE: 54in
HYD. OIL: ▶19.8 gal REQUIRED FOR BOTH STAGES EXTENDED

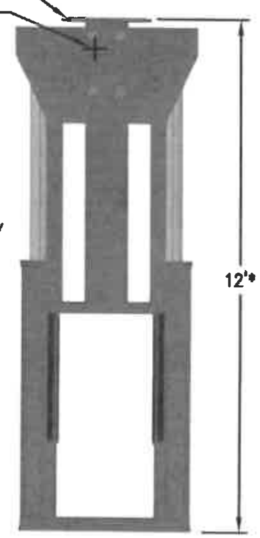
CAPACITY:
- 125 TON/LEG
- CONTACT BCR ENG FOR HIGHER CAPACITIES.



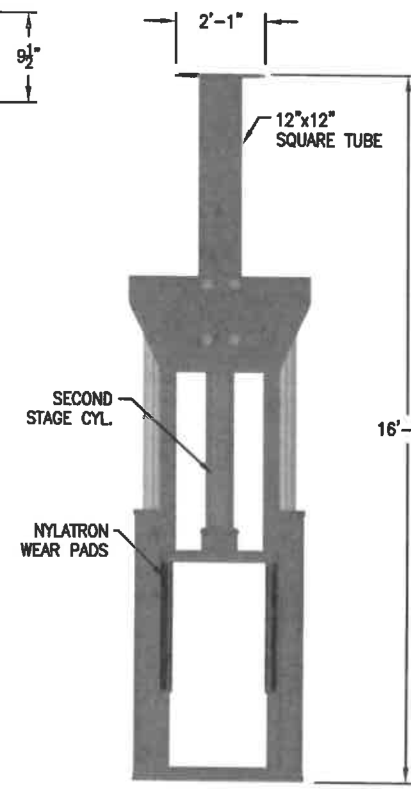
TOP PLATE
N.T.S.



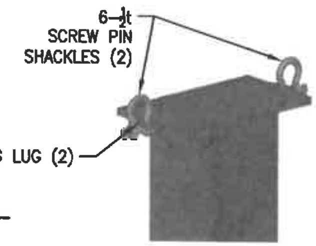
FRONT VIEW (RETRACTED)
N.T.S.



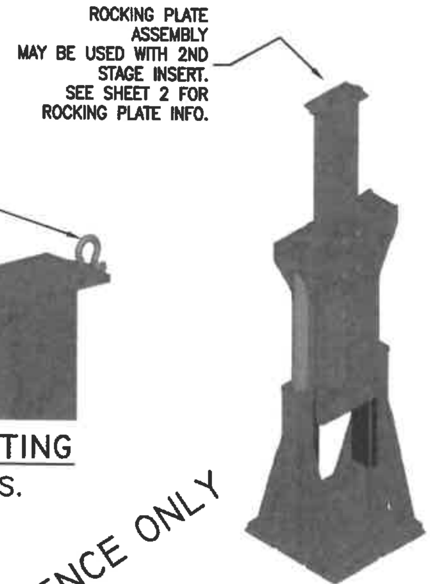
FIRST STAGE
N.T.S.



SECOND STAGE
N.T.S.



LIFTING
N.T.S.



REFERENCE ONLY

60in Second Stage PU Gantry

OPERATING PRESSURE (PSI)	*CAPACITY PER GANTRY (US Tons)	**PRESSURE UNDER BASE (PSF)
500	8	1456
1000	17	2493
1500	25	3530
2000	33	4567
2500	41	5604
3000	50	6641
3500	58	7678
4000	66	8715
4500	75	9751
5000	83	10788
5500	91	11825
6000	100	12862
6500	108	13899
7000	116	14936
***7500	125	16044

*Capacity of Second Stage
**Assumes equal Loading w/4' x 4' base
**Includes Weight of Gantry
***Maximum Operating Pressure

GENERAL NOTES
1. OPERATIONAL SECOND STAGE CAN REPLACE STANDARD DEAD SECTION IF NEEDED FOR A PROJECT.
2. CAPACITIES WITH DEAD SECTION OR OPERATIONAL SECOND STAGE ARE AS NOTED ON THIS SHEET; OR OTHERWISE DETERMINED BY ENGINEERING.
* ADD X DIMENSION FROM EP29-SP1.1 IF USING ROCKING PLATE ASSEMBLY.

▶INCLUDES 10% EXTRA OIL VOLUME

REV #	REVISIONS	DATE	REV. BY	CHK BY:
06	ADDED 2ND STAGE/DEAD SECTION FIT NOTE	3/21/16	JCT	KDR
07	CORRECTED OVERALL HEIGHT DIMS	7/11/16	JCT	JZB

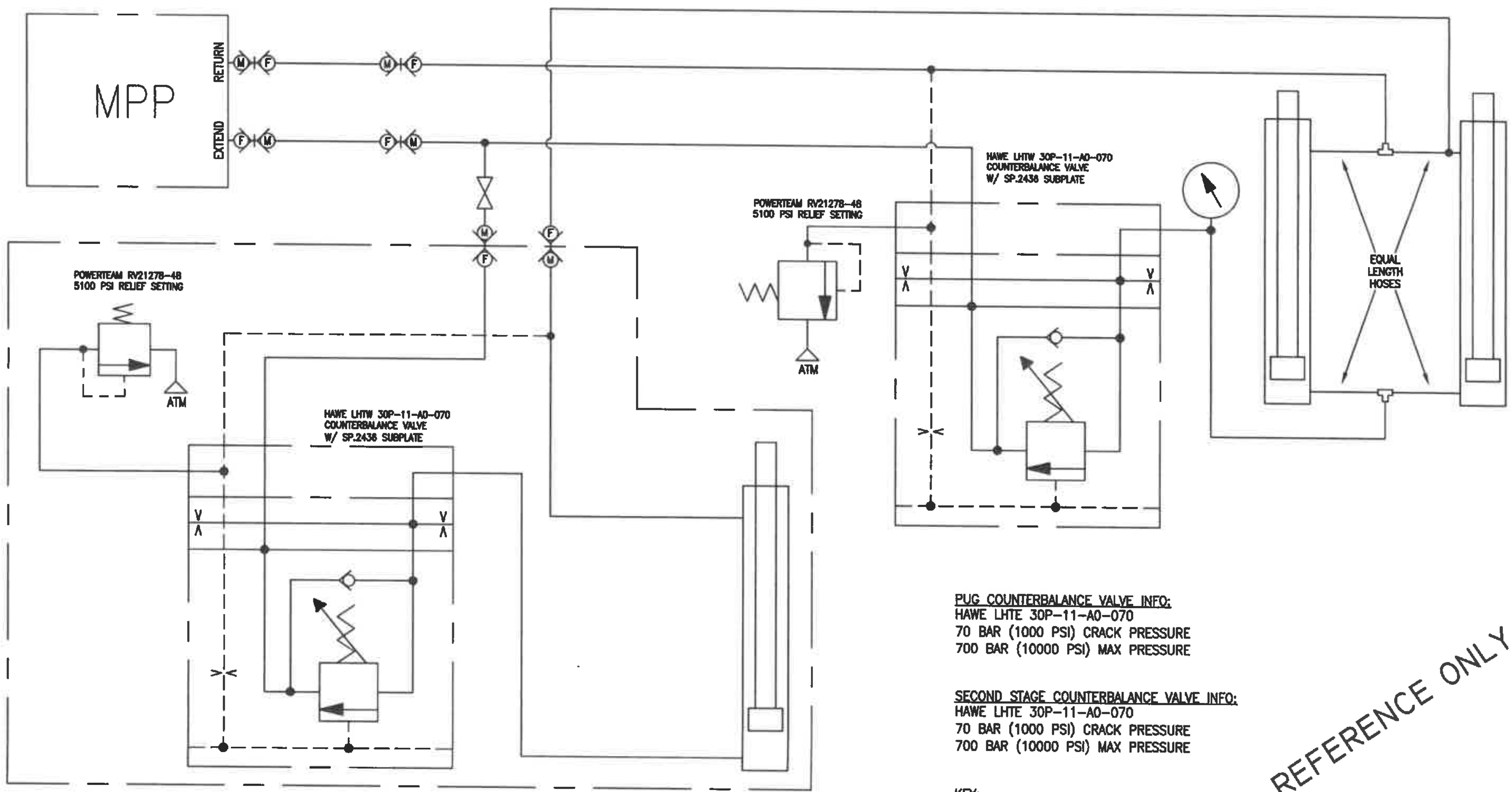
BARNHART CRANE AND-RIGGING
SPECIFICATION SHEET 3 OF 4
BARNHART Minds Over Matter

APPROVED BY:	KDR
DWG NUMBER	EP29-SP1.2
REV NUMBER	07

SCALE	DATE	DRAFTED BY:
N.T.S	04/24/10	SPB

60in PULL UP GANTRY W/ 2ND STAGE

X:\QPulse4\Docs\Eng. Doc\Equipment Folders\Equipment Packages\EP29 – 60in Stroke Pull Up Gantry\Drawings\Autocad\EP29-SPM1.0-1.3.dwg   Aug 25, 2016 – 9:01am   jtyler



PUG COUNTERBALANCE VALVE INFO:
HAWE LHTE 30P-11-A0-070
70 BAR (1000 PSI) CRACK PRESSURE
700 BAR (10000 PSI) MAX PRESSURE

SECOND STAGE COUNTERBALANCE VALVE INFO:
HAWE LHTE 30P-11-A0-070
70 BAR (1000 PSI) CRACK PRESSURE
700 BAR (10000 PSI) MAX PRESSURE

KEY:
SHUTOFF VALVE=
MALE/FEMALE QUICK COUPLING=

REFERENCE ONLY

Doc. #	SP-306
Rev. #	06
Page #	4 OF 4

GENERAL NOTES

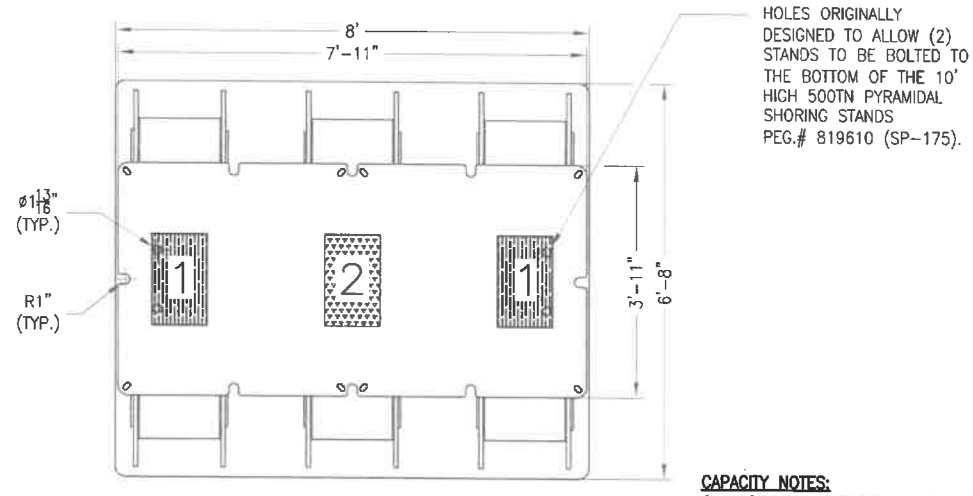
REV #	REVISIONS	DATE	REV. BY	CHK BY:
06	ADDED 2ND STAGE/DEAD SECTION FIT NOTE	3/21/16	JCT	KDR
07	CORRECTED OVERALL HEIGHT DIMS	7/11/16	JCT	JZB

BARNHART CRANE AND RIGGING
SPECIFICATION SHEET 4 OF 4
BARNHART Minds Over Matter

APPROVED BY:	KDR
DWG NUMBER	EP29-SP1.3
SCALE	N.T.S
DATE	04/24/10
DRAFTED BY:	SPB
REV NUMBER	07

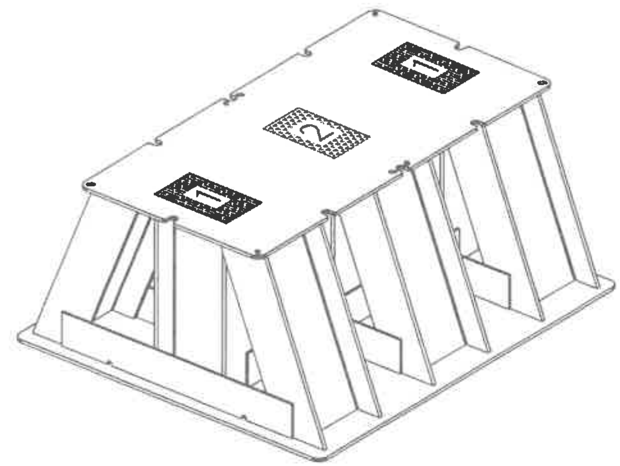
60in PUG HYDRAULIC SCHEMATIC

X:\R&D\Existing Package Closure\EP227 - 1000 kip 42in Shoring Stand\Drawings\AutoCad\EP227-SPM1.0.dwg Aug 23, 2013 - 2:24pm wmaranto

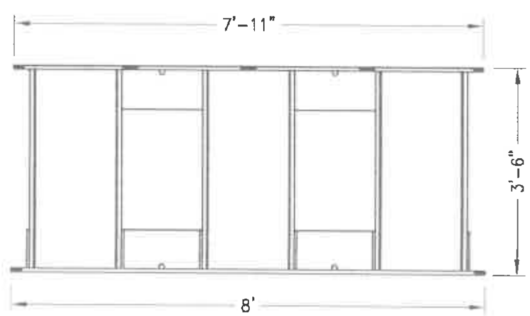


1 PLAN VIEW
N.T.S.

CAPACITY NOTES:
1. **1000 kip** CAPACITY IS VALID IF LOAD IS SUPPORTED ON OUTER HATCHED AREAS LABELED "1" IN VIEW 1 & 4.
2. **500 kip** CAPACITY SHOULD BE USED IF LOAD IS ONLY SUPPORTED OVER CENTER HATCHED AREA LABELED "2" IN VIEW 1 & 4.
3. FOR OTHER LOADING SCENARIOS, CONTACT BCR R&D ENGINEERING.



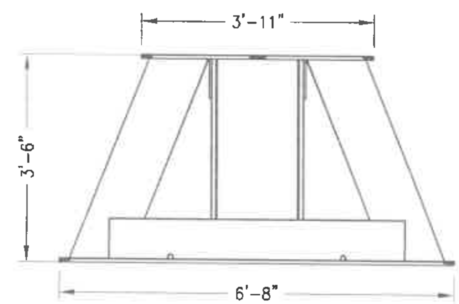
4 ISO VIEW
N.T.S.



2 ELEVATION VIEW
N.T.S.

REFERENCE ONLY

Doc. #	SP-176
Rev. #	01
Page #	1 of 1



3 END VIEW
N.T.S.

GENERAL NOTES
1. RATED CAPACITY: **SEE CAPACITY NOTES.**
2. WEIGHT: 6,300 LBS
3. PEG # 819611
4. QTY: 16 AS OF 3/27/2013

REV #	REVISIONS	DATE	REV. BY	CHK BY:
00	ISSUED FOR REFERENCE	08/23/13	WHM	FVT

BARNHART CRANE AND RIGGING
SPECIFICATION SHEET 1 OF 1
BARNHART Minds Over Matter

SCALE	DATE	DRAFTED BY:	APPROVED BY:
N.T.S.	11/19/12	TRB	FVT

DWG NUMBER: EP227-SP1.0
REV NUMBER: 00

1000 KIP 42IN SHORING STAND

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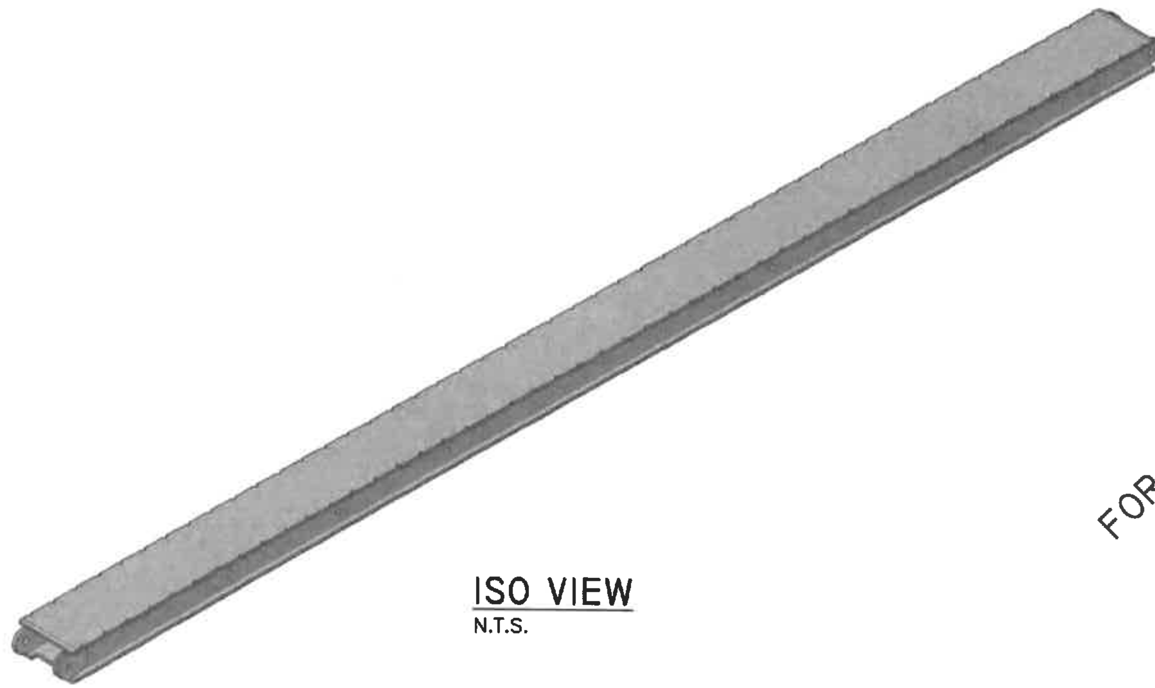
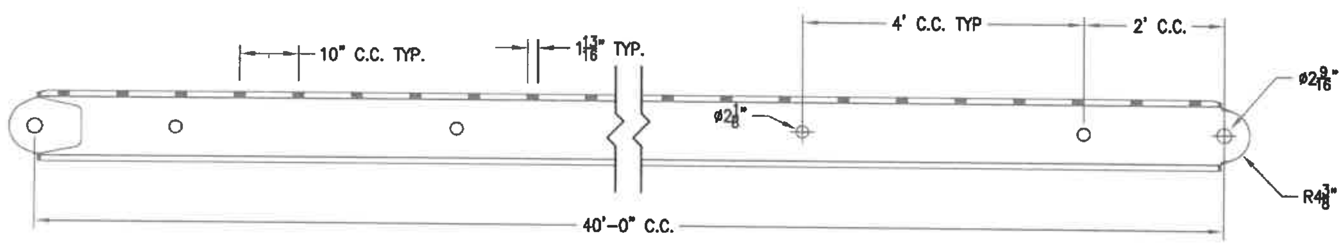
X:\QPulse4\Docs\Eng. Doc\Equipment Folders\Equipment Packages\EP253 – 24in Wide x 12in Deep 40ft Slide Beam\Drawings\AutoCad\EP253–SPM1.0.dwg Feb 24, 2014 – 5:33pm zbrumfield

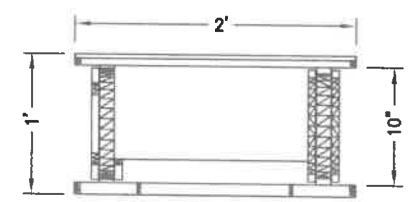
FOR REFERENCE ONLY



ISO VIEW
N.T.S.



SIDE ELEVATION
3/8"=1'-0"



END ELEVATION
3/4"=1'-0"

Doc. #	SP-384
Rev. #	01
Page #	1 OF 1

GENERAL NOTES
1. WEIGHT – 10350 LBS
2. PLASTIC SECTION MODULUS – 312 in^3
3. MAX MOMENT – 1556 kip-ft
4. SHEAR LIMIT – 600 kips
5. PEG ID# – 811240
6. ALSO SHOWN IN SP-006

REV #	REVISIONS	DATE	REV. BY	CHK BY:
00	INITIAL ISSUE	1/14/13	TKD	NDS
01	REFERENCED SP-006	02/24/14	JZB	JZB

BCR ENGINEERING
SPECIFICATION SHEET 1 OF 1
BARNHART
Minds Over Matter

APPROVED BY:	DWG NUMBER	REV NUMBER
NDS	EP253-SP1.0	01

SCALE	DATE	DRAFTED BY:
AS SHOWN	1/14/13	TKD

2' Wide x 1' Deep 40' Slide Beam

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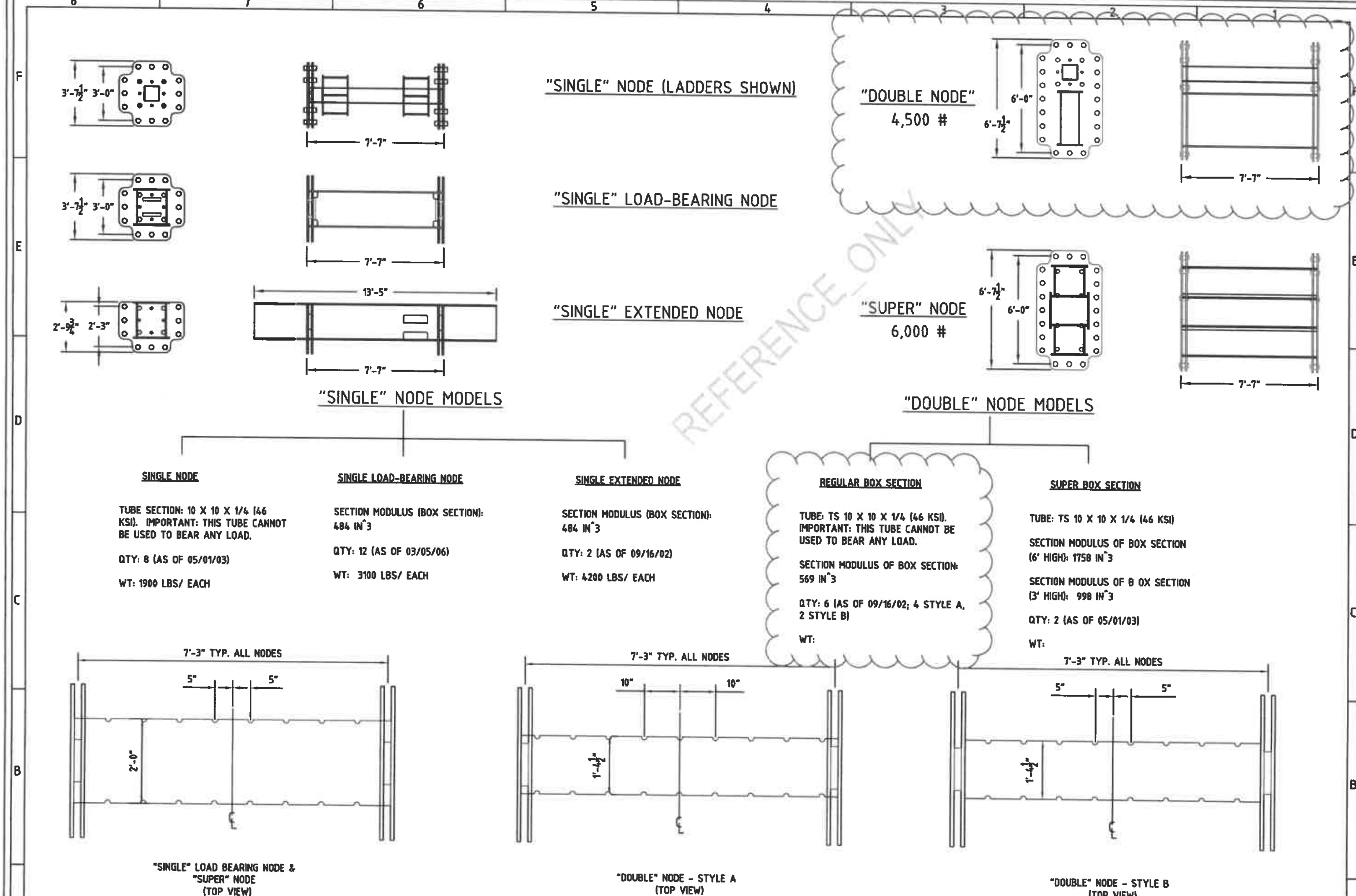


GENERAL NOTES

1. ALL PINS FOR CONNECTING BENTS TO NODES OR FEET ARE 3" DIAMETER "TORPEDO" PINS (100 KSI).
2. ALL MATERIAL IS A514 STEEL.
3. ACCESSORIES INCLUDE LADDERS AND PLATFORMS.

REV #	REVISIONS	DATE	CHK BY:
01	Added Dimensions	1/3/03	JLY
02	REVISED QTY'S OF NODES	5/1/03	JLY
03	REVISED QTY'S OF NODES	3/10/06	JLY

BARNHART CRANE & RIGGING

SPECIFICATION SHEET

SCALE	DATE	DRAFTED BY:	REV NUMBER
NTS	09/06/02	SAS	03

APPROVED BY: JLY

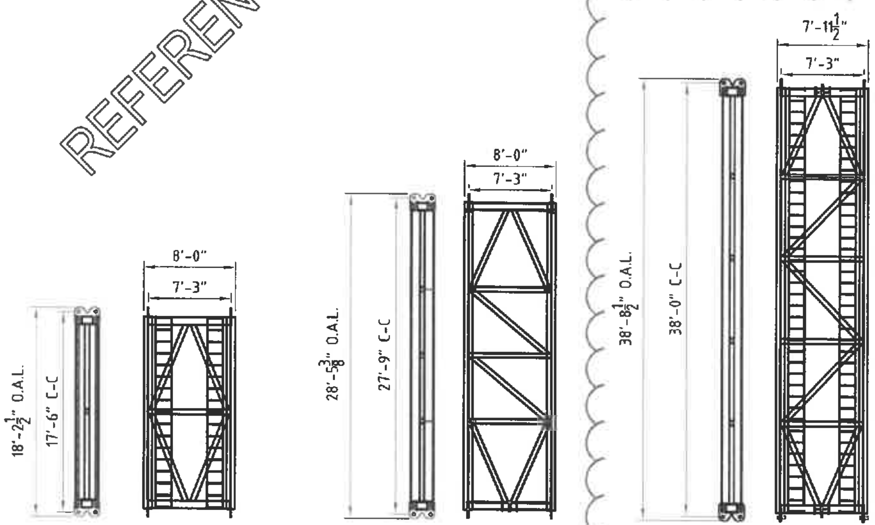
DWG NUMBER: SP-014

MODULAR LIFT TOWER NODES

REFERENCE ONLY

DATA APPLICABLE TO ALL BENTS:

1. ALL PINS FOR CONNECTING BENTS TO NODES OR FEET ARE 3" DIAMETER "TORPEDO" PINS (100 KSI).
2. ACCESSORIES INCLUDE NODES, FEET, AND VARIOUS BRACES.
3. CAPACITIES VARY BASED ON CONFIGURATION. SEE BARNHART ENGINEERING FOR DETAILS.
4. ALL PIN OFF PLATES ARE A514 STEEL.



FIXED LENGTH BENTS

17' 6" (HALF BENT)

MAIN CHORDS: W 24 X 84 (GR 50)

LG. HOR. BRACING: TS 12 X 8 X 1/2

"K" TYPE BRACING: TS 5 X 5 X 5/16

QTY: 9 (AS OF 09/06/02)

WT: 4500 LBS/ EACH

27' 9" (THREE-QUARTER BENT)

MAIN CHORDS: W 24 X 84 (GR 50)

LG. HOR. BRACING: TS 12 X 8 X 1/2

"K" TYPE BRACING: TS 5 X 5 X 5/16

QTY: 3 (AS OF 09/06/02)

WT: 6500 LBS/ EACH

38' (FULL LENGTH BENT)

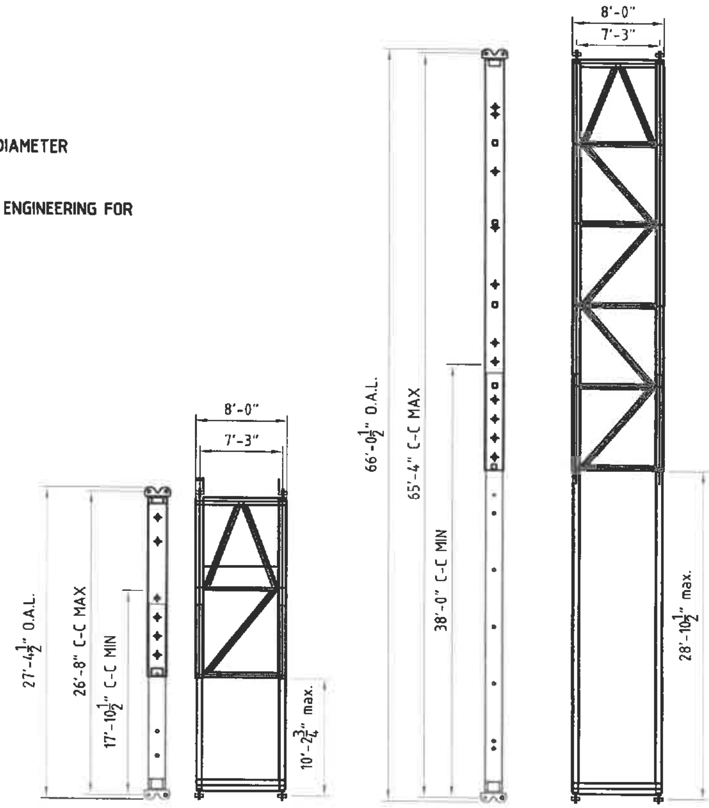
MAIN CHORDS: W 21 X 68 (GR 50)

LG. HOR. BRACING: TS 12 X 8 X 1/2

"K" TYPE BRACING: TS 5 X 5 X 5/16

QTY: 18 (AS OF 09/06/02)

WT: 8500 LBS/ EACH



TELESCOPING BENTS

COMPONENTS (BOTH)

OUTER TUBE: TS 20 X 8 X 5/16 (REINFORCEMENT PL 6 X 1/2 (A36))

INNER TUBE: TS 18 X 6 X 5/16 (REINFORCEMENT PL 8 X 1/2 (A36))

LG. HOR. BRACING: TS 12 X 8 X 1/2

"K" TYPE BRACING: TS 5 X 5 X 5/16

QTY: 4 LARGE BENTS, 2 SMALL (AS OF 09/06/02)

DETAILS

PIN SIZE: 2 1/2" DIAMETER (BODY OF BENTS)

NUMBER OF PINS REQUIRED/ BENT: 4

BENTS TELESCOPE BETWEEN EXTREME LENGTHS ON 20" INTERVALS.

WT: LG - 13800 LBS/ EACH, SM - 7000 LBS/ EACH

GENERAL NOTES

REV #	REVISIONS	DATE	CHK BY:
01	REVISED DIM'S ON TELESCOPING BENTS	02-24-03	JLY

BARNHART CRANE & RIGGING

SPECIFICATION SHEET

BARNHART CRANE & RIGGING CO.

SCALE	DATE	DRAFTED BY:	APPROVED BY:
NTS	09/06/02	SAS	JLY

DWG NUMBER - SP-03

REV NUMBER 01

MODULAR LIFT TOWER BENTS

Attachment 2

24in Wide Slide Beam
Calculation - EP253-EC1.0

BCR 24" Wide x 12" Deep Slide Beam Design (20' Sections)

Task:

Perform design calculations for BCR 24" Slide Beam System.

Parameters:

1. Design per the AISC 13th Edition ASD as applicable. All references in this calculation are to the 13th Ed. Specification unless noted otherwise.
2. Reference drawing 202166-F1.0 and F1.1 for fabrication details.
3. Slide system to be able to integrate as a slide system atop the BCR 8' deep girders.
4. Slide beams are constructed of ASTM A514 plate material - Fy = 100 ksi min.

Constants:

$k := 1000 \cdot lb$ $\quad psi := 1 \frac{lb}{in^2}$ $\quad ksi := 1 \frac{k}{in^2}$ $\quad g := 32.2 \frac{ft}{sec^2}$ $\quad TN := 2000 \cdot lb$

$E := 29000 \cdot ksi$

Hot Rolled Steel Properties:

$F_{y36} := 36 \cdot ksi$ $\quad F_{u36} := 58 \cdot ksi$

$F_{y50} := 50 \cdot ksi$ $\quad F_{u50} := 65 \cdot ksi$

$F_{y46} := 46 \cdot ksi$ $\quad F_{u46} := 58 \cdot ksi$

$F_{y100} := 100 \cdot ksi$ $\quad F_{u100} := 110 \cdot ksi$

Cold Rolled Steel Properties:

$F_{y1018} := 36 \cdot ksi$

$F_{y1045} := 77 \cdot ksi$

$F_{y4140} := 100 \cdot ksi$

Weld Filler Properties:

$F_{E70} := 70 \cdot ksi$

$F_{E100} := 100 \cdot ksi$

Slide Beam Section Properties (Properties derived from RISA Section calculation):

$d := 12 \cdot in$ $\quad A := 65.9 in^2$

Compr Flange: $b_f := 22.25 \cdot in$ $\quad t_f := 1 \cdot in$ $\quad$ Web: $t_w := 1.25 in$ $\quad h := d - 2 \cdot t_f = 10 \cdot in$

Tens Flange: $b := 24 in$ $\quad A_w := (h - 2.125 \cdot in) \cdot t_w \cdot 2 = 19.69 \cdot in^2$

$I_x := 1607.9 \cdot in^4$ $\quad I_y := 3757.2 \cdot in^4$

$r_x := \sqrt{\frac{I_x}{A}}$ $\quad r_x = 4.94 \cdot in$ $\quad r_y := \sqrt{\frac{I_y}{A}}$ $\quad r_y = 7.55 \cdot in$

$S_x := 261.6 \cdot in^3$ $\quad Z_x := 311.9 \cdot in^3$

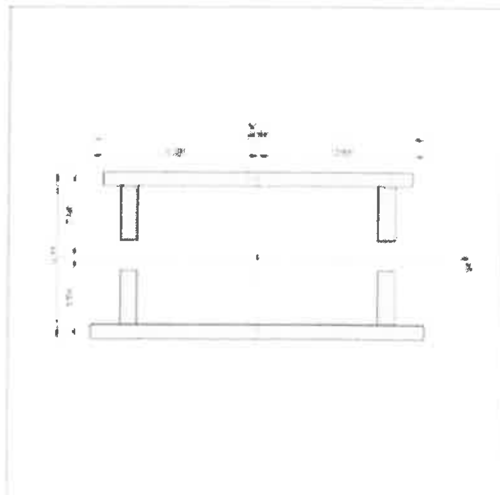
$S_y := 313.1 \cdot in^3$ $\quad Z_y := 449.9 \cdot in^3$ $\quad J := 3179 \cdot in^4$

Section Properties: 24 Slide Beam

Number of Shapes	=	6	
Total Width	=	24.000	in
Total Height	=	12.000	in
Center, Xo	=	0.000	in
Center, Yo	=	-0.146	in
X-bar(Right)	=	12.000	in
X-bar(Left)	=	12.000	in
Y-bar(Top)	=	6.146	in
Y-bar(Bot)	=	5.854	in

Equivalent Properties:

Area, Ax	=	65.940	in^2
Inertia, Ixx	=	1607.88	in^4
Inertia, Iyy	=	3757.22	in^4
Inertia, Ixy	=	0.000	in^4
Modulus, Sx(Top)	=	261.62	in^3
Modulus, Sx(Bot)	=	274.66	in^3
Modulus, Sy(Left)	=	313.10	in^3
Modulus, Sy(Right)	=	313.10	in^3
Radius, rx	=	4.938	in
Radius, ry	=	7.548	in
Plastic Modulus, Zx	=	311.89	in^3
Plastic Modulus, Zy	=	449.90	in^3



Section Diagram

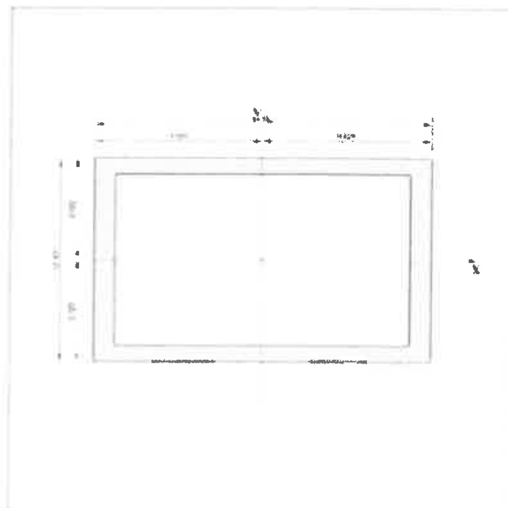
24in Wide x 12in Deep 40ft Slide Beam **EQUIP. # EP253** **DOC. # EP253-EC1.0** **REV. 00**	BARNHART **Minds Over Matter**	**By: Scott Fletcher** **6/19/2013** **Page 3 of 11** **Chk: __JRS___** **Rev.: 00**

Section Properties: 24 in Slide Beam-J

Number of Shapes	=	1	
Total Width	=	19.750	in
Total Height	=	12.000	in
Center, Xo	=	0.000	in
Center, Yo	=	0.000	in
X-bar(Right)	=	9.875	in
X-bar(Left)	=	9.875	in
Y-bar(Top)	=	6.000	in
Y-bar(Bot)	=	6.000	in

Equivalent Properties:

Area, Ax	=	64.500	in^2
Inertia, Ixx	=	1406.50	in^4
Inertia, Iyy	=	3426.27	in^4
Inertia, Ixy	=	0.000	in^4
Modulus, Sx(Top)	=	234.42	in^3
Modulus, Sx(Bot)	=	234.42	in^3
Modulus, Sy(Left)	=	346.96	in^3
Modulus, Sy(Right)	=	346.96	in^3
Radius, rx	=	4.670	in
Radius, ry	=	7.288	in
Plastic Modulus, Zx	=	279.75	in^3
Plastic Modulus, Zy	=	426.28	in^3
Torsional, J	=	3179.12	in^4



Section Diagram

24in Wide x 12in Deep 40ft Slide Beam **EQUIP. # EP253** **DOC. # EP253-EC1.0** **REV. 00**	**BARNHART** **Minds Over Matter**	**By: Scott Fletcher** **6/19/2013** **Page 4 of 11** **Chk: __JRS___** **Rev.: 00**

Limiting Width-Thickness Checks per AISC Table B4.1:

Check flange: Web set in: $w_s := 2.125\text{in}$

$$\lambda_p := 1.12 \cdot \sqrt{\frac{E}{F_{y100}}} \qquad \lambda_p = 19.07 \quad \text{(compact flange limit)}$$

$$\lambda := \frac{b_f - (2 \cdot w_s)}{t_f} = 18$$

$$\lambda_r := 1.40 \cdot \sqrt{\frac{E}{F_{y100}}} \qquad \lambda_r = 23.84 \quad \text{(non-compact flange limit)}$$

$$\text{flg\_check} := \begin{cases} \text{"Compact Flange"} & \text{if } \lambda \le \lambda_p \\ \text{"Non-Compact Flange"} & \text{if } \lambda_p < \lambda \le \lambda_r \\ \text{"Slender Flange"} & \text{otherwise} \end{cases} = \text{"Compact Flange"}$$

Check web:

$$\frac{h}{t_w} = 8$$

$$\lambda_p := 2.42 \cdot \sqrt{\frac{E}{F_{y100}}} \qquad \lambda_p = 41.21 \quad \text{(compact web limit)}$$

$$\lambda_r := 5.70 \cdot \sqrt{\frac{E}{F_{y100}}} \qquad \lambda_r = 97.07 \quad \text{(non-compact web limit)}$$

$$\text{web\_check} := \begin{cases} \text{"Compact Web"} & \text{if } \frac{h}{t_w} \le \lambda_p \\ \text{"Non-Compact Web"} & \text{if } \lambda_p < \frac{h}{t_w} \le \lambda_r \\ \text{"Slender Web"} & \text{otherwise} \end{cases} = \text{"Compact Web"}$$

Therefore, the slide beam has compact flanges and compact webs in the basic cross-section.

Bending Capacity Calculations Per AISC Spec. Chapter F, Section F7:

$\Omega_b := 1.67$

Since the flanges and the webs of the slide beam are compact, the entire section is compact and only the limit state of *Yielding* applies.

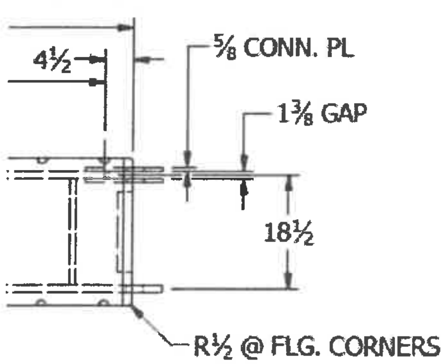
Capacity based on Yielding: $M_{n1} := F_{y100} \cdot Z_x$ $\qquad M_{n1} = 2599.17 \cdot ft \cdot k$ (AISC F7-1)

Girder capacity in bending based on the nominal cross-section is therefore:

$$Allowable\_Bending\_Capacity := \frac{M_{n1}}{\Omega_b} \qquad \boxed{Allowable\_Bending\_Capacity = 1556 \cdot ft \cdot k}$$

Pin Connection Analysis Per AISC Spec. Chapter D, Section D5; Chapter G, Section G2; Chapter J, Section J7: $\Omega_v := 1.67 \qquad \Omega := 2$

Pin connection at ends of slide beam consists of a 1.25" thick web plate (male) on one side and (2) 5/8" connection plates (female) on the other side. This allows the web plate to fit into another slide beam. In the calcs below, the shear capacity on the 1.25" web is equivalent to the (2) 5/8" connection plates.



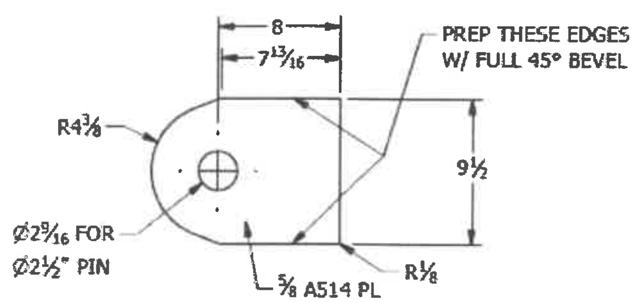


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Plate Thickness: $t_{pl} := 1.25in$ (two 5/8" thick plates are equivalent)

Pin diameter: $d_{pin} := 2.5in$ $\qquad d_{hole} := 2.5625in$ (use 4140 pins - 100 ksi yield)

No. of shear planes: $n_p := 4$ ... for entire connection.

Allowable shear load based on shear capacity of pin: $V_n := 0.6 \cdot F_{y4140} \cdot \left(\frac{\pi \cdot d_{pin}^{2}}{4} \right) \cdot n_p = 1178.1 \cdot k$ (AISC G2-1) $\boxed{\frac{V_n}{\Omega_v} = 705.45 \cdot k}$

Outside radius of connecting plate: $R_{pl} := 4.75in$

Tensile Rupture on Pin Holes:

$b_{effpl} := \min\left(2 \cdot t_{pl} + 0.63in, R_{pl} - \frac{d_{hole}}{2} \right) = 3.13 \cdot in$ For plate.

$A_{pl} := \left(t_{pl} \cdot b_{effpl}\right) \cdot 2 = 7.83 \cdot in^2$ Effective net area for pinned web.

$P_n := \left(A_{pl}\right) \cdot F_{u100} = 860.75 \cdot k$ (Equation D5-1) Nominal tensile rupture capacity of plate.

$P_{all} := 2 \cdot P_n = 1721.5 \cdot k$

Total capacity: $\frac{P_{all}}{\Omega} = 860.75 \cdot k$ (For Entire Connection)

Shear Rupture on Pin Holes:

$a_1 := R_{pl} - \left(0.5 \cdot d_{hole}\right) = 3.47 \cdot in$

$A_{sf} := 2 \cdot t_{pl} \cdot \left(a_1 + \frac{d_{hole}}{2} \right)$ $A_{sf} = 11.875 \cdot in^2$ (Per Plate)

$P_{n2} := \left(0.6F_{u100} \cdot A_{sf} \cdot 2\right)$ (Equation D5-2) $\frac{P_{n2}}{\Omega} = 784 \cdot k$ (For Entire Connection)

Allowable bearing load at pin connected plates:

$R_n := \left(1.8 \cdot F_{y100} \cdot d_{pin} \cdot t_{pl}\right) \cdot 2 = 1125 \cdot k$ $\frac{R_n}{\Omega} = 562.5 \cdot k$ --> Note that this is a servicibility limit state only and not a strength limit state.

Connection strength summary:

Shear on 100 ksi pin = 705 k
Tensile rupture on connection plates @ pin hole = 861 k
Shear rupture on connection plates @ pin hole = 784 k
Bearing on pin / plates = 563 k (servicibility limit state only)

Shear Capacity Calculations Per AISC Spec. Chapter G, Sections G2 & G3:

Shear capacity at nominal girder cross-section:

$A_w = 19.69 \cdot in^2$ $\qquad \frac{h}{t_w} = 8$ $\qquad \Omega_v := 1.67$

Dist. between web stiffeners / diaphragms: $a := 48 \cdot in$ $\qquad$ Panel aspect ratio: $\frac{a}{h} = 4.8$

$$k_v := \min\left[5 + \frac{5}{\left(\frac{a}{h}\right)^2}, 5\right] = 5$$ (per Section G5)

$$C_v := \begin{cases} 1.0 & \text{if } \frac{h}{t_w} \le 1.10 \cdot \sqrt{\frac{k_v \cdot E}{F_{y100}}} \\ \frac{1.10 \cdot \sqrt{\frac{k_v \cdot E}{F_{y100}}}}{\frac{h}{t_w}} & \text{if } 1.10 \cdot \sqrt{\frac{k_v \cdot E}{F_{y100}}} < \frac{h}{t_w} \le 1.37 \cdot \sqrt{\frac{k_v \cdot E}{F_{y100}}} \\ \frac{1.51 \cdot E \cdot k_v}{\left(\frac{h}{t_w}\right)^2 \cdot F_{y100}} & \text{if } \frac{h}{t_w} > 1.37 \cdot \sqrt{\frac{k_v \cdot E}{F_{y100}}} \end{cases} = 1$$

Therefore, the nominal shear strength of the girder cross section is:

$$V_n := 0.6 \cdot F_{y100} \cdot A_w \cdot C_v$$

$$V_n = 1181.25 \cdot k$$

Allowable shear strength of nominal girder section:

$$\boxed{\frac{V_n}{\Omega_v} = 707.34 \cdot k}$$

= approximately the shear capacity of the end connection, **(OK)**.

Connecting Weld Design Per AISC Spec. Chapter J:

Flange to web welds: $\Omega_w := 2.0$ $\qquad V_{des} := 600k$ **<-- iterated to get reasonable weld**

Calculate maximum horizontal shear stress in section due to maximum design shear above that will result in a reasonable weld size.

$$Q_{upper} := b_f \cdot t_f \cdot \left(6.146in - \frac{t_f}{2}\right) = 125.62 \cdot in^3$$

$$Q_{lower} := b \cdot t_f \cdot \left(5.854in - \frac{t_f}{2}\right) = 128.5 \cdot in^3$$

$$Q_{max} := \max(Q_{upper}, Q_{lower}) = 128.5 \cdot in^3$$

$$f_h := \left(\frac{V_{des} \cdot Q_{max}}{I_x}\right) = 47.95 \cdot \frac{k}{in}$$

The connecting welds will distribute this stress over 2 webs, therefore: $f_{hw} := \frac{f_h}{2} = 23.97 \cdot \frac{k}{in}$

Use matching 100 ksi filler metal for welds and calculate required fillet weld and alternate groove weld required:

Fillet weld required: $\omega_f := \dfrac{f_{hw}}{0.7071 \cdot \frac{0.60}{\Omega_w} \cdot F_{E100}} = 1.13 \cdot in$

Groove weld required: $\omega_g := \dfrac{f_{hw}}{\frac{0.60}{\Omega_w} \cdot F_{E100}} = 0.799 \cdot in$ --> use 13/16" partial penetration groove welds for flange to web connection.

Design weld at each 5/8" thick connection plate for shear and resulting maximum twisting per AISC Chapter J:

$P := \frac{V_{des}}{4} = 150 \cdot k$ $\quad d := 9.5in$ $\quad b := 8.5in$ $\quad L := d + 2 \cdot b = 26.5 \cdot in$

CG of weld off vertical line of plate: $x := \dfrac{d \cdot 0in + 2 \cdot \left(b \cdot \frac{b}{2}\right)}{d + 2 \cdot b} = 2.73 \cdot in$

Eccentricity from hole (load point) to CG of weld: $e_x := 8in - x = 5.27 \cdot in$

$J_w := \dfrac{(2 \cdot b + d)^3}{12} - \dfrac{b^2 \cdot (b + d)^2}{(2 \cdot b + d)} = 667.44 \cdot in^3$ (Blodgett - for C-shaped weld)

Direct shear stress: $f_v := \frac{P}{L} = 5.66 \cdot \frac{k}{in}$

Torsional stress on weld (y): $f_{Ty} := \dfrac{P \cdot e_x \cdot (b - x)}{J_w} = 6.84 \cdot \frac{k}{in}$

Torsional stress on weld (x): $f_{Tx} := \dfrac{P \cdot e_x \cdot \left(\frac{d}{2}\right)}{J_w} = 5.63 \cdot \frac{k}{in}$

Total stress: $f_{all} := \sqrt{\left(f_v + f_{Ty}\right)^2 + f_{Tx}^2} = 13.71 \cdot \frac{k}{in}$

Fillet weld required: $\omega_f := \dfrac{f_{all}}{0.7071 \cdot \dfrac{0.60}{\Omega_w} \cdot F_{E100}} = 0.65 \cdot in$

Groove weld required: $\omega_g := \dfrac{f_{all}}{\dfrac{0.60}{\Omega_w} \cdot F_{E100}} = 0.46 \cdot in$

--> To make weld constructable, balance weld by using 9/16" fillet weld along vertical edge of connection plate and use CJP weld along 7.5" horizontal legs. The CJP weld will be a "single bevel groove weld" per AISC Table 8-2, p. 8-43. This weld will fully tie the connection plates to the inner web plate (which serves as backer) and the flanges.

Concentrated Load Calculations Per AISC Spec. Chapter J, Section J10:

Web Local Yielding (Section J10.2): $\Omega := 1.50$ $d := 12in$

Assume minimum bearing length at any concentrated load point along length of the slide beam is greater than or equal to 2":

$N := 2 \cdot in$ $k_c := t_f + .8125in = 1.81 \cdot in$

For concentrated load applied at a distance from the member end < depth of member, d:

$R_{n1} := (2.5 \cdot k_c + N) \cdot F_{y100} \cdot t_w$ $R_{n1} = 816.41 \cdot k$ (per web) (AISC J10-3)

$\dfrac{2R_{n1}}{\Omega} = 1088.54 \cdot k$ >> max shear capacity... **(OK)**

Web Crippling (Section J10.3): $\Omega := 2.0$

For concentrated load applied at a distance from the member end < d/2:

$R_{n2} := 0.40 \cdot t_w^{\,2} \cdot \left[1 + 3 \cdot \left(\dfrac{N}{d}\right) \cdot \left(\dfrac{t_w}{t_f}\right)^{1.5}\right] \cdot \sqrt{\dfrac{E \cdot F_{y100} \cdot t_f}{t_w}}$ $R_{n2} = 1617.18 \cdot k$ (per web) (AISC J10-5a)

$\dfrac{2R_{n2}}{\Omega} = 1617.18 \cdot k$ >> max shear capacity... **(OK)**

Web Compression Buckling (Section J10.5): $\Omega := 1.67$

For concentrated load applied at a distance from the member end < d/2:

$$R_{n3} := \frac{1}{2} \cdot \frac{24 \cdot t_w^{\,3} \cdot \sqrt{E \cdot F_{y100}}}{h} = 3991.26 \cdot k$$ (per web) (AISC J10-8)

$$\frac{2 \cdot R_{n3}}{\Omega} = 4779.96 \cdot k$$ >> max shear capacity... **(OK)**

DESIGN SUMMARY:

1. **Bending Capacity = 1,556 ft-k**
2. **Shear Capacity = 600 k based on flange-to-web welds.**

***** END OF CALCULATIONS *****

1.0 Scope

This document serves to set forth the operational parameters and procedure that Barnhart Crane & Rigging, Co. Inc. (Barnhart) will utilize in the during the lift, move, and set evolutions for the University City Prosperity Project – FIU Pedestrian Bridge.

2.0 Reference Documents

2.1. PR1575-DP1.0 - Design Parameters

2.2. PR1575-G1.0 - Gantry & Shoring Details

2.3. PR1575-L1.0 - Travel Path

2.4. PR1575-L1.1 - Initial Staging

2.5. PR1575-L1.2 - Set Location/Elevation Details

2.6. PR1575-L1.3 - Travel Path & Matting Details

2.7. PR1575-T1.0 - Transport Configuration

2.8. PR1575-T1.1 - Shoring/Structural Eqp Details

3.0 Pre-Requisites

3.1. **Perform** all Barnhart project activities in accordance with the Barnhart Health and Safety Manual, HSE-SM-01 & HSE-MAN-02.

3.2. **Complete** a Job Hazard Analysis (JHA) at the beginning of each shift.

3.3. **Verify** all Barnhart personnel and craft labor are qualified to perform their assigned tasks and possess the required task specific Qualification Cards per the Barnhart Personnel Qualification Matrix.

3.4. **Verify** current revision of all drawings before execution of work.

3.5. **Perform** all transport activities utilizing a Goldhofer trailer in accordance with Barnhart Standard Operating Procedure for Platform Trailer Operations, ENG-SOP-006 (Latest Revision).

3.6. **Perform** all Pull Up Gantry activities in accordance with Barnhart Standard Operating Procedure for Pull Up Gantry (gantry), ENG-SOP-015 (Latest Revision).

4.0 Equipment Set-Up and Configuration:

4.1. **Prior** to the road closure weekend, assemble and configure transport equipment in are south of temporary bridge staging area.

4.2. **Ensure** trailers are synced together such that travel and steering are controlled by a single operator and individual trailer travel at equal speed.

4.3. **Perform** full operational checks of the pumps, gantries and Goldhofer trailer.

4.4. **Install** LED levels set to 1° on trailer decks and slide beams.

4.5. **Place** required civil improvements and matting along travel path.

5.0 Bridge Main Span Initial Lift

5.1. **Zone** the trailers in a global 3-Zone configuration.

5.2. **Open** all the valves from the multipurpose Pumps to the (8) gantries.

5.1. **Stroke** up all (8) gantries until wedge mats are just touching bridge span by extending the main stage of the (2) gantry's supporting a single 24" slide track at a time (ensure securement chaining is not in place prior to extending gantries).

5.2. **Ensure** dead section bears firmly on main stage bearing plate. **Install** shims between dead section and gantry bearing plates at all (8) gantry locations, if necessary.

5.3. **Install** ¼" thick plywood between wedge mats and bridge to ensure full contact, if needed.

5.4. **Stroke** the main stage of all (8) gantries up until gantry pressures reach 3,000 psi

5.5. **Check** levelness and Goldhofer zone pressures.

5.6. **Lift** bridge span in a slow and controlled manner by alternatingly raising main stage of the (4) west gantries and (4) east gantries until the bridge span is off the temporary shoring towers and is fully supported by the transport equipment.

5.7. During the initial lifting operations, the maximum height difference between the east and west sides shall not exceed 1/4". Continue to monitor pressures and ensure that Goldhofer deck and shoring system is level.

5.8. Once bridge has been lifted clear of shoring the maximum height difference between the east and west sides shall not exceed 2". Continue to monitor pressures and ensure that Goldhofer deck and shoring system is level.

5.9. **Pause lift operation if gantry pressure gauges reach 3,750 psi.** A 3,750 psi gantry pressure corresponds to a 2,000 kip load which is around 2.8% greater than the anticipated static load. **Pause lift operation if Goldhofer zone pressures reach 200 bar (2,900 psi).**

5.10. **Determine** CG location using operator's remote to verify the CG is located within the 12" tolerance, measured relative to the center of effort of Goldhofer trailer.

5.11. If CG is located outside of the tolerance, record the CG location, lower bridge back onto the temporary shoring towers, and contact Barnhart Engineering for direction.

5.12. **Install** securement chains and snug chains. **Do not over tighten chains.**

6.0 Bridge Span Transport

6.1. **Check** levelness of trailer deck.

6.2. **Check** zone pressures at all (3) Goldhofer zones and **ensure zone pressure differences do not exceed 200 bar (2,900 psi).**

6.3. **Record** initial zone pressures, and ensure zone pressures during transport do not exceed +/- 20 bar of initial pressure readings.

6.4. `**Monitor** trailer pressures. With the trailer decks level, the **maximum anticipated static Goldhofer side and pool zone pressure is 174 bar (2,524 psi) and 185 bar (2,683 psi), respectively.**

6.5. **Travel** bridge from staging area onto SW 8th Street while monitor LED levels. Transport speed not to exceed 0.3 mph. **Transporter crossfall angle not to exceed 3.6 degrees in either direction. 3.6 degrees = 3" vertical rise over 48".**

6.6. **Stop** when bridge is just west of the pylon base & south landing bent and is parallel to final set position.

6.7. **Confirm** bridge is in the correct north/south position relative to the abutments.

7.0 Bridge Main Span Final Lift

7.1. **Check** levelness of trailer deck.

7.2. **Check** zone pressures at all (3) Goldhofer zones and **ensure zone pressure differences do not exceed 250 psi.**

7.3. **Loosen** securement chains. **Do Not travel or operate Goldhofer with chains loosened.**

7.4. **Open** all the valves from the Multipurpose Pumps to the (8) gantries.

7.5. **Stroke** gantry main stage up one side at a time (north/south). **Pause lift operation if gantry pressure gauges reach 3,750 psi.**

7.6. **Raise** gantries slowly alternating one side at a time (north/south) until bridge ends are 1" +/- above PT bars protruding from pylon base. Monitor gantry and Goldhofer pressures throughout the lifting operations. The north and south sides shall remain within a 2" maximum height difference throughout the operation.

7.7. **Close** all valves from the Multipurpose Pump to gantries.

7.8. **Tighten** securement chains and snug chains. **Do not over tighten chains.**

8.0 Final Bridge Span Positioning

8.1. **Check** levelness of trailer deck.

8.2. **Check** zone pressures at all (3) Goldhofer zones and **ensure zone pressure differences do not exceed 200 bar (2,900 psi)**.

8.3. **Monitor** trailer pressures.

8.4. **Travel** bridge east over pylon base & south landing bent.

8.5. **Stop** when bridge is positioned over the pylon base & south landing bent and is in final set position.

8.6. **Confirm** alignment of bridge with customer.

9.0 Final Bridge Span Setting

9.1. **Check** levelness of trailer deck.

9.2. **Check** zone pressures at all (3) Goldhofer zones and **ensure zone pressure differences do not exceed 20 bar**.

9.3. **Loosen** securement chains. **Do Not travel or operate Goldhofer with chains loosened**.

9.4. **Open** all the valves from the Multipurpose Pumps to the (8) gantries.

9.5. **Install** bearing on south landing bent (to be performed by others).

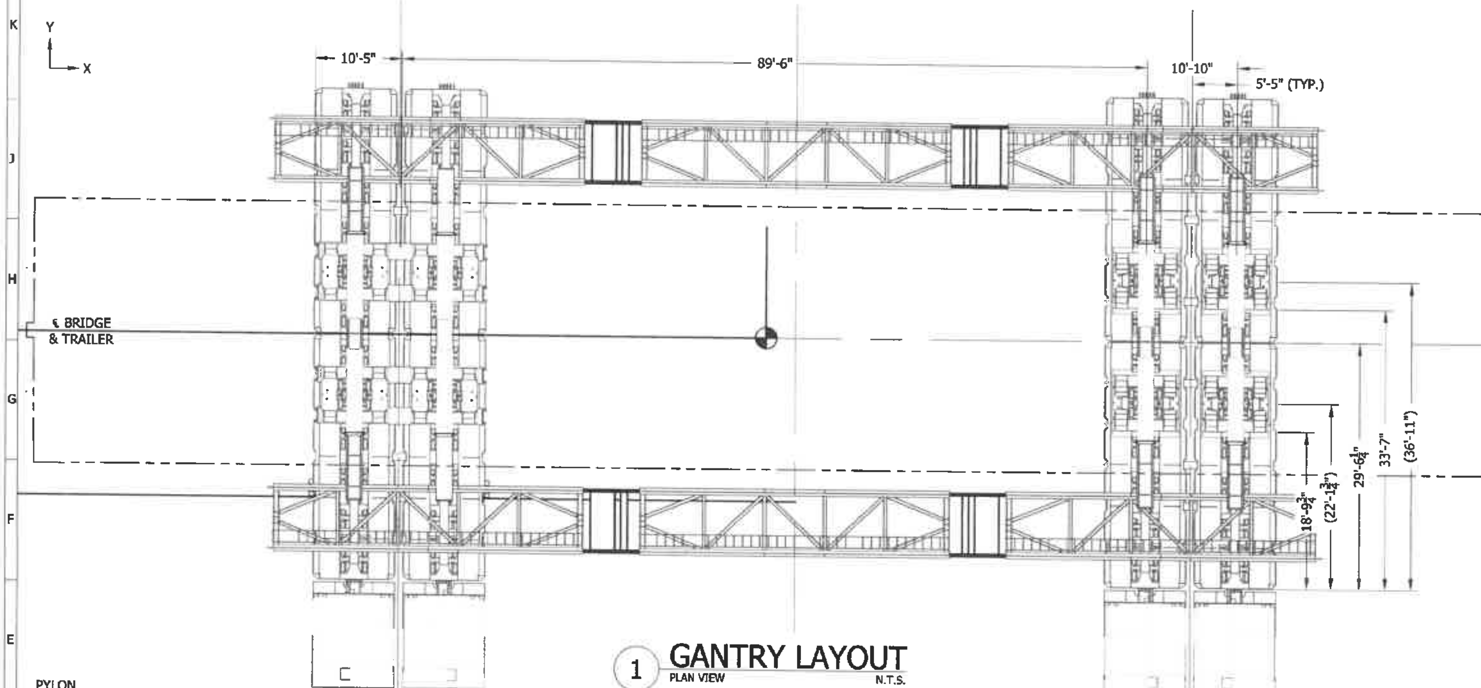
9.6. **Lower** gantries slowly alternating one side at a time (north/south) until bridge span is supported on the pylon base & south landing bent. Monitor gantry and Goldhofer pressures throughout the lowering operations. The east and west sides shall remain within a 1/4" maximum height difference throughout the operation.

9.7. **Check** zone pressures at all (8) Goldhofer zones and **ensure zone pressure differences do not exceed 20 bar**.

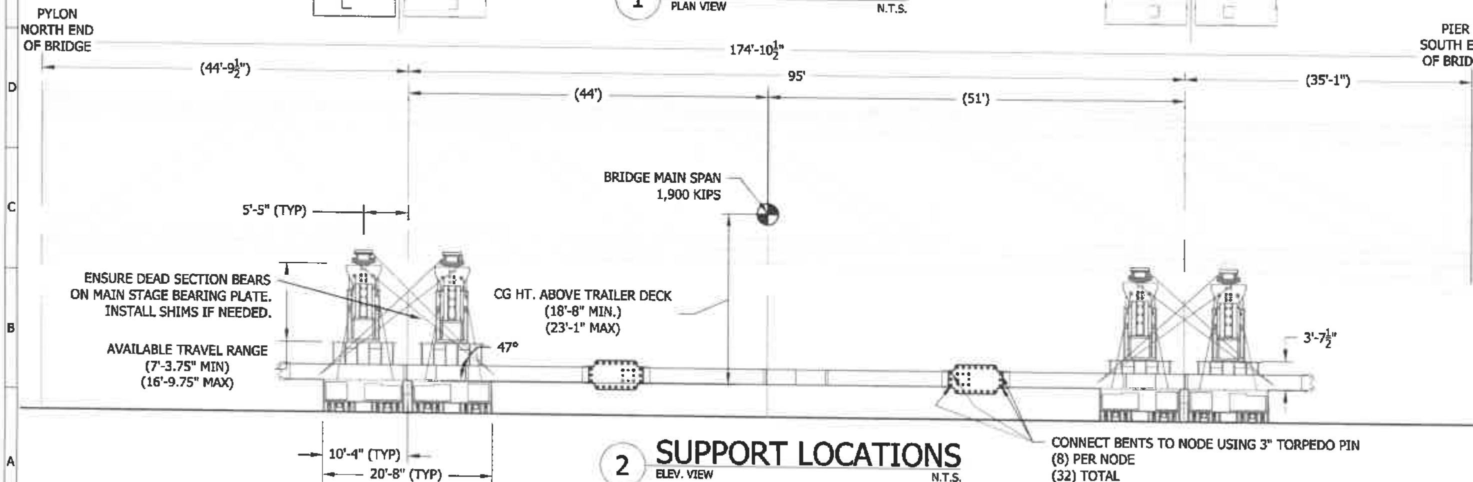
9.8. **Retract** gantry second stage to achieve 1" +/- clearance between transport shoring equipment and bridge. If necessary, wedge mats may be removes and/or gantry first stage may be retracted.

9.9. **Travel** transporter back to staging area.

***** END OF DOCUMENT *****



1 GANTRY LAYOUT
PLAN VIEW N.T.S.



2 SUPPORT LOCATIONS
ELEV. VIEW N.T.S.

NOTES:
1. BARNHART HAS NOT ANALYZED THE BRIDGE OR GROUND FOR THE IMPOSED LOADINGS.
2. BRIDGE SPANS DIMENSIONS AND WEIGHT PER FIGG PROJECT ID 434688-1-58-01, SHEET B-37; CG LOCATION PER EMAIL RECEIVED 5/9/2017
3. DIMENSIONS ARE APPROXIMATE TO WITHIN ½"; DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE ONLY.
4. PULL-UP GANTRY OPERATIONS PER BARNHART ENG-SOP-012, LATEST REVISION

SHOP DRAWING REVIEW

- ____ FOR INFORMATION ONLY
- X ACCEPTED
- ____ ACCEPTED AS NOTED
- ____ ACCEPTED AS NOTED & RESUBMIT
- ____ NOT ACCEPTED

This review is only for general conformance with design intent of the project and general compliance with the information given in the contract documents. Review, corrections or comments made concerning the shop drawings during this review do not relieve the contractor from compliance with requirements of the drawings and specifications, nor relieve the contractor of contractual responsibility for any error or deviation from contract requirements. The contractor is responsible for confirming and correlating all quantities, dimensions and structural capabilities - Selecting fabrication processes and techniques of construction - Coordinating his work with that of all other trades - and performing his work in a safe and satisfactory manner.

FIGG Subconsultant:
Firm:
By: ________ Date: ________

FIGG BRIDGE ENGINEERS, Inc.
By: EDL Date: 9/18/17

REV. #	DESCRIPTION	DATE	DWN	CHK
B	SHIFTED NORTH TRAILER INWARD 7'	9/1/2017	KCA	JJE
A	ISSUED FOR REVIEW	6/8/2017	DLT	JJE

REVISION HISTORY

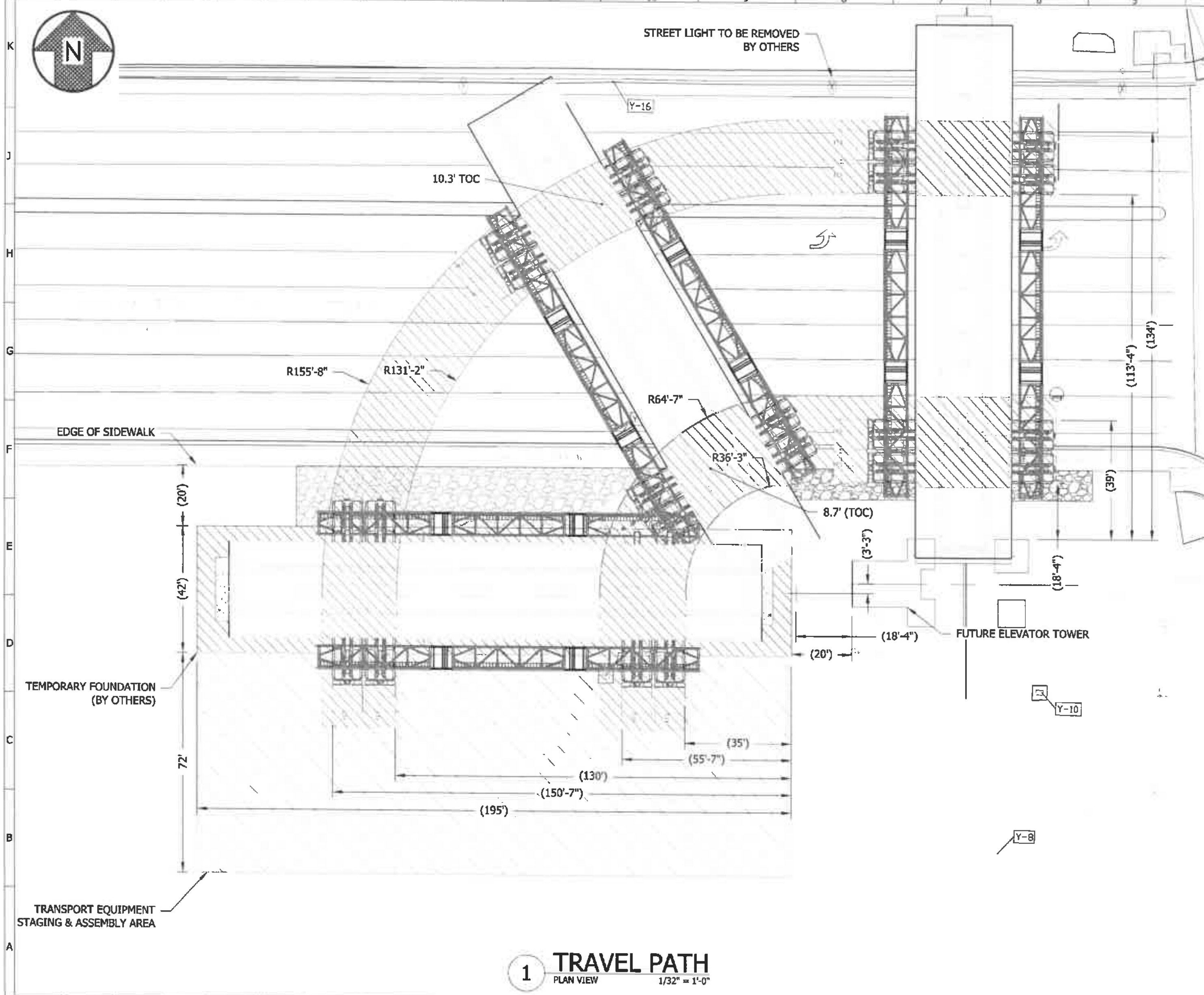
PROJECT: UCPP - FIU PEDESTRIAN BRIDGE
CUSTOMER: MUNILLA CONSTRUCTION MANAGEMENT

BARNHART Minds Over Matter

TITLE: TRANSPORTATION SHORING & BRACING DETAILS

DWG NUMBER: PR1575-G1.0
REVISION #: B

Attachment C - SPMT Bridge Movement Plan



NOTES:

1. DIMS ARE APPROX. TO WITHIN 1'-0". DIMS IN PARENTHESES ARE FOR REFERENCE ONLY.
2. SITE LAYOUT, DIMENSIONS, AND ELEVATIONS PER "MANNY VERA - TOPO ELEVATIONS" RECEIVED VIA EMAIL 4/20/2017 & "TEMP FOUNDATION ELEVATION" RECEIVED VIA EMAIL 4/21/2017.
3. BCR HAS NOT DETERMINED THE ADEQUACY OF STRUCTURES OR GROUND ALONG THE HAUL PATH TO SUPPORT THE IMPOSED LOAD. DETERMINATION OF ADEQUACY IS THE RESPONSIBILITY OF OTHERS.
4. ALL GOLDHOFER SETUP & OPERATION BCR ENG-SOP-006, U.N.O.

SHOP DRAWING REVIEW

____ FOR INFORMATION ONLY
_X_ ACCEPTED
____ ACCEPTED AS NOTED
____ ACCEPTED AS NOTED & RESUBMIT
____ NOT ACCEPTED

This review is only for general conformance with design intent of the project and general compliance with the information given in the contract documents. Review, corrections or comments made concerning the shop drawings during this review do not relieve the contractor from compliance with requirements of the drawings and specifications, nor relieve the contractor of contractual responsibility for any error or deviation from contract requirements. The contractor is responsible for confirming and correlating all quantities, dimensions and structural capabilities - Selecting fabrication processes and techniques of construction - Coordinating his work with that of all other trades - and performing his work in a safe and satisfactory manner.

FIGG Subconsultant:
Firm:
By: ______ Date: ______

FIGG BRIDGE ENGINEERS, Inc.
By: EDL Date: 9/18/17

REV. #	DESCRIPTION	DATE	DWN	CHK
A	ISSUED FOR REFERENCE	5/4/2017	DLT	JJE
B	REVISED TRAILER ARRANGMENT AND TRAVEL PATH DIMS	6/9/2017	DLT	JJE
C	SHIFTED NORTH TRAILER IN 7'	9/1/2017	KCA	JJE

REVISION HISTORY

PROJECT: UCPP - FIU PEDESTRIAN BRIDGE

CUSTOMER: MUNILLA CONSTRUCTION MANAGEMENT

BARNHART Minds Over Matter

TITLE: TRAVEL PATH LAYOUT

DWG NUMBER: PR1575-L1.0

REVISION #: C

SCALE: AS SHOWN