TRANSMITTAL OF EXECUTED DOCUMENTS

April 10, 2012

To: Brandy Adamson, NTTA Contracts Specialist

NTTA Contracts Department

From: Kim M. Robins

PD, Program Support, Contracts Manager

RE: Contract No: 02659-SWP-01-IL-PM

Supplemental Agreement #01

Attached are two original copies of the above referenced document for NTTA Master Record.

If I can be of further assistance please contact me at ext. 2428. Thank you.

NTTA 02659-SWP-01-IL-PM

Locke Lord LLP

Attorneys & Counselors

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Dallas, Texas 75201
Telephone: 214-740-8000
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Received by Legal
APR 03 2012

April 3, 2012

VIA HAND DELIVERY

Mr. Thomas J. Bamonte
General Counsel
North Texas Tollway Authority
5900 West Plano Parkway
Plano, Texas 75093

Re: Chisholm Trail Parkway

Dear Mr. Bamonte:

I enclose for your records two (2) original fully-executed counterparts of a Construction Coordination Supplemental Agreement dated March 23, 2012 (the "Agreement") between the NTTA and Union Pacific Railroad Company ("UPRR"). The Agreement supplements certain existing agreements relating to the construction of Chisholm Trail Parkway around and over the UPRR's Davidson Yard in Fort Worth.

If you have any questions, please do not hesitate to call.

Very truly yours,

TPA

Thomas P. Arnold

TPA:sc
Enclosures

cc (w/o encs.) (via email): Gerry Carrigan
Elizabeth Mow
Kevin Reilly
Enrique Guillen
Scott Yates
Frank Stevenson

DAL:0567318/47205:2096831v1

NTTA 02659-SWP-01-12-PM

UP Real Estate Folder No.: 2549-58
Agreement Number _____

CONSTRUCTION COORDINATION SUPPLEMENTAL AGREEMENT

DAVIDSON YARD
FORT WORTH, TARRANT COUNTY, TEXAS

THIS CONSTRUCTION COORDINATION SUPPLEMENTAL AGREEMENT (this "Supplemental Agreement") is made and entered into as of the 23rd day of March, 2012 (the "Effective Date"), by and between **UNION PACIFIC RAILROAD COMPANY**, a Delaware corporation (the "Railroad") and the **NORTH TEXAS TOLLWAY AUTHORITY**, a regional tollway authority and political subdivision of the State of Texas (the "NTTA").

RECITALS:

The Railroad, the NTTA, the City of Fort Worth, Texas (the "City"), and the Texas Department of Transportation, an agency of the State of Texas ("TxDOT" and, together with the NTTA and the City, the "Project Partners"), have entered into that certain Southwest Parkway/SH 121 Union Pacific Railroad/Project Partners Formal Agreement executed as of January 8, 2009, as amended by a First Amendment to Formal Agreement dated as of May 19, 2009, a Second Amendment to Formal Agreement dated as of June 17, 2009, a Third Amendment to Formal Agreement dated as of August 20, 2009, a Fourth Amendment to Formal Agreement dated as of September 1, 2009 and a Fifth Amendment to Formal Agreement (the "Fifth Amendment") dated as of September 23, 2009 (as amended, the "Formal Agreement"), pursuant to which the Railroad and the Project Partners established certain agreements and understandings with respect to the design, construction, operation and maintenance of Southwest Parkway/SH 121, now known as Chisholm Trail Parkway (defined as "SWP/SH 121" solely to maintain consistency with the Formal Agreement and its referenced amendments).

In order to implement the Formal Agreement, and pursuant to the Fifth Amendment, the Railroad, the NTTA and the City entered into that certain Construction Coordination Agreement dated as of September 23, 2009 (the "Construction Coordination Agreement"), to describe, in greater detail, their understandings and agreements (as theretofore generally set forth in the Formal Agreement) regarding the coordination of their respective construction activities in connection with the final design, construction and performance of the other elements of the work included in the Crossing Project, the Railroad Project and the City Utility Work (collectively called the "Project" in the Fifth Amendment and the Construction Coordination Agreement).

Exhibit C-2 to the Construction Coordination Agreement, entitled the "Southwest Parkway – UPRR Construction Coordination Constraints, Allowances, and Requirements for Construction Over the UPRR Davidson Yard," among other matters, contains provisions regarding General Track/Yard Operation Requirements, Work Zones, Absolute Work Zones, Conditional Work Zones, Work Zone Delineation, Access, Equipment, Materials and the Demolition of the existing Hulen Street Bridge, and also includes an attached Construction Phasing Narrative and related renderings (the "Exhibit C-2 Construction Constraints Exhibit"). The Exhibit C-2 Construction Constraints Exhibit specifically provided that it did not preclude the eventual NTTA Contractor from suggesting alternatives or utilizing other means and methods that generally meet the outlined conditions if approved by the Railroad, and would be considered in good faith by the Railroad.

Since the Fifth Agreement, the Construction Coordination Agreement, and the Exhibit C-2 Construction Constraints Exhibit were executed and/or adopted, the NTTA Contractor has proposed a new approach to, and modifications of, the construction means, methods and techniques (including the

use of shoring towers), and the access and sequencing, for the performance of that portion of the Crossing Project consisting of the construction of the Structures and the demolition of existing Hulen Street Bridge (hereinafter collectively called the "Structure Project"), than was originally contemplated by the Exhibit C-2 Construction Constraints Exhibit. The proposed re-sequencing also alters the timing of the demolition, removal and track construction work in the vicinity of the Temporary Hump Lead (the "Temporary Hump Lead Removal and Track Construction Work"), which was, and is, to be performed by the Railroad as part of the Railroad Project.

The NTTA has requested that the Railroad approve the new approach described above and the Railroad is willing to accommodate and approve the proposed changes to the NTTA's construction means, methods and techniques, access and scheduling for the Structure Project, provided they are undertaken in a manner which is consistent with the existing provisions of the Formal Agreement and the Construction Coordination Agreement intended to assure safe, orderly, efficient, and productive construction activity during the NTTA Construction Period. Accordingly, the NTTA and the Railroad agree to enter into this Supplemental Agreement to document their amended understanding and agreement with respect to the performance of the Structure Project.

AGREEMENT:

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, it is mutually agreed by and between the parties hereto as follows:

Section 1. RECITALS

The Recitals set forth above are hereby incorporated into this Supplemental Agreement and made part hereof.

Section 2. RELATIONSHIP TO THE FORMAL AGREEMENT

This Supplemental Agreement is intended to supplement and complement those provisions of the Formal Agreement respecting (a) the initial construction of the Structures and performance of the other elements of the Structure Project by the NTTA within the Davidson Yard during the NTTA Construction Period and at such other time or times as the NTTA is authorized to carry out its construction activities under, and as provided in, the Formal Agreement, and (b) the performance by the Railroad of the Railroad Temporary Hump Lead Removal and Track Construction Work, subsequent to the UPRR Construction Period and during the NTTA Construction Period, as described below in Section 4. Capitalized terms used but not defined in this Supplemental Agreement shall have the meanings given to such terms in the Formal Agreement and in the Construction Coordination Agreement.

Because the Structure Project and the Temporary Hump Lead Removal and Track Construction Work do not affect the performance of the City Utility Work, this Supplemental Agreement is intended to pertain solely to the Railroad and to the NTTA regarding the performance of their respective obligations, as described above, and not to the City.

Section 3. MODIFICATION OF SEQUENCING AND ACCESS

The Railroad hereby grants its approval to (a) those certain changes requested by NTTA to its construction means, methods and techniques, access and sequencing for the Structure Project as set forth in **Exhibit 1**, attached hereto and made part hereof (hereinafter, the "Modified Construction Sequencing and Access Plan"), and (b) the NTTA Sequencing Timetable attached hereto as **Exhibit 2** and made part hereof (the "NTTA Sequencing Timetable"). By approving such changes in the construction means,

methods and techniques, access and sequencing, the NTTA acknowledges and agrees that the Railroad is making no representations or warranties as to the adequacy, fitness or sufficiency of such construction means, methods and techniques, access and sequencing, as modified. The NTTA shall cause the Structure Work to be performed in accordance with the modified "Southwest Parkway -- UPRR Construction Coordination Constraints, Allowances, and Requirements for Construction Over the UPRR Davidson Yard" that are attached hereto as **Exhibit 3** and made part hereof ("Modified Exhibit C-2") and the Modified Construction Sequencing and Access Plan (which is subject to amendment pursuant to the terms of Section III.G.4. of the Formal Agreement). The NTTA Sequencing Timetable represents a more detailed elaboration of the final line (entitled "SWP 2B Phase Const. over Yard") of the Construction Schedule attached as Exhibit G to the Construction Coordination Agreement. As provided in greater detail in Section III.E.4. of the Formal Agreement (as amended by Section 3(d) of the Fifth Amendment), the milestones in the Construction Schedule, including the NTTA Sequencing Timetable, constitute guidelines (rather than deadlines which serve as events of default) and in no event will any Party be liable in damages if that Party misses any such milestone (although there may be other consequences), as further provided therein. The Construction Schedule (including the NTTA Sequencing Timetable) is subject to amendment as provided in the Formal Agreement and the Construction Coordination Agreement.

Section 4. UPRR CONSTRUCTION PERIOD; NTTA CONSTRUCTION PERIOD

The NTTA and the Railroad stipulate and agree that:

A. The UPRR Construction Period shall expire on 12:01 a.m. on March 24, 2012.

B. The NTTA Construction Period shall commence on 12:02 a.m. on March 24, 2012.

C. The NTTA has specifically requested, and the Modified Construction Sequencing and Access Plan and the NTTA Sequencing Timetable contemplate, that the Railroad shall perform the Temporary Hump Lead Removal and Track Construction Work at the beginning of the NTTA Construction Period, notwithstanding and without affecting the stipulation and agreements set forth in Sections 4(A) and 4(B), above, and with the NTTA acknowledging and agreeing that its construction efforts will need to avoid interference with the Railroad's Temporary Hump Lead Removal and Track Construction Work until completed, as provided in Modified Exhibit C-2 and the Modified Construction Sequencing and Access Plan. The Temporary Hump Lead Removal and Track Construction Work was, and shall continue to be, a Project expense reimbursable to the Railroad from the NTTA's $95 Million Obligation under the Formal Agreement, without any increase in the amount of such $95 Million Obligation.

D. The NTTA and the Railroad confirm that, notwithstanding anything contained in either this Supplemental Agreement and the Exhibits attached hereto, and consistent with the agreed-upon 4+4+4 Plan on which the Formal Agreement is based: (i) no more than four (4) departure tracks in the 4+4+4 Plan in the Railroad's departure yard may be temporarily closed at one time; (ii) with the result that at all times eight (8) long-line departure tracks and three (3) main lines shall remain open; and (iii) the NTTA work conducted over the Hump Lead shall be governed by the terms of Modified Exhibit C-2, and no work over the Hump Lead shall occur at any time, whether or not the Hump Lead is in operation, except as permitted under the terms of Modified Exhibit C-2.

Section 5. **EXHIBIT C-2 SUPPLEMENTAL AGREEMENT MODIFICATION**

Attached hereto as **Exhibit 3** and made part hereof is a Modified Exhibit C-2 which shall apply to the performance of the Structure Work in lieu of the original Exhibit C-2 Construction Constraints Exhibit.

Section 6. **CONSTRUCTION ACCESS**

The license granted by the Railroad in the Construction Coordination Agreement for temporary access pathways through, and temporary staging areas within, the Davidson Yard for the NTTA during the NTTA's construction of the Crossing Project, solely as such license relates to the performance of the Structure Work, is hereby modified as and to the extent set forth in the Modified Construction Sequencing and Access Plan and as further described in Modified Exhibit C-2. As provided in the Construction Coordination Agreement, the NTTA's right to use the respective modified access and staging areas shall expire with respect to each such access or staging area on the earlier of final completion of all of the portions of NTTA's work on the Project that require the use of such access or staging area or the expiration of the NTTA Construction Period (as the same may be extended in accordance with the Formal Agreement).

Section 7. **ASSIGNMENT; SUCCESSORS AND ASSIGNS**

A. Except as provided in Section III.G.6. of the Formal Agreement and in Section 13 of the Fifth Amendment, neither the Railroad or the NTTA shall assign this Supplemental Agreement without the prior written consent of the other.

B. Subject to the provisions of Section 7.A. above, this Supplemental Agreement shall inure to the benefit of and be binding upon the successors and assigns of the Railroad and the NTTA.

Section 8. **MISCELLANEOUS**

A. All notices under this Supplemental Agreement shall be delivered to the Railroad or the NTTA, as the case may be, at the respective addresses and pursuant to the procedures set forth in the Formal Agreement.

B. The NTTA and the Railroad agree that any disputes between them arising out of or relating to this Supplemental Agreement, including, without limitation, all rights to receive payments from, or the benefits of performance by, the other Party under or as a result of this Supplemental Agreement shall be resolved exclusively pursuant to the dispute resolution procedures set forth in Section III.P.9. and Section III.R. of the Formal Agreement.

C. Without in any manner abrogating or otherwise affecting any obligation of the Project Partners to the Railroad, this Supplemental Agreement does not affect the rights and obligations of TxDOT, the City and the NTTA amongst themselves regarding the development of SWP/SH 121.

D. Each of the NTTA and the Railroad hereby represents and warrants to the other that, as of the date hereof, (i) it has not delivered written notice of any default by the other under the terms and conditions of the Formal Agreement or the Construction Coordination Agreement that has not been cured, and (b) to the best of its current actual knowledge, without any independent investigation, the construction required of the Railroad under the Formal Agreement prior to the expiration of the UPRR Construction Period has progressed to the point required under the Formal Agreement, and the NTTA Retaining Walls and Early Project Work (as such term is defined in Section 3 of the Construction

Coordination Agreement) required of the NTTA prior to the expiration of the UPRR Construction Period have progressed to the point required under the Formal Agreement. The signatories to this Supplemental Agreement each represent and warrant that each has the authority to enter into this Supplemental Agreement on behalf of the Party represented.

E. The liability of the NTTA and the Railroad under this Supplemental Agreement shall be subject to Section III.P.13. of the Formal Agreement, including the exceptions to the limitations set forth in said Section III.P.13. Without limitation of the foregoing, it is understood and agreed that any actual, direct damages incurred by the Railroad or the NTTA under this Supplemental Agreement shall be aggregated with any actual, direct damages incurred by the Railroad and the Project Partners (respectively) under the Formal Agreement for purposes of the maximum cumulative amount of liability to which such Parties may be liable, as specified in the Formal Agreement.

F. This Supplemental Agreement may be executed in multiple counterparts, each of which for all purposes is deemed an original, and all of which constitute collectively one Agreement. Signatures of this Supplemental Agreement transmitted by facsimile or via electronic mail (*.pdf or similar file types) shall be valid and effective to bind the Party so signing.

G. In the event any provision of this Supplemental Agreement is found to be void or violative of public policy or otherwise unenforceable, the remainder of this Supplemental Agreement shall continue to be effective and enforceable notwithstanding such finding.

H. The following Exhibits and Schedules to this Supplemental Agreement are attached hereto and incorporated herein by reference:

Exhibit 1:	Modified Construction Sequencing and Access Plan
Exhibit 2:	NTTA Sequencing Timetable
Exhibit 3:	Modified Exhibit C-2

I. Except as modified by this Supplemental Agreement, the terms of the Construction Coordination Agreement and to the exhibits thereto (including, without limitation, Exhibits C-1 and C-2) shall continue, unmodified in full force and effect.

[Signature Page Follows]

IN WITNESS WHEREOF, the parties have caused this Supplemental Agreement to be duly executed as of the Effective Date first herein written.

UNION PACIFIC RAILROAD COMPANY
(Federal Tax ID #94-6001323)

By: Lawrence E. Wzorek

Printed Name: Lawrence E. Wzorek

Title: Assistant Vice President - Law

NORTH TEXAS TOLLWAY AUTHORITY

By: _____

Printed Name: _____

Title: _____

Signature Page to
Supplemental Agreement

IN WITNESS WHEREOF, the parties have caused this Supplemental Agreement to be duly executed as of the Effective Date first herein written.

UNION PACIFIC RAILROAD COMPANY
(Federal Tax ID #94-6001323)

By:_____

Printed Name: _____

Title:_____

NORTH TEXAS TOLLWAY AUTHORITY

By:_____

Printed Name: Gary Cunningham

Title: Interim Exec. Dir.

14997950\V-4
15001182\V-3

EXHIBIT 1

MODIFIED CONSTRUCTION SEQUENCING AND ACTION PLAN

[follows this page]

EXHIBIT 2

NTTA SEQUENCING TIMETABLE

[follows this page]

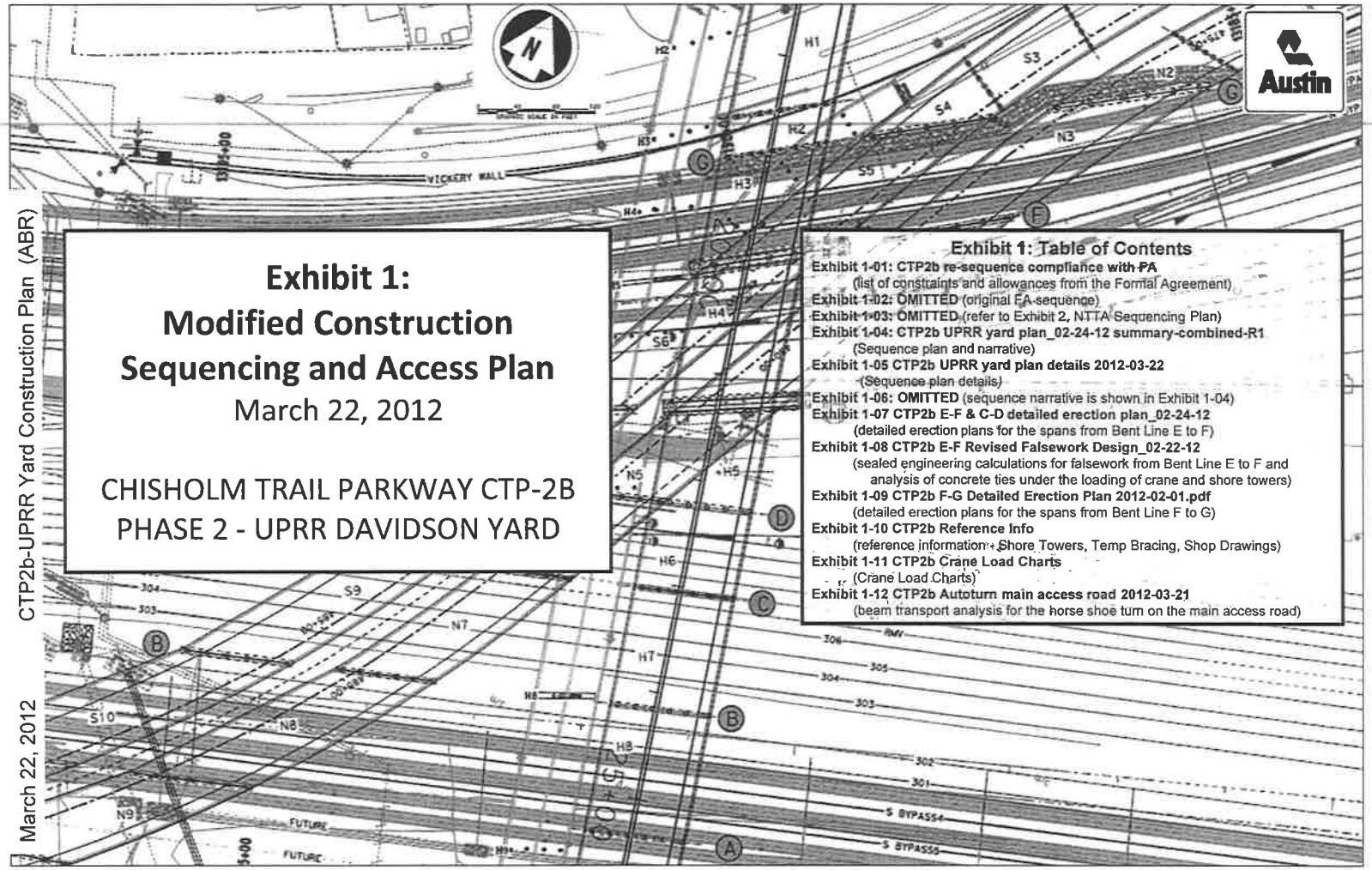


Exhibit 1:
Modified Construction Sequencing and Access Plan

March 22, 2012

CHISHOLM TRAIL PARKWAY CTP-2B
PHASE 2 - UPRR DAVIDSON YARD

Exhibit 1: Table of Contents

Exhibit 1-01: CTP2b re-sequence compliance with PA
(list of constraints and allowances from the Formal Agreement)
Exhibit 1-02: OMITTED (original FA sequence)
Exhibit 1-03: OMITTED (refer to Exhibit 2, NTTA Sequencing Plan)
Exhibit 1-04: CTP2b UPRR yard plan_02-24-12 summary-combined-R1
(Sequence plan and narrative)
Exhibit 1-05 CTP2b UPRR yard plan details 2012-03-22
(Sequence plan details)
Exhibit 1-06: OMITTED (sequence narrative is shown in Exhibit 1-04)
Exhibit 1-07 CTP2b E-F & C-D detailed erection plan_02-24-12
(detailed erection plans for the spans from Bent Line E to F)
Exhibit 1-08 CTP2b E-F Revised Falsework Design_02-22-12
(sealed engineering calculations for falsework from Bent Line E to F and analysis of concrete ties under the loading of crane and shore towers)
Exhibit 1-09 CTP2b F-G Detailed Erection Plan 2012-02-01.pdf
(detailed erection plans for the spans from Bent Line F to G)
Exhibit 1-10 CTP2b Reference Info
(reference information - Shore Towers, Temp Bracing, Shop Drawings)
Exhibit 1-11 CTP2b Crane Load Charts
(Crane Load Charts)
Exhibit 1-12 CTP2b Autoturn main access road 2012-03-21
(beam transport analysis for the horse shoe turn on the main access road)

Exhibit 1-01 CTP2b re-sequence compliance with FA
CTP2b Yard WorkPlan

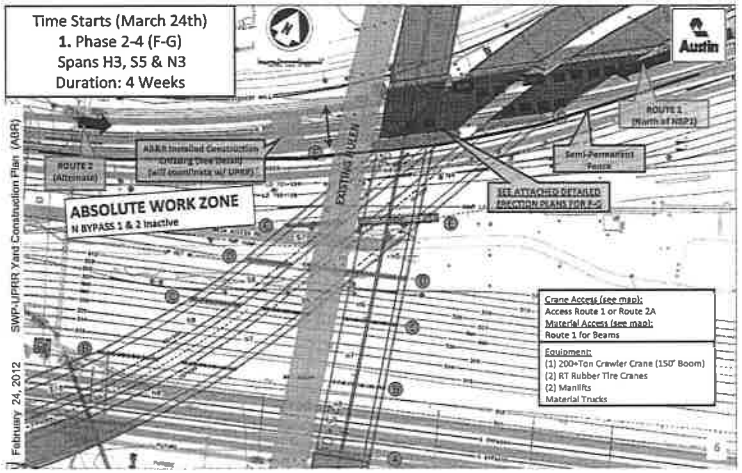
Document/Section	Comply	If Non-compliance, reason or measures	Stage per Sequence Plan
8th Amendment for Formal Agreement: Construction Coordination Agreement (CCA)			
Section 9 Plans			
D. No changes in the Crossing Project Plans ...shall be made unless the Railroad has confirmed in writing that such changes do not violate the Design Requirements (page 7)	yes	submitting contractor Yard Workplan to revise sequence	
Exhibit C-2 to CCA, Constraints, Allowances, and Requirements			
1. General Track/Yard Operation Requirements			
a. At all times, either the Temp Hump or the Perm Hump shall be operational.	no	With the revised sequence, the Temp Hump will be permanently closed at the beginning of the 12 month time over the yard. The UPRR will construct the replacement lead to the west of Hulen and de-commission the Temp Hump. The Permanent Hump will be protected with a 'beam supported roof' system that will allow normal construction operations over the active Permanent Hump. Major construction operations, such as beam placement, will be performed over the Permanent Hump "in-between cuts" or during the weekly 4-hour shutdowns.	
b. At all times, a minimum of 3 maintain bypass tracks shall be operational (NBP1, NBP2, SFBP3, SBP4, or SBP5)	yes		
c. ...tracks LD101-104 and LD105-108 shall be operation and clear of any materials or equipment for approximately 10-15 minutes every 2 hours	yes	HMAC crossings will be constructed for Span E-F to allow quicker crane mobile-nets	7,18,19,21
d. Hump tracks inactive 4 hours weekly	yes		
e. No more than one set of 4 contiguous departure tracks can be shut down at one time	yes		
f. UPRR flagger	yes		
g. switch locks and derails	yes	coordinate with UPRR field personnel for installation	
h. contractor to verify utilities	yes		
i. forms ...engineered systems and protected	yes	refer to workplan details	
j. drilling adjacent to tracks...check for track settlement	yes		
k. work performed at distance less than 12' from an adjacent track requires track outage unless otherwise approved.	yes		
l. some construction activities over live tracks are allowable	yes	beam supported roof system for Permanent Hump Lead	
2. Work Zones			
...not more than one set of 4 tracks can be shut down (301-312, BP1-5)	yes	close coordination with UPRR field personel required for short duration Abs WZ in order to move cranes	3,9
...Contractor can employ 24/7 work schedule	yes	Contractor plans on 24/7 work schedule	
...Contractor shall coordinate daily and provide advance notice of Work Zone changes.	yes		
...clean Work Zone to pre-construction condition	yes		
...haul/disposal of excavated soils and materials	yes		
Absolute Work Zone			
a. ABS WZ definition	yes		
b. only one ABS WZ at a time	no	per coordination with UPRR, bent lines B & C can be constructed concurrently utilizing 2 ABS WZ, but only closing 4 tracks (301-302 & 306-307) with tracks 303-305 active	3
c. Tracks LD101-104 and LD105-108 can not be included in an ABS, and not more than one of the Hump Leads	yes	With the revised sequence, the Temp Hump will be permanently closed at the beginning of the 12 month time over the yard. The UPRR will construct the replacement lead to the west of Hulen and de-commission the Temp Hump. The Permanent Hump will be protected with a 'beam supported roof' system that will allow normal construction operations over the active Permanent Hump. Major construction operations, such as beam placement, will be performed over the Permanent Hump "in-between cuts" or during the weekly 4-hour shutdowns.	
d. ABS WZ east/west limits	yes	coordinate with UPRR field personnel for limits	
e. ABS WZ delineated by visual awareness or semi permanent fence	yes		
f. fencing to extend to east/west limits	yes	coordinate with UPRR field personnel for limits	
g. construction vehicles, equipment and materials may occupy inactive tracks, with proper protection	yes		
h. Railroad operations may disrupt ABS WZ only in case of unsafe or unusual operating conditions	yes		
i. See construction phasing narrative for additional requirements	yes		

Document/Section	Comply	If Non-compliance, reason or measures	Stage per Sequence Plan
Conditional Work Zone			
a. includes Bent Lines D-E and E-F	yes		
b. require varying levels of coordination	yes		
c. includes main access road, tracks LD101-104, LD105-108, Hump Leads	yes	temp detour (HMAC) provided for Main Access Road HMAC Track Crossing as shown in sequence plans	2,6-8,11-19,22-23
d. LD101-104 and LD105-108 operational 10-15minutes every 2 hours	yes		
e. defineation by visual awareness or semi permanent fencing	yes		
f. construction vehicles, equipment and materials may occupy tracks, but clear as noted above			
g. Main Access Road TCP	yes	temp detour (HMAC) provided for Main Access Road	2,6-8,17-19,22-23
h. See construction phasing narrative for additional requirements	yes		
3. Work Zone Delineation			
a. all dimensions measured from centerline of track	yes		
b. WZ delineation either semi-permanent fence (6') or visual awareness (3'), equip/materials not to extend past vertical plan, include dust barriers	yes		
c. semi-permanent fence to be rigid and create physical barrier, reasonably removed	yes		
d. visual awareness semi-rigid and highly visible	yes		
4. Access			
a. General			
i. coordination required when crossing live tracks	yes	Routes 3a and Main Access Road	3-612-16,23
ii. Live tracks may be blocked, coordinate with UPRR to minimize delays	yes	Routes 3a and Main Access Road	3-612-16,23
iii. Provide traffic control for impacted roads	yes	temp detour (HMAC) provided for Main Access Road	2,7,8,17,18,21,22
b. Access 1 3500' west of Hulen, south side	yes	revised to UPRR driveway off Edwards Ranch Road see Routes 3a & 3b	
c. Access 2 500' west of Hulen, north side	yes	see Routes 2a, 2b	
d. Access 3 200' east of Hulen, north side	yes	see Route 1	
e. Access 4 1000' west of Hulen, south side	yes	see Routes 3a & 3b	
f. UPRR drive off Vickery (5000' west of Hulen)	yes	see Route 2	
g. UPRR drive off Vickery (7800' east of Hulen)	yes	not planned for use	
h. Rail loading yard	yes	not planned for use	
i. Mopac Bridge	yes	not planned for use	
j. Existing Hulen Street Bridge	yes	will be utilized	
k. new bridge	yes	will be utilized	
5. Equipment			
a. Road Crossings over live tracks require flaggers	yes	coordinate with UPRR field personnel	
b. equipment storage in WZ	yes	will be utilized	
c. small to medium rubber tire vehicles	yes	will be utilized	
d. medium to large rubber tire vehicles	yes	will be utilized	
e. track vehicles	yes	will be utilized	
f. "Hi-rail" vehicles	yes	not planned for use	
g. rail mounted or flatcars	yes	not planned for use	
h. concrete trucks	yes	see work plan for routes	
i. existing Hulen bridge	yes	will be utilized	
j. new bridge	yes	will be utilized	

Document/Section	Comply	If Non-compliance, reason or measures	Stage per Sequence Plan
6. Materials			
a. Materials stored within WZ	yes	will be utilized	
b. Material stored outside of WZ	yes	coordinate with UPRR field personnel for limits	
c. existing Hulen bridge	yes	will be utilized	
d. new bridge	yes	will be utilized	
e. Rail	yes	not planned for use	
7. Demo of existing Hulen Bridge			
foundations removed to 5' below adjacent rail or 2' below ground if further than 30' from rail	yes		
a. sequence	yes	refer to workplan for sequence	
b. preferred method to work from above	yes	refer to workplan slab removed from above but will need to work from ground for girder and column demo	
c. UPRR provided rail cars	yes	not planned for use	
d. see Construction Phasing for additional requirements	yes		

Austin Bridge and Road Construction Sequences

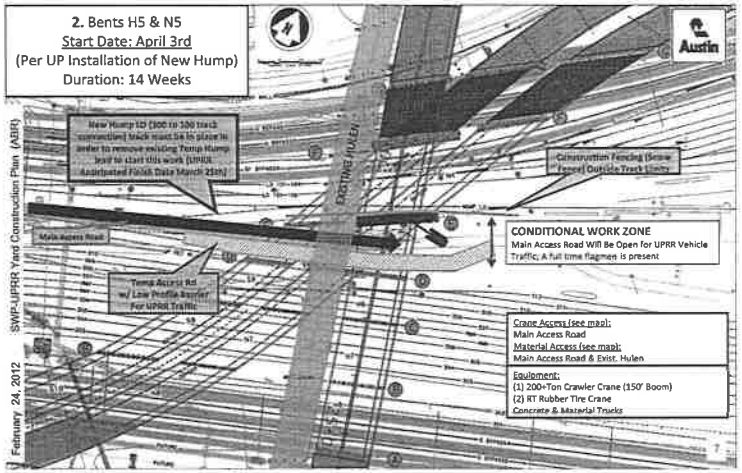
Sequence	1		
	Span F-G		
Phase 2 Stage	4		
Start Note:	March 24th		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	H3, S5, N3		
Deck	H3, S5, N3		
Other			
Predecessors			
Concurrent Activities	Bent Line E		
Tracks			
Not Constructed			
Inactive	NBP 1 & 2		
Duration	4 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 1 & Route 2	
Material	Access	Concrete, Misc	Route 1 & Route 2
		Beams	Route 1
	Storage	Minimal Storage: Inside work zone, outside NBP1 Track Protection Limits	
Equipment	Access	Route 1 & Route 2	
	Storage	Inside work zone, outside NBP1 Track Protection Limits	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing on the South		
South limit	12' North of SFBP 3		
North limit	Unrestricted		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Beams will approach on Route 1 (North of NBP1), Crane will sit North of NBP1; Trucks will leave on Route 2		
	Crane will only need to walk over tracks in one location; in this location wood mats will be used to span the tracks (see Crane on Tracks Standard Detail)		
	AB&R to isntall construciton crossing over NBP1&2 for future access. See Construction Crossing Detail per discussion with Ted.		



Austin Bridge and Road Construction Sequences

Sequence	2		
	Bent Line E		
Phase 2 Stage	6 (N5 moved from 2C Contract)		
Start Note:	March 27th (Per Installation of New Hump and removal of Temporary Hump)		
Construction			
Drill Shafts	H5 (East DS Only), N5 Each End per New Design		
Columns	H5 (East DS Only), N5 Each End per New Design		
Caps	H5 & N5		
Beams			
Deck			
Other			
Predecessors	Install New Hump Track		
	Remove Temp Hump Track		
Concurrent Activities	Spans F-G, Bent B&C, Spans B-C & Span A-B (if needed)		
Tracks			
Not Constructed			
Inactive			
Duration	14 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Road	
Material	Access	Concrete, Misc	Existing Hulen and Main Access Road
		Beams	N/A
	Storage	Minimal Storage: On Existing Hulen Deck	
Equipment	Access	Main Access Road	
	Storage	In work zone (at least 12' from Hump Ld and not on Main Access Road)	
Work Zone Delineation	Conditional		
Fencing	Snow Fencing at 10' South of Hump LD		
South limit	Limited Operation to the South		
North limit	10' South of Hump LD (Obstructions are min of 12' from CL of track)		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	H5 will be constructed first, N5 will follow (per approval of RFI to add columns/Drilled Shafts to N5 and eliminate longitudinal post tensioning)		
	Temp Detour for UPRR Traffic with Low Profile Barrier & Barrels & Snow Fence to separate		
	Four flaggers will be required (two locations on 12-hr shifts for 24/7 construction)		

rev: 3/16/12



Austin Bridge and Road Construction Sequences

Sequence	3a		
	Bent Line B & C		
Phase 2 Stage	1 & 2		
Start Note:	Following 1		
Construction			
Drill Shafts	H8, N8, S10, H7, N7, S9		
Columns	H8, N8, S10, H7, N7, S9		
Caps	H8, N8, S10, H7, N7, S9		
Beams			
Deck			
Other			
Predecessors	AWZ SBP4&5, 301-302 and then AWZ 303-306 to cross track w Equipment - 3 Days		
Concurrent Activities	Bent Line E (Bent H5 & N5)		
Tracks			
Not Constructed			
Inactive	301-302, 306-307		
Duration	4.5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A for Bent Line B; Bent Line C Use Manlifts/Man Basket to access from Existing Hulen	
Material	Access	Concrete, Misc	Bent B: Route 3A; Bent C: Existing Hulen
		Beams	N/A
	Storage	Minimal Storage: Inside work zone, Existing Hulen Deck	
Equipment	Access	Route 3A/3B	
	Storage	Inside Work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing North & South		
South limit	Bent B: 12' North of SBP4; Bent C: 12' North of 305		
North limit	Bent C: 12' South of 303; Bent C. 12' South of 308		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Bent Line C: Pump concrete down from Exist Hulen, DS Spoils will be stockpiled and hauled off at the end		
	Four flaggers will be required (two locations on 12-hr shifts for 24/7 construction)		

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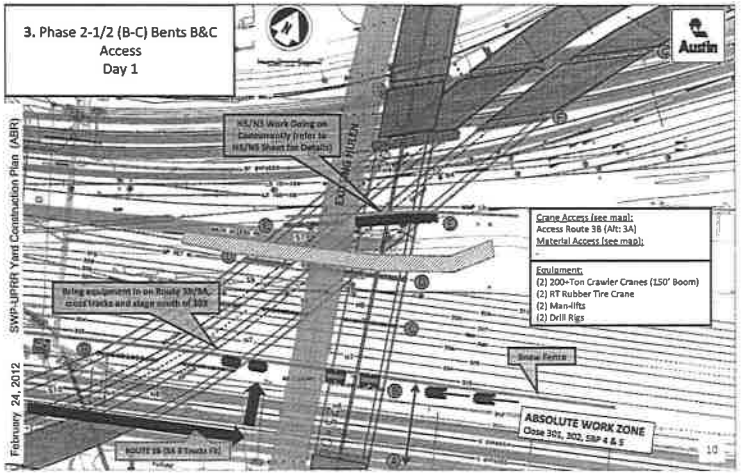

Austin Bridge and Road Construction Sequences

Sequence	3b		
	Bent Line B & C		
Phase 2 Stage	1 & 2		
Start Note:	Following 1		
Construction			
Drill Shafts	H8, N8, S10, H7, N7, S9		
Columns	H8, N8, S10, H7, N7, S9		
Caps	H8, N8, S10, H7, N7, S9		
Beams			
Deck			
Other			
Predecessors	AWZ SBP4&5, 301-302 and then AWZ 303-306 to cross track w Equipment - 3 Days		
Concurrent Activities	Bent Line E (Bent H5 & N5)		
Tracks			
Not Constructed			
Inactive	301-302, 306-307		
Duration	4.5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A for Bent Line B; Bent Line C Use Manlifts/Man Basket to access from Existing Hulen	
Material	Access	Concrete, Misc	Bent B: Route 3A; Bent C: Existing Hulen
		Beams	N/A
	Storage	Minimal Storage: Inside work zone, Existing Hulen Deck	
Equipment	Access	Route 3A/3B	
	Storage	Inside Work Zone	
Work Zone Defineation	Absolute		
Fencing	Construction Fencing North & South		
South limit	Bent B: 12' North of SBP4; Bent C: 12' North of 305		
North limit	Bent C: 12' South of 303; Bent C: 12' South of 308		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Bent Line C: Pump concrete down from Exist Hulen, DS Spoils will be stockpiled and hauled off at the end		
	Four flaggers will be required (two locations on 12-hr shifts for 24/7 construction)		

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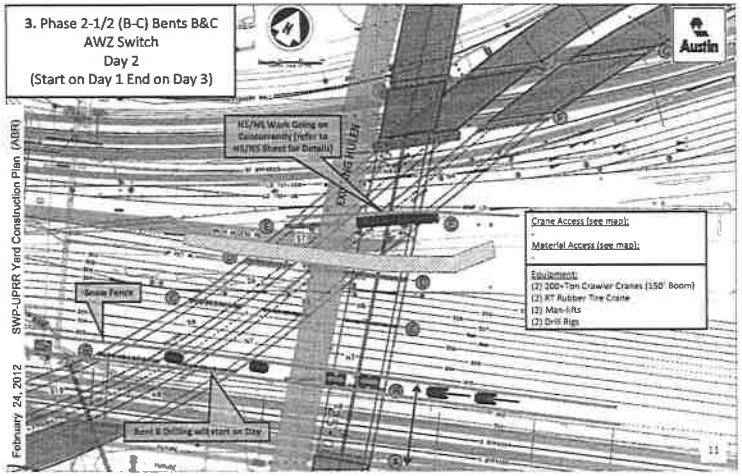

Austin Bridge and Road Construction Sequences

Sequence	3c		
	Bent Line B & C		
Phase 2 Stage	1 & 2		
Start Note:	Following 1		
Construction			
Drill Shafts	H8, N8, S10, H7, N7, S9		
Columns	H8, N8, S10, H7, N7, S9		
Caps	H8, N8, S10, H7, N7, S9		
Beams			
Deck			
Other			
Predecessors	AWZ SBP4&5, 301-302 and then AWZ 303-306 to cross track w Equipment - 3 Days		
Concurrent Activities	Bent Line E (Bent HS & NS)		
Tracks			
Not Constructed			
Inactive	301-302, 306-307		
Duration	4.5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A for Bent Line B; Bent Line C Use Manlifts/Man Basket to access from Existing Hulen	
Material	Access	Concrete, Misc	Bent B: Route 3A; Bent C: Existing Hulen
		Beams	N/A
	Storage	Minimal Storage: Inside work zone, Existing Hulen Deck	
Equipment	Access	Route 3A/3B	
	Storage	Inside Work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing North & South		
South limit	Bent B: 12' North of SBP4; Bent C: 12' North of 305		
North limit	Bent C: 12' South of 303; Bent C: 12' South of 308		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Bent Line C: Pump concrete down from Exist Hulen, DS Spoils will be stockpiled and hauled off at the end		
	Four flaggers will be required (two locations on 12-hr shifts for 24/7 construction)		

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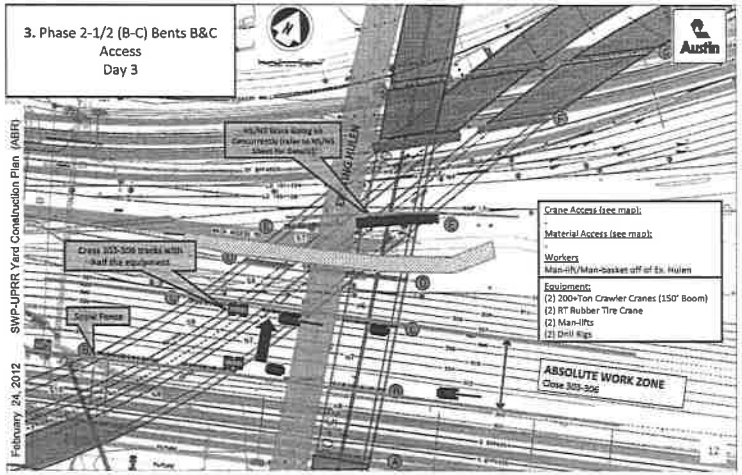

Austin Bridge and Road Construction Sequences

Sequence	3		
	Bent Line B & C		
Phase 2 Stage	1 & 2		
Start Note:	Following 1		
Construction			
Drill Shafts	H8, N8, S10, H7, N7, S9		
Columns	H8, N8, S10, H7, N7, S9		
Caps	H8, N8, S10, H7, N7, S9		
Beams			
Deck			
Other			
Predecessors	AWZ SBP4&5, 301-302 and then AWZ 303-306 to cross track w Equipment - 3 Days		
Concurrent Activities	Bent Line E (Bent H5 & N5)		
Tracks			
Not Constructed			
Inactive	301-302, 306-307		
Duration	4.5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A for Bent Line B; Bent Line C Use Manlifts/Man Basket to access from Existing Hulen	
Material	Access	Concrete, Misc	Bent B: Route 3A; Bent C: Existing Hulen
		Beams	N/A
	Storage	Minimal Storage: Inside work zone, Existing Hulen Deck	
Equipment	Access	Route 3A/3B	
	Storage	Inside Work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing North & South		
South limit	Bent B: 12' North of SBP4; Bent C: 12' North of 305		
North limit	Bent C: 12' South of 303; Bent C: 12' South of 308		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Bent Line C: Pump concrete down from Exist Hulen, DS Spoils will be stockpiled and hauled off at the end		
	Four flaggers will be required (two locations on 12-hr shifts for 24/7 construction)		
	Crash Wall options will be investigated (possibly be dowelled into rock). Any proposed changes will be submitted to UPRR for approval prior to construction. Crash walls will be constructed one at a time with minimal revisions (if any) to work zones.		

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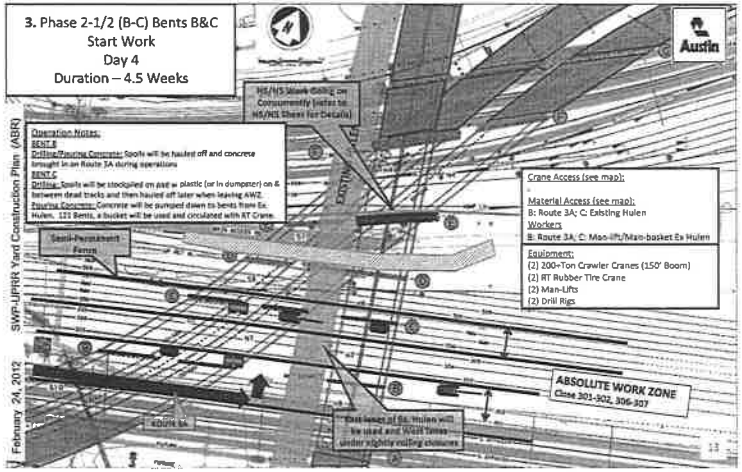
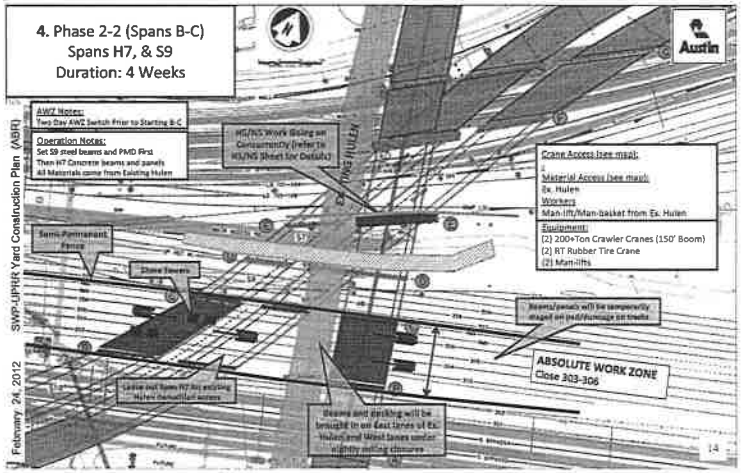


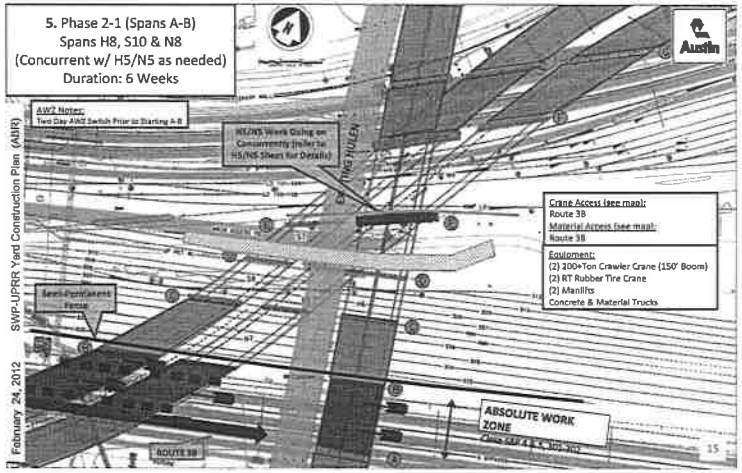
Austin Bridge and Road Construction Sequences

Sequence	4		
	Span B-C (H7 & S9)		
Phase 2 Stage	2		
Start Note:	Following 3		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	H7, S9		
Deck	H7, S9		
Other			
Predecessors	Switch AWZ-2 Days		
Concurrent Activities	Bent Line E (H5 & N5)		
Tracks			
Not Constructed			
Inactive	303, 304, 305, 306		
Duration	4 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A & 3B, Walk in from West and Manlift/Man Basket from Hulen	
Material	Access	Concrete, Misc	N/A
		Beams	Existing Hulen
	Storage	Minimal Storage: On Existing Hulen Deck	
Equipment	Access	Route 3A/3B	
	Storage	In work zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing North & South		
South limit	12' North of 302		
North limit	12' South of 307		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	N7 Left out due to conflict with Existing Hulen		
	Beams picked off of Existing Hulen, S9 set first, then H7 beams and panels will be temporarily staged on tracks and then set (so as not to get blocked in)		



Austin Bridge and Road Construction Sequences

Sequence			5
			Span A-B
Phase 2 Stage			1
Start Note:			Following 4
Construction:			
Drill Shafts			
Columns			
Caps			
Beams	H8, N8, S10		
Deck	H8, N8, S10		
Other			
Predecessors	Switch AWZ-2Days		
Concurrent Activities	Bent Line E (H5 & N5)		
Tracks			
Not Constructed			
Inactive	301, 302, SBP 4 & 5		
Duration	6 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3B	
Material	Access	Concrete, Misc	Route 3B
		Beams	Route 3B
	Storage	Minimal Storage: Inside work zone, Existing Hulen Deck	
Equipment	Access	Route 3B	
	Storage	Inside Work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing North		
South limit	Unrestricted		
North limit	12' South of 303		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Beam trucks will approach on Route 3B. After beam is set, truck & trailer will collapse and exit to the East		



Austin Bridge and Road Construction Sequences

Sequence	6A		
	Span E-F (N4)		
Phase 2 Stage	5		
Start Note:	Following 5		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	N4		
Deck	N4		
Other			
Predecessors	301, 302, SBP 4 & 5		
Concurrent Activities			
Tracks			
Not Constructed			
Inactive	SF Bypass 3 & N Bypass 2		
Duration	3 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Rd & Route 2	
Material	Access	Concrete, Misc	Existing Hulen
		Beams	Existing Hulen
	Storage	Minimal Storage: On Existing Hulen Deck	
Equipment	Access	Main Access Rd & Route 2	
	Storage	In work zone	
Work Zone Delineation	Conditional		
Fencing	Construction/Snow Fence		
South limit	Natural barrier with retaining wall and slope at Bent Line D		
North limit	12' South of NPB 2		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Beams will come in on Existing Hulen. See E-F Detailed Erection Plan and Falsework Design		
	AB&R installed construction crossing in work area. See Constructon Crossing Detail per discussion with Ted		
	Crossings in the NBP1&2 for Route 2 will be frequently blocked by trains		

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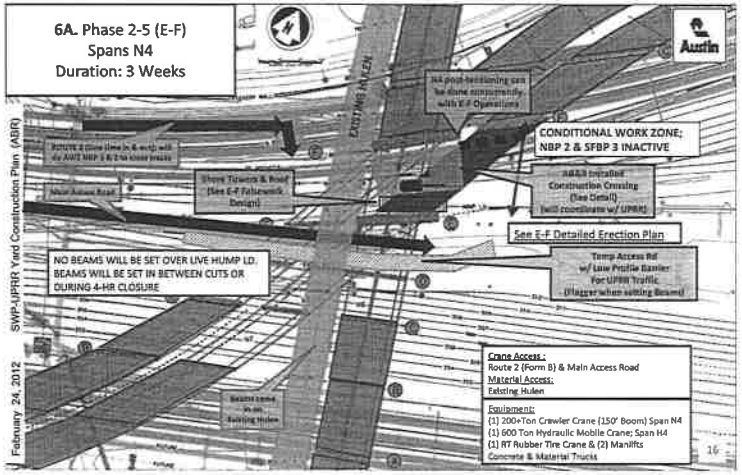

Austin Bridge and Road Construction Sequences

Sequence	6B	
	Span E-F (H4)	
Phase 2 Stage	7	
Start Note:	Following 6A	
Construction		
Drill Shafts		
Columns		
Caps		
Beams	H4	
Deck	H4	
Other		
Predecessors	SFBP3 & NBP2	
Concurrent Activities		
Tracks		
Not Constructed		
Inactive	SFBP3	
Duration	1 Week	
	Note: Durations are approximate and for informational purposes only	
Resources		
Labor	Access	Main Access Rd & Route 2
Material	Access	Concrete, Misc Existing Hulen
		Beams Existing Hulen
	Storage	Minimal Storage: On Existing Hulen Deck
Equipment	Access	Main Access Rd & Route 2
	Storage	In work zone
Work Zone Delineation	Conditional	
Fencing	Construction/Snow Fence	
South limit	Natural barrier with retaining wall and slope at Bent Line D	
North limit	12' South of NPB 2	
Existing Hulen	East two lanes available for staging if needed	
Operation Notes:	A 600ton hydraulic crane is needed to set H4 Girders. Beams will come in on Existing Hulen. See E-F Detailed Erection Plan and Falsework Design	
	Tracks 308, 309, & 310 will be shut down. 307 will be live until SFBP3 is open and then 307 will be shut down to allow beam setting for next phase.	
	Crossings in the NBP1&2 for Route 2 will be frequently blocked by trains	

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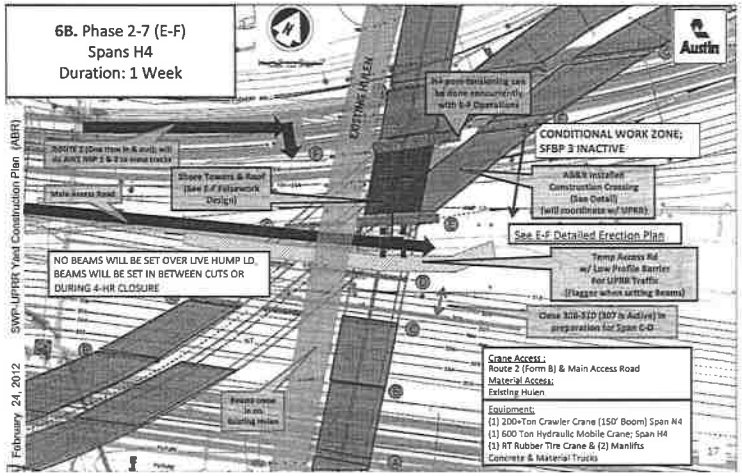
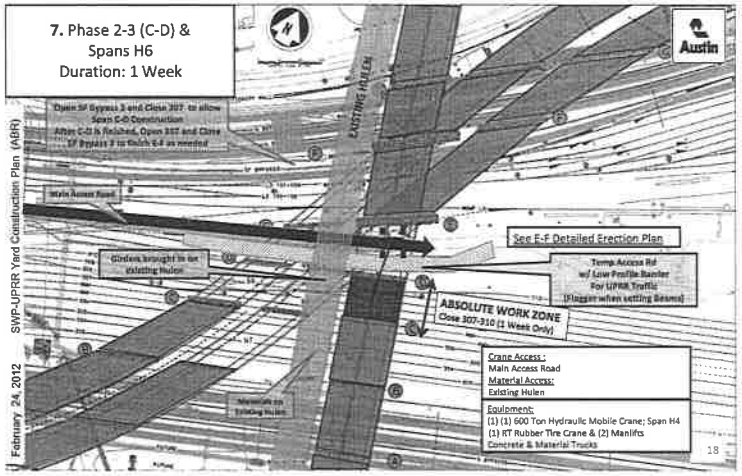
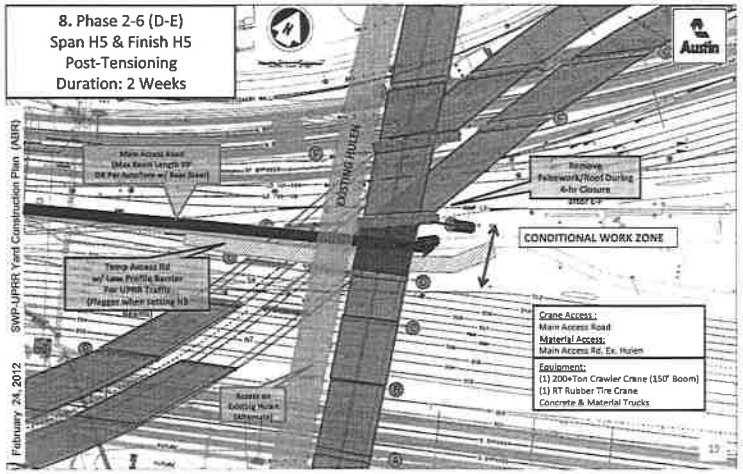


Sequence	7		
	Span C-D (H6)		
Phase 2 Stage	3		
Start Note:	Following 6B		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	H6		
Deck	H6		
Other			
Predecessors	SFBP3 & N Bypass 2		
Concurrent Activities			
Tracks			
Not Constructed			
Inactive	307, 308, 309, 310		
Duration	1 Week		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Rd	
Material	Access	Concrete, Misc	Existing Hulen
		Beams	Existing Hulen
	Storage	Minimal Storage: On Existing Hulen Deck	
Equipment	Access	Main Access Rd	
	Storage	In work zone	
Work Zone Delineation	Absolute		
Fencing	Construction/Snow Fence		
South limit	12' North of 306		
North limit	Natural barrier with retaining wall and slope at Bent Line D		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	A 600ton hydraulic crane is needed to set H6 beams and panels. AB&R reserves the option to place a crane down below on the tracks within the RR allowances		
	Beams will come in on Existing Hulen.		
	Tracks 308, 309, & 310 will be shut down. 307 will be live until SFBP3 is open and ten 307 will be shut down to allow beam setting.		



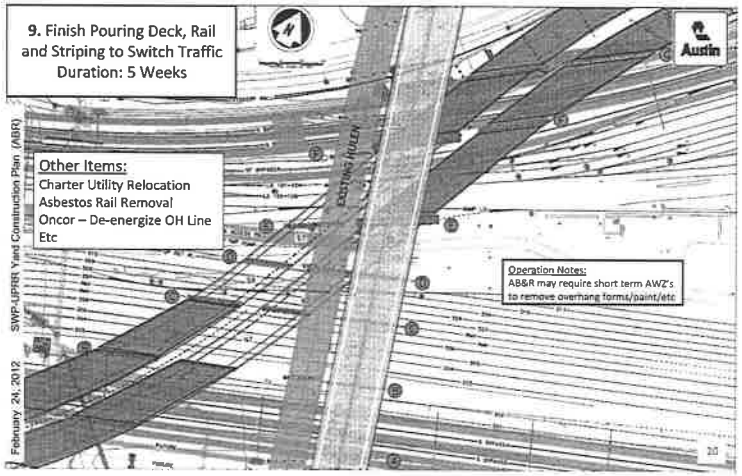
Austin Bridge and Road Construction Sequences

Sequence	8		
	Span D-E (H5) & Post Tensioning at H5		
Phase 2 Stage	6		
Start Note:	Following 6&7		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	H5		
Deck	H5		
Other			
Concurrent Activities			
Tracks			
Not Constructed			
Inactive			
Duration	2 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Road	
Material	Access	Panels	Main Access Road
		Beams	Main Access Road (Existing Hulen Bridge as backup)
	Storage	Minimal Storage: On Existing Hulen Deck	
Equipment	Access	Main Access Road	
	Storage	In work zone; outside Main Access Road	
Work Zone Delineation	Conditional		
Fencing	Construction Fencing North		
South limit	12' North of 310 (Natural slope barrier & retaining wall)		
North limit	12' South of Hump LD		
Existing Hulen	East two lanes available for staging if needed		
Operation Notes:	Max beam length = 99', able to travel down Main Access Rd		
	During beam setting, Access Road not in use (flagger present)		



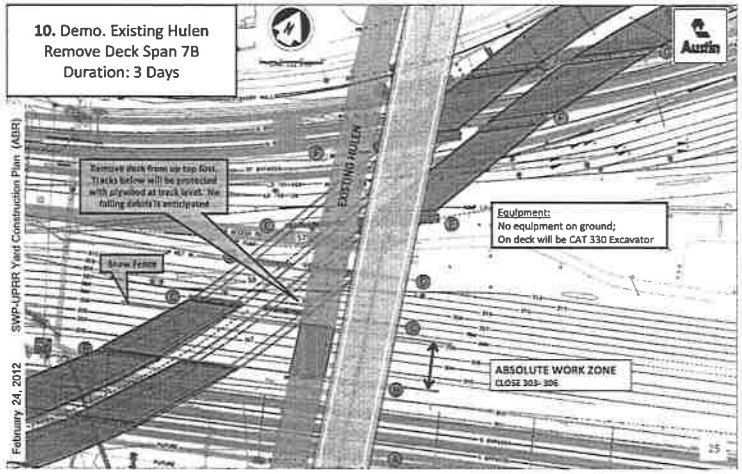
Austin Bridge and Road Construction Sequences

Sequence	9		
	Switch Traffic to New Hulen Bridge		
Phase 2 Stage			
Start Note:	Following Deck Placement from C-F		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	Short Term AWZ May be required to remove overhang forms/etc; Coordinate w UPRR		
Duration	5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Coordinate w UPRR if needed	
Material	Access	Concrete, Misc	Coordinate w UPRR if needed
		Beams	
	Storage	Coordinate w UPRR if needed	
Equipment	Access	Coordinate w UPRR if needed	
	Storage	Coordinate w UPRR if needed	
Work Zone Delineation			
Fencing	Construction Fencing, short term, for overhang form removal/painting,etc		
South limit			
North limit			
Existing Hulen			
Operation Notes:	Time period includes finishing deck placement & curb & rail, Striping, Charter Utility Relocation, Asbestos Rail Removal, Etc		



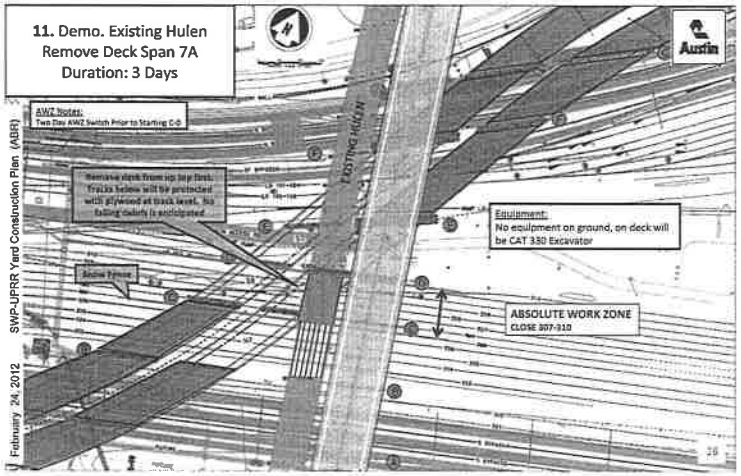
Austin Bridge and Road Construction Sequences

Sequence	10		
	Demolish (B-C) Ex Hulen - Deck - Span 7B		
Phase 2 Stage	8		
Start Note:	Following Switch Traffic to New Hulen		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	303, 304, 305, 306		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Deck Removal Done From On Top	
Material	Access	Small Materials	Deck Removal Done From On Top
		Beams	Deck Removal Done From On Top
	Storage	Deck Removal Done From On Top	
Equipment	Access	Deck Removal Done From On Top	
	Storage	Deck Removal Done From On Top	
Work Zone Delineation	Absolute		
Fencing			
South limit			
North limit			
Existing Hulen			
Operation Notes:	Deck is removed in Sections with Excavator on Top of Deck		
	Equipment may be brought in down below prior in preperation for beam removal, and for track protection under AWZ coordinated with UP		



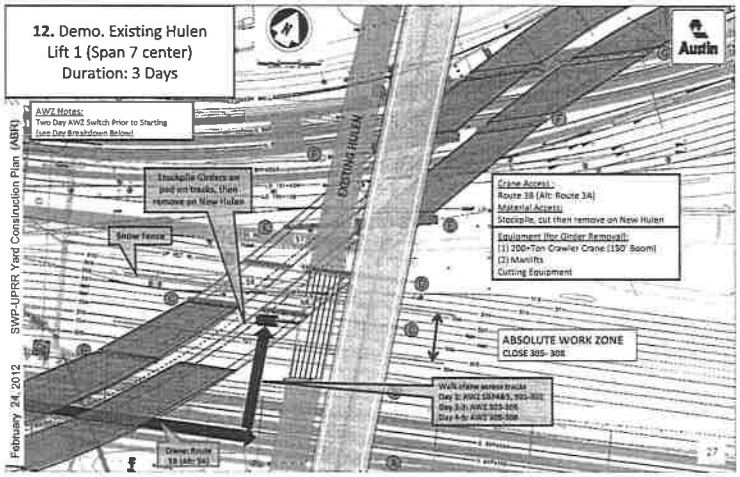
Austin Bridge and Road Construction Sequences

Sequence	11		
	Demolish (C-D) Ex Hulen Deck Span 7A		
Phase 2 Stage	8		
Start Note:	Following Deck Removal 7B		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Predecessors	Switch AWZ - 2 Days		
Tracks			
Not Constructed			
Inactive	307, 308, 309, 310		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Deck Removal Done From On Top	
Material	Access	Small Materials	Deck Removal Done From On Top
		Beams	Deck Removal Done From On Top
	Storage	Deck Removal Done From On Top	
Equipment	Access	Deck Removal Done From On Top	
	Storage	Deck Removal Done From On Top	
Work Zone Delineation	Absolute		
Fencing			
South limit			
North limit			
New Hulen			
Operation Notes:	Deck is removed in Sections with Excavator on Top of Deck		
	Equipment may be brought in down below prior in preperation for beam removal, and for track protection under AWZ coordinated with UP		



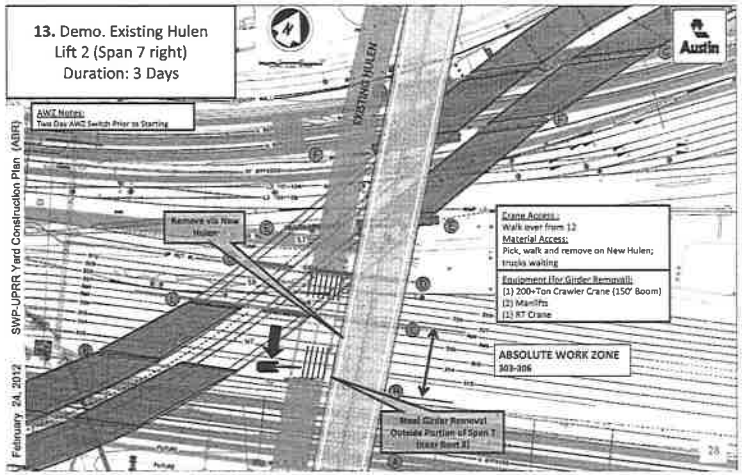
Austin Bridge and Road Construction Sequences

Sequence	12		
	Beam Removal (Lift 1) - Demolish Ex Hulen Span 7 (center)		
Phase 2 Stage	8		
Start Note:	Following Deck Removal Span 7A		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Predecessors	Cross Tracks from Route 3A, Need two AWZ's, 2 days each		
Tracks			
Not Constructed			
Inactive	305, 306, 307, 308		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A and New Hulen via Man basket during AWZ	
Material	Access	Small Materials	New Hulen
		Beams	Stockpiled down below, cut and then lifted to New Hulen
	Storage	In work Zone	
Equipment	Access	Route 3A (cross tracks under AWZ's, 4 days)	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: North & South		
South limit	12' North of 304		
North limit	12' South of 309		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Remove Girders One at A Time, stockpile down below, cut and lift up to New Hulen to be hauled off		



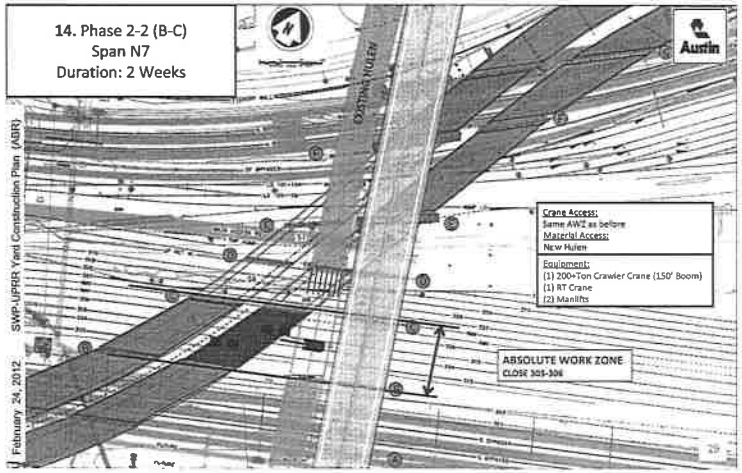
Austin Bridge and Road Construction Sequences

Sequence	13		
	Beam Removal (Lift 2) - Demolish Ex Hulen Span 7 (right)		
Phase 2 Stage	8		
Start Note:	Following Beam Removal Span 7 (center)		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Predecessors	305-308, Switch AWZ (trade two tracks), 1 day		
Tracks			
Not Constructed			
Inactive	303, 304, 305, 306		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A and New Hulen via Man basket during AWZ	
Material	Access	Small Materials	New Hulen
		Beams	New Hulen Haul Off
	Storage	Minimal in work zone	
Equipment	Access	Walk over from 12	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing; North & South		
South limit	12' North of 302		
North limit	12' South of 307		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Remove Girders One at A Time, Lift Up to New Hulen and Haul Off		



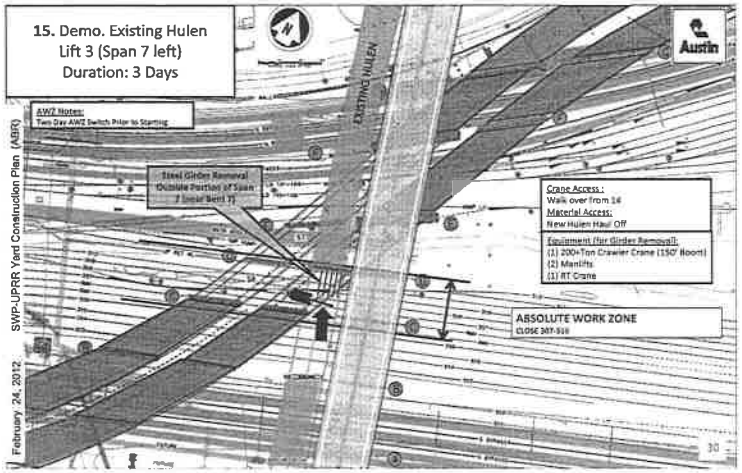
Austin Bridge and Road Construction Sequences

Sequence	14		
	Span B-C (N7)		
Phase 2 Stage	2		
Start Note:	Following Beam Removal Span 7 (right)		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	N7		
Deck	N7		
Other			
Predecessors	Same AWZ		
Tracks			
Not Constructed			
Inactive	303, 304, 305, 306		
Duration	2 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A and New Hulen via Man basket during AWZ	
Material	Access	Small Materials	New Hulen
		Beams	New Hulen
	Storage	Minimal in work zone	
Equipment	Access	Already in work zone from 13	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: North & South		
South limit	12' North of 302		
North limit	12' South of 307		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Beams brought in & Set from New Hulen		



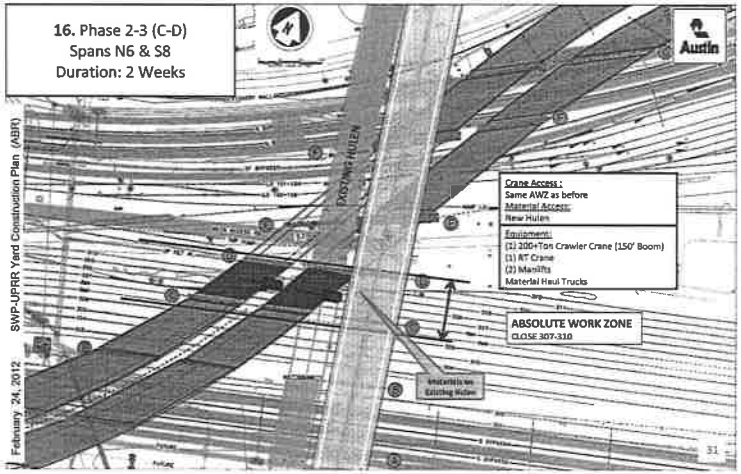
Austin Bridge and Road Construction Sequences

Sequence	15		
	Beam Removal (Lift 3) - Demolish Ex Hulen Span 7 (left)		
Phase 2 Stage	8		
Start Note:	Following Span N7		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Predecessors	Switch AWZ from 303-306 - 2 Days		
Tracks			
Not Constructed			
Inactive	307, 308, 309, 310		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A and New Hulen via Man basket during AWZ	
Material	Access	Small Materials	New Hulen
		Beams	New Hulen
	Storage	Minimal in work zone	
Equipment	Access	Walk over from 14	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: South		
South limit	12' North of 306		
North limit	Retaining Wall North of 310		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Remove Girders One at A Time,Lift to New Hulen and Haul off		



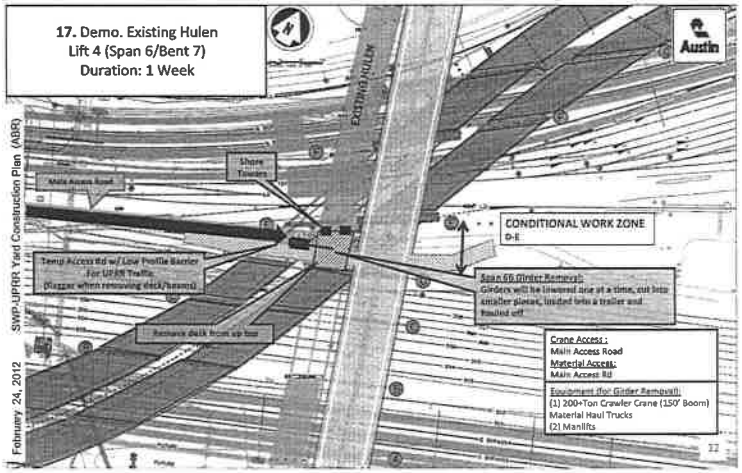
Austin Bridge and Road Construction Sequences

Sequence	16		
	Span C-D (N6, S8)		
Phase 2 Stage	3		
Start Note:	Following Beam Removal Span 7 (left)		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	N6, S8		
Deck	N6, S8		
Other			
Predecessors	Same AWZ as 15		
Tracks			
Not Constructed			
Inactive	307, 308, 309, 310		
Duration	2 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3A and New Hulen via Man basket during AWZ	
Material	Access	Small Materials	New Hulen
		Beams	New Hulen
	Storage	Minimal in work zone	
Equipment	Access	Same AWZ as 15	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: South		
South limit	12' North of 306		
North limit	Retaining Wall North of 310		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Beams brought in & Set from New Hulen		



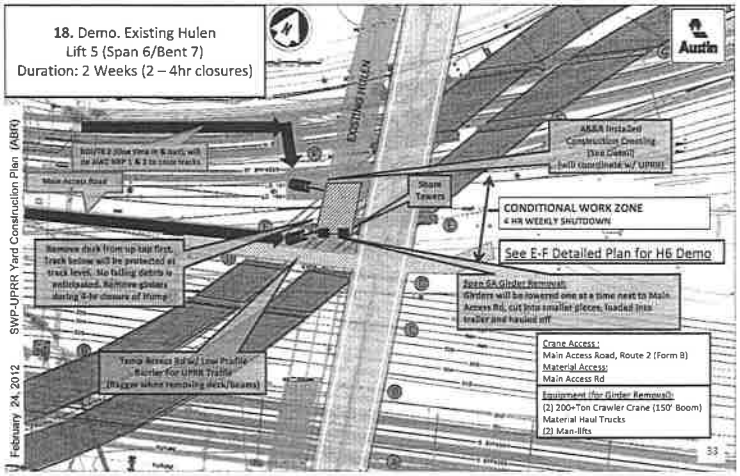
Austin Bridge and Road Construction Sequences

Sequence	17		
	Deck & Beam Removal (Lift 4) - Demolish Ex Hulen Span 6B & Bent 7		
Phase 2 Stage	8		
Start Note:	Following Spans N6 & S8		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive			
Duration	1 Week		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Rd	
Material	Access	Small Materials	Main Access Rd
		Beams	Egress: Main Access Rd
	Storage	Minimal in work zone	
Equipment	Access	Main Access Rd	
	Storage	In work Zone; Outside Limits Temp Detour	
Work Zone Delineation	Conditional		
Fencing	Construction Fencing: North		
South limit	Natural Slope/Wall		
North limit	12' South of Hump Lead		
New Hulen			
Operation Notes:	Deck removal anytime with flagger for vehicle traffic below.		
	Shore towers set up prior anytime to support remaining girders. Vehicle traffic on Temp Detour.		
	Beams lowered, set on truck and hauled off		



Austin Bridge and Road Construction Sequences

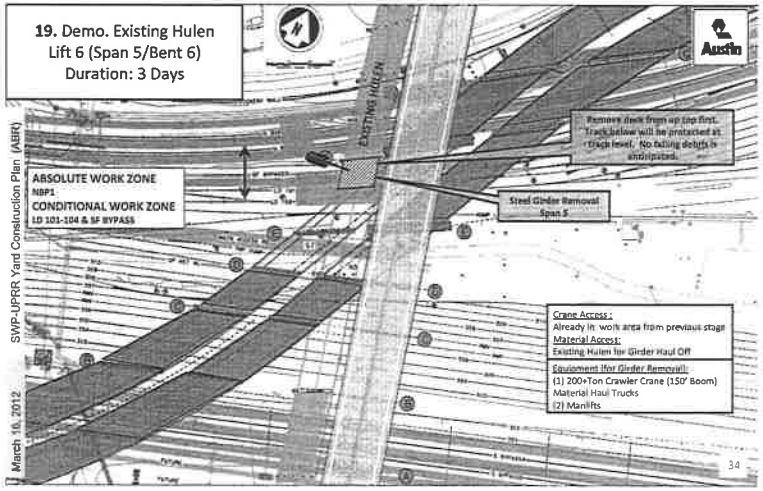
Sequence	18		
	Deck & Beam Removal (Lift 5) - Demolish Ex Hulen Span 6A		
Phase 2 Stage	8		
Start Note:	Following Removal Span 6B		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	SFBP3		
Duration	2 Weeks (2- 4hr Closures)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 2 & Main Access Rd	
Material	Access	Small Materials	Route 2 & Main Access Rd
		Beams	Egress: Route 2 & Main Access Rd
	Storage	Minimal in work zone	
Equipment	Access	Route 2 & Main Access Rd	
	Storage	In work Zone; Outside Limits of LD Tracks	
Work Zone Delineation	Conditional		
Fencing	Construction Fencing: North		
South limit	12' North of Hump LD		
North limit	12' South of NBP2		
New Hulen			
Operation Notes:	Two Cranes (One South of Bent Line E; the Other North of LD01-104); Beam Removal Performed During 4-HR closure of Hump LD. AB&R to Install construction crossing prior		
	Beams will be set on ground, cut and hauled off. See Detailed Demo Plan E-F Span 6. Deck removal anytime with track protection coordinated with UPRR		



Austin Bridge and Road Construction Sequences

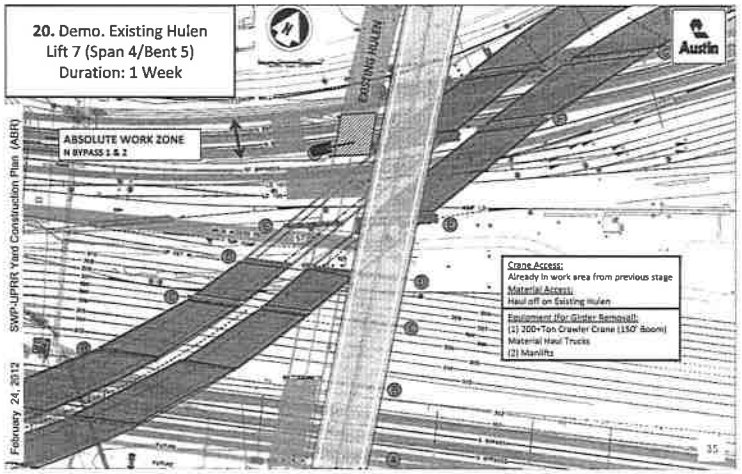
Sequence	19		
	Deck & Beam Removal (Lift 6) - Demolish Ex Hulen Span 5 & Bent 6		
Phase 2 Stage	8		
Start Note:	Following Removal Span 6		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	SFBP3 & NBP2		
Duration	3 Days (1/2 Week)		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 2	
Material	Access	Small Materials	Route 2
		Beams	Egress: Existing Hulen
	Storage	Minimal in work zone	
Equipment	Access	Route 2 (Crane already in work zone from previous activity)	
	Storage	In work Zone; Outside Limits of LD Tracks	
Work Zone Delineation	Conditional & Absolute		
Fencing	Construction Fencing: North		
South limit	12' North of Hump LD		
North limit	12' South of NBP1		
New Hulen			
Operation Notes:	Single Crane; Track Protection; Remove Girders One at A Time, Load on Truck on Existing Hulen and Haul off		
	Deck removal anytime with track protection coordinated with UPRR		

rev: 3/16/12



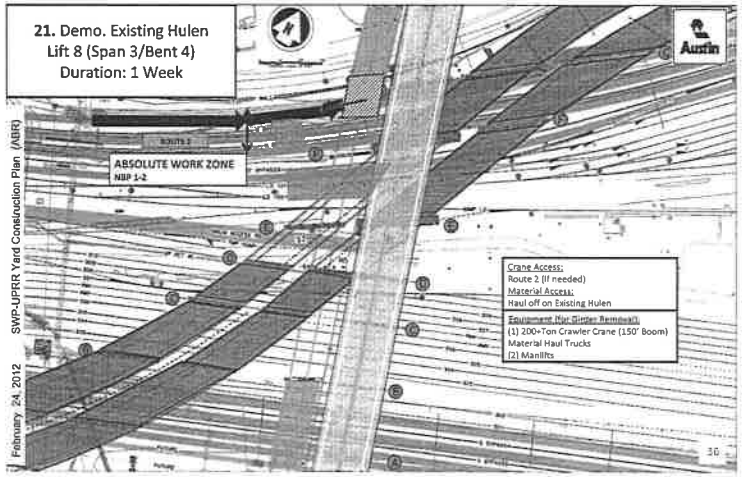
Austin Bridge and Road Construction Sequences

Sequence	20		
	Deck & Beam Removal (Lift 7) - Demolish Ex Hulen Span 4 & Bent 5		
Phase 2 Stage	8		
Start Note:	Following Removal Span 5		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	NBP1 & NBP2		
Duration	1 Week		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 2	
Material	Access	Small Materials	Route 2
		Beams	Egress: Existing Hulen
	Storage	Minimal in work zone	
Equipment	Access	Route 2 (already in work zone from 19	
	Storage	In work Zone; Outside Limits of LD Tracks	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: South		
South limit	12' North of SFBP3		
North limit	Unrestricted		
New Hulen			
Operation Notes:	Single Crane; Sits south of NBP2; Remove Girders One at A Time, Load on Truck on Existing Hulen and Hual Off		
	Deck removal anytime with track protection coordinated with UPRR		



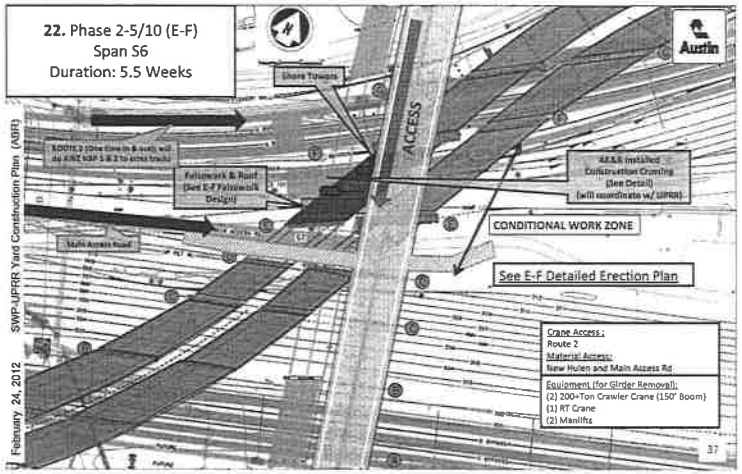
Austin Bridge and Road Construction Sequences

Sequence	21		
	Deck & Beam Removal (Lift 8) - Demolish Ex Hulen Span 3 & Bent 4		
Phase 2 Stage	8		
Start Note:	Following Removal Span 4		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	NBP1 & NBP2		
Duration	1 Week		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 2	
Material	Access	Small Materials	Route 2
		Beams	Egress: Existing Hulen
	Storage	Minimal in work zone	
Equipment	Access	Route 2 (already in work zone from 19)	
	Storage	In work Zone; Outside Limits of LD Tracks	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: South		
South limit	12' North of SFBP3		
North limit	Unrestricted		
New Hulen			
Operation Notes:	Single Crane; Sits North of NBP1 or on Vickery; Remove Girders One at A Time, Load on Truck on Existing Hulen and Hual Off		
	Deck removal anytime with track protection coordinated with UPRR		



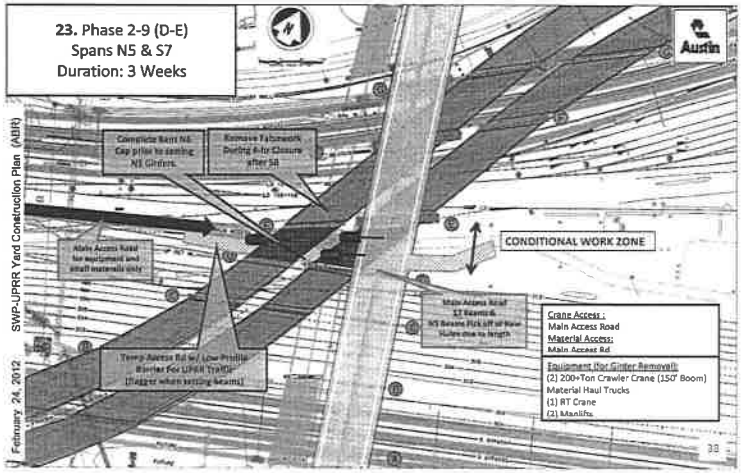
Austin Bridge and Road Construction Sequences

Sequence	22		
	Span E-F (S6)		
Phase 2 Stage:	5 & 10		
Start Note:	Following Removal of Hulen Span 4 & Bent 5		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	S6		
Deck	S6		
Other			
Tracks			
Not Constructed			
Inactive	SFBP3		
Duration	5.5 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 2 & Main Access Road	
Material	Access	Small Materials	New Hulen, Route 2 & Main Access Road
		Beams	New Hulen
	Storage	Minimal in work zone	
Equipment	Access	Route 2 (Main Access Rd)	
	Storage	Work Zone (Outside Limits of LD Tracks)	
Work Zone Delineation	Conditional		
Fencing	Construction Fencing: North		
South limit	12' North of Hump LD		
North limit	12' South of NBP2		
New Hulen			
Operation Notes:	See Detailed Erecton Plane E-F - Span S6 (Two Cranes Needed for part of the lift, the others just need one crane)		
	See Detailed Falsework and "Roof" Design		
	AB&R will install Construction Crossing prior		



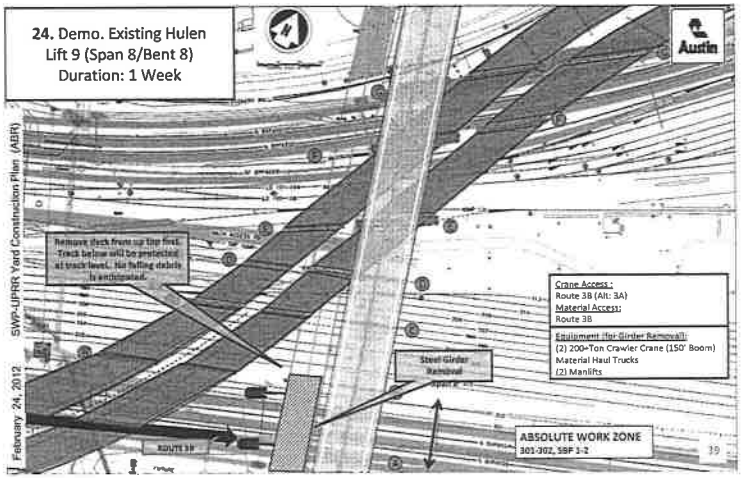
Austin Bridge and Road Construction Sequences

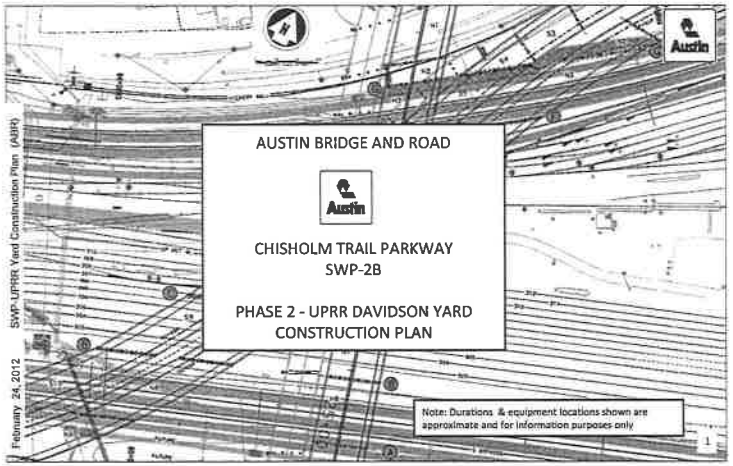
Sequence	23		
	Span D-E (N5 & S7)		
Phase 2 Stage	9		
Start Note:	Following E-F (Span S6)		
Construction			
Drill Shafts			
Columns			
Caps			
Beams	N5, S7		
Deck	N5, S7		
Other			
Tracks			
Not Constructed			
Inactive			
Duration	3 Weeks		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Main Access Road	
Material	Access	Small Materials	Main Access Road
		Beams	New Hulen (Beams too long for Main Access Rd)
	Storage	Minimal in work zone	
Equipment	Access	Main Access Road	
	Storage	In work Zone; Outside Main Access Road	
Work Zone Delineation	Conditional		
Fencing	Construction Fencing: North		
South limit	Natural slope/Retaining Wall		
North limit	12' South of Hump LD		
New Hulen			
Operation Notes:	Two Cranes; Beams come in on New Hulen		

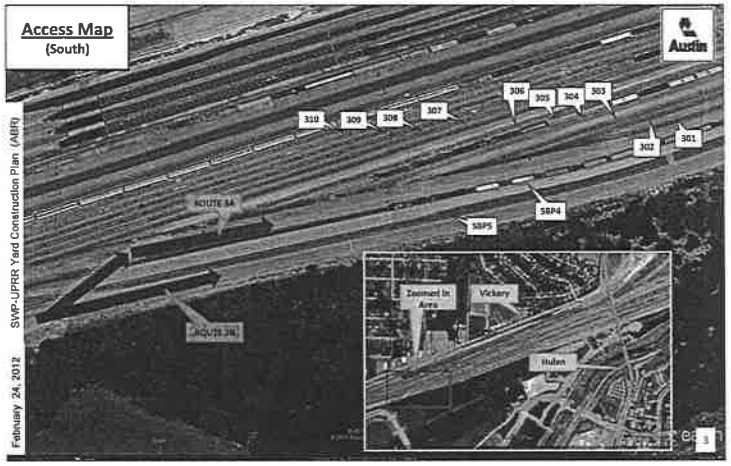


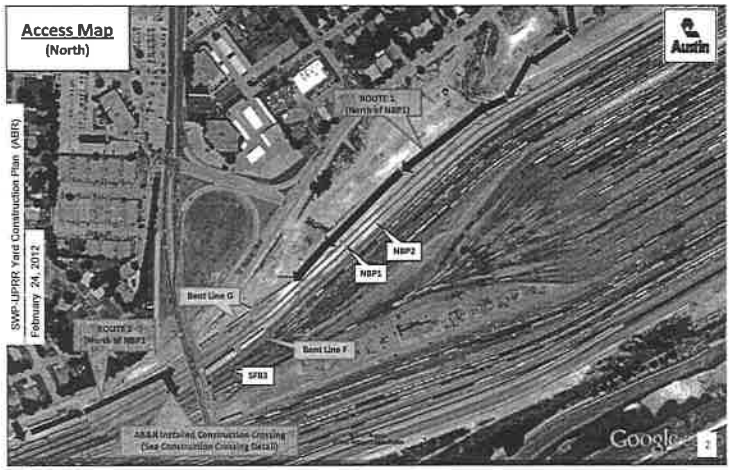
Austin Bridge and Road Construction Sequences

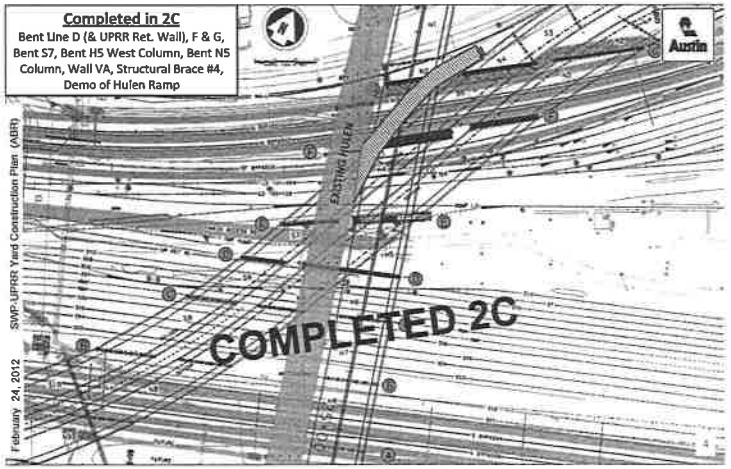
Sequence	24		
	Deck & Beam Removal (Lift 9) - Demolish Ex Hulen Span 8 & Bent 8		
Phase 2 Stage	8		
Start Note:	Following Spans N5 & S7		
Construction			
Drill Shafts			
Columns			
Caps			
Beams			
Deck			
Other			
Tracks			
Not Constructed			
Inactive	SBP 4 & 5, 301, 302		
Duration	1 Week		
	Note: Durations are approximate and for informational purposes only		
Resources			
Labor	Access	Route 3B	
Material	Access	Small Materials	Route 3B
		Beams	Route 3B
	Storage	Stage beams, cut and haul off in work zone	
Equipment	Access	Route 3B	
	Storage	In work Zone	
Work Zone Delineation	Absolute		
Fencing	Construction Fencing: North		
South limit	Unrestricted		
North limit	12' South of 303		
New Hulen			
Operation Notes:	Two Cranes; Track Protection; Remove Girders One at Time; Set on Ground, Cut in Half and haul off		
	Deck removal will precede beam removal; track protection		

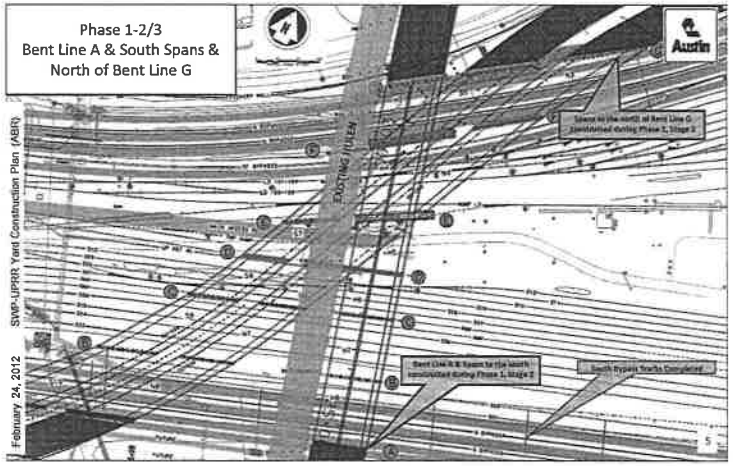


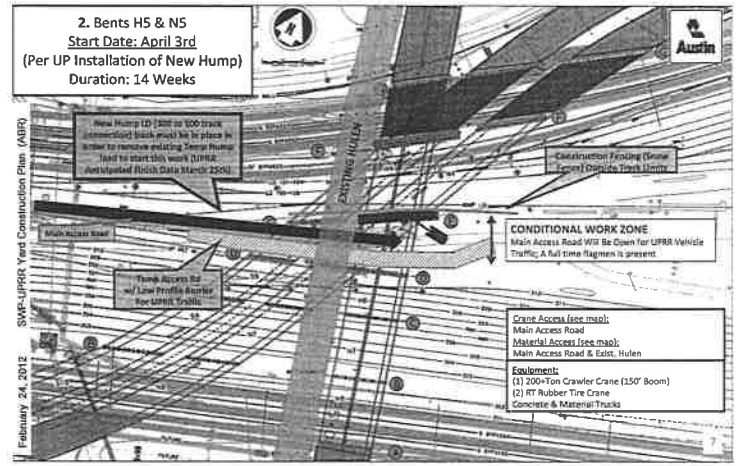

AUSTIN BRIDGE AND ROAD
Austin
CHISHOLM TRAIL PARKWAY
SWP-2B
PHASE 2 - UPRR DAVIDSON YARD
CONSTRUCTION PLAN
Note: Durations & equipment locations shown are approximate and for information purposes only
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
1

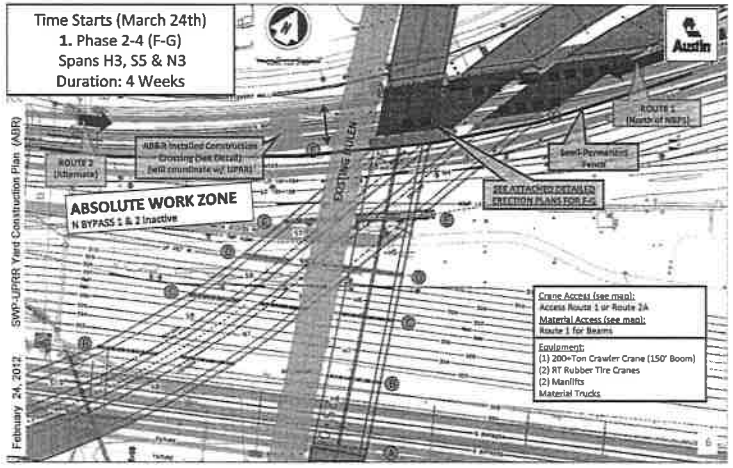

Access Map
(South)
Austin
310
309
308
307
306
305
304
303
302
301
ROUTE 3A
ROUTE 3B
SBP4
SBP5
Zoomed In Area
Vickery
Hulen
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
3

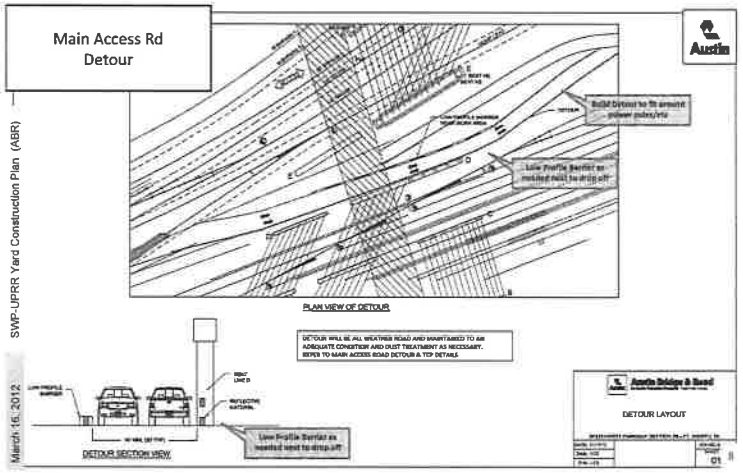

Access Map
(North)
Austin
ROUTE 1
(North of NBP1)
NBP2
NBP1
Bent Line G
Bent Line F
SPB3
ROUTE 2
(North of NBP1)
AA&M Installed Construction Crossing
(See Construction Crossing Detail)
Google
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
2


Completed in 2C
Bent Line D (& UPRR Ret. Wall), F & G, Bent S7, Bent H5 West Column, Bent N5 Column, Wall VA, Structural Brace #4, Demo of Hulen Ramp
Austin
EXISTING HULEN
COMPLETED 2C
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
4

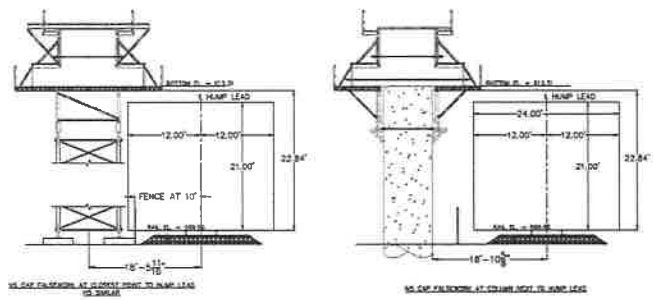

Phase 1-2/3
Bent Line A & South Spans &
North of Bent Line G
Austin
EXISTING HULEN
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012


2. Bents H5 & N5
Start Date: April 3rd
(Per UP Installation of New Hump)
Duration: 14 Weeks
Austin
EXISTING HULEN
CONDITIONAL WORK ZONE
Main Access Road Will Be Open for UPRR Vehicle Traffic; A full time flagmen is present.
Crane Access (see map):
Main Access Road
Material Access (see map):
Main Access Road & Exist. Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom)
(2) RT Rubber Tire Crane
Concrete & Material Trucks
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012


Time Starts (March 24th)
1. Phase 2-4 (F-G)
Spans H3, S5 & N3
Duration: 4 Weeks
Austin
EXISTING HULEN
ROUTE 1
(North of NSPS)
ROUTE 2
(Alternate)
ABSOLUTE WORK ZONE
N BYPASS 1 & 2 Inactive
SEE ATTACHED DETAILED ERECTION PLANS FOR F-G
Crane Access (see map):
Access Route 1 or Route 2A
Material Access (see map):
Route 1 for Beams
Equipment:
(1) 200+Ton Crawler Crane (150' Boom)
(2) RT Rubber Tire Cranes
(2) Manlifts
Material Trucks
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012


Main Access Rd
Detour
Austin
PLAN VIEW OF DETOUR
DETOUR SECTION VIEW
DETOUR LAYOUT
SWP-UPRR Yard Construction Plan (ABR)
March 16, 2012

H5 & N5 CAP FALSEWORK CLEARANCE FROM HUMP LEAD

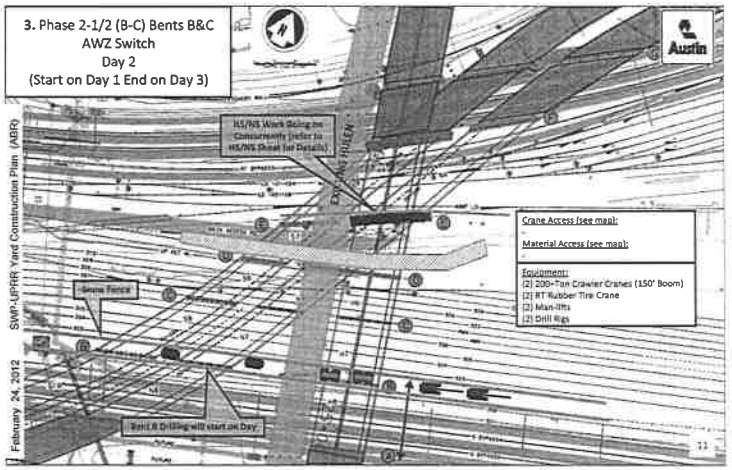


SWP-UPRR Yard Construction Plan (ABR)

February 24, 2012

9

3. Phase 2-1/2 (B-C) Bents B&C AWZ Switch Day 2 (Start on Day 1 End on Day 3)

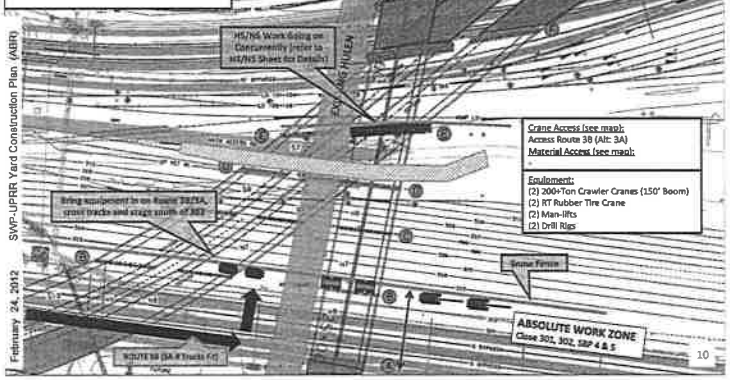


SWP-UPRR Yard Construction Plan (ABR)

February 24, 2012

11

3. Phase 2-1/2 (B-C) Bents B&C Access Day 1

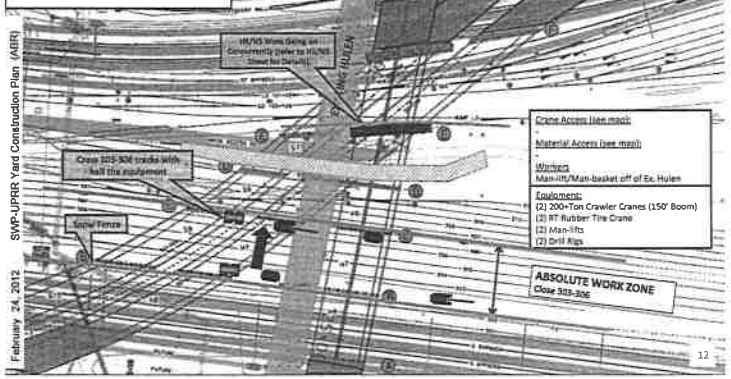


SWP-UPRR Yard Construction Plan (ABR)

February 24, 2012

10

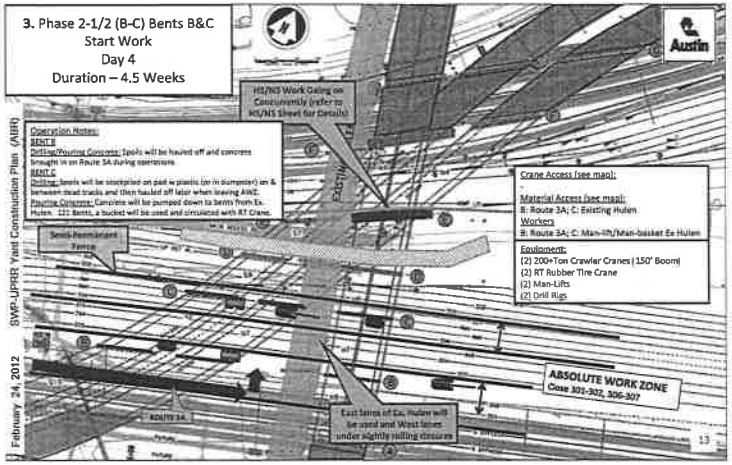
3. Phase 2-1/2 (B-C) Bents B&C Access Day 3

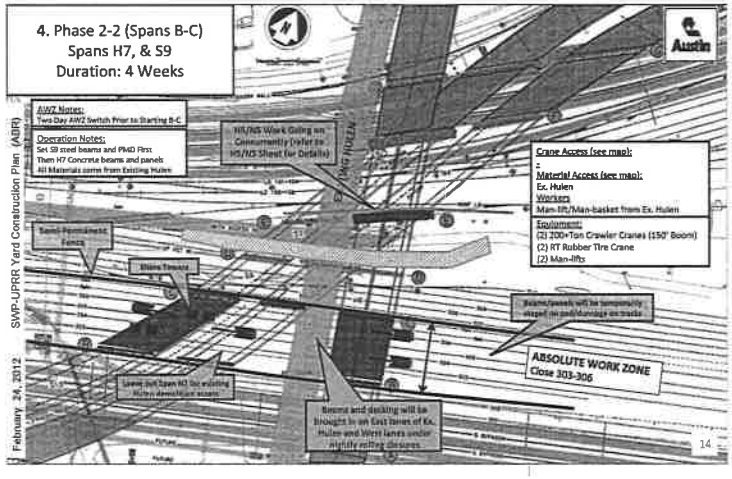


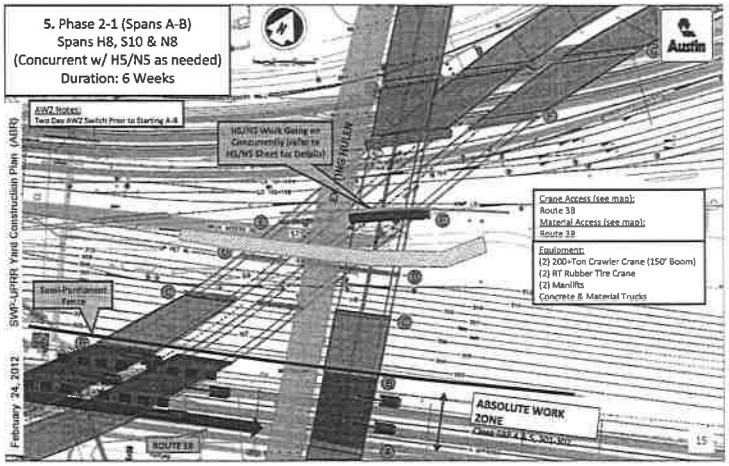
SWP-UPRR Yard Construction Plan (ABR)

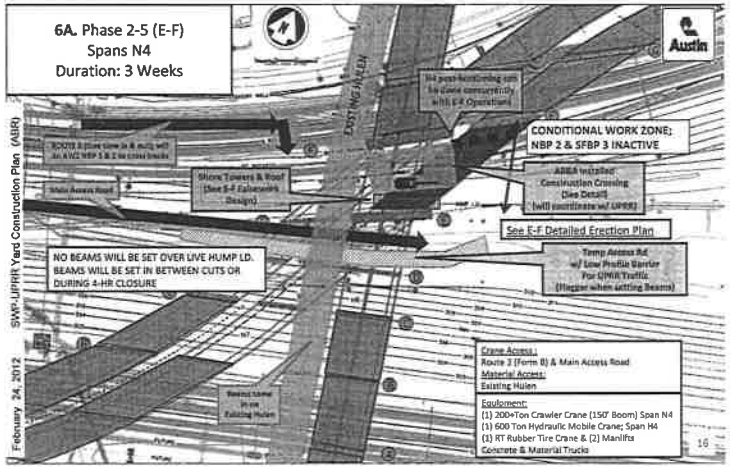
February 24, 2012

12


3. Phase 2-1/2 (B-C) Bents B&C
Start Work
Day 4
Duration – 4.5 Weeks
H5/N5 Work Going on Concurrently (refer to H5/N5 Sheet for Details)
Operation Notes:
BENT B
Drilling/Pouring Concrete: Spoils will be hauled off and concrete brought in on Route 3A during operations
BENT C
Drilling: Spoils will be stockpiled on pad w plastic (in in dumpster) on & between dead tracks and then hauled off later when leaving AWZ.
Pouring Concrete: Concrete will be pumped down to bents from Ex. Hulen. ??? Bents, a bucket will be used and circulated with RT Crane.
Crane Access (see map):
Material Access (see map):
B: Route 3A; C: Existing Hulen
Workers
B: Route 3A; C: Man-lift/Man-basket Ex Hulen
Equipment:
(2) 200+Ton Crawler Cranes (150' Boom)
(2) RT Rubber Tire Crane
(2) Man-Lifts
(2) Drill Rigs
Semi-Permanent Fence
ABSOLUTE WORK ZONE
Close 301-302, 306-307
East lanes of Ex. Hulen will be used and West lanes under nightly rolling closures
ROUTE 3A
EXISTING HULEN
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
13


4. Phase 2-2 (Spans B-C)
Spans H7, & S9
Duration: 4 Weeks
AWZ Notes:
Two Day AWZ Switch Prior to Starting B-C
Operation Notes:
Set S9 steel beams and PMD First
Then H7 Concrete beams and panels
All Materials come from Existing Hulen
H5/N5 Work Going on Concurrently (refer to H5/N5 Sheet for Details)
Crane Access (see map):
Material Access (see map):
Ex. Hulen
Workers
Man-lift/Man-basket from Ex. Hulen
Equipment:
(2) 200+Ton Crawler Cranes (150' Boom)
(2) RT Rubber Tire Crane
(2) Man-lifts
Semi-Permanent Fence
Slope Towers
Beams/panels will be temporarily staged on pad/storage on tracks
ABSOLUTE WORK ZONE
Close 303-306
Leave out Span N7 for existing Hulen demolition access
Beams and decking will be brought in on East lanes of Ex. Hulen and West lanes under nightly rolling closures
EXISTING HULEN
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
14


5. Phase 2-1 (Spans A-B)
Spans H8, S10 & N8
(Concurrent w/ H5/N5 as needed)
Duration: 6 Weeks
AWZ Notes:
Two Day AWZ Switch Prior to Starting A-B
H5/N5 Work Going on Concurrently (refer to H5/N5 Sheet for Details)
Crane Access (see map):
Route 3B
Material Access (see map):
Route 3B
Equipment:
(2) 200+Ton Crawler Crane (150' Boom)
(2) RT Rubber Tire Crane
(2) Manlifts
Concrete & Material Trucks
Semi-Permanent Fence
ABSOLUTE WORK ZONE
ROUTE 3B
EXISTING HULEN
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
15


6A. Phase 2-5 (E-F)
Spans N4
Duration: 3 Weeks
No post-tensioning can be done concurrently with E-F Operations
CONDITIONAL WORK ZONE:
NBP 2 & SFBP 3 INACTIVE
ABER Installed Construction Crossing (See Detail) (will coordinate w/ UPRR)
See E-F Detailed Erection Plan
Temp Access Rd w/ Low Profile Barrier For UPRR Traffic (Flagger when setting Beams)
Slope Towers & Roof (See E-F Falsework Design)
NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET IN BETWEEN CUTS OR DURING 4-HR CLOSURE
Beams Stored in the Existing Hulen
Crane Access:
Route 3 (Form B) & Main Access Road
Material Access:
Existing Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom) Span N4
(1) 600 Ton Hydraulic Mobile Crane; Span H4
(1) RT Rubber Tire Crane & (2) Manlifts
Concrete & Material Trucks
EXISTING HULEN
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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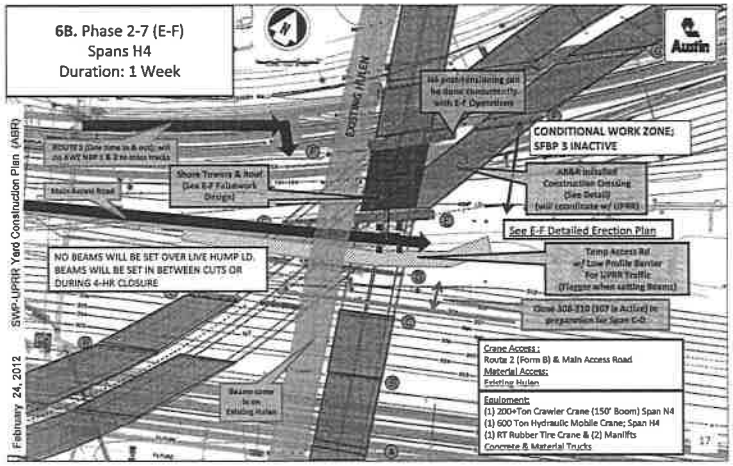
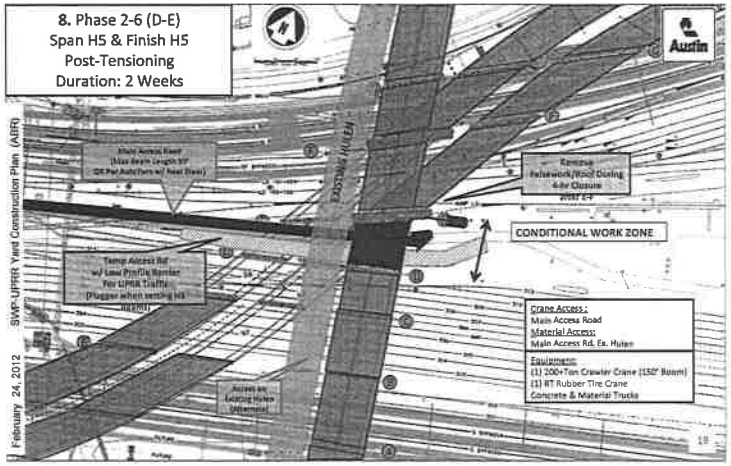
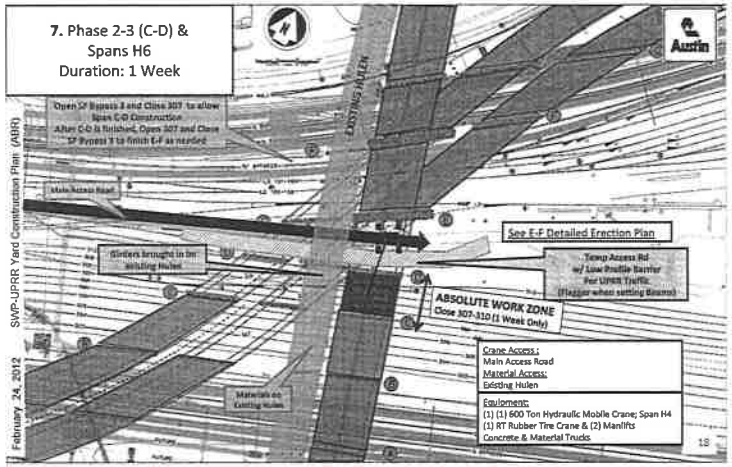
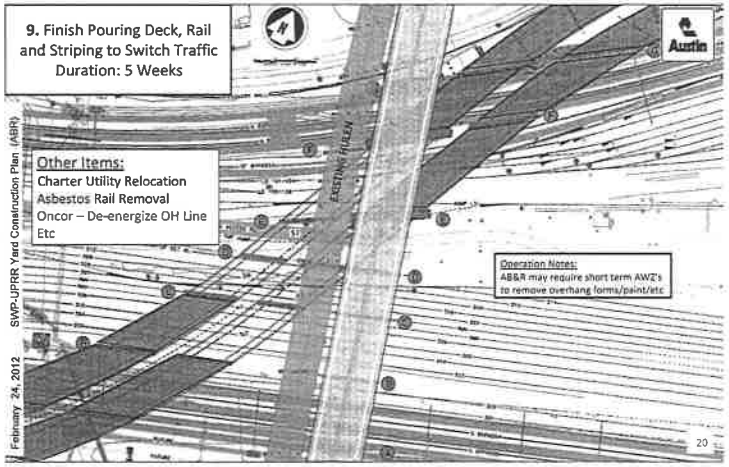

6B. Phase 2-7 (E-F)
Spans H4
Duration: 1 Week
Austin
EXISTING HULEN
CONDITIONAL WORK ZONE; SFBP 3 INACTIVE
See E-F Detailed Erection Plan
NO BEAMS WILL BE SET OVER LIVE HUMP LD. BEAMS WILL BE SET IN BETWEEN CUTS OR DURING 4-HR CLOSURE
Crane Access:
Route 2 (Form B) & Main Access Road
Material Access:
Existing Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom) Span N4
(1) 600 Ton Hydraulic Mobile Crane; Span H4
(1) RT Rubber Tire Crane & (2) Manlifts
Concrete & Material Trucks
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
17


8. Phase 2-6 (D-E)
Span H5 & Finish H5
Post-Tensioning
Duration: 2 Weeks
Austin
EXISTING HULEN
CONDITIONAL WORK ZONE
Crane Access:
Main Access Road
Material Access:
Main Access Rd. Ex. Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom)
(1) RT Rubber Tire Crane
Concrete & Material Trucks
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
19


7. Phase 2-3 (C-D) &
Spans H6
Duration: 1 Week
Austin
EXISTING HULEN
See E-F Detailed Erection Plan
ABSOLUTE WORK ZONE
Close 307-310 (1 Week Only)
Crane Access:
Main Access Road
Material Access:
Existing Hulen
Equipment:
(1) (1) 600 Ton Hydraulic Mobile Crane; Span H4
(1) RT Rubber Tire Crane & (2) Manlifts
Concrete & Material Trucks
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
18


9. Finish Pouring Deck, Rail
and Striping to Switch Traffic
Duration: 5 Weeks
Austin
EXISTING HULEN
Other Items:
Charter Utility Relocation
Asbestos Rail Removal
Oncor – De-energize OH Line
Etc
Operation Notes:
AB&R may require short term AWZ's
to remove overhang forms/paint/etc
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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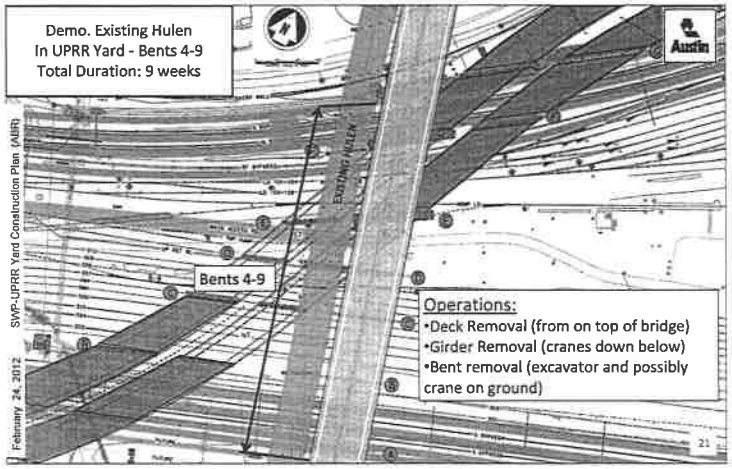
Demo. Existing Hulen
In UPRR Yard - Bents 4-9
Total Duration: 9 weeks
Austin
Bents 4-9
Operations:
•Deck Removal (from on top of bridge)
•Girder Removal (cranes down below)
•Bent removal (excavator and possibly crane on ground)
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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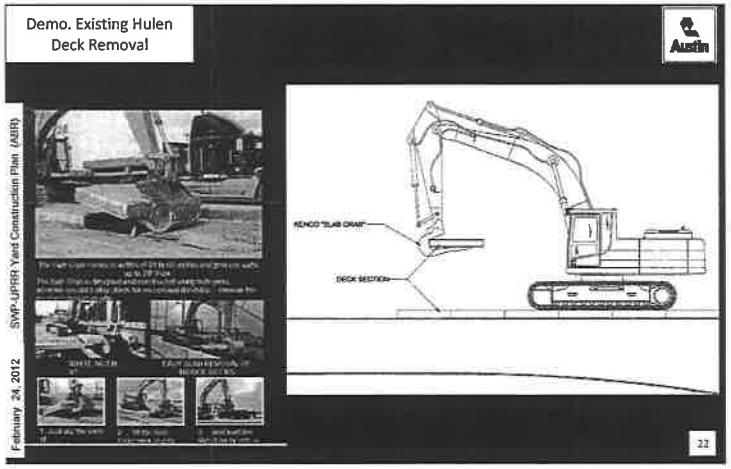
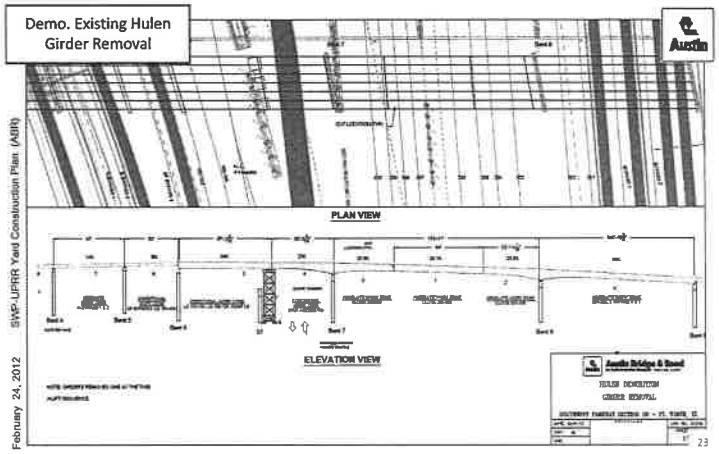
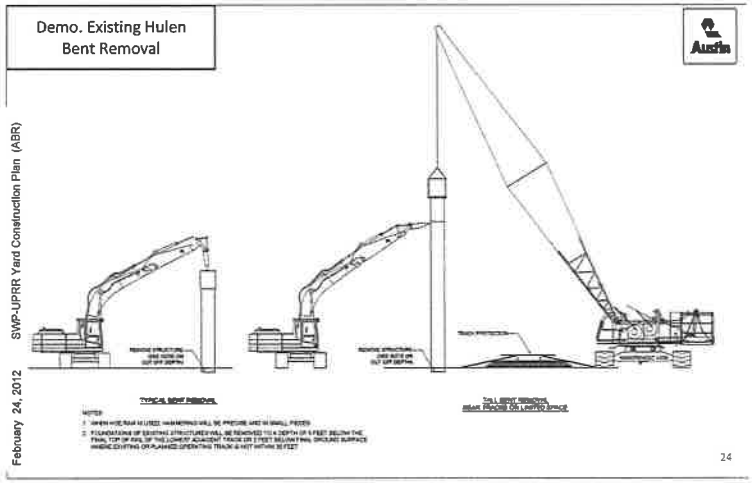
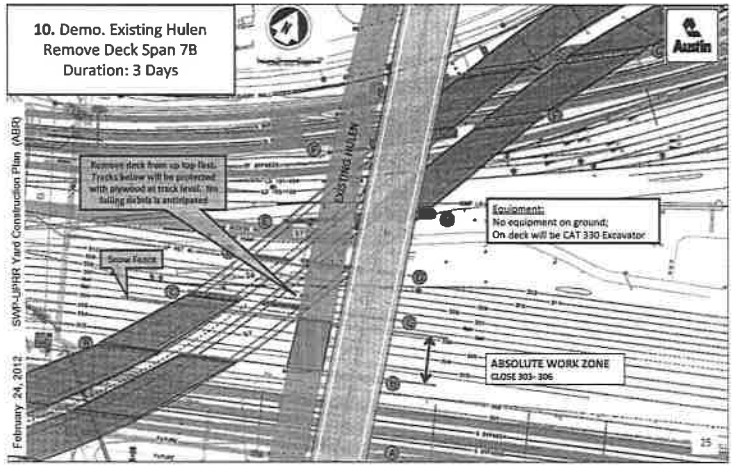
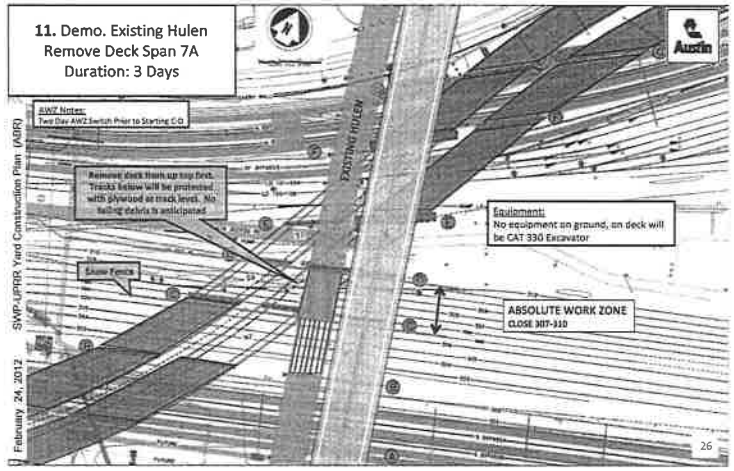
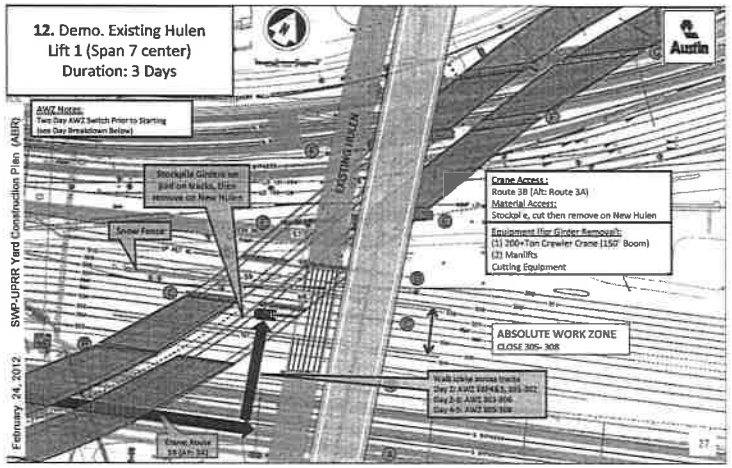

Demo. Existing Hulen
Deck Removal
Austin
KENCO "SLAB CRAB"
DECK SECTION
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
22

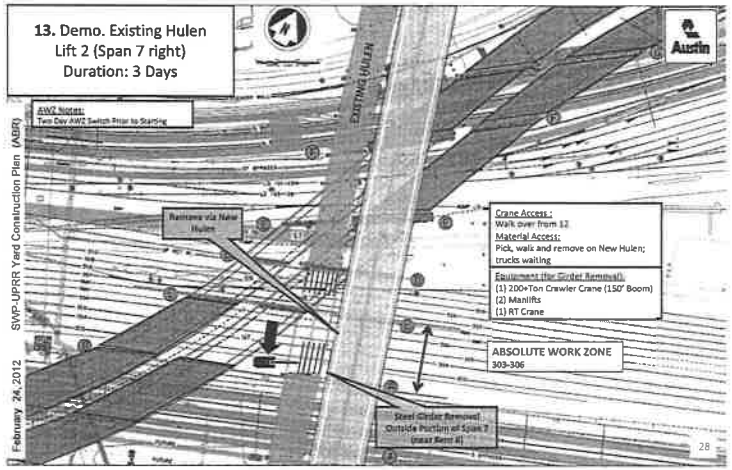

Demo. Existing Hulen
Girder Removal
Austin
PLAN VIEW
ELEVATION VIEW
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
23


Demo. Existing Hulen
Bent Removal
Austin
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
24


10. Demo. Existing Hulen
Remove Deck Span 7B
Duration: 3 Days
Austin
EXISTING HULEN
Remove deck from up top first. Tracks below will be protected with plywood at track level. No falling debris is anticipated
Snow Fence
Equipment:
No equipment on ground;
On deck will be CAT 330 Excavator
ABSOLUTE WORK ZONE
CLOSE 303- 306
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
25


11. Demo. Existing Hulen
Remove Deck Span 7A
Duration: 3 Days
Austin
EXISTING HULEN
AWZ Notes:
Two Day AWZ Switch Prior to Starting C-D
Remove deck from up top first. Tracks below will be protected with plywood at track level. No falling debris is anticipated
Snow Fence
Equipment:
No equipment on ground, on deck will be CAT 330 Excavator
ABSOLUTE WORK ZONE
CLOSE 307-310
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
26


12. Demo. Existing Hulen
Lift 1 (Span 7 center)
Duration: 3 Days
Austin
EXISTING HULEN
AWZ Notes:
Two Day AWZ Switch Prior to Starting
(see Day Breakdown Below)
Stockpile Girders on pad on tracks, then remove on New Hulen
Snow Fence
Crane Access:
Route 3B (Alt: Route 3A)
Material Access:
Stockpile, cut then remove on New Hulen
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
(2) Manlifts
Cutting Equipment
ABSOLUTE WORK ZONE
CLOSE 305- 308
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
27


13. Demo. Existing Hulen
Lift 2 (Span 7 right)
Duration: 3 Days
Austin
EXISTING HULEN
AWZ Notes:
Two Day AWZ Switch Prior to Starting
Remove via New Hulen
Crane Access:
Walk over from 12
Material Access:
Pick, walk and remove on New Hulen; trucks waiting
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
(2) Manlifts
(1) RT Crane
ABSOLUTE WORK ZONE
303-306
Steel Girder Removal Outside Portion of Span 7 (near Bent 8)
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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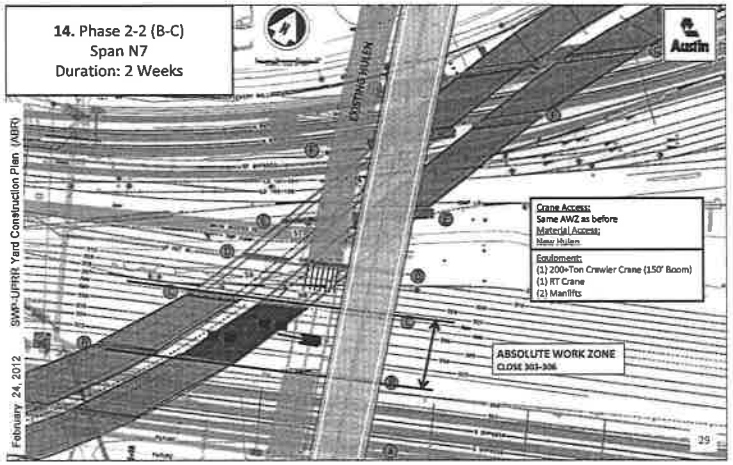
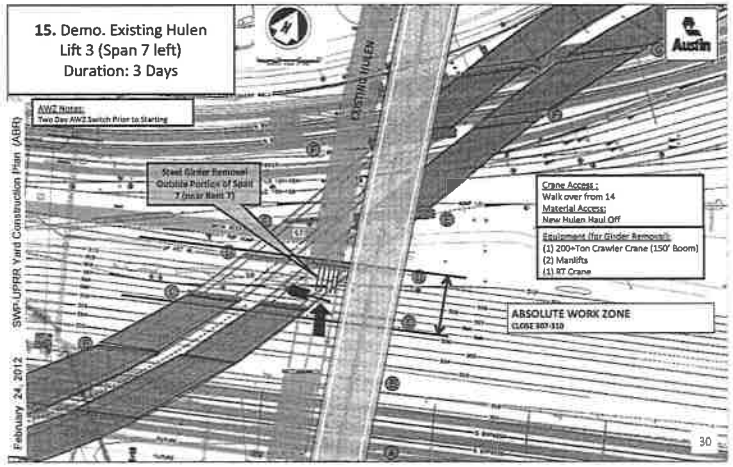
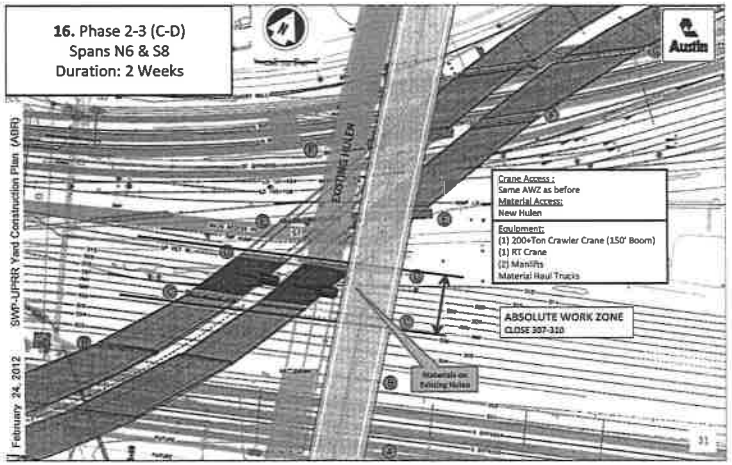
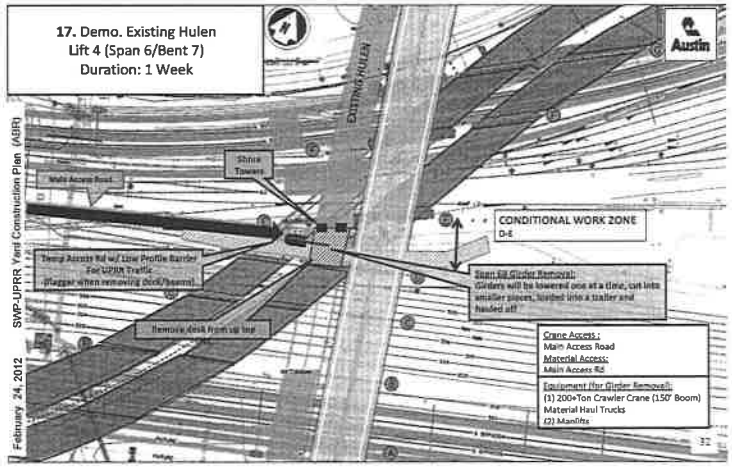
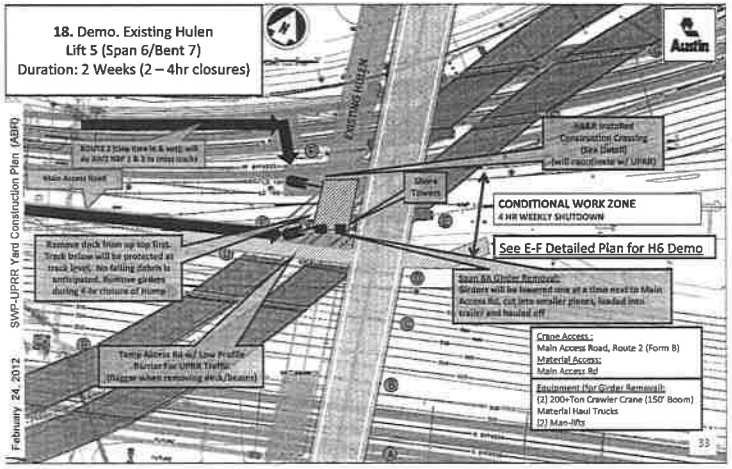
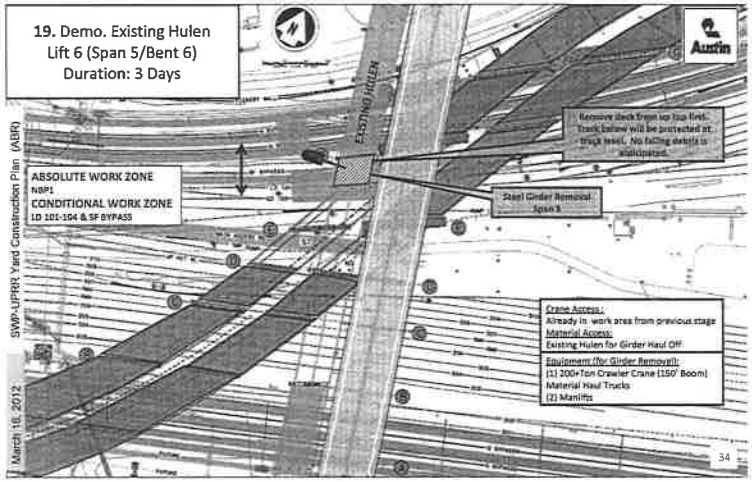

14. Phase 2-2 (B-C)
Span N7
Duration: 2 Weeks
Austin
EXISTING HULEN
Crane Access:
Same AWZ as before
Material Access:
New Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom)
(1) RT Crane
(2) Manlifts
ABSOLUTE WORK ZONE
CLOSE 303-306
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
29

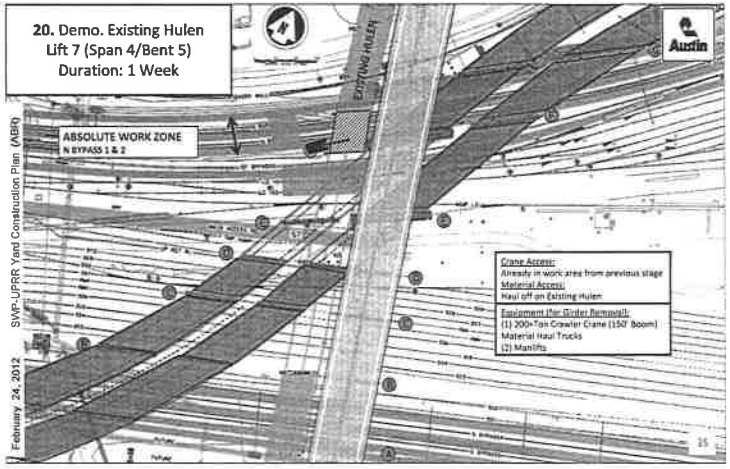

15. Demo. Existing Hulen
Lift 3 (Span 7 left)
Duration: 3 Days
Austin
EXISTING HULEN
AWZ Notes:
Two Day AWZ Switch Prior to Starting
Steel Girder Removal
Outside Portion of Span
7 (near Bent 7)
Crane Access :
Walk over from 14
Material Access:
New Hulen Haul Off
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
(2) Manlifts
(1) RT Crane
ABSOLUTE WORK ZONE
CLOSE 307-310
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
30

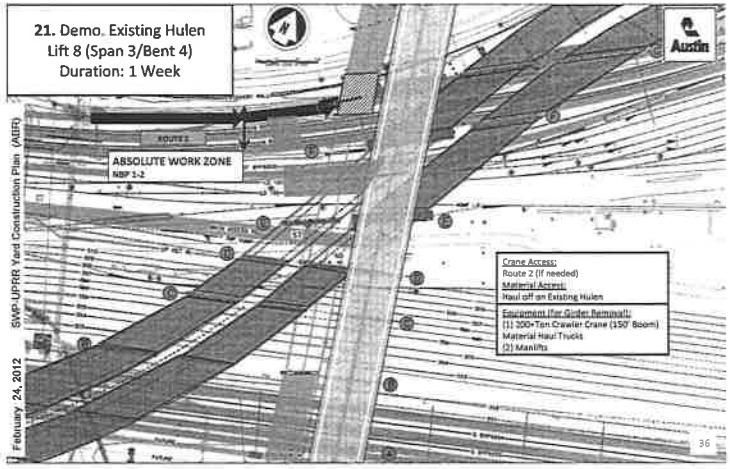

16. Phase 2-3 (C-D)
Spans N6 & S8
Duration: 2 Weeks
Austin
EXISTING HULEN
Crane Access :
Same AWZ as before
Material Access:
New Hulen
Equipment:
(1) 200+Ton Crawler Crane (150' Boom)
(1) RT Crane
(2) Manlifts
Material Haul Trucks
ABSOLUTE WORK ZONE
CLOSE 307-310
Materials on
Existing Hulen
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
31

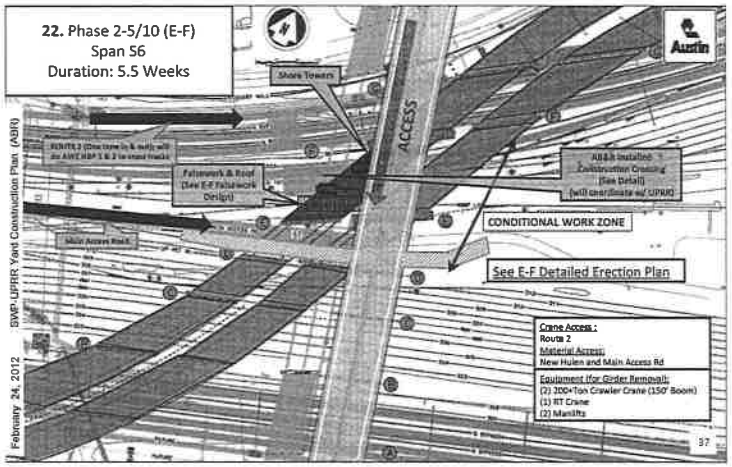

17. Demo. Existing Hulen
Lift 4 (Span 6/Bent 7)
Duration: 1 Week
Austin
EXISTING HULEN
Shine
Towers
Main Access Road
CONDITIONAL WORK ZONE
D-E
Temp Access Rd w/ Low Profile Barrier
For UPRR Traffic
(Flagger when removing deck/beams)
Span 6B Girder Removal:
Girders will be lowered one at a time, cut into
smaller pieces, loaded into a trailer and
hauled off
Remove deck from up top
Crane Access :
Main Access Road
Material Access:
Main Access Rd
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Manlifts
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
32


18. Demo. Existing Hulen
Lift 5 (Span 6/Bent 7)
Duration: 2 Weeks (2 – 4hr closures)
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
Austin
EXISTING HULEN
Main Access Road
Shore Towers
CONDITIONAL WORK ZONE
4 HR WEEKLY SHUTDOWN
See E-F Detailed Plan for H6 Demo
Remove deck from up top first. Track below will be protected at track level. No falling debris is anticipated. Runtime girders during 4 hr closure of Hulen
Crane Access:
Main Access Road, Route 2 (Form B)
Material Access:
Main Access Rd
Equipment (for Girder Removal):
(2) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Man-lifts
33


19. Demo. Existing Hulen
Lift 6 (Span 5/Bent 6)
Duration: 3 Days
SWP-UPRR Yard Construction Plan (ABR)
March 16, 2012
Austin
EXISTING HULEN
ABSOLUTE WORK ZONE
NBP1
CONDITIONAL WORK ZONE
ID 101-104 & SF BYPASS
Remove deck from up top first. Track below will be protected at track level. No falling debris is anticipated.
Steel Girder Removal Span 5
Crane Access:
Already in work area from previous stage
Material Access:
Existing Hulen for Girder Haul Off
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Manlifts
34


20. Demo. Existing Hulen
Lift 7 (Span 4/Bent 5)
Duration: 1 Week
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
Austin
EXISTING HULEN
ABSOLUTE WORK ZONE
N BYPASS 1 & 2
Crane Access:
Already in work area from previous stage
Material Access:
Haul off on Existing Hulen
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Manlifts
35


21. Demo. Existing Hulen
Lift 8 (Span 3/Bent 4)
Duration: 1 Week
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
Austin
ROUTE 2
ABSOLUTE WORK ZONE
NBP 1-2
Crane Access:
Route 2 (if needed)
Material Access:
Haul off on Existing Hulen
Equipment (for Girder Removal):
(1) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Manlifts
36


22. Phase 2-5/10 (E-F)
Span S6
Duration: 5.5 Weeks
Shore Towers
ACCESS
Falsework & Roof (See E-F Falsework Design)
CONDITIONAL WORK ZONE
See E-F Detailed Erection Plan
Crane Access :
Route 2
Material Access:
New Hulen and Main Access Rd
Equipment (for Girder Removal):
(2) 200+Ton Crawler Crane (150' Boom)
(1) RT Crane
(2) Manlifts
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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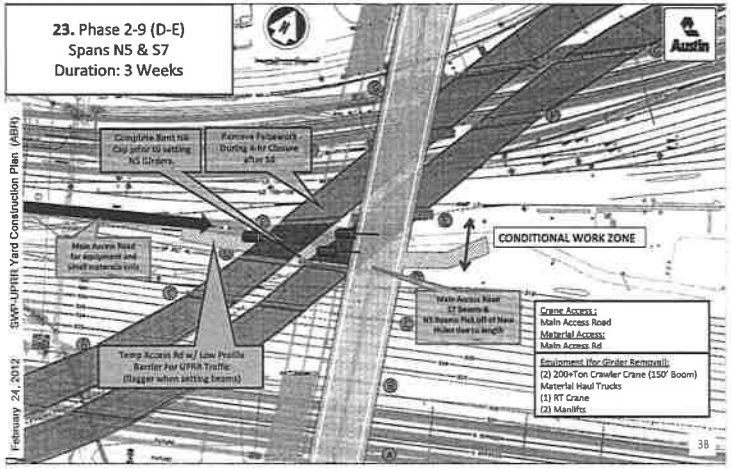
23. Phase 2-9 (D-E)
Spans N5 & S7
Duration: 3 Weeks
Complete Bent N4 Cap prior to setting N5 Girders
Remove Falsework During 4-hr Closure after S6
Main Access Road for equipment and small materials only
CONDITIONAL WORK ZONE
Temp Access Rd w/ Low Profile Barrier For UPRR Traffic (Flagger when setting beams)
Crane Access :
Main Access Road
Material Access:
Main Access Rd
Equipment (for Girder Removal):
(2) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(1) RT Crane
(2) Manlifts
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
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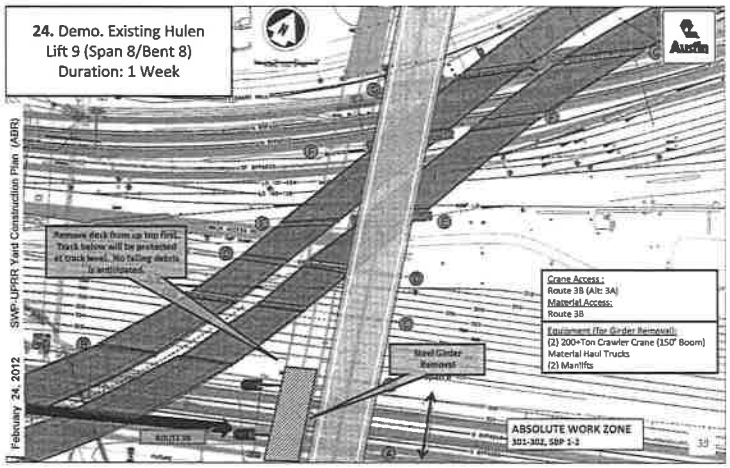
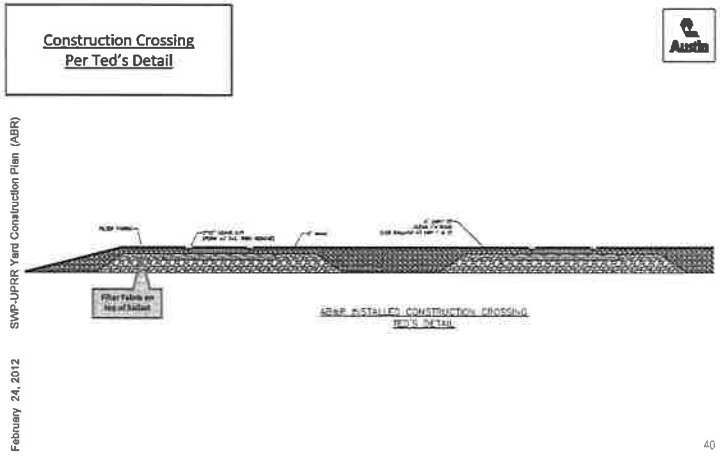
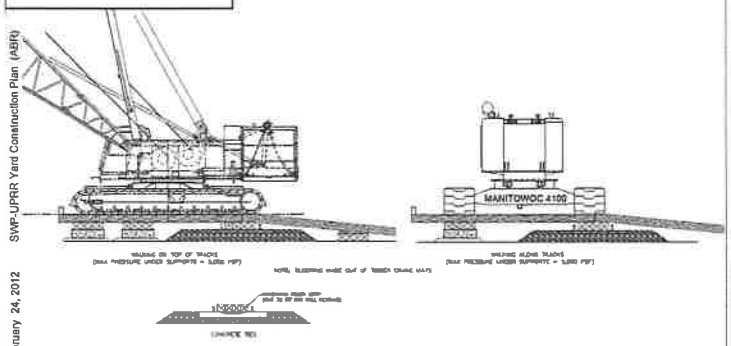
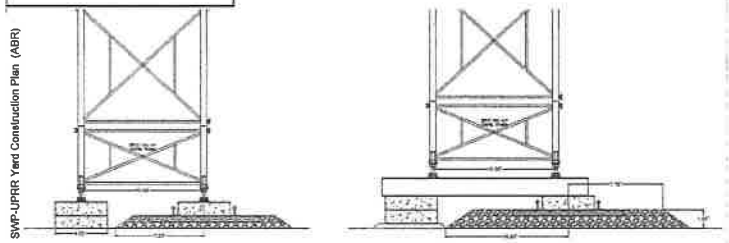

24. Demo. Existing Hulen Lift 9 (Span 8/Bent 8)
Duration: 1 Week
Remove deck from up top first. Track below will be protected at track level. No falling debris is anticipated.
Steel Girder Removal Operation
ABSOLUTE WORK ZONE
301-302, SBP 1-2
Crane Access :
Route 3B (Alt: 3A)
Material Access:
Route 3B
Equipment (for Girder Removal):
(2) 200+Ton Crawler Crane (150' Boom)
Material Haul Trucks
(2) Manlifts
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
39

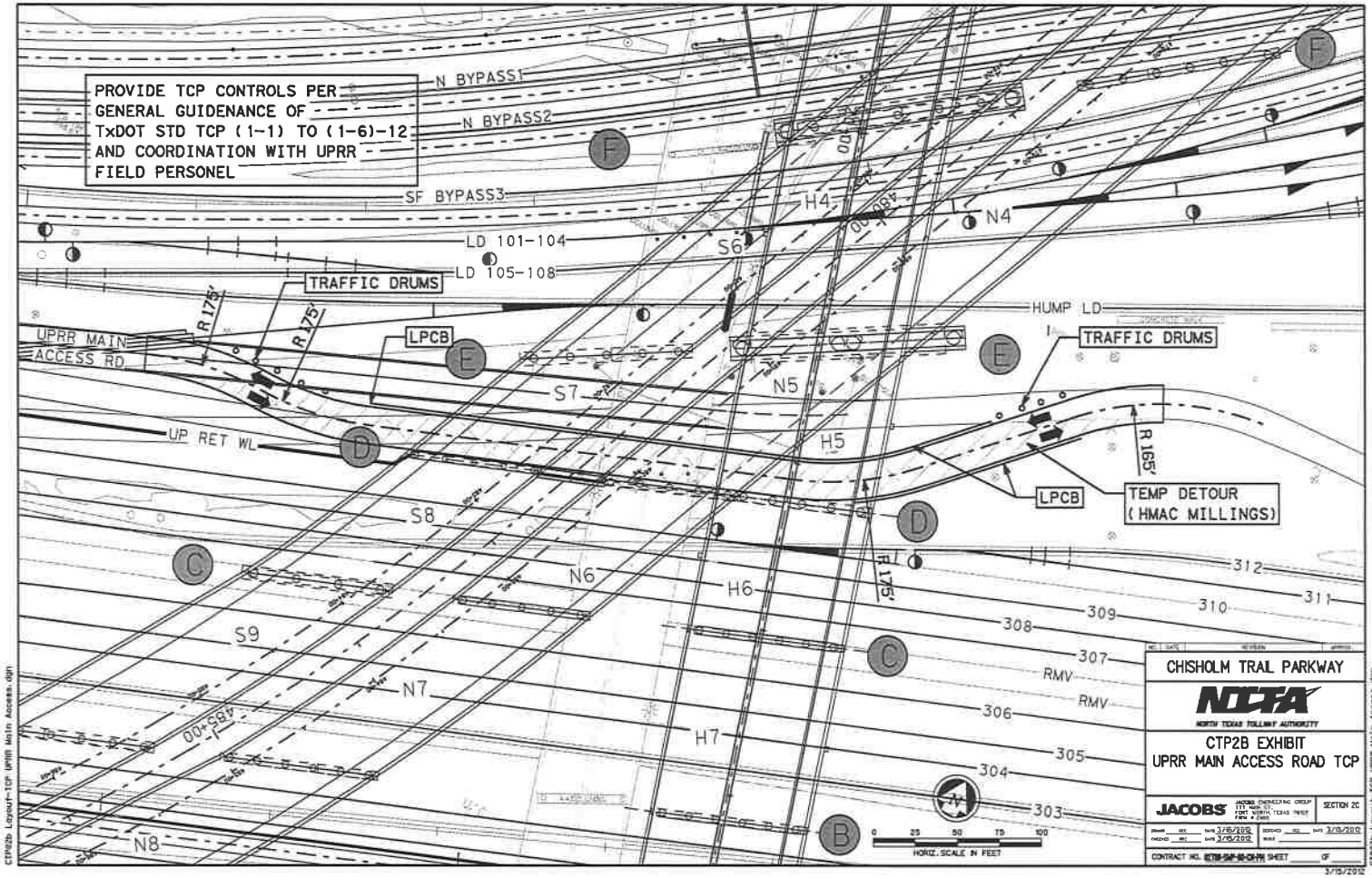

Construction Crossing
Per Ted's Detail
Filter Fabric on top of Ballast
ABMP INSTALLED CONSTRUCTION CROSSING
TED'S DETAIL
SWP-UPRR Yard Construction Plan (ABR)
February 24, 2012
40

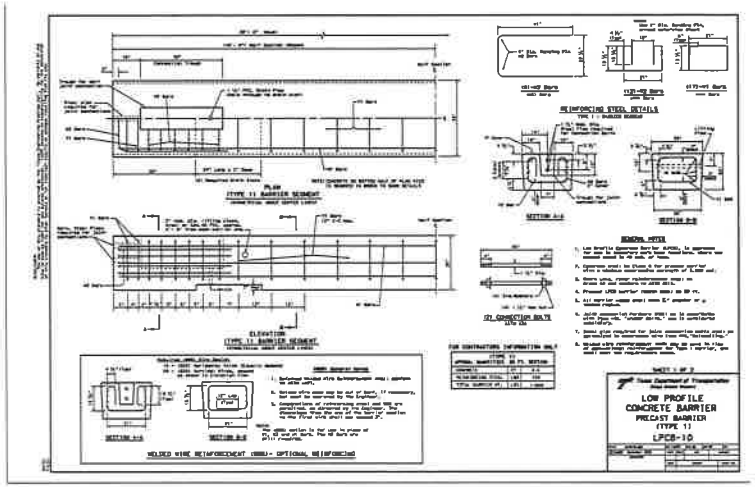
Standard Details
Crane on Tracks

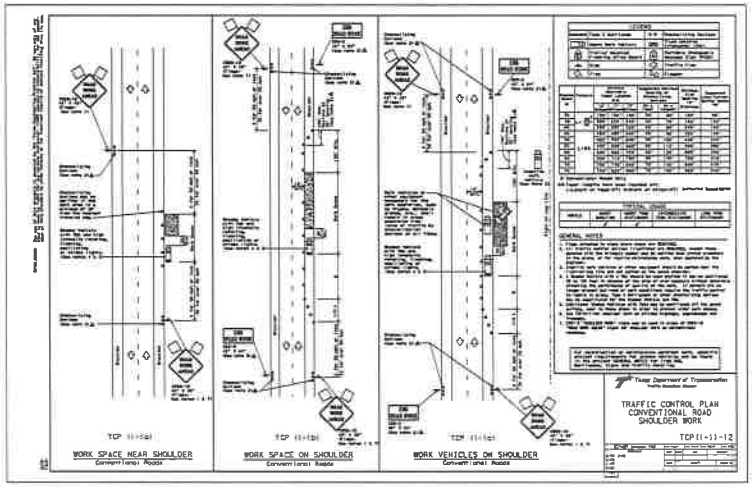


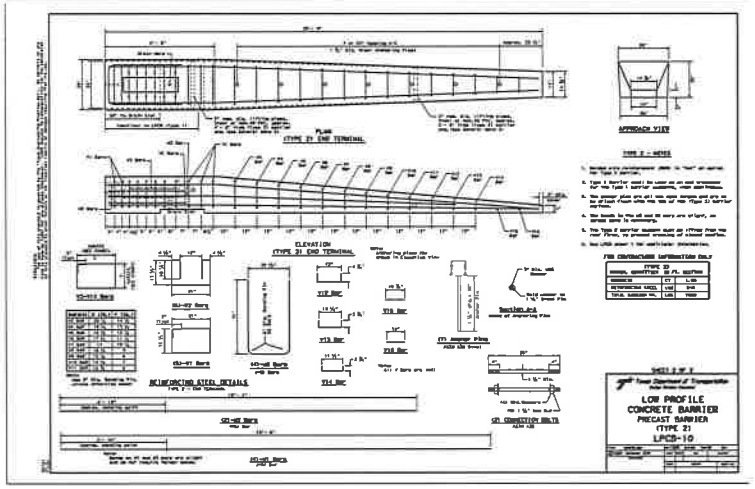
Standard Details
Shore Towers on Tracks

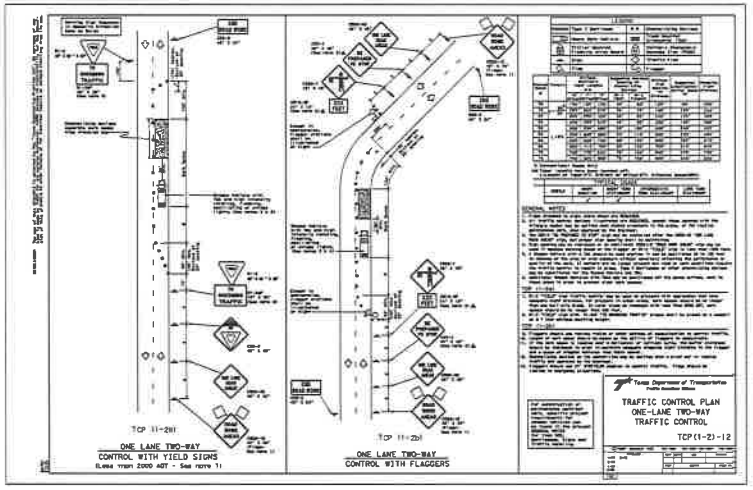


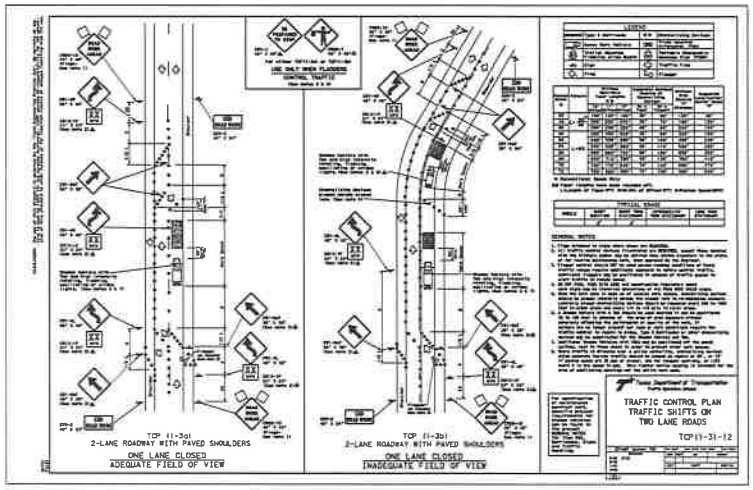

PROVIDE TCP CONTROLS PER
GENERAL GUIDENANCE OF
TxDOT STD TCP (1-1) TO (1-6)-12
AND COORDINATION WITH UPRR
FIELD PERSONEL
N BYPASS1
N BYPASS2
SF BYPASS3
LD 101-104
LD 105-108
TRAFFIC DRUMS
UPRR MAIN
ACCESS RD
R 175'
R 75'
LPCB
UP RET WL
HUMP LD
TRAFFIC DRUMS
R 165'
LPCB
TEMP DETOUR
(HMAC MILLINGS)
R 175'
S6
S7
S8
S9
N4
N5
N6
N7
N8
H4
H5
H6
H7
312
311
310
309
308
307
RMV
RMV
306
305
304
303
HORIZ. SCALE IN FEET
0 25 50 75 100
CHISHOLM TRAIL PARKWAY
NTTA
NORTH TEXAS TOLLWAY AUTHORITY
CTP2B EXHIBIT
UPRR MAIN ACCESS ROAD TCP
JACOBS
SECTION 2C
CONTRACT NO.
SHEET
OF
3/15/2012
CTP02b Layout-TCP UPRR Main Access.dgn

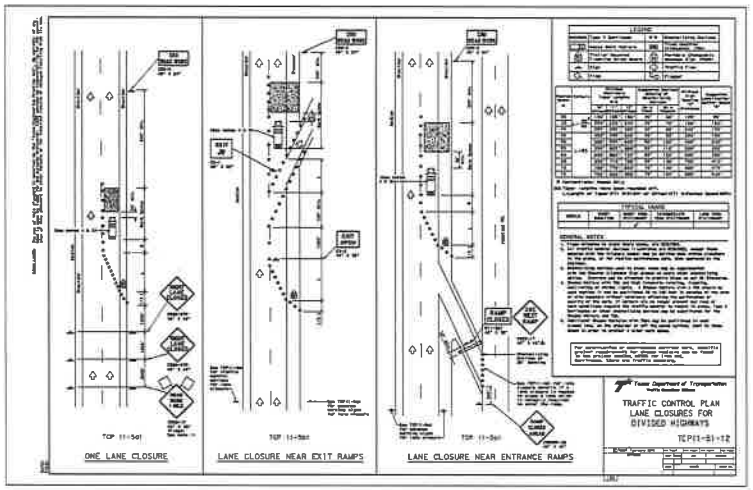

PLAN
(TYPE 1) BARRIER SEGMENT
REINFORCING STEEL DETAILS
ELEVATION
(TYPE 1) BARRIER SEGMENT
SECTION A-A
SECTION B-B
GENERAL NOTES
WELDED WIRE REINFORCEMENT (WWR) - OPTIONAL REINFORCING
FOR CONTRACTORS INFORMATION ONLY
Texas Department of Transportation
LOW PROFILE
CONCRETE BARRIER
PRECAST BARRIER
(TYPE 1)
LPCB-10

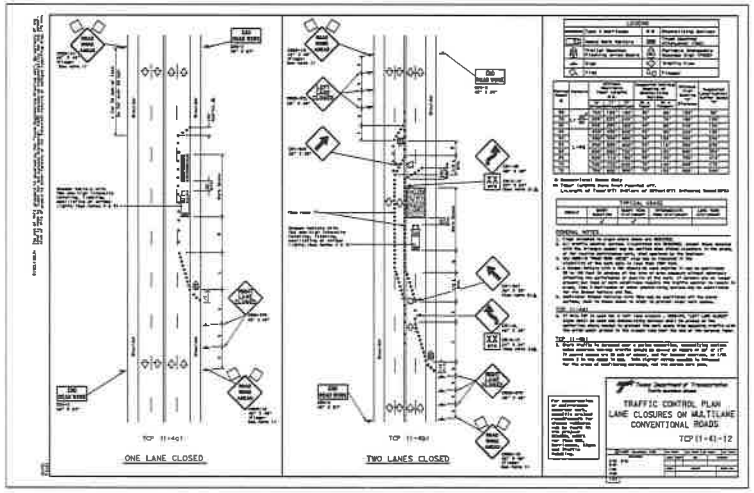

TCP (1-1b)
WORK SPACE NEAR SHOULDER
Conventional Roads
TCP (1-1b)
WORK SPACE ON SHOULDER
Conventional Roads
TCP (1-1c)
WORK VEHICLES ON SHOULDER
Conventional Roads
GENERAL NOTES
Texas Department of Transportation
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK
TCP(1-1)-12

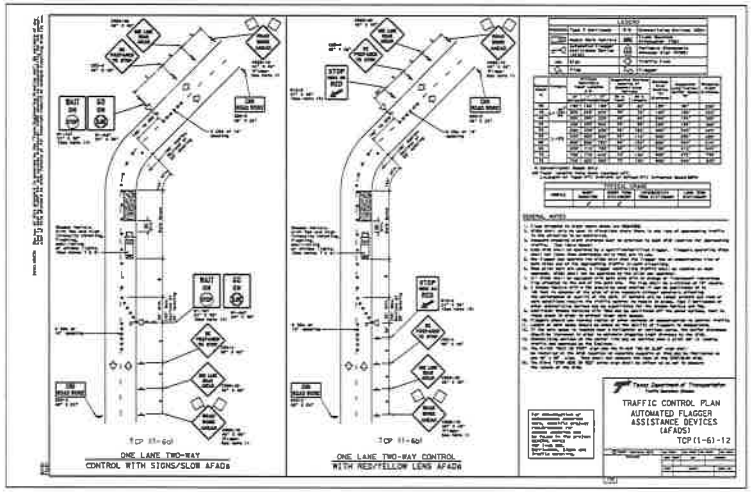

PLAN
(TYPE 2) END TERMINAL
APPROACH VIEW
ELEVATION
(TYPE 2) END TERMINAL
REINFORCING STEEL DETAILS
FOR CONTRACTORS INFORMATION ONLY
Texas Department of Transportation
LOW PROFILE
CONCRETE BARRIER
PRECAST BARRIER
(TYPE 2)
LPCB-10

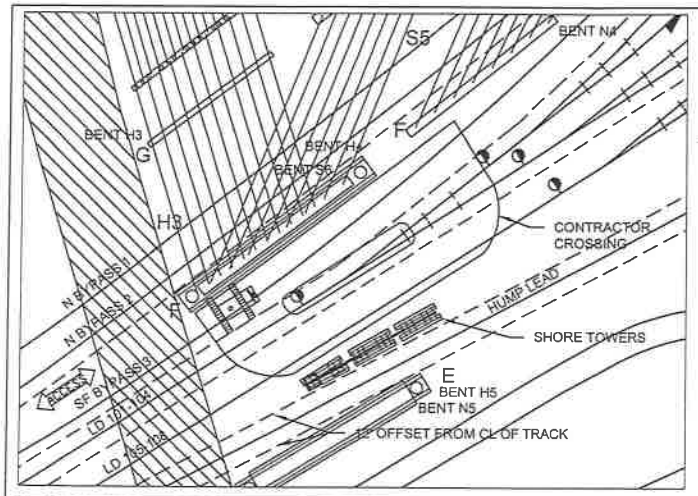

TCP (1-2b)
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See note 1)
TCP (1-2b)
ONE LANE TWO-WAY
CONTROL WITH FLAGGERS
GENERAL NOTES
Texas Department of Transportation
TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL
TCP(1-2)-12


TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW
TCP (1-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
INADEQUATE FIELD OF VIEW
LEGEND
TYPICAL GRADE
GENERAL NOTES
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO LANE ROADS
TCP(1-3)-12


TCP (1-5a)
ONE LANE CLOSURE
TCP (1-5b)
LANE CLOSURE NEAR EXIT RAMPS
TCP (1-5c)
LANE CLOSURE NEAR ENTRANCE RAMPS
LEGEND
TYPICAL GRADE
GENERAL NOTES
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
LANE CLOSURES FOR
DIVIDED HIGHWAYS
TCP(1-5)-12


TCP (1-4a)
ONE LANE CLOSED
TCP (1-4b)
TWO LANES CLOSED
LEGEND
TYPICAL GRADE
GENERAL NOTES
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
LANE CLOSURES ON MULTILANE
CONVENTIONAL ROADS
TCP(1-4)-12


TCP (1-6a)
ONE LANE TWO-WAY
CONTROL WITH SIGNS/SLOW AFADs
TCP (1-6b)
ONE LANE TWO-WAY CONTROL
WITH RED/YELLOW LENS AFADs
LEGEND
TYPICAL GRADE
GENERAL NOTES
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
AUTOMATED FLAGGER
ASSISTANCE DEVICES
(AFADS)
TCP(1-6)-12

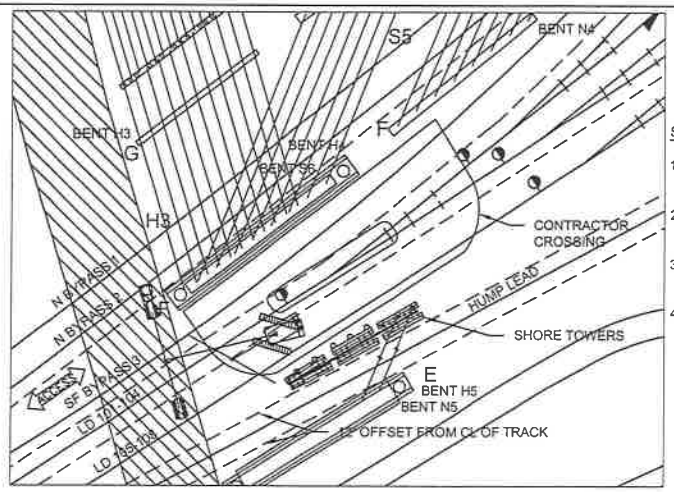


TYPICAL STEPS TO ERECT ONE GIRDER

STEP 1:

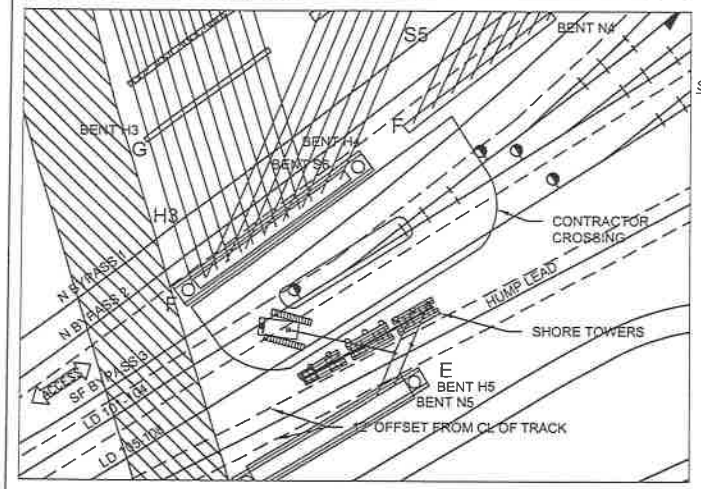
1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).

- SHORE TOWERS WILL BE ERECTED PRIOR IN BETWEEN CUTS AND DURING 4-HR CLOSURE (1 WEEK PRIOR)



STEP 2: (30 MIN.)

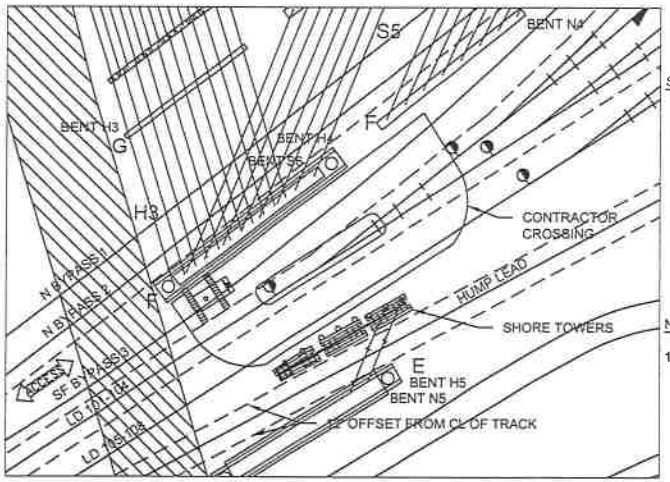
1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
3. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION.
4. WALK TO SETTING POSITION.



IN BETWEEN CUTS
OR DURING 4-HR CLOSURE

STEP 3: (15 MIN.)

1. SWING BOOM CLOCKWISE.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM WITH CRANE UNTIL ALL TEMPORARY BRACING IS IN PLACE.
4. ONCE BRACING IS IN PLACE AND THE BEAM IS SECURE THE CRANE WILL RELEASE THE BEAM.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

TOTAL TIME TO ERECT ONE GIRDER IS: 1 HR. AND 5 MIN.

NOTE:

1. LD101-104 AND LD105-108 WILL BE CLEARED FOR 15 MIN. EVERY 2 HRS.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN N4	PLATE	68.7'	46K	46K	9K	55K	70'	64.8K	84.8%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

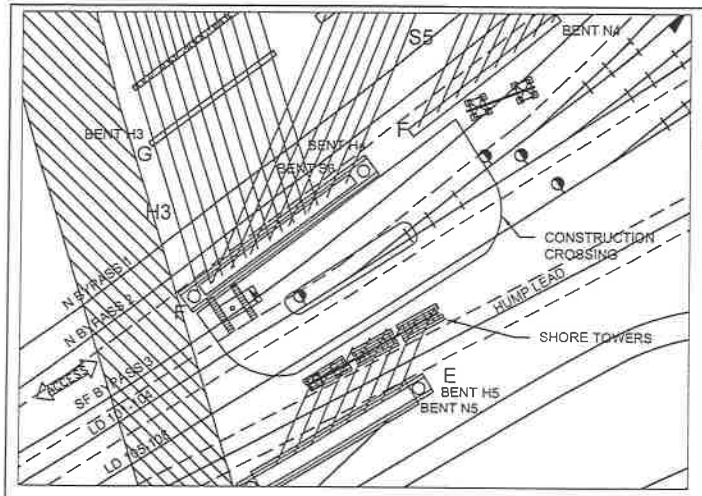
NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET IN BETWEEN CUTS
OR DURING 4-HR CLOSURE

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN N4
GIRDERS 17-24 (GROUP 3)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		N4-01

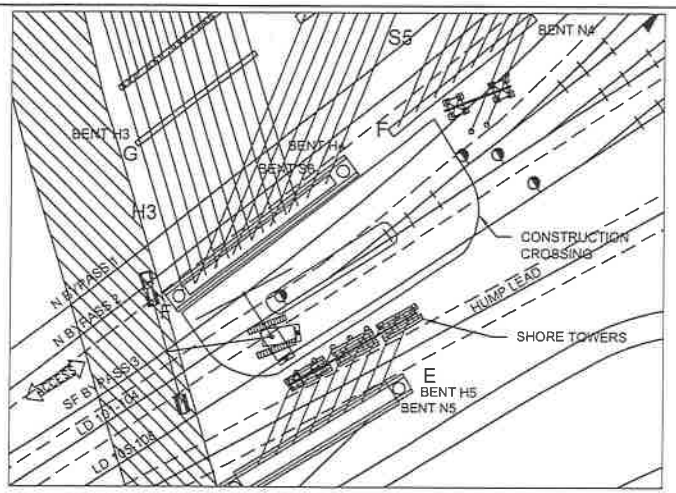


TYPICAL STEPS TO ERECT ONE GIRDER

STEP 1:

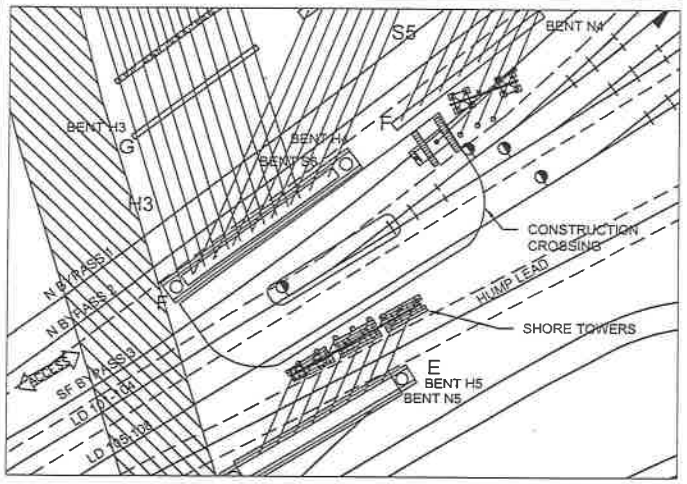
1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).

- SHORE TOWERS WILL BE ERECTED IN DAYS PRIOR TO SETTING (3 DAYS)



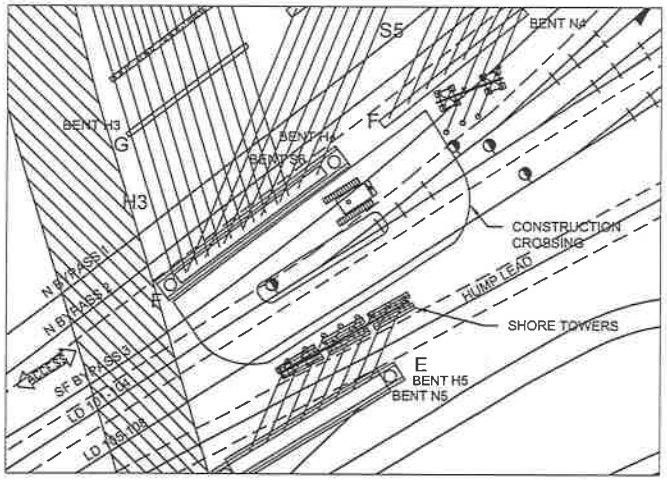
STEP 2: (30 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
3. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION.
4. WALK TO SETTING POSITION.



STEP 3: (35 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM WITH CRANE UNTIL ALL TEMPORARY BRACING IS IN PLACE.
4. ONCE BRACING IS IN PLACE AND THE BEAM IS SECURE THE CRANES WILL RELEASE THE BEAM.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

TOTAL TIME TO ERECT ONE GIRDER IS: 1 HR. AND 25 MIN.

NOTE:

1. LD101-104 AND LD105-108 WILL BE CLEARED FOR 15 MIN. EVERY 2 HRS.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN N4	PLATE	71.4'	49K	49K	9K	58K	70'	64.8K	89.5%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

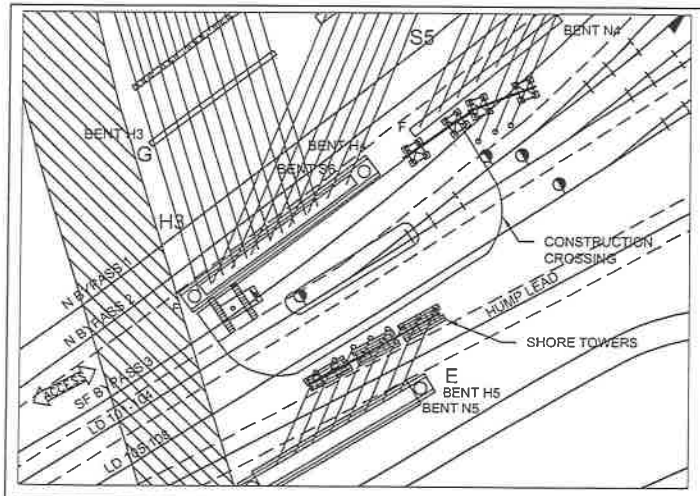
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN N4
GIRDERS 1-3 (GROUP 1)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		N4-02

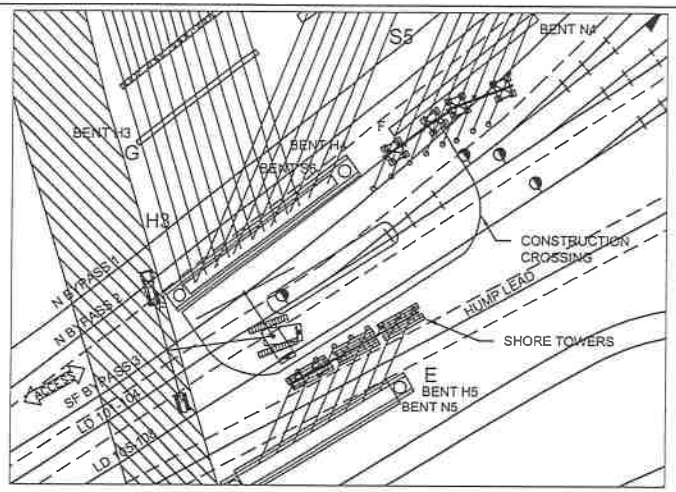


TYPICAL STEPS TO ERECT ONE GIRDER

STEP 1:

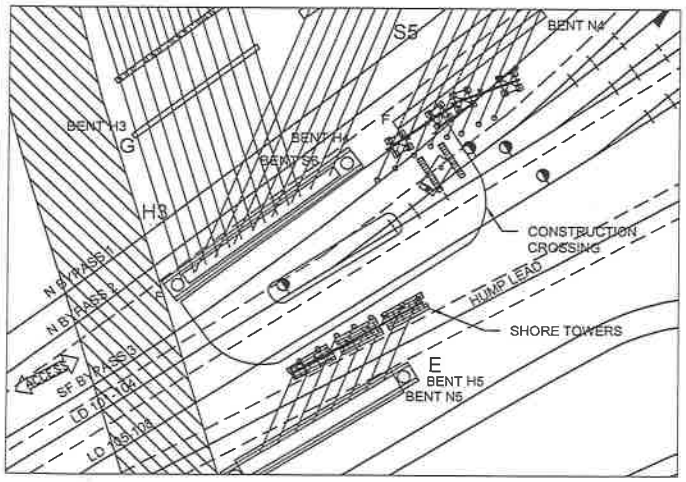
1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).

- SHORE TOWERS WILL BE ERECTED IN DAYS PRIOR TO SETTING (3 DAYS)



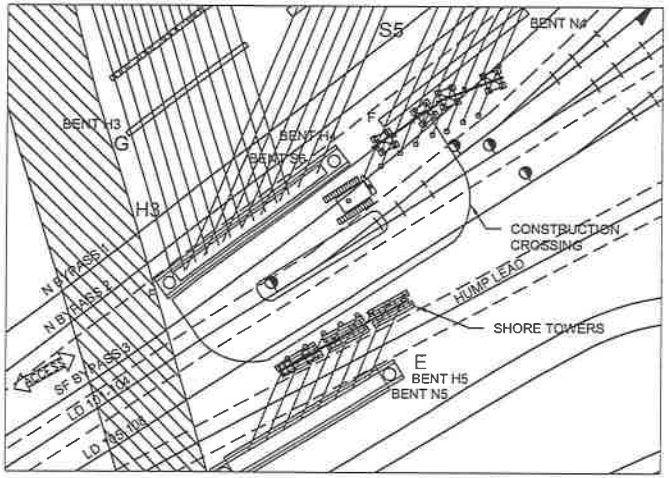
STEP 2: (30 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
3. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION.
4. WALK TO SETTING POSITION.



STEP 3: (35 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM WITH CRANE UNTIL ALL TEMPORARY BRACING IS IN PLACE.
4. ONCE BRACING IS IN PLACE AND THE BEAM IS SECURE THE CRANES WILL RELEASE THE BEAM.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

TOTAL TIME TO ERECT ONE GIRDER IS: 1 HR. AND 25 MIN.

NOTE:

1. LD101-104 AND LD105-108 WILL BE CLEARED FOR 15 MIN. EVERY 2 HRS.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN N4	PLATE	53.4'	37K	37K	9K	46K	70'	53.9K	85.3%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

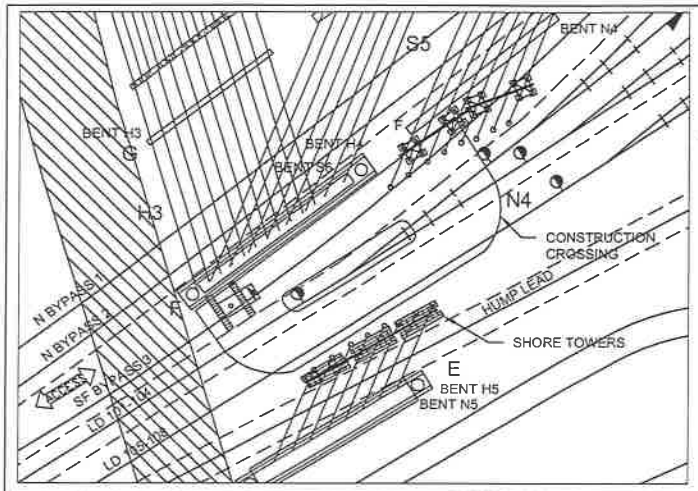
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN N4
GIRDERS 4-8 (GROUP 1)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

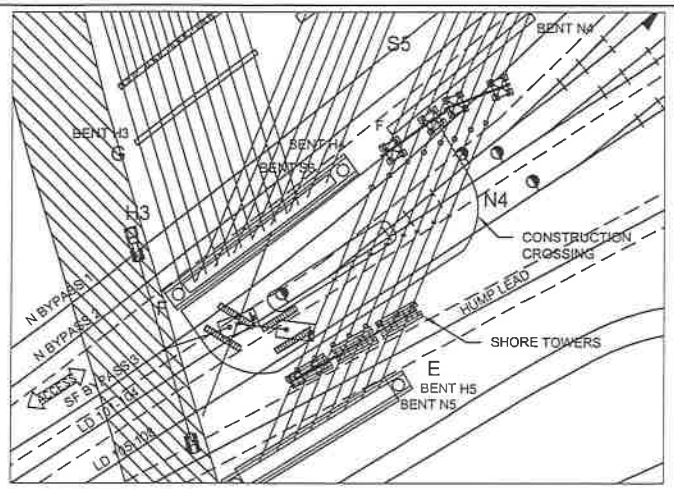
DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		N4-03



TYPICAL STEPS TO ERECT ONE GIRDER

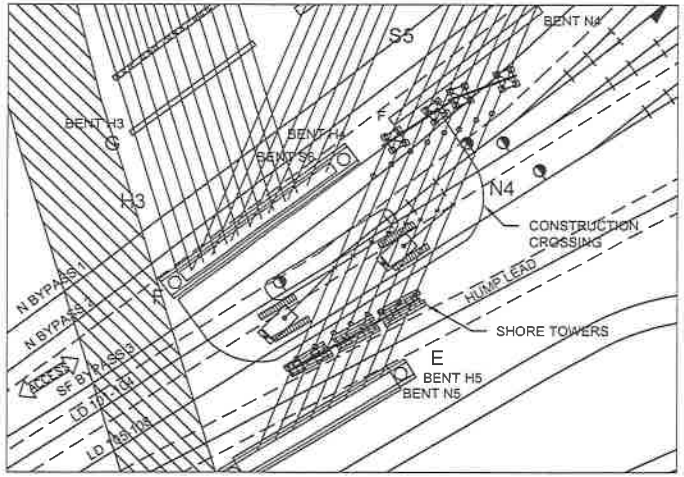
STEP 1:

1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).



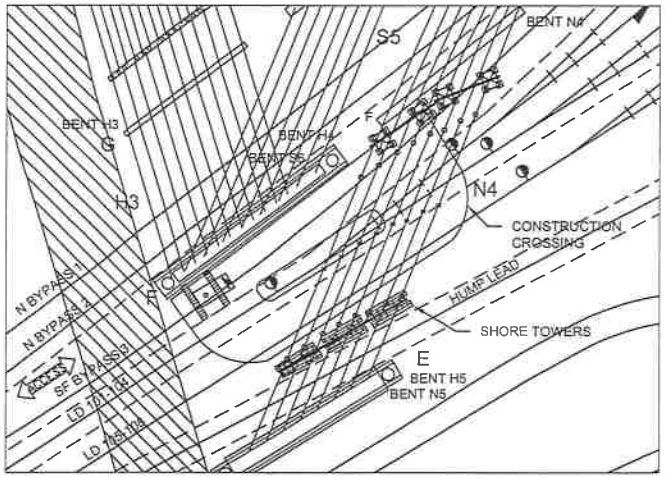
STEP 2: (30 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
3. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION.
4. WALK TO SETTING POSITION.



STEP 3: (35 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM WITH CRANE UNTIL ALL TEMPORARY BRACING IS IN PLACE.
4. ONCE BRACING IS IN PLACE AND THE BEAM IS SECURE THE CRANES WILL RELEASE THE BEAM.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

TOTAL TIME TO ERECT ONE GIRDER IS: 1 HR. AND 25 MIN.

NOTE:

1. LD101-104 AND LD105-108 WILL BE CLEARED FOR 15 MIN. EVERY 2 HRS.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN N4	PLATE	130'	89K	89K	9K	98K	45'	118.2K	82.9%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

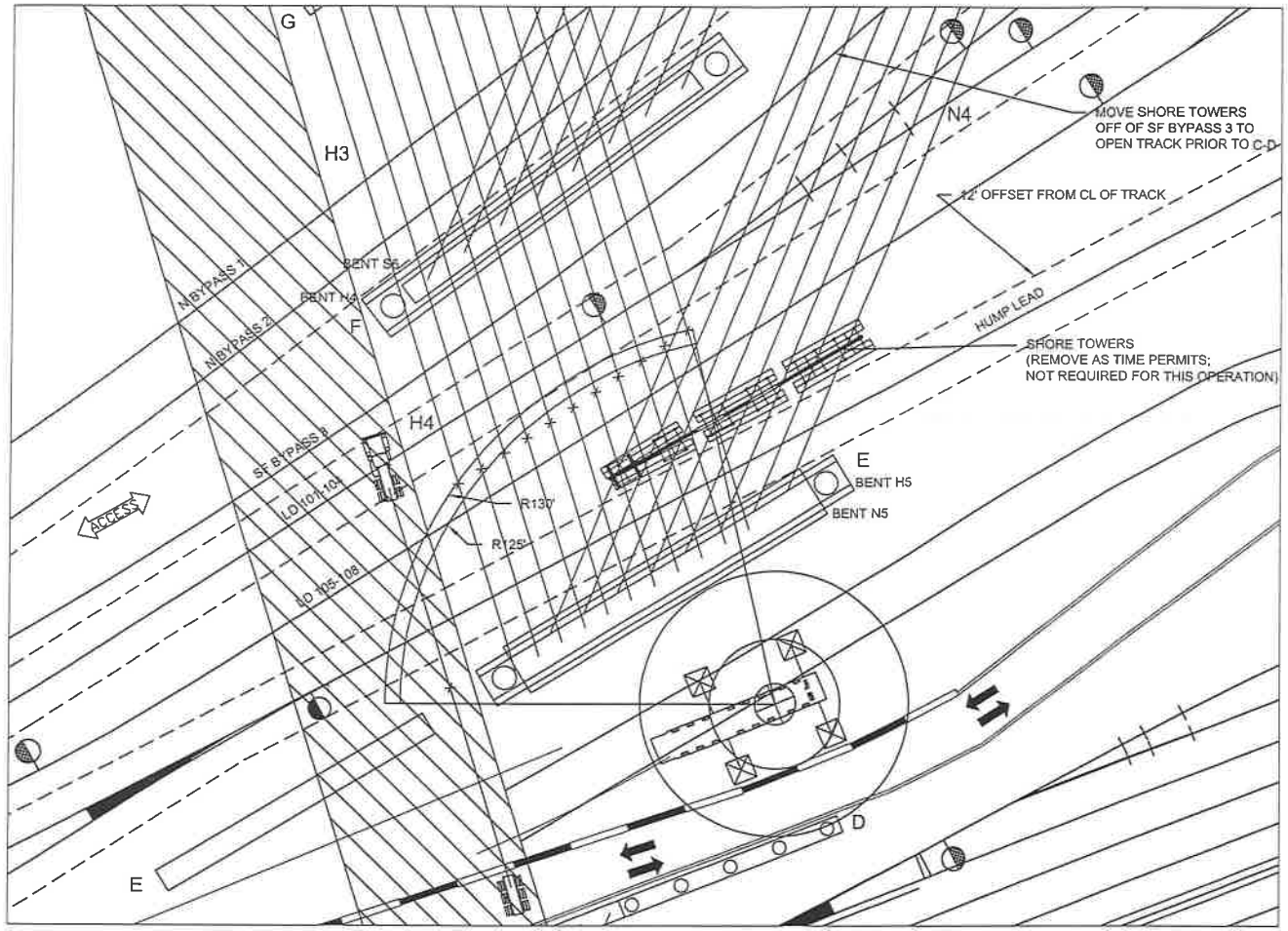
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN N4
GIRDERS 9-16 (GROUP 2)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		N4-04



STEP 1: (3 HRS.)
CRANE WILL ARRIVE AND SET-UP
(MOBILIZE).

STEP 2: (15 MIN. EACH - 8 HRS TOTAL)
CRANE WILL SET GIRDERS IN BETWEEN
CUTS & DURING 4-HR WINDOW

STEP 3: (AS NEEDED)
AFTER H4 GIRDERS ARE SET &
DIAPHRAGMS ARE INSTALLED, SF BYPASS 3
WILL OPEN UP AND 307 WILL BE CLOSED TO
ALLOW FOR C-D BEAM SETTING (SEE NEXT
PAGE).

NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET IN BETWEEN CUTS
OR DURING 4-HR CLOSURE

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: LTM 1500 - 8.1 TY3 (600 TON) BOOM: 223' COUNTER WEIGHT: 363,800 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN H4	PLATE	129.6'	53K	53K	9K	62K	130'	70K	88.5%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

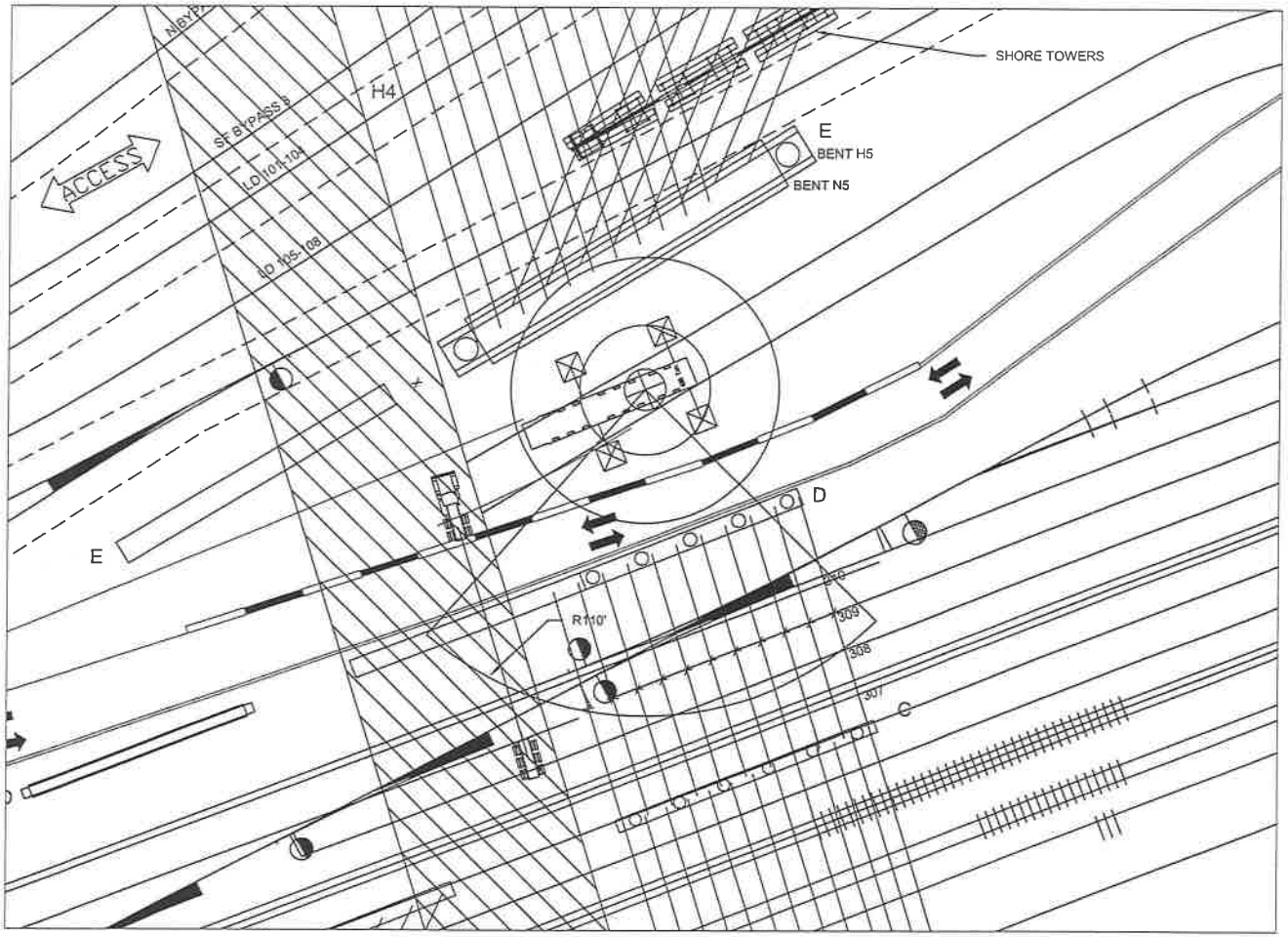
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAIL SPAN H4
GIRDER 1 TO 11

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		H4-01



PRIOR TO START:

TRACKS 308-310 WILL BE CLOSED, ALONG WITH SF BYPASS 3 DURING E-F ERECTION.

AFTER H4 ERECTION IS FINISHED, SF BYPASS WILL OPEN UP AND 307 WILL BE CLOSED TO COMPLETE THE AWZ

THEN SET CONCRETE BEAMS (5 HRS)

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: LTM 1500 - 8.1 TY3 (600 TON) BOOM: 189' COUNTER WEIGHT: 363,800 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN H6	IV	81.5'	66.9K	73.6K	9K	82.6K	110'	94K	87.8%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING PLUS 10%

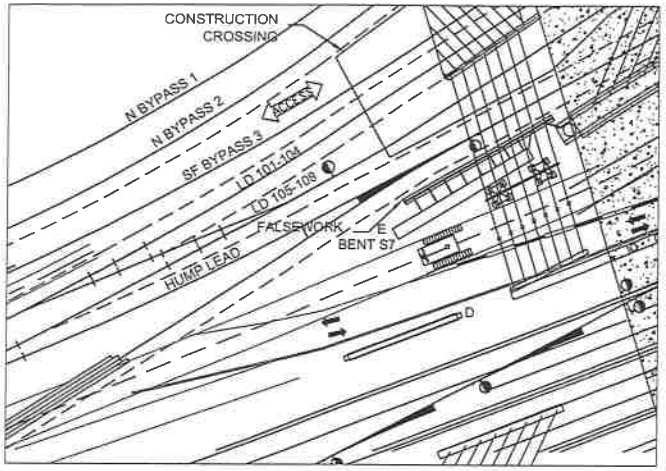
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

C-D
LIFT DETAIL SPAN H6
BEAM 1 TO 11

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

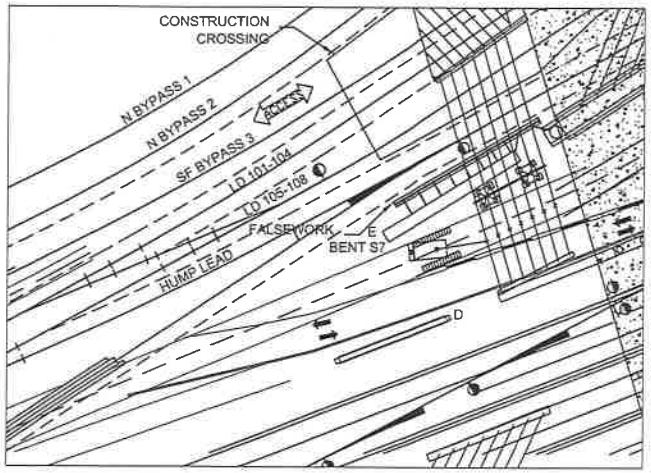
DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		H6-01



TYPICAL STEPS TO REMOVE ONE GIRDER AT HULEN SPAN 6B

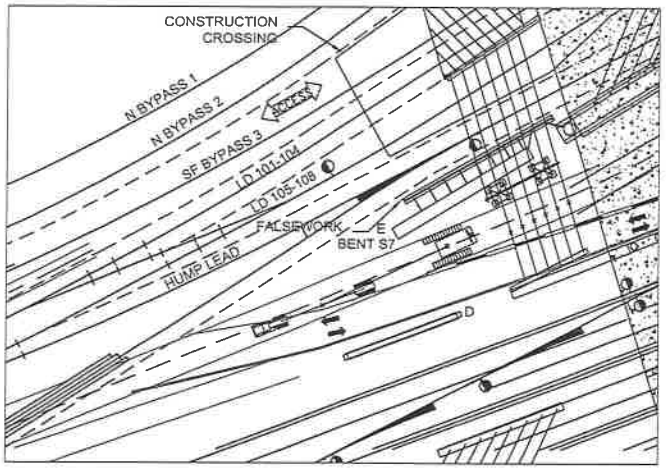
STEP 1:

1. CRANE WILL SIT ON ACCESS ROAD.
2. TRAFFIC DETOURED AROUND.
3. TRAFFIC STOPPED DURING REMOVAL OF GIRDER BY FLAGGER.



STEP 2: (20 MIN.)

1. WALK CRANE TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. CRANE WILL RIG UP TO GIRDER, APPLY UPLIFT AND CUT WILL BE MADE.
3. REMOVE GIRDER.

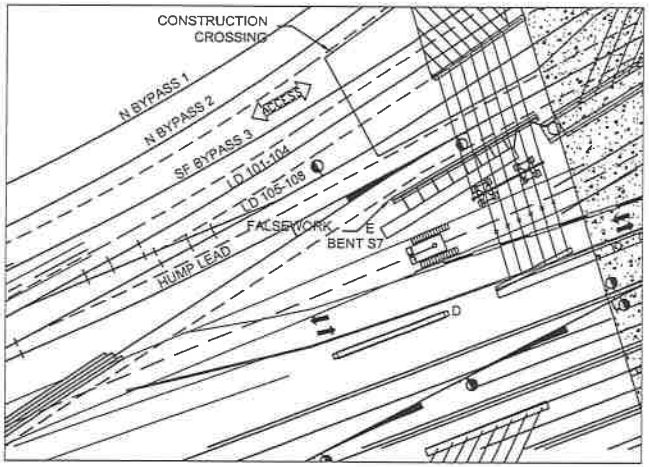


STEP 3: (20 MIN.)

1. TURN AND SET GIRDER ON TRUCK TO BE HAULED OFF.

NOTE:

1. REPEAT SETPS 2-3 FOR ALL GIRDERS.



STEP 4: (10 MIN.)

1. WHEN FINISHED, CRANE WILL BE STAGED OUTSIDE DETOUR LIMITS.

TOTAL TIME TO REMOVE ONE GIRDER IS: 40 MIN.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A & B: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN 6	PLATE	58.4'	32K	35.2K	9K	44.2K	85'	49.6K	89%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING PLUS 10%

** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

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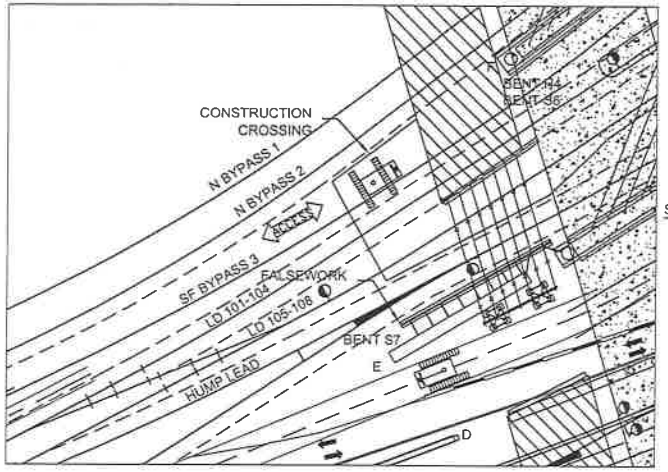
An Austin Industries Company FIRM NO. 11355

EXISTING HULEN STREET BRIDGE
DEMO DETAILS SPAN 6B (D-E)
GIRDERS 1-7 (TYP)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

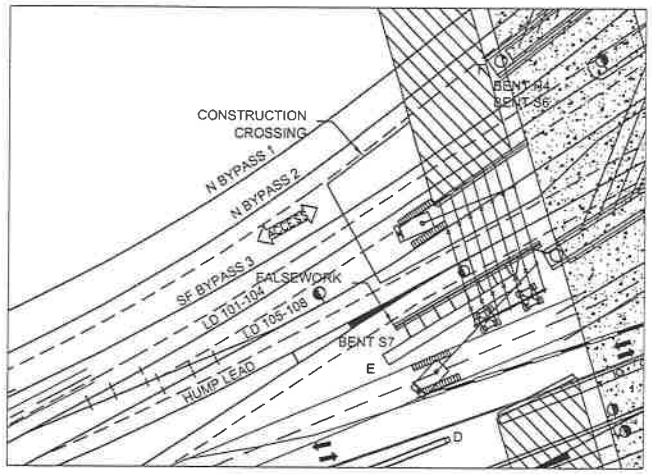
DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		D6-01



TYPICAL STEPS TO REMOVE ONE GIRDER AT HULEN SPAN 6A

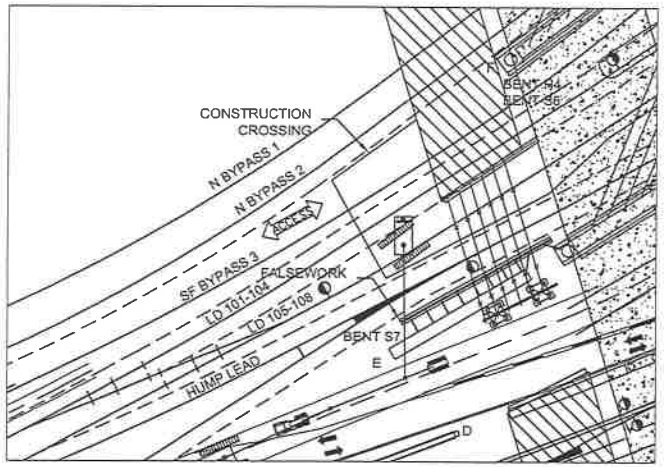
STEP 1:

1. CRANE A WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS.
2. CRANE B SITS ON ACCESS ROAD.
3. TRAFFIC DETOURED AROUND.
4. TRAFFIC STOPPED DURING REMOVAL OF GIRDER BY FLAGGER.



STEP 2: (20 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. CRANES WILL RIG UP TO GIRDER, APPLY UPLIFT AND CUT WILL BE MADE.
3. REMOVE GIRDER.

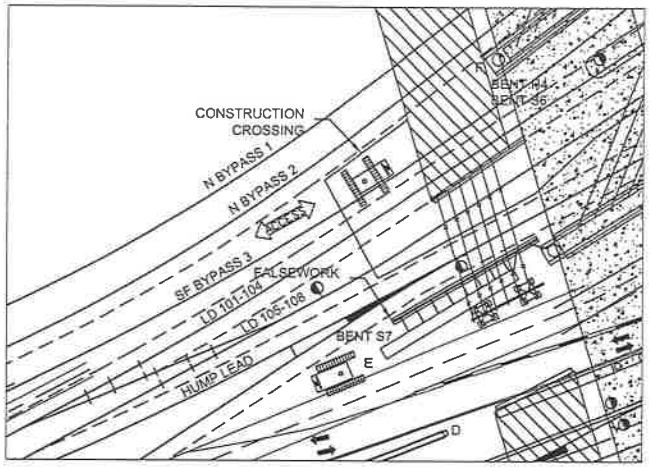


STEP 3: (20 MIN.)

1. WALK CRANES TO SETTING POSITION.
2. SET GIRDER ON GROUND, CUT AND LOAD PIECES ON TRUCK.

NOTE:

1. REPEAT STEPS 2-3 UNTIL 20 MIN. BEFORE END OF 4 HR. HUMP CLOSURE.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

REMOVE 5 GIRDERS IN FIRST 4 HR. WINDOW AND THE REMAINING 2 IN NEXT WINDOW.

NO BEAMS WILL BE REMOVED OVER LIVE HUMP LD.
BEAMS WILL BE REMOVED DURING 4-HR CLOSURE

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A & B: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN 6	PLATE	87.3'	34K	18.7K	9K	27.7K	100'	40.5K	68.4%

* LIFT WEIGHT
WEIGHT OF THE BEAM EACH CRANE WILL BE LIFTING PLUS 10%

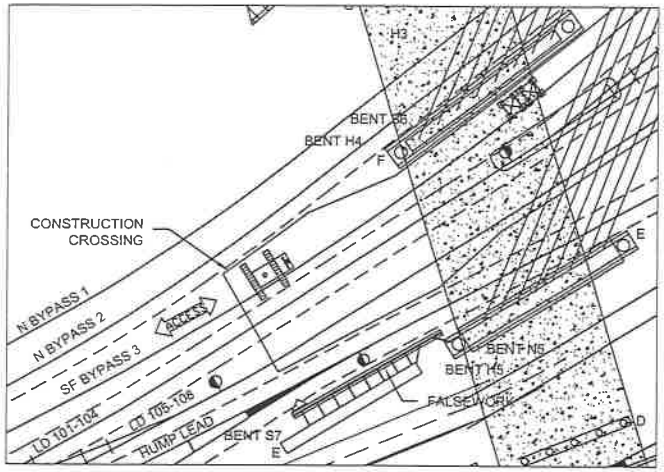
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

EXISTING HULEN STREET BRIDGE
DEMO DETAILS SPAN 6A (E-F)
GIRDERS 1-7

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		D6-02

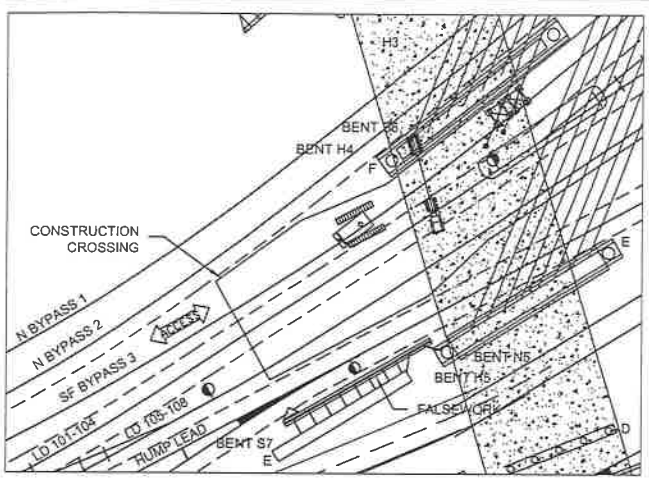


TYPICAL STEPS TO ERECT ONE GIRDER

STEP 1:

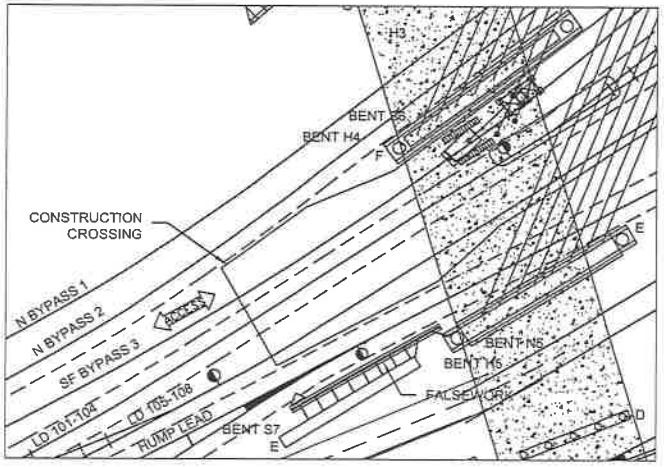
1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).

- SHORE TOWERS WILL BE ERECTED IN DAYS PRIOR TO SETTING (3 DAYS)



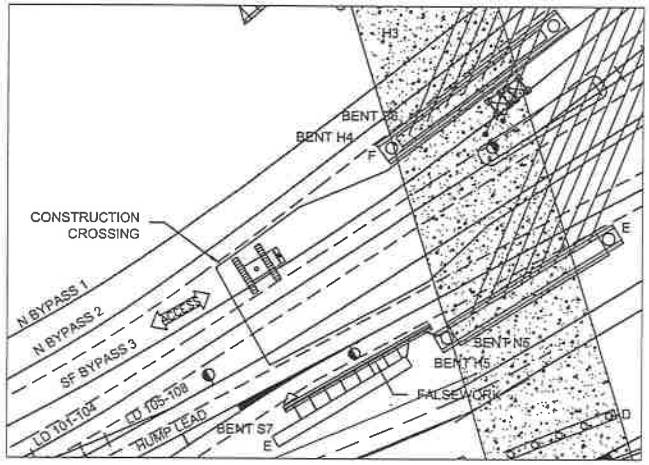
STEP 2: (30 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
3. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION.
4. WALK TO SETTING POSITION.



STEP 3: (35 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM WITH CRANE UNTIL ALL TEMPORARY BRACING IS IN PLACE.
4. ONCE BRACING IS IN PLACE AND THE BEAM IS SECURE THE CRANES WILL RELEASE THE BEAM.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

TOTAL TIME TO ERECT ONE GIRDER IS: 1 HR. AND 25 MIN.

NOTE:

1. LD101-104 AND LD105-108 WILL BE CLEARED FOR 15 MIN. EVERY 2 HRS.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 100' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN S6	PLATE	58.5'	36K	36K	9K	45K	55'	92.3K	48.7%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

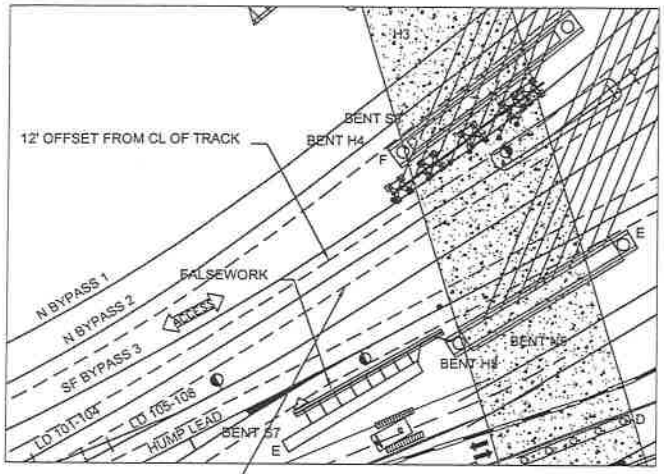
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN S6
GIRDERS 1-8 (GROUP 1)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		S6-01

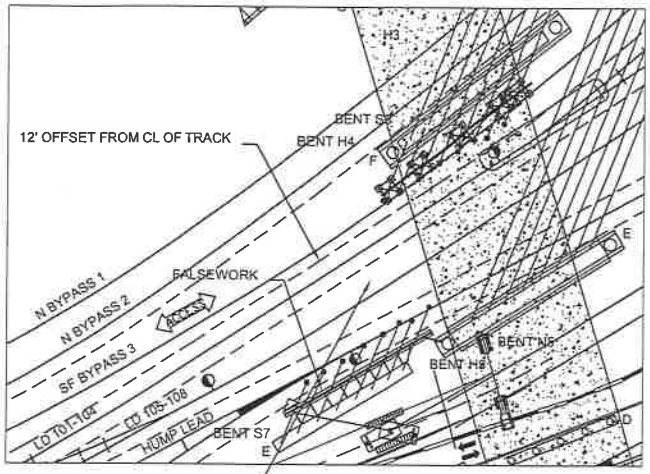


NOTE: CRANE MAY SIT ON LD TRACKS FOR THIS LIFT; IF SO CRANE WILL CLEAR LD TRACKS FOR 15MIN EVERY TWO HOURS

TYPICAL STEPS TO ERECT ONE BEAM

STEP 1:

1. CRANE WILL SIT SOUTH OF BENT S7.



NOTE: CRANE MAY SIT ON LD TRACKS FOR THIS LIFT; IF SO CRANE WILL CLEAR LD TRACKS FOR 15MIN EVERY TWO HOURS

STEP 2:

1. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.
2. LOWER GIRDER TO TWO FEET ABOVE FINAL ELEVATION
3. SET IN FINAL POSITION IN BETWEEN CUTS; INSTALL BRACING

GIRDERS WILL BE SET IN BETWEEN CUTS.

TIME TO SET 1 GIRDER IS 15 MIN OR LESS

NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET IN BETWEEN CUTS
OR DURING 4-HR CLOSURE

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN S6	PLATE	47.3'	30K	30K	9K	39K	90'	45.7K	85.3%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

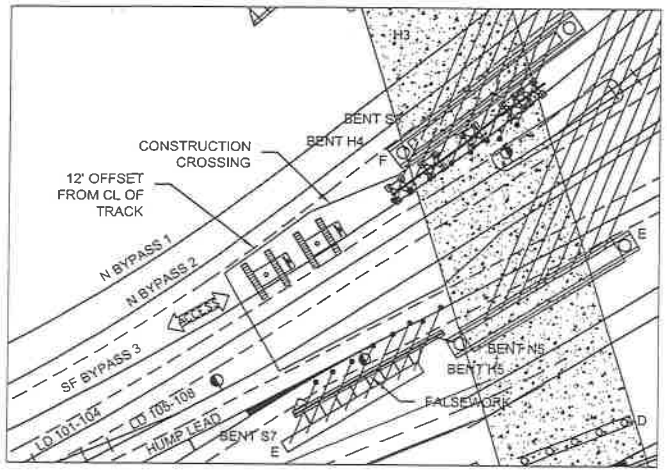
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN S6
GIRDERS 17-24 (GROUP 3)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		S6-02

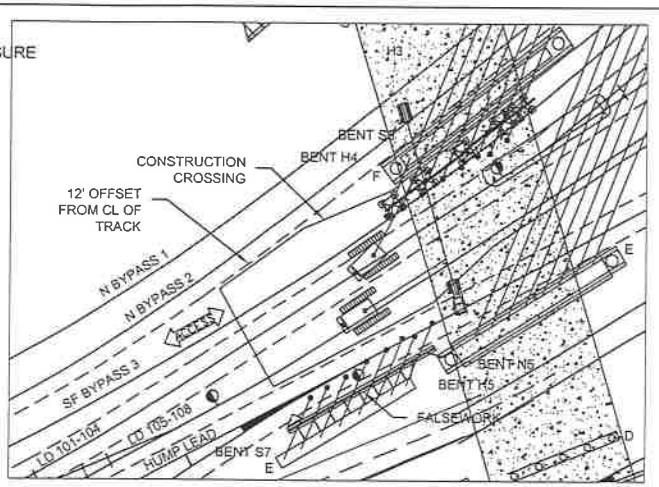


THIS OPERATION IS DURING 4-HR CLOSURE

TYPICAL STEPS TO ERECT ONE GIRDER

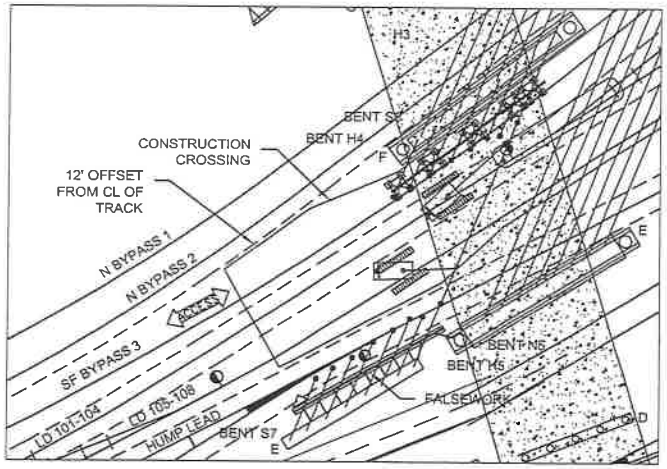
STEP 1:

1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).



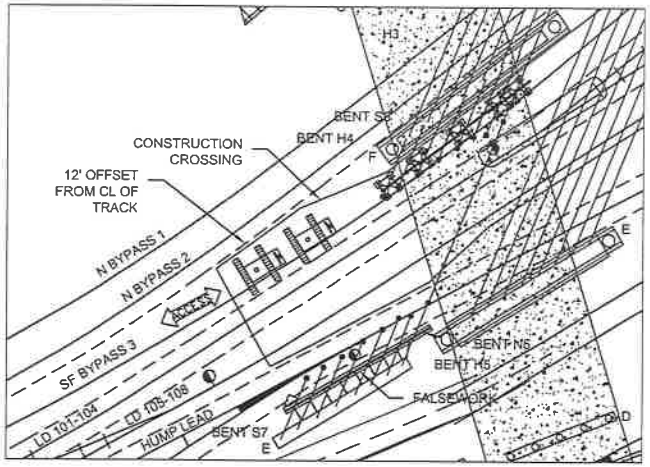
STEP 2: (20 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.



STEP 3: (50 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM UNTIL 50% OF BOLTS/PINS AND DIAPHRAGMS ARE INSTALLED, RELEASE GIRDER.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

THIS OPERATION IS DURING 4-HR CLOSURE
2 GIRDERS PER WINDOW

ROOF INSTALLATION & DECKING OPERATIONS
MAY START DURING THIS TIME AS NEEDED

NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET DURING 4-HR CLOSURE

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A & B: MANITOWOC 4100 S2 BOOM: 100' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN S6	PLATE	130'	84K	42K	9K	51K	50'	104.7K	48.7%

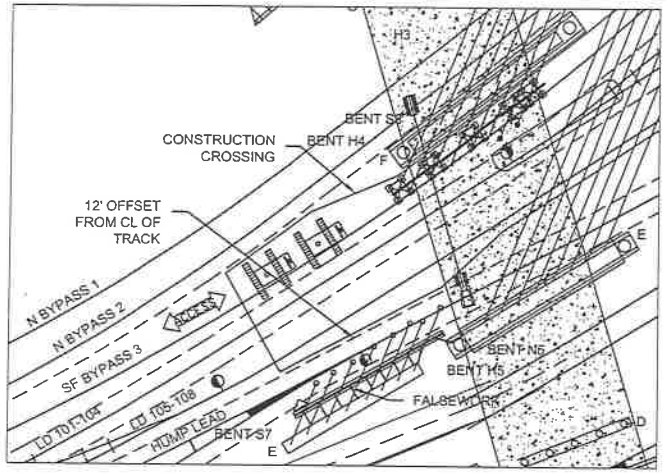
* LIFT WEIGHT
WEIGHT OF THE BEAM EACH CRANE WILL BE LIFTING

** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN S6
GIRDERS 9-12 (GROUP 2)
DURING 4-HR CLOSURE
SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		S6-03

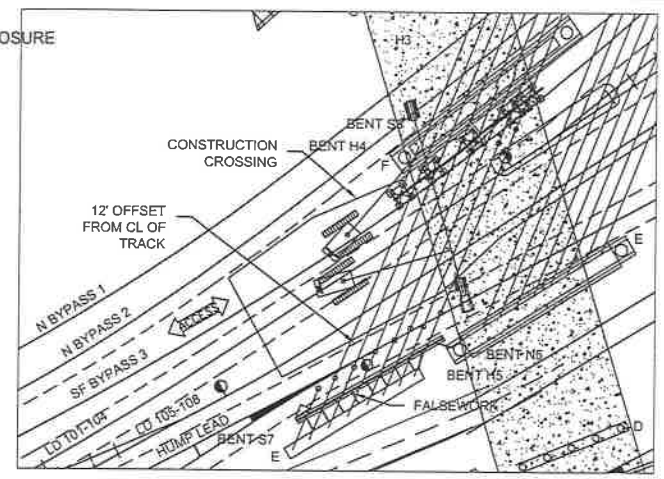


THIS OPERATION IS DURING 4-HR CLOSURE

TYPICAL STEPS TO ERECT ONE GIRDER

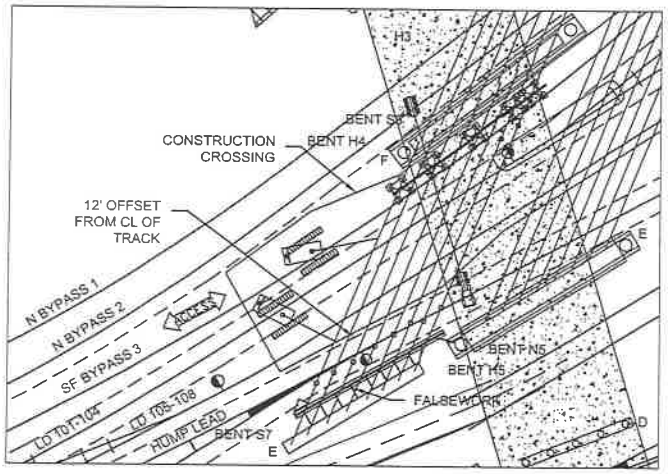
STEP 1:

1. CRANES WILL SIT ON SF BYPASS ALSO KNOWN AS "SAFE ZONE" BEFORE WORK STARTS AND DURING TRAIN OCCURRENCES (15 MIN. EVERY 2 HRS.).



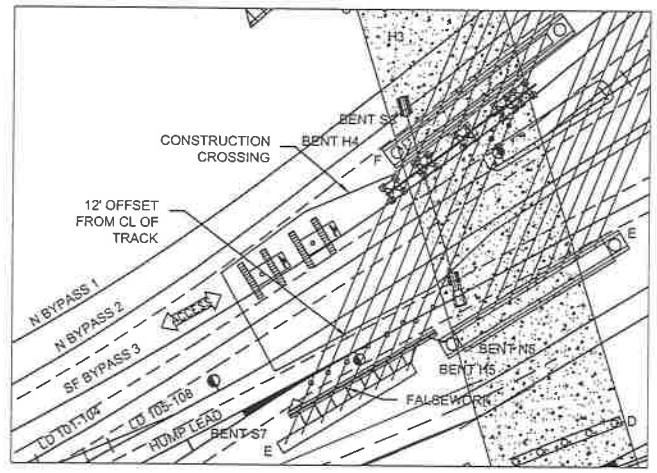
STEP 2: (20 MIN.)

1. WALK CRANES TO PICKING LOCATION, ON CONSTRUCTION CROSSING.
2. PICK GIRDER FROM EXISTING HULEN ST. BRIDGE.



STEP 3: (50 MIN.)

1. SWING BOOM (CLOCKWISE AWAY FROM HUMP) TO SET.
2. SET GIRDER IN APPROPRIATE POSITION STARTING WITH GIRDER 1.
3. CONTINUE TO SUPPORT BEAM UNTIL 50% OF BOLTS/PINS AND DIAPHRAGMS ARE INSTALLED. RELEASE GIRDER.



STEP 4: (20 MIN.)

1. CRANES WILL RETURN TO "SAFE ZONE".
2. REPEAT STEPS AS REQUIRED TO COMPLETE GIRDER SEQUENCE.

THIS OPERATION IS DURING 4-HR CLOSURE
2 GIRDERS PER WINDOW

ROOF INSTALLATION & DECKING OPERATIONS
MAY START DURING THIS TIME AS NEEDED

NO BEAMS WILL BE SET OVER LIVE HUMP LD.
BEAMS WILL BE SET IN BETWEEN CUTS
OR DURING 4-HR CLOSURE

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A & B: MANITOWOC 4100 S2 BOOM: 100' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN S6	PLATE	130'	84K	42K	9K	51K	50'	104.7K	48.7%

* LIFT WEIGHT
WEIGHT OF THE BEAM EACH CRANE WILL BE LIFTING

** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

E-F
LIFT DETAILS SPAN S6
GIRDERS 13-16 (GROUP 2)
DURING 4-HR CLOSURE
SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/24/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		S6-04

AUSTIN BRIDGE AND ROAD, LP
FIRM NO. 11355

02/22/12

E-F FALSEWORK DESIGN

- Calculations
- Reference Materials
- Shop Drawings

PROJECT NAME: SOUTHWEST PARKWAY SECTION 2B
LOCATION: FT WORTH, TX

COMPANY PROJECT NUMBER: 610018

PREPARED BY:
LAFE SARGENT, P.E.

STATE OF TEXAS
LAFE S. SARGENT
102372
LICENSED
PROFESSIONAL ENGINEER
02/22/12

THIS STAMP APPLIES TO ALL CALCULATIONS PERFORMED BY AUSTIN BRIDGE & ROAD, LP
PAGES 1-7/7

FALSEWORK & ROOF DESIGN OVER HUMP LD

DESIGN CRITERIA

AISC 13TH EDITION

AREMA MANUAL FOR RAILWAY ENGINEERING (2011) - 28.8 FALSEWORK

ASD DESIGN $F_b := \frac{F_y}{1.66667} = 30ksi$ $F_v := \frac{F_y}{1.5} = 20ksi$ $F_y := 50ksi$ ALL COMPONENTS

LOADS

WIND LOAD 80 MPH $\frac{0 + 20ft}{2}$ $Q := 10$ $P_W := 2psf \cdot Q = 20psf$ per AREMA

LIVE LOAD $P_{LL} := 100psf$

DESCRIPTION OF FALSEWORK

SPAN N4

SPAN N4 CONSISTS OF THREE GIRDER PIECES. THE SHORT OUTSIDE PIECES WILL BE SET FIRST ON SHORE TOWERS FOLLOWED BY THE LONG MIDDLE PIECE WHICH WILL BE SPLICED TO THE PREVIOUSLY SET OUTSIDE PIECES. THE SHORT OUTSIDE PIECE OVER THE HUMP WILL BE SET FIRST. THE TEMPORARY SHORE TOWER BENT SUPPORTING THESE GIRDERS WILL BE ANALYSED.
AFTER THE MIDDLE LONG GIRDERS ARE SET AND FULLY SPLICED, THE TOWERS WILL BE REMOVED.

SPAN N8

SPAN S8 CONSISTS OF THREE GIRDER PIECES. THE SHORT OUTSIDE PIECES WILL BE SET FIRST ON SHORE TOWERS/FALSEWORK FOLLOWED BY THE LONG MIDDLE PIECE WHICH WILL BE SPLICED TO THE PREVIOUSLY SET OUTSIDE PIECES. THE SHORT OUTSIDE PIECE OVER THE HUMP WILL BE SET FIRST ON FALSEWORK THAT ALLOWS THE GIRDERS TO CANTILEVER OVER THE HUMP. THE TEMPORARY SHORE TOWER BENT SUPPORTING THESE GIRDERS WILL BE ANALYSED.
AFTER THE MIDDLE LONG GIRDERS ARE SET AND FULLY SPLICE, THE FALSEWORK WILL BE REMOVED.

SPAN N4 - TEMPORARY SHORE TOWER BENT

SEE ATTACHED BEAMPRO ANALYSIS

A1: WORST CASE LOAD UNDER GIRDER
A2: TEMPORARY BENT - GIRDER 1-3
A3: TEMPORARY BENT - GIRDERS 1-8

$R_{max} := 132.7kip$ $M_{max} := 241kip \cdot ft$

$V_{max} := 99kip$ $\Delta_{max} := .10in < \frac{15ft}{240} = 0.75in$

CAP BEAM - W18X130 OR EQUIVALENT $A := 38.25in^2$ $I := 2460in^4$ $S := 256in^3$ $t_w := .67in$

BENDING $f_b := \frac{M_{max}}{S} = 11.297ksi$ < $F_b = 30ksi$ BRACE AT TOWERS OK

SHEAR $f_v := \frac{V_{max}}{18in \cdot t_w} = 9.209ksi$ < $F_v = 20ksi$ OK

SHORE TOWERS: EFCO 50KIP SHORE TOWER (RATED AT 50 KIP PER LEG) = 200KIP

PER AREMA $R_{MAX} := R_{max} \cdot 150\% = 199.05kip$ < 200kip OK

DISTRIBUTION BEAMS HP14X89 $A := 26.1in^2$ $I := 904in^4$ $S := 131in^3$ $t_w := .615in$

BENDING $f_b := \frac{R_{max} \cdot 4ft}{4S} = 24.311ksi$ < $F_b = 30ksi$ BRACE AT EACH END OK

SHEAR $f_v := \frac{R_{max} \cdot 0.5}{14in \cdot t_w} = 7.706ksi$ < $F_v = 20ksi$ OK

FOOTINGS SOIL CONDITIONS CONSIST OF BALLAST ON TOP OF HARD BASE AREA WILL BE LEVELED WITH CLEAN ROCK AND COMPACTED

ACTUAL ESTIMATED BEARING CAPACITY = 6,000 PSF+/- (ADEQUATE FOR RR TRACKS, ROCK/BALLAST, DENSELY COMPACTED). USE 2:1 FACTOR OF SAFETY $BP := 3ksf$

MAX LOAD FIND VERTICAL LOAD ON TOWER DUE TO HORIZONTAL WIND LOAD

$R_w := 20psf \cdot 9.5ft \cdot 11.5ft \cdot \frac{28ft}{86ft} = 7.114kip$

FIND DEAD LOAD OF TOWER AND FOOTING

EFCO 50 KIP SHORE TOWER - 8' FRAME

2"x2"x1/8" TUBE $wt_{2L} := 4 \cdot 2in \cdot 0.125in \cdot 490pcf = 3.403plf$

3"x2"x1/8" TUBE $wt_{3L} := (2.3in + 2 \cdot 2in) \cdot 0.125in \cdot 490pcf = 4.253plf$

4"x4"X3/16" LEG $wt_{4L} := 4 \cdot 4in \cdot \frac{3}{16}in \cdot 490pcf = 10.208plf$

ONE 8' TALL 4 SIDED FRAME $WT_{FR} := 2\left[8ft \cdot 2\left(wt_{2L} + wt_{3L}\right) + 11.3ft \cdot 4 \cdot wt_{2L} + 3.4ft \cdot wt_{2L} + 2 \cdot 8ft \cdot wt_{4L}\right] = 0.934kip$

TOTAL SHORE TOWER w/ SREW JACKS $ST := 2 \cdot WT_{FR} + 8 \cdot 500lbf = 2.267kip$

DISTRIBUTION BEAMS $BM_D := 3 \cdot 10ft \cdot 89plf = 2.67kip$

FOOTINGS $FT := 150pcf \cdot 10 \cdot 4ft \cdot 4ft = 2.4kip$

TOTAL DEAD LOAD AT ONE TOWER $DL_T := ST + BM_D + 4 \cdot FT = 14.337kip$

TOTAL LEG LOAD = LOAD ON TOWER + WIND + TOWER & FOOTING

$R_T := \frac{R_{max} + R_w + DL_T}{4} = 34.588kip$

FOOTING AREA $A_{ft} := \frac{R_T}{BP} = 12.863ft^2$ USE A 4'x4' PAD OR BETTER

CONCRETE PAD - 1'x4'x4' - #7 BARS @ 8" O.C. EW 3" CLEAR FROM BOTTOM

CONCRETE FOOTING DESIGN

$M := 2438psf \cdot \frac{(4ft - 1ft)}{2} \cdot \frac{1.58}{2} = 32.913kip \cdot in$ TRY #7 BAR AT 8" O.C.

$s := \frac{\frac{12}{8} \cdot 60ksi \cdot .6in^2}{0.85 \cdot 3ksi \cdot 3in} = 1.765in$

$M_n := 60ksi \cdot \frac{12}{8} \cdot 0.6in^2 \cdot \left(9in - \frac{s}{2}\right) = 438.353kip \cdot in$ > $M = 32.913kip \cdot in$ OK

OR HARDWOOD TIMBER CRANE MATS - 12" THICK WITH 1" STEEL PLATE ON TOP

ANCHOR SHORE TOWER LEG TO FOOTING

USE HILTI WEDGE ANCHOR OR SCREW ANCHOR - 1/2"x4" SWL > 2,000 LB SHEAR OK

OR USE 3/8" LAG SCREW INTO WOOD MATS

"ROOF" N4 (TYPICAL H4) 3/4" PLYWOOD ON 4X4 JOIST THAT RUN PERPINDICULAR TO BEAMS (NEAR BEAM ENDS, JOISTS WILL FLAIR OUT DUE TO THE SKEW)

$P_{LL} = 100\text{-psf}$

APA PLYFORM CLASS 1 MAX PRESSURES FOR 3/4" PLYWOOD

20" SUPPORT SPACING $P_{allow} := 325\text{psf}$ > $P_{LL} = 100\text{-psf}$ OK

JOISTS 4X4 $A := 12.25\text{in}^2$ $S := 7.15\text{in}^3$

$L_{PERP} := 7\text{ft}$ $L_{SKEW} := 11.75\text{ft}$

PERPINDICULAR 16" O.C.

$f_b := \frac{P_{LL} \cdot 16\text{in} \cdot L_{PERP}^2}{8} \frac{1}{S} = 1770.629\text{psi}$ < $F_{b4X4} := 1500\text{psi}$ OK

$f_v := \frac{3}{2} \frac{P_{LL} \cdot 16\text{in} \cdot L_{PERP}}{2} \frac{1}{A} = 37.143\text{psi}$ < $F_{v4X4} := 140\text{psi}$ OK

SKEW 8" O.C.

$f_b := \frac{P_{LL} \cdot 8\text{in} \cdot L_{SKEW}^2}{8} \frac{1}{S} = 1448.208\text{psi}$ < $F_{b4X4} := 1500\text{psi}$ OK

$f_v := \frac{3}{2} \frac{P_{LL} \cdot 8\text{in} \cdot L_{SKEW}}{2} \frac{1}{A} = 35.969\text{psi}$ < $F_{v4X4} := 140\text{psi}$ OK

DUE TO GIRDER SKEW, SOME, IF NOT ALL, JOISTS WILL NEED TO BE ON SKEW

PANELS WILL BE CLAMPED DOWN WITH 10,000LB DROP FORGED STEEL C-CLAMP

SPAN 5II - FALSEWORK BENT

SEE ATTACHED BEAMPRO ANALYSIS (WORST CASES)

$R_{max} := 90\text{kip}$ $M_{max} := 164\text{kip-ft}$

$V_{max} := 74\text{kip}$ $\Delta_{max} := .04\text{in}$ < $\frac{10.5\text{ft}}{240} = 0.525\text{-in}$

A4: LOAD UNDER GIRDER 1
A5: LOAD UNDER GIRDER 8
A8: FALSEWORK BENT 1 - GIRDER 1
A7: FALSEWORK BENT 1 - GIRDERS 1-4
A6: FALSEWORK BENT 2 - GIRDER 8
A9: FALSEWORK BENT 2 - GIRDERS 5-8

CAP BEAM - W18X130 OR EQUIVALENT $A := 38.2\text{in}^2$ $I := 2466\text{in}^4$ $S := 256\text{in}^3$ $t_w := .67\text{in}$

BENDING $f_b := \frac{M_{max}}{S} = 7.688\text{-ksi}$ < $F_b = 30\text{-ksi}$ GRADE ATTOWERS OK

SHEAR $f_v := \frac{V_{max}}{18\text{in} \cdot t_w} = 6.126\text{ ksi}$ < $F_v = 20\text{-ksi}$ OK

COLUMN ANALYSIS $L := 35\text{ft}$

TRY HP12X53 $A := 15.5\text{in}^2$ $r_{yy} := 2.86\text{in}$ $k := 1$

$\frac{k \cdot L}{r_{yy}} = 83.916$ < 120 $F_a := \left[16000 - 0.38\left(\frac{L}{r_{yy}}\right)^2\right]\text{psi} = 13.324\text{ ksi}$

$P_{ALLOW} := F_a \cdot A = 206.522\text{-kip}$

$P_{MAX} := R_{max} \cdot 150\% = 135\text{-kip}$ < P_{ALLOW} OK

LATERAL BRACING

TRANSVERSE TO FALSEWORK BENT

$H = 4\%$ OF DL $H := 0.04 \cdot R_{max} = 3.6\text{-kip}$

USE L4x4x3/8 ANGLE BRACED TO CAP & HS COLUMN

$A := 2.86\text{in}^2$ $r := 1.23\text{in}$ LEVEL $L_1 := 10\text{ft}$ ON ANGLE $L_2 := 14\text{ft}$

LEVEL $\frac{k \cdot L_1}{r} = 97.561$ > 120 $F_a := \left[16000 - 0.38\left(\frac{L_1}{r}\right)^2\right]\text{psi} = 12.310\text{-ksi}$

$P_{ALLOW} := F_a \cdot A = 35.416\text{-kip}$

ON ANGLE USE L6x6x3/8 OR EQUIVALENT $A := 4.34\text{in}^2$ $r := 1.87\text{in}$

$\frac{k \cdot L_2}{r} = 89.84$ < 120 $F_a := \left[16000 - 0.38\left(\frac{L_2}{r}\right)^2\right]\text{psi} = 12.933\text{-ksi}$

$P_{ALLOW} := F_a \cdot A = 56.646\text{-kip}$ $P_{ANGLE} := P_{ALLOW} \cdot \sin\left(45 \cdot \frac{\pi}{180}\right) = 40.055\text{-kip}$

ANCHOR BOLTS/CONNECTION BOLTS

USE 3/4" ANCHOR BOLT (HILTI SCHREW ANCHOR OR WEDGE ANCHOR)
@ 1/4" EMBEDMENT SWL = 6,489LB FOR f'c = 2,500PSI CONCRETE
FOR 3,600PSI:

$P_{allow} := 6489\text{lbf}\left(\frac{3600}{2500}\right)^{\frac{1}{2}} = 7786.8\text{ lbf}$ $FS_{allow} := 1.44$

TOTAL HORIZONTAL CAPACITY = 7,781 LB (THIS INCLUDES A 1.44 FACTOR OF SAFETY)

LONGITUDINAL BRACING

WIND $H_w := 20\text{psf} \cdot 9\text{ft} \cdot 11.5\text{ft} = 20.7\text{-kip}$ <— CONTROLS

2% DL $H_{2DL} := 2\% \cdot R_{max} \cdot 5 = 9\text{-kip}$

USE L4x4x3/8 ANGLE WELDED TO COLUMNS ON 45 DEGREE ANGLE (MAX) FROM HORIZONTAL

$A := 2.86\text{in}^2$

$T_{DIA} := \frac{H_w}{\cos\left(45 \cdot \frac{\pi}{180}\right)} = 29.274\text{-kip}$

$f_t := \frac{T_{DIA}}{A} = 10.236\text{-ksi}$ < 21ksi A36 STEEL OR BETTER OK

DIAGONAL IN EACH DIRECTION

FOOTING DESIGN

A STEEL GRADE BEAM WILL DISTRIBUTE THE COLUMN LOADS TO TRANSVERSE BEAMS ON A CONTINOUS WOOD MATT

FIND MINIMUM LENGTH OF 4' WIDE MATT $BP = 3000\text{-psf}$

FIND VERTICAL LOAD ON TOWER DUE TO HORIZONTAL WIND LOAD

$R_w := 20\text{psf} \cdot 9\text{ft} \cdot 11.5\text{ft} \cdot \frac{25\text{ft}}{80\text{ft}} = 6.017\text{-kip}$ PLUS DEAD LOAD $R_{wd} := 10\text{kip}$

$L := \frac{R_{max} + 10\text{kip}}{4\text{ft} \cdot BP} = 8.333\text{ ft}$ SEE SHOP DRAWING FOR DETAILS

GRADE BEAMPOSTS BOTTOMS WILL BE RESTRAINED LATERALLY TO RESIST 2,000LBS AT EACH POST

ROOF 3/4" PLYWOOD ON 4X4'S AT 16" O.C. SYSTEM WILL HANG DOWN AND BE SUPPORTED BY DBL C-CHANNEL BEAMS SUPPORTED BY COIL ROD

$P_{LL} = 100\text{-psf}$

USE 1/2"ϕ COIL ROD - SWL = 3,000LB $w := P_{LL} \cdot \frac{8\text{ft}}{2} = 400\text{-plf}$

FIND COIL ROD SPACING $S := \frac{9\text{kip}}{w} = 22.5\text{ ft}$ USE 12'

USE DBL C4x7.2 OR EQUAL $A := 2.13\text{in}^2$ $S := 2.29\text{in}^3$ $I := 4.38\text{in}^4$ $E := 29000\text{ksi}$

BENDING $f_b := \frac{w \cdot (12\text{ft})^2}{8} \frac{1}{2 \cdot S} = 18.863\text{-ksi}$ < $F_b := 30\text{-ksi}$ OK

SHEAR $f_v := \frac{w \cdot 12\text{ft}}{2A} = 1.127\text{-ksi}$ < $F_v = 20\text{-ksi}$ OK

DEFLECTION $\Delta := \frac{5 \cdot w \cdot (12\text{ft})^4}{384 \cdot E \cdot 2 \cdot I} = 0.705\text{-in}$ USE 10'

$\Delta := \frac{5 \cdot w \cdot (10\text{ft})^4}{384 \cdot E \cdot 2 \cdot I} = 0.339\text{-in}$ < $\frac{10\text{ft}}{240} = 0.5\text{-in}$ SPACE COIL ROD AT 10' OK

UPPER SUPPORTS

SHEAR $f_v := \frac{w \cdot 12\text{ft}}{2A} = 1.127\text{-ksi}$ < $F_v = 20\text{-ksi}$ OK

SPAN 5II - CANTILEVERED GIRDER HOLD DOWN DESIGN

GIRDER 1

TOTAL WEIGHT $WT := 28\text{kip}$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 24.22\text{ft}$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 20.39\text{ft}$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1\text{ft}$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = 5.531\text{-kip}$

GIRDER 2

TOTAL WEIGHT $WT := 27\text{kip}$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 22.4\text{ft}$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 20.89\text{ft}$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1\text{ft}$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = 2.05\text{ kip}$

GIRDER 3

TOTAL WEIGHT $WT := 30\text{kip}$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 23.17\text{ft}$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 21.40\text{ft}$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1\text{ft}$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = 3.544\text{-kip}$ <—CONTROLS

GIRDER 4

TOTAL WEIGHT $WT := 30\text{kip}$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 24.72ft$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 21.92ft$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1ft$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = 4.015\ kip$

GIRDER 5

TOTAL WEIGHT $WT = 29kip$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 24.67ft$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 22.55ft$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1ft$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = 2.833\ kip$

GIRDER 6

TOTAL WEIGHT $WT := 28kip$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 23.04ft$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 23.2ft$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1ft$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = -0.202\ kip$

GIRDER 7

TOTAL WEIGHT $WT := 28kip$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 23.67ft$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 23.8ft$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1ft$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = -0.16\ kip$

GIRDER 8

TOTAL WEIGHT $WT := 29kip$

CENTER OF GRAVITY FROM END OF GIRDER $L_{CG} := 23.65ft$

DISTANCE TO SUPPORT FROM END OF GIRDER $L_S := 24.35ft$

DISTANCE TO HOLD DOWN FROM END OF GIRDER $L_{HD} := 1ft$

UPLIFT FORCE AT END OF GIRDER $R_{UP} := \frac{WT \cdot (L_{CG} - L_S)}{L_S - L_{HD}} = -0.869\ kip$

WORST CASE - GIRDER 3 $R_{UP} := 5.544kip$

HOLD DOWN METHOD

WIRE ROPE

1/2"ϕ WIRE ROPE IWRC6X37 - SWL (≅ 1 F.S.) = 5KIP

MAX ANGLE FROM VERTICAL = 18 DEGREES

$T_{WR} := \frac{R_{UP}}{2 \cdot \cos\left(18 \cdot \frac{\pi}{180}\right)} = 2.915\ kip$ < 5kip OK

TOTAL FACTOR OF SAFETY ON WIRE ROPE = 8.5

THIMBLE

USE THIMBLE ON CABLE

CAPACITY = WIRE ROPE CAPACITY AS LONG AS SHACKLE PIN DIAMETER IS EQUAL TO WIRE ROPE DIAMETER OR GREAT UP TO A MAX DIAMETER OF (2L+W)*0.2

$d_{min} := 0.5in$ $d_{max} := (2 \cdot 1.88in + 1.13in) \cdot 0.2 = 0.978\ in$

SHACKLES

SHACKLES OPTIONAL SIZES:

3-1/4 TONS: PIN DIAMETER = 0.75in

4-3/4 TONS: PIN DIAMETER = 0.88in

CROSBY SHACKLES 6:1 FACTOR OF SAFETY

ULTIMATE FACTOR OF SAFETY OF SHACKLES = 5:1

TURNBUCKLE

TURNBUCKLES MUST HAVE WORKING LOAD LIMIT OF 1 1/2 TONS OR BETTER

MIN FACTOR OF SAFETY = 5:1

ANCHOR BOLT

USE 3/4" ANCHOR BOLT (HILTI SCREW ANCHOR OR WEDGE ANCHOR)

@ 1/4" EMBEDMENT SWL = 6,480LB FOR f'c = 2,500PSI CONCRETE

FOR 3,000PSI:

$P_{allow} := 6480lbf \cdot \left(\frac{3000}{2500}\right)^{\frac{1}{2}} = 7786.9 \cdot lbf$ $FS_{allow} := 1.44$

TOTAL FACTOR OF SAFETY OF ANCHOR = $FS_T := \frac{P_{allow} \cdot 1.44}{T_{WR}} = 3.847$

L4X4X3/8 ANGLE

TWO 1/2" PLATES WELDED TO THE ANGLE WITH A 1 1/2" PIN RUNNING THROUGH TO CONNECT SHACKLE TO

DIAMETER OF PLATE $d := 3.5in$

DIAMETER OF PIN HOLE 1.56in

PLATE THICKNESS $t := 0.5in$

PIN BEARING LENGTH $l := 1in$

USE A36 GRADE STEEL OR BETTER

PLATE FACTOR OF SAFETY $FS := \frac{36ksi}{\frac{T_{WR}}{2 \cdot t \cdot l}} = 12.231$

PIN $t_c := 3in$ $A := \frac{\pi \cdot (1.5in)^2}{4} = 1.767\ in^2$ $S := \frac{\pi \cdot (1.5in)^3}{32} = 0.331\ in^3$

$f_b := \frac{T_{WR} \cdot t_c}{4} \cdot \frac{1}{S} = 6.597\ ksi$ $FS := \frac{36ksi}{f_b} = 5.457$

$f_v := \frac{T_{WR}}{2 \cdot A} = 0.825\ ksi$ $FS := \frac{36ksi}{2 \cdot 0.825ksi} = 21.818$

WELD 1/4" ALL AROUND

AISC $R_n := 2.0 \cdot 16ksi \cdot 4in \cdot (2)in = 85.12kip$ $FS := \frac{R}{T_{WR}} = 30.566$

Center of Gravity
Steel Plate Girder
Of
Right to Left
Beam 1

Section	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
Top Flange	1.11	20	185.00	44.08	35.48	
Web	0.875	60	178.50	9.25	4.63	
Bottom Flange	1.25	20	213.10	9.25	4.63	
Sub-Total						
Stiffeners	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
BS1 on (1)	1	12	98	113.47	35.41	118614.81
BS1 on (2)	1	12	98	113.47	11.31	4465.17
BS2 on	1	12	98	113.47	3.38	1334.54
BS3 on	1.25	13	60	275.48	2.27	796.13
BS4 on	1.25	13	60	275.48	2.27	796.13
Sub-Total				2,126.06		125,945.04
Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (lbs)	CG (in)	Moment (lbs-ft)
BS2bn	2	0.75	18	44.25	517.25	47.88	24,764.69
BS3bn	4	0.625	13	44.25	1,345.45	47.88	64,440.08
BS3b/A	2	0.25	12	12	87.24	63.81	5,565.28
BS3b	2	0.5	20.25	88.375	1,035.69	44.88	46,485.61
Sub-Total					2,985.73		141,255.66
Total	Weight 23,959.06	Moment 878,424.88					
C.G.	36.65 (from right end of girder						

Section	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
Top Flange	1.11	20	185.00	44.08	35.48	
Web	0.875	60	178.50	9.25	4.63	
Bottom Flange	1.25	20	213.10	9.25	4.63	
Sub-Total						
Stiffeners	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
BS1 on (1)	1	12	98	113.47	35.41	118614.81
BS1 on (2)	1	12	98	113.47	11.31	4465.17
BS2 on	1	12	98	113.47	3.38	1334.54
BS3 on	1.25	13	60	275.48	2.27	796.13
BS4 on	1.25	13	60	275.48	2.27	796.13
Sub-Total				2,126.06		125,945.04
Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (lbs)	CG (in)	Moment (lbs-ft)
BS2bn	2	0.75	18	44.25	517.25	47.88	24,764.69
BS3bn	4	0.625	13	44.25	1,345.45	47.88	64,440.08
BS3b/A	2	0.25	12	12	87.24	63.81	5,565.28
BS3b	2	0.5	20.25	88.375	1,035.69	44.88	46,485.61
Sub-Total					2,985.73		141,255.66
Total	Weight 23,959.06	Moment 878,424.88					
C.G.	36.65 (from right end of girder						

Note: Weight does not include SWL, deer stand

Section	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)	Section	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
Top Flange	1.11	20	185.00	44.08	35.48		Top Flange	1.11	20	185.00	44.08	35.48	
Web	0.875	60	178.50	9.25	4.63		Web	0.875	60	178.50	9.25	4.63	
Bottom Flange	1.25	20	213.10	9.25	4.63		Bottom Flange	1.25	20	213.10	9.25	4.63	
Sub-Total							Sub-Total						
Stiffeners	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)	Stiffeners	Thickness (in)	Width/Height (in)	Weight (lbs/ft)	Length (ft)	CG (in)	Moment (lbs-ft)
BS1 on (1)	1	12	98	113.47	35.41	118614.81	BS1 on (1)	1	12	98	113.47	35.41	118614.81
BS1 on (2)	1	12	98	113.47	11.31	4465.17	BS1 on (2)	1	12	98	113.47	11.31	4465.17
BS2 on	1	12	98	113.47	3.38	1334.54	BS2 on	1	12	98	113.47	3.38	1334.54
BS3 on	1.25	13	60	275.48	2.27	796.13	BS3 on	1.25	13	60	275.48	2.27	796.13
BS4 on	1.25	13	60	275.48	2.27	796.13	BS4 on	1.25	13	60	275.48	2.27	796.13
Sub-Total				2,126.06		125,945.04	Sub-Total				2,126.06		125,945.04
Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (lbs)	CG (in)	Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (lbs)	CG (in)
BS2bn	2	0.75	18	44.25	517.25	47.88	BS2bn	2	0.75	18	44.25	517.25	47.88
BS3bn	4	0.625	13	44.25	1,345.45	47.88	BS3bn	4	0.625	13	44.25	1,345.45	47.88
BS3b/A	2	0.25	12	12	87.24	63.81	BS3b/A	2	0.25	12	12	87.24	63.81
BS3b	2	0.5	20.25	88.375	1,035.69	44.88	BS3b	2	0.5	20.25	88.375	1,035.69	44.88
Sub-Total					2,985.73		Sub-Total					2,985.73	
Total	Weight 23,959.06	Moment 878,424.88					Total	Weight 23,959.06	Moment 878,424.88				
C.G.	36.65 (from right end of girder						C.G.	36.65 (from right end of girder					

Note: Weight does not include SWL, deer stand

Section Thickness (in) Width/Height (in) Weight (lbs/ft) Length (ft) CG (in) Moment (lbs-ft)

Top Flange 1.11 20 185.00 44.08 35.48

Web 0.875 60 178.50 9.25 4.63

Bottom Flange 1.25 20 213.10 9.25 4.63

Sub-Total

Stiffeners Thickness (in) Width/Height (in) Weight (lbs/ft) Length (ft) CG (in) Moment (lbs-ft)

BS1 on (1) 1 12 98 113.47 35.41 118614.81

BS1 on (2) 1 12 98 113.47 11.31 4465.17

BS2 on 1 12 98 113.47 3.38 1334.54

BS3 on 1.25 13 60 275.48 2.27 796.13

BS4 on 1.25 13 60 275.48 2.27 796.13

Sub-Total 2,126.06 125,945.04

Splice Plates QTY (ea) Thickness (in) Width (in) Length (in) Weight (lbs) CG (in) Moment (lbs-ft)

BS2bn 2 0.75 18 44.25 517.25 47.88 24,764.69

BS3bn 4 0.625 13 44.25 1,345.45 47.88 64,440.08

BS3b/A 2 0.25 12 12 87.24 63.81 5,565.28

BS3b 2 0.5 20.25 88.375 1,035.69 44.88 46,485.61

Sub-Total 2,985.73 141,255.66

Total Weight 23,959.06 Moment 878,424.88

C.G. 36.65 (from right end of girder

Note: Weight does not include SWL, deer stand

Center of Gravity
Steel Plate Girder
S6 Girder 2
Right to Left

Section

	1 Thickness (in)	1 Width/Height (in)	1 Lbs/ft (lbs/ft)	1 Length (ft)	1 CG (ft)	2 Thickness (in)	2 Width/Height (in)	2 Lbs/ft (lbs/ft)	2 Length (ft)	2 CG (ft)	3 Thickness (in)	3 Width/Height (in)	3 Lbs/ft (lbs/ft)	3 Length (ft)	3 CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	118.10	42.15	21.08											5,019.95	105,781.45
Web	0.875	60	178.65	9.25	4.63	0.875	79	235.22	3.47	10.99	0.875	98	291.79	29.42	27.43	13,015.05	352,019.01
Bottom Flange	1.25	28	118.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	29.42	27.43	5,102.25	137,754.49
Sub-Total																23,136.24	595,318.81

Stiffeners

	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801ae (1)	2	1	12	98	666.94	22.07	14719.71
801ah & 801ae	2	1	12	98	666.94	12.73	8490.20
802a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	2.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,295.17		29,063.38

Splice Plates

	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	537.01	42.15	22,626.77
802n	4	0.875	28	44.25	570.92	42.15	24,064.38
802p/t	2	0.25	22	28	87.34	42.15	3,682.30
802h	2	0.5	20.25	88.375	507.47	42.15	21,389.88
Sub-Total					1,702.73		71,763.33

	Weight	Moment
Total	25,224.19	695,845.81

Note: Weight does not include bolts, shear studs

C.G. 27.59 from right end of girder

Center of Gravity
Steel Plate Girder
S6 Girder 3
Right to Left

Section

	1 Thickness (in)	1 Width/Height (in)	1 Lbs/ft (lbs/ft)	1 Length (ft)	1 CG (ft)	2 Thickness (in)	2 Width/Height (in)	2 Lbs/ft (lbs/ft)	2 Length (ft)	2 CG (ft)	3 Thickness (in)	3 Width/Height (in)	3 Lbs/ft (lbs/ft)	3 Length (ft)	3 CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	118.10	47.32	23.66											5,585.88	132,140.28
Web	0.875	60	178.65	9.25	4.63	0.875	79	235.22	3.47	10.99	0.875	98	291.79	34.60	30.02	12,564.55	377,086.75
Bottom Flange	1.25	28	118.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	34.60	30.02	5,782.17	174,349.39
Sub-Total																23,982.60	687,576.34

Stiffeners

	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801ae (1)	2	1	12	98	666.94	32.72	21822.41
801ah & 801ae	2	1	12	98	666.94	18.51	12010.42
802a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	2.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,295.17		39,086.31

Splice Plates

	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	537.01	47.32	25,837.89
802n	4	0.875	28	44.25	570.92	47.32	27,016.04
802p/t	2	0.25	22	28	87.34	46.15	4,030.65
802h	2	0.5	20.25	88.375	507.47	47.32	24,013.28
Sub-Total					1,702.73		79,997.86

	Weight	Moment
Total	27,979.90	704,080.50

Note: Weight does not include bolts, shear studs

C.G. 25.17 from right end of girder

Center of Gravity
Steel Plate Girder
S6 Girder 4
Right to Left

Section

	1 Thickness (in)	1 Width/Height (in)	1 Lbs/ft (lbs/ft)	1 Length (ft)	1 CG (ft)	2 Thickness (in)	2 Width/Height (in)	2 Lbs/ft (lbs/ft)	2 Length (ft)	2 CG (ft)	3 Thickness (in)	3 Width/Height (in)	3 Lbs/ft (lbs/ft)	3 Length (ft)	3 CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	118.10	45.98	22.99											5,476.09	125,891.31
Web	0.875	60	178.65	9.25	4.63	0.875	79	235.22	3.47	10.99	0.875	98	291.79	33.28	29.25	12,172.55	401,446.77
Bottom Flange	1.25	28	118.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	33.28	29.25	5,832.58	127,504.50
Sub-Total																23,481.22	654,842.59

Stiffeners

	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801ae (1)	2	1	12	98	666.94	42.47	28325.18
801ae (1)	2	1	12	98	666.94	29.37	19598.88
801ah & 801ae	2	1	12	98	666.94	12.73	8490.20
802a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	2.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,962.12		61,668.52

Splice Plates

	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	537.01	45.98	24,691.70
802n	4	0.875	28	44.25	570.92	45.98	26,253.01
802p/t	2	0.25	22	28	87.34	45.98	4,015.80
802h	2	0.5	20.25	88.375	507.47	45.98	23,333.28
Sub-Total					1,702.73		78,293.79

	Weight	Moment
Total	27,927.07	890,266.93

Note: Weight does not include bolts, shear studs

C.G. 26.72 from right end of girder

Center of Gravity
Steel Plate Girder
9E Girder 8
Right to Left

Section

	1					2					3						
	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	119.10	48.16	23.07											5,732.33	132,173.01
Web	0.875	80	174.65	9.25	4.63	0.875	79	285.22	3.47	10.89	0.875	90	291.79	33.42	20.43	11,230.24	301,597.14
Bottom Flange	1.25	28	119.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	33.42	29.43	5,841.64	128,342.20
Sub-Total																23,357.02	558,752.35

Stiffeners	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801aa (1)	1	1	12	98	668.94	35.17	23456.44
801ab & 801ac	2	1	12	98	668.94	13.67	9147.13
801a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	3.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,295.17		37,857.03

Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	577.01	46.16	26,616.03
802n	4	0.875	18	44.25	770.92	46.16	35,562.56
802p/r	2	0.25	22	28	87.34	46.16	4,029.97
802h	2	0.5	10.25	88.375	507.47	46.16	23,410.47
Sub-Total					1,942.73		89,619.02

	Weight	Moment
Total	27,594.92	674,882.00

Note: Weights does not include bolts, shear studs

C.G. 24.47 from right end of girder

Center of Gravity
Steel Plate Girder
9E Girder 8
Right to Left

Section

	1					2					3						
	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	119.10	43.25	21.63											5,153.24	111,574.01
Web	0.875	80	174.65	9.25	4.63	0.875	79	285.22	3.47	10.89	0.875	90	291.79	30.17	18.00	11,387.47	304,261.78
Bottom Flange	1.25	28	119.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	30.17	28.00	5,201.23	117,194.10
Sub-Total																21,844.45	533,029.79

Stiffeners	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801aa (1)	1	1	12	98	668.94	25.57	17015.77
801ab & 801ac	2	1	12	98	668.94	13.78	9499.20
801a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	3.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,295.17		30,767.44

Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	577.01	43.28	24,964.06
802n	4	0.875	18	44.25	770.92	43.28	33,361.33
802p/r	2	0.25	22	28	87.34	43.28	3,780.86
802h	2	0.5	10.25	88.375	507.47	43.28	21,968.30
Sub-Total					1,942.73		84,074.54

	Weight	Moment
Total	25,882.35	647,871.78

Note: Weights does not include bolts, shear studs

C.G. 25.04 from right end of girder

Center of Gravity
Steel Plate Girder
9E Girder 7
Right to Left

Section

	1					2					3						
	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Thickness (in)	Width/Height (in)	Lbs/ft (lbs/ft)	Length (ft)	CG (ft)	Total Wt (Lbs)	Total Moment (Lb-ft)
Top Flange	1.25	28	119.10	43.94	21.97											5,233.11	114,971.95
Web	0.875	80	174.65	9.25	4.63	0.875	79	285.22	3.47	10.89	0.875	90	291.79	31.31	18.23	11,178.30	354,844.43
Bottom Flange	1.25	28	119.10	9.25	4.63	1.25	28	119.10	4.70	10.99	1.25	28	119.10	31.22	28.33	5,179.63	146,681.10
Sub-Total																21,591.04	616,237.43

Stiffeners	QTY (ea)	Thickness (in)	Width (in)	Height (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
801aa (1)	1	1	12	98	668.94	27.47	18050.41
801ab & 801ac	2	1	12	98	668.94	13.72	8870.16
801a	2	1	12	60	408.33	9.25	3777.08
801d	1	1.25	13	60	276.48	3.67	738.19
801c	1	1.25	13	60	276.48	2.67	738.19
Sub-Total					2,295.17		32,114.23

Splice Plates	QTY (ea)	Thickness (in)	Width (in)	Length (in)	Weight (Lbs)	CG (ft)	Moment (Lb-ft)
802m	2	0.75	28	44.25	577.01	43.94	25,356.41
802n	4	0.875	18	44.25	770.92	43.94	35,086.32
802p/r	2	0.25	22	28	87.34	43.94	3,837.63
802h	2	0.5	10.25	88.375	507.47	43.94	22,298.05
Sub-Total					1,942.73		86,578.41

	Weight	Moment
Total	26,178.94	814,730.28

Note: Weights does not include bolts, shear studs

C.G. 31.12 from right end of girder

BeamPro - version (5.8 - 32 bit)

HH WORST GIRDER LOAD A1

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SUMMARY

GIRDER NO.	LENGTH (FT)	C.G. (FT)	DIST TO SUPPORT (FT)	DIST TO HOLD DOWN (FT)	UPLIFT FORCE (KIPS)
1	44.88	24.22	20.39	1	5.53
2	42.15	22.42	20.89	1	2.05
3	47.32	25.17	21.4	1	5.54
4	45.98	24.72	21.92	1	4.02
5	46.14	24.67	22.55	1	2.85
6	43.29	23.04	23.2	1	-0.2
7	43.94	23.67	23.8	1	-0.16
8	43.5	23.65	24.35	1	-0.37

Center of Gravity
Steel Plate Girder
34
Right to left

Section	Thickness (in)	Width/Height (in)	Weight (lb/ft)	Length (ft)	CG (ft)	Elements (in)	Widths/Heights (in)	Widths (in)	Heights (in)	Length (in)	CG (in)	First Moment (lb-in)
						1						
Top Flange	1.25	28	155.10	43.50	21.75							3,180.75	112,500.00
Web	0.875	60	178.65	9.25	4.63	0.875	79	0.875	79.79	30.78	38.15	14,499.92	166,071.46
Bottom Flange	0.25	28	118.10	9.25	4.63	1.25	26	1.25	26	30.78	38.15	5,122.23	195,200.05
Sub-total												23,803.89	473,771.51
						2							
Top Flange	1.25	28	155.10	43.50	21.75							3,180.75	112,500.00
Web	0.875	60	178.65	9.25	4.63	0.875	79	0.875	79.79	30.78	38.15	14,499.92	166,071.46
Bottom Flange	0.25	28	118.10	9.25	4.63	1.25	26	1.25	26	30.78	38.15	5,122.23	195,200.05
Sub-total												23,803.89	473,771.51

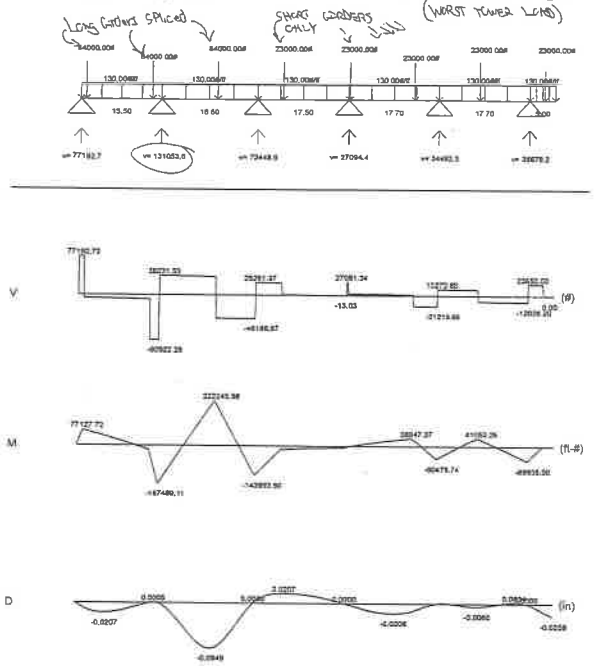
Stiffeners	QTY	Thickness (in)	Width (in)	Weight (lb/ft)	CG (in)	Moment (in-lb)
Bottom (1)	1	1	12	33.40	23.35	780.27
Bottom & Bottom	1	1	12	33.40	12.20	407.50
Bottom	1	1	12	33.40	9.25	308.90
Bottom	1.25	12	10	21.40	7.67	164.19
Bottom	1	0.5	10.44	18.37	12.99	238.63
Bottom	1	0.5	20.44	35.97	23.54	846.74
Bottom	1	0.5	20.44	35.97	23.73	853.42
Bottom	1	0.5	20.44	35.97	23.54	846.74
Bottom	1	0.5	20.44	35.97	23.73	853.42
Sub-total				2,177.23		54,984.43

Plate Girder	QTY (in)	Thickness (in)	Width (in)	Length (in)	Weight (lbs/ft)	CG (in)	Moment (in-lb)
Bottom	1	0.75	28	44.25	127.51	47.33	6,035.39
Bottom	8	0.875	12	44.25	170.02	47.33	57,018.00
Bottom/1	1	0.25	12	38	51.04	46.13	4,009.05
Bottom	1	0.5	10.33	40.375	140.87	47.33	54,010.39
Sub-total					1,451.73		74,972.84

Total	Weight 2,530.26	Moment 4,004,736	Moment divided by weight (from above)
C.G.	23.65 from right end of girder		

BeamPro - version (5.8 - 32 bit)

N4- SKIRT TURNER BENT (WORST TURNER LOAD) A2



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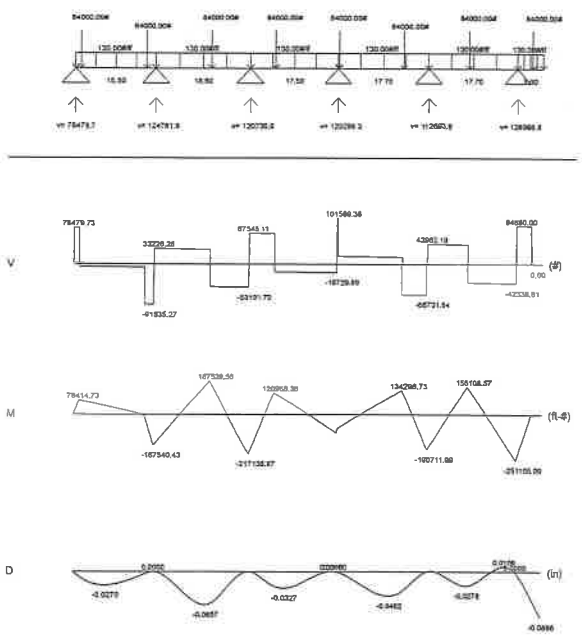
BeamPro - version (5.8 - 32 bit)

M4- ALL GIRDERS SPLICED A3



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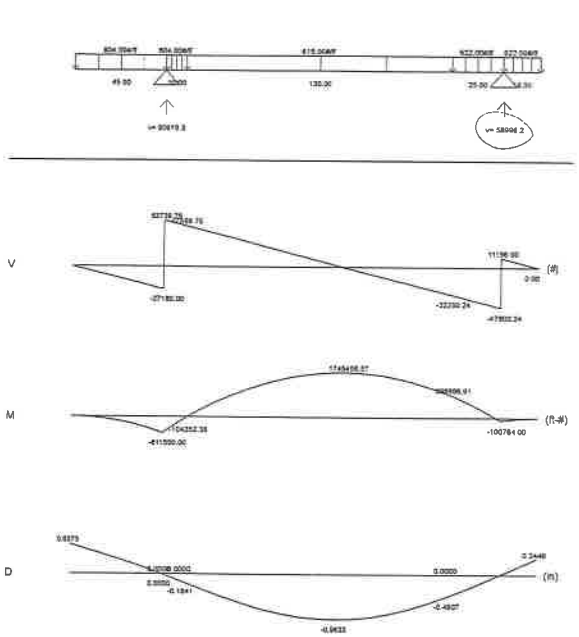
BeamPro - version (5.8 - 32 bit)

S6 - GIRDER 1 A4



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BeamPro - version (5.8 - 32 bit)

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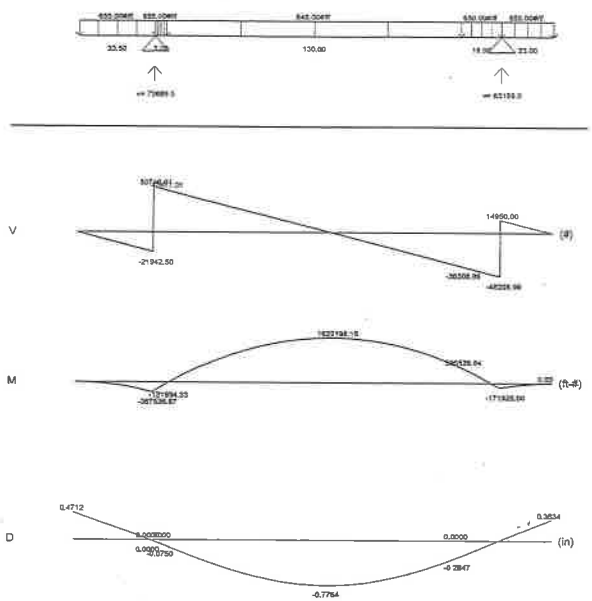
S6 - GIRDER 8



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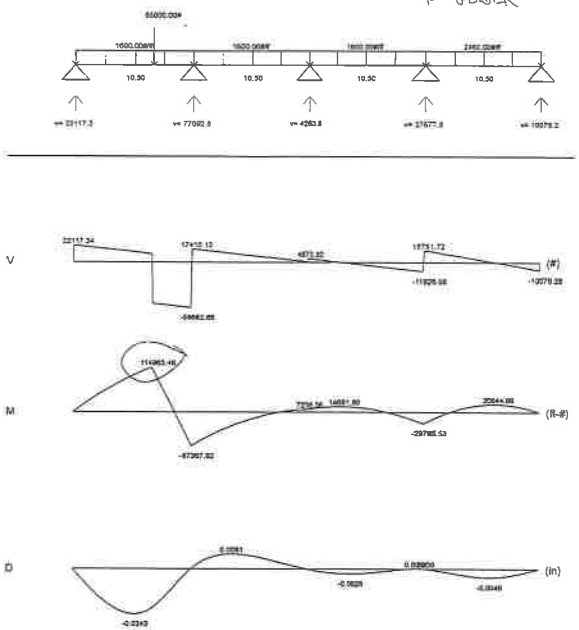
BeamPro - version (5.8 - 32 bit)

A6

S6 - F.W BEAT 1
1st GIRDER



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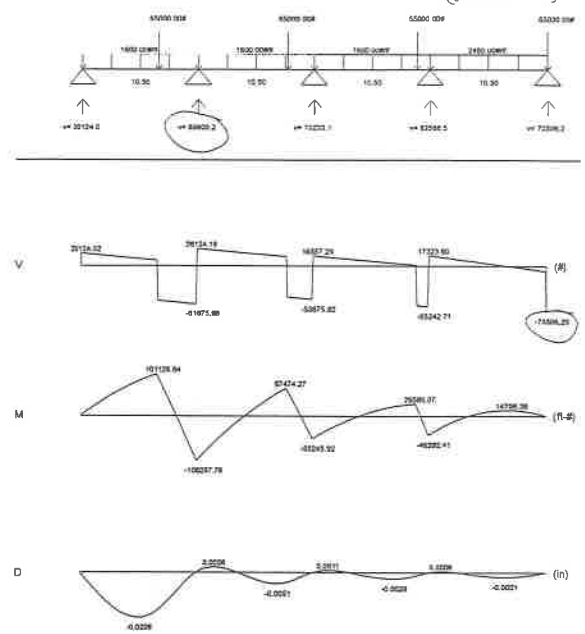
S6 - F.W BEAT 1
(GIRDERS 1-4)



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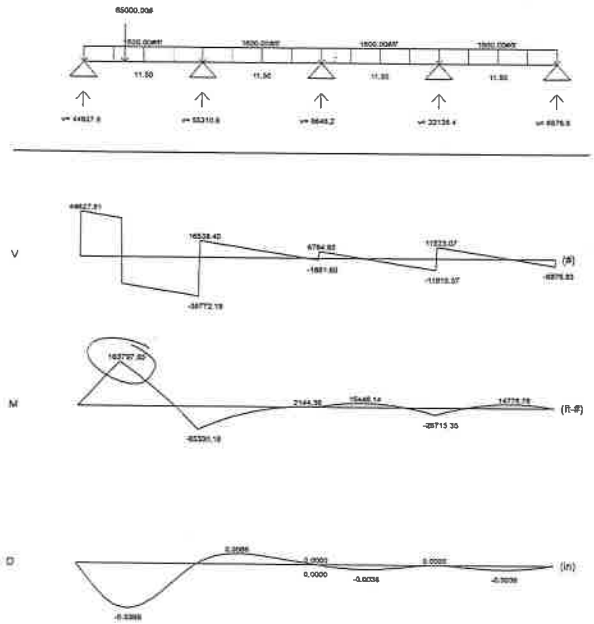
S6- F.W. BENT 2 GIRDER 5 A8



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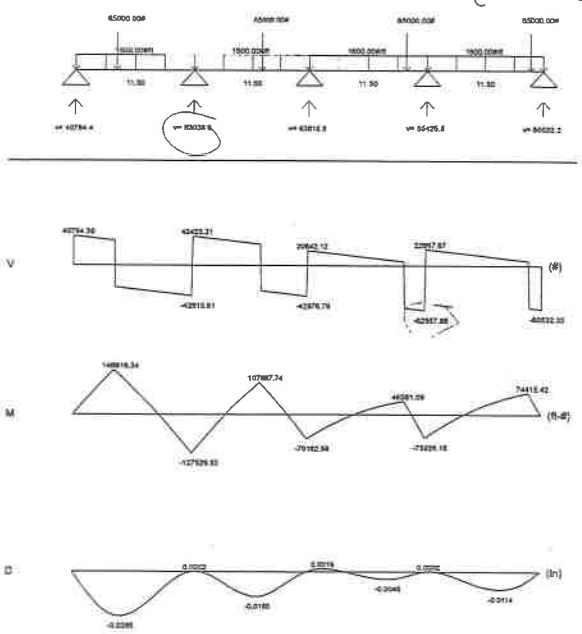

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TABLE 3

RECOMMENDED MAXIMUM PRESSURES ON PLYFORM CLASS I (psf)[a] FACE GRAIN ACROSS SUPPORTS[b]

Support Spacing (in.)	Plywood Thickness (in.) 15/32		1/2		19/32		5/8		23/32		3/4		1-1/8	
4	2715	2715	2945	2945	3110	3110	3270	3270	4010	4010	4110	4110	5965	5965
8	885	885	970	970	1195	1195	1260	1260	1540	1540	1580	1580	2295	2295
12	355	355	405	430	540	540	575	575	695	695	730	730	1370	1370
16	150	200	175	230	245	305	285	325	345	390	370	415	740	770
20	-	115	100	135	145	190	160	210	210	270	225	285	485	535
24	-	-	-	-	-	100	-	110	110	145	120	160	375	340
32	-	-	-	-	-	-	-	-	-	-	-	-	130	170

(a) Deflection limited to 1/360th of the span, 1/270th where shaded.
(b) Plywood continuous across two or more spans.

TABLE 4

RECOMMENDED MAXIMUM PRESSURES ON PLYFORM CLASS I (psf)[a] FACE GRAIN PARALLEL TO SUPPORTS[b]

Support Spacing (in.)	Plywood Thickness (in.) 15/32		1/2		19/32		5/8		23/32		3/4		1-1/8	
4	1385	1385	1585	1585	1620	1620	1770	1770	2110	2110	2325	2325	4815	4815
8	390	390	470	470	530	530	635	635	835	835	895	895	1850	1850
12	110	150	145	195	185	225	210	260	375	490	460	490	1145	1145
16	-	-	-	-	-	-	-	120	100	215	200	270	710	725
20	-	-	-	-	-	-	-	-	115	125	145	155	400	400
24	-	-	-	-	-	-	-	-	-	-	-	100	255	255

(a) Deflection limited to 1/360th of the span, 1/270th where shaded.
(b) Plywood continuous across two or more spans.

Recommended Pressures on Plyform

Recommended maximum pressures on the more common thicknesses of Plyform Class I are shown in Tables 3 and 4. Tables 5 and 6 show pressures for Structural I Plyform. Calculations for these pressures were based on deflection limitations of 1/360th or 1/270th of the span, or shear or bending strength: whichever provided the most conservative (lowest load) value. Use unshaded columns for design of architectural concrete forms where appearance is important.

Though not manufactured specifically for concrete forming, grades of plywood other than Plyform have been used for forming when thin panels are needed for curved forms. The recommended pressures shown in the following tables give a good estimate of performance for sanded grades such as APA A-C Exterior and APA B-C Exterior, and unsanded grades such as APA Rated Sheathing Exterior and Exposure 1 (CDX) (marked PS 1), provided face grain is across supports. For Group 1 sanded grades, use the tables for Plyform Class I. For unsanded grades (Span Rated PS 1 panels) use the Plyform Class I tables assuming 15/32" Plyform for 32/16 panels, 19/32" for 40/20 and 23/32" for 48/24.

Textured plywood has recently been used to obtain various patterns for architectural concrete. Many of these panels have some of the face ply removed due to texturing. Consequently, strength and stiffness will be reduced. As textured plywood is available in a variety of patterns and wood species, it is impossible to give exact factors for strength and stiffness reductions. For approximately equivalent strength, specify the desired grade in Group 1 species and determine the thickness assuming Plyform Class I.

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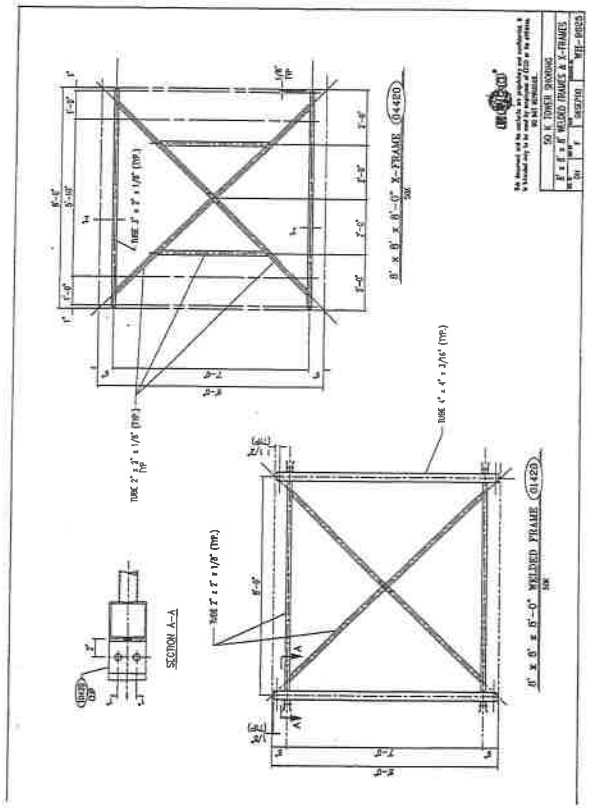


3.3.5 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

3.3.5.1 Product Description
3.3.5.2 Material Specifications
3.3.5.3 Technical Data
3.3.5.4 Installation Instructions
3.3.5.5 Ordering Information

Listings/Approvals

ICC-ES (International Code Council)
ESR-3027
(Cracked & Uncracked Concrete)
AC 106 ESR Pending
(Grout filled concrete masonry)
City of Los Angeles
Research Report No. 25897

Independent Code Evaluation

ISO® / IRC® 2006 (AC 193 / ACI 355.2)
IBC® / IRC® 2006 (AC 193 / ACI 355.2)
IBC® / IRC® 2003 (AC 193 / ACI 355.2)

3.3.5.1 Product Description

Hilti KWIK HUS-EZ (KH-EZ) anchors are comprised of a body with hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003 inch (8 µm) zinc coating in accordance with DIN EN ISO 4042. The KWIK HUS-EZ (KH-EZ) system is available in a variety of lengths with diameters of 1/4 inch, 3/8 inch, 1/2 inch, 5/8 inch and 3/4 inch (6.4mm, 9.5mm, 12.7mm, 15.9mm and 19.1mm). The hex head is larger than the diameter of the anchor and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. Applicable base materials include normal-weight concrete, structural lightweight concrete lightweight concrete over metal deck, and grout filled concrete masonry.

Guide Specifications

Screw anchors shall be KWIK HUS-EZ as supplied by Hilti, Inc. Anchors shall be manufactured from heat treated carbon steel material, zinc plated to a minimum thickness of 8µm. Anchor head shall display name of manufacturer, product name, diameter and length. Anchors shall be installed using a drill bit of same nominal diameter as anchor.

Product Features

- Suitable for cracked and uncracked normal weight and lightweight concrete, and grout filled concrete masonry.
- Suitable for seismic and nonseismic loads.
- Quick and easy to install.
- Length and diameter identification clearly stamped on head facilitates quality control and inspection after installation.
- Through fixture installation improves productivity and accurate installation.
- Thread design enables quality setting and exceptional load values in wide variety of base material strengths.
- Anchor is fully removable
- Anchor size is same as drill bit size and uses standard diameter drill bits.
- Suitable for reduced edge distances and spacing.

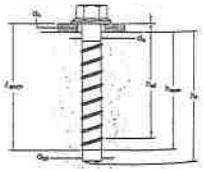
3.3.5.2 Material Specifications

Hilti KWIK HUS-EZ anchors are manufactured from carbon steel. The anchors are bright zinc plated to a minimum thickness of 8µm.

3.3.5.3 Technical Data

The data contained in Tables 1-5 of this section have been evaluated in accordance with AC 193. For more detail, see ICC-ES ESR 3027.

Figure 1 — KWIK HUS-EZ anchor installation details



KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.5

Table 1 — KWIK HUS-EZ Specification Table[1,2,3]

Characteristic	Symbol	Units	Nominal Anchor Diameter (inches)												
			1/4		3/8			1/2			5/8		3/4		
Nominal Diameter	d_a	in.	1/4		3/8			1/2			5/8		3/4		
Drill Bit Diameter	d_o	in.	1/4		3/8			1/2			5/8		3/4		
Baseplate Clearance Hole Diameter	d_h	in.	3/8		1/2			5/8			3/4		7/8		
Installation Torque[4]	T_{inst}	ft-lbf	18		40			45			85		115		
Impact Wrench Torque Rating[3]	T_{impact}	ft-lbf	114	137	114	450		137	450		450		450		
Nominal Embedment depth	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	5	4	5-1/4	
Effective Embedment Depth	h_{ef}	in.	1.18	1.92	1.11	1.86	2.50	1.50	2.16	3.22	2.39	3.89	2.92	4.64	
Minimum Hole Depth	h_o	in.	2	2-7/8	1-7/8	2-3/4	3-1/2	2-5/8	3-1/8	4-5/8	3-5/8	5-3/8	4-3/8	6-5/8	
Critical Edge Distance[2]	c_{ac}	in.	2.80	2.78	2.13	2.82	2.75	2.75	3.25	3.63	5.81	4.41	7.25		
Minimum Spacing at critical edge Distance	$s_{min,ac}$	in.	1.50		2.25			3					4		
Minimum Edge Distance[2]	c_{min}	in.	1.50					1.75							
Minimum Spacing at Minimum Edge Distance	s_{min}	in.	3										4		
Minimum Concrete Thickness	h_{min}	in.	3.25	4.125	3.25	4	4.875	4.5	4.75	6.75	5	7	6	8.125	
Wrench socket size	-	in.	7/16		9/16			3/4			13/16		1-1/8		
Head height	-	in.	0.24		0.35			0.49			0.57		0.70		
Effective tensile stress area	A_{se}	in.^{2}	0.045		0.086			0.161			0.268		0.362		
Minimum specified ultimate strength	f_{uta}	psi	134,000		106,225	120,300		112,540			90,190		81,600		

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m, 1 psi = 6.89 Pa, 1 in^2 = 645 mm^2, 1 lb/in = 0.175 N/mm

1 The data presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.

2 For installations through the soffit of steel deck into concrete (see Figure 2) anchors installed in the lower flute may be installed with a maximum 1 inch offset in either direction from the center of the flute.

3 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over-torquing can damage the anchor and/or reduce its holding capacity.

4 $T_{inst,max}$ applies to installations using a calibrated torque wrench.

3.3.5 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 2 — KWIK HUS EZ (KH EZ) Tension Strength Design Information[1,2,3,4,5]

Characteristic	Symbol	Units	Nominal Anchor Diameter (inches)											
			1/4		3/8			1/2			5/8		3/4	
Anchor Category 1,2 or 3			1											
Nominal Embedment Depth	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	5	4	6-1/4
Steel Strength in Tension (ACI 318 D.5.1)[6]														
Tension Resistance of Steel	N_{sa}	lb.	5070		9125		10335		18120			24210		32013
Reduction Factor for Steel Strength[7]	ϕ_{sa}	-	0.65											
Concrete Breakout Strength in Tension (ACI 318 D.5.2)														
Effective Embedment Depth	h_{ef}	in.	1.18	1.92	1.11	1.86	2.50	1.52	2.16	3.22	2.39	3.98	2.92	4.84
Critical Edge Distance	c_{ac}	in.	2.00	2.75	2.10	2.92	3.74	2.75	3.87	5.25	3.53	5.62	4.81	7.28
Effectiveness Factor — Uncracked Concrete	k_{uncr}	-	24					27						
Effectiveness Factor — Cracked Concrete	k_{cr}	-	17											
Modification factor for cracked and uncracked concrete[8]	$\psi_{c,N}$	-	1.0											
Reduction Factor for Concrete Breakout Strength[9]	ϕ_{cb}	-	0.65 (Condition B)											
Pullout Strength in Tension (Non Seismic Applications) (ACI 318 D.5.3)														
Characteristic pullout strength, uncracked concrete (2,500psi)	$N_{p,uncr}$	lb.	1305[11]	2348[11]	N/A									
Characteristic pullout strength, cracked concrete (2500 psi)	$N_{p,cr}$	lb.	932[11]	1168[11]	728[11]	N/A								
Reduction factor for pullout strength[7]	ϕ_p	-	0.65 (Condition B)											
Pullout Strength in Tension (Seismic Applications) (ACI 318 D.5.3)														
Characteristic Pullout Strength, Seismic (2,500 psi)	N_{eq}	lb.	932[11]	1168[11]	728[11]	N/A								
Reduction Factor for Pullout Strength[7] (2,500 psi)	ϕ_{eq}	-	0.85 (Condition B)											
Axial Stiffness in Service Load Range														
Uncracked Concrete	β_{uncr}	lb/in.	760,000											
Cracked Concrete	β_{cr}	lb/in.	293,000											

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m, 1 psi = 6.89 Pa, 1 in² = 645 mm², 1 lb/in = 0.175 N/mm

1 The data in this table is intended for use with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of D.3.3 shall apply.

2 Values of ϕ in this table apply when the load combinations for ACI 318 Section 9.2, IBC Section 1605.2.1 are used and the requirements of ACI 318 D.4.4 for Condition B are met. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be used. For situations where reinforcement meets the requirements of Condition A, ACI 318 Section D.4.4 provides the appropriate ϕ factor.

3 N/A denotes that pullout resistance does not govern and does not need to be considered.

4 The characteristic pullout resistance for concrete compressive strengths greater than 2500 psi may be increased by multiplying the value in the table by $(f'_c/2{,}500)^{0.5}$ for psi or $(f'_c/17.2)^{0.5}$ for MPa.

5 For sand-lightweight concrete, multiply concrete capacity values and pullout values by 0.60.

KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.5

Table 5 – KWIK HUS-EZ (KH-EZ) Allowable Stress Design Values for Illustrative Purposes[1,2,3,4,5,6,7,8,9,10,11,12]

Nominal Anchor Diameter (in.)	Embedment Depth, h_{nom} (in.)	Effective Embedment Depth, h_{ef} (in.)	Allowable Tension Load[10] (lbs)	Allowable Shear Load[11] (lbs)
1/4	1-5/8	1.18	389	645
	2-1/2	1.92	1060	645
3/8	1-5/8	1.11	830	982
	2-1/2	1.86	1374	1400
	3-1/4	2.50	2141	2160
1/2	2-1/4	1.52	1142	1230
	3	2.16	1934	2080
	4-1/4	3.22	3521	3850
5/8	3-1/4	2.39	2252	2425
	5	3.98	4657	4675
3/4	4	2.92	3041	3549
	6-1/4	4.84	6489	6943

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

1 Single anchor with static tension or shear load only.

2 Concrete determined to remain uncracked for the life of the anchorage.

3 Load combinations are taken from ACI 318 Section 9.2 (no seismic loading).

4 40% dead load and 60% live load, controlling load combination 1.2D + 1.6L.

5 Calculation of weighted average for conversion factor α = 1.2(0.4) + 1.6(0.6) = 1.44.

6 f'_c = 2,500 psi (normal weight concrete).

7 $c_{a1} = c_{a2} \geq c_{ac}$, see Table 1.

8 $h \geq h_{ef}$, see Table 1.

9 Values are for Condition B where supplementary reinforcement in accordance with ACI 318 D.4.4 is not provided.

10 Allowable Tension Load = factored Load (Lesser of N_s or Concrete Breakout from Table 2) ÷ 1.44

11 Allowable Shear Load = factored Load (Lesser of V_{sa} or Concrete Pryout from Table 3) ÷ 1.44

12 Values are for single anchors installed without influence of base material edge distance or adjacent anchors.

Crosby© Round Pin Shackles

Load Rated® Fatigue Rated® QUALITY CHECK® MAXTOUGH®

ROUND PIN ANCHOR SHACKLES

G-213 / S-213

G-213 Round pin anchor shackles meet the performance requirements of Federal Specification RR-C-271F Type IVA, Grade A, Class 1, except for those provisions required of the manufacturer. For additional information, see page 69.

- Capacities 1/2 through 35 metric tons
- Forged Quenched and Tempered, with alloy pins.
- Working Load Limit permanently shown on every shackle
- Hot Dip galvanized or Self Colored.
- Fatigue rated.
- Shackles 25t and larger are RFID EQUIPPED.
- Shackles can be furnished proof tested with certificates to designated standards, such as ABS, DNV, Lloyds, or other certification. Charges for proof testing and certification available when requested at the time of order.
- Shackles are Quenched and Tempered and can meet DNV impact requirements of 42 joules (31 ft-lbs.) at -20 degree C (-4 degree F).
- Look for the Red Pin® ... the mark of genuine Crosby quality.

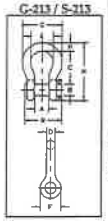
ROUND PIN CHAIN SHACKLES

G-215 / S-215

G-215 Round pin chain shackles meet the performance requirements of Federal Specification RR-C-271F Type IVB, Grade A, Class 1, except for those provisions required of the manufacturer. For additional information, see page 69.

G-213 / S-213 Round Pin Anchor Shackles

G-213 / S-213

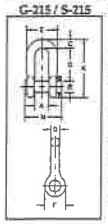


Nominal Size (in.)	Working Load Limit (t)*	Stock No. G-213	Stock No. S-213	Weight Each (lbs.)	A	B	C	D	E	F	G	H	W	P	Tolerance +/- C	Tolerance +/- A
1/4	1/2	1018017	1018026	.13	.47	.31	1.12	.25	.79	.81	1.28	1.84	1.34	.25	.00	.06
3/16	3/4	1018033	1018044	.18	.63	.38	1.22	.31	.84	.75	1.47	2.28	1.59	.31	.06	.06
3/8	1	1018055	1018062	.29	.88	.44	1.44	.38	1.03	.91	1.78	2.49	1.88	.38	.13	.06
7/16	1-1/2	1018071	1018081	.38	.75	.50	1.88	.44	1.16	1.06	2.03	2.81	2.13	.44	.13	.06
1/2	2	1018088	1018105	.71	.81	.63	1.88	.50	1.31	1.19	2.31	3.25	2.38	.50	.13	.06
5/8	3-1/4	1018115	1018124	1.02	1.06	.75	2.38	.63	1.69	1.53	2.94	4.19	2.81	.63	.13	.06
3/4	4-3/4	1018133	1018142	2.22	1.25	.88	2.81	.75	2.00	1.81	3.50	4.97	3.44	.81	.25	.06
7/8	6-1/2	1018151	1018160	3.49	1.44	1.00	3.31	.88	2.25	2.09	4.00	5.63	3.91	.97	.25	.06
1	8-1/2	1018175	1018185	5.00	1.69	1.13	3.75	1.00	2.88	2.38	4.69	6.56	4.53	1.06	.25	.06
1-1/8	9-1/2	1018197	1018204	6.87	1.81	1.25	4.25	1.13	2.81	2.59	5.16	7.47	5.13	1.25	.25	.06
1-1/4	12	1018213	1018222	8.75	2.03	1.38	4.69	1.25	3.25	2.00	5.75	8.25	5.56	1.38	.25	.06
1-3/8	13-1/2	1018231	1018240	13.25	2.25	1.50	5.25	1.43	3.63	3.31	6.38	9.16	6.13	1.50	.25	.13
1-1/2	17	1018259	1018268	17.25	2.38	1.63	5.75	1.54	3.88	3.63	6.88	10.00	6.50	1.62	.25	.13
1-3/4	25	1018277	1018286	29.46	2.88	2.00	7.00	1.94	5.00	4.19	8.88	12.34	7.75	2.25	.25	.13
2	35	1018295	1018302	45.75	3.25	2.25	7.75	2.06	5.75	4.81	9.97	13.88	8.75	2.40	.25	.13

* NOTE: Maximum Proof Load is 2.0 times the Working Load Limit. Minimum Ultimate Strength is 4 times the Working Load Limit. For Working Load Limit reduction due to side loading applications, see page 68.

G-215 / S-215 Round Pin Chain Shackles

G-215 / S-215



Nominal Size (in.)	Working Load Limit (t)*	Stock No. G-215	Stock No. S-215	Weight Each (lbs.)	A	B	C	D	E	F	G	K	W	Q	Tolerance +/- Q	Tolerance +/- A
1/4	1/2	1018810	1018820	.10	.47	.31	.25	.25	.97	.62	.81	1.53	1.34	.06	.06	
3/16	3/4	1018836	1018847	.18	.53	.38	.31	.31	1.15	.75	1.07	1.81	1.63	.06	.06	
3/8	1	1018854	1018865	.25	.88	.44	.38	.38	1.47	.92	1.38	2.31	1.88	.13	.06	
7/16	1-1/2	1018874	1018883	.40	.75	.50	.44	.44	1.62	1.06	1.46	2.67	2.13	.13	.06	
1/2	2	1018892	1018918	.50	.81	.63	.50	.50	1.81	1.19	1.69	3.03	2.38	.13	.06	
5/8	3-1/4	1018918	1018927	1.01	1.06	.75	.63	.63	2.22	1.50	2.24	3.78	2.81	.13	.06	
3/4	4-3/4	1018936	1018945	2.00	1.25	.88	.81	.75	2.75	1.81	2.40	4.53	3.44	.25	.06	
7/8	6-1/2	1018954	1018963	2.28	1.44	1.00	.87	.88	3.25	2.10	2.84	5.22	3.91	.25	.06	
1	8-1/2	1018972	1018981	4.75	1.69	1.13	1.00	1.00	3.69	2.38	3.34	6.44	4.53	.25	.06	
1-1/8	9-1/2	1018990	1019007	6.30	1.81	1.25	1.25	1.13	4.07	2.69	3.81	6.79	5.13	.25	.06	
1-1/4	12	1019016	1019025	9.00	2.03	1.38	1.38	1.25	4.53	2.00	3.97	7.50	5.50	.25	.13	
1-3/8	13-1/2	1019034	1019043	12.50	2.25	1.50	1.50	1.38	5.00	3.31	4.43	8.25	6.13	.25	.13	
1-1/2	17	1019052	1019061	16.15	2.38	1.63	1.62	1.50	5.38	3.62	4.87	9.00	6.50	.25	.13	
1-3/4	25	1019070	1019089	29.96	2.88	2.00	2.12	1.75	6.38	4.19	5.62	10.87	7.75	.25	.13	
2	35	1019096	1019105	43.25	3.25	2.25	2.38	2.13	7.50	4.80	6.34	12.16	8.75	.25	.13	

* NOTE: Maximum Proof Load is 2.0 times the Working Load Limit. Minimum Ultimate Strength is 4 times the Working Load Limit. For Working Load Limit reduction due to side loading applications, see page 68.

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2

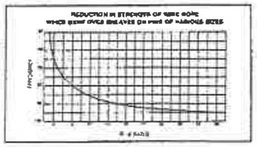


Figure 5.
When a wire rope is bent around any sheave or other circular object there is a loss of strength due to this bending action. As the D/d ratio becomes smaller this loss of strength becomes greater and the rope becomes less efficient. This curve, derived from actual test data, relates the efficiency of a rope to different D/d ratios. This curve is based on static loads only and applies to 6x19 and 6x37 class ropes.

Figure 6

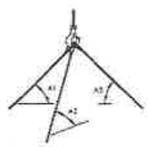


Figure 7. For bridle slings with legs of unequal length, use the smallest horizontal angle for rated capacity calculations.

PROOF LOAD is a specific load applied to a sling or assembly in a non-destructive test to verify the workmanship of the sling. All swaged socket or poured socket assemblies should be proof loaded. The proof load is generally two (2) times the vertical rated capacity for mechanical splice slings. The maximum proof load for hand tucked slings is 1.25 times the vertical rated capacity. Care should be taken to assure that sling eyes are not damaged during the proof load.

EYE DIMENSIONS are generally eight (8) sling body diameters wide by sixteen (16) body diameters long. Whenever possible thimbles are recommended to protect the rope in the sling eye. Eye dimensions for thimbles are contained in table 2. Table 2 contains only dimensions for thimbles used in standard single part slings. Other specialized thimbles are available. Consult your sling manufacturer for details.

PIN DIAMETER should not be any greater than the natural width of the sling eye. For any sized eye and type of sling body, the maximum allowable pin diameter may be calculated as follows:

Maximum pin diameter = (2L + W) x 0.2

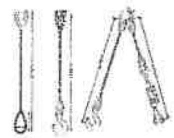
Where

L = length of eye

W = width of eye

The minimum pin diameter should never be smaller than the nominal sling diameter.

GRADE & CONSTRUCTION of wire rope for slings is generally accepted to be bright Improved Plow Steel or Extra Improved Plow Steel grade 6x19 or 6x37 classification regular lay. IWRC rope has a higher rated capacity than Fiber Core rope for mechanically spliced slings, but the same rated capacity for hand tucked slings. This is because when making a hand tucked splice, the core (IWRC) of the rope is cut in the splice area and doesn't add to the overall strength of the sling. Rated capacities of slings using galvanized rope depend on the method of galvanizing. The sling manufacturer should be consulted regarding rated capacities for these types of slings.



MINIMUM SLING BODY LENGTH is the minimum length of wire rope between splices, sleeves or fittings. Generally the minimum body length is equal to ten (10) times the sling body diameter. This allows approximately one and one half (1 1/2) rope lays between splices. For multi-part slings the minimum body length between splices is equal to forty (40) times the component rope diameter.

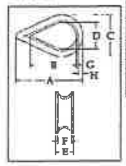
LENGTH TOLERANCE is generally plus or minus two (2) body diameters, or plus or minus 0.5% of the sling length, whichever is greater. The legs of bridle slings, or matched slings are normally held to within one (1) body diameter. Tolerances on poured or swaged socket assemblies are generally much closer. Tolerances should always be specified to the sling manufacturer before the order is placed. This eliminates a lot of frustration and confusion later.

Wire Rope Thimbles

G-411

- Hot Dip galvanized steel.
- The standard choice for light duty applications and loading conditions.

G-411 meets the performance requirements of Federal Specification FF-T-276b Type II, except for those provisions required of the contractor. For additional information, see page 426.



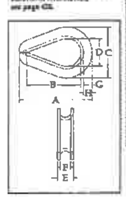
Standard Wire Rope Thimbles

Rope Dia. (in.)	Rope Dia. (mm)	G-411 Stock No.	Weight Per 100 (lbs.)	Dimensions (in.) A	B	C	D	E	F	G	H
1/8	3-4	1037034	3.30	1.94	1.31	1.06	.69	.25	.16	.05	.13
3/16	5	1037276	3.30	1.94	1.31	1.06	.69	.31	.22	.05	.13
1/4	6-7	1037292	3.50	1.94	1.31	1.06	.69	.38	.28	.05	.13
5/16	8	1037316	4.50	2.13	1.50	1.25	.81	.44	.34	.05	.13
3/8	9-10	1037338	6.70	2.38	1.63	1.47	.94	.53	.41	.09	.16
1/2	11-13	1037354	12.50	2.75	1.88	1.75	1.13	.69	.53	.08	.19
5/8	16	1037372	24.80	3.50	2.25	2.38	1.38	.81	.66	.13	.24
3/4	18-20	1037390	47.10	3.75	2.50	2.69	1.63	1.00	.78	.14	.24
7/8	22	1037416	54.80	5.00	3.50	3.19	1.88	1.27	.94	.19	.44
1	24-26	1037434	87.50	5.88	4.23	3.75	2.60	1.39	1.09	.19	.41
1-1/8 - 1-1/4	28-32	1037452	175.06	6.25	4.50	4.31	2.75	1.75	1.31	.22	.50

G-414

- Available in Hot Dip galvanized or Stainless Steel (Type 304).
- Stainless steel recommended for more corrosive environments where greater protection is required.
- Greater protection against wear and deformation of the wire rope eye.
- Longer service life.

G-414 meets the performance requirements of Federal Specification FF-T-276b Type III, except for those provisions required of the contractor. For additional information, see page 426.



Extra Heavy Wire Rope Thimbles

Rope Dia. (in.)	Rope Dia. (mm)	G-414 Stock No.	SS-414 Stainless	Weight Per 100 (lbs.)	Dimensions (in.) A	B	C	D	E	F	G	H
*1/4	6-7	1037638	1037980	8.50	3.16	1.62	1.50	.88	.41	.28	.08	.25
*5/16	8	1037657	1037998	11.00	3.00	1.88	1.81	1.06	.50	.34	.08	.30
*3/8	9-10	1037675	1038004	21.00	3.88	2.12	2.12	1.12	.63	.41	.11	.28
7/16	11-12	1037693	-	34.70	3.25	2.38	2.38	1.25	.72	.47	.12	.41
*1/2 - 9/16	13-15	1037719	1038022	51.00	3.62	2.75	2.75	1.50	.88	.56	.15	.43
*5/8	16	1037755	1038040	75.70	4.25	3.25	3.12	1.75	1.00	.66	.16	.52
*3/4	18-20	1037773	1038058	150.40	5.00	3.75	3.81	2.00	1.22	.78	.22	.59
7/8	22	1037791	-	177.80	5.50	4.25	4.25	2.25	1.38	.94	.22	.78
1	24-26	1037817	-	313.20	6.12	4.50	4.75	2.57	1.56	1.06	.25	.88
1-1/8 - 1-1/4	28-32	1037835	-	406.60	7.00	5.13	5.88	2.88	1.88	1.31	.25	1.25
1-1/4 - 1-3/8	32-35	1037853	-	666.00	8.00	6.50	6.81	3.50	2.25	1.44	.37	1.38
1-3/8 - 1-1/2	35-38	1037871	-	1284.30	8.00	8.25	7.12	3.50	2.62	1.58	.50	1.31
1-5/8	40	1037889	-	1700.00	11.25	8.00	8.12	4.00	3.00	1.72	.60	1.38
1-3/4	44	1037915	-	1775.00	12.19	9.00	9.10	4.50	3.06	1.94	.60	1.50
1-7/8 - 2	48-52	1037933	-	2775.00	15.12	12.00	10.38	6.00	3.38	2.38	.60	1.69
2-1/4	56	1037951	-	3800.00	17.50	14.00	11.88	7.00	3.88	2.39	.63	1.63

*SS-414 sizes available in stainless steel type 304

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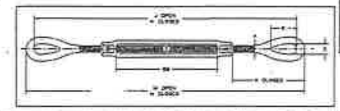
Eye & Eye Turnbuckles

Fatigue Rated

HG-226

- End fittings are Quenched and Tempered or Normalized, bodies heat treated by normalizing.
- Hot Dip galvanized steel.
- Turnbuckle eyes are forged elongated, by design, to maximize easy attachment in system and minimize stress in the eye. For turnbuckle sizes 1/4" through 2-1/2", a shackle one size smaller can be reeved through eye.
- Modified UNJ thread on end fittings for improved fatigue properties. Body has UNC threads.
- Meets or exceeds all requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements. Importantly, these turnbuckles meet other critical performance requirements including fatigue life, impact properties and material traceability, not addressed by ASME B30.26.
- TURNBUCKLES RECOMMENDED FOR STRAIGHT OR IN-LINE PULL ONLY.
- Lock Nuts available for all sizes (see page 178)
- Comprehensive end fitting data provided on page 175.
- Fatigue Rated

Meets the performance requirements of Federal Specification FF-T-791b, Type 1, Form 1 — CLASS 4, and ASTM F-1145, except for those provisions required of the contractor. For additional information, see page 426.



HG-226 Eye & Eye

Thread Dia. & Take Up (in.)	HG-226 Stock No.	Working Load Limit (lbs)*	Weight Each (lbs.)	Dimensions (in.) A	J Open	K Closed	M Open	H Closed	R	J	X Closed	BB
† 1/4 x 4	1031252	500	.29	.25	11.94	7.94	12.38	8.38	.81	.34	1.75	4.07
† 5/16 x 4-1/2	1031270	800	.48	.31	13.92	9.42	14.48	9.98	.95	.44	2.20	4.58
† 3/8 x 6	1031298	1200	.73	.38	17.58	11.58	18.24	12.24	1.13	.53	2.48	6.10
1/2 x 6	1031314	2200	1.70	.50	19.94	13.94	20.82	14.82	1.41	.71	3.36	6.09
1/2 x 12	1031350	2200	2.83	.50	32.22	20.22	32.11	21.11	1.41	.71	3.54	12.38
5/8 x 6	1031378	3500	3.75	.63	21.73	15.73	23.73	16.73	1.80	.88	4.38	6.03
5/8 x 12	1031412	3500	4.17	.63	34.28	22.28	35.05	23.05	1.80	.88	4.34	12.39
3/4 x 6	1031430	5200	4.23	.75	23.24	17.24	24.30	18.30	2.08	1.00	5.12	6.13
3/4 x 12	1031476	5200	6.13	.75	35.64	23.64	36.90	24.90	2.08	1.00	5.09	12.38
3/4 x 18	1031494	5200	7.83	.75	47.64	29.64	48.90	30.90	2.00	1.00	5.12	18.53
7/8 x 12	1031516	7200	8.83	.88	36.70	24.70	38.29	26.29	2.38	1.25	5.79	12.16
7/8 x 18	1031537	7200	11.2	.88	49.17	31.17	52.67	32.67	2.38	1.25	5.79	18.63
1 x 6	1031555	10000	9.52	1.00	26.24	20.24	28.05	22.80	2.06	1.43	6.50	8.18
1 x 12	1031573	10000	13.5	1.00	38.24	26.24	40.05	28.00	3.00	1.43	6.50	12.16
1 x 18	1031591	10000	18.3	1.00	50.24	32.24	52.00	34.00	3.00	1.43	6.50	18.18
1 x 24	1031617	10000	20.2	1.00	62.84	38.84	64.60	40.60	3.00	1.43	6.47	24.34
1-1/4 x 12	1031635	15200	18.8	1.25	42.14	30.14	44.38	32.38	3.50	1.83	8.49	12.06
1-1/4 x 18	1031653	15200	23.8	1.25	54.14	36.14	56.38	38.38	3.50	1.83	8.49	18.06
1-1/4 x 24	1031671	15200	27.8	1.25	66.75	42.75	68.94	44.94	3.50	1.83	8.49	24.63
1-1/2 x 12	1031699	21400	28.7	1.50	44.24	32.24	46.74	34.74	4.08	2.12	8.40	12.33
1-1/2 x 18	1031715	21400	34.1	1.50	56.24	38.24	58.74	40.74	4.08	2.12	8.40	18.33
1-1/2 x 24	1031733	21400	39.6	1.50	68.00	44.00	71.38	47.38	4.38	2.12	8.88	24.34
1-3/4 x 18	1031779	28000	50.7	1.75	57.38	39.38	60.38	42.38	4.65	2.38	9.87	18.37
1-3/4 x 24	1031797	28000	58.2	1.75	69.38	45.38	72.38	48.38	4.65	2.38	9.87	24.37
2 x 24	1031813	37000	83.5	2.00	75.68	51.68	79.18	55.18	5.97	2.59	13.03	24.48
2-1/2 x 24	1031831	60000	149	2.50	79.18	55.18	83.18	59.18	6.49	3.12	13.75	24.60
2-3/4 x 24	1031859	75000	174	2.75	81.34	57.34	85.84	61.84	7.00	3.25	15.08	24.65

*Proof Load is 2.5 times the Working Load Limit. Ultimate Load is 5 times the Working Load Limit.
† Mechanical Galvanized

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DAYTON SUPERIOR

B-11 Flat Washers

Dayton Superior B-11 Flat Washers are made from flat steel plate and are available in the sizes shown in the accompanying chart. For best results the space spanned by the washer should not exceed the bolt diameter plus 1/4".

B-11 Flat Washer

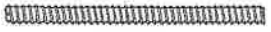
To Order:
Specify: (1) quantity, (2) name, (3) bolt diameter.
Example:
1,200 pcs. B-11, Standard, 1/2" bolt.

B-11 Flat Washer Selection Chart

Bolt Diameter	Type	Safe Working Load (lbs.)	Size
1/2"	Standard	4,500	3" x 4" x 1/4"
1/2"	Heavy	6,750	4" x 5" x 1/4"
3/4"	Standard	6,750	4" x 5" x 1/4"
3/4"	Heavy	9,000	5" x 5" x 3/8"
1"	Standard	18,000	5" x 5" x 7/16"
1"	Heavy	37,500	7" x 7" x 3/4"
1 1/4"	Standard	27,000	5" x 5" x 7/16"
1 1/4"	Heavy	37,500	7" x 7" x 3/4"
1 1/2"	Standard	27,000	5" x 5" x 3/4"
1 1/2"	Heavy	37,500	7" x 7" x 3/4"

DWL provides a factor of safety of approximately 2 to 1.

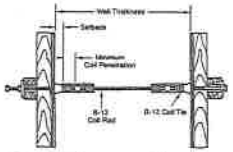
B-12 Coil Rod

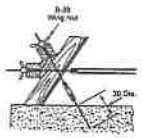


B-12 Coil Rod

Dayton Superior B-12 Coil Rod is available in 1/2" to 1-1/2" diameters in 12' lengths. Field cutting can be accomplished with bolt cutters or carborundum blades.

B-12 threaded rod can be used with Coil Ties in many forming combinations to tie formwork, for adjustable ties, for concrete embedments and/or emergency ties.





B-12 Coil Rod Selection Chart

Coil Rod Diameter	Safe Working Loads Tension (lbs.)	Safe Working Loads Shear (lbs.)	Minimum Rod Area (sq. in.)	Tensile Stress (psi.)	Yield Stress (psi.)	Minimum Coil Penetration
1/2"	9,000	6,000	.1963	130,000	110,000	2"
5/8"	12,000	8,000	.2124	113,000	96,000	2-1/4"
3/4"	18,000	12,000	.3976	117,000	100,000	2-1/4"
7/8"	31,000	20,600	.4477	117,000	100,000	2-1/2"
1"	38,000	25,300	.5410	140,000	120,000	2-1/2"
1-1/8"	45,000	30,000	.7163	126,000	105,000	2-1/2"
1-1/4"	56,000	37,500	.9181	122,000	105,000	2-1/2"
1-1/2"	68,000	45,300	1.3852	98,000	83,000	2"

DWL provides a factor of safety of approximately 3 to 1.
Warning: See Page 7 before using B-12 Coil Rod.

To Order:
Specify: (1) quantity, (2) name, (3) diameter, (4) length.
Example:
500 pcs. B-12 Coil Rod, 1" diameter x 12' long.

T_c = $P L \sec \Phi$

T_c = hoop or interlock force at connection

P = maximum lateral pressure from cell fill and water

L = ½ the center-to-center distance of full circular cells

Φ = angle between centerline of cells and a line from center of cell to point on cell periphery where connecting arc is attached.

d. The interlock tension shall not exceed the manufacturer's recommended values.

e. The maximum coefficient of friction of steel on steel at the interlocks shall not exceed 0.3.

28.5.6.13 Construction Requirements

a. Cofferdams for foundation construction shall be carried well below the bottom of the excavation or as near the bottom of the excavation as foundation conditions will permit and shall be well braced and as watertight as practical. The interior dimensions of cofferdams shall provide sufficient clearance inside the walls for constructing forms, driving piles, pumping outside the forms, and inspection.

b. Cofferdams which are tilted or moved out of position by any causes during the process of construction shall be righted or enlarged so as to provide the necessary clearances.

c. No shoring will be permitted in cofferdams which will induce stress, shock, or vibration in the permanent structure.

d. Cellular cofferdams with diaphragm walls shall be filled equally on each side of the diaphragm walls to avoid distortion of the cells.

e. After completion of the construction, the cofferdams with all sheeting and bracing shall be removed as directed by the Engineer or as shown on the plans. Such removal shall be done in a manner that will not disturb or mar the permanent structure.

SECTION 28.6 DESIGN OF FALSEWORK SYSTEMS

28.6.1 REVIEW AND APPROVAL OF FALSEWORK DRAWINGS (2002)

a. Falsework design drawings and calculations covering falsework adjacent to or over Railroad's operating tracks shall be certified to be complete and satisfactory to the submitting public agency prior to being submitted to the Railroad.

b. There shall be sufficient detail in the drawings to permit a complete stress analysis. In particular, the drawings shall show the size of all load-supporting members; all lateral and longitudinal bracing, including connections; the method of adjustment; and similar design features.

c. All design-controlling dimensions shall be shown, including, but not limited to, beam length; beam spacing; post location and spacing; vertical distance between connectors in diagonal bracing; overall height of falsework bents; and similar dimensions critical to the analysis.

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d. The falsework drawings shall include a superstructure placing diagram showing the concrete placing sequence and construction joint locations. When a schedule of placing concrete is shown on the contract plans, no deviation will be permitted without the approval of design engineer.

e. When footing type foundations are to be used, the Contractor shall determine the bearing value of the soil and shall show the values assumed in the design of the falsework on the falsework drawings.

f. Anticipated total settlements of the falsework and forms shall be shown on the falsework drawings.

g. Falsework footings shall be designed to carry the load imposed upon them without exceeding the estimated soil bearing values and anticipated settlements. Refer to Part 3 of this Chapter for allowable soil pressures of various material and settlements.

h. When falsework will be supported on pile bents, the required pile capacity and the maximum allowable driving tolerances shall be shown.

i. The support systems for form panels supporting concrete deck slabs and overhangs on girder bridges shall also be considered to be falsework and designed as such.

j. The falsework drawings shall show all openings which are required through the falsework. Horizontal and vertical clearances shall be adequate and be shown on the plans.

k. Temporary bracing shall be provided to all falsework bents adjacent to the operating tracks, and shall be designed to withstand all imposed loads during erection, construction and removal. Wind loads shall be included in the design of such bracing.

l. In addition to the falsework drawings, the design engineer shall submit a copy of design calculations. The design calculations shall show the stresses and deflections of all load-supporting members, calculations furnished by the design engineer are for information only, rather than for review and acceptance. Accordingly, design and/or construction details which may be shown in the falsework in the form of sketches on the calculation sheets shall be shown on the falsework drawings as well; otherwise the drawings will not be complete.

28.6.2 DESIGN LOADS (2002)

a. The design loads for falsework shall consist of the sum of dead and live vertical loads, and the assumed horizontal load. The minimum total design load for any falsework shall be not less than 100 pounds per square foot (4.8 kPa) for the combined live and dead load regardless of slab thickness.

b. Dead load shall include the weight of concrete, reinforcing steel, forms and falsework. The weight (mass density) of concrete, reinforcing steel and forms shall be assumed to be not less than 160 pounds per cubic foot (2563 kg/m³) for normal concrete.

c. Live loads shall consist of the actual weight of equipment to be supported by the falsework applied as concentrated loads at the points of contact and a uniform load of not less than 20 pounds per square foot (958 Pa) applied over the area supported, plus 75 pounds per linear foot (1096 N/m) applied at the outside edge of deck overhangs.

d. The assumed horizontal load to be resisted by the falsework bracing system shall be the sum of the actual horizontal loads due to equipment, construction sequence or other causes and an allowance for wind, but in no case shall the assumed horizontal load to be resisted in any direction be less than 2 percent of the total dead load.

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e. The falsework shall be designed so that it will have sufficient rigidity to resist the assumed horizontal load without considering the weight of the concrete.

f. The minimum horizontal load to be allowed for wind on each heavy-duty steel shore having a vertical load carrying capacity exceeding 30 kips (133 kN) per leg shall be the sum of the products of the wind impact area, shape factor, and the applicable wind pressure value for each height zone. The wind impact area is the total projected area of all the elements in the tower face normal to the applied wind. The shape factor for heavy-duty shoring shall be taken as 2.2. Wind pressure values shall be determined from the following table:

Height Zone Distance above ground	WIND PRESSURE Shores Adjacent to Traffic Openings	At Other Locations
0 to 30 ft. (0 to 9 m)	20 psf (958 Pa)	15 psf (718 Pa)
30 to 50 ft. (9 to 154 m)	25 psf (1197 Pa)	20 psf (958 Pa)
50 to 100 ft. (154 to 30 m)	30 psf (1436 Pa)	25 psf (1197 Pa)
Over 100 ft. (30 m)	35 psf (1676 Pa)	30 psf (1436 Pa)

g. The minimum horizontal load to be allowed for wind on all other types of falsework, including falsework supported on heavy-duty shoring, shall be the sum of the products of the wind impact area and the applicable wind pressure value for each height zone. The wind impact area is the gross projected area of the falsework and any unrestrained portion of the permanent structure, excluding the areas between falsework posts or towers where diagonal bracing is not used. Wind pressure values shall be determined from the following table:

Height Zone (Feet above ground)	WIND PRESSURE VALUE For Members over and Bents Adjacent to Traffic Openings	At Other Locations
0 to 30 (0 to 9 m)	2.0 Q psf (Pa)	1.5 Q psf (Pa)
30 to 50 (9 to 154 m)	2.5 Q psf (Pa)	2.0 Q psf (Pa)
50 to 100 (154 to 30 m)	3.0 Q psf (Pa)	2.5 Q psf (Pa)
Over 100 (30 m)	3.5 Q psf (Pa)	3.0 Q psf (Pa)

The value of Q in the above tabulation shall be determined as follows:

$Q = 1 + 0.2W$ ($Q = 1 + 0.656W$); but shall not be more than 10

In the preceding formula, W is the width of the falsework system in feet (meters), measured in the direction of the wind force being considered.

h. The entire superstructure cross-section, except railing, shall be considered to be placed at one time. If the concrete is to be prestressed, the falsework shall be designed to support any increased or readjusted loads caused by the prestressing forces.

28.6.3 DESIGN STRESSES, LOADINGS, AND DEFLECTIONS (2002)

a. The maximum allowable design stresses and loadings listed are based on the use of undamaged, high-quality structural grade material. Stresses and loadings shall be reduced by the design engineer if lesser quality materials are to be used.

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b. The maximum allowable stresses, loadings and deflections used in the design of the falsework shall be as follows:

28.6.3.1 Timber

a. Compression perpendicular to the grain 450 psi (3,100 kPa).

b. Compression parallel to the grain $480{,}000/(L/d)^2$ psi ($33{,}000/(L/d)^2$ MPa), but not to exceed 1,600 psi (11.0 MPa).

c. Flexural stress 1,800 psi (12.4 MPa) reduced to 1,500 psi (10.3 MPa) for members with a nominal depth of 8 inches (20 mm) or less.

d. Horizontal shear 140 psi (965 kPa).

e. Axial tension 1,200 psi (8.3 MPa).

f. Deflection due to the weight of concrete only L/240 of the span irrespective of the fact that the deflection may be compensated for by camber strips.

g. In the foregoing formulas, L is the unsupported length, d is the least dimension of a square or rectangular column, or the width of a square of equivalent cross-sectional area for round columns.

h. The maximum modulus of elasticity, E, for timber shall be 1.6×10^6 psi (11.0×10^3 MPa).

i. Timber piles, maximum loading 45 tons (400 kN).

j. Timber connections shall be designed in accordance with the stress and loads allowed in the National Design Specification of Wood Construction, as published by the National Forest Products Association except that (1) reductions in allowable loads required therein for high moisture condition of the lumber and service conditions shall not apply, and (2) the design value of bolts in two member connections (single shear) when used for falsework bracing shall be 0.75 of the tabulated design value.

28.6.3.2 Steel

a. For identified grades of steel, design stresses, except stresses due to flexural compression, shall not exceed those specified in the Manual of Steel Construction as published by the AISC.

b. When the grade of steel cannot be positively identified, design stresses, except stresses due to flexural compression, shall not exceed either those specified in said AISC Manual for ASTM Designation A36 steel or the following:

c. Tension, axial and flexural 22,000 psi (151.7 MPa).

d. Compression, axial $16{,}000 - 0.38\,(L/r)^2$ psi ($110.3 - 0.38(L/r)^2$ MPa) except L/r shall not exceed 120.

e. Shear on gross section of web 14,500 psi (100 MPa).

f. Web crippling for rolled shapes 27,000 psi (186 MPa).

g. For all grades of steel, design stresses and deflections shall not exceed the following:

h. Compression, flexural $12{,}000/(Ld/bt)$ psi ($82{,}000/(Ld/bt)$ MPa), but not to exceed 22,000 psi (151.7 MPa) for unidentified steel or steel conforming to ASTM Designation A36 nor 0.6 F_y, for other identified steel.

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i. Deflection due to the weight of concrete only L/240 irrespective of the fact that the deflection may be compensated for by camber strips.

j. In the foregoing formulas, L is the unsupported length; d is the least dimension of rectangular columns, or the width of a square of equivalent cross-sectional area for round columns, or the depth of beams; b is the width and t is the thickness of the compression flange; and r is the radius of gyration of the member. All dimensions are expressed in inches (millimeters). F_y is specified minimum yield stress in psi (MPa), for the grade of steel used.

k. The modulus of elasticity, E, used for steel shall be 30×10^6 psi (2.07×10^5 MPa).

28.6.3.3 Manufactured Assemblies

a. The maximum loadings and deflections used on jacks, brackets, columns, joists and other manufactured devices shall not exceed the manufacturer's recommendations except that the dead load deflection of such joists used at locations other than under deck slabs between girders shall not exceed L/240. If requested by the Engineer, the design engineer shall furnish engineering data from the manufacturer verifying the manufacturer's recommendations or shall perform tests as necessary to demonstrate the adequacy of any such device proposed for use.

28.6.4 SPECIAL CONDITIONS (2002)

a. In addition to the minimum requirements specified in Section 28.6.2 falsework over or adjacent to the railroad tracks which are open to traffic shall be protected from impact by motor vehicles and construction equipment. The falsework design shall include, but not be limited to, the following minimum provisions:

b. The vertical load used for design of falsework posts and towers, but not footings, which support the portion of the falsework over openings, shall be the greater of the following:

(1) 150 percent of the design load calculated in accordance with the provisions for the design load previously specified but not including any increased or readjusted loads caused by the prestressing forces, or

(2) The increased or readjusted loads caused by the prestressing forces.

c. Falsework posts adjacent to railroads shall consist of either steel with a minimum section modulus about each axis of 9.5 inches cubed (156,700 mm^3) sound timbers with a minimum section modulus about each axis of 250 inches cubed (4,097,000 mm^3).

d. Each falsework post adjacent to railroad shall be mechanically connected to its supporting footing at its base, or otherwise laterally restrained, so as to withstand a force of not less than 2,000 pounds (8.90 kN) applied at the base of the post in any direction except toward the railroad track. Such posts also shall be mechanically connected to the falsework cap or stringer. Such mechanical connection shall be capable of resisting a load in any horizontal direction of not less than 1,000 pounds (4.45 kN).

e. For falsework spans over railroads all stringers shall be mechanically connected to falsework cap or framing. Such mechanical connections shall be capable of resisting a load in any direction, including uplift on the stringer, of not less than 500 pounds (2.22 kN).

f. When timber members are used to brace falsework bents which are located adjacent to railroads, all connections for such timber bracing shall be bolted type using 5/8 inch (15 mm) diameter or larger bolt.

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g. Falsework bents adjacent to tracks shall have a minimum horizontal clearance of twelve feet (3.7 m) from centerline of track. Falsework to be sheathed solid on the side adjacent to track between 3 feet (0.9 m) and 17 feet (5.2 m) above the top of rail elevation. Sheathing shall consist of plywood not less than 5/8 inch (15 mm) thick or lumber not less than one inch thick (25 mm), nominal. Bracing on such bents shall be adequate so that the bent will resist the required assumed horizontal load or 5,000 pounds (22.2 kN) whichever is greater. Collision posts and sheathing shall not be required if horizontal clearances to falsework is 18 feet (5.5 m) or greater.

h. A minimum vertical clearance of 22'-8" (6.9 m), or as established by the Railroad, above top of higher rail shall be maintained at all times.

28.6.5 FALSEWORK CONSTRUCTION (2002)

a. The falsework shall be constructed to conform to the falsework drawings. The materials used in the falsework construction shall be of quality necessary to sustain the stress required by the falsework design. The workmanship used in falsework construction shall be of such quality that the falsework will support the loads imposed on it without excessive settlement or take-up beyond that shown on the falsework drawings.

b. Falsework shall be founded on solid footings, safe against undermining, protected from softening, and capable of supporting the loads imposed on it. When requested by the Engineer, the Contractor shall demonstrate by suitable load tests that the soil bearing values assumed for the design of the falsework do not exceed the supporting capacity of the soil.

c. When falsework is to be supported on piles, the piles shall be driven until the required pile capacity is obtained as shown on the falsework drawings.

d. For falsework over or adjacent railroad tracks, all details of the falsework system which contribute to the horizontal stability and resistance to impact, except for bolts in bracing, shall be installed at the time each element of the falsework is erected and shall remain in place until the falsework is removed.

e. Falsework shall be designed to compensate for falsework deflection, vertical alignment and anticipated structure deflection.

f. Contractor shall provide tell-tales attached to the soffit forms and readable from the ground in enough systematically placed locations to determine the total settlement of the entire portion of the structure where concrete is being placed.

28.6.6 REMOVING FALSEWORK (2002)

a. Falsework supporting any span of a simple span concrete bridge shall not be released before 10 days after the last concrete, excluding concrete above the bridge deck, has been placed in that span and in the adjacent portions of each adjoining span of a length equal to at least ¼ the length of the span where falsework is to be released.

b. Falsework for cast-in-place prestressed portions of structures shall not be removed until after the prestressing tendons have been tensioned and released.

c. Falsework supporting any span of a continuous or rigid frame bridge shall not be removed until all required prestressing has been completed in that span and in the adjacent portions of each adjoining span for a length equal to at least ¼ the length of the span where falsework is to be removed.

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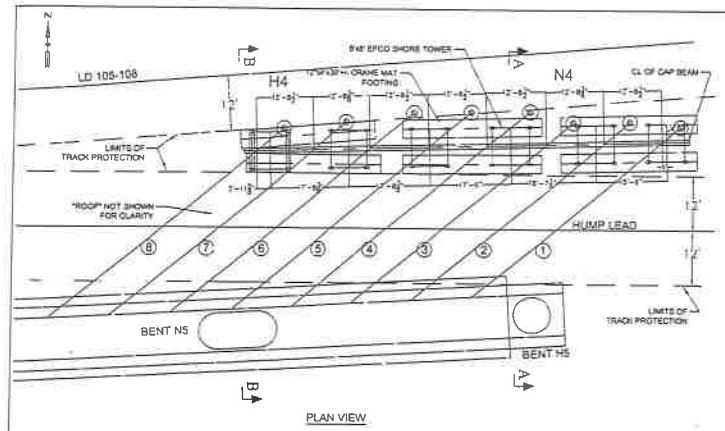


PLAN VIEW

GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1 ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4. COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{EXX} = 70KSI
4. EFCO 50KIP SHORE TOWERS (50KIP/LEG)

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI, MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

SPLICE LOCATION

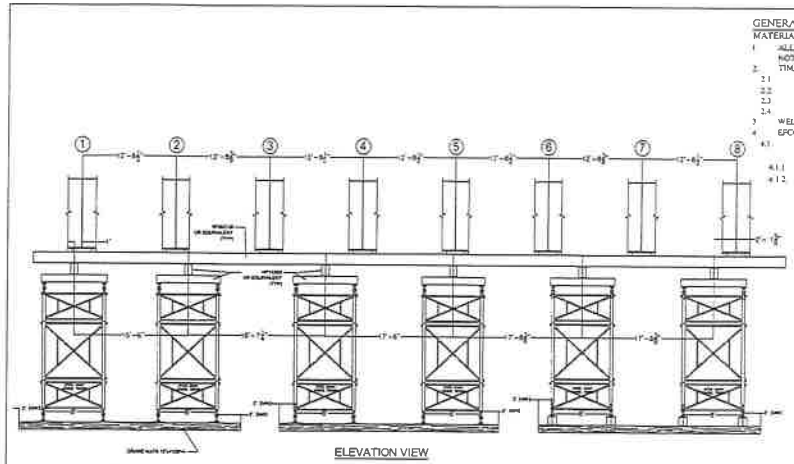
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — PROFESSIONAL ENGINEER — 03/05/12

Austin Bridge & Road

SPAN N4 FALSEWORK DESIGN
SHORE TOWERS
LAYOUT

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 03/05/12 | REVISIONS | JOB NO. 60003 | DRWN: LGS | SHEET NO. 01 | CHK:



ELEVATION VIEW

GENERAL NOTES

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1 ALLOW. BENDING STRESS = 1,500PSI
   - 2.2 ALLOW. SHEAR STRESS = 140PSI
   - 2.3 E = 1,600,000PSI
   - 2.4 COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{EXX} = 70KSI
4. EFCO 50KIP SHORE TOWERS (50KIP/LEG)
   - 4.1. BOLT OR WELD ALL BEAMS & LEGS FOR POSITIVE COMPRESSION
     - 4.1.1 BEAMS: USE ½" A325 BOLT
     - 4.1.2 CRANE MATS: ½" LAG SCREW

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI; MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

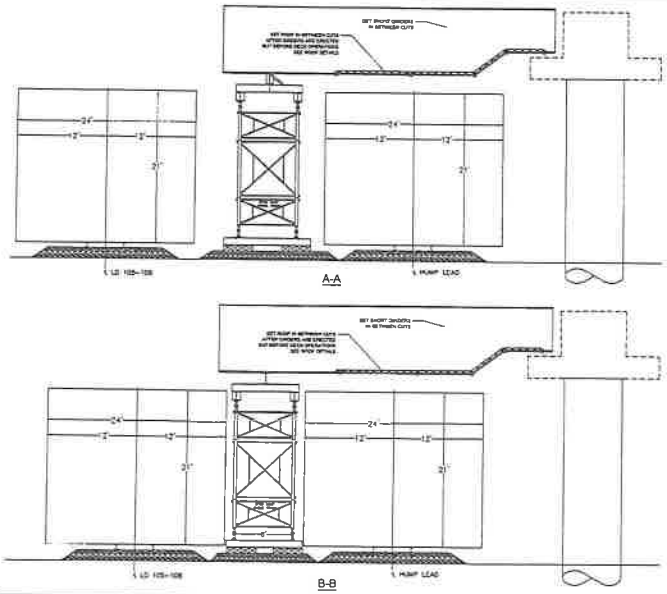
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — PROFESSIONAL ENGINEER — 03/05/12

Austin Bridge & Road

SPAN N4 FALSEWORK DESIGN
SHORE TOWERS
ELEVATION VIEW

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 03/05/12 | REVISIONS | JOB NO. 60003 | DRWN: LGS | SHEET NO. 03 | CHK:



GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3 E = 1,600,000PSI
   - 2.4 COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{EXX} = 70KSI
4. EFCO 50KIP SHORE TOWERS (50KIP/LEG)

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI; MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

INSTALLATION NOTES:

1. INSTALL SHORE TOWERS IN BETWEEN CUTS OF THE HUMP LD OR DURING 4-HR CLOSURE
   - 1.1 EQUIPMENT WILL SIT ON LD 101-109 TRACKS (NORTH SIDE)
   - 1.2. LD 101-104 & 105-109 WILL BE CLEARED FOR 15 MIN EVERY TWO HOURS

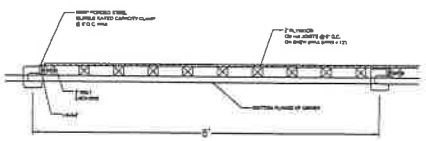
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — PROFESSIONAL ENGINEER — 03/05/12

Austin Bridge & Road

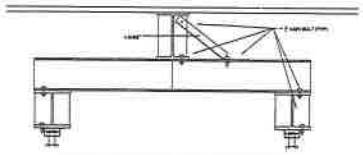
SPAN N4 FALSEWORK DESIGN
SHORE TOWERS
SECTION VIEW

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

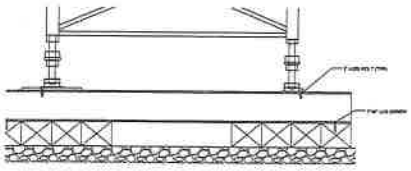
DATE: 03/05/12 | REVISIONS | JOB NO. 60003 | DRWN: LGS | SHEET NO. 02 | CHK:



N4 ROOF DETAIL - GIRDER ELEVATION VIEW



SHORE TOWER BEAM BOLTING (TYPICAL)



SHORE TOWER FOOTING BOLTING/ANCHORING (TYPICAL)

GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4 COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{EXX} = 70KSI
4. EFCO 50KIP SHORE TOWERS (50KIP/LEG)

ROOF:

1. ROOF WILL PROTECT HUMP LD WHEN INSTALLING PERMANENT METAL DECKING (NO LOADS ARE ANTICIPATED ON ROOF
2. OVERHANG FORMS WILL BE INSTALLED IN BETWEEN CUTS & DURING 4-HR CLOSURE

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

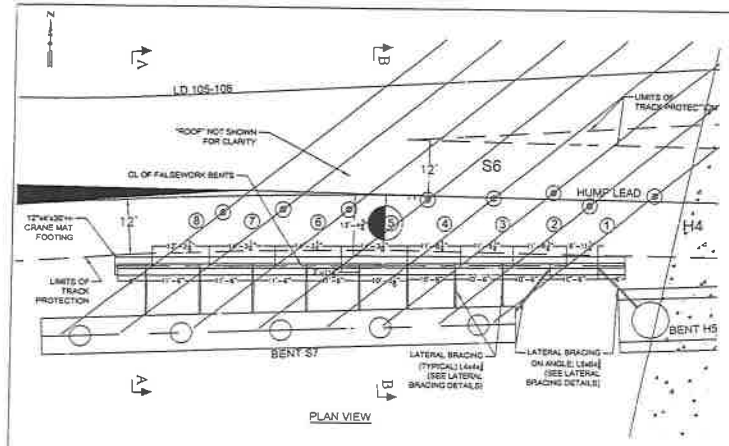
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — PROFESSIONAL ENGINEER — 03/05/12

Austin Bridge & Road

SPAN N4 FALSEWORK DESIGN
SHORE TOWERS
DETAILS

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 03/05/12 | REVISIONS | JOB NO. 60003 | DRWN: LGS | SHEET NO. 04 | CHK:



PLAN VIEW

GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4. COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{uw} = 70KSI
4. EPCO 50KIP SHORE TOWERS (50KIP/LEG)

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI; MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

GIRDER INSTALLATION NOTES:

1. WHEN ERECTING LONG 130' CENTER GIRDER PIECE, DO NOT PLACE ANY LOAD ON THE CANTILEVERED GIRDER
2. INSTALL 50% OF BOLTS IN TOP & BOTTOM FLANGES AND WEB
3. REMOVE OR LOOSEN HOLD DOWN SYSTEM
4. THEN RELEASE LOAD WITH CRANE

(S) SPLICE LOCATION

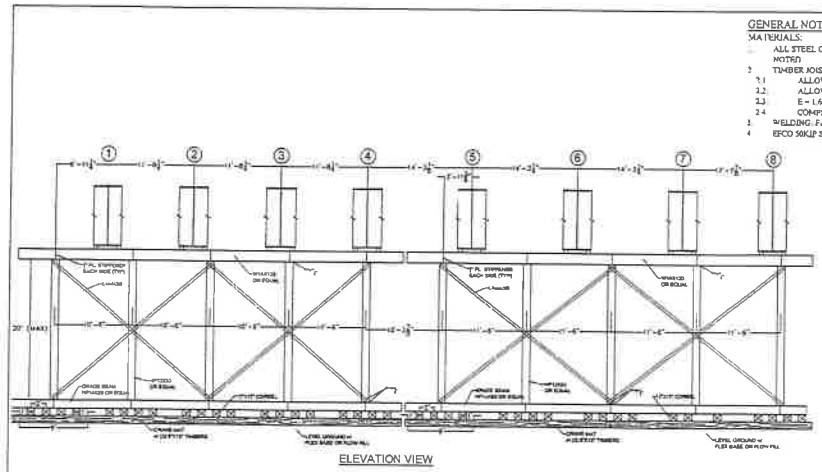
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — 02/20/12

Austin Bridge & Road

SPAN S6 FALSEWORK DESIGN
BRACED TEMP. BENT
LAYOUT

SOUTHWEST PARKWAY SECTION 26 - FT. WORTH, TX

DATE: 02/01/12 | REVISIONS | JOB NO. 03802 | SHEET NO. 05



ELEVATION VIEW

GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4. COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{uw} = 70KSI
4. EPCO 50KIP SHORE TOWERS (50KIP/LEG)

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI; MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

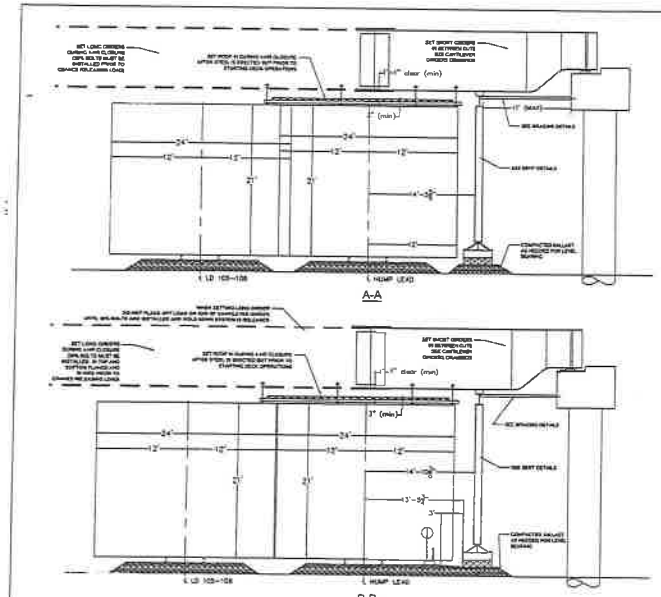
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — 02/20/12

Austin Bridge & Road

SPAN S6 FALSEWORK DESIGN
BRACED TEMP. BENT
BENT ELEVATION

SOUTHWEST PARKWAY SECTION 26 - FT. WORTH, TX

DATE: 02/01/12 | REVISIONS | JOB NO. 03802 | SHEET NO. 07



GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4. COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{uw} = 70KSI
4. EPCO 50KIP SHORE TOWERS (50KIP/LEG)

DESIGN ASSUMPTIONS:

1. MIN SOIL BEARING CAPACITY = 3,000PSI; MAX ALLOWABLE SETTLEMENT OF ½"
2. ANTICIPATED TOTAL SETTLEMENT OF FALSEWORK SYSTEM = ½" (INCORPORATE IN TOP ELEVATION CALCULATION)

FALSEWORK INSTALLATION NOTES:

1. INSTALL FALSEWORK IN BETWEEN HUMP CUTS & DURING 4-HR CLOSURE

GIRDER INSTALLATION NOTES:

1. WHEN ERECTING LONG 130' CENTER GIRDER PIECE, DO NOT PLACE ANY LOAD ON THE CANTILEVERED GIRDER
2. INSTALL 50% OF BOLTS IN TOP & BOTTOM FLANGES AND WEB
3. REMOVE OR LOOSEN HOLD DOWN SYSTEM
4. THEN RELEASE LOAD WITH CRANE

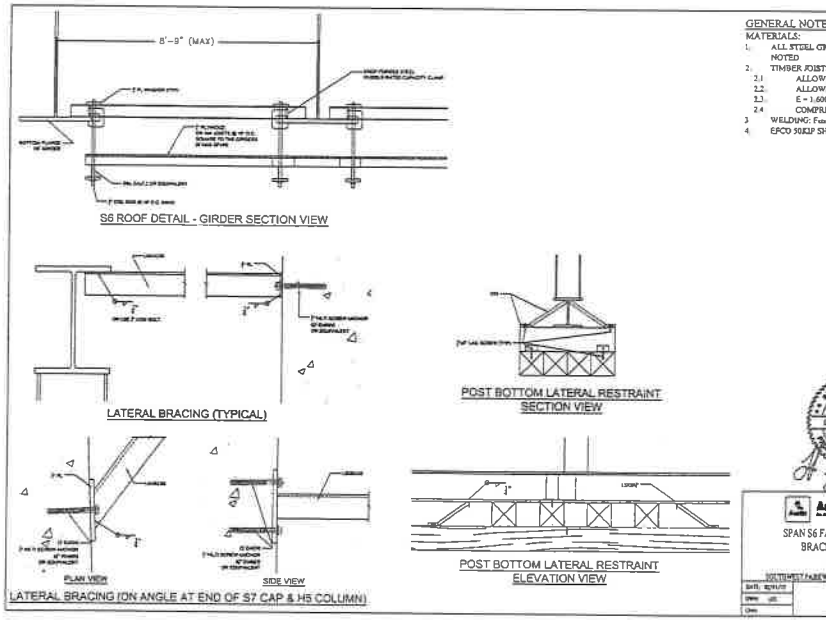
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — 02/20/12

Austin Bridge & Road

SPAN S6 FALSEWORK DESIGN
BRACED TEMP. BENT
SECTION VIEW

SOUTHWEST PARKWAY SECTION 26 - FT. WORTH, TX

DATE: 02/01/12 | REVISIONS | JOB NO. 03802 | SHEET NO. 06



GENERAL NOTES:

MATERIALS:

1. ALL STEEL GRADE 50 UNLESS OTHERWISE NOTED
2. TIMBER JOISTS:
   - 2.1. ALLOW. BENDING STRESS = 1,500PSI
   - 2.2. ALLOW. SHEAR STRESS = 140PSI
   - 2.3. E = 1,600,000PSI
   - 2.4. COMPRESSION PERP. GRAIN = 450PSI
3. WELDING: F_{uw} = 70KSI
4. EPCO 50KIP SHORE TOWERS (50KIP/LEG)

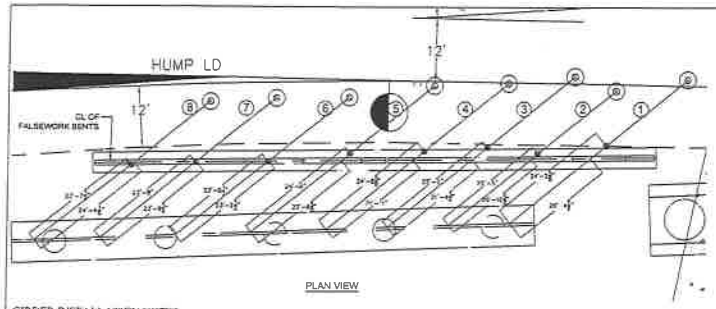
STATE OF TEXAS — LAFE G. SARGENT — 102372 — LICENSED — 02/20/12

Austin Bridge & Road

SPAN S6 FALSEWORK DESIGN
BRACED TEMP. BENT
DETAILS

SOUTHWEST PARKWAY SECTION 26 - FT. WORTH, TX

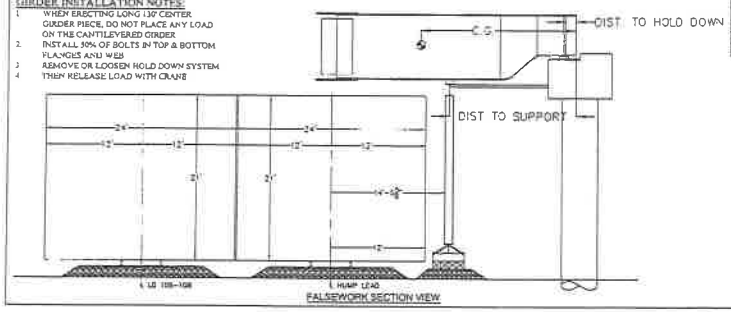
DATE: 02/01/12 | REVISIONS | JOB NO. 03802 | SHEET NO. 08



PLAN VIEW

GIRDER INSTALLATION NOTES:

1. WHEN ERECTING LONG 130' CENTER GIRDER PIECE, DO NOT PLACE ANY LOAD ON THE CANTILEVERED GIRDER
2. INSTALL 50% OF BOLTS IN TOP & BOTTOM FLANGES AND WEB
3. REMOVE OR LOOSEN HOLD DOWN SYSTEM
4. THEN RELEASE LOAD WITH CRANE



FALSEWORK SECTION VIEW

GENERAL NOTES:

1. HOLD DOWN SYSTEM INSTALL ON EVERY GIRDER.
2. HOLD DOWN SYSTEM IS INDEPENDENT OF LATERAL BRACING
   2.1. TEMPORARY LATERAL BRACING INSTALLED ON FIRST GIRDER SET (SEE TXDOT STANDARDS) AND DIAPHRAGMS ARE INSTALLED ON SUBSEQUENT GIRDERS
3. HOLD DOWN IS PERPENDICULAR TO GIRDERS
4. HOLD DOWN SYSTEM AND LATERAL BRACING MUST BE INSTALLED BEFORE CRANES RELEASE LOAD
5. WHEN SPLICING LONG GIRDER, 50% OF BOLTS IN TOP FLANGE, BOTTOM FLANGE AND WEB MUST BE INSTALLED BEFORE RELEASING ANY WEIGHT

GIRDER NO.	LENGTH (FT)	C.G. (FT)	DIST TO SUPPORT (FT)	DIST TO HOLD DOWN (FT)	UPLIFT FORCE (KIPS)
1	44.98	24.22	20.29	1	5.53
2	42.15	22.42	20.89	1	2.05
3	47.32	25.17	22.4	1	5.54
4	45.98	24.72	21.92	1	4.02
5	46.14	24.67	22.55	1	2.85
6	43.29	23.04	22.2	1	-0.2
7	43.94	23.67	23.8	1	-0.16
8	43.5	23.65	24.35	1	-0.87

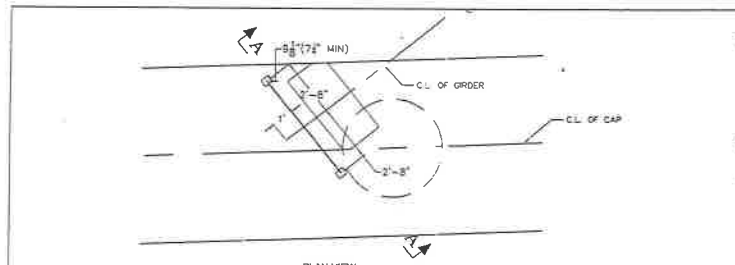
STATE OF TEXAS
LAFE G. SARGENT
102372
LICENSED
PROFESSIONAL ENGINEER
02/22/12

Austin Bridge & Road

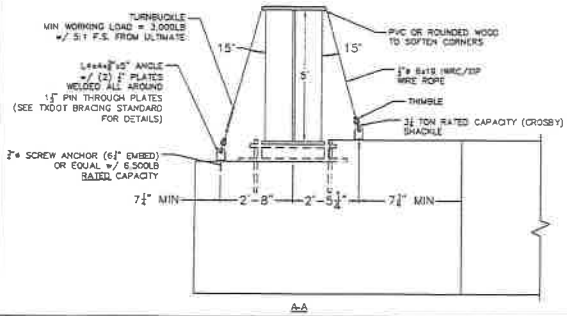
SPAN S6
CANTILEVER END GIRDERS
END HOLD DOWN DESIGN

SOUTHWEST FAREWAY SECTION 28 - FT. WORTH, TX

DATE: 01/30/12		JOB NO. [illegible]
DWN: [illegible]		SHEET NO. 09
CHK:		



PLAN VIEW



A-A

GENERAL NOTES:

1. HOLD DOWN SYSTEM INSTALL ON EVERY GIRDER.
2. HOLD DOWN SYSTEM IS INDEPENDENT OF LATERAL BRACING
   2.1. TEMPORARY LATERAL BRACING INSTALLED ON FIRST GIRDER SET (SEE TXDOT STANDARDS) AND DIAPHRAGMS ARE INSTALLED ON SUBSEQUENT GIRDERS
3. HOLD DOWN IS PERPENDICULAR TO GIRDERS
4. HOLD DOWN SYSTEM AND LATERAL BRACING MUST BE INSTALLED BEFORE CRANES RELEASE LOAD
5. WHEN SPLICING LONG GIRDER, 50% OF BOLTS IN TOP FLANGE, BOTTOM FLANGE AND WEB MUST BE INSTALLED BEFORE RELEASING ANY WEIGHT

GIRDER INSTALLATION NOTES:

1. WHEN ERECTING LONG 130' CENTER GIRDER PIECE, DO NOT PLACE ANY LOAD ON THE CANTILEVERED GIRDER
2. INSTALL 50% OF BOLTS IN TOP & BOTTOM FLANGES AND WEB
3. REMOVE OR LOOSEN HOLD DOWN SYSTEM
4. THEN RELEASE LOAD WITH CRANE

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LICENSED
PROFESSIONAL ENGINEER
02/22/12

Austin Bridge & Road

SPAN S6
CANTILEVER END GIRDERS
END HOLD DOWN DESIGN

SOUTHWEST FAREWAY SECTION 28 - FT. WORTH, TX

DATE: 01/30/12		JOB NO. [illegible]
DWN: [illegible]		SHEET NO. 10
CHK:		

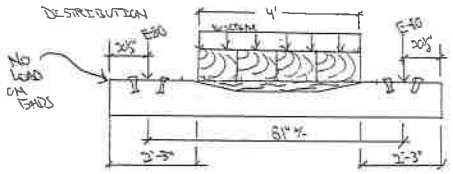
CRANE / SHORE TOWER ON PRESTRESSED TIES | VGS | 02/23/12 | 1/1

DESIGN METHOD: COMPARE RESULTING MOMENT TO DESIGN MOMENT FOR COOPER E-80 LIVE LOAD (80K AXLE LOAD)

LOADS: CRANE MANITOWOC 14000
GROSS WT. = 450,000 LB + 50,000 LB (LOAD) = 500 KIP

50K SHORE TOWER - MAX LOAD = 50K / LEG

DISTRIBUTION



ASSUME TRACKS @ 2'-6" O.C.

LOAD ON TIE

CRANE: TRACKS = 23.17' CONTACT

PRESSURE = $\frac{500^K}{2 \cdot 23.17'}$ = 10.79 K/LF

2 TRACKS

LOAD ON TIE: 10.79 K/LF (2.5') = 27K ← CONTROLS

TOWER = 50K / (2 TIES) = 25K

W_{TIE} = 27K / 8.5' = 3.18 KLF

COOPER E-80 LOAD

W_{E80} = 80K / 8.5 KLF = 9.42 KLF

COMPARE MOMENTS

M_{CRANE} = 3.18 KLF (2.25') (2.25'/2) = 8.1 K-FT (+)

M_{E80} = −9.42 KLF (1.71'/2) + 9.42 KLF 5.08'/2 · 1/2 · 5.08'/2 = 16.6 K-FT (−)
13.7 K-FT (+)

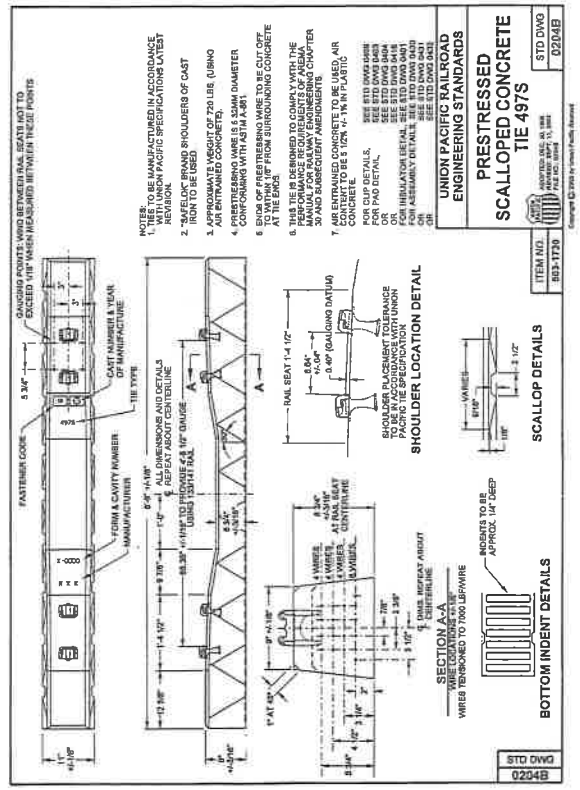
13.7 K-FT > 8.1 K-FT O.K.

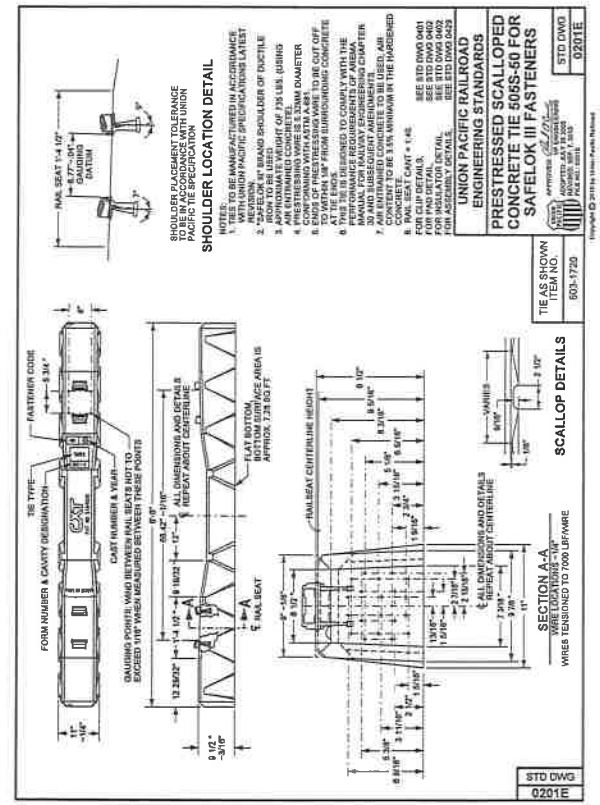
LOAD PER WIRE (−) vs (+)

E-80 16.6 K-FT (12"/1) / (4 ea · 5.75") = 8.67 K/EA

CRANE 8.1 K-FT (12"/1) / (6 ea · 4.75") = 3.41 < 8.67 OK

TOPS 35500





Crane Weights

14000

Note: Weights may fluctuate ± 3% due to manufacturing tolerances

	Weight Pounds	Weight Kilograms
LIFTCRANE:		
Upperworks and lowerworks complete, carbody jacking, counterweight, 10.25 ft (3,12 m) retractable gantry, 27 ft (8,23 m) live mast, boom stops and load lines, fully rigged 20,0 m (65 6 ft) Boom No. 76, upper boom point, 220 Ton (200t) block and 15 Ton (14t) hook and weight ball		
14000 SERIES 1	321,540	145 848
14000 SERIES 2	415,610	188 517
UPPERWORKS MACHINERY MODULE WITH CARBODY:		
Carbody, upperworks with two full power drums, operator's cab, gantry, backhitch, mast, mast hoist wire rope, carbody jacking arrangement (optional), and maximum length hoist and whip lines	83,450	37 882
CRAWLERS:		
27.17 ft (8,28 m) crawler assembly (each) with drive, 48 in. (1 219 mm) treads and steps	38,600	17 509
COUNTERWEIGHT - UPPER:		
Tray	21,235	9 632
Counterweight side box (8 on SERIES 1, 6 on SERIES 2 (each))	17,650	8 006
Counterweight center box (1 on SERIES 2)	5,910	2 681
Total upperworks counterweight – 14000 SERIES 1	127,000	57 606
14000 SERIES 2	168,000	76 203
COUNTERWEIGHT - LOWER:		
Carbody counterweight (2 on SERIES 2 (each))	26,500	12 020
Carbody counterweight steps (each)	50	23
Total lowerworks counterweight - 14000 SERIES 2	53,000	24 040
GANTRY:		
10.25 ft (3,12 m) gantry	4,735	2 148
Backhitch assembly (each leg)	855	388
Backhitch cylinders and pins (each)	745	338
MAST:		
27 ft (8,23 m) mast with straps	5,100	2 313
Mast raising cylinders with supports (each)	520	236
LOWERWORKS OPTIONS:		
Carbody jacking with pads (each)	650	295
Barrier assembly - swing radius	270	122

Crane Weights

14000

Note: Weights may fluctuate ± 3% due to manufacturing tolerances

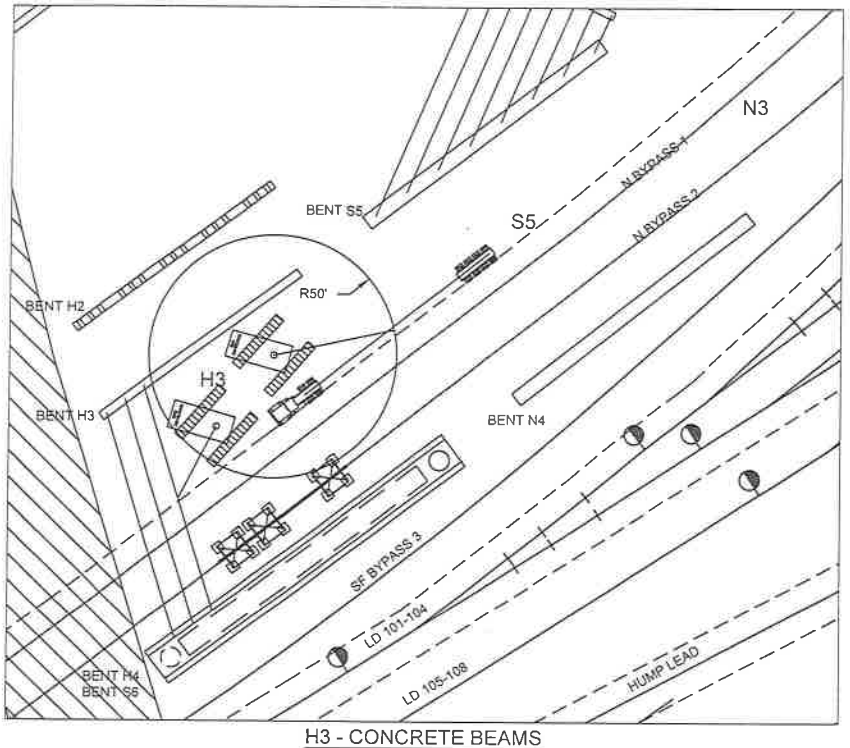
	Weight Pounds	Weight Kilograms
BOOM NO. 76:		
18 ft (5,5 m) butt	3,775	1 712
29.5 ft (9,0 m) top with straps, upper and lower point and wire rope guide	11,280	5 117
9.8 ft (3,0 m) insert with boom straps	1,630	739
18 ft (5,5 m) insert with aux. sheaves and boom strap	4,260	1 932
19.7 ft (6,0 m) insert with boom straps	2,640	1 197
39.4 ft (12,0 m) insert with boom straps	4,575	2 075
39.4 ft (12,0 m) insert with boom straps (with jib backstay lugs)	4,885	2 125
25.33 ft (7,7 m) basic strap (each)	290	132
9.8 ft (3,0 m) strap (with connector links) (each)	140	64
10.4 ft (3,2 m) strap (with connector links) (each)	160	73
19.7 ft (6,0 m) strap (with connector links) (each)	245	111
39.4 ft (12,0 m) strap (with connector links) (each)	445	202
Intermediate strut arrangement	415	188
Boom stop (each tube)	530	240
JIB NO. 134:		
15 ft (4,6 m) butt	560	254
15 ft (4,6 m) top (with jib point)	895	406
10 ft (3,0 m) insert	350	159
20 ft (6,1 m) insert	585	265
30.75 ft (9,4 m) basic pendant (each)	115	52
9.5 ft (2,9 m) pendant (each)	65	29
19.0 ft (5,8 m) pendant (each)	85	39
12.5 ft (3,8 m) strut with sheave	665	302
Backstay link (each) attached to strut	25	11
Backstay tie link	10	5
Backstay link (each)	65	29
Backstay spreader	50	23
44.58 ft (13,6 m) backstay pendant (each)	150	68
4.67 ft (1,4 m) backstay pendant (each)	50	23
Backstay link (each) attached to boom insert	20	9
Jib stop assembly	190	86
Wire rope anchor	110	50
Load sensor	45	20
JIB NO 135:		
15 ft (4,6 m) butt	335	152
15 ft (4,6 m) top (with jib point and wheel)	685	311
10 ft (3,0 m) insert	175	79
70 ft (21,3 m) basic pendant (each)	90	41
9 ft (2,7 m) pendant (each)	20	9
Pendant link (each)	5	2
17.79 ft (5,4 m) strut with sheave	440	200
Backstay link (each)	5	2
56.54 ft (17,2 m) backstay pendant (each)	75	34
Jib stop assembly	95	43

Crane Weights

14000

Note: Weights may fluctuate ± 3% due to manufacturing tolerances

	Weight Pounds	Weight Kilograms
LUFFING JIB NO. 133:		
27 ft (8,2 m) butt	2,390	1 084
23 ft (7,0 m) top (with jib point, hand winches, and pendant links)	3,200	1 451
10 ft (3,0 m) insert	580	263
20 ft (6,1 m) insert	980	445
40 ft (12,2 m) insert	1,795	814
Offset link adapter for fold under arrangement	280	127
20.13 ft (6,1 m) basic pendant (each)	185	84
25.92 ft (7,9 m) basic pendant (each)	200	91
10.08 ft (3,1 m) pendant (each)	130	59
40.25 ft (12,3 m) pendant (each)	260	118
26 ft (7,9 m) jib strut with guide sheaves, luffing sheaves and links	4,395	1 994
22.5 ft (6,9 m) main strut with luffing sheaves and links	3,150	1 429
Backstay beam link attached to main strut	610	277
12.25 ft (3,7 m) basic backstay pendant (each)	145	66
3.25 ft (1,0 m) backstay link (each)	90	41
2 ft (0,6 m) backstay link (each)	65	29
34.58 ft (10,5 m) basic backstay pendant (each)	240	109
10 ft (3,0 m) backstay pendant (each)	130	59
19.7 ft (6,0 m) backstay pendant (each)	175	79
39.4 ft (12,0 m) backstay pendant (each)	260	118
Rope guide on boom top for fold under arrangement	440	200
Jib stop assembly	880	399
Main strut stop assembly	260	118
Wire rope guide on jib top	665	302
Wire rope anchor	225	102
Luffing jib hinge pin (each)	25	11
UPPERWORKS OPTIONS:		
CE Code - rotating bed	260	118
Cold weather package - rotating bed	135	61
Rigging winch assembly	505	229
Cab mounting assembly with cab-lift	110	50
BOOM OPTIONS:		
Upper boom point with load sensor and limit control (single sheave)	1,260	571
Auxiliary drum assembly in boom butt	3,750	1 701
Boom assembly ladder storage	90	41
220 Ton (200 t) load block (7 sheave)	5,450	2 472
15 Ton (14 t) hook and weight ball	1,310	594
WIRE ROPE:		
Mast Hoist		
960 ft (293 m) of 22 mm wire rope - 1.80 lb per ft (2,68 kg/m)	1,765	801
Load Lines		
26 mm - 2.39 lbs per ft (3,56 kg/m) 1,475 ft (450 m) No.76 boom	3,525	1 599
Whip Lines		
26 mm - 2.39 lbs per ft (3,56 kg/m)		
960 ft (293 m) No. 76 boom only	2,295	1 041
1,020 ft (311 m) No. 134 jib	2,440	1 107
Auxiliary Line		
770 ft (235 m) of 1 in. (25,4 m) wire rope - 2.26 lb per ft (3,36 kg/m)	1,740	789



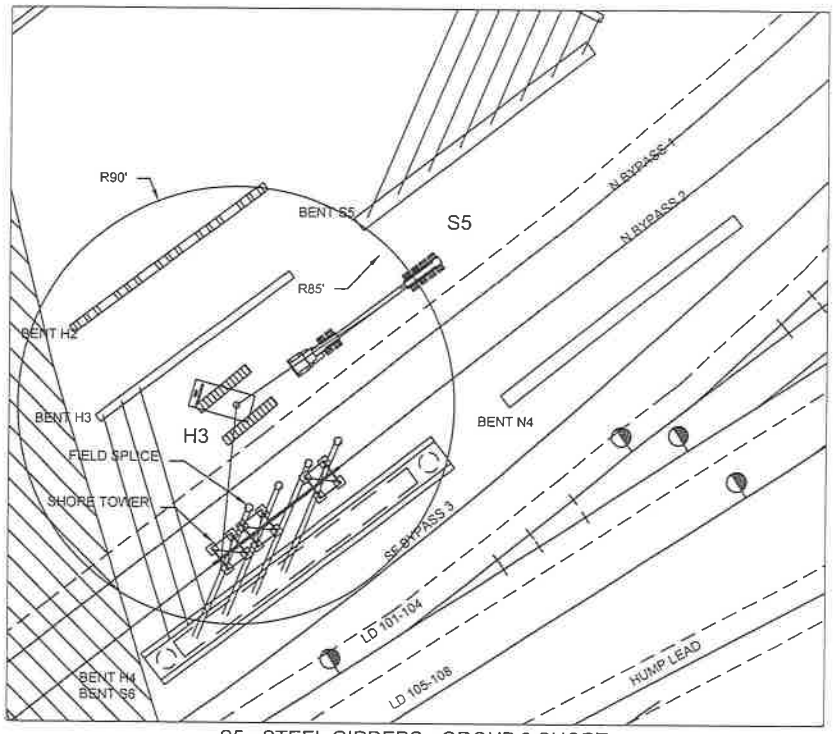
H3 - CONCRETE BEAMS

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (20 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



S5 - STEEL GIRDERS - GROUP 2 SHORT

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK GIRDER OFF OF TRUCK, TURN AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN H3	IV	96'	78.8K	86.7K	4K	90.7K	50'	102.4K	88%
SPAN S5-2	STL	59'	31K	31K	9K	40K	90'	46.8K	85.5%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

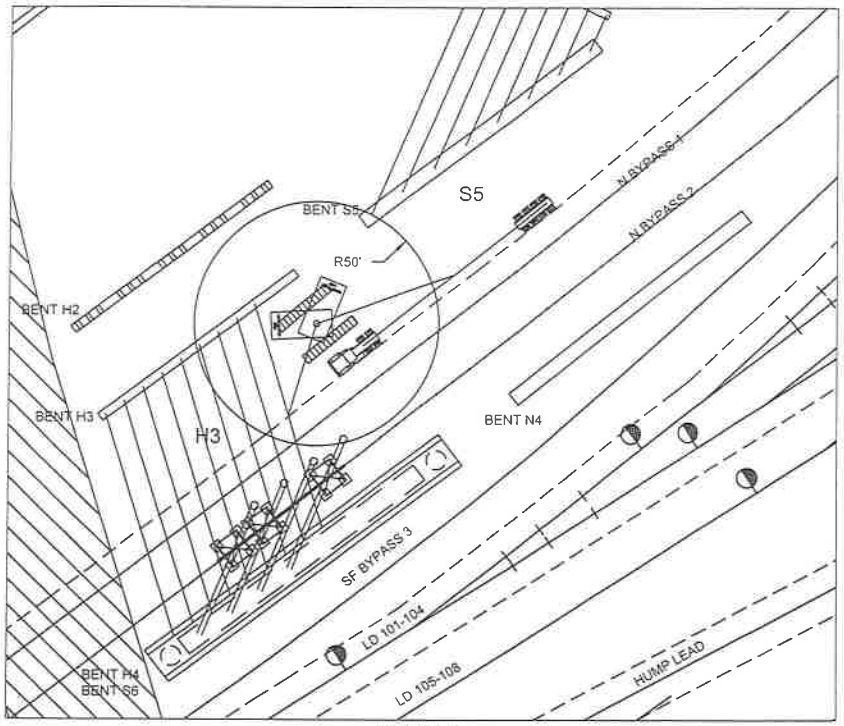
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN H3 (Gr. 9-11)
SPAN S5 (Gr. 13-16 Group 2)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		FG-01



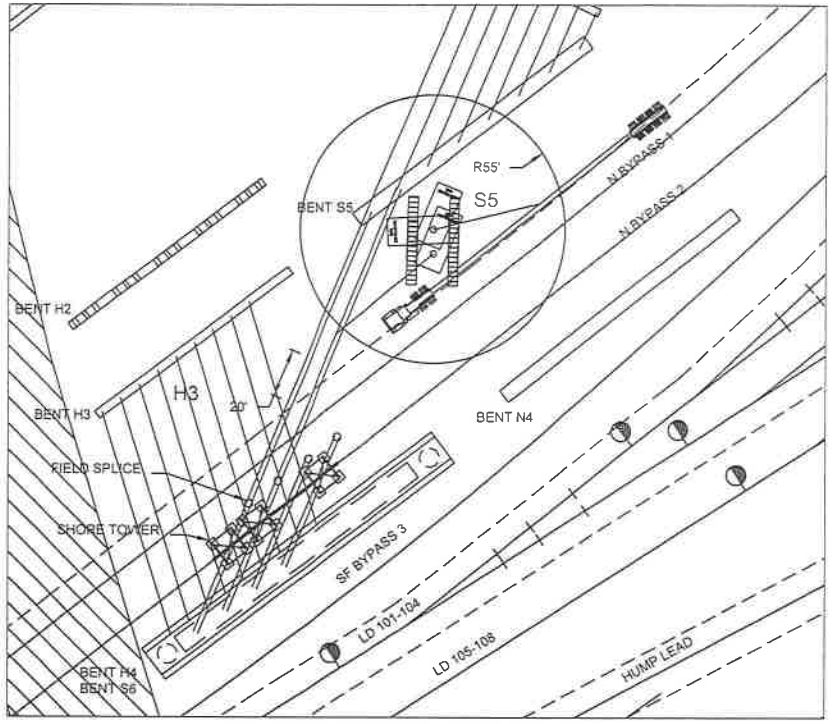
H3 - CONCRETE BEAMS

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (20 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



S5 - STEEL GIRDERS - GROUP 1 LONG

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN H3	IV	96'	78.8K	86.7K	4K	90.7K	50'	102.4K	88%
SPAN S5-1	STL	128.6'	67K	67K	9K	76K	55'	91K	83.5%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

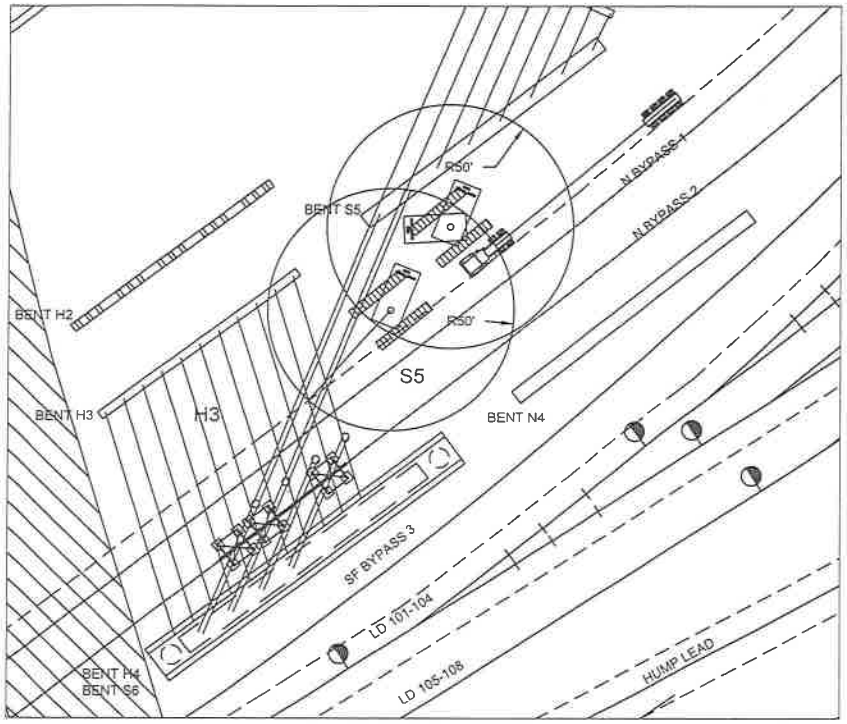
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN H3 (Gr. 3-8)
SPAN S5 (Gr. 7-8)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN CCS		SHEET NO.
CHK: LGS		FG-02



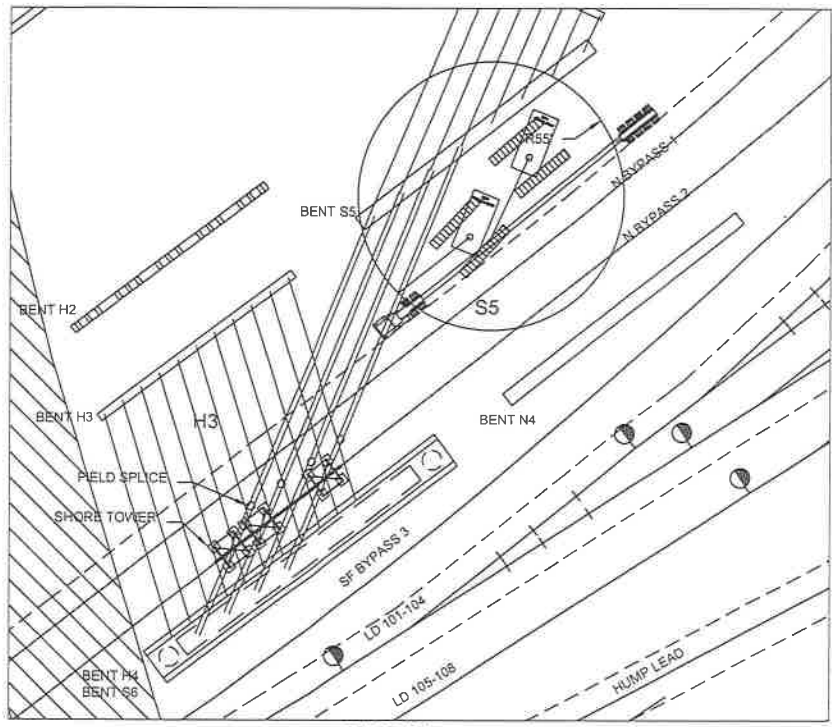
H3 - CONCRETE BEAMS

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (20 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



S5 - STEEL GIRDERS - GROUP 1 LONG

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
H3	IV	96'	78.8K	86.7K	4K	90.7K	50'	102.4K	88%
S5-1	STL	128.6'	63K	63K	9K	72K	55'	91K	79%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

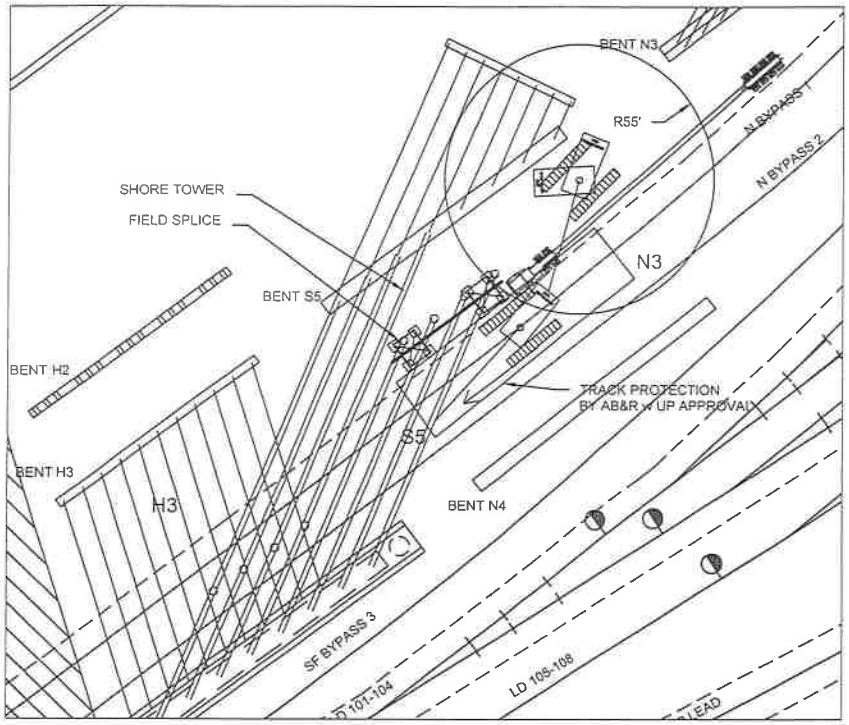
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN H3 (Gr. 1-2)
SPAN S5 (Gr. 5-6)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		FG-03



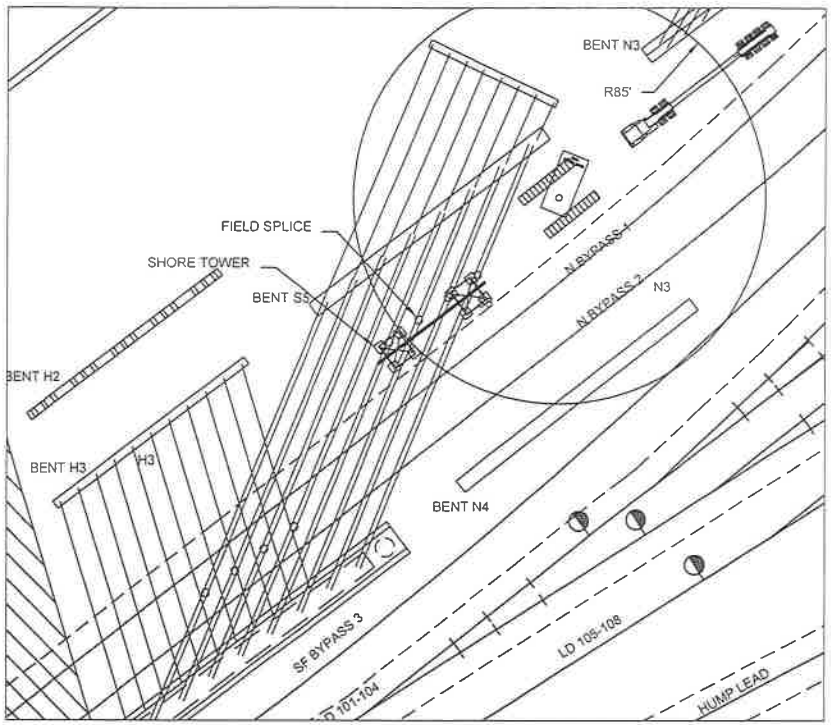
S5 - STEEL GIRDERS - GROUP 2 LONG

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



S5 - STEEL GIRDERS - GROUP 1 SHORT

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
S5-2	STL	130'	63K	63K	9K	72K	55'	91K	79%
S5-1	STL	58.6'	30K	30K	9K	39K	90'	46.8K	83.3%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

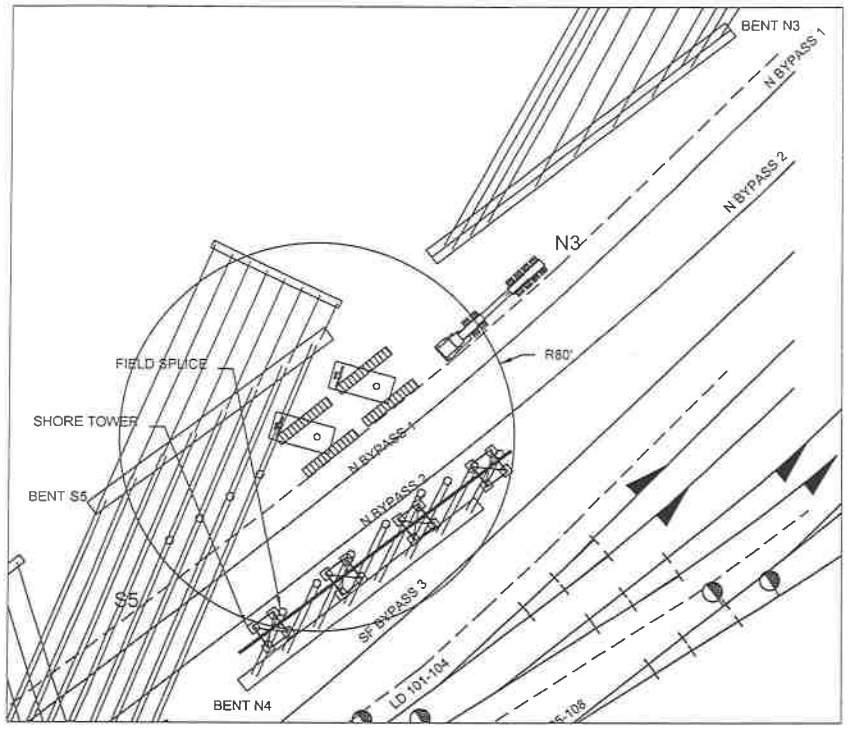
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN S5 (Gr. 9-12)
SPAN S5 (Gr. 1-4)

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		FG-04



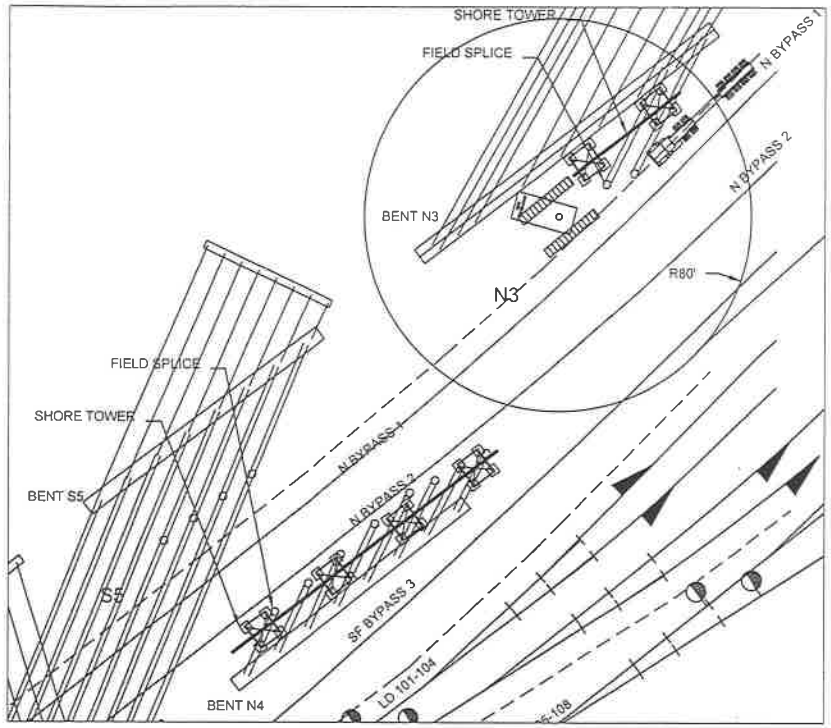
N3 - STEEL GIRDERS - GROUP 3

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



N3 - STEEL GIRDERS - GROUP 1

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (30 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
N3-2	STL	40'	26K	26K	9K	35K	50'	103.4K	33.8%
N3-1	STL	62.5'	40K	40K	9K	49K	80'	55K	89.1%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

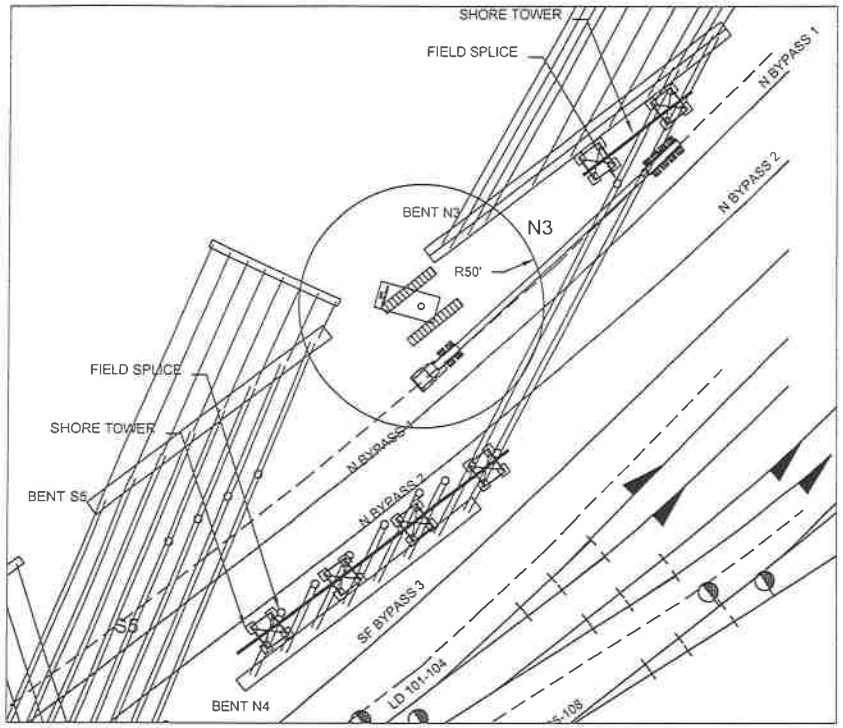
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN N3
GROUP 1 & 3

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		FG-05



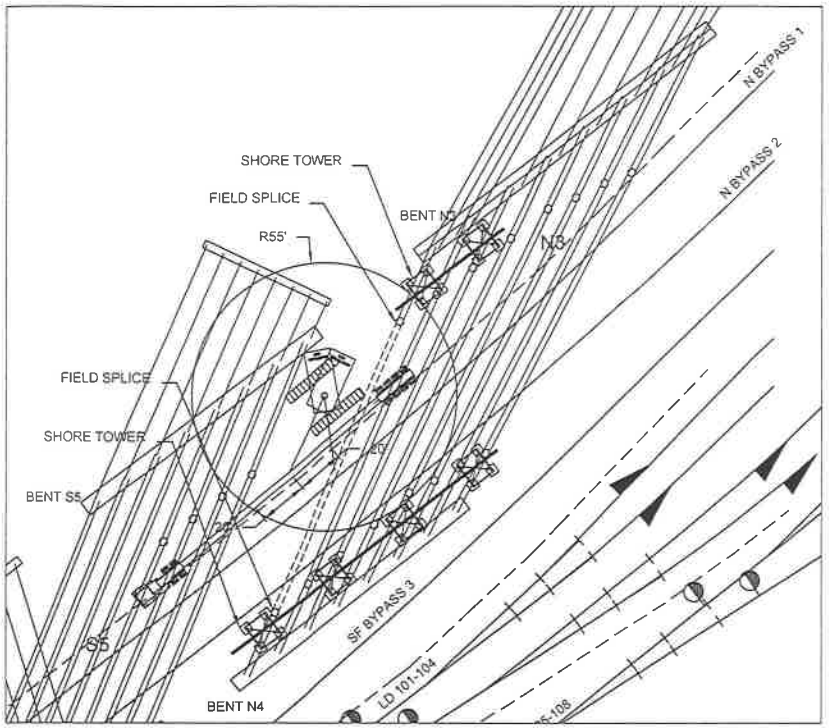
N3 - STEEL GIRDERS - GROUP 2 - G1-2

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (40 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN, WALK INTO POSITION AND SET.



N3 - STEEL GIRDERS - GROUP 2 - G8

STEP 1:

1. CRANE SITS NORTH OF SBP1.

STEP 2: (40 MIN.)

1. PICK BEAM OFF OF TRUCK, TURN AND EXTEND BOOM, BRING BEAM UP BETWEEN PREVIOUSLY SET BEAM, TURN AND SET.

LIFT	GIRDER TYPE	MAX BEAM LGTH	TOTAL WEIGHT	CRANE A: MANITOWOC 4100 S2 BOOM: 150' COUNTER WEIGHT: 206,400 LBS					
				LIFT WEIGHT*	BLOCK/ RIGGING	TOTAL	Rmax**	CHART CAPACITY	% of CHART CAPACITY
SPAN N3	PLATE	129.9'	83K	83K	9K	92K	50'	102.4K	89.8%

* LIFT WEIGHT
WEIGHT OF THE BEAM THE CRANE WILL BE LIFTING

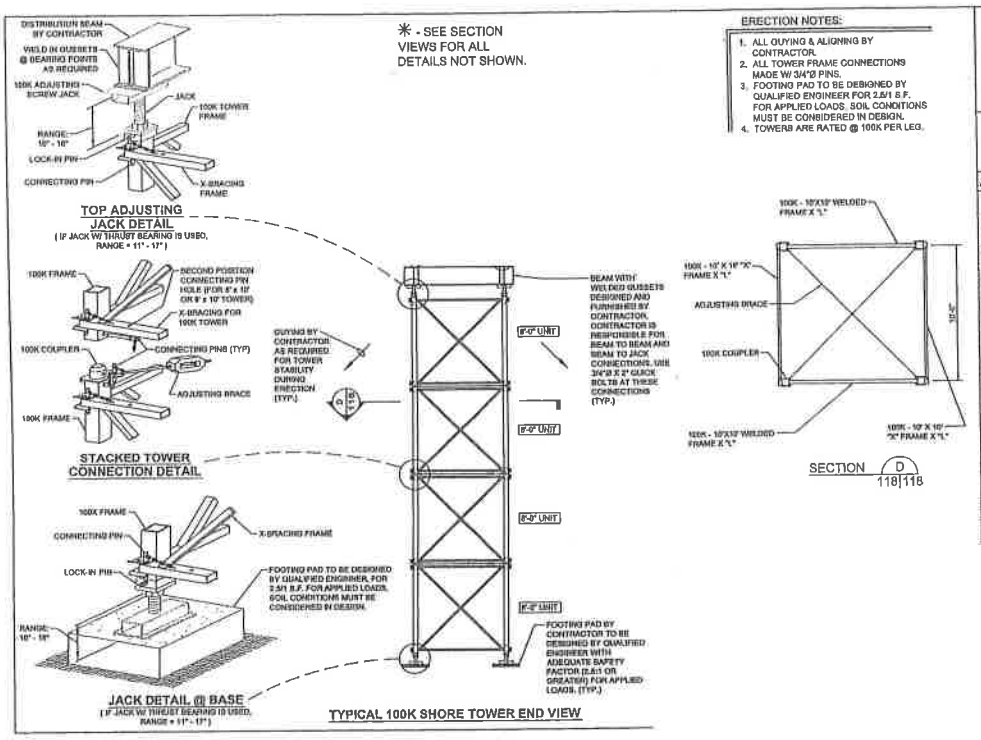
** Rmax:
MAXIMUM WORKING RADIUS AT MAX. LIFT WEIGHT

Austin Bridge & Road
An Austin Industries Company FIRM NO. 11355

F-G
LIFT DETAILS SPAN N3
GROUP 2

SOUTHWEST PARKWAY SECTION 2B - FT. WORTH, TX

DATE: 02/01/12		JOB NO. 610018
DWN: CCS		SHEET NO.
CHK: LGS		FG-06



ERECTION NOTES:

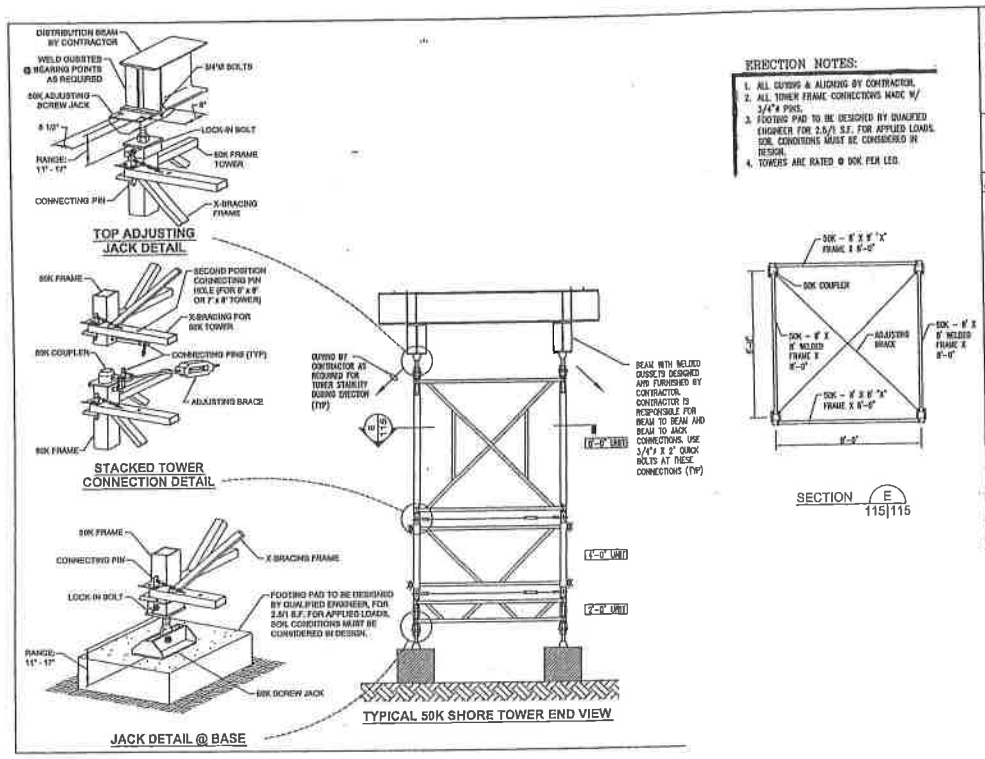
1. ALL GUYING & ALIGNING BY CONTRACTOR.
2. ALL TOWER FRAME CONNECTIONS MADE W/ 3/4"Ø PINS.
3. FOOTING PAD TO BE DESIGNED BY QUALIFIED ENGINEER FOR 2.5/1 S.F. FOR APPLIED LOADS. SOIL CONDITIONS MUST BE CONSIDERED IN DESIGN.
4. TOWERS ARE RATED @ 100K PER LEG.

ATTENTION

FACE SHEETS MUST BE IMMEDIATELY CLEANED AFTER EVERY POUR AND MUST BE WELL OILED WITH FORM RELEASE AGENT

⚠ THINK SAFETY - WORK SAFELY

GENERAL NOTES



ERECTION NOTES:

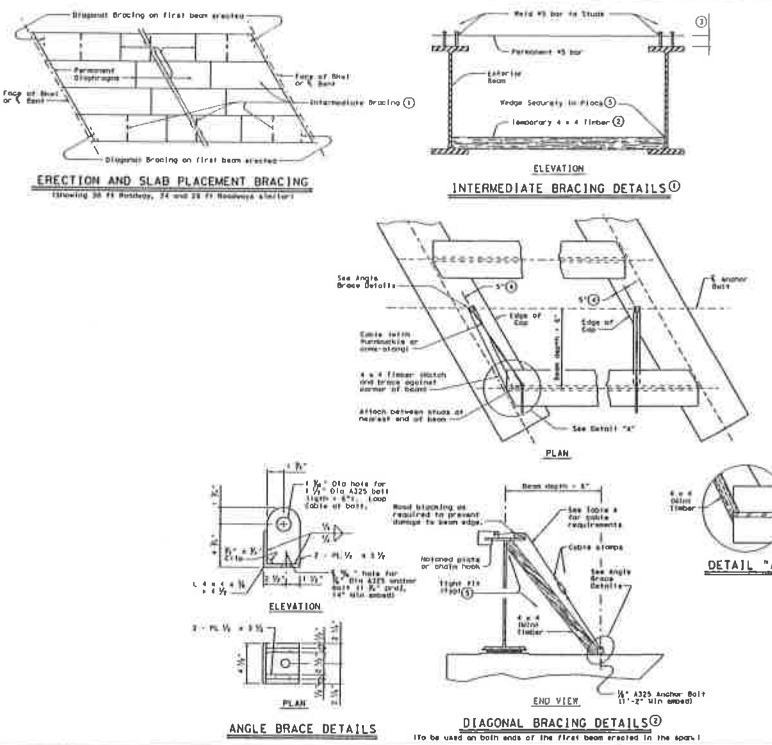
1. ALL GUYING & ALIGNING BY CONTRACTOR.
2. ALL TOWER FRAME CONNECTIONS MADE W/ 3/4"Ø PINS.
3. FOOTING PAD TO BE DESIGNED BY QUALIFIED ENGINEER FOR 2.5/1 S.F. FOR APPLIED LOADS. SOIL CONDITIONS MUST BE CONSIDERED IN DESIGN.
4. TOWERS ARE RATED @ 50K PER LEG.

ATTENTION

FACE SHEETS MUST BE IMMEDIATELY CLEANED AFTER EVERY POUR AND MUST BE WELL OILED WITH FORM RELEASE AGENT

⚠ THINK SAFETY - WORK SAFELY

GENERAL NOTES



1. Install in exterior bays prior to slab placement. Space equally between permanent diaphragms (12'-6" Max Spa).
2. Pressure treated landscape timbers must not be used. Remove temporary bracing after deck is placed.
3. Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to stud connectors.
4. It is acceptable to tie anchor bolts to cap reinforcement.
5. Use wedges as necessary to obtain tight fit. Nail wedges to timbers.
6. All hardware used with cable must be able to develop the minimum ultimate strength specified. Use thimbles at all loops in cable. Install cable clamps with saddles bearing against the live end and U-bolts bearing against the dead end.

TABLE A

Beam Type	Req Min Cable Ultimate Strength (6)
W18 & W21	10.5 k
W24 & W27	14.3 k
W30 & W33	18.2 k
W36 & W40	20.6 k

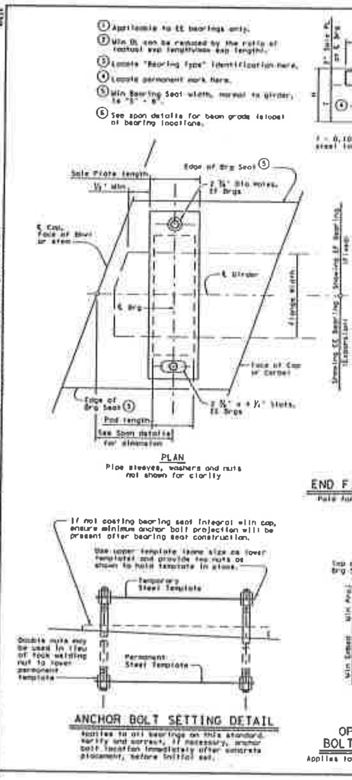
GENERAL NOTES:
Permanent diaphragms shall be placed immediately after erection of each beam. Intermediate bracing shall remain in place until slab concrete has attained a compressive strength of 3,000 psi.
All bracing required on this standard is considered subsidiary to Structural Steel (Rolled Beam).

The details shown on this sheet are applicable for use only with the Steel Beam Standard Designs shown on Standards SBSD-24, SBSD-28 and SBSD-30.

Texas Department of Transportation
Bridge Division

STANDARD
ERECTION AND BRACING REQUIREMENTS
STEEL BEAM SPANS

SBBR



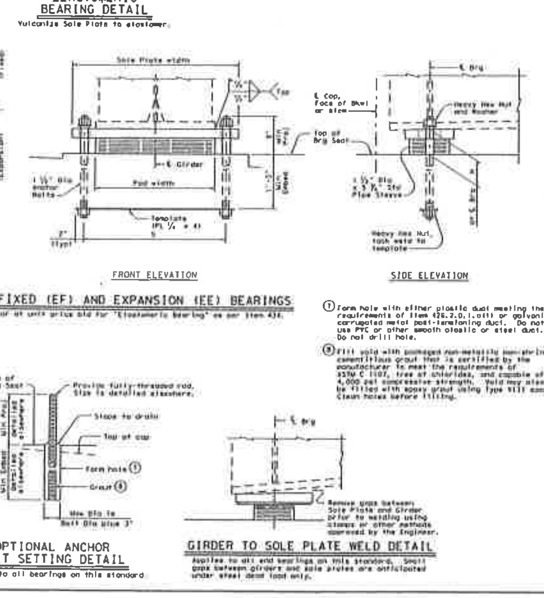


TABLE OF END BEARING DESIGNS

Bearing Type	Elastomeric Pad Width (in)	Elastomeric Pad Length (in)	Sole Plate Width (in)	Sole Plate Length (in)	H (in)	S (in)	T (in)	Flange Width Min (in)	Flange Width Max (in)	Reactions Min DL (1)(2) (kip)	Reactions Max DL (kip)	Reactions Max Total (kip)	Max Expansion Length (1) (ft)
EE1 or EF1	15	9	25.5	11	5.5	20.0	3.49	10	15	59	115	144	250
EE2 or EF2	18	9	28.5	11	5.5	23.0	3.49	10	18	71	148	185	250
EE3 or EF3	21	9	31.5	11	5.5	26.0	3.49	11	21	83	181	226	250
EE4 or EF4	24	9	34.5	11	5.5	29.0	3.49	14	24	95	215	268	250
EE5 or EF5	27	9	37.5	11	5.5	32.0	3.49	17	27	106	249	312	250
EE6 or EF6	30	9	40.5	11	5.5	35.0	3.49	20	30	118	284	355	250
EE7 or EF7	32	9	42.5	11	5.5	37.0	3.49	22	32	126	307	384	250
EE8 or EF8	34	9	44.5	11	5.5	39.0	3.49	24	34	134	331	414	250
EE9 or EF9	36	9	46.5	11	5.5	41.0	3.49	26	36	142	355	443	250

GENERAL NOTES:
The bearings shown on this standard are intended for use with continuous and simple span rolled beams and plate girders. None of the bearings shown are designed to resist uplift.
See span details for bearing type and location.
The bearing fabricator is required to develop a bearing layout which identifies location and orientation of all bearings. Permanently mark each bearing in accordance with the bearing layout. A copy of the bearing layout is to be provided to the Engineer.
Anchor bolts must conform to ASTM F 1554 Grade 105 or ASTM A 193 Grade B7. Nuts must [illegible]
For painted bridges, steel for sole plates must conform to ASTM A 36 or A 588. For unpainted (weathering) bridges, steel for sole plates must conform to ASTM A 588.
Shop drawings for approval are required. [illegible]
Install anchor bolt nuts finger-tight or loosely snug.

All bearings on this standard require wood float bearing seat surfaces that are clean and free of all loose material before placement of bearings.

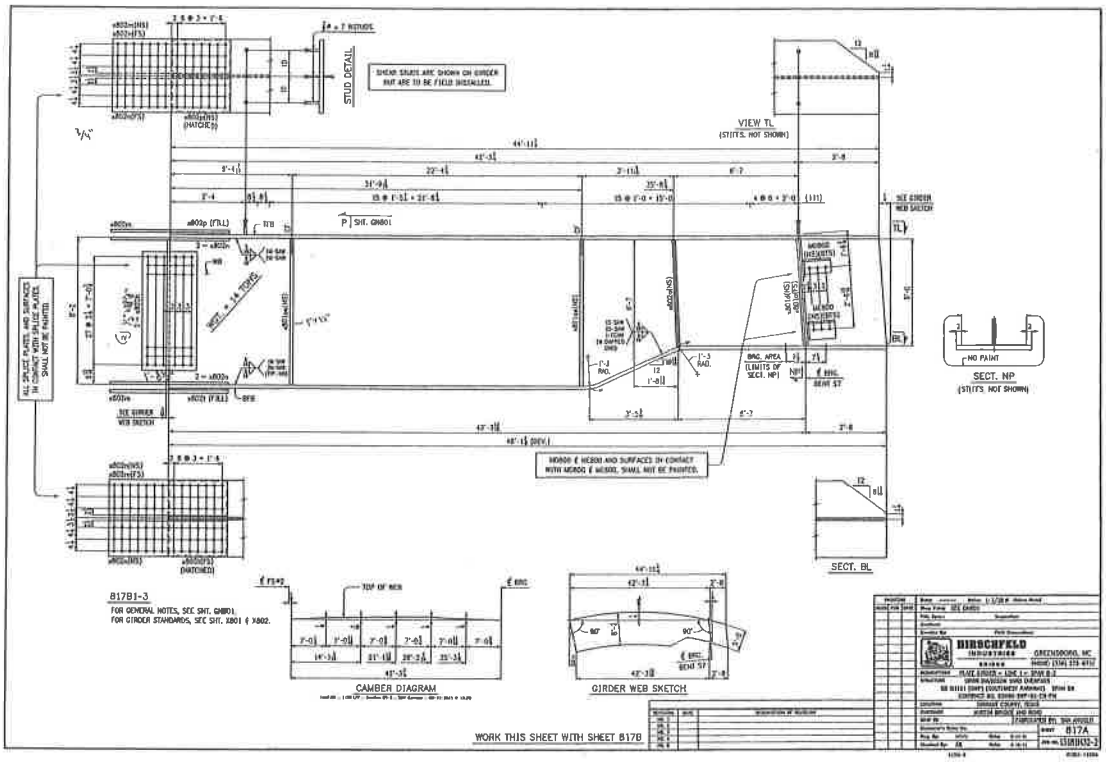
These bearings are not intended for use with bridges over 100 ft wide. The anchor bolts are not designed to restrain temperature-induced lateral movement.

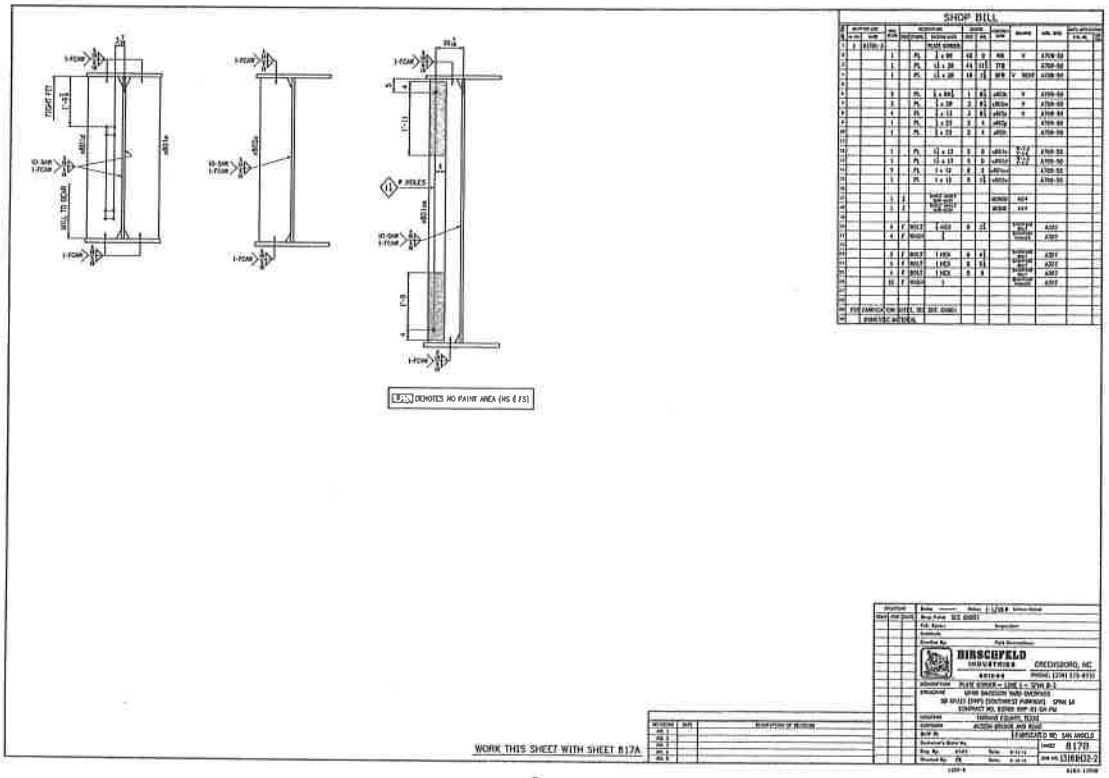
SHEET 1 OF 3

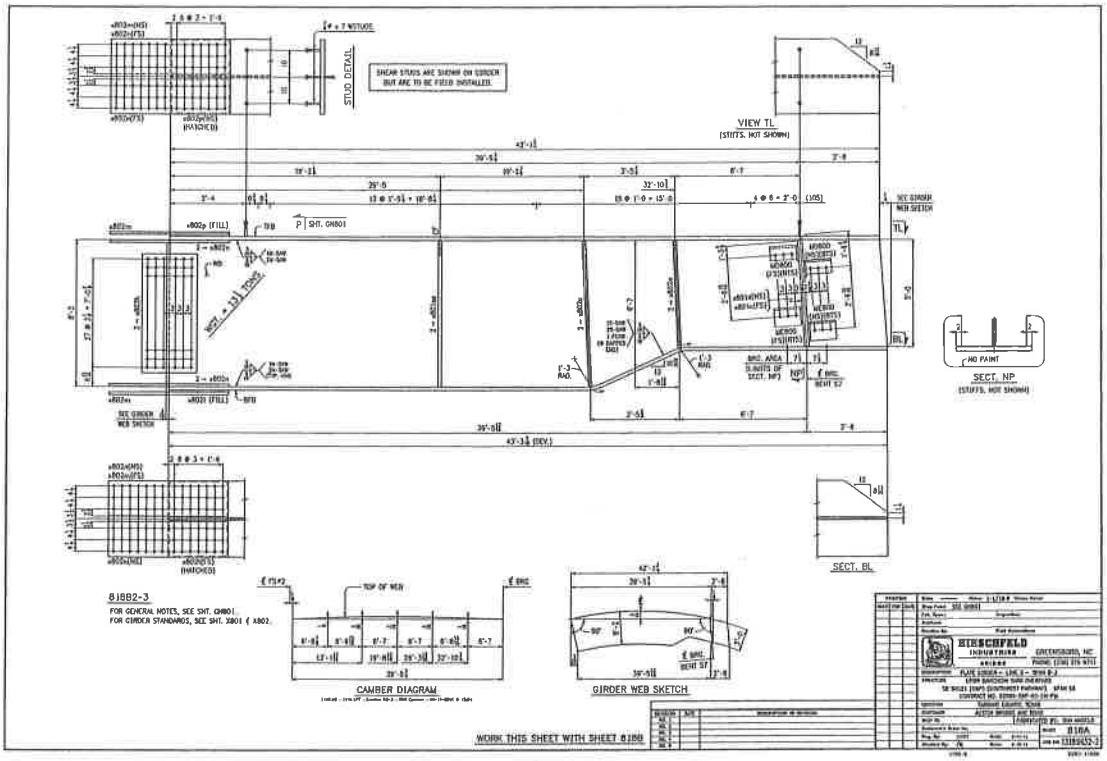
Texas Department of Transportation
Bridge Division

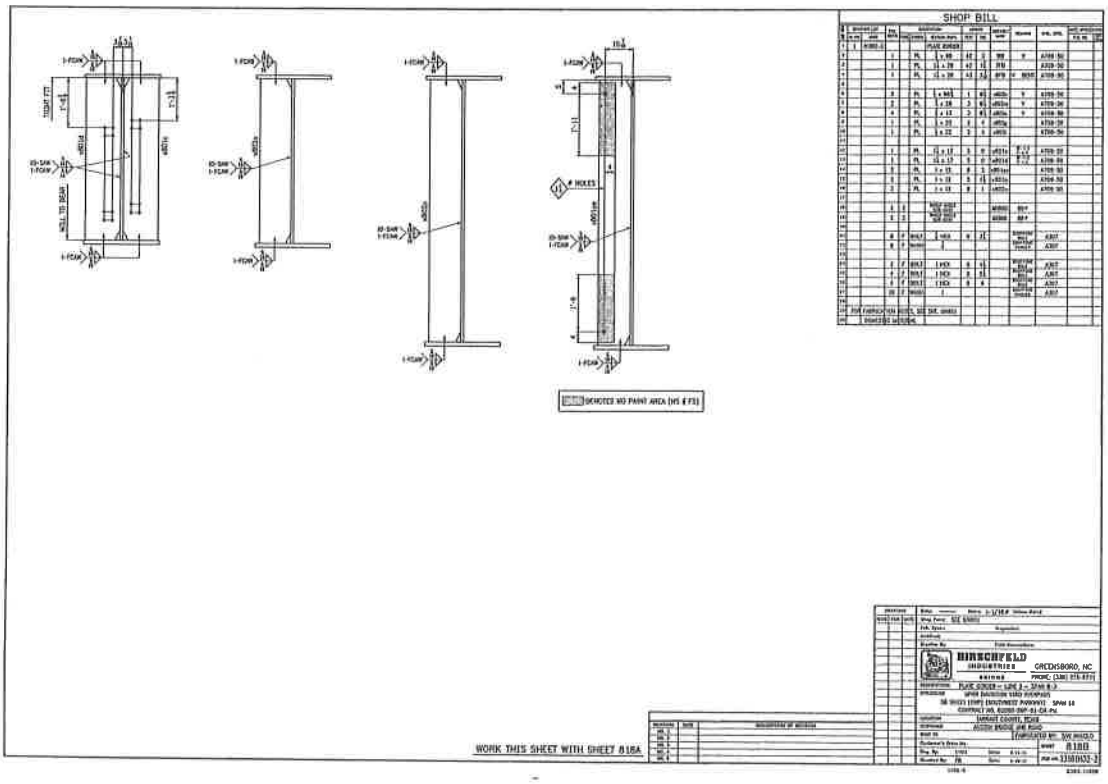
ELASTOMERIC
BEARING DETAILS
STEEL GIRDERS AND BEAMS

SGEB


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED.
VIEW TL
(STIFFS. NOT SHOWN)
SECT. NP
(STIFFS. NOT SHOWN)
NO PAINT
SECT. BL
817B1-3
FOR GENERAL NOTES, SEE SHT. GN801.
FOR GIRDER STANDARDS, SEE SHT. X801 & X802.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 817B
BIRSCHFELD INDUSTRIES
GREENSBORO, NC
817A


SHOP BILL
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 817A
BIRSCHFELD INDUSTRIES
GREENSBORO, NC
817B


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED.
VIEW TL
(STIFFS. NOT SHOWN)
SECT. NP
(STIFFS. NOT SHOWN)
NO PAINT
SECT. BL
818B2-3
FOR GENERAL NOTES, SEE SHT. GN801.
FOR GIRDER STANDARDS, SEE SHT. 3801 & 3802.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 818B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
818B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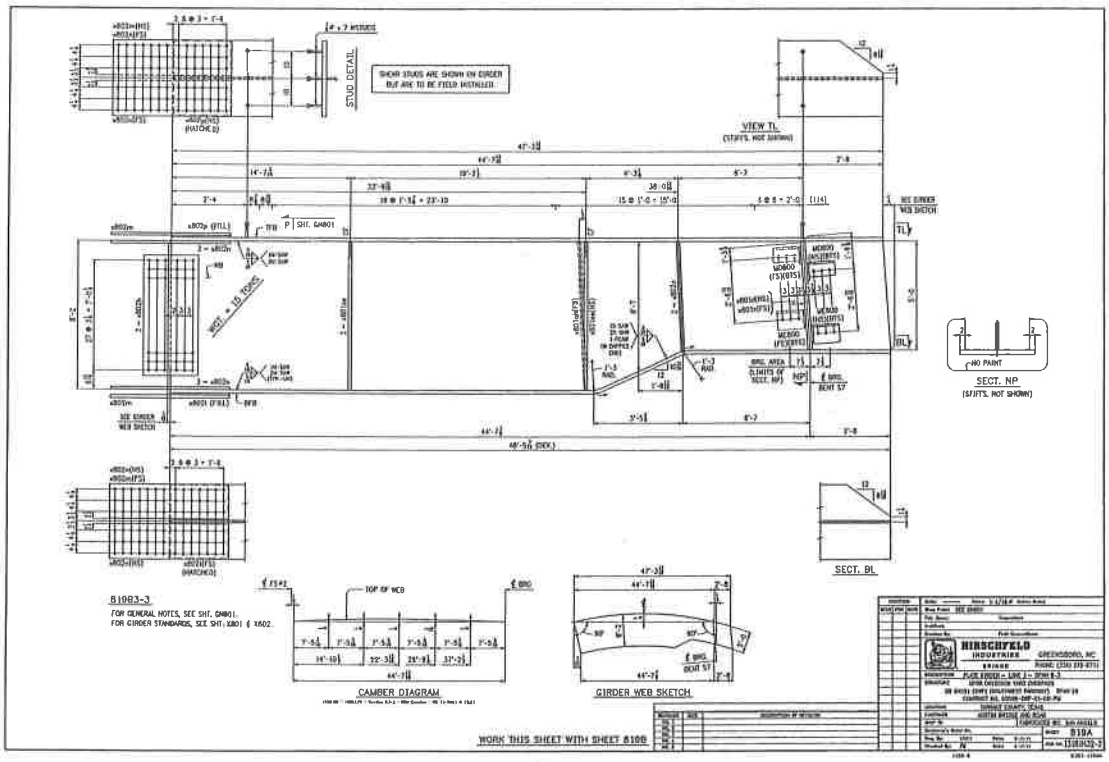
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 818A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
818B


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED
VIEW TL
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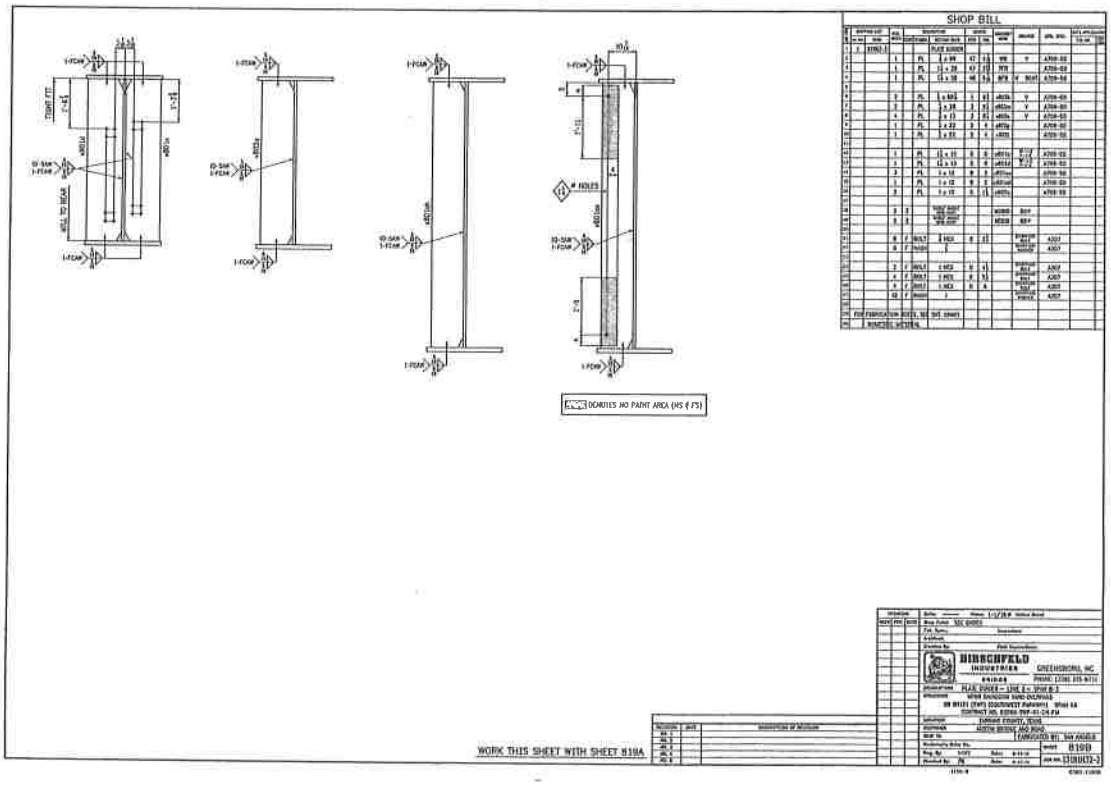
SEE GIRDER WEB SKETCH
SECT. NP
(STIFFS. NOT SHOWN)
NO PAINT
SECT. BL
B19B3-3
FOR GENERAL NOTES, SEE SHT. GN801.
FOR GIRDER STANDARDS, SEE SHT. X801 & X602.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET B19B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
B19A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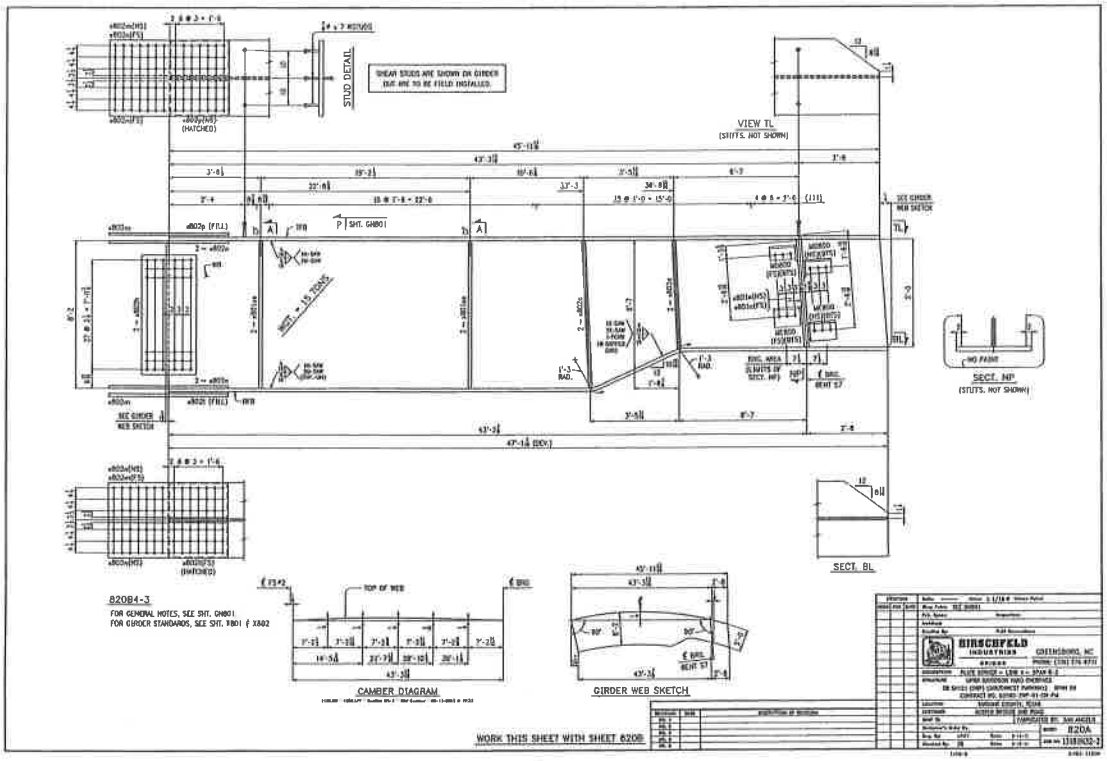
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET B19A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
B19B


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED.
VIEW TL
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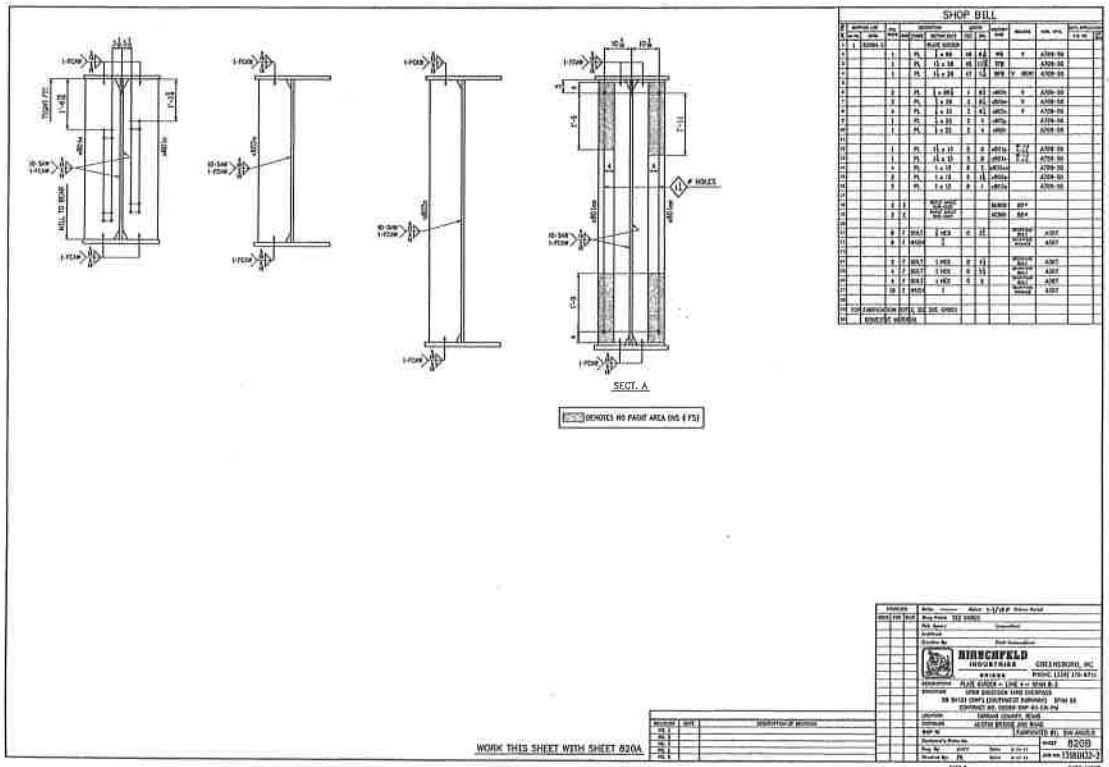
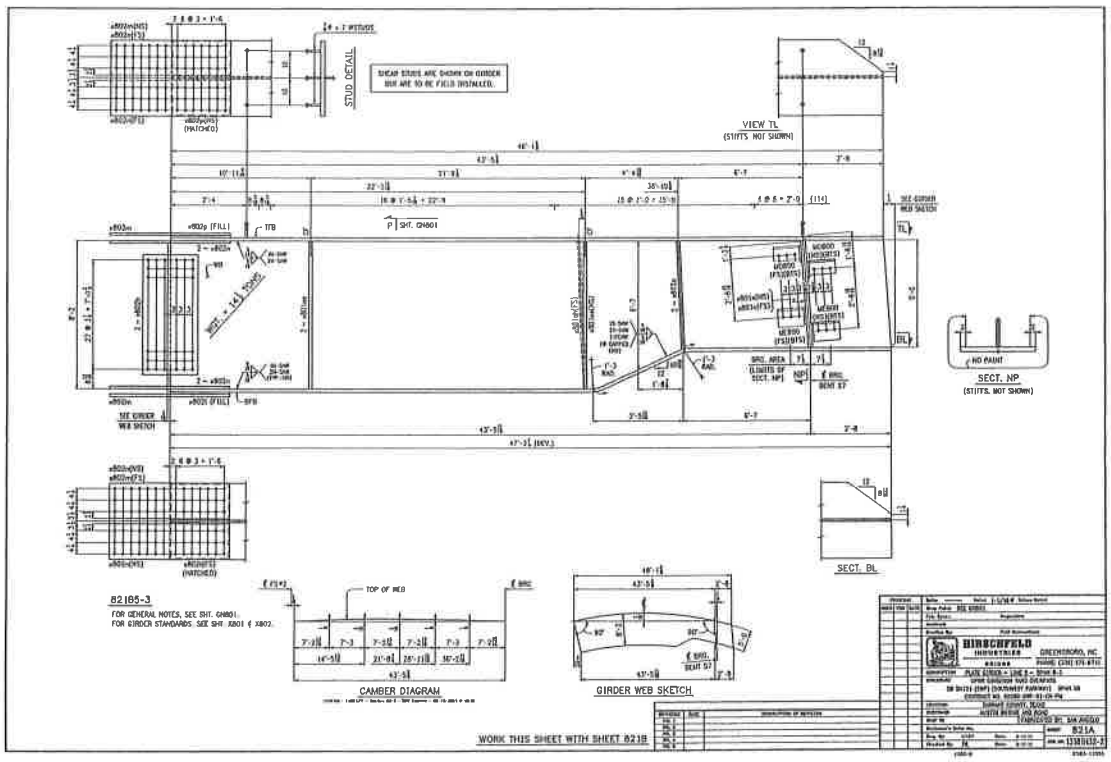
SECT. NP
(STIFFS. NOT SHOWN)
SECT. BL
820B4-3
FOR GENERAL NOTES, SEE SHT. GN801
FOR GIRDER STANDARDS, SEE SHT. Y801 & X802
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 820B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
820A


SHOP BILL
SECT. A
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 820A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
820B


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED.
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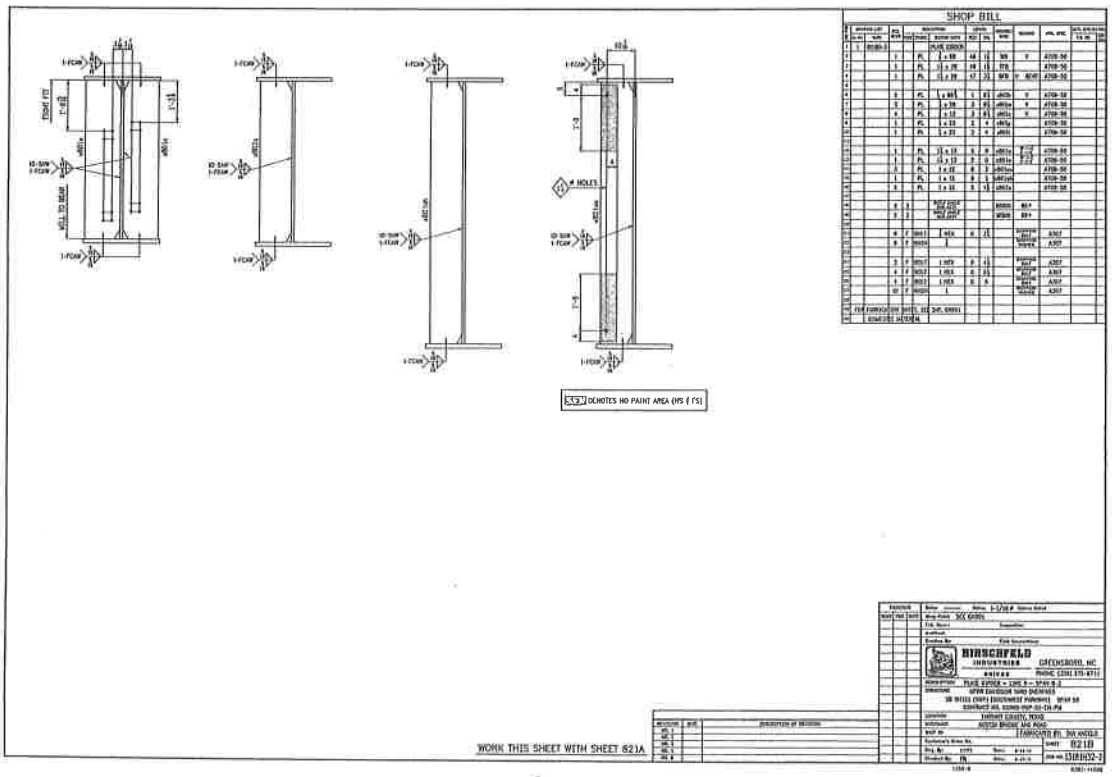
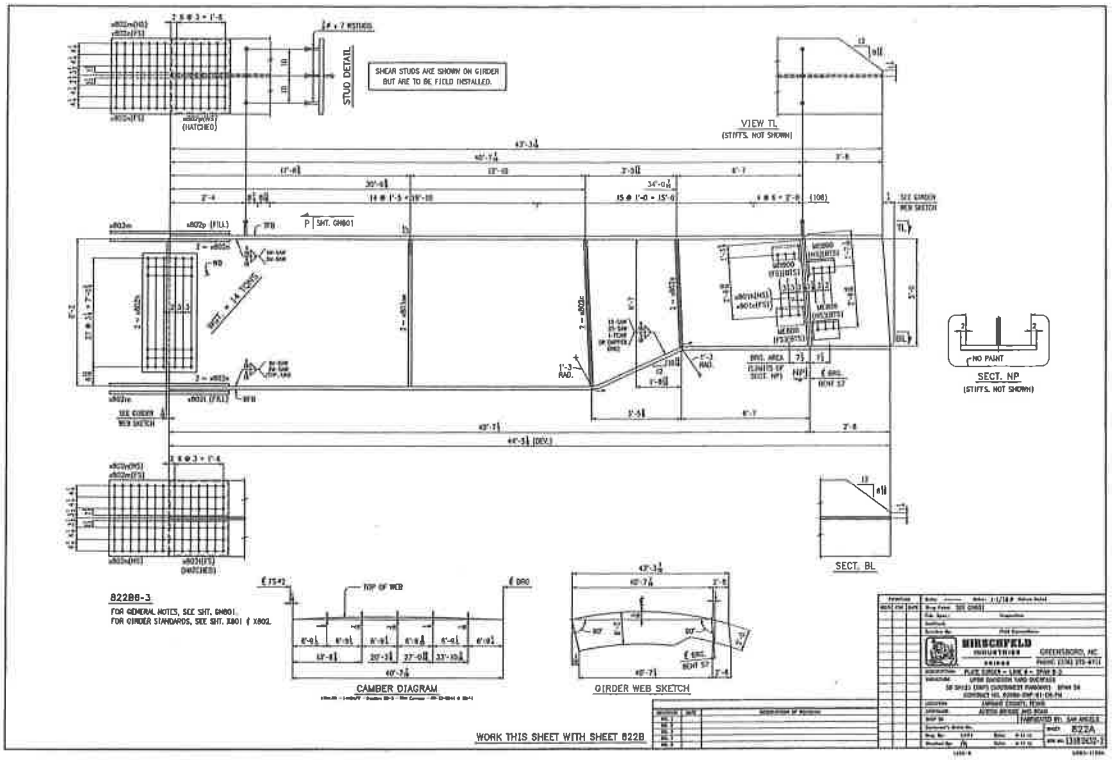
SECT. NP
(STIFFS, NOT SHOWN)
NO PAINT
SECT. BL
82185-3
FOR GENERAL NOTES, SEE SHT. GN801.
FOR GIRDER STANDARDS, SEE SHT. X801 & X802.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 821B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
PLATE GIRDER - LINE 2 - SPAN B-2
UPPER EXCELSIOR SAND ENTRANCE
SB 35123 (SMP) (SOUTHWEST PARKWAY) SPAN 5B
CONTRACT NO. 02080-MP-03-CH-PM
TARRANT COUNTY, TEXAS
NORTH BRIDGE AND ROAD
TARRANT CO. BR. SAN ANGELO
821A
13180132-2


SHOP BILL
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 821A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
PLATE GIRDER - LINE 2 - SPAN B-2
UPPER EXCELSIOR SAND ENTRANCE
SB 35123 (SMP) (SOUTHWEST PARKWAY) SPAN 5B
CONTRACT NO. 02080-MP-03-CH-PM
TARRANT COUNTY, TEXAS
NORTH BRIDGE AND ROAD
TARRANT CO. BR. SAN ANGELO
821B
13180132-2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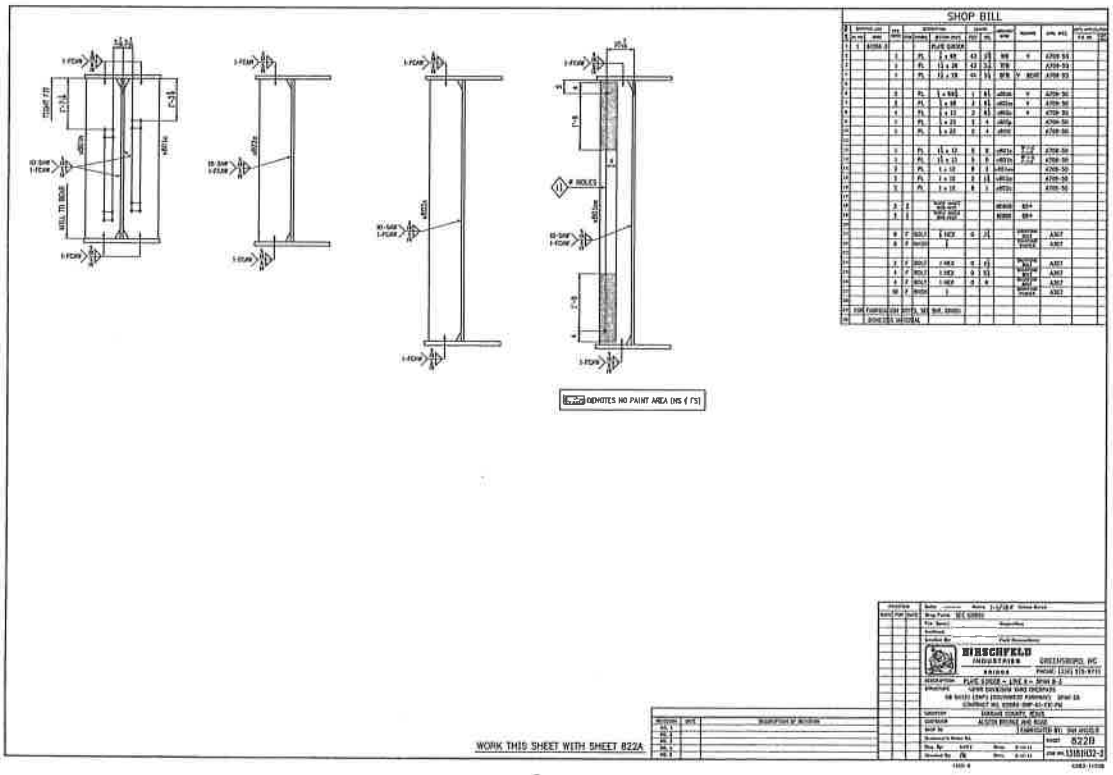
STUD DETAIL
VIEW TL
(STIFFS. NOT SHOWN)
SECT. NP
(STIFFS. NOT SHOWN)
SECT. BL
822B8-3
FOR GENERAL NOTES, SEE SHT. GN001.
FOR GIRDER STANDARDS, SEE SHT. X001 & X002.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 822B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
822A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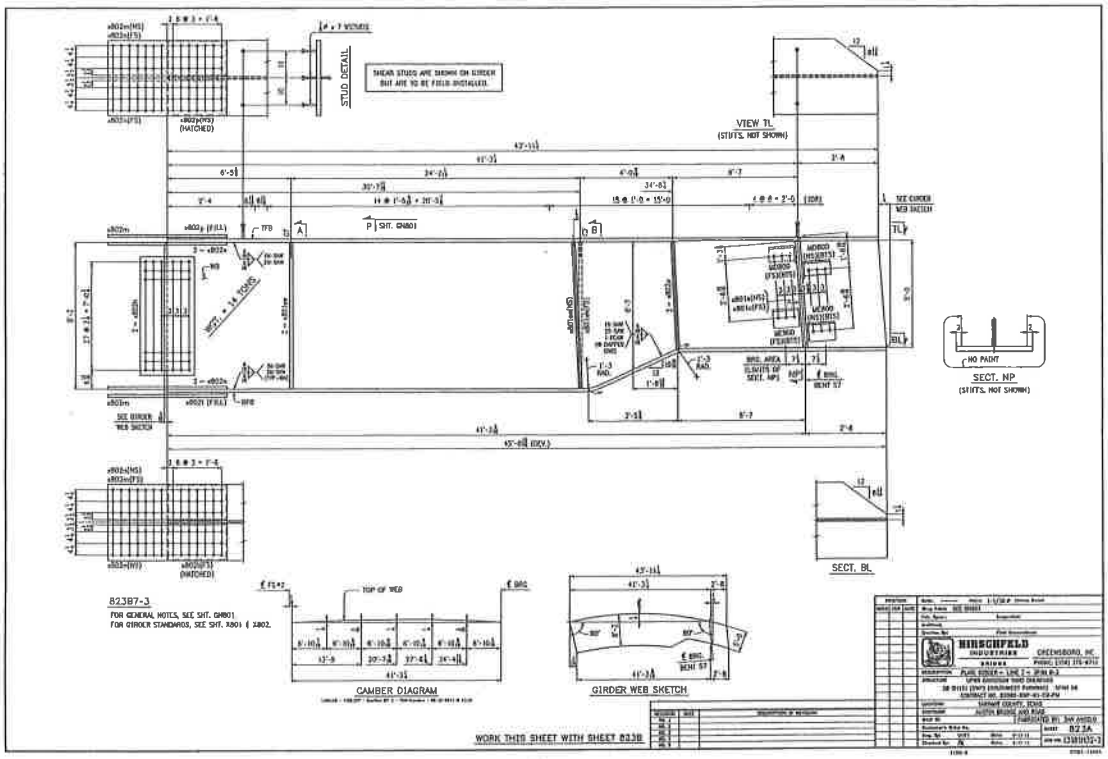
DENOTES NO PAINT AREA (NS & TS)
WORK THIS SHEET WITH SHEET 822A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
822B


STUD DETAIL
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VIEW TL
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SECT. NP
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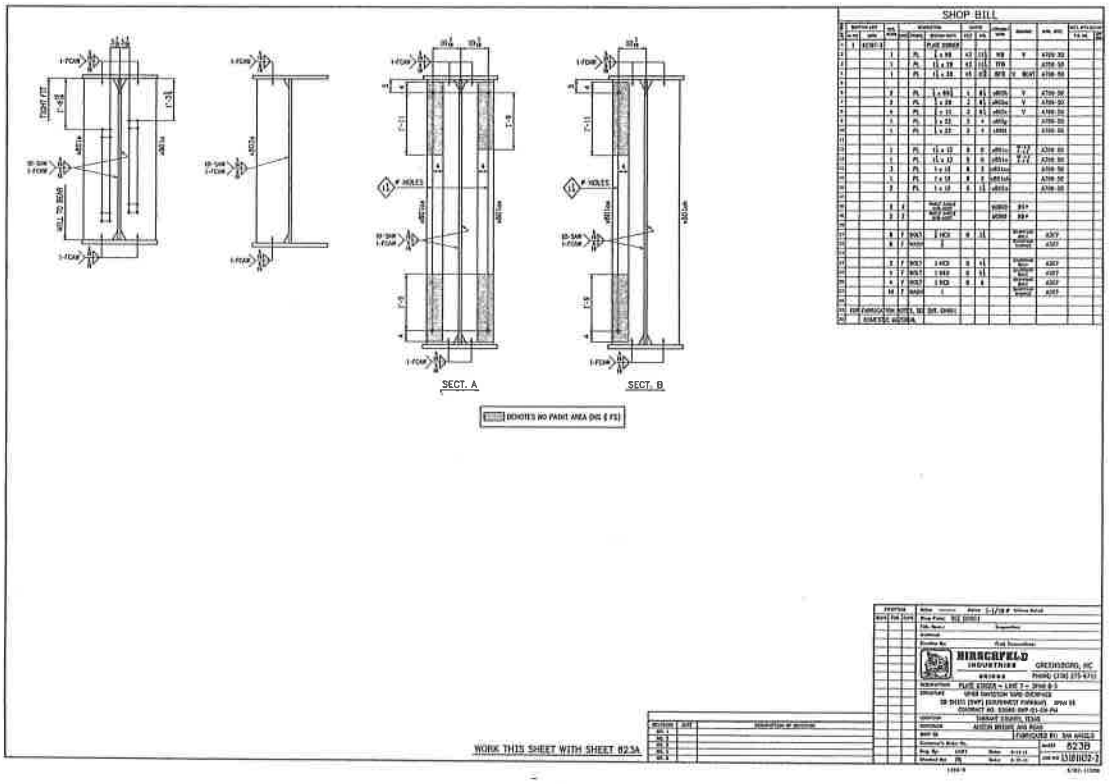
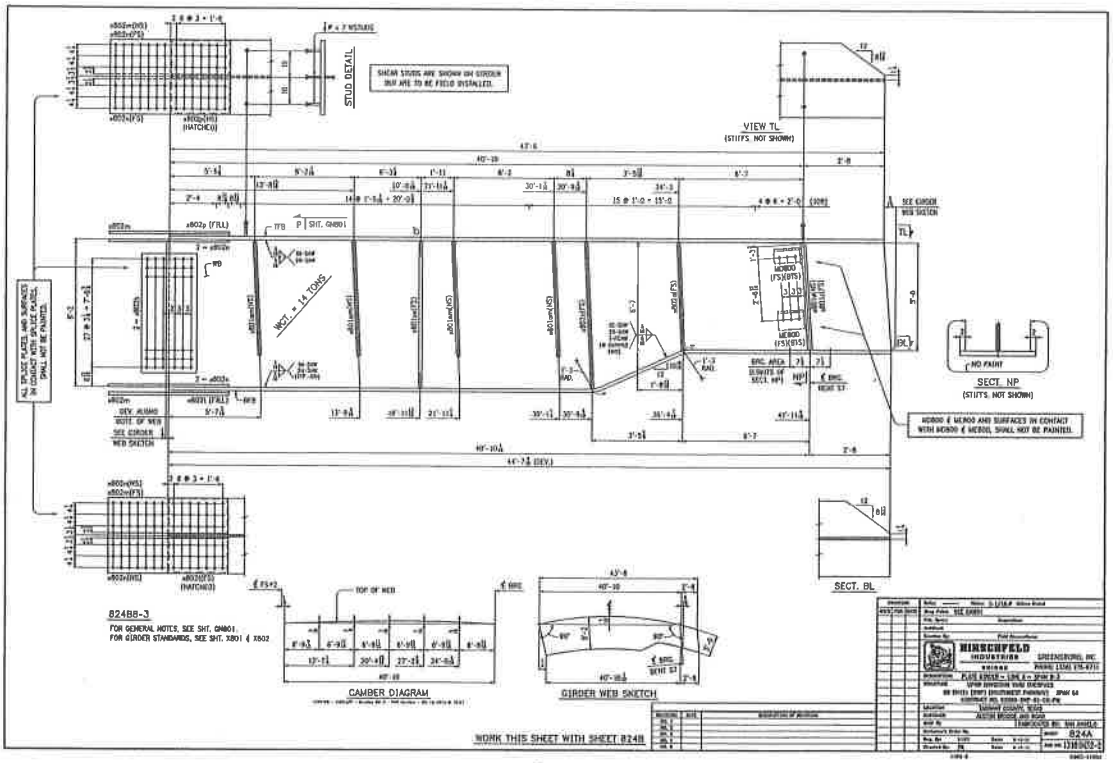
NO PAINT
SECT. BL
823B7-3
FOR GENERAL NOTES, SEE SHT. GN801
FOR GIRDER STANDARDS, SEE SHT. X801 & X802.
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 823B
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
PLATE GIRDER - LINE 2 - SPAN B-3
UPPER DIVISION YARD CHEMICAL
SHEET 823A


SHOP BILL
SECT. A
SECT. B
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 823A
HIRSCHFELD INDUSTRIES
GREENSBORO, NC
PLATE GIRDER - LINE 2 - SPAN B-3
UPPER DIVISION YARD CHEMICAL
SHEET 823B


STUD DETAIL
SHEAR STUDS ARE SHOWN ON GIRDER BUT ARE TO BE FIELD INSTALLED.
VIEW TL
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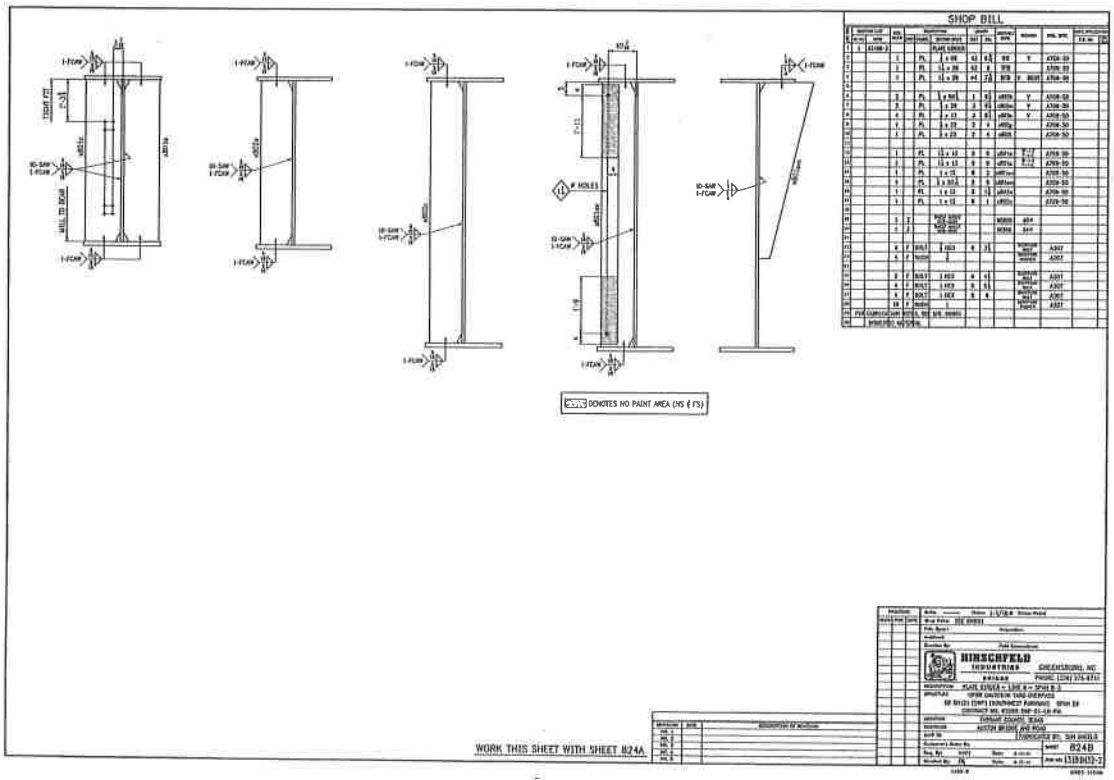
SECT. NP
(STIFFS. NOT SHOWN)
NO PAINT
MEMBOD & MEMOD AND SURFACES IN CONTACT WITH MEMOD & MEBOD, SHALL NOT BE PAINTED.
ALL SPLICE PLATES AND SURFACES IN CONTACT WITH SPLICE PLATES, SHALL NOT BE PAINTED.
WCT. = 14 TONS
SECT. BL
824B8-3
FOR GENERAL NOTES, SEE SHT. GN801
FOR GIRDER STANDARDS, SEE SHT. X801 & X802
CAMBER DIAGRAM
GIRDER WEB SKETCH
WORK THIS SHEET WITH SHEET 824B
HINSCHFELD INDUSTRIES
GREENSBURG, INC.
PLATE GIRDER - LINE A - SPAN B-3
TURNAUT COUNTY, TEXAS
AUSTIN BRIDGE AND ROAD
824A


SHOP BILL
DENOTES NO PAINT AREA (NS & FS)
WORK THIS SHEET WITH SHEET 824A
HINSCHFELD INDUSTRIES
GREENSBURG, INC.
PLATE GIRDER - LINE A - SPAN B-3
TURNAUT COUNTY, TEXAS
AUSTIN BRIDGE AND ROAD
824B

Lifting capacities on guyed telescopic boom
Forces de levage à la flèche télescopique haubanée

TY3

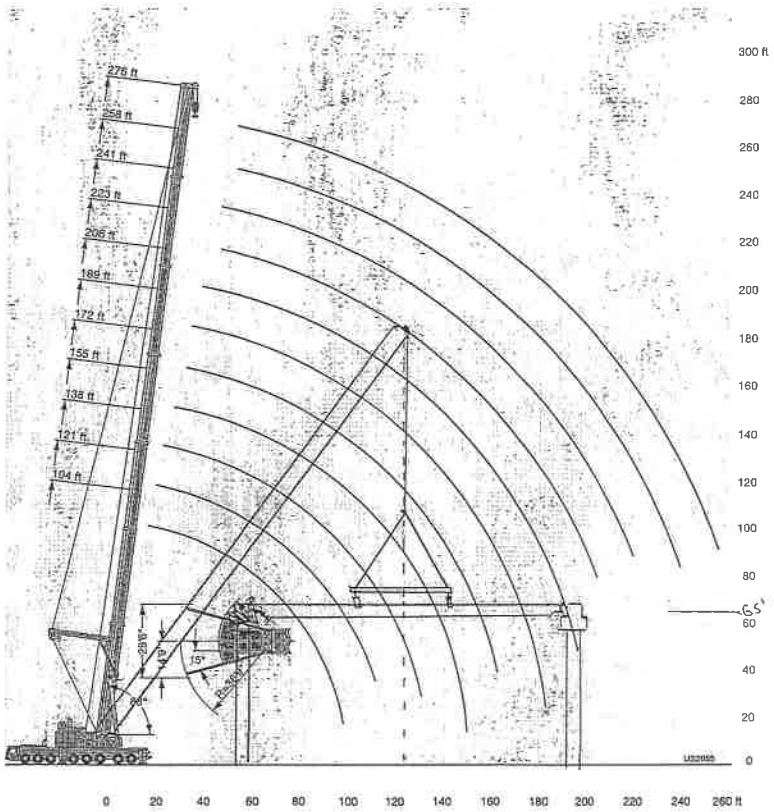
104 - 276 ft | 360° | 363800 lbs | 85%

	104 ft	121 ft	138 ft	155 ft	172 ft	189 ft	206 ft	223 ft	241 ft	258 ft	276 ft	
16	453											16
17	451											17
18	447	372										18
20	439	371										20
22	431	363	285									22
24	421	355	282									24
26	409	349	276	270								26
28	399	341	270	265	248							28
30	388	333	265	260	247							30
32	348	322	260	254	242	212						32
34	331	310	255	249	237	210						34
36	316	298	250	245	233	207						36
38	300	286	246	240	228	204	179					38
40	286	274	241	235	224	200	178					40
45	256	245	231	225	219	191	172	154	136			45
50	229	229	214	215	203	182	166	150	133	114	91	50
55	209	213	196	201	190	174	160	144	129	112	96	55
60	194	194	182	185	176	167	153	139	125	109	93	60
65	180	180	176	171	167	160	147	134	121	105	90	65
70	165	166	163	162	159	152	141	129	117	102	86.5	70
75	151	152	152	152	146	144	134	124	113	99	84	75
80	139	141	143	140	138	135	128	118	109	95	81	80
85	128	133	132	129	131	126	122	112	105	93	78	85
90	118	123	122	123	122	117	116	107	101	90.5	75.5	90
95	102	115	114	116	113	110	110	103	96.5	87.5	73	95
100		107	106	109	105	105	103	98.5	92	85	70.5	100
105		99.5	98.5	102	98	100	96	95	87.5	82.5	68.5	105
110		91.5	92	95.5	91.5	94	90	90.5	82.5	79.5	66.5	110
115			86	89.5	86	88.5	84	85.5	77.5	77	64	115
120			80.5	84	80.5	83	78.5	80.5	72.5	73.5	62	120
125			76	79	75	78	73	75.5	68.5	69.5	59.8	125
130			63	74.5	70.5	73	68.5	71	64	65.5	58.1	130
135				70	66.5	69	64.5	66.5	60.5	61.5	56.4	135
140				65	62.5	65	60.5	62.5	56.6	58.1	54.7	140
145				57.7	58.6	61	56.8	59	52.9	54.8	52.9	145
150				40.1	55.2	57.7	53.2	55.5	49.4	51.7	52.9	150
155					52	54.5	50	52.3	46.2	48.6	48.2	155
160					46	51.5	46.9	49.3	43.2	45.6	45.6	160
165						48.7	44.1	46.4	40.3	42.7	43	165
170						46	41.4	43.7	37.7	40.1	40.5	170
175						41.4	38.9	41.2	35.2	37.5	38	175
180						33.6	36.5	38.9	32.8	35.2	35.7	180
185							34	36.6	30.8	32.9	33.4	185
190							30.8	34.5	28.4	30.8	31.3	190
195							24.8	32.5	26.2	28.8	29.3	195
200								30.6	24.1	26.6	27.3	200
205								27.9	22.4	24.5	25.3	205
210									20	22.4	23.8	210
215									18	20.5	22.1	215
220									15.8	18.8	20.5	220
225										17	19	225
230										16.2	17.6	230
235										13.4	16.2	235
240										11.3	14.9	240
245											13.5	245
250											11.8	250
255											9.5	255

TAB 230628

Lifting heights
Hauteurs de levage

TY3



Remarks referring to load charts

1. The tabulated lifting capacities do not exceed 85% of the tipping load.
2. The crane's structural steelwork is in accordance with DIN 15018, part 3. Design and construction of the crane comply with DIN 15018, part 2, and with F. E. M. regulations.
3. The 85% overturning limit values take into account wind force 5 = wind speed 20 mph.
4. Lifting capacities are given in kips.
5. The weight of the hook blocks and hooks must be deducted from the lifting capacities.
6. Working radii are measured from the slewing centreline.
7. The lifting capacities given for the telescopic boom only apply if the folding jib is taken off.
8. Lifting capacities are subject to modifications.
9. Lifting capacities above 604000 lbs only with special equipement.
10. The data of this brochure serves only for general information. All information is provided without warranty. Instructions for the correct commissioning of the crane please take from the operation manual and the load chart book.

Remarques relatives aux tableaux des charges

1. Les forces de levage indiquées ne dépassent pas 85% de la charge de basculement.
2. La norme DIN 15018, 3ème partie est appliquée pour les charpentes. La construction de la grue est réalisée conformément à la norme DIN 15018, 2ème partie, et aux règles de la F. E. M.
3. A 85% de la charge de basculement, il a été tenu compte d'un vent de force 5 = vitesse de vent 20 mph.
4. Les forces de levage sont données en kips.
5. Les poids des moufles et crochets doit être soustrait des charges indiquées.
6. Les portées sont calculées à partir de l'axe de rotation.
7. Les forces indiquées pour la flèche télescopique s'entendent fléchette dépliable déposée.
8. Les forces de levage sont modifiables sans préavis.
9. Les forces de levage plus de 604000 lbs seulement avec équipement supplémentaire.
10. Les données de cette brochure sont données à titre informatif. Ces renseignements sont sans garantie. Les consignes relatives à la bonne mise en service de la grue sont disponibles dans le manuel d'utilisation et le manuel de tableaux de charge.

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LIFTCRANE CAPACITIES

MEETS ANSI B30.5 REQUIREMENTS

4100W SERIES 2 CRAWLER

BOOM NO. 22C WITH OPEN THROAT TOP OFFSET 4½ DEGREES
146,400 LB. CRANE COUNTERWEIGHT
60,000 LB. CARBODY COUNTERWEIGHT
26'6" CRAWLERS EXTENDED

WARNING: This chart will apply only when two 12,000 lb. side ctwts. and two 30,000 lb. carbody ctwts. bear MEC registered Serial Numbers.

LIFTING CAPACITIES: Capacities for various boom lengths and operating radii are for freely suspended loads and do not exceed 75% of a static tipping load. Capacities based on structural competence are shown by shaded areas.

Upper boom point capacity for liftcrane service with single part whip line or combination of two single part lines is 28,300 lbs. In all cases, upper boom point capacities cannot exceed those listed for the main boom capacity.

Capacities are shown in pounds. Weight of upper boom point, jib, (see chart A), all load blocks, hooks, weight ball, slings, hoist lines, etc. beneath boom and jib point sheaves, is considered part of the main boom load. Boom is not to be lowered beyond radii where combined weights are greater than rated capacity. Where no capacity is shown, operation is not intended or approved.

OPERATING CONDITIONS: Machine to operate in a level position on a firm surface with crawlers fully extended and gantry in working position and be rigged in accordance with and under conditions referred to in rigging drawing No. 190693 and load line specification chart No. 6592-A.

Crane operator judgment must be used to allow for dynamic load effects of swinging, hoisting or lowering, travel, wind conditions, as well as adverse operating conditions and physical machine depreciation.

OPERATING RADIUS: Operating radius is the horizontal distance from the axis of rotation to the center of vertical hoist line or load block with the load freely suspended. Add 14" to boom point radius for radius of sheave when using single part hoist line.

Boom angle is the angle between horizontal and centerline of boom butt and inserts and is an indication of operating radius. In all cases, operating radius shall govern capacity.

BOOM POINT ELEVATION: Boom point elevation, in feet, is the vertical distance from ground level to centerline of boom point shaft.

MACHINE EQUIPMENT: Machine equipped with 26'6" extendible crawlers, 48" treads, 17' retractable gantry, 12 part boom hoist reeving, four 1⅜" boom pendants, 1st ctwt. 41,900 lbs., 2nd ctwt. 41,500 lbs., 3rd ctwt. 39,000 lbs., two 12,000 lbs. side ctwt's. and two 30,000 lbs. carbody ctwt's.

HOIST REEVING FOR MAIN LOAD BLOCK						
No. Parts of Line	1	2	3	4	5	6
Max. Load — Lbs.	32,500	65,000	97,500	130,000	162,500	195,000
No. Parts of Line	7	8	9	10	11	12
Max. Load — Lbs.	227,500	260,000	292,500	325,000	357,500	400,000
No. Parts of Line	13					
Max. Load — Lbs.	430,000					

LOAD AND WHIP LINE SPECIFICATIONS
LOAD LINE: 1-1/8" — 6x31 Warrington-Seale, Extra Improved Plow Steel, Regular Lay, IWRC. Minimum Breaking Strength 65 Ton. (Approx. Weight Per Ft. in Lbs. 2.34)
WHIP LINE: 1-1/8" — 6x31 Warrington-Seale, Improved Plow Steel, Regular Lay, IWRC. Minimum Breaking Strength 56.5 Ton. Maximum Load — 28,300 Lbs. Per Line. (Approx. Weight Per Ft. in Lbs. 2.34)

MAXIMUM BOOM AND JIB LENGTHS LIFTED UNASSISTED				DEDUCT FROM CAPACITIES WHEN JIB IS ATTACHED	
OVER FRONT OF CRAWLERS		OVER SIDE OF EXTENDED CRAWLERS			
Boom Lgth.	Jib No. 123	Boom Lgth.	Jib No. 123	Jib Lgth.	Jib No. 123
260'	—	260'	—	30'	3,000 Lb.
250'	—	250'	—	40'	3,600 Lb.
240'	40'	240'	40'	50'	4,200 lb.
230'	60'	230'	60'	60'	4,900 lb.
Load block, hook and weight ball on ground at start. To comply with B30.5 requirements, upper boom point cannot be used on 260' boom.				Jib deducts include jib adapter.	

DEDUCT FROM CAPACITIES WHEN UPPER BOOM POINT IS ATTACHED	
One Sheave Point	1,200 lbs.
Two Sheave Point	1,500 lbs.

For jib capacities, consult jib chart.

Boom Lgth.: Feet	Oper. Rad.: Feet	Boom Ang.: Deg.	Boom Point Elev.	Capacity: Crawlers Extended
70	16.5	82.4	76.1	[illegible]
	17	82.0	76.0	[illegible]
	18	81.2	75.8	[illegible]
	19	80.3	75.6	[illegible]
	20	79.5	75.4	[illegible]
	22	77.8	74.9	[illegible]
	24	76.1	74.3	[illegible]
	26	74.4	73.7	266,100
	28	72.7	73.0	237,500
	30	71.0	72.3	214,300
	32	69.2	71.4	195,100
	34	67.4	70.5	178,900
	36	65.6	69.5	165,200
	38	63.7	68.5	153,300
	40	61.8	67.3	143,000
	45	57.0	64.0	122,100
	50	51.8	60.1	106,300
	55	46.1	55.3	93,900
	60	39.8	49.4	84,000
	65	32.4	41.8	75,800
	70	22.7	31.0	[illegible]

Boom Lgth.: Feet	Oper. Rad.: Feet	Boom Ang.: Deg.	Boom Point Elev.	Capacity: Crawlers Extended
80	17	83.0	86.2	[illegible]
	18	82.3	86.0	[illegible]
	19	81.6	85.8	[illegible]
	20	80.8	85.6	[illegible]
	22	79.4	85.2	[illegible]
	24	77.9	84.7	[illegible]
	26	76.4	84.2	[illegible]
	28	74.9	83.6	237,000
	30	73.4	82.9	213,800
	32	71.9	82.2	194,600
	34	70.4	81.4	178,500
	36	68.8	80.6	164,700
	38	67.3	79.7	152,800
	40	65.7	78.7	142,400
	45	61.6	76.0	121,500
	50	57.4	72.7	105,700
	55	52.9	68.9	93,300
	60	48.1	64.5	83,400
	65	42.9	59.1	75,200
	70	37.0	52.6	68,300
	75	30.1	44.4	62,500
	80	21.0	32.7	[illegible]

Boom Lgth.: Feet	Oper. Rad.: Feet	Boom Ang.: Deg.	Boom Point Elev.	Capacity: Crawlers Extended
90	19	82.6	96.0	[illegible]
	20	81.9	95.8	[illegible]
	22	80.6	95.4	[illegible]
	24	79.3	95.0	[illegible]
	26	78.0	94.5	[illegible]
	28	76.7	94.0	236,600
	30	75.3	93.4	213,400
	32	74.0	92.8	194,200
	34	72.7	92.1	178,000
	36	71.3	91.4	164,200
	38	69.9	90.6	152,300
	40	68.6	89.7	142,000
	45	65.1	87.4	121,100
	50	61.4	84.6	105,200
	55	57.7	81.4	92,800
	60	53.7	77.7	82,900
	65	49.5	73.5	74,700
	70	45.1	68.5	67,800
	75	40.2	62.7	62,000
	80	34.7	55.6	57,000
	85	28.2	46.7	52,600
	90	19.7	34.3	[illegible]

Boom Lgth.: Feet	Oper. Rad.: Feet	Boom Ang.: Deg.	Boom Point Elev.	Capacity: Crawlers Extended
100	20	82.7	105.9	[illegible]
	22	81.5	105.6	[illegible]
	24	80.4	105.2	[illegible]
	26	79.2	104.8	[illegible]
	28	78.0	104.3	[illegible]
	30	76.8	103.8	212,900
	32	75.7	103.2	193,700
	34	74.5	102.6	177,500
	36	73.3	102.0	163,700
	38	72.0	101.3	151,800
	40	70.8	100.5	141,400
	45	67.7	98.5	120,500
	50	64.6	96.0	104,700
	55	61.3	93.3	92,300
	60	57.9	90.1	82,300
	65	54.4	86.5	74,100
	70	50.7	82.4	67,200
	75	46.8	77.7	61,400
	80	42.6	72.3	56,400
	85	38.0	66.0	52,000
	90	32.8	58.5	48,200
	95	26.6	49.0	44,900
	100	18.6	35.8	[illegible]

WARNING! CHECK AMOUNT OF COUNTERWEIGHT ON MACHINE BEFORE USE OF THIS CHART.

Capacities continued on reverse side.

Boom Lgth.: Feet	Oper. Rad.: Feet	Boom Ang.: Deg.	Boom Point Elev.	Capacity: Crawlers Extended
110	22	82.3	115.7	[illegible]
	24	81.3	115.4	[illegible]
	26	80.2	115.0	[illegible]
	28	79.1	114.6	[illegible]
	30	78.1	114.1	[illegible]
	32	77.0	113.6	193,300
	34	75.9	113.1	177,100
	36	74.8	112.5	163,300
	38	73.7	111.8	151,400
	40	72.6	111.2	141,000
	45	69.9	109.3	120,100
	50	67.0	107.2	104,200
	55	64.1	104.7	91,800
	60	61.2	101.9	81,800
	65	58.1	98.8	73,600
	70	54.9	95.3	66,800
	75	51.6	91.3	60,900
	80	48.1	86.8	55,900
	85	44.4	81.7	51,600
	90	40.4	75.9	47,800
	95	36.1	69.2	44,400
	100	31.1	61.1	41,400
	105	25.3	51.1	38,700
	110	17.6	37.2	[illegible]
120	22	83.0	125.9	[illegible]
	24	82.0	125.5	[illegible]
	26	81.0	125.2	[illegible]
	28	80.0	124.8	[illegible]
	30	79.1	124.4	[illegible]
	32	78.1	123.9	192,800
	34	77.1	123.4	176,600
	36	76.1	122.9	162,800
	38	75.1	122.3	150,900
	40	74.1	121.7	140,500
	45	71.6	120.0	119,500
	50	69.1	118.1	103,700
	55	66.5	115.9	91,300
	60	63.8	113.4	81,300
	65	61.1	110.6	73,100
	70	58.3	107.5	66,200
	75	55.4	104.0	60,400
	80	52.4	100.1	55,300
	85	49.2	95.8	51,000
	90	45.9	91.0	47,200
	95	42.4	85.5	43,800
	100	38.6	79.4	40,800
	105	34.4	72.2	38,100
	110	29.7	63.7	35,700
	115	24.1	53.2	33,500
130	24	82.6	135.7	[illegible]
	26	81.7	135.3	[illegible]
	28	80.8	135.0	[illegible]
	30	79.9	134.6	[illegible]
	32	79.0	134.2	[illegible]
	34	78.1	133.7	176,300
	36	77.2	133.2	162,500
	38	76.3	132.7	150,600
	40	75.4	132.1	140,200
	45	73.1	130.6	119,300
	50	70.8	128.8	103,400
	55	68.4	126.8	91,000
	60	66.0	124.6	81,000
	65	63.5	122.0	72,800
	70	61.0	119.2	65,900
	75	58.4	116.1	60,000
	80	55.7	112.7	55,000
	85	53.0	108.9	50,700
	90	50.1	104.8	46,800
	95	47.1	100.1	43,500
	100	43.9	95.0	40,500
	105	40.6	89.2	37,800
	110	36.9	82.6	35,300
	115	33.0	75.1	33,100
	120	28.5	66.1	31,100
	125	23.1	55.1	29,300
140	26	82.3	145.5	[illegible]
	28	81.6	145.1	[illegible]
	30	80.7	144.8	[illegible]
	32	79.8	144.4	[illegible]
	34	79.0	144.0	[illegible]
	36	78.1	143.5	162,000
	38	77.3	143.0	150,100
	40	76.5	142.5	139,700
	45	74.3	141.1	118,700
	50	72.2	139.4	102,800
	55	70.0	137.6	90,400
	60	67.8	135.5	80,400
	65	65.6	133.2	72,200
	70	63.3	130.7	65,300
	75	60.9	127.9	59,500
	80	58.5	124.8	54,400
	85	56.1	121.4	50,100
	90	53.5	117.7	46,200
	95	50.9	113.7	42,900
	100	48.1	109.2	39,900
	105	45.3	104.2	37,200
	110	42.2	98.8	34,700
	115	39.0	92.7	32,500
	120	35.5	85.7	30,500
	125	31.7	77.8	28,700
	130	27.4	68.5	27,000
	135	22.2	57.0	25,500
150	28	82.1	155.3	[illegible]
	30	81.3	154.9	[illegible]
	32	80.5	154.6	[illegible]
	34	79.7	154.2	[illegible]
	36	79.0	153.8	161,600
	38	78.2	153.3	149,600
	40	77.4	152.8	139,200
	45	75.4	151.5	118,200
	50	73.4	150.0	102,400
	55	71.4	148.3	89,900
	60	69.4	146.4	79,900
	65	67.3	144.3	71,700
	70	65.2	141.9	64,800
	75	63.0	139.4	59,000
	80	60.9	136.6	53,900
	85	58.6	133.5	49,600
	90	56.3	130.1	45,700
	95	54.0	126.5	42,400
	100	51.5	122.5	39,400
	105	49.0	118.2	36,700
	110	46.4	113.4	34,200
	115	43.6	108.2	32,000
	120	40.7	102.4	30,000
	125	37.6	95.0	28,200
	130	34.2	88.8	26,500
	135	30.5	80.5	25,000
	140	26.4	70.8	23,500
	145	21.4	58.8	22,200
160	28	82.6	165.4	[illegible]
	30	81.8	165.1	[illegible]
	32	81.1	164.7	[illegible]
	34	80.4	164.4	[illegible]
	36	79.7	164.0	[illegible]
	38	78.9	163.6	149,100
	40	78.2	163.1	138,700
	45	76.3	161.9	117,700
	50	74.5	160.5	101,800
	55	72.6	158.9	89,300
	60	70.7	157.1	79,300
	65	68.8	155.1	71,100
	70	66.8	153.0	64,200
	75	64.9	150.6	58,400
	80	62.9	148.0	53,300
	85	60.8	145.2	49,000
	90	58.7	142.2	45,100
	95	56.5	138.8	41,800
	100	54.4	135.2	38,700
	105	52.1	131.4	36,000
	110	49.7	127.1	33,600
	115	47.3	122.5	31,400
	120	44.8	117.5	29,400
	125	42.1	112.0	27,600
	130	39.3	105.9	25,900
	135	36.3	99.2	24,300
	140	33.1	91.7	22,900
	145	29.5	83.0	21,600
	150	25.5	72.9	20,400
	155	20.7	60.5	[illegible]
170	30	82.3	175.2	[illegible]
	32	81.6	174.9	[illegible]
	34	81.0	174.5	[illegible]
	36	80.3	174.2	[illegible]
	38	79.6	173.8	148,800
	40	78.9	173.3	138,400
	45	77.2	172.2	117,400
	50	75.4	170.9	101,500
	55	73.7	169.4	89,100
	60	71.9	167.7	79,000
	65	70.1	165.9	70,800
	70	68.3	163.9	63,900
	75	66.4	161.7	58,100
	80	64.6	159.3	53,000
	85	62.7	156.7	48,700
	90	60.8	153.9	44,900
	95	58.8	150.9	41,500
	100	56.8	147.5	38,500
	105	54.7	144.0	35,800
	110	52.6	140.2	33,300
	115	50.4	136.0	31,100
	120	48.1	131.5	29,100
	125	45.8	126.7	27,300
	130	43.3	121.4	25,600
	135	40.8	115.7	24,100
	140	38.1	109.3	22,600
	145	35.2	102.3	21,300
	150	32.0	94.5	20,100
	155	26.6	85.5	18,900
	160	24.7	75.1	17,800
	165	20.0	62.2	[illegible]
180	32	82.1	185.0	[illegible]
	34	81.5	184.7	[illegible]
	36	80.8	184.3	[illegible]
	38	80.2	184.0	[illegible]
	40	79.5	183.6	137,900
	45	77.9	182.5	116,900
	50	76.3	181.2	101,000
	55	74.6	179.8	88,500
	60	72.9	178.3	78,500
	65	71.3	176.6	70,300
	70	69.6	174.7	63,400
	75	67.8	172.6	57,500
	80	66.1	170.4	52,500
	85	64.3	168.0	48,100
	90	62.5	165.4	44,300
	95	60.7	162.5	40,900
	100	58.9	159.5	37,900
	105	57.0	156.2	35,200
	110	55.0	152.7	32,700
	115	53.0	149.0	30,500
	120	51.0	144.9	28,500
	125	48.9	140.5	26,700
	130	46.7	135.8	25,000
	135	44.4	130.7	23,500
	140	42.0	125.2	22,000
	145	39.6	119.2	20,700
	150	36.9	112.6	19,500
	155	34.1	105.3	18,300
	160	31.1	97.2	17,200
	165	27.7	87.9	16,200
	170	23.9	77.1	15,300
	175	19.4	63.8	[illegible]
190	32	82.5	195.1	[illegible]
	34	81.9	194.8	[illegible]
	36	81.3	194.5	[illegible]
	38	80.7	194.1	[illegible]
	40	80.1	193.8	[illegible]
	45	78.5	192.7	116,400
	50	77.0	191.5	100,500
	55	75.4	190.2	88,000
	60	73.9	188.8	78,000
	65	72.3	187.1	69,700
	70	70.7	185.4	62,800
	75	69.1	183.4	57,000
	80	67.4	181.4	52,000
	85	65.8	179.1	47,600
	90	64.1	176.6	43,800
	95	62.4	174.0	40,400
	100	60.7	171.2	37,400
	105	58.9	168.2	34,700
	110	57.1	164.9	32,200
	115	55.3	161.4	30,000
	120	53.4	157.7	28,000
	125	51.5	153.7	26,200
	130	49.5	149.5	24,500
	135	47.5	144.9	22,900
	140	45.3	140.0	21,500
	145	43.1	134.6	20,200
	150	40.8	128.9	18,900
	155	38.4	122.6	17,800
	160	35.9	115.8	16,700
	165	33.2	108.3	15,700
	170	30.2	99.8	14,800
	175	27.0	90.3	13,900
	180	23.3	79.1	13,100
	185	18.9	65.4	[illegible]
200	34	82.3	204.9	[illegible]
	36	81.7	204.5	[illegible]
	38	81.2	204.3	[illegible]
	40	80.6	203.9	[illegible]
	45	79.1	203.0	115,900
	50	77.7	201.8	100,000
	55	76.2	200.6	87,500
	60	74.7	199.2	77,400
	65	73.2	197.7	69,200
	70	71.7	196.0	62,300
	75	70.2	194.2	56,400
	80	68.6	192.2	51,400
	85	67.1	190.1	47,000
	90	65.5	187.8	43,200
	95	63.9	185.3	39,800
	100	62.3	182.7	36,800
	105	60.6	179.8	34,100
	110	59.0	176.8	31,600
	115	57.3	173.6	29,400
	120	55.5	170.2	27,400
	125	53.0	166.5	25,600
	130	51.9	162.6	23,900
	135	50.1	156.4	22,300
	140	48.1	153.9	20,900
	145	46.2	149.1	19,600
	150	44.1	144.0	18,300
	155	42.0	138.4	17,200
	160	39.7	132.5	16,100
	165	37.4	126.0	15,100
	170	34.9	118.9	14,200
	175	32.3	111.1	13,300
	180	29.4	102.4	12,400
	185	26.2	92.5	11,700
	190	22.6	81.0	10,900
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	45	79.6	213.2	115,500
	50	78.3	212.1	99,600
	55	76.9	210.9	87,100
	60	75.4	209.6	77,100
	65	74.0	208.1	68,800
	70	72.6	206.6	61,900
	75	71.2	204.8	56,100
	80	69.7	203.0	5,1000
	85	68.2	201.0	46,700
	90	66.7	198.8	42,800
	95	65.2	196.5	39,400
	100	63.7	194.0	36,400
	105	62.2	191.3	33,700
	110	60.6	188.5	31,300
	115	59.0	185.5	29,100
	120	57.4	182.3	27,100
	125	55.7	178.9	25,200
	130	54.1	175.2	23,500
	135	52.3	171.4	22,000
	140	50.6	167.3	20,600
	145	48.8	162.9	19,200
	150	46.9	158.2	18,000
	155	45.0	153.2	16,800
	160	43.0	147.9	15,800
	165	40.9	142.1	14,800
	170	38.7	135.9	13,800
	175	36.5	129.2	12,900
	180	34.0	121.9	12,100
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	55	77.5	221.2	86,600
	60	76.1	220.0	76,600
	65	74.8	218.6	68,300
	70	73.4	217.1	61,400
	75	72.0	215.4	55,500
	80	70.7	213.7	50,500
	85	69.3	211.8	46,100
	90	67.9	209.7	42,300
	95	66.4	207.5	38,900
	100	65.0	205.2	35,800
	105	63.6	202.7	33,100
	110	62.1	200.0	30,700
	115	60.6	197.2	28,500
	120	59.1	194.2	26,500
	125	57.5	191.0	24,600
	130	55.9	187.6	23,000
	135	54.3	184.0	21,400
	140	52.7	180.2	20,000
	145	51.0	176.1	18,600
	150	49.3	171.8	17,400
	155	47.6	167.3	16,300
	160	45.7	162.4	15,200
	165	43.9	157.2	14,200
	170	41.9	151.7	13,200
	175	39.9	145.7	12,300
	180	37.8	139.3	11,500
	185	35.6	132.4	10,700
	190	33.2	124.8	10,000
	195	30.7	116.5	9,300
	200	28.0	107.3	8,600
	205	25.0	96.9	8,000
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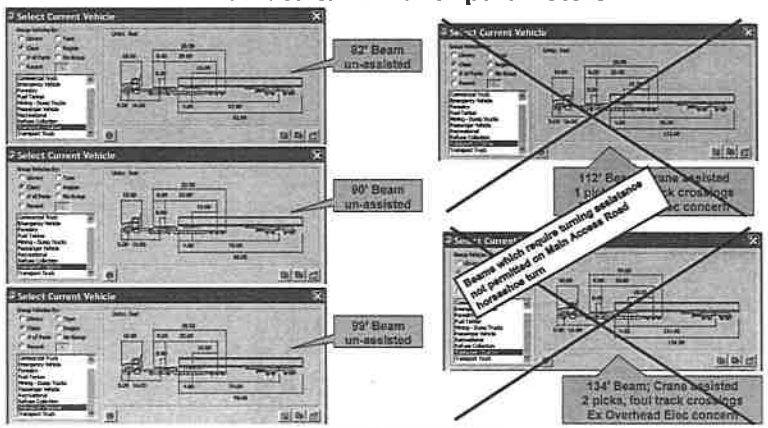
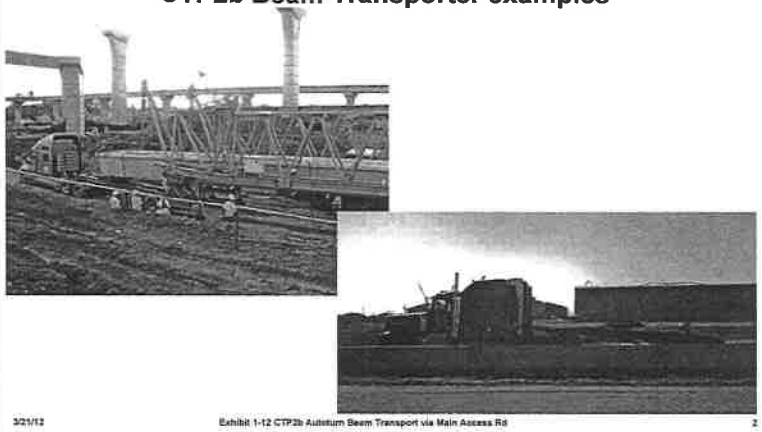
	215	17.5	70.0	[illegible]

Capacities continued on next page.

CTP2b Auto-turn Trailer parameters



CTP2b Beam Transporter examples



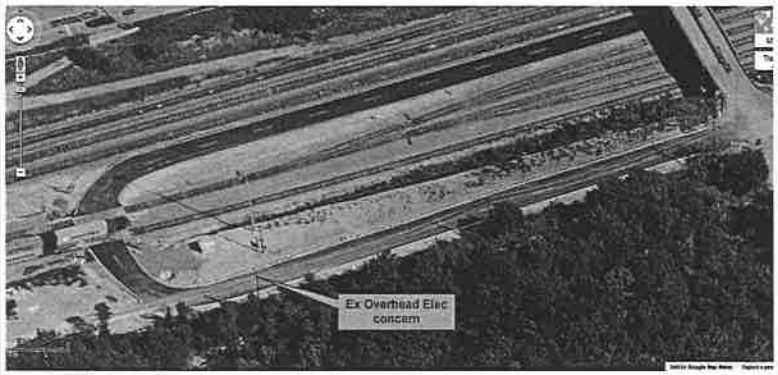
CTP2b Beam Lengths

Span	Shortest Span	Longest Span
H6	82'	82'
H5	82'	99'
N5	112' Crane assisted Not allowed	134' Crane assisted (2 picks) Not allowed
S7	90'	112' Crane assisted Not allowed

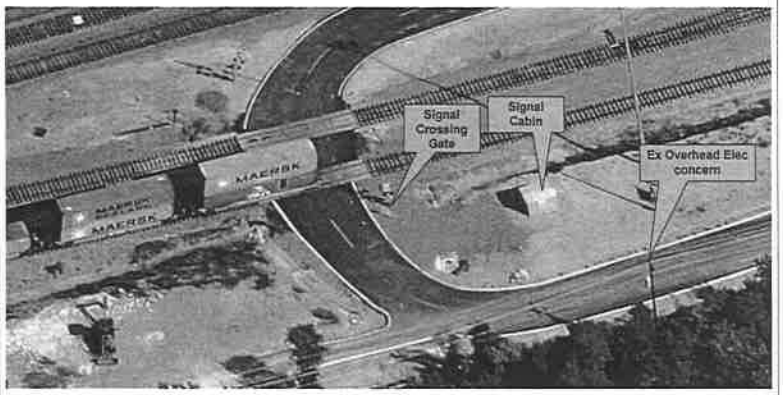
Beams which require turning assistance not permitted on Main Access Road horseshoe turn

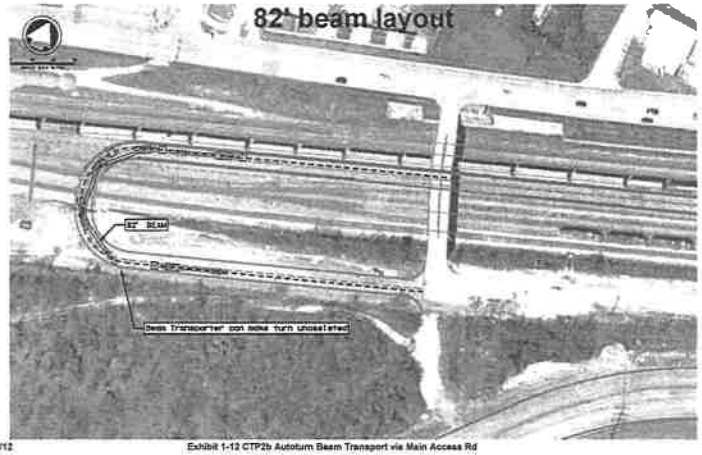
CTP2b UPRR Main Access Horseshoe Aerial

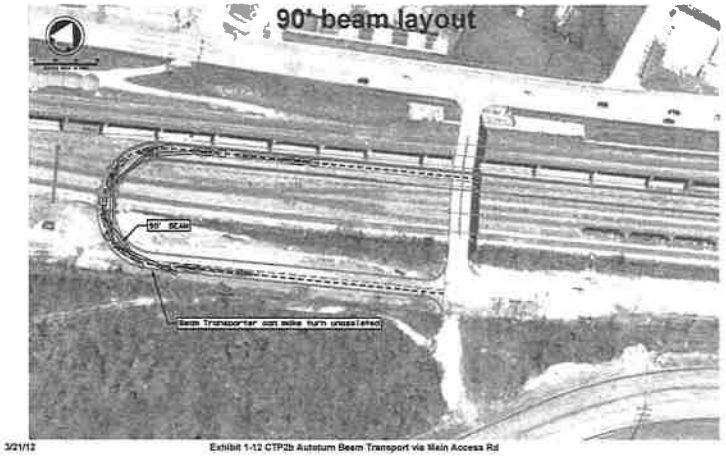
CTP2b UPRR Main Access Horseshoe Aerial



CTP2b UPRR Main Access Horseshoe Aerial







99' beam layout

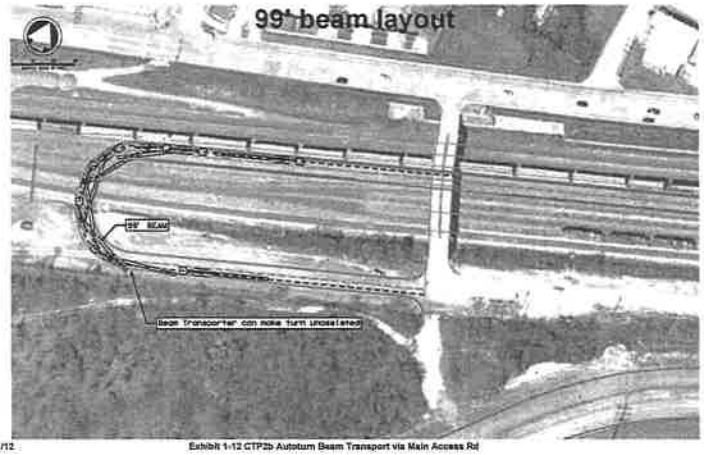
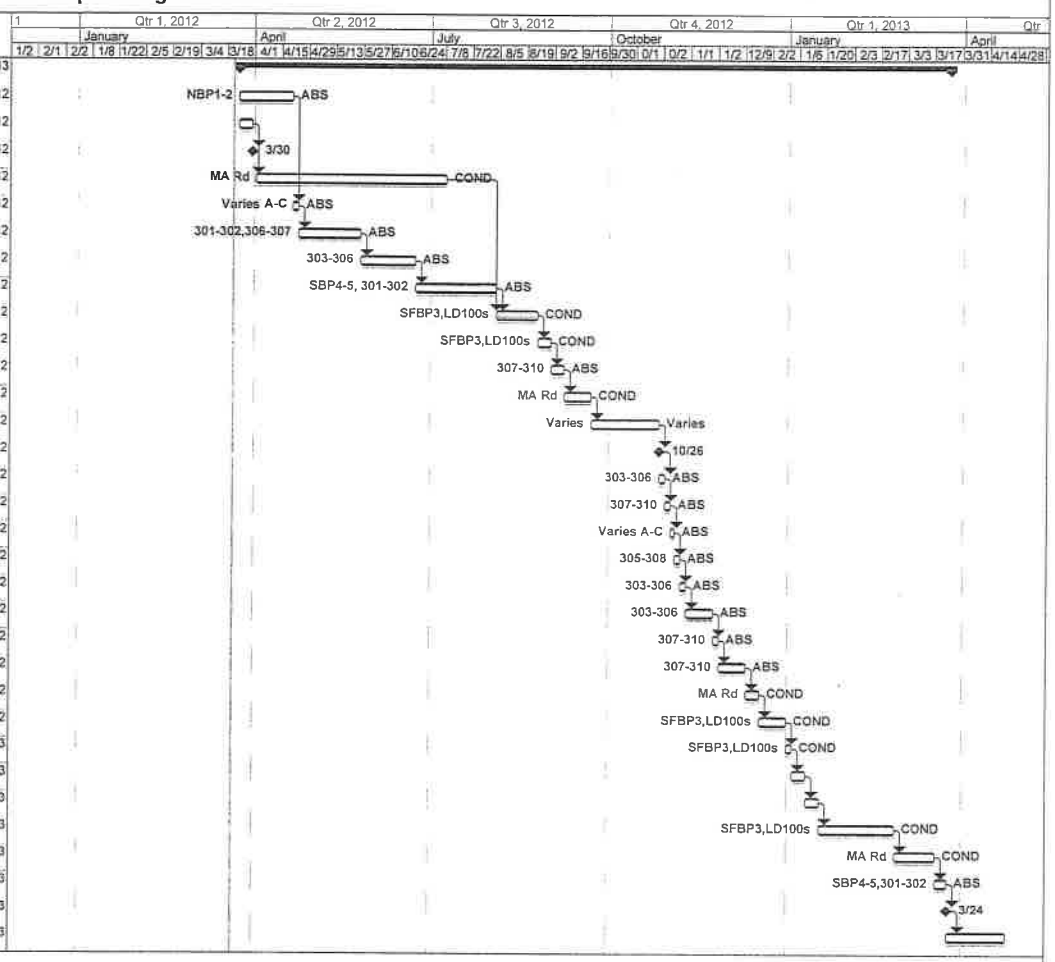


Exhibit 2: NTTA Sequencing Timetable

ID	Stage	Task Name	WZ	Tracks Closed	Routes	Duration	Start	Finish
1		**Phase 2**				366 days	Sat 3/24/12	Sun 3/24/13
2	1	Span F-G (Abs WZ-H3,S5,N3)	ABS	NBP1-2	1,2	28 days	Sat 3/24/12	Fri 4/20/12
3		UPRR 300-100 track connection		HUMP		7 days	Sat 3/24/12	Fri 3/30/12
4		Temp Hump Lead out of service				0 days	Fri 3/30/12	Fri 3/30/12
5	2	Bent Line E (H5, N5)	COND	MA Rd	MA Rd	98 days	Mon 4/2/12	Sun 7/8/12
6	3a	Bent Line B & C ABS WZ Transition	ABS	Varies A-C	3A,3B	3 days	Sat 4/21/12	Mon 4/23/12
7	3b	Bent Line B & C	ABS	301-302,306-307	3A	32 days	Tue 4/24/12	Fri 5/25/12
8	4	Span B-C (S9, H7)	ABS	303-306	O/H Hulen	28 days	Sat 5/26/12	Fri 6/22/12
9	5	Span A-B (S10, N8, H8)	ABS	SBP4-5, 301-302	3B	42 days	Sat 6/23/12	Fri 8/3/12
10	6a	Span E-F (N4)	COND	SFBP3,LD100s	2, MA Rd	21 days	Sat 8/4/12	Fri 8/24/12
11	6b	Span E-F (H4)	COND	SFBP3,LD100s	2, MA Rd	7 days	Sat 8/25/12	Fri 8/31/12
12	7	Span C-D (H6)	ABS	307-310	O/H Hulen	7 days	Sat 9/1/12	Fri 9/7/12
13	8	Span D-E (H5)	COND	MA Rd	MA Rd	14 days	Sat 9/8/12	Fri 9/21/12
14	9	Span B-F (Hulen deck and finish)	Varies	Varies		35 days	Sat 9/22/12	Fri 10/26/12
15		Switch Hulen Bridge Traffic				0 days	Fri 10/26/12	Fri 10/26/12
16	10	Demo Hulen deck B-C (7B)	ABS	303-306	O/H Hulen	3 days	Sat 10/27/12	Mon 10/29/12
17	11	Demo Hulen deck C-D (7A)	ABS	307-310	O/H Hulen	3 days	Tue 10/30/12	Thu 11/1/12
18	12a	ABS WZ Transition and Crane Access	ABS	Varies A-C	3A	2 days	Fri 11/2/12	Sat 11/3/12
19	12	Demo Hulen girder C (7 Ctr)	ABS	305-308	Stkpile 306	3 days	Sun 11/4/12	Tue 11/6/12
20	13	Demo Hulen girder B-C (7 Rt)	ABS	303-306	O/H Hulen	3 days	Wed 11/7/12	Fri 11/9/12
21	14	Span B-C (N7)	ABS	303-306	O/H Hulen	14 days	Sat 11/10/12	Fri 11/23/12
22	15	Demo Hulen girder C-D (7 Lt)	ABS	307-310	O/H Hulen	3 days	Sat 11/24/12	Mon 11/26/12
23	16	Span C-D (N6, S8)	ABS	307-310	O/H Hulen	14 days	Tue 11/27/12	Mon 12/10/12
24	17	Demo Hulen deck & girder D-E (7/6)	COND	MA Rd	MA Rd	7 days	Tue 12/11/12	Mon 12/17/12
25	18	Demo Hulen deck & girder E-F- (6/7)	COND	SFBP3,LD100s	2, MA Rd	14 days	Tue 12/18/12	Mon 12/31/12
26	19	Demo Hulen deck & girder F south (5/6)	COND	SFBP3,LD100s	O/H Hulen	3 days	Tue 1/1/13	Thu 1/3/13
27	20	Demo Hulen deck & girder F-G- (4/5)	ABS	NBP1-2	2, O/H	7 days	Fri 1/4/13	Thu 1/10/13
28	21	Demo Hulen deck & girder G (3/4)	ABS	NBP1-2	2, O/H	7 days	Fri 1/11/13	Thu 1/17/13
29	22	Span E-F (S6)	COND	SFBP3,LD100s	O/H, MA Rd	39 days	Fri 1/18/13	Mon 2/25/13
30	23	Span D-E (cap N6, Span N5,S7)	COND	MA Rd	O/H, MA Rd	21 days	Tue 2/26/13	Mon 3/18/13
31	24	Demo Hulen deck & girder A-B (8/8)	ABS	SBP4-5,301-302	3B	6 days	Tue 3/19/13	Sun 3/24/13
32		Complete Phase 2				0 days	Sun 3/24/13	Sun 3/24/13
33		Construct UPRR driveway east of Mopac				30 days	Mon 3/25/13	Tue 4/23/13



Date: Wed 3/21/12

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

EXHIBIT 3

MODIFIED EXHIBIT C-2

[follows this page]

EXHIBIT 3
MODIFIED EXHIBIT C-2

Southwest Parkway – UPRR Construction Coordination
Constraints, Allowances, and Requirements for
Construction over the UPRR Davidson Yard

This Exhibit to the Construction Coordination Agreement (the "Agreement") delineates the Constraints, Allowances, and Requirements for the construction of SWP/SH 121 over the Union Pacific Railroad Company ("UPRR") Davidson Yard (the "Yard"). Capitalized terms used in this Exhibit and defined in the Agreement have the meanings given in the Agreement.

This Exhibit establishes the principal Constraints, Allowances, and Requirements for construction activities by the NTTA in the Yard related to constructing the Hulen Street Bridge and the SWP/SH 121 Bridges over the Yard, including the demolition of the existing Hulen Street Bridge. The included Construction Phasing Narrative provides a further delineation of access and storage rights, work zones and other special conditions on a phase by phase basis to satisfy the operational and construction needs of UPRR and the NTTA. This Exhibit will be provided by the NTTA to the NTTA's Contractor for the Crossing Project, and, where appropriate, the Crossing Project Plans will contain notes and plan details incorporating or otherwise consistent with this Exhibit. While this Exhibit documents the agreement between the Project Partners and UPRR with respect to the Constraints, Allowances, and Requirements for construction activities by the NTTA in the Yard as of the Effective Date, it does not preclude the Contractor from suggesting alternatives or utilizing other means and methods that generally meet the conditions outlined herein if approved by the UPRR and the Project Partners, and as such will be considered in good faith by the UPRR and the Project Partners.

1. **General Track/Yard Operation Requirements.**

Pursuant to the Construction Coordination Supplemental Agreement dated as of March ___, 2012 and the Exhibits thereto, including, without limitation, the Modified Construction Sequencing and Access Plan (as defined therein) and this Modified Exhibit C-2, at the request of the NTTA, the Temporary Hump Lead will be permanently closed and removed by UPRR at the beginning of the NTTA Construction Period, and UPRR will also construct the replacement lead to the west of Hulen and de-commission the Temporary Hump Lead as part of the Temporary Hump Lead Removal and Construction Work. The Permanent Hump Lead will be protected with a beam supported roof system that, once constructed, will allow normal construction operations over the active Permanent Hump Lead on the terms and conditions set forth herein, including the condition in Section 4 below that beams may be set above the Permanent Hump Lead only when it is inactive. Until the aforesaid beam supported roof system is constructed, all construction operations, including initial beam placement, will be performed over the Permanent Hump Lead only during the weekly 4-hour shutdowns or during the approximate 10-15 minute period between hump train cuts on the terms and conditions set forth in this Exhibit. If construction operations repeatedly exceed such permitted periods, UPRR may curtail or temporarily suspend construction operations during such periods as needed to maintain normal hump lead operations in the Yard.

a. At all times after the Temporary Hump Lead is removed, the Permanent Hump Lead shall be operational.

b. At all times a minimum of three mainline bypass tracks shall be operational. This includes any three of: N BYPASS1, N BYPASS2, SF BYPASS3, S BYPASS4, or S BYPASS5.

c. When contained within any Work Zone, tracks LD 101-104 and LD 105-108 shall be operational and clear of any materials (except for asphalt crossing placed for crane access) or equipment for approximately 10-15 minutes every two (2) hours.

d. The Permanent Hump Lead and the west end ladder of the 100 series tracks are inactive during a four (4) hour window once a week, generally on Wednesdays unless unusual operating issues require shutdown on a different day of the week.

e. No more four (4) departure tracks in the 4+4+4 Plan can be shut down at any given time. See Work Zones.

f. A UPRR flagger is required when working within 25-feet of an active track. Provided that Work Zones are delineated with fencing, Contractor operations can continue at all times unless specified otherwise in the Construction Phasing Narrative. UPRR flagger must be secured for the duration of all construction activities in the Yard. UPRR will provide set pricing for use in bidding.

g. Switch locks and derails will be used to make tracks at the ends of Work Zones inaccessible to rail-mounted vehicles; the installation of such switch locks and derails must be coordinated with UPRR field personnel. Switch locks and derails can be removed only under flagger authorization.

h. Contractor is responsible for verifying utility locations as shown on the PS&E plans in the vicinity of the new piers. Contractor is responsible for protection of utilities within the Work Zone.

   i. Attention is directed to the possible presence (specifically at Bent Line F) of underground utilities owned by the UPRR such as irrigation, illumination, fiber optic, telephone, etc. Except for fiber optic cables and City of Fort Worth (CoFW) utilities, the Contractor is responsible for the relocation of utilities at his own expense, subject to utility owner approval.

   ii. Relocation of fiber optic cables from UPRR property is UPRR responsibility and relocation of CoFW utilities is CoFW responsibility.

i. All forms shall be engineered systems and if forms are left up overnight, they shall be secured and protected by Contractor.

j. Any foundation drilling adjacent to live track will require track monitoring as part of the process. If track settlement is observed during drilling activities, drilling will stop and UPRR will be notified.

k. As a general rule, any work performed at a distance less than 12'-0" from an adjacent live track requires a coordinated track outage unless it is otherwise approved by

UPRR. Placing visual awareness fencing ten (10) feet south of the Permanent Hump Lead is allowable where necessary to erect falsework for Bent Line E.

l. Subject to the requirements pertaining to uses over the Permanent Hump Lead, some construction activities over live tracks are allowable, provided tracks are adequately protected from all falling objects including tools, materials, and wet concrete/aggregate. These activities include concrete deck pours, rail slip-forming, striping, rail/fencing, etc. These activities must be coordinated during weekly meetings with UPRR.

2. **Work Zones.**

Each Work Zone shall be either an Absolute Work Zone or a Conditional Work Zone, as defined further below.

Allowing for the above General Track/Yard Operation Requirements and the Construction Phasing Narrative, no more than four (4) departure tracks in the 4+4+4 plan can be shut down (inactive) to yard operations and available for continuous Contractor use in construction of SWP/SH121, leaving eight (8) departure tracks and three main lines in service at all times. These tracks are limited to tracks 301-312, N BYPASS1, N BYPASS2, SF BYPASS3, S BYPASS4 and S BYPASS5 (see Items 1.a. – 1.e. for related requirements).

The Contractor can employ a 24/7 work schedule in all Work Zones, provided all safety, flagging availability and lighting measures, are in place. Contractor must give UPRR two-week advance notice to arrange for extra night shift flagging.

The Contractor shall coordinate daily with UPRR operations and provide updates on schedule and resources on a weekly basis. Contractor must notify UPRR in advance (48 hour—preferred, 24 hour—minimum) of any change in a Work Zone location.

UPRR will endeavor to minimize Work Zone transition times so long as the Contractor provides adequate notice on a requested Work Zone switch, as coordinated in the weekly meeting. UPRR will endeavor to provide for timely transition, typically within 48 hours, although transition times will increase as more tracks are involved in the applicable Work Zones. If any damage to tracks or ballast has been caused by Contractor's operations in the Work Zone being vacated, the transition of Contractor's operations to the next Work Zone shall be suspended to permit UPRR to repair such damage at the Contractor's cost on a priority basis and restore the tracks in such vacated Work Zone to operating condition.

Upon completion of all work in a Work Zone, the Work Zone shall be cleaned of all waste and debris and returned to pre-construction condition. In cases where a Work Zone or portions of a Work Zone may be used again in a future phase, approved material and equipment storage is permissible.

The Contractor is responsible for hauling and disposal of all excavated soils and materials generated by Contractor, subject to any special arrangements between NTTA and UPRR for handling contaminated soils.

Protection methods by Contractor for all tracks in Work Zones must be approved by UPRR.

3. **Absolute Work Zone.**

a. An Absolute Work Zone is defined as an area pre-designated for Contractor's primary use not closer than 12 feet to any active track containing a grouping of four (4) or less inactive tracks. See Items 1.a. — 1.e. for related requirements and this section (Work Zones) for additional constraints.

b. One Absolute Work Zone at a time will be permitted, except that there will be 2 Absolute Work Zones in one instance as shown in Sequence 3 at Bent Lines B and C as shown on the Modified Construction Sequencing and Access Plan.

c. Tracks LD 101-104 and LD 105-108 and the Permanent Hump Lead cannot be included in an Absolute Work Zone.

d. An Absolute Work Zone shall extend east and west to the nearest derails or switches, utilizing east/west limits agreed upon with UPRR field personnel, provided that the east end of the Contractor's work area for the 300 yard/departure yard will end at MP 249.75 on the Dallas subdivision, also known as the point 450 feet east of the existing Hulen Bridge. The east/west limits are dictated by Contractor requirements, and, with UPRR coordination, are adjustable subject to the east end constraint described in the previous sentence. Tracks in and out of Work Zone at east/west limits shall be rendered inaccessible to rail-mounted equipment, unless rail access is coordinated with UPRR.

e. Absolute Work Zones shall be delineated by visual awareness or semi-permanent fencing as described under Work Zone Delineation and in the Construction Phasing Narrative.

f. Fencing, either semi-permanent or visual awareness must extend to the east/west limits of the Work Zone utilizing east/west limits agreed upon with UPRR field personnel.

g. Construction vehicles, equipment and materials may operate/occupy inactive tracks (with approved track protection) for the duration of work in an Absolute Work Zone.

h. Railroad operations may disrupt an Absolute Work Zone only in the case of unsafe or unusual operating conditions as established in UPRR/NTTA agreement, with the understanding that the Contractor's activities at any given time may limit responsiveness to clearing the Absolute Work Zone for UPRR operations.

i. See the Modified Construction Sequencing and Access Plan for additional requirements.

4. **Conditional Work Zone**

a. Construction work areas between Bent lines D-E and E-F are Conditional Work Zones.

b. Conditional Work Zones require varying levels of coordination with UPRR regarding rail traffic and main access road vehicle traffic. Railroad operations may also disrupt Contractor's activities in a Conditional Work Zone in the case of unsafe or unusual operating conditions as established in the Formal Agreement.

c. Conditional Work Zones include work over the Main Access Road, Tracks LD 101-104, LD 105-108 and the Permanent Hump Lead.

d. Tracks LD 101-104 and LD 105-108 shall be operational for approximately 10-15 minutes every two (2) hours.

e. Conditional Work Zones shall be delineated by visual awareness or semi-permanent fencing as described under Work Zone Delineation, unless otherwise conflicting with Yard operations.

f. Construction vehicles, equipment and materials may operate/occupy tracks (with approved track protection) on a temporary basis during construction, but tracks must then be cleared to accommodate items "2b" and "2d" (under Conditional Work Zone) as needed. No cranes or related material are permitted on the Permanent Hump Lead, but rubber-tired vehicles and manlifts will permitted during the weekly 4-hour shutdowns or during the approximate 10-15 minute period between hump train cuts. If any damage to the Permanent Hump Lead is cause by such permitted use, the Contractor's operations in that area shall be suspended to permit UPRR to repair such damage at the Contractor's cost on a priority basis.

g. The Main Access Road will have multiple detours between Bent line D-E during the course of construction to accommodate SWP/SH121 construction. Traffic Control and all-weather road surfacing shall be provided for the detours and coordinated in advance with UPRR.

h. See the Modified Construction Sequencing and Access Plan for additional requirements.

Setting beams and installing the Beam Supported Roof over the Permanent Hump Lead must be performed ONLY when the Hump Lead is inactive, which is only during the weekly four-hour window or as otherwise expressly permitted by UPRR during the approximate 10-15 minute period between hump train cuts. Once the Beam Supported Roof is in place, construction activities proceed as described in Section 1.I.

5. **Work Zone Delineation.**

a. All dimensions referenced herein and in the Construction Phasing Narrative from active track(s) are measured from the centerline of track.

b. Work Zone delineation can be provided by semi-permanent fencing (6' minimum height) or visual awareness fencing (3' minimum height). Equipment or materials can not extend past the vertical plane of the fence. Dust barriers to be included in all fences.

c. Semi-permanent fencing shall be rigid and of composition to create a physical barrier separation of SWP/SH121 construction work operations and rail yard operations. Semi-permanent fencing shall be able to be reasonably removed without major excavation or adverse impacts to surrounding areas.

d. Visual awareness fencing shall be semi-rigid and highly visible in color (e.g. orange snow fencing). Simple staked supports are permissible.

6. **Access.**

a. General.

i. Coordination with UPRR required when crossing live tracks at any access point or into or out of Work Zones.

ii. Live tracks may be blocked at access points by stopped trains for extended periods. Contractor and UPRR shall coordinate access times/locations in order to minimize delays.

iii. Contractor will provide traffic control (coordinated with and approved by UPRR) for UPRR access roads impacted by construction activities.

b. NTTA Access #1 (approximately 3500' feet west of Hulen Street along the south side of the Yard) is hereby replaced with NTTA Access #1A (at the Edwards Ranch Road Entrance memorialized in the August 11, 2011 correspondence between UPRR and NTTA, approximately 6,300' west of Hulen along the south side of the Yard connecting to Edwards Ranch Road at the updated location for the "Proposed UPRR Driveway").

i. Access to the interior of the Yard via the existing road crossings at the existing Main Access Road (approximately 4000' west of Hulen Street).

ii. Main access point for Main Access Road and Routes 3A and 3B.

c. NTTA Access #2 (approximately 500' west of Hulen Street off of Vickery Blvd).

i. Access to the north side of the Yard.

ii. Main access point for construction of Vickery wall.

iii. Main access point for Route 2. Beam trucks with empty shortened trailers must use Route 2 only as an exit.

iv. At Contractor's option and expense, Contractor will construct and remove at conclusion of Contractor's activities in the Yard as indicated on the Modified Construction Sequencing and Access Plan, road crossing approximately 100' west of Hulen across N BYPASS1 & 2 and SF BYPASS 3.

v. Existing UPRR Access Roads on north side of Yard are only 10 feet wide.

d. NTTA Access #3 (approximately 2000' east of Hulen Street off of Vickery Blvd).

i. Access to the north side of the Yard.

ii. Main access point for construction of 2-tiered wall.

iii. Main access point for Route 1. Beam trucks with loaded extended trailers must use Route 1 as an entrance. Unloaded beam trucks may use Route 1 as an alternate exit, but due to the proximity to tracks and ballast, only if UPRR operations personnel are notified in advance of the exiting and if cranes are used to turn such beam trucks for exiting. If any damage to adjoining tracks or ballast is caused by such exiting, unloading of beam trucks in that area shall be suspended to permit UPRR to repair such damage at the Contractor's cost on a priority basis.

iv. Existing UPRR Access Roads on north side of Yard are only 10 feet wide.

e. NTTA Access #4 (approximately 1000' west of Hulen Street off of SWP/SH121 ROW Parcel 58-PT3).

i. Access to the south side of the Yard.

ii. Labor access for construction of Bent lines south of the Hump Leads.

iii. At Contractor's option and expense, Contractor will construct and remove at conclusion of Contractor's activities in the Yard, a 40-foot wide road crossing approximately 400' west of Hulen continuous across S BYPASS4 & 5 and tracks 301 to 310.

iv. Access point for Routes 3A and 3B.

f. Proposed UPRR driveway off of Vickery (UP station 13244+00, approximately 5300' west of Hulen Street) and proposed road crossings across N BYPASS1 & 2 and SF BYPASS3 (UP station 13230+00).

i. Access to north side of the Yard and Route 2.

ii. Allowable for small to medium rubber tire construction vehicles and `high-rail' equipment.

iii. Existing UPRR Access Roads on north side of Yard only 10 feet wide.

g. Proposed UPRR driveway off of Vickery (UP station 13115+00, approximately 7800' ft. east of Hulen Street) and proposed road crossings across N BYPASS1 & 2 and SF BYPASS3 is hereby eliminated.

h. Rail loading yard (approximately 5 miles northeast of the Yard).

i. Materials can be off-loaded from road vehicles to rail and then moved into the Yard via rail after advance notice to UPRR's local operations personnel. (This is a transload area only and is not intended for Contractor storage.)

i. Main Access Road.

i. Trucks delivering bridge beams via the Main Access Road will be limited to maximum beam length of 99 feet. Longer beams must be delivered via the Existing Hulen Street Bridge.

ii. As coordinated with UPPR, Contractor will construct various detours on the Main Access Road in areas of Bent lines D-E. Some NTTA construction will require periodic, temporary shutdown of the Main Access Road to UPRR personnel, provided that an adequate detour is in place during such shutdown.

iii. Contractor will provide traffic flaggers along Main Access Road when necessary based on construction activity. When only room for one lane of traffic, additional traffic control (i.e., stop signs, one-way traffic signal or traffic flaggers) may be required by UPRR at Contractor's expense.

j. Existing Hulen Street Bridge.

i. Allowable to shut down one half of the bridge (one-lane traffic in each direction) and can be used for construction materials access, accessible from the north or south.

ii. Closures can alternate on the northbound and southbound, as dictated by Work Zones, provided all protection and traffic control are provided.

k. MOPAC Bridge (approximately 6800' west of Hulen Street). Contractor access is denied at MOPAC Bridge for large equipment and materials, unless approved by local UPRR operations personnel on a case-by-case basis.

l. Proposed new SWP/SH121 and Hulen Street Bridges.

i. Allowable to use previously constructed spans for construction staging/access.

7. **Equipment.**

Equipment into and out of the Yard is permitted as outlined under Access and in the Construction Phasing Narrative.

a. Road crossings over live tracks will require UPRR flaggers.

b. Equipment may be stored within a Work Zone up to the defined Work Zone Delineation, which can be as close as 12 feet to active tracks. Equipment stored within the Work Zone must be secure and stable so as not to provide any possibility of

interference to adjacent live tracks. Other designated locations for storing and pre-staging equipment are to be coordinated with UPRR.

c. Small to medium construction rubber tired vehicles (pickups, front end loaders, backhoes, etc).

   i. Allowable access at all road crossings and track access roads.

   ii. UPRR approved track protection not required when operating on inactive tracks unless activity has potential for damaging tracks.

d. Medium to large construction rubber tired vehicles (augers, cranes, dump trucks, etc).

   i. Allowable access at all road crossings and track access roads.

   ii. UPRR approved track protection required when operating on inactive tracks.

e. Track vehicles.

   i. Allowable access at all road crossings and track access roads.

   ii. UPRR approved track protection required when operating on inactive tracks.

f. 'High-rail' vehicles (modified for rail/track access).

   i. Allowable access at all road crossings and track access roads.

   ii. Track protection not required when operating on inactive tracks.

   iii. Inactive tracks to be rendered inaccessible to rail-mounted traffic at east/west limits when occupied by Contractor's rail-mounted equipment.

g. Rail mounted or Rail Flatcars.

   i. Allowable on inactive tracks.

   ii. Rail mounted equipment may be used by the Contractor and work-trains can be supplied/coordinated with UPRR for track movement at a cost to the Contractor.

   iii. Inactive tracks to be rendered inaccessible to rail-mounted traffic at east/west limits when occupied by Contractor's rail-mounted equipment.

h. Concrete trucks.

   i. Preferred method utilizes concrete from the bridges above and pumped or bucketed to the Work Zone from above.

ii. Access to Yard permitted where compliant with Access and Work Zone requirements.

i. Existing Hulen Street Bridge.

i. One-half of the bridge may be used for equipment staging, provided adequate Traffic Control are in effect.

ii. Contractor will ensure equipment does not exceed the structural capacity of the bridge.

j. Previously constructed spans of the new Hulen Street and SWP/SH121 Bridges

i. Contractor will ensure equipment does not exceed the structural capacity of the bridge.

k. Additional Track Protection Requirements; Cranes and Shore Towers. Additional required track protection measures and additional provisions governing cranes and shore towers are contained in the Modified Construction Sequencing and Access Plan, Sheets 40-42.

8. **Materials.**

Material storage inside the Yard is permitted within current Work Zones or other designated locations to be coordinated with UPRR. Material storage is also permissible on existing Hulen Street Bridge (with proper protection and traffic control), proposed new spans of SWP/SH121 and Hulen Street Bridges, and rail cars.

a. Material storage within Work Zones.

i. Inactive tracks within the Work Zone; track protection shall be required to ensure rails are not damaged and the track ballast is not contaminated.

ii. Rail access roads may be used within the Work Zone, but must be returned to original condition when no longer used.

iii. Rail flatcars may be used within the Work Zone.

iv. Materials may be stored within a Work Zone up to the defined Work Zone Delineation, which can be as close as 12 feet to active tracks. Materials stored within the Work Zone must be secure and stable so as not to provide any possibility of interference to adjacent live tracks.

b. Material storage outside of Work Zones.

i. Storing and pre-staging of materials is permitted at approved locations and is to be coordinated with UPRR.

c. Material storage on existing Hulen Street Bridge provided proper protection and traffic control is provided, as approved by the City.

   i. One-half of the bridge may be used for material storage, provided adequate Traffic Control is in effect.

   ii. All construction loading is the responsibility of the Contractor to protect structural integrity of the existing bridge.

d. Material storage on previously constructed spans of proposed new Hulen Street or SWP/SH121 Bridges.

   i. No restrictions.

   ii. All construction loading is the responsibility of the Contractor to protect structural integrity of the Bridges.

e. Materials may be shipped to the Yard via rail, and can be coordinated for storage on rail car within the Yard with UPRR. There will be a cost to the Contractor.

9. **Demolition of existing Hulen Street Bridge.**

Foundations of existing structures will be removed to a depth of 5 feet below the final top of rail of the lowest adjacent track or 2 feet below final ground surface where existing or planned operating track is not within 30 feet.

a. General sequence of work is as follows:

   i. Close a series of tracks in accordance with General Track/Yard Operational Requirements and Work Zones to establish the Work Zone.

   ii. Cut and remove deck in pieces, from overhead or within Work Zone.

   iii. Cut and remove girders in pieces.

   iv. Demo caps in pieces.

   v. Demo columns in pieces.

b. Due to the limited space on the ground and congestion in the Yard, the preferred method of debris removal is via the overhead bridges. Debris may be loaded on rail cars within the Work Zone (on inactive tracks), and hauled away via rail.

c. If the Contractor utilizes UPRR-provided rail cars, there will be a cost to the Contractor.

d. See the Modified Construction Sequencing and Access Plan for further details.