CANNONDESIGN

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

WEBSTER UNIVERSITY ISB
PROJECT NAME

8274 BIG BEND BLVD
ADDRESS

NUMBER

WEBSTER UNIVERSITY
OWNER

CANNON DESIGN
ARCHITECT / ENGINEER

DEVIN D GATES
SUBMITTED BY

055113-004
CONTRACTOR / CM SUBMITTAL NO.

CANNON DESIGN SUBMITTAL NO.

DRAWING / DETAIL REFERENCE

055113
SPECIFICATION SECTION / PARAGRAPH

MANUFACTURER / SUPPLIER

ITEM / PRODUCT ID

REQUIRED DATE

PRIORITY

◯ CRITICAL

ITEM BEING SUBMITTED (check only one)

- ◉ Shop Drawings
- ◯ Samples (_____ copies)
- ◯ LEED Submittal
- ◯ Certification / Qualifications
- ◯ Record Documents
- ◯ Product Data
- ◯ Coordination Drawing
- ◯ Calculations
- ◯ Schedules
- ◯ O&M Manuals
- ◯ Other _____

ITEM BEING SUBMITTED FOR (check only one)

◉ Action ◯ Information Only ◯ Record

REMARKS OR DEVIATIONS

Larry Lasalle from Lasalle Iron Works has offered his number so that he may be contacted directly with any questions if needed. 314-771-5350

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)

PARIC

PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

By:
Devin D. Gates

DEVIN D GATES — 11/17/16
REVIEWED BY — DATE

To be completed by Reviewer

05 5113-004
CANNON DESIGN SUBMITTAL NUMBER

11/17/16
RECEIVED DATE

- ◯ A. No Exceptions Taken
  No further review of submittal is required.
- ◯ B. Make Corrections Noted
  Incorporate corrections in work; resubmission is not required.
- ◯ C. Revise and Resubmit
  Revise as noted, and resubmit for review.
- ◯ D. Rejected
  Submittal is not in compliance with Contract Documents; provide new submittal.
- ◉ E. For Record / Information Only
  Submittal was reviewed for Record / Information purposes only.
- ◯ F. Not Required for Review
  Submittal is not required by Contract Documents and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

A/E COMMENTS ◯ See attached sheet(s) for additional comments

SHOP DRAWING / SUBMITTAL REVIEW

- ☐ NO EXCEPTION TAKEN
- ☐ EXCEPTIONS NOTED, RESUBMITTAL NOT REQUIRED
- ☐ REJECTED
- ☒ REVIEWED FOR INFORMATION ONLY
- ☐ REVISE AND RESUBMIT AS NOTED

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of the construction, coordination of his work with that of all other trades and the satisfactory performance of his work.

DAVID MASON & ASSOCIATES, INC.

REVIEW BY: JYW DATE: 12/05/2016

JILL WALKER / DMA — 12/05/2016
REVIEWED BY — DATE

Structural Engineering Calculations

Project:

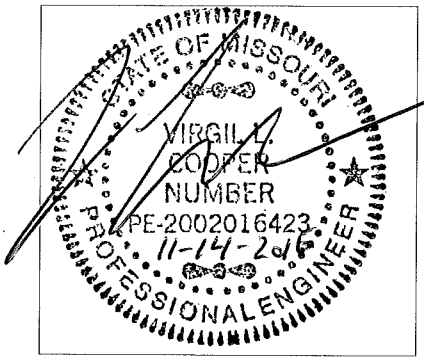
Interdisciplinary Science Building
Webster University, St. Louis, Missouri

Stair #2

Prepared By:

ASDG, LLC
1009 Lincoln Highway
Fairview Heights, IL 62208
Ph: 618.628.0887 Fx: 618.628.0889

ASDG Project Number: 16103.01
Date: November 14, 2016



V. Lee Cooper

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

- STAIR # 2 DESIGN CRITERIA

DEAD LOADS:

PAN STAIR:

2" CONC FILL	25	PSF
14 GA PAN	5	PSF
MISC	5	PSF
	35	PSF

LANDING:

2½" CONC ON 2" x 20 GA DECK	45	PSF
14 GA PAN	5	PSF
MISC	5	PSF
	55	PSF

GUARD RAIL: 5 PSF (3.5) = 18 PLF

LIVE LOADS: 100 PSF UNIFORM

300 # CONCENTRATED ON 4" x 4" AREA

MAX MEMBER DEFLECTION, Δ_{LL} = 0.25"

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

- CHECK LANDING SLAB ;

MAX SPAN = 4.5'

DL = 55 PSF
LL = 100 PSF
155

* USE 2 1/2" CONC (f'c = 3000 psi)
ON 2" x 20 GA G60 COMP DECK

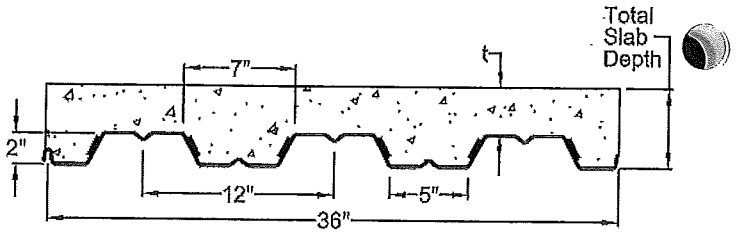
MAX UNSHORED SPAN = 8-2 OK

ALLOW LL = 361 PSF @ SPAN = 5'-6"

OK BY INSPECTION

2 VLI

Maximum Sheet Length 42'-0
Extra Charge for Lengths Under 6'-0
ICBO Approved (No. 3415)



Interlocking side lap is not drawn to show actual detail.

STEEL SECTION PROPERTIES

Deck Type	Design Thickness in	Deck Weight psf	Section Properties I_p in^4/ft	S_p in^3/ft	I_n in^4/ft	S_n in^3/ft	V_a lbs/ft	F_y ksi
2VLI22	0.0295	1.62	0.324	0.263	0.321	0.266	1832	50
2VLI20	0.0358	1.97	0.409	0.341	0.406	0.346	2698	50
2VLI19	0.0418	2.30	0.492	0.420	0.489	0.426	3190	50
2VLI18	0.0474	2.61	0.559	0.495	0.558	0.504	3608	50
2VLI16	0.0598	3.29	0.704	0.653	0.704	0.653	3618	40

(N=9.35) NORMAL WEIGHT CONCRETE (145 PCF)

TOTAL SLAB DEPTH	DECK TYPE	SDI Max. Unshored Clear Span 1 SPAN	2 SPAN	3 SPAN	Superimposed Live Load, PSF — Clear Span (ft.-in.) 5'-6	6'-0	6'-6	7'-0	7'-6	8'-0	8'-6	9'-0	9'-6	10'-0	10'-6	11'-0	11'-6	12'-0	12'-6
4.00 (t=2.00) 39 PSF	2VLI22	7'-4	9'-6	9'-9	274	239	211	188	145	129	115	104	94	85	78	71	65	59	54
	2VLI20	8'-7	10'-10	11'-2	310	269	236	210	188	170	155	117	106	96	87	80	73	67	61
	2VLI19	9'-9	11'-11	12'-4	344	298	261	231	207	186	169	155	142	106	97	88	81	74	68
	2VLI18	10'-9	12'-9	12'-9	373	324	285	253	228	206	188	172	159	147	137	103	95	87	81
	2VLI16	11'-1	13'-2	13'-5	400	376	330	292	261	235	214	195	180	166	154	143	109	100	93
4.50 (t=2.50) 45 PSF	2VLI22	6'-11	9'-0	9'-4	319	278	245	190	168	150	134	121	109	99	90	83	76	69	63
	2VLI20	8'-2	10'-3	10'-7	361	313	275	244	219	198	152	136	123	112	102	93	85	78	72
	2VLI19	9'-2	11'-5	11'-9	400	346	303	268	240	216	196	180	136	124	113	103	94	86	79
	2VLI18	10'-2	12'-4	12'-4	400	376	331	295	264	239	218	200	184	171	130	119	110	102	94
	2VLI16	10'-5	12'-6	12'-11	400	400	383	339	303	274	248	227	209	193	150	137	126	117	108
5.00 (t=3.00) 51 PSF	2VLI22	6'-7	8'-7	8'-11	364	317	279	247	192	171	153	138	125	113	103	94	86	79	72
	2VLI20	7'-9	9'-10	10'-2	400	356	313	278	249	193	173	156	141	128	116	106	97	89	82
	2VLI19	8'-9	10'-11	11'-3	400	394	345	306	273	247	224	172	156	141	128	117	107	99	91
	2VLI18	9'-7	11'-10	11'-11	400	400	377	336	301	273	249	228	210	162	148	136	126	116	107
	2VLI16	9'-11	12'-0	12'-4	400	400	400	386	346	312	283	259	238	187	171	157	144	133	123
5.50 (t=3.50) 57 PSF	2VLI22	6'-4	8'-0	8'-6	400	355	278	244	216	192	172	155	140	127	116	106	97	89	81
	2VLI20	7'-5	9'-5	9'-9	400	400	351	312	244	217	194	175	158	143	131	119	109	100	92
	2VLI19	8'-4	10'-5	10'-9	400	400	388	343	307	277	215	193	175	159	144	132	121	111	102
	2VLI18	9'-2	11'-4	11'-7	400	400	400	377	338	306	279	256	199	182	167	153	141	130	121
	2VLI16	9'-5	11'-6	11'-10	400	400	400	400	388	350	318	290	230	210	192	176	162	150	138
6.00 (t=4.00) 63 PSF	2VLI22	6'-1	7'-5	8'-2	400	394	308	270	239	213	191	172	156	141	129	118	108	99	90
	2VLI20	7'-1	9'-1	9'-4	400	400	390	346	271	241	215	194	175	159	145	132	121	111	102
	2VLI19	8'-0	10'-1	10'-5	400	400	400	381	340	307	239	215	194	176	160	146	134	123	113
	2VLI18	8'-10	10'-11	11'-3	400	400	400	400	375	339	309	243	221	202	185	170	157	145	134
	2VLI16	9'-1	11'-1	11'-5	400	400	400	400	400	388	352	322	255	233	213	195	180	166	154
6.50 (t=4.50) 69 PSF	2VLI22	5'-11	6'-11	7'-11	400	390	339	297	263	234	210	189	171	155	141	129	118	108	99
	2VLI20	6'-11	8'-9	9'-0	400	400	400	337	297	264	237	213	193	175	159	145	133	122	112
	2VLI19	7'-10	9'-8	10'-0	400	400	400	400	374	293	262	236	213	193	176	161	147	135	124
	2VLI18	8'-7	10'-6	10'-11	400	400	400	400	400	373	340	268	243	222	203	187	172	159	147
	2VLI16	8'-10	10'-8	11'-0	400	400	400	400	400	400	387	309	280	256	234	215	198	183	169

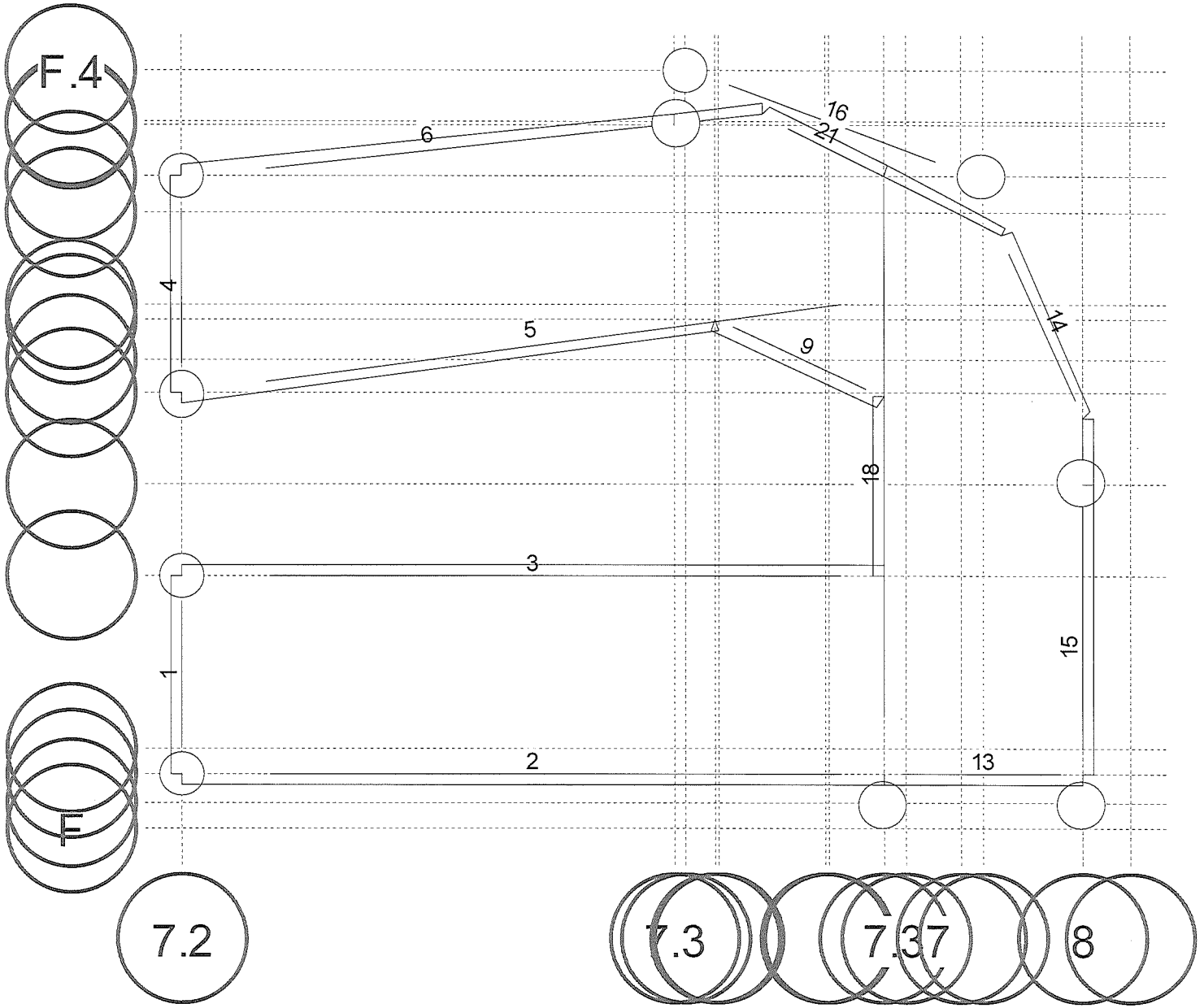
Notes:
1. Minimum exterior bearing length required is 2.00 inches. Minimum interior bearing length required is 4.00 inches. If these minimum lengths are not provided, web crippling must be checked.
2. Always contact Vulcraft when using loads in excess of 200 psf. Such loads often result from concentrated, dynamic, or long term load cases for which reductions due to bond breakage, concrete creep, etc. should be evaluated.
3. All fire rated assemblies are subject to an upper live load limit of 250 psf.

Flo Map

RAM Steel 15.03.00.000
DataBase: Webster U Stair 2 Revised
Building Code: IBC

11/09/16 10:52:41
Steel Code: AISC 360-10 ASD

Floor Type: Stair Plan



Flo Map

RAM Steel 15.03.00.000
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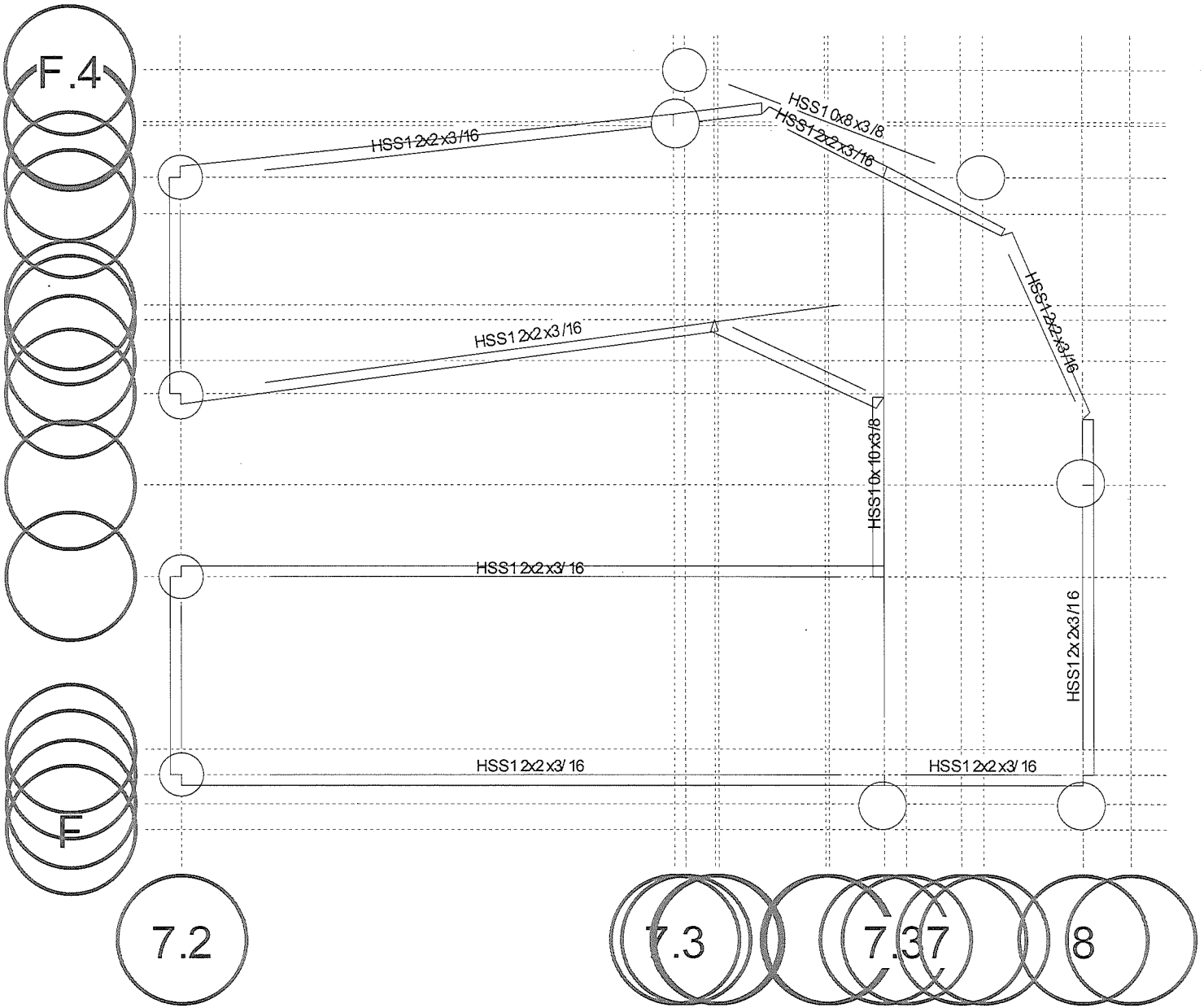
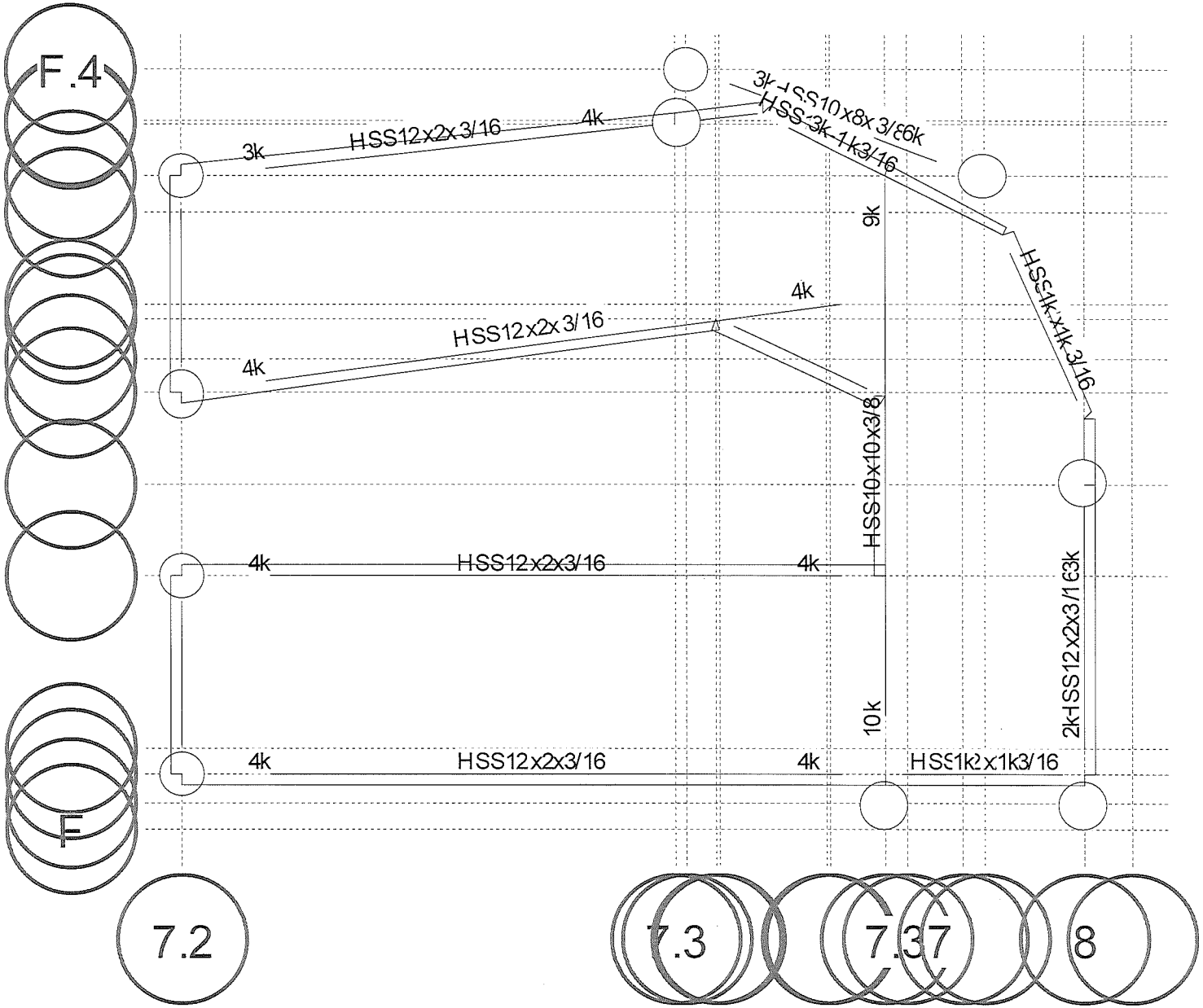


Floor Type: Stair Plan



Gravity Beam Design

RAM Steel 15.03.00.000
DataBase: Webster U Stair 2 Revised 11/09/16 10:52:41
Building Code: IBC Steel Code: AISC 360-10 ASD

Floor Type: Stair Plan **Beam Number = 5**

SPAN INFORMATION (ft): I-End (0.00,9.92) J-End (15.94,12.13)

Beam Size (User Selected) = HSS12X2X3/16 Fy = 46.0 ksi
Total Beam Length (ft) = 16.09
Mp (kip-ft) = 59.42

POINT LOADS (kips):

Dist	DL	RedLL	Red%	NonRLL	StorLL	Red%	RoofLL	Red%	PartL
12.250	0.08	0.00	0.0	0.14	0.00	0.0	0.00	0.0	0.00

LINE LOADS (k/ft):

Load	Dist	DL	LL	Red%	Type	PartL
1	0.000	0.000	0.000	---	NonR	0.000
	0.679	0.110	0.000			0.000
2	0.000	0.000	0.000	---	NonR	0.000
	0.679	0.025	0.245			0.000
3	0.680	0.110	0.000	---	NonR	0.000
	13.969	0.100	0.000			0.000
4	0.680	0.025	0.245	---	NonR	0.000
	13.969	0.022	0.223			0.000
5	13.970	0.100	0.000	---	NonR	0.000
	16.089	0.067	0.000			0.000
6	13.970	0.022	0.223	---	NonR	0.000
	16.089	0.015	0.149			0.000
7	0.000	0.012	0.000	---	NonR	0.000
	12.174	0.012	0.000			0.000
8	0.000	0.003	0.026	---	NonR	0.000
	12.174	0.003	0.026			0.000
9	12.175	0.011	0.000	---	NonR	0.000
	12.250	0.000	0.000			0.000
10	12.175	0.003	0.026	---	NonR	0.000
	12.250	0.000	0.000			0.000
11	12.251	0.000	0.000	---	NonR	0.000
	16.089	0.039	0.000			0.000
12	12.251	0.000	0.000	---	NonR	0.000
	16.089	0.009	0.087			0.000
13	0.000	0.016	0.000	---	NonR	0.000
	16.089	0.016	0.000			0.000

SHEAR: Max Va (DL+LL) = 3.46 kips Vn/1.67 = 61.80 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	13.9	8.1	0.0	1.00	1.67	34.95
Controlling		DL+LL	13.9	8.1	0.0	1.00	1.67	34.95

REACTIONS (kips):

	Left	Right
DL reaction	1.26	1.31
Max +LL reaction	2.07	2.15
Max +total reaction	3.33	3.46

DEFLECTIONS:

Dead load (in)	at	8.04 ft	=	-0.126	L/D	= 1537
Live load (in)	at	8.04 ft	=	-0.206	L/D	= 937
Net Total load (in)	at	8.04 ft	=	-0.332	L/D	= 582

Gravity Beam Design

RAM Steel 15.03.00.000
DataBase: Webster U Stair 2 Revised 11/09/16 10:52:41
Building Code: IBC Steel Code: AISC 360-10 ASD

Floor Type: Stair Plan **Beam Number = 18**

SPAN INFORMATION (ft): I-End (15.94,0.58) J-End (15.94,15.68)

Beam Size (User Selected) = HSS10X10X3/8 Fy = 46.0 ksi
Total Beam Length (ft) = 15.09
Mp (kip-ft) = 180.93

POINT LOADS (kips):

Dist	DL	RedLL	Red%	NonRLL	StorLL	Red%	RoofLL	Red%	PartL
0.708	0.07	0.00	0.0	0.06	0.00	0.0	0.00	0.0	0.00
0.708	1.23	0.00	0.0	2.00	0.00	0.0	0.00	0.0	0.00
5.208	1.22	0.00	0.0	2.00	0.00	0.0	0.00	0.0	0.00
9.256	0.10	0.00	0.0	0.18	0.00	0.0	0.00	0.0	0.00
11.545	1.31	0.00	0.0	2.15	0.00	0.0	0.00	0.0	0.00
14.287	0.86	0.00	0.0	1.27	0.00	0.0	0.00	0.0	0.00

LINE LOADS (k/ft):

Load	Dist	DL	LL	Red%	Type	PartL
1	5.209	0.000	0.000	---	NonR	0.000
	5.466	0.012	0.000			0.000
2	5.209	0.000	0.000	---	NonR	0.000
	5.466	0.003	0.026			0.000
3	5.467	0.012	0.000	---	NonR	0.000
	9.091	0.012	0.000			0.000
4	5.467	0.003	0.026	---	NonR	0.000
	9.091	0.003	0.026			0.000
5	9.091	0.012	0.000	---	NonR	0.000
	9.256	0.000	0.000			0.000
6	9.091	0.003	0.026	---	NonR	0.000
	9.256	0.000	0.000			0.000
7	9.256	0.000	0.000	---	NonR	0.000
	11.544	0.020	0.000			0.000
8	9.256	0.000	0.000	---	NonR	0.000
	11.544	0.004	0.044			0.000
9	11.545	0.009	0.000	---	NonR	0.000
	14.286	0.000	0.000			0.000
10	11.545	0.002	0.020	---	NonR	0.000
	14.286	0.000	0.000			0.000
11	0.709	0.101	0.000	---	NonR	0.000
	8.823	0.101	0.000			0.000
12	0.709	0.023	0.225	---	NonR	0.000
	8.823	0.023	0.225			0.000
13	8.824	0.101	0.000	---	NonR	0.000
	12.919	0.060	0.000			0.000
14	8.824	0.023	0.225	---	NonR	0.000
	12.919	0.013	0.134			0.000
15	12.919	0.060	0.000	---	NonR	0.000
	14.286	0.000	0.000			0.000

Load	Dist	DL	LL	Red%	Type	PartL
16	12.919	0.013	0.134	---	NonR	0.000
	14.286	0.000	0.000			0.000
17	0.000	0.045	0.000	---	NonR	0.000
	15.093	0.045	0.000			0.000

SHEAR: Max Va (DL+LL) = 9.07 kips Vn/1.67 = 103.28 kips

MOMENTS:

Span	Cond	LoadCombo	Ma	@	Lb	Cb	Ω	Mn / Ω
			kip-ft	ft	ft			kip-ft
Center	Max +	DL+LL	28.6	6.8	0.0	1.00	1.67	108.34
Controlling		DL+LL	28.6	6.8	0.0	1.00	1.67	108.34

REACTIONS (kips):

	Left	**Right**
DL reaction	3.61	3.41
Max +LL reaction	5.45	5.02
Max +total reaction	9.07	8.43

DEFLECTIONS:

Dead load (in)	at	7.55 ft	=	-0.082	L/D	= 2203
Live load (in)	at	7.55 ft	=	-0.124	L/D	= 1462
Net Total load (in)	at	7.55 ft	=	-0.206	L/D	= 879

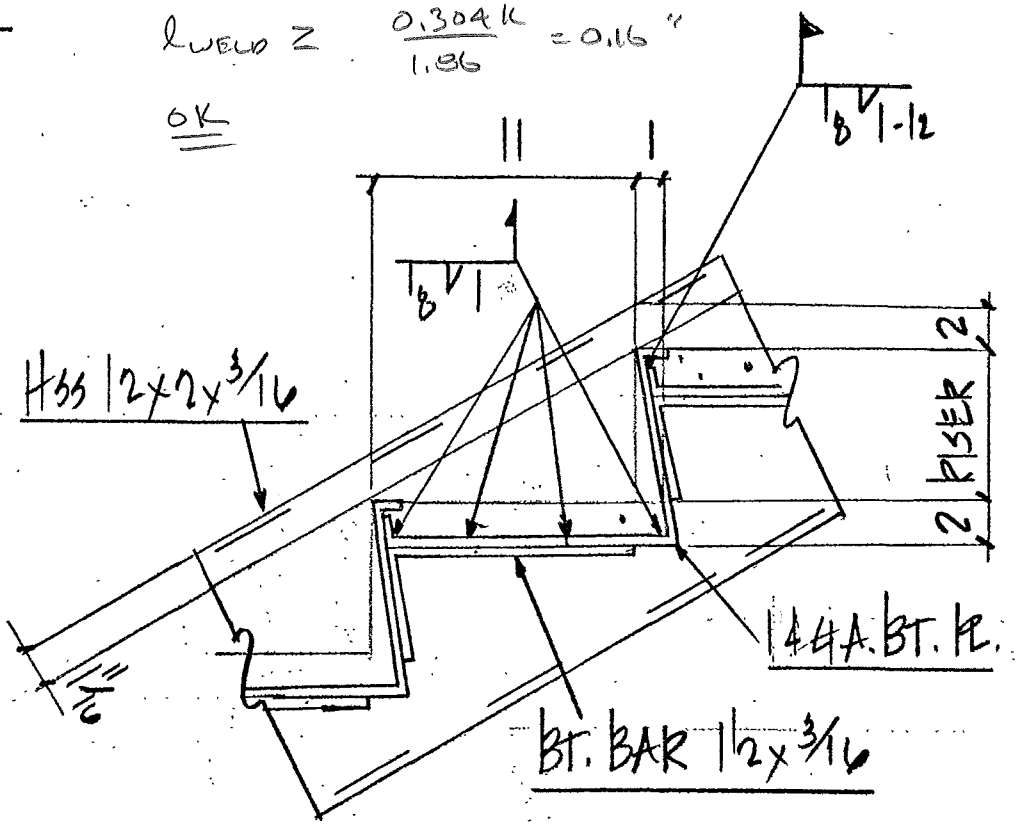
* CHECK STEEL PAN TREAD/RISER & CONNECTION

$R = 135 PSF (1)(\frac{4.5}{2}) = 304\#$

1/8" FILLET WELD; $V_{ALLOW} = 1.86$ K/IN

$\ell_{WELD} = \frac{0.304K}{1.86} = 0.16"$

OK



TYP. TREAD DETAIL

SECT'S. & DETAILS ARE SHOWN ON "E2 & E3"

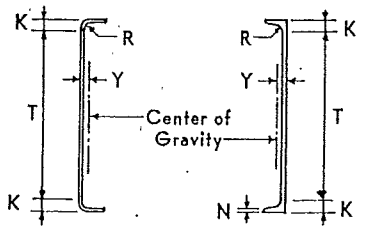
LOAD AND DEFLECTION TABLES FOR STEEL STRINGERS, RISERS AND SUBTREADS

10" DEPTH SECTIONS

SEE GENERAL NOTES BELOW	FIBER STRESS = 20,000 PSI									FIBER STRESS = 22,0				
	3/16"	1/4"	5/16"	3/8"	1½"	2"	1⅛" 3/16"	1½" 3/16"	2⅝" 1/4"	1⅛"	1⅛" 1⅛" MC10	1½" MC10	1½"	
Weight, lb. per ft.	6.38	8.5	10.6	12.8	8.03	14.41	12.88	14.78	23.8		6.5	13.0	8.4	16.
Web Thickness, in.	.1875	.25	.3125	.375	.1875	.1875					.15		.17	
Area, sq. inches	1.88	2.5	3.13	3.75	2.3	4.24	3.79	4.34	6.99		1.91	3.82	2.46	4.9
I, in.^{4}	15.6	20.8	26.04	31.25	25.9	42.9	37.7	47.6	88.2		22.1	44.2	32.0	64.
S, in.^{3}	3.12	4.16	5.21	6.25	5.2	8.58	7.52	9.52	17.66		4.4	8.8	6.4	12.

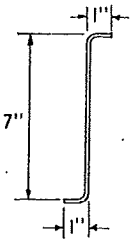
SPAN (feet)	DEFL. (in.)	TOTAL ALLOWABLE UNIFORM LOAD IN KIPS									DEFL. (in.)	TOTAL ALLOWABLE UNIFC			
6	.07	6.9	9.3	11.6	13.8	11.6	19.1	16.7	21.2	39.3	.08	10.8	21.5	15.6	31.
7	.10	5.9	7.9	9.9	11.9	9.9	16.4	14.3	18.2	33.7	.11	9.2	18.4	13.4	26.
8	.13	5.2	6.9	8.7	10.4	8.7	14.3	12.5	15.9	29.5	.15	8.1	16.1	11.7	23:
9	.17	4.6	6.2	7.7	9.3	7.7	12.7	11.1	14.1	26.2	.18	7.2	14.3	10.4	20.
10	.21	4.2	5.6	6.9	8.3	6.9	11.5	10.0	12.7	23.6	.23	6.5	12.9	9.4	18.
11	.25	3.8	5.0	6.3	7.6	6.3	10.4	9.1	11.6	21.4	.28	5.9	11.7	8.5	17:
12	.30	3.5	4.6	5.8	7.0	5.8	9.5	8.4	10.6	19.7	.33	5.4	10.7	7.8	15.
13	.35	3.2	4.3	5.3	6.4	5.3	8.8	7.7	9.8	18.1	.38	5.0	9.9	7.2	14.
14	.41	3.0	4.0	5.0	6.0	5.0	8.2	7.2	9.1	16.8	.45	4.6	9.2	6.7	13.
15	.47	2.8	3.7	4.6	5.6	4.6	7.6	6.7	8.5	15.7	.51	4.3	8.6	6.2	12.
16	.53	2.6	3.5	4.3	5.2	4.3	7.2	6.3	7.9	14.7	.58	4.0	8.1	5.9	11.
17	.60	2.4	3.3	4.1	4.9	4.1	6.7	5.9	7.5	13.9	.66	3.8	7.6	5.5	11.
18	.67	2.3	3.1	3.9	4.6	3.9	6.4	5.6	7.1	13.1	.74	3.6	7.2	5.2	10.
19	.75	2.2	2.9	3.7	4.4	3.7	6.0	5.3	6.7	12.4	.82	3.4	6.8	4.9	9.
20	.83	2.1	2.8	3.5	4.2	3.5	5.7	5.0	6.4	11.8	.91	3.2	6.4	4.7	9.
See drawings below — T						9.25		9.12	8.62	8.0		9.12	9.12	8.62	8.6
See drawings below — N						.1875		.19	.25	.44		.19	.19	.25	.2
See drawings below — K						.375		.44	.69	1.0		.44	.44	.69	.6
See drawings below — R						.1875		.125	.25	.34		.125	.125	.25	.2
See drawings below — Y						.26		.68	.85	1.39		.180	1.125	2.84	1.5

SYMBOLS FOR CHANNEL DIMENSIONS



LOADS AND DEFLECTIONS FOR SHEET STEEL RISERS

CHECK STEEL PAN RISERS)
SPAN = 4'-6"



W_{ALLOW} = 2.9 KIPS

$W_{ALLOW} = \frac{2.9K(1000)}{(1)(4.5)}$

= 644 PSF > 135 PSF

OK

GENERAL NOTES

Allowable loads and deflections listed in tables are based on fiber stresses at column headings and apply to laterally braced members. Stringers are considered to be laterally braced by attached treads and risers.

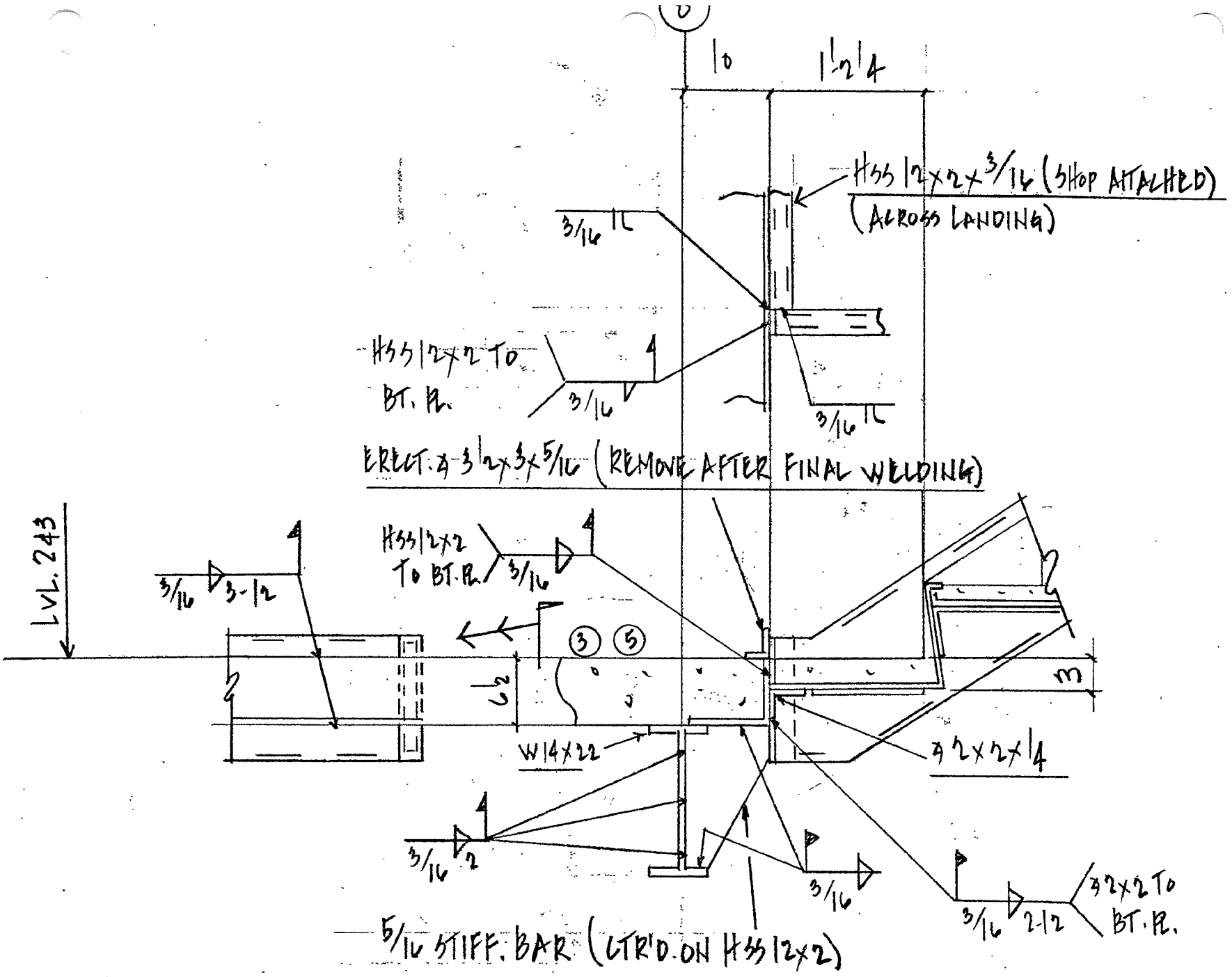
For stresses other than those listed, loads will be proportionately smaller or larger.

Loads below heavy lines will cause deflections exceeding 1/360 of span. Deflections for loads less than those listed will be proportionately less; see example at lower right of facing page.

Weight of material is not included.

SECTION			LOADS AND DEFLECTIONS FOR VARIOUS SPANS									
Thickness	I	S	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-
16 Gage	3.07	.88	3.0	2.6	2.4	2.1	1.9	1.8	1.6	1.5	1.4	1.
14 Gage	3.88	1.11		3.3	2.9	2.6	2.4	2.2	2.0	1.9	1.8	1.
12 Gage	5.42	1.55				3.7	3.4	3.1	2.9	2.7	2.5	2.
10 Gage	6.94	1.98						4.0	3.7	3.4	3.2	3.
Deflection, △, inches			.033	.043	.054	.067	.081	.096	.113	.130	.150	.17

Total allowable uniform load (W) in kips and deflection (△) in inches for sheet steel risers with turned edges. Riser supported laterally by bolted connections. Minimum bolt size is 1/4", maximum spacing 15". Allowable fiber stress used in calculations 18,000 psi. Weight of material is not included


D
10
1'-2 1/4
HSS 12x2x3/16 (SHOP ATTACHED)
(ACROSS LANDING)
3/16
HSS 12x2 TO BT. PL.
3/16
3/16
ERECT. @ 3 1/2 x 3 x 5/16 (REMOVE AFTER FINAL WELDING)
LVL. 243
HSS 12x2 TO BT. PL.
3/16
3/16
3-12
3
5
27
W14x22
@ 2x2x1/4
3/16
2
3/16
3/16
2-12
@ 2x2 TO BT. PL.
5/16 STIFF. BAR (CTR'D ON HSS 12x2)

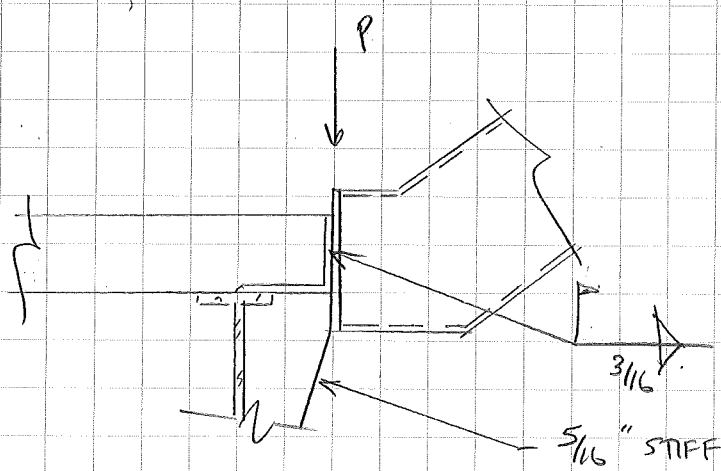
SECT. L

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR # 2

BY VLC DATE 11/9/2016 SHEET NO.

- CHECK TYPICAL BOTTOM OF STRINGER CONNECTION CONNECTION;



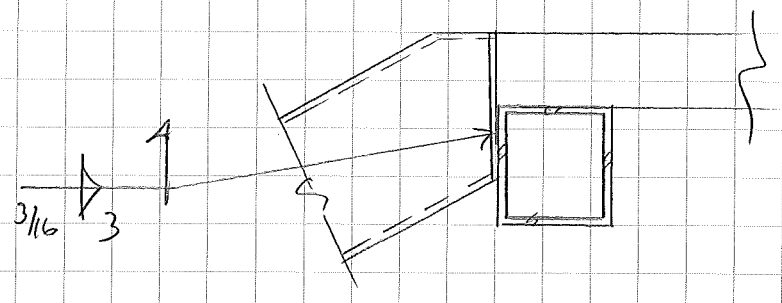
USE $P_{MAX} = 4$ KIPS

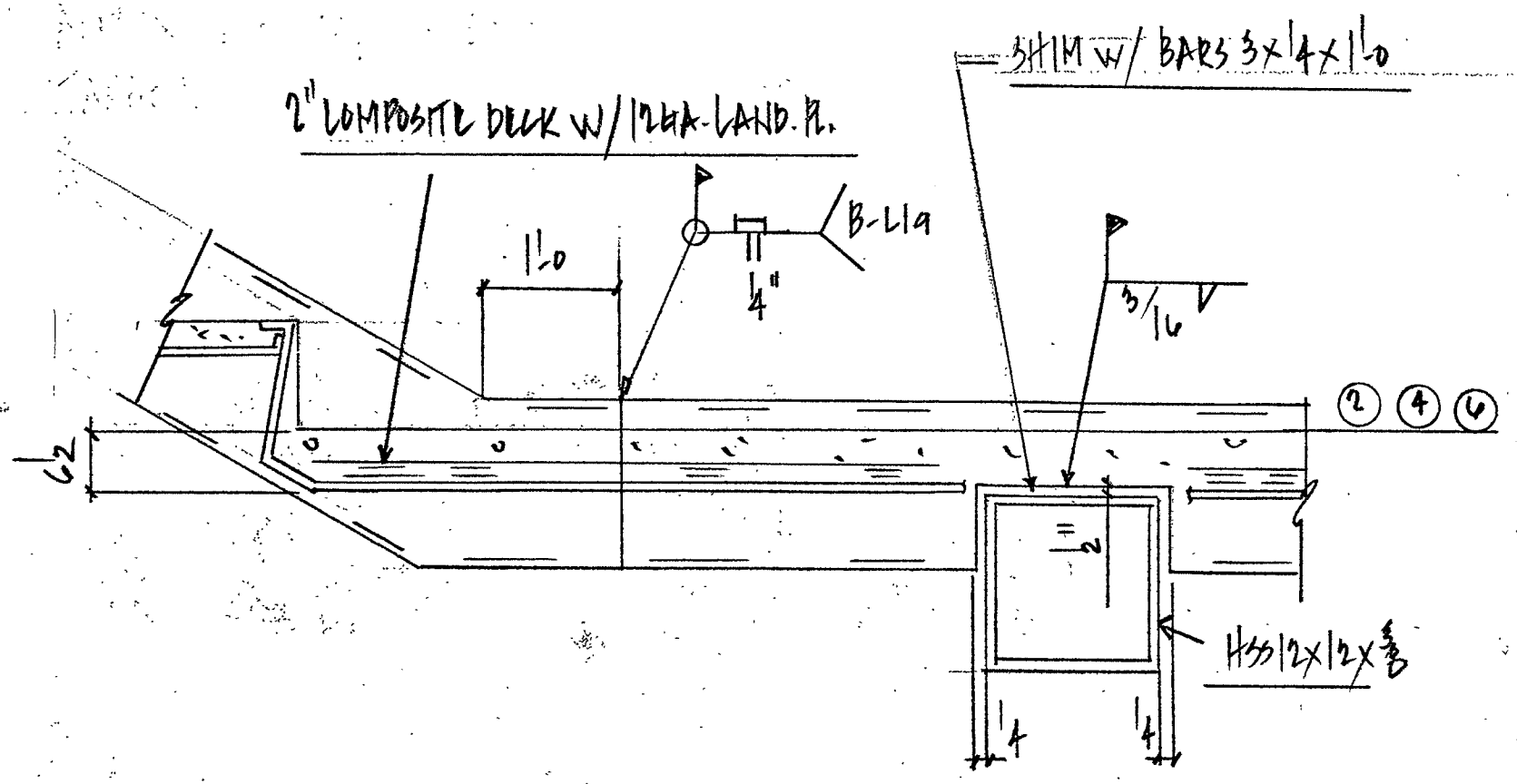
" 3/16" FILLET WELD; $V_{ALLOW} = 2.78$ K/IN

$$\ell_{WELD} = \frac{4K}{2.78} = 1.44"$$

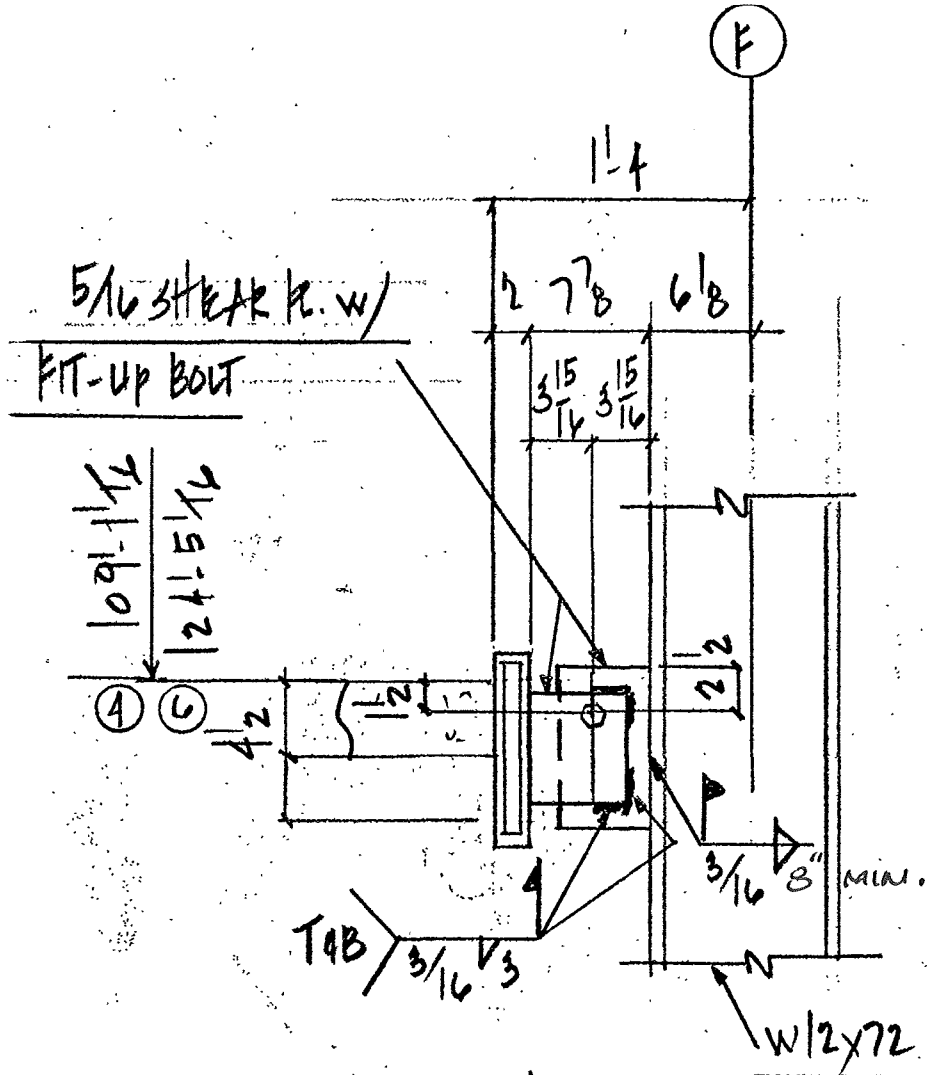
USE 3" MW TWO SIDES

- TOP CONNECTION SIMILAR;

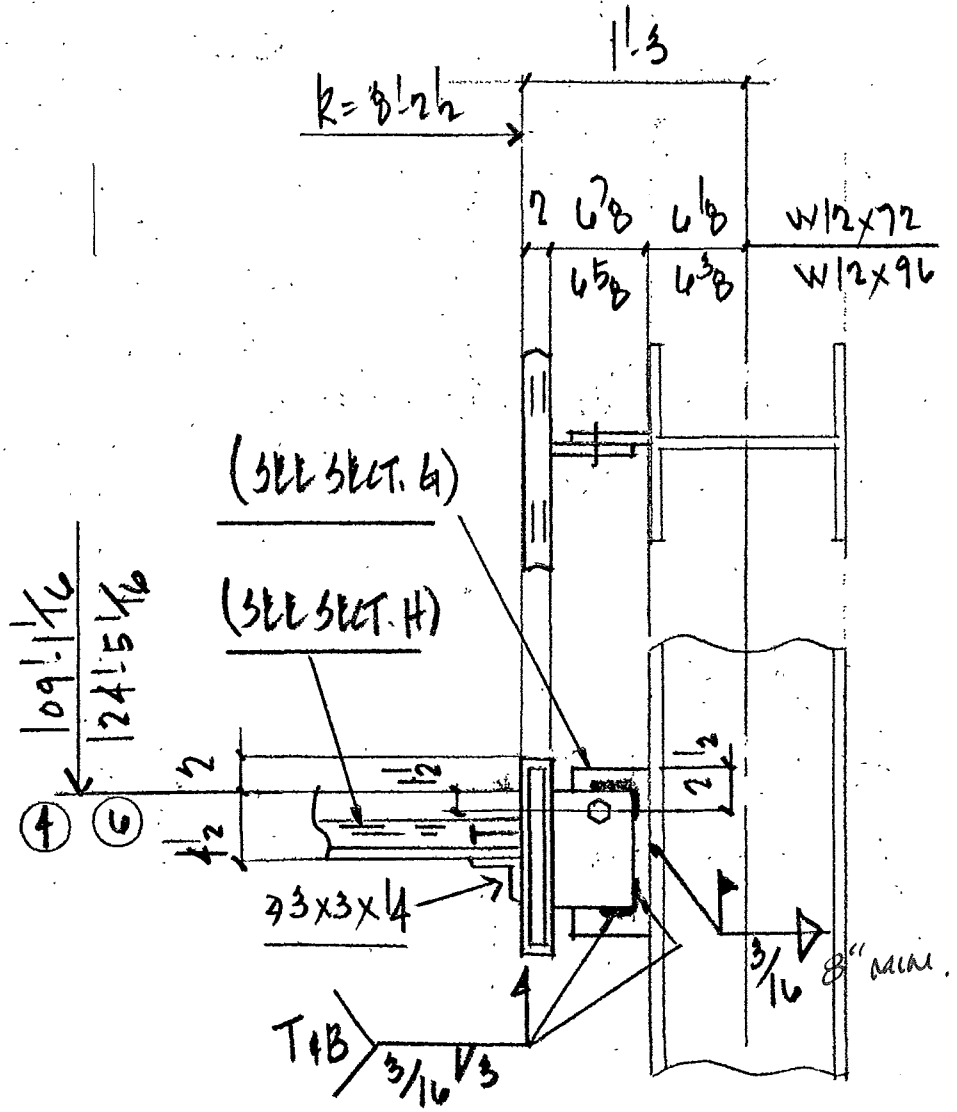



2" COMPOSITE DECK W/ 12GA. LAND. PL.
SHIM W/ BARS 3x1/4x1'-0
B-11a
1'-0
1/4"
3/16
2
4
6
6"
2
HSS 12x12x 1/2
1/4
1/4

SECT. PP


F
1 1/4
5/16 SHEAR PL. W/
FIT-UP BOLT
2 7/8
6 1/8
3 15/16
3 15/16
10 1/2
24 1/2
4
6
2
2
2
3/16
8" MIN.
TYP
3/16
3
W12X72

SECT. 4


1'-3
K = 8'-2 1/2
2
6 7/8
6 1/8
W12x72
6 5/8
6 3/8
W12x96
(SEE SECT. G)
(SEE SECT. H)
109'-1 1/16
124'-5 1/16
4
6
2
2
2
2 1/2
2 1/2
3x3x1/4
3/16
8" MIN.
T+B
3/16
3

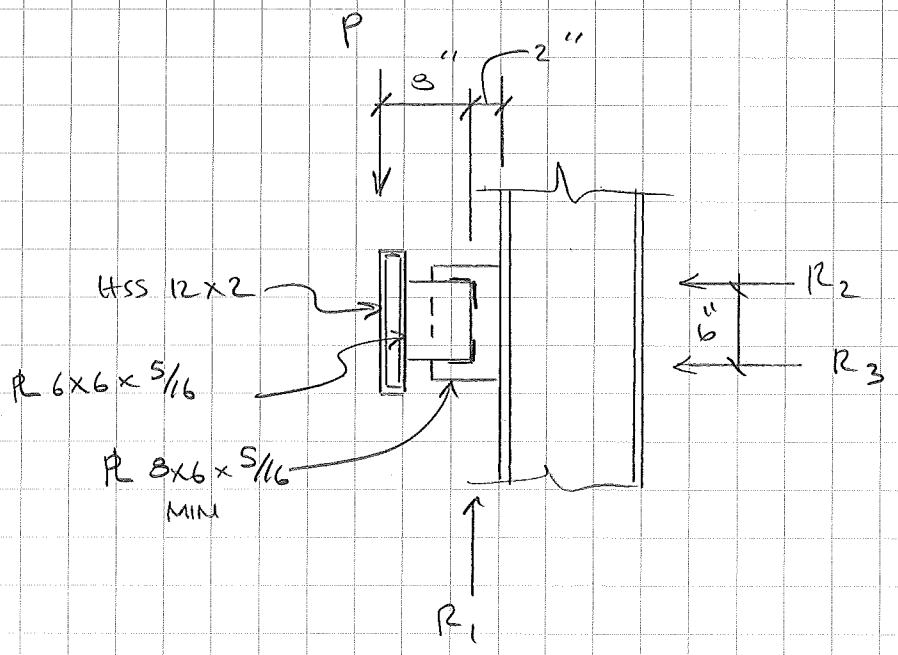
SECT. K

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

- DESIGN TYPICAL TUBE STRINGER TO BUILDING COLUMN CONNECTION)



USE P_{MAX} = 4 KIPS

- CHECK PLATE-TO-PLATE WELD)

R_1 = 4 KIPS) $\ell_{WELD} \geq \frac{4K}{2.78\ K/IN} = 1.44"$

$R_2 = R_3 = \frac{4K(8")}{6"} = 5.33$ KIPS

$\ell_{WELD} \geq \frac{5.33K}{2.78} = 1.92"$

USE 3" RETURN AT EA CORNER

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VCC DATE 11/9/2016 SHEET NO.

- CHECK STAIR R TO COLUMN WELD;

* USE AISC WELD COEFF TABLES

$P_{ALLOW} = CC_1 D\ell$ USE $\frac{3}{16}$" WELD

USE $\ell_{WELD} = 8"$

$a\ell = e = 10"$

$a = \frac{10"}{8"} = 1.25$

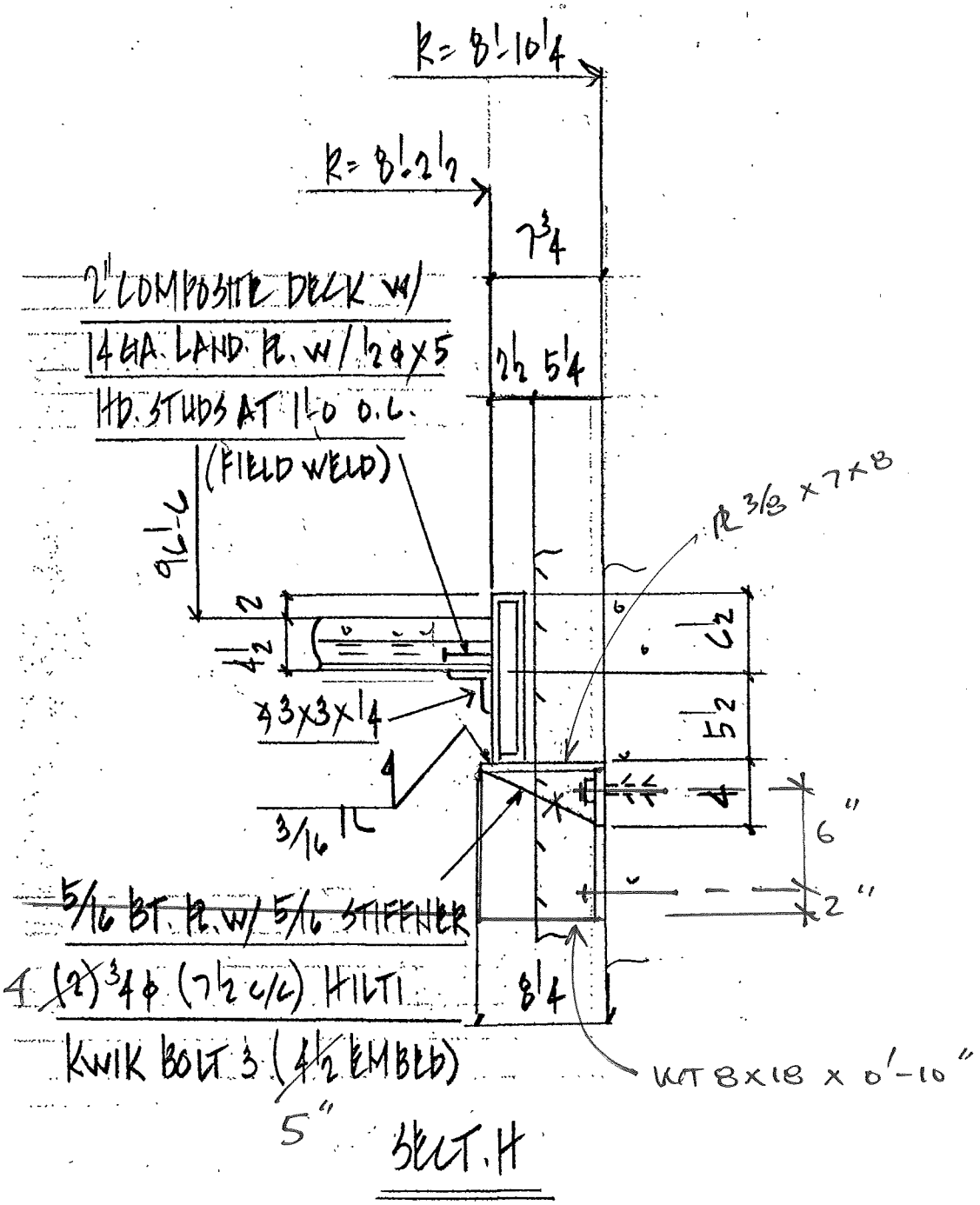
USE $k = 0$

$C_1 = 1.10$ (E70XX)

$P_{ALLOW} = 0.302(1.0)(3)(8")$

$= 7.2$ KIPS ? 9 KIPS

USE 3/16" x 8" 2-SIDED FILLET WELD


R = 8'-10 1/4
R = 8'-2 1/2
7 3/4
2" COMPOSITE DECK W/
14GA. LAND PL. W/ 1/2φ x 5
HD. STUDS AT 11-0 O.C.
(FIELD WELD)
2 1/2
5 1/4
9 1/2
2
4 1/2
3x3x1/4
3/16
5/16 BT. PL. W/ 5/16 STIFFENER
4 (2) 3/4φ (7 1/2 c/c) HILTI
KWIK BOLT 3 (4 1/2 EMBED)
5"
PL 3/8 x 7 x 8
6
6 1/2
5 1/2
4
6"
2"
8 1/4
WT 8 x 18 x 0'-10"

SECT. H

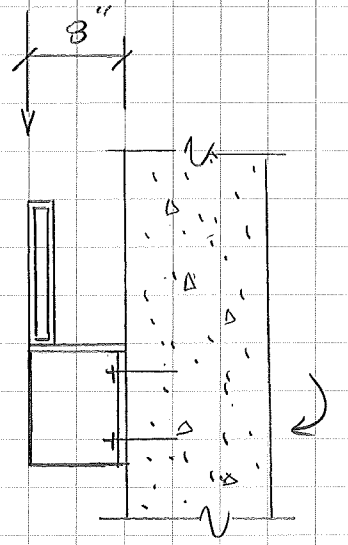
JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

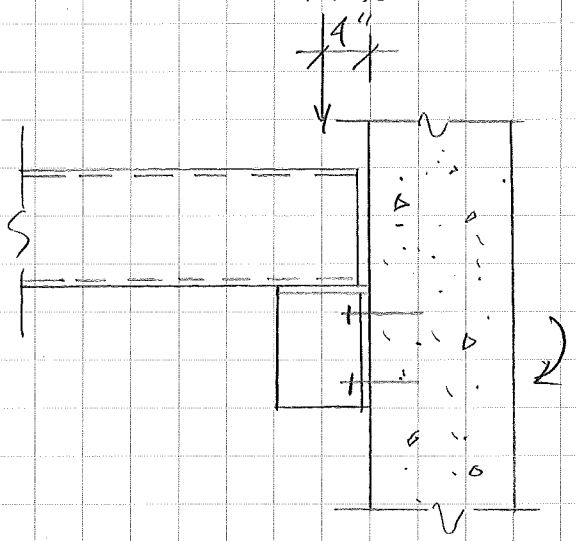
- DESIGN TYPICAL TUBE STRINGER TO HEADER CONNECTION TO CONCRETE WALL;

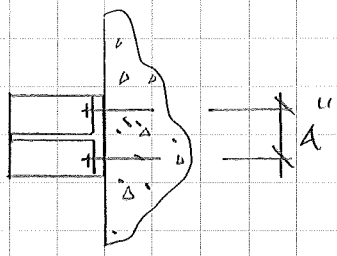
$P_{MAX} = 4$ KIPS ($P_u = 6.4$ KIPS)



$M_u = 6.4(8) = 51.2$ K-IN

$P_{MAX} = 10$ KIPS ($P_u = 16$ KIPS)



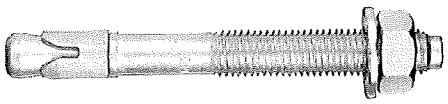


$M_u = 16(4) = 64$ K-IN

Company:	ASDG	Page:	1
Specifier:		Project:	Webster University
Address:		Sub-Project I Pos. No.:	Stair #2
Phone I Fax:	|	Date:	11/9/2016
E-Mail:			

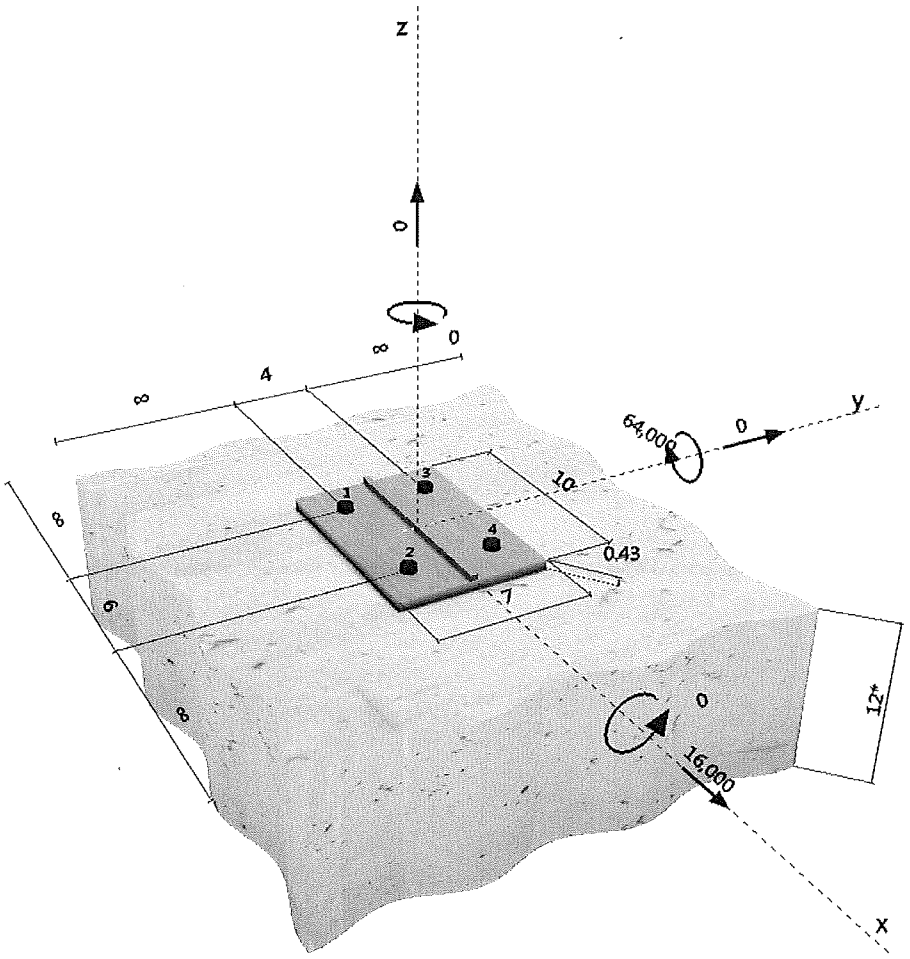
Specifier's comments:

1 Input data



Anchor type and diameter:	**Kwik Bolt 3 - CS 3/4 (5)**
Effective embedment depth:	h_{ef} = 5.000 in., h_{nom} = 5.563 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-2302
Issued I Valid:	2/1/2016 | 12/1/2017
Proof:	Design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.430 in.
Anchor plate:	l_x x l_y x t = 10.000 in. x 7.000 in. x 0.430 in.; (Recommended plate thickness: not calculated
Profile:	Rectangular plates and bars (AISC); (L x W x T) = 10.000 in. x 0.313 in. x 0.000 in.
Base material:	uncracked concrete, 4000, f_c' = 4000 psi; h = 12.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

Geometry [in.] & Loading [lb, in.lb]



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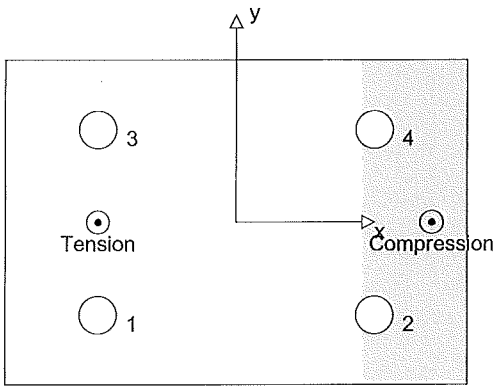
Company:	ASDG	Page:	2
Specifier:		Project:	Webster University
Address:		Sub-Project I Pos. No.:	Stair #2
Phone I Fax:	|	Date:	11/9/2016
E-Mail:			

2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	4421	4000	4000	0
2	0	4000	4000	0
3	4421	4000	4000	0
4	0	4000	4000	0

max. concrete compressive strain: 0.25 [‰]
max. concrete compressive stress: 1105 [psi]
resulting tension force in (x/y)=(-3.000/0.000): 8842 [lb]
resulting compression force in (x/y)=(4.238/0.000): 8842 [lb]

3 Tension load

	Load N_{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	4421	19080	24	OK
Pullout Strength*	4421	8703	51	OK
Concrete Breakout Strength**	8842	13972	64	OK

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-2302
$\phi N_{sa} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.24	106000

Calculations

N_{sa} [lb]
25440

Results

N_{sa} [lb]	ϕ steel	ϕN_{sa} [lb]	N_{ua} [lb]
25440	0.750	19080	4421

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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3.2 Pullout Strength

$N_{pn,f'_c} = N_{p,2500} \sqrt{\frac{f'_c}{2500}}$ refer to ICC-ES ESR-2302

$\phi \; N_{pn,f'_c} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

f'_c [psi]	$N_{p,2500}$ [lb]
4000	10585

Calculations

$\sqrt{\frac{f'_c}{2500}}$
1.265

Results

N_{pn,f'_c} [lb]	ϕ concrete	$\phi \; N_{pn,f'_c}$ [lb]	N_{ua} [lb]
13389	0.650	8703	4421

3.3 Concrete Breakout Strength

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ ACI 318-08 Eq. (D-5)

$\phi \; N_{cbg} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9 \, h_{ef}^2$ ACI 318-08 Eq. (D-6)

$\Psi_{ec,N} = \left(\frac{1}{1 + \frac{2 \, e'_N}{3 \, h_{ef}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-9)

$\Psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$ ACI 318-08 Eq. (D-11)

$\Psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-08 Eq. (D-13)

$N_b = k_c \, \lambda \, \sqrt{f'_c} \, h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\Psi_{c,N}$
5.000	0.000	0.000	∞	1.000

c_{ac} [in.]	k_c	λ	f'_c [psi]
9.500	24	1	4000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\Psi_{ec1,N}$	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	N_b [lb]
285.00	225.00	1.000	1.000	1.000	1.000	16971

Results

N_{cbg} [lb]	ϕ concrete	$\phi \; N_{cbg}$ [lb]	N_{ua} [lb]
21496	0.650	13972	8842

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Company:	ASDG	Page:	4
Specifier:		Project:	Webster University
Address:		Sub-Project I Pos. No.:	Stair #2
Phone I Fax:	|	Date:	11/9/2016
E-Mail:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	4000	10786	38	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	16000	42132	38	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-2302

$\phi V_{steel} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.24	106000

Calculations

V_{sa} [lb]
16594

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
16594	0.650	10786	4000

4.2 Pryout Strength

$$V_{cpg} = k_{cp}\left[\left(\frac{A_{Nc}}{A_{Nc0}}\right)\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N}\,N_b\right]$$ ACI 318-08 Eq. (D-31)

$\phi V_{cpg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2$$ ACI 318-08 Eq. (D-6)

$$\Psi_{ec,N} = \left(\frac{1}{1+\frac{2 e_N'}{3 h_{ef}}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-9)

$$\Psi_{ed,N} = 0.7 + 0.3\left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-11)

$$\Psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-13)

$$N_b = k_c \lambda \sqrt{f_c'}\, h_{ef}^{1.5}$$ ACI 318-08 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	5.000	0.000	0.000	∞

$\Psi_{c,N}$	c_{ac} [in.]	k_c	λ	f_c' [psi]
1.000	9.500	24	1	4000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\Psi_{ec1,N}$	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	N_b [lb]
399.00	225.00	1.000	1.000	1.000	1.000	16971

Results

V_{cpg} [lb]	$\phi_{concrete}$	ϕV_{cpg} [lb]	V_{ua} [lb]
60189	0.700	42132	16000

Input data and results must be checked for agreement with the existing conditions and for plausibility!
PROFIS Anchor (c) 2003-2009 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Company: ASDG
Specifier:
Address:
Phone I Fax: |
E-Mail:

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.633	0.380	5/3	67	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

6 Warnings

- Load re-distributions on the anchors due to elastic deformations of the anchor plate are not considered. The anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the loading! Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!

Fastening meets the design criteria!

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Company:	ASDG	Page:	6
Specifier:		Project:	Webster University
Address:		Sub-Project I Pos. No.:	Stair #2
Phone I Fax:	|	Date:	11/9/2016
E-Mail:			

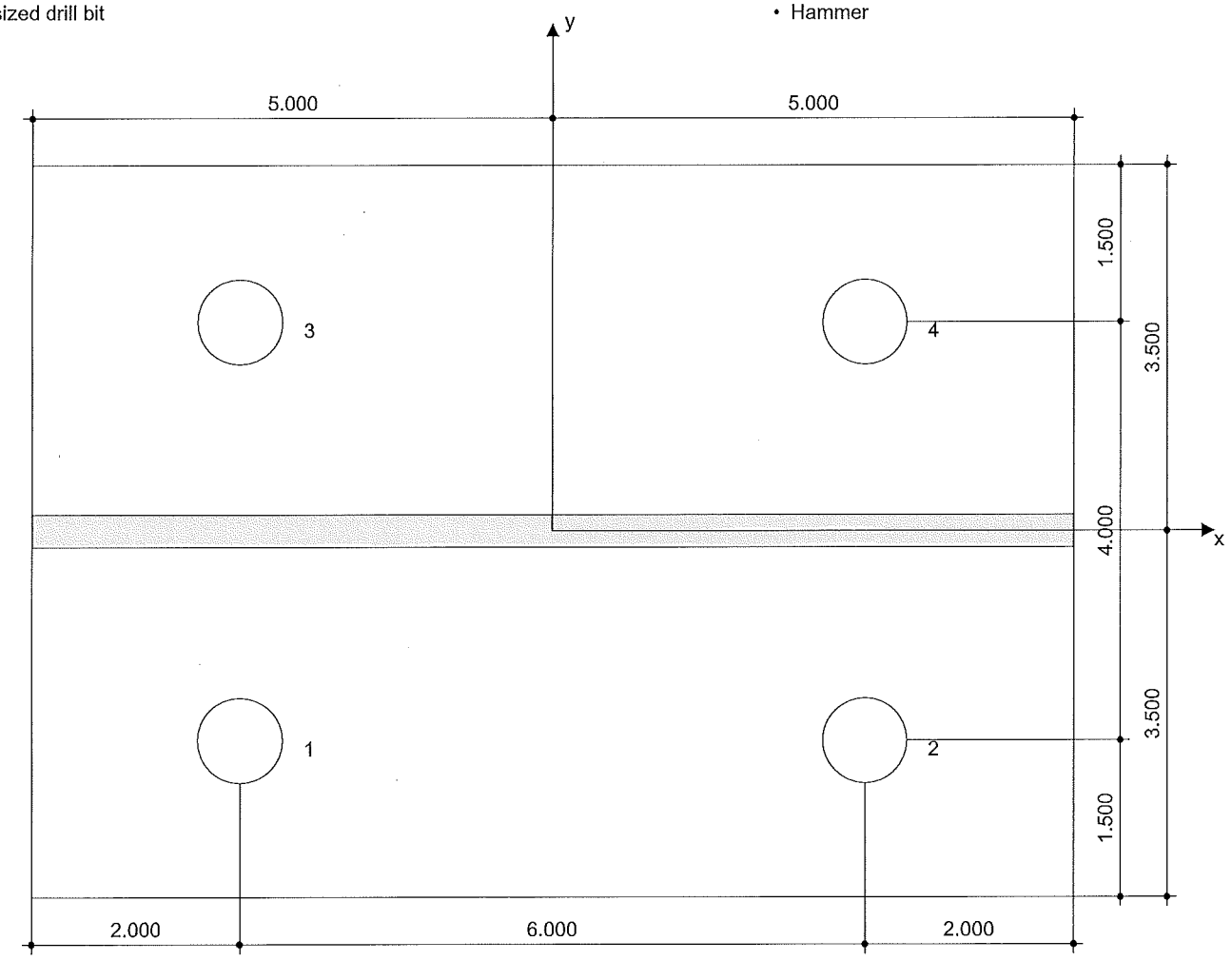
7 Installation data

Anchor plate, steel: -
Profile: Rectangular plates and bars (AISC); 10.000 x 0.313 x 0.000 in.
Hole diameter in the fixture: d_f = 0.813 in.
Plate thickness (input): 0.430 in.
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt 3 - CS 3/4 (5)
Installation torque: 1320.002 in.lb
Hole diameter in the base material: 0.750 in.
Hole depth in the base material: 5.750 in.
Minimum thickness of the base material: 8.000 in.

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer	• Manual blow-out pump	• Torque wrench
• Properly sized drill bit		• Hammer



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-3.000	-2.000	-	-	-	-
2	3.000	-2.000	-	-	-	-
3	-3.000	2.000	-	-	-	-
4	3.000	2.000	-	-	-	-

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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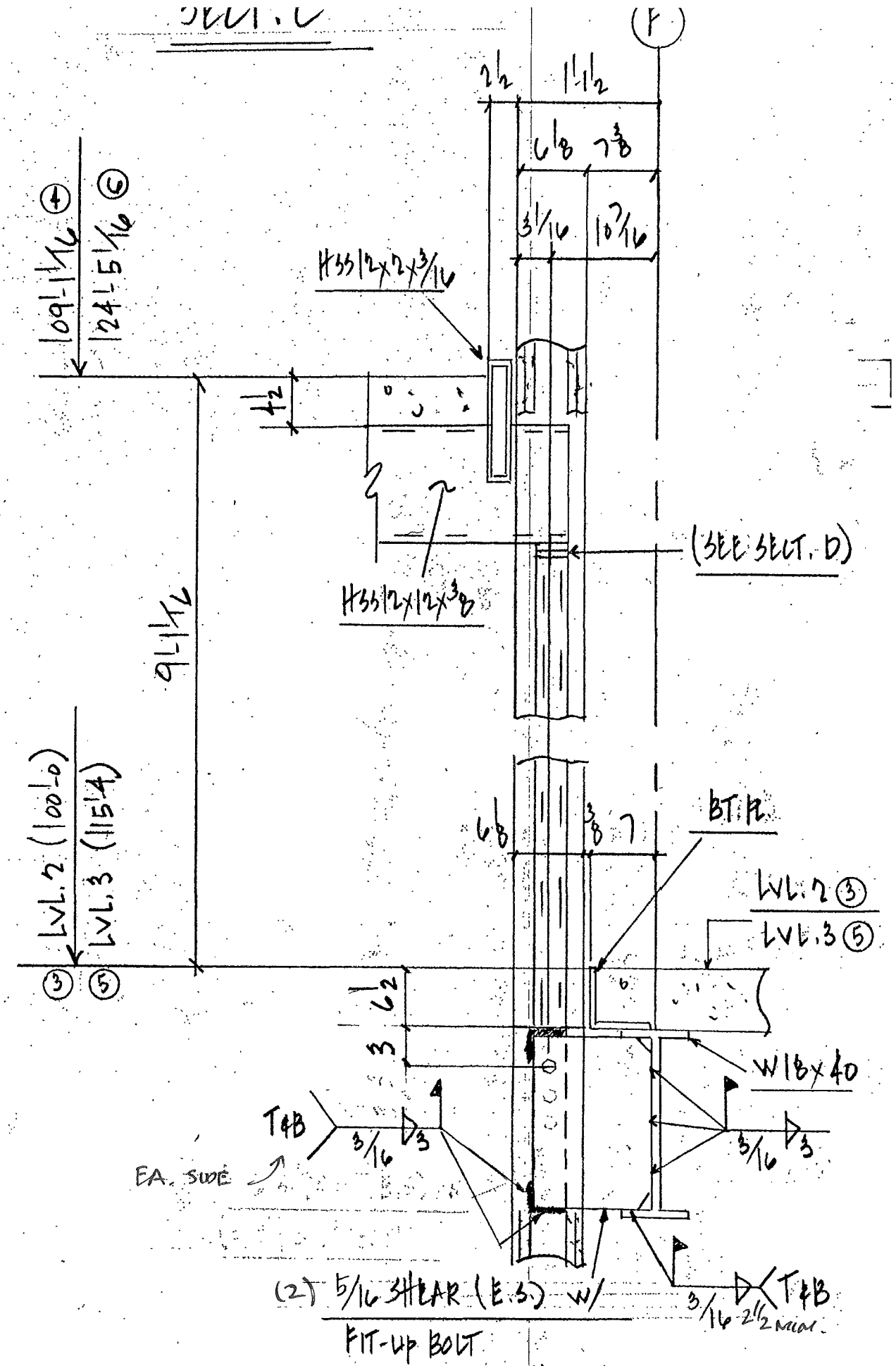
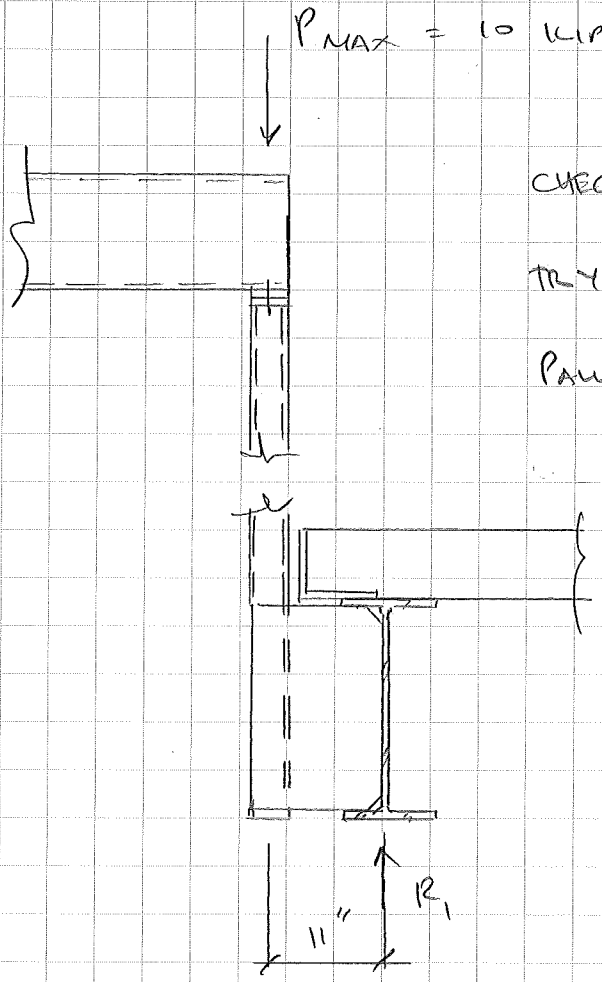

SECT. C
F
2 1/2
1-1 1/2
6 1/8
7 3/8
3 1/16
10 7/16
HSS12x2x3/16
109'-1 1/16 ④
124'-5 1/16 ⑥
4 1/2
(SEE SECT. D)
HSS12x12x3/8
91'-1 1/2
LVL.2 (100'-0)
LVL.3 (115'-4)
③
⑤
6 1/8
3/8
7
BT. PL.
LVL.2 ③
LVL.3 ⑤
6 1/2
3
W18x40
T4B
3/16
3
EA. SIDE
(2) 5/16 SHEAR (E.S.) W/
FIT-UP BOLT
T4B
3/16
2 1/2 MIN.
SECT. F
1 1/2 MIN.

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

- CHECK HSS STRUT @ BRACKET SUPPORT FOR HEADER,



CHECK STRUT, HT = 9'

TRY HSS 3x3x 3/16

P_{ALLOW} = 31K > 10K OK

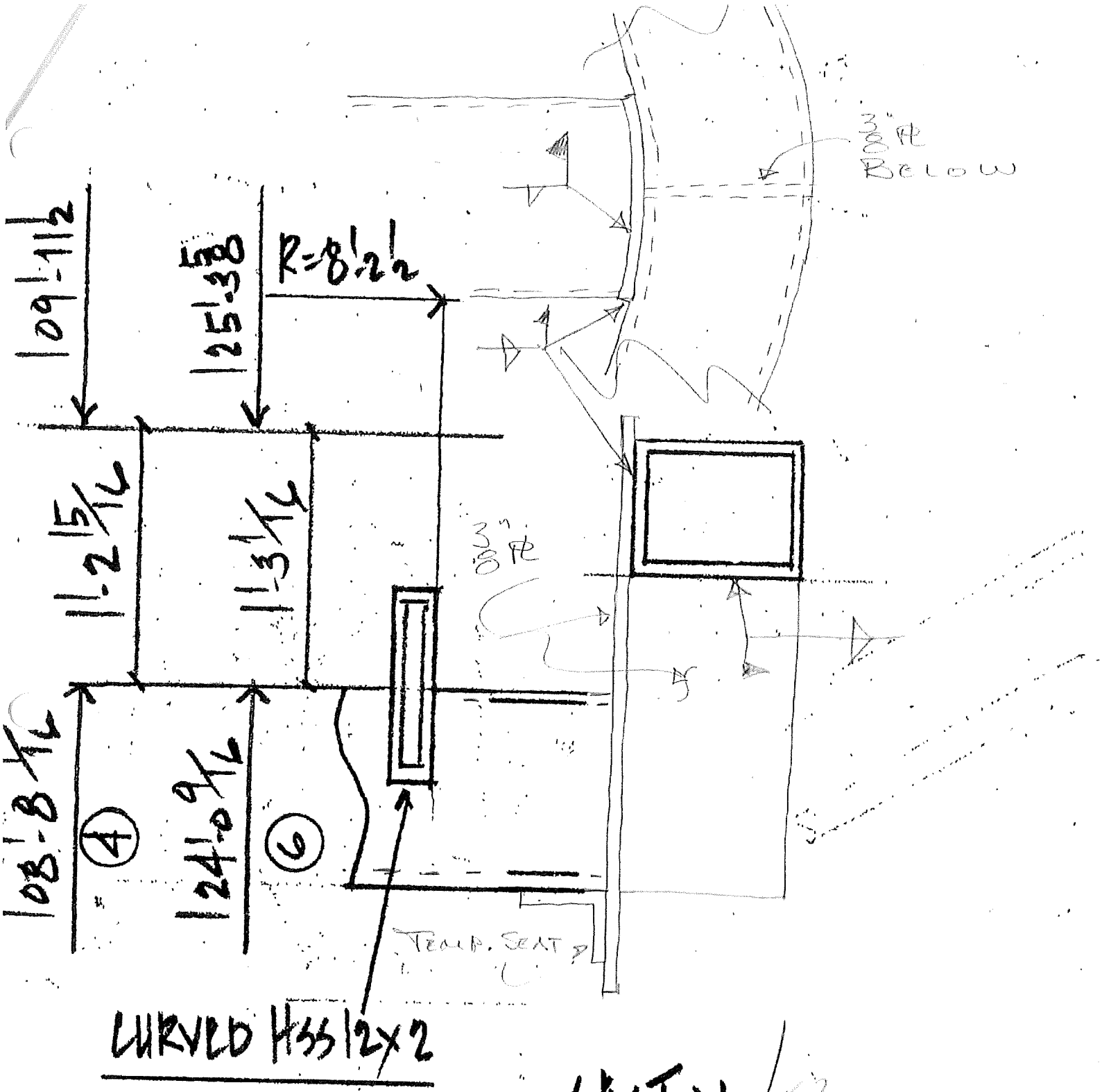
R_1 = 10 KIPS

$\ell_{WELD} \geq \frac{10K}{2.78\ K/IN} = 3.6"$

3/16 FILLET

$R_2 = R_3 = \frac{10K(11")}{15.5} = 7.1K$

$\ell_{WELD} \geq \frac{7.1K}{2.78} = 2.6"$



CURVED HSS 12x2

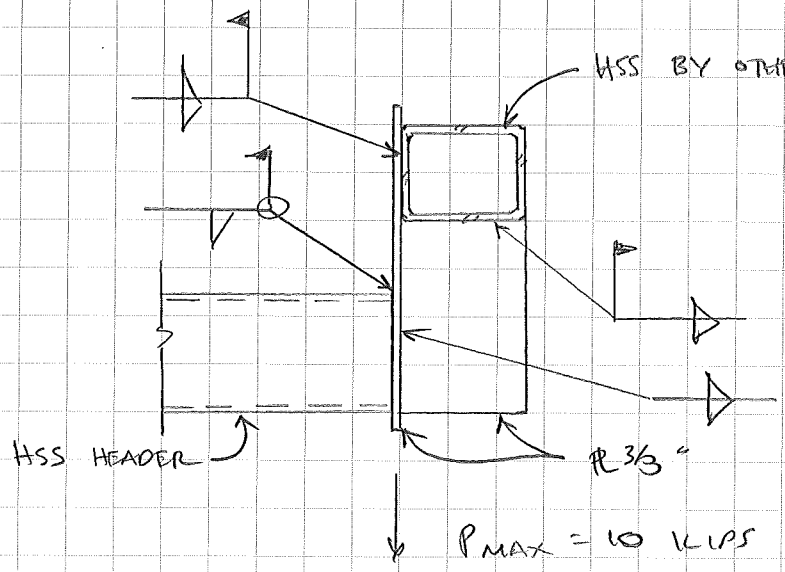
SECT. V / E3

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

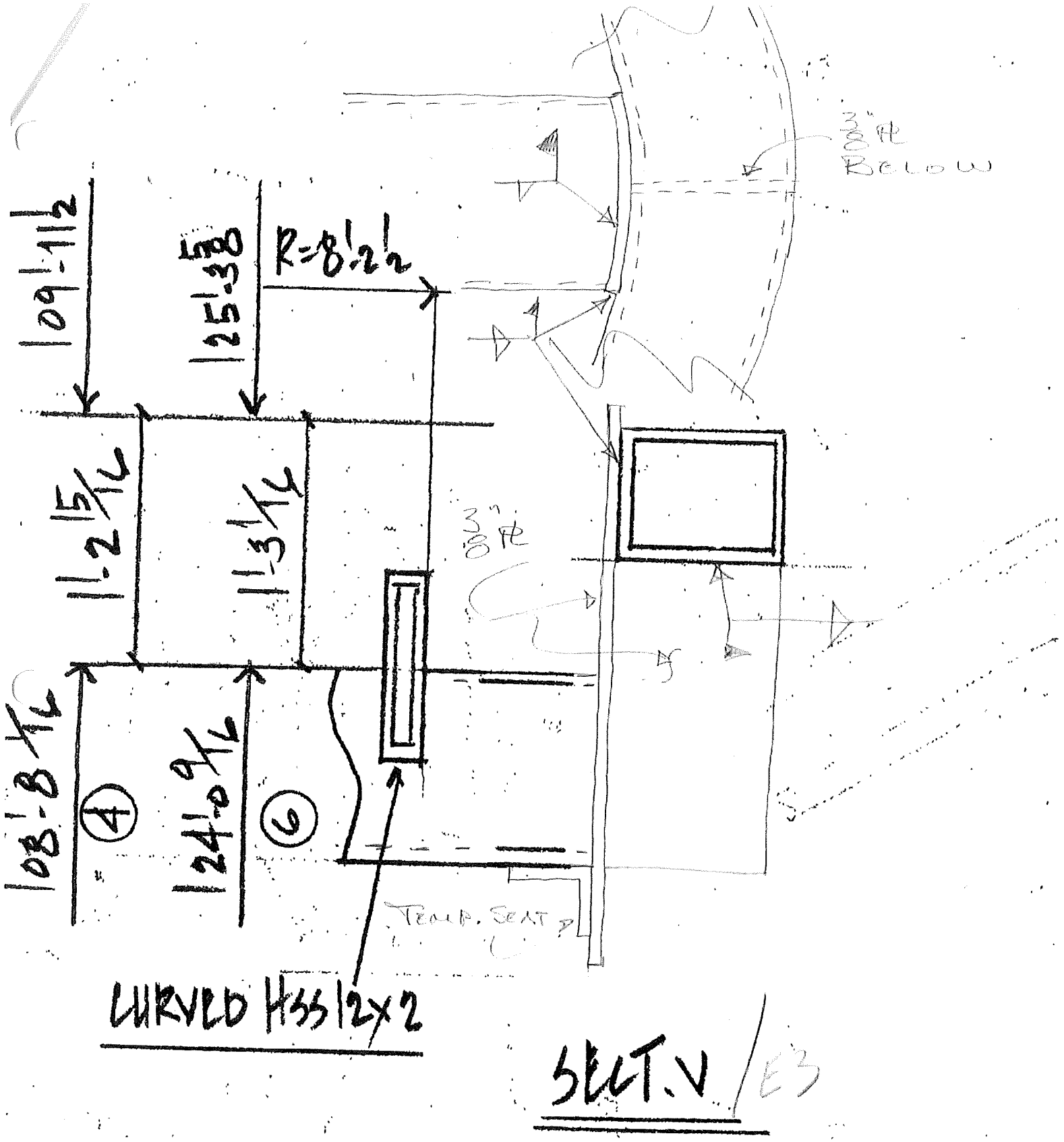
SUBJECT STAIR #2

BY VLC DATE 11/9/2016 SHEET NO.

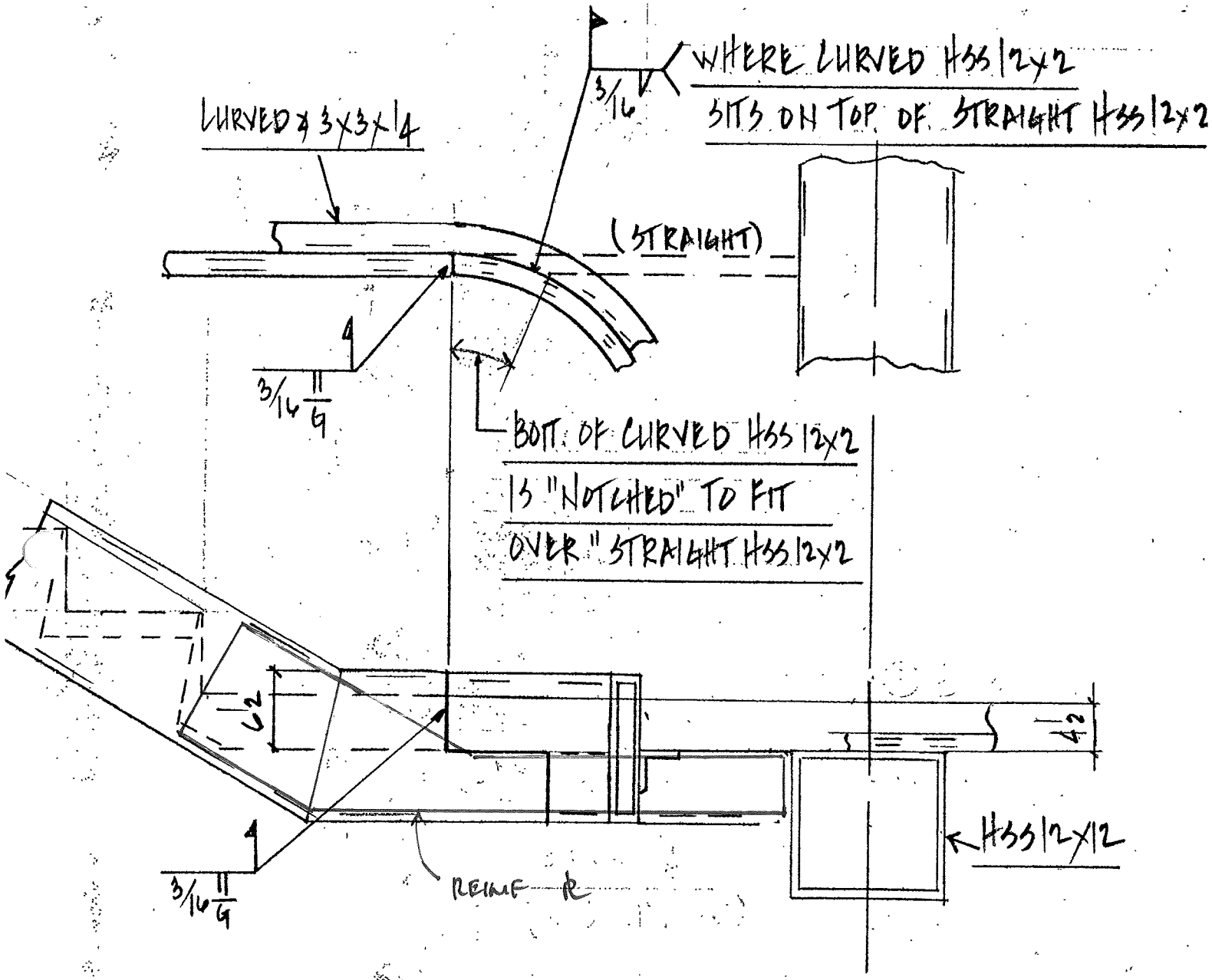
- DESIGN HANGER CONNECTION FOR HSS HEADER)



$\ell_{WELD} = \frac{10\ K}{2.78\ K/in} = 3.6"$


109'-11 1/2"
125'-3 3/8"
R=8'-2 1/2"
11'-2 5/16"
11'-3 1/16"
108'-8 1/16"
124'-0 9/16"
4
6
3" Ø PIPE BELOW
3" Ø PIPE
TEMP. SEAT
CURVED HSS 12x2

SECT. V / E3


WHERE CURVED HSS 12x2
SITS ON TOP OF STRAIGHT HSS 12x2
3/16
CURVED 3x3x1/4
(STRAIGHT)
3/16
BOTT. OF CURVED HSS 12x2
IS "NOTCHED" TO FIT
OVER " STRAIGHT HSS 12x2
12
42
HSS 12x12
3/16
RELIEF R

SECT. TT

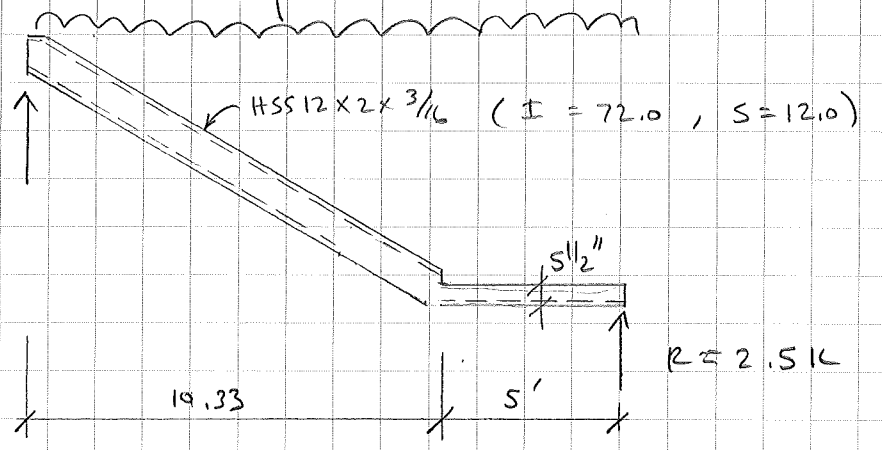
JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR # 2

BY VLC DATE 11/10/2016 SHEET NO.

- CHECK TUBE STRINGER W/ REDUCED SECTION

$w = (35+100)\left(\frac{4.5}{2}\right) + 19 \text{ PLF} = 322 \text{ PLF}$



$M_{MAX} = \frac{322(15.33)^2(12)}{8(1000)} = 114 \text{ K-IN}$

$M_{RED} = \frac{322(10.33)}{2}(15.33-10.33)\left(\frac{12}{1000}\right) = 100 \text{ K-IN}$

$I = \frac{5(225)(15.33)^4(1728)}{384(29000000)(0.125)} = 38.6$ (LL)

* REINFORCE REDUCED SECTION W/ 1½ x 5" BAR

$I = \frac{1}{12}(1.5)(5)^3 = 15.6 \text{ in}^4$

$S = \frac{1}{6}(1.5)(5)^2 = 6.25 \text{ in}^3$

$f_b = \frac{M}{S} = \frac{100}{6.25} = 16 \text{ KSI}$

USE 1½ x 5" A36 BAR

JOB NO. 1603.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

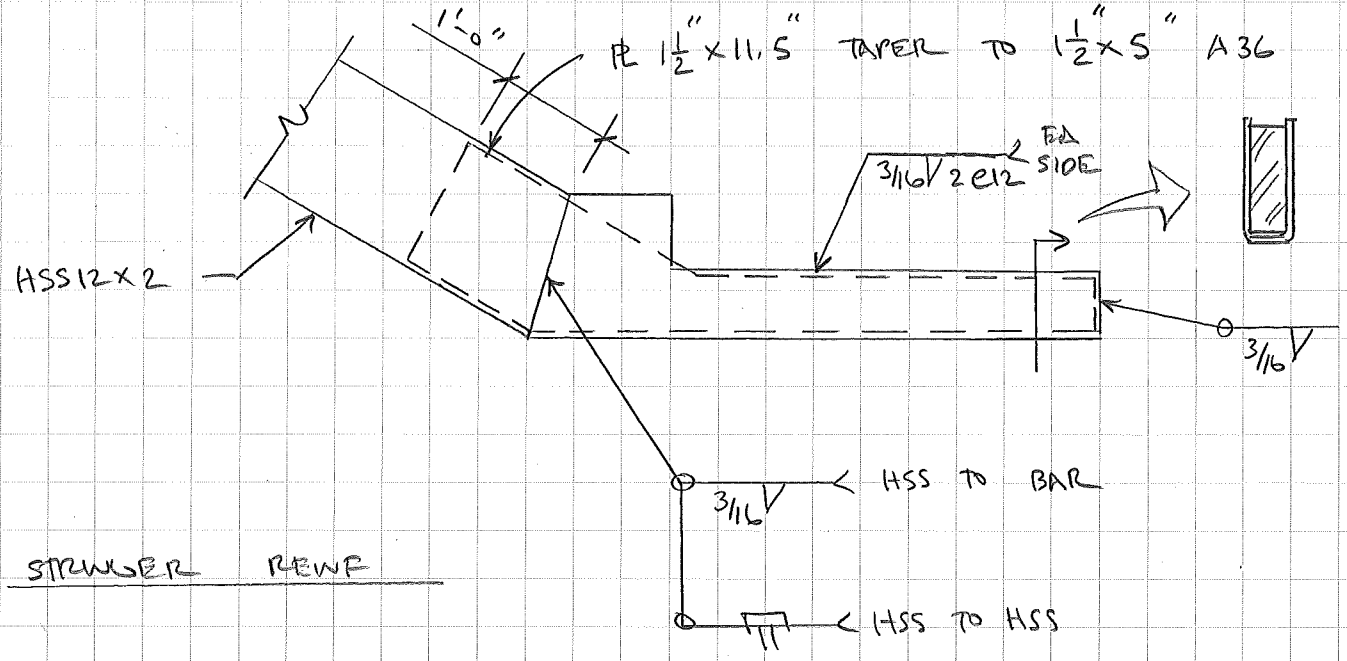
BY VLC DATE 11/14/2016 SHEET NO.

- DETERMINE LENGTH OF 3/16" FILLET WELD TO TRANSFER MOMENT

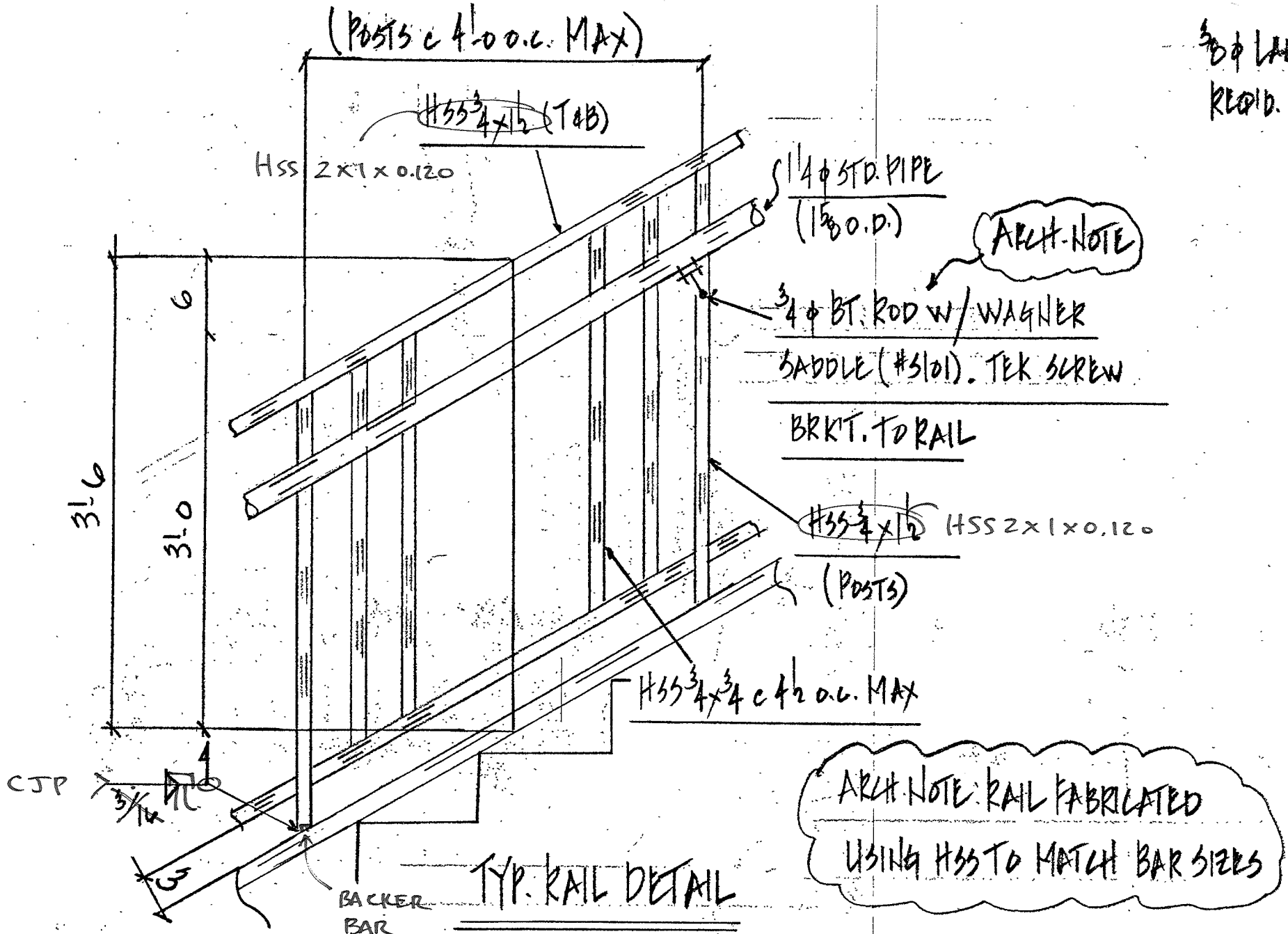
$$l \geq \frac{100 \text{ K-IN}}{11.5"(2.78 \text{K/IN})} = 3.13" \quad \text{SAY } \underline{\text{OK}}$$

- DETERMINE LENGTH OF 3/16" FILLET WELD TO TRANSFER SHEAR AT END OF STRINGER

$$l \geq \frac{2.5\text{K}}{2.78 \text{K/in}} = 0.9" \quad \text{SAY } \underline{\text{OK}}$$



STRINGER REINF


(POSTS @ 4'-0 O.C. MAX)
HSS 3/4 x 1/2 (T&B)
HSS 2 x 1 x 0.120
1 1/4 ϕ STD. PIPE
(1 5/8 O.D.)
ARCH. NOTE
3/4 ϕ BT. ROD W/ WAGNER
SADDLE (#5101). TEK SCREW
BRKT. TO RAIL
HSS 3/4 x 1/2
HSS 2 x 1 x 0.120
(POSTS)
HSS 3/4 x 3/4 @ 4 1/2 O.C. MAX
3'-6
6
3'-0
4
CJP
3/16
PL
6
BACKER
BAR
TYP. RAIL DETAIL
ARCH. NOTE: RAIL FABRICATED
USING HSS TO MATCH BAR SIZES
3/8 ϕ LAG
REQ'D.
POST / POST
1

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR # 2

BY VLC DATE 11/10/2016 SHEET NO.

- CHECK GUARDRAIL & HANDRAIL:

DESIGN LOADS: UNIFORM LOAD = 50 PLF
POINT LOAD = 200 #

I. CHECK HANDRAIL: PIPE 1 1/4 STD
$I = .195\ in^4$
$S = .235\ in^3$
$Z = .324\ in^3$

MAX SPAN = 4.0'

LRFD: $w_u = 1.6(50) = 80$ PLF
$P_u = 1.6(200) = 320$ #

$$M_u = \frac{80(4)^2(12)}{8(1000)} = 1.92 \text{ K-IN}$$

OR $$= \frac{320(4)(12)}{4(1000)} = 3.84 \text{ K-IN} \leftarrow \text{CONTROLS}$$

$$\phi M_n = 0.9(35)(.324) = 10.2 \text{ K-IN} > 3.84$$

OK

USE 1 1/4" STD PIPE

JOB NO. 16103.01 JOB WEBSTER UNIVERSITY STAIRS

SUBJECT STAIR #2

BY VLC DATE 11/10/2016 SHEET NO.

II CHECK TOP RAIL; TRY HSS 2.0 X 1.0 X 0.120
I = 0.322 S = 0.322

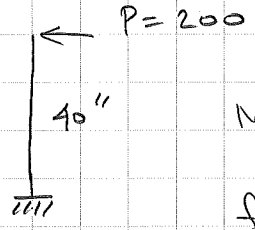
ASD; w = 50 PLF
P = 200 #

$$M = \frac{200(4)(12)}{4(1000)} = 2.4 \text{ K·IN}$$

$$f_b = \frac{M}{S} = \frac{2.4}{0.322} = 7.5 < 0.66(46) = 30 \text{ KSI}$$ OK

$$\Delta_{LL} = \frac{200(4)^3(1728)}{48(29000000)(.322)} = 0.049'' \text{ OK}$$

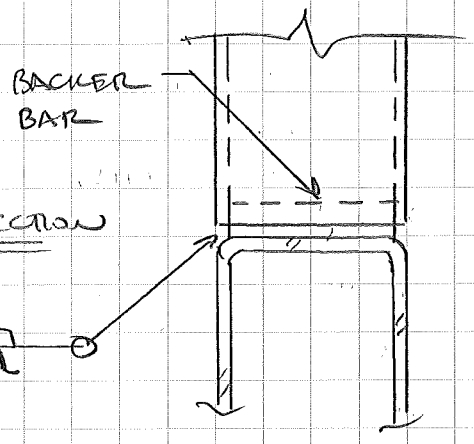
III CHECK GUARDRAIL POSTS; TRY HSS 2.0 X 1.0 X 0.120
I = 0.322 S = 0.322



$$M = \frac{200\#(40'')}{1000} = 8 \text{ K·IN}$$

$$f_b = \frac{M}{S} = \frac{8}{0.322} = 24.8 \text{ KSI} < 30 \text{ KSI}$$ OK

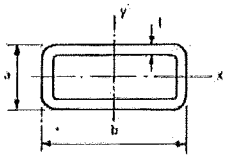
WELD AT BASE;



& USE CJP BY INSPECTION

Table 5.39

RECTANGULAR TUBING



Steel

Stainless Steel

Some sizes listed may not be available in stainless steel. Check with supplier.

a	b	t	Area	I_x	S_x	r_x	I_y	S_y	r_y
.500	1.000	.065	.178	.007	.027	.194	.021	.043	.347
.500	1.250	.065	.211	.008	.033	.198	.038	.061	.425
.625	2.000	.083	.408	.026	.083	.252	.181	.181	.665
.750	1.000	.065	.211	.018	.048	.292	.028	.057	.367
.750	1.250	.065	.243	.022	.058	.299	.049	.079	.451
.750	1.500	.065	.276	.025	.068	.304	.078	.104	.532
.750	1.500	.083	.346	.031	.082	.297	.095	.127	.526
1.000	1.250	.065	.276	.043	.085	.394	.061	.097	.470
1.000	1.250	.083	.346	.052	.104	.387	.074	.119	.463
1.000	1.500	.065	.308	.050	.100	.402	.095	.126	.555
1.000	1.500	.083	.387	.060	.121	.395	.116	.155	.548
1.000	1.500	.120	.542	.079	.158	.381	.155	.206	.534
1.000	2.000	.083	.470	.078	.156	.407	.238	.238	.711
1.000	2.000	.120	.662	.102	.204	.392	.322	.322	.697
1.000	2.500	.083	.553	.095	.191	.415	.418	.335	.869
1.000	3.000	.083	.636	.113	.226	.421	.668	.445	1.025
1.000	3.500	.083	.719	.130	.261	.426	.997	.570	1.177
1.250	1.750	.083	.470	.117	.187	.498	.199	.228	.651
1.250	2.000	.083	.512	.131	.209	.506	.276	.276	.734
1.250	2.500	.083	.595	.159	.255	.517	.479	.383	.897
1.250	3.000	.083	.678	.187	.300	.526	.756	.505	1.057
1.250	3.500	.083	.761	.216	.345	.532	1.119	.639	1.213
1.500	2.000	.083	.553	.200	.266	.601	.314	.314	.753
1.500	2.000	.120	.781	.270	.359	.588	.429	.429	.739
1.500	2.500	.083	.636	.241	.322	.616	.540	.432	.921
1.500	2.500	.120	.902	.326	.435	.601	.741	.593	.906
1.500	2.500	.145	1.096	.382	.510	.590	.879	.703	.895
1.500	3.000	.083	.720	.283	.377	.627	.845	.563	1.084
1.500	3.000	.120	1.022	.384	.512	.613	1.167	.778	1.069
1.500	3.000	.180	1.490	.518	.690	.589	1.627	1.085	1.045
1.500	3.500	.083	.802	.325	.433	.636	1.240	.708	1.243
1.750	3.000	.065	.601	.323	.369	.733	.746	.497	1.114
1.750	4.000	.065	.731	.415	.474	.766	1.509	.754	1.440
2.000	3.000	.083	.802	.543	.543	.823	1.021	.681	1.128
2.000	3.000	.120	1.142	.746	.746	.808	1.416	.944	1.113
2.000	3.000	.188	1.64	.977	.977	.771	1.86	1.24	1.06
2.000	3.000	.250	2.089	1.147	1.147	.740	2.203	1.469	1.030
2.000	4.000	.083	.968	.696	.696	.848	2.053	1.027	1.456
2.000	4.000	.120	1.382	.958	.958	.833	2.870	1.435	1.441
2.000	4.000	.188	2.030	1.329	1.329	.810	4.075	2.038	1.417
2.000	4.000	.250	2.630	1.627	1.627	.787	5.109	2.554	1.395
2.000	5.000	.188	2.390	1.628	1.628	.825	7.181	2.872	1.733
2.000	5.000	.250	3.089	1.918	1.918	.790	8.470	3.388	1.660
2.000	6.000	.188	2.750	1.927	1.927	.837	11.481	3.827	2.043
2.500	4.000	.180	2.210	2.236	1.789	1.005	4.733	2.366	1.463
2.500	5.000	.180	2.570	2.721	2.177	1.029	8.227	3.291	1.789
3.000	4.000	.120	1.622	2.412	1.608	1.219	3.774	1.887	1.525
3.000	4.000	.188	2.390	3.419	2.279	1.196	5.390	2.695	1.502
3.000	4.000	.250	3.105	4.278	2.852	1.174	6.795	3.398	1.479
3.000	5.000	.188	2.750	4.135	2.757	1.226	9.273	3.709	1.836
3.000	5.000	.250	3.535	4.934	3.290	1.150	10.960	4.386	1.760
3.000	6.000	.188	3.110	4.852	3.235	1.249	14.531	4.844	2.161
3.000	6.000	.250	4.057	6.098	4.066	1.226	18.546	6.182	2.138
3.000	8.000	.188	3.894	6.162	4.108	1.258	29.139	7.285	2.735
3.000	8.000	.250	5.089	7.567	5.045	1.219	36.531	9.133	2.679
4.000	6.000	.188	3.470	9.333	4.666	1.640	17.580	5.860	2.251
4.000	6.000	.250	4.533	11.854	5.927	1.618	22.499	7.500	2.228
4.000	6.000	.375	6.454	28.553	9.518	2.103	15.097	7.549	1.529
4.000	8.000	.188	4.269	11.837	5.919	1.665	34.862	8.715	2.858
4.000	8.000	.250	5.589	14.782	7.391	1.626	44.042	11.010	2.807
4.000	8.000	.375	7.954	59.860	14.966	2.743	20.042	10.021	1.587