#### Southern California Edison Company

P. O. BOX 800 2244 WALNUT GROVE AVENUE ROSEMEAD, CALIFORNIA 91770

M. O. MEDFORD MANAGER, NUCLEAR LICENSING

April 26, 1985

Director, Office of Nuclear Reactor Regulation Attention: J. A. Zwolinski. Chief Operating Reactors Branch No. 5 Division of Licensing U. S. Nuclear Regulatory Commission Washington, D.C. 20555

Gentlemen:

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- Subject: Docket No. 50-206 SEP Topic II-3.B, Flooding Potential and Protection Requirements San Onofre Nuclear Generating Station Unit 1
- References: A. Letter, Walter A Paulson, NRC, to Kenneth P. Baskin, SCE, dated August 27, 1984
  - B. Letter M. O. Medford, SCE, to D. M. Crutchfield, NRC, dated February 24, 1984

The Reference A letter provided the NRC staff's Safety Evaluation Report on the subject topic. One of the conclusions of that report was that the structural capacity of the Fuel Storage and Ventilation Building roofs required further review. Two issues are associated with the rooftop loading. The first is the appropriate coefficient of discharge used in calculating flow through the scuppers. The second is the appropriateness of using a stress increase factor of 1.6 in the roofdeck stress calculations. In conversations with members of the NRC staff, the information necessary to complete the review was identified. This letter transmits the information necessary to resolve the rooftop ponding issue associated with this topic.

The ponding depths submitted in the Reference B letter were based on calculations that did not consider a coefficient of discharge. The coefficient used in the enclosed calculations is 0.82. This number is greater than the NRC recommended value of 0.6, but is justified by review of the "Handbook of Hydraulics" by King and Brater (6th Edition). The NRC recommended value of 0.6 is an average value for sharp edged circular orifices under medium to high head. This is not an appropriate modeling of the SONGS 1 scuppers. The orifice and head configuration assumed by the NRC acts to maximize the contraction of the jet and results in a low coefficient of Drawings TO Raveson Adars discharge. There are three reasons why the scupper configuration has a higher coefficient of discharge than 0.6. The first is the length of the scupper in



TELEPHONE (818) 302-1749

#### Mr. J. A. Zwolinski

relation to its area. The handbook cited above, on page 4-19, defines a standard short tube as a tube whose length is 2 to 3 times its diameter. In such cases the coefficient of discharge generally used is 0.82. Relating the scupper dimensions (2 inch by 8 inch rectangular) to tube diameters would yield length to diameter ratios of 4 to 1 and 1 to 1 respectively. with an average value of 2.5. This value is within the defined range for a standard short tube. If an equivalent diameter of tube is considered based on the area of the scupper, the length to diameter ratio is 1.8, also very near the defined range. Table 4-10 of King's handbook further confirms this coefficient. In that table a coefficient of 0.80 is listed for the orifice dimensions and end conditions of the scuppers. It should be noted that while this table is for submerged tubes, pages 4-9 and 4-10 indicate that submergence does not greatly affect the coefficient. The second reason for a greater than 0.6 coefficient is the rectangular shape. Table 4-5 of King's Handbook indicates that a rectangular orifice similar to the scuppers would have a coefficient 3% greater than for a circular orifice with the same area and head conditions. The third reason for a 0.82 coefficient is due to the low head of the orifice. Figure 4-6 of King's Handbook indicates an increase in the coefficient for low heads.

The revised maximum rooftop ponding depths on the Ventilation Equipment and Fuel Storage Buildings due to the inclusion of this coefficient of discharge were determined to be 5.3 inches and 9.07 inches respectively as opposed to the 5.00 inch and 7.64 inch values previously submitted.

The second issue requiring resolution is the justification for using a stress increase factor of 1.6 in the roof deck calculations. Upon reexamination of the bending calculations to consider the revised ponding depths and to determine the necessity to take credit for the 1.6 stress increase factor, it was determined that the bending stresses resulting from these ponding loads are below the allowable stresses with no credit taken for the 1.6 factor. The allowable stress is in accordance with AISI publication "Specification for the Design of Cold-Formed Steel Structural Members." Enclosure 2 is a copy of the calculations for the roof framing and deck analysis. Also enclosed as requested by members of the NRC staff to assist in reviewing the bases for these conclusions are SCE Design Drawings Nos. 567676, 567677, 567678, 567892, 568139, 568140 and 568145; Specification No. 3246-BS0-258-1-1 by Inland Steel Products Co.; and portions of Inland Floor System Catalog No. 270 indicating properties and material for Type BF 18-16 decking.

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Mr. J. A. Zwolinski

April 26, 1985

This information should be sufficient to conclude your review and confirm our determination that these rooftops are adequately designed to withstand ponding loads resulting from a Probable Maximum Precipitation event at the San Onofre site. If you have any questions, please contact me.

Very truly yours,

m.o. medford

Enclosures

- 1. Calculation, "Roof Ponding of Fuel Storage Building and Ventilation Building, Part IVA"
- 2. Calculation, "Roof Ponding of Fuel Storage Building and Ventilation Building (Structural) Part IVB"
- 3. SCE Drawing Nos. 567676, 567677, 567678, 567892, 568139, 568140, 568145
- 4. Inland Steel Products Specification No. 3246-BS0-258-1-1
- 5. Inland Floor Systems Catalog Page 18

CALCULATION TITLE PAGE

PROJECT SONGS   PMF JOB ORDER	NO. 6733 DISCIPLINE CIVIL
SUBJECT: ROOF PONDING OF FUEL STORAGE BUI	DING AND VENTILATION BUILDING
CALCULATION NO. DC 99 PART I A	NO. PAGES <u>8</u>
RESPONSIBLE ENGINEER (signature) <u>T. WAN</u> INDEPENDENT REVIEW ENG. (signature) <u>D. SCH</u>	AFER Dally, John DATE 12/2/83

ORIGINAL ISSUE

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GROUP LEADER	C. M. Knarr	2-14-14	_ culturan_
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RECORD OF REVISIONS

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SCE 26-121 REV 7/81

### ENGINEERING DEPARTMENT CALCULATION SHEET

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DESIGN CALCULATION NO OF **Design Requirements** DC 99 -- IV A DESIGN INPUT SHEET 2 Я Design Input Change PROJEC SUBJECT ROOF PONDING OF FUEL STORAGE BLDG AND VENTLATION BLDG SONGS 1 PMF SPECIFICATION REFERENCE QUALITY CLASS SAFETY RELATED Design Input Purpose: Studies the PMP roof top ponding of fuel storage building and ventilation building in case the roofdrams are clogged. References: 1. SCG DW6'S 56 8145, 567676, 567677, 567678, 567892. 2. Design of Roadside Drainage channels", by U.S. Bureau of Public works. 3. "Handbook of Hydralics", by King, 5th Edition. 4. Probable Maximum Flood Project Design Criteria Manual, SONGS 8/31/77. Design Assumptions: 1. Time of concentration for design = 5 min. use Rational Method to determine the peak flow. DATE ENDENT REVIEW ENGINEER DATE RESPONSIBLE ENGINEER GROUP LE DATE 2-14-12-9-83 12/2/83

SHEEI О ENGINEERING DEPARTMENT CALCULATION SHEET CALCULATION NO. DC \_\_\_\_ P9 \_\_ IP A SUBJECT: Roof Ponding of Fuel Storage Bldge Ventilation Bldg. 3/30/83 CHK. BY \_DATE <u>5-4-83</u> MADE BY Datson/T. Wang 6733 DATE\_ J.O. NO. Dwg 568145. I. Ventilation Bldg. (SKETCH) 567676 42-8 overflow Scupper Bot. EL 39-0 = (2"x8") 8"Wall7 EL 38-7 THE STROOT Drain L VX3X4 (all around) 9015-8 18 ŝ 9 El. 39-0 TOS, 39-2% TOR 6-4 7-4 4-4 \$-3 8-2 8-3 Root area = 20 x 42.67 = 853,4 sq. ft. TOS EL 39:0 I"Insulation ( 12" Metal Roof TOS EL 38-7 EL. 39-10 <u>EL 39-0</u> TYP. Tzy Port Top of Roof 8.B15-2 EL38-91/2 L2 NOWS of 36" A A325 boits Section (A DWG. NO. 568145 567676

8 SHEETS HEET OF L ENGINEERING DEPARTMENT CALCULATION SHEET CALCULATION NO. DC \_\_\_\_\_ - \_\_\_ A SUBJECT: Roof Ponding of Fuel Storage Bldg & Ventilation Bldg G. Dotson DATE 3/30/83 DATE 4-1-83 6733 T. Wang MADE BY J.O. NO. Dwg. 568 145, 567676 I. Fuel Storage Blog. (SKETCH) <u> 46</u>-8 26-4 8-4 11-1 9:8 1245-3 52 Open 2 Area 12 819 2 r 8"Wall 12 WF 45-3 CRANE) Overflow Scupper Bot El 65-0 (2"x8") 31.8 CRANE 4" Roof Drain 122 °Ò Overflow Scupser Bot EL 65-0 (2"x8 ġ 00 3" Roof Drain Area "B" Area "A" 2819 Slope 6" 9 Stope 6". TOS 65-0 TOR 64 - 83" TORGQ'-BY 105 64-6 TOS 64-12 WF 45-3 27-9 18-11 High Point Root Area A Area = 27.75 × 56.25 + 12.42 × 11.08 = 1698.60 Area B" 18,92 x 48,67 + 7,58 x 9.67 + 12,42 x ,92 = 1005.6 Sq. ft. Total = 2704.2 Sy 12. DWG. NO. 568145

OF 8 SHEETS 5 ENGINEERING DEPARTMENT CALCULATION SHEET CALCULATION NO. DC \_\_\_\_99\_\_\_ IV A SUBJECT: Roof Ponding of F.S. BE' V.B SJ-T. Wang & DOKTOATE 3/10/83 DATE 4-1-83 \_СНК. ВУ <u>673</u> MADE BY J.O. NO. I. Fuel Storage Bldg. (SKETCH) 46-8 Overflow Scupper Bott, EL 65-0 (2"x8") 18-11 6418/2 TOR EL 64-6 T.O.S. 6" <u>6</u>" 9:21/2 9-2 9-2 1-11 9:2 TOR 65-2% EL 65-0 12 819 L A"Roof EL.6540 Drain TOS 4 faipper 1 Roof 31/2" TOR 64-81 12WF 45-3 12HF 45-3 L3x3x 1/4 Top of Roof EL. 64-8! 12 [3].8 Crane Beam Section 568145 DWG. NO. H1.7676

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SUBJECT: Root Ponding of FSB # V.B CALCULATION NO. DC \_\_\_\_\_ -\_\_\_ J.O. NO. 6733 MADE BY T. Wang DATE 3/30/83 CHK. BY 4- DATE 4-1-83 no Rev. 1 V. Fonding on Fuel storage Building Reof Aren A whter accumulated P=3.5" R=CIA  $=1 \times 14.5 \times \frac{1698.6}{43.560} = 0.565 \text{ cfs}$  $Q_{t} = \frac{2}{3}\sqrt{2g} \left(h_{2}^{3/2} - h_{1}^{3/2}\right)$  $h_2^{3/2} - \left(h_2 - \frac{2}{12}\right)^{3/2} = \frac{0.565}{(0.82)_3^2 \times \frac{8}{12} \sqrt{2\times 32.12}} =$ 0.1932 h = 0.48' = 5.76" 0.68 8.16 Ponding Hp = 5.76735 = 9.26" > 6" (The High Ridge point of the Roof) 8.16 The water will flow over to the other side of roof "B' Area B  $Q = 1 \times 14.5 \times \frac{1005.6}{43.560} = 0.335$  cfs  $h_{2}^{3/2} - (h_{2} - \frac{2}{12})^{3/2} = \frac{0.335}{0.335} = 0.5940$   $\int_{12}^{(0.82)} \frac{1}{3} \times \frac{5}{12} \sqrt{2} \times \frac{32.2}{0.1145}$ h = 0,23 = 2,76 0,296 3.55 Ponding Hp = 355 7105 76" ( The High Ridge point of the Roof) The water will also flow over to the other side of roof A Take "A" & "B" as one Aren, A = 1698.6+1005.6 = 2704,20  $Q = 1 \times 14.5 \times \frac{27042}{43.560} = 0.90$  efs  $h_{2}^{3/2} - (h_{2} - \frac{2}{12})^{3/2} = \frac{0.900}{(0.82)^{\frac{2}{3}} \times \frac{2KB}{\sqrt{2}} \sqrt{2\times32.2}} = \frac{0.126}{0.15386}$ h = 0.345 = 4.14 Ponding =  $H_p = 4.17 + 3.5 = 4.07$ DWG. NO. 567676

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CALCULATION TITLE PAGE

PROJECT <u>SONGS | PMF</u> JOB ORDER NO. <u>6733</u> DISCIPLINE <u>CIVIL</u> SUBJECT: <u>ROOF PONDING OF FUEL STORAGE BUILDING AND VENTILATION BUILDING (STRUCTURAL</u>) CALCULATION NO. <u>DC 99 PART IZ B</u> NO. PAGES <u>26</u> RESPONSIBLE ENGINEER (signature) <u>Lighthan</u> <u>PAPE 9/18/84</u> INDEPENDENT REVIEW ENG. (signature) <u>MPR/VENTICAL</u>

ORIGINAL ISSUE

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RECORD OF REVISIONS

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DESIGN	INPUT	SHEET
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Design Requirements Design Input Change



PROJECT SUBJECT ROOF PUNDING OF FUEL STORAGE BUILDING AND VENTILATION BUILDING (STRUCTURE) SONGS 1 PMF SPECIFICATION REFERENCE SAFETY RELATED Design Input\_ frame integrity of Ventilation Equipment Building Purpose: Evaluate the root and fuel storage Building for PMP reaftop panding roofdrains are clogged References: 1. SCE DWG'S 568145, 567676, 567677, 567678, 567892 2. AISC, "Steel construction Manual", 6th & B th Edition 3. Steel Deck Institute Dessign Manual, By SDI "Floor Systems" Catalog NO. 270, 1963 by INLAND STEEL PRODUCTS CO. 4. 5. "Simplified Steel Design," by HSC, 1975. Bechtel Calculation Book 5, DC26, SON65 6. Cadculation DC 99 Part IVA for PMP calculation. . . . 7. Design Assumptions: 1. Concrete : fe'= 2500 psi, fc=1125 psi 2. Structural steel: fy = 36,000 psi (A36) Bolt connections, A325 botts Friction Type 3. Metal Deck : INLAND B.F-18-16 GALV. ASTM A 446, fy = 33,000 Psi, fs = 20,000 psi 4. Concrete Block Walls: Hollow Grade At units fm = 1350 psi, fm = 450 psi, V = 60 psi (shear wall) ts = 20,000 psi, Es = 30,000,000 psi Em=1,350,000 p4i, N=22 5. No seismic, wind, or normal L.L. is considered with the PMP condition . Condition INDEPENDENT REVEW E SIBLE ENGINEER DATE orman

CE 26-88 REV 6/81

OF 65 SHEETS SHEET 3 GINEERING DEPARTMENT CALCULATION SHEET SUBJECT: Roof Ponding of Fuel Storage Blage Ventilation Blag (STR EALCULA - I B TION NO. DC \_\_\_\_\_99\_\_\_\_ 3/30/83 CHK. BY\_ MADE BY Dotson/T. Wang DATE 5-4-83 6733 DATE\_ J.O. NO. I. Ventilation Blog. (SKETCH) (A Dug 568145. 567676 42-8 Overflow Scupper, Bot. EL 39-0 ± (2"x8") 8"Wall-El 38-7 Tos \_\_\_\_\_ 38-9% Top 3" Roof Drain L VX3X 1 (all around) 0 EL. 39-0 TOS 39-24 TOR 6-4 8-3 8-3 8-2 20 x 42.67 = 853,4 59.12. Root area = in the second TOS EL 39:0 1"Insulation ( 12" Metal Roof Tos EL 38-7 EL. 39-10 EL 39-8.B15-2 Top of Roof Is nows of 36"4 A325 boits 5638-91/2 Section DWG. NO. 568145 567676

SHEET OF 25 SHEETS 4-ENGINEERING DEPARTMENT ALCULATION SHEET - IIB SUBJECT: Roof Ponding of Fuel Storage Bldg & Ventilation Ridg(STRADSIGN TION NO. DC \_\_\_\_99\_\_\_ T. Wary G. Dotson DATE 3/30/83 6733 J.O. NO.\_\_ CHK. BY MADE BY I. Fuel Storage Blog. (SKETCH) Dwg. 568 145, 567676 46-8 26-4 8-4 11-1 9:8 12 WE 45-3 Open Area 12 819 ሳ 2 r 8"Wall 21445-3 -Overflow Scupper Bot El 65-0 (2"x8") 4" Roof Drain 20 Overflow Scupper Bot EL 65-0 (2"x8" 00 3" Root Drain Arca "B" Area "A" Slope 6" Slope 6 TOR 64-83" TOS 64-6 TOS 65-0 TORGQ'-B TOS 64-6 12 WF 45-3 27-9 18-11 High Point Root Area = 27.75 x 56.25 + 12.42 × 11.08 = 1698.60 Area 18,92 × 48.67 + 7.58 × 9.67 + 12, 42 × ,92 = 1005.6 Sg B. Area B Total = 27.04.2 Sq. 12. DWG. NO. 568145 3/32 567676 77 (CW

OF 25 SHEETS SHEET ζ ENGINEERING DEPARTMENT CALCULATION SHEET CALCULATION NO. DC \_\_\_\_\_ 99 - IV B SUBJECT: Roof Ponding of F.S. B & V.B. (STRUCTUREL) 3/10/83 出 T. WALLAR, DOKODATE <u>6733</u> DATE 4-1-83 СНК. ВУ MADE BY J.O. NO. I. Fuel Storage Bldg. (SKETCH) 16'-8 Overflow Scupper Bott, EL 65-0 (2"x8") 18-11 6" 9:219 9:2 9-2 6" <u>|</u>-// 9:21/2 9-2 TOR 651 21/2 EL 65-0 64-8% TOR 12 819-2. TVA A"Root EL 64 6 EL,6540 Drain Ŧ.Ō.Š. TOS V Soupper TOR 64-8% + Roof 12NF 45-3 12WF45-3 31/2" L3x3x 1/4 . TOP OF ROOF 12131.8: EL 64-8% Crane Beam Section DWG. NO. 568145 567676 to see .

# CALCULATION SHEET

T

SUBJEC	T:Ro	of Pi	ondih	g of	FS	ΒĘ	VB	(5	TRUC	TURA	+L)	DESIGN Calcul	ATION NO.	oc _99	-	$-\blacksquare$	в
J.O. NO.	6-	733	٩	MADE B	Y	Tin	lang		C	DATE_	9/9	5/84	СНК. ВҮ	45	DAT	<u>=  2</u>	3 - 80
	·			 			I., 1.	- <u>'</u> 4 1					13 2		1	÷	
₩_, С	HECK	PONV	WO (	N ALL	OKAN		/VITH	<b>A</b> -1	56	SPE	<. 5.	C C · I ·	())	<b></b>			
· * •/*			i a				· ,							· • •,	A	· · ·	• •
· · · · ·	Meta	l De	ck :	INC	AND	B	F-18	3 -1	6	GAL	<b>V.</b>	(51	р <del>а</del> . #BS	0-25	8)	•	. :
	· · · · · · · ·		-	Т. <del>с</del>	= 0 10	i my	1 6.	: = D.	LA.	m3/1	1	NIAND	FLOAR SY	stens (	tuloa	7. 71 19	162)
			••• • • • •				∵ ت. ™ آلا	<b>.</b>	<b>-</b> -1						i i i i i i i i i i i i i i i i i i i	-70,11	
			<u>}</u>	fy	= 3	3,000	](A5	TM	A 4	46)	· ر	fs =	20,000 f	รเ		;	; ; ;
- به م م		:! 		ω	= 5.	5 #/c	7	•••••••		· • • • } • • • •		· · · · ·	·····	,, , , , , , , , , , , , , , , , , , ,			
		] 								·	, 						11/2
<u>A.</u>	VENTI	LATIC	N B	LDG				· · · · · ·	: : :				<u> </u>	24"			
	Beau	n 813	\$15.	·	· • • • • • • • • • • • • • • • • • • •				; ;- ; ; ;	• • • •	•	:	· - +	Metal	Peck	•••••	
· · · · · · · · ·		,	- in		; ; ) , _ //			, ii		· · ·	••		· · · · · · · · · · · · · · · · · · ·		: :		
	/†	=4.4	5,-	a – D	).(2 		f = 2	•   · _		•	: 			20'			· · · · · · ·
	S <sub>x</sub>	= 11.	8m3	I,=	48~	<b>4</b>						1		Lp		1	1
	Per	ALS (	- Spe	<b>7</b> .5	EC:1,	13.3	com	mer	ta r	7		1			-	MASO	nry
				j	AL 0			_		l		-				Wan	
	The	STA bi	ury i	iyam	Lev F	- nam	9 - J	<u> </u>	100	T		-	8B15.	2	·		
	con si	3 <i>Hng</i>	of a	mete	al ro	of o	lick	of	rel	the	1 L			KC I	•		LS 8,2
	Slen	tei	dept	L - 51	nan	ratio	ma	y. b.	e a	nalyz	red	· · · · · · · ·					<b>-/</b>
· · · · · · · ·	by r		1 12	31		×/2	3.7	0.4		mista	nts	-			<u>z'</u>		
		77		· · · · · · · · · · ·											· · · · · · · · · · · · · · · · · · ·	+	
	up,	Us	, Ср	and	Cs (	26	speci	fiel	7 n	n th	<b>.</b>						·
	spec	. <b>T</b>	he m	etal.	dec	k m	any be	• <del> </del>	ren	ted	as .	a	Ventil	ation P	ldg Fr	aming	
	Secon	dary	i me	mber	· · ·	 			· ·					3			
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· · · · · · · · · · · · · · · · · · ·	<u> </u>							+	1		3		DWG. NO	. 5681	45	,	

# CALCULATION SHEET

SUBJECT:	Root Pon	ding of 1	-SB & VB (ST	eucrural)	DESIGN CALCULATION N	10. DC	99	IB
J.O. NO. 67	733		T. Wang	DATEQ/	<u>7/84 снк.</u>	ву	DATE	12-3-84
II. LCON	4.)	.,		· · · · · · · · · · · · · · · ·	:		• • • •	; ; ; ; ;
A. VENI	TILATION	BLDG (CONT	7.)	· · · ·				 : 
	for meta	Peck, (	as secondary	member)	•			P
	M, =	135 (8.	$\frac{25)^2}{114} = 114$	9 1#/ft wid	th (without	nt pond	ing) Ingr	- Kolish
	ſ	Mo _ 11	4.9 ×12 - 2,8	13 PSI	(see pg	.9, wp	= 13.5 70	"
	T0 -	5	0,49		2012			
	u <sub>s</sub> =	(0, 80 Fy -	$\frac{f_{\circ}}{f_{\circ}}_{s} = \frac{0}{2}$	80×33,000 2813	- 2813	8.39	· ·   . 	
·····		20 61	4 22/	$(825)^4$		· · · · · · · · ·		
	Cs =	107 IS	<u> </u>	(0.61)	= 0.048		······································	
				· · · · · · · · · · · · · · · · · · ·				
f	or Bear	~ 8BIS, 126(20)	(as primary )2	mein bor)				#// \
	Mo =	8	- = 6300	( W/o	ponding)	(See pg	.9. ~2p	120 )
	fo =	5	11.8 - 640	7				
	U, =	( 0,8 0 Fy -	$-f_{0}$ = 0	80× 36,000 -	-6407	3.50		
		Jan Ja	4	251/2214				
	Cp =		$\frac{-p}{p} = \frac{32(8)}{10}$	1 (49)	0,088	· · · · · · · · · · · · · · · · · · ·		
·····				35 / -	00081	• • • • • • • • • • • • • • • • • • •		
	rom rig		, for up=	<u>, , , , , , , , , , , , , , , , , , , </u>				
		· · · · · · · · · · · · · · · · · · ·	P ~ 0.0 >> 9.088	$= C_{0} C_{alm}$	unted			· · · · · · · · · · · · · · · · · · ·
	: Roof	Donding	is considered	of accord	ding to	AISC -	pec,	
	Howe	ver, such	this is an	extreme See Dos	10001 cas	e, roo	furen	cher
			er charce.		/			
	<i>L</i> ,							name :
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<sup>NG. NO.</sup> 568145 567676

OF 25 SHEETS SHEET 🎢 ENGINEERING DEPARTMEN CALCULATION SHEET Roof Ponding of FSB F, VB (STRUCTURAL) DESIGN CALCULATION NO. DC \_99\_\_\_\_ \_I B 6733 9/12/84 CHK. BY DATE 12-3-84 7. Wang MADE BY DATE ..... J.O. NO II. (CONT.) B. FUEL STORAGE BUILDING FOR AREA A" - 12 WF45 15 PRIMARY MEMBER, 12B19 15 SECONDARY MEMBER 5=9-2"  $L_{s} = 24', L_{p} = 27'-6''$  $I_{s} = 130, 1^{m^{2}}, I_{p} = 350, 8^{m}$  $C_p = \frac{32 L_s L_p^4}{10^7 I_p} = \frac{32(24)(27.5)^4}{10^7 (350.8)} = 0.125$  $C_{s} = \frac{32 \text{ s } L_{s}^{4}}{10^{7} \text{ t s}} = \frac{32(9,167)(34)^{4}}{10^{7}(130,1)} = 0.075$ Ip=350,8 42.8 GIR DURY (GI) MiD HID Cp+0.9 Cs = 0,125+0,9×0.075=0,200 D - 8 20,25 (0.K) for metal Deck, 12WF45  $\frac{2554}{10^6} = \frac{25(9,167)^4}{10^6} = 0,177^{104}$ < 0,61 = Id (0.14.) 8-5 ". Roof ponding is considered to be ok according to AISC Spee. However, since this is an extreme load case, roof member stresses will be checked. See pgs. 11-12 + 16-22. 568145 567676

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Roof Ponding of FSB & VB (Structural) Design Calculation NO. DC 99 - ID B MADE BY T. WANG DATE 2-3-84 N. DESIGN LOADS Design loads are calculated for accumulation of ponding at low point.  $W_{D} = 6.0 + 5.5 + 1.0 + 1.0 = 13.5 #/5'$ (Reofing) (Deck) (Insulation) (mechanical) L.L.: Ponding only (From Ref. 7) V Grand Charles Sand St A. VENTILATION BLOG preliminary, Hpl= 5.38, WLp = 62,4x 5.38 = 28 th at Low point HpH= 5,38-5=0,38, W2p=62,4x 0,38 = 2 10 at High point Deflection accumulation: (At point C, see Pg. 6)  $\frac{\text{Metal Deck}}{\text{Metal Deck}} \Delta_{Lp} = \frac{5}{384} + \frac{(0,028+0,002)}{(1728)} + \frac{1}{29,000} \times 0.61 = \frac{5}{384} + \frac{1}{29,000} \times 0.61 = \frac{1}{2$ : 0, 0,9" (too more the 3 spans)  $\Delta_{\text{DP}} = \frac{5}{384} \frac{a0135(8.55)^4(1728)}{29,000 \times 0.61} = 0.08\%$ Ap = 0.117" Beam 8B15 Wdp=13.5×8.25+15=126 W1p = 28 X8, 25 = 23 ( Low Point) =2×8,25 = 16,5 (High point) 8B15 l = 20', T = 48''' $W_{L_p} = \frac{(23) + 16.5}{7} (20) = 2,475$  $\Delta_{Lpmux} \cong 0.01304 \frac{WL^3}{ET} = 0.01304 \frac{2475(>0\times12)^3}{29,000,000\times98} = 0.321^{\prime\prime}, (at x = 9.5193L per Alsc)$ △Dmm = 384 -29,000 × 48 = 0.33 Ap= 0.65"  $\Delta_{p} = 0.17 + 0.65 = 0.82'''$ 568145

CE OD 397-B NEW 8/77 (C

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SHEET 10 OF 25 SHEETS NEERING DEPARTMEN CULATION SHE SUBJECT: Root Ponding of FSB & VB (Structural) DESIGN CALCULATION NO. DC 99 ΠB \_\_\_\_\_DATE\_\_\_\_\_9/12/84\_\_\_\_CHK. BY\_\_\_ 6733 \$ DATE 12-3-84 T. Wang J.O. NO.\_ MADE BY II. (cont.) A. (conti) At point c,  $H_p = \frac{5,38+0,38}{7} = 2,88''$  Before deflection = 2.88 + 0.82 = 3.70 After deflection Live load increased by  $W_{La} = 62.4 \times \frac{0.82}{12} = 4.24^{4/0'}$  at point C, Take 1 WLa = 4.24 = 2112 1/0' Say 2,2 1/0' merense for design, i.e. DESIGN LOADS (Assume no further secondary deflection occurs)  $W_{L} = 28 + 22 = 30.2^{\circ}$  at Low point = 2+22=4.27 at High point 30.20 568145 567676

1.5 IC DEPARTM CULATION SHEET Roof fonding of FSB & VB (Structural) DESIGN CALCULATION NO. DC 99 IV 8 \_DATE 9/12/84 CHK. BY\_ 6733 15 DATE 2-3-84 MADE BY T. WANA J.O. NO., I. (cont) B. Fuel Storage Bldg preliminary,  $H_{pl} = 9.07''$ ,  $w_{2p} = 62.4 \times \frac{9.07}{12} = 47.2^{4/5'}$  $H_{PH} = 9.07 - 6 = 3.07, W_{4P} = 62.4 \times \frac{3.07}{12} = 16.0$ Deflection Accumulation : (At point D, see 199.8) Metal Deck,  $\Delta_{p} = \frac{5}{-384} \frac{WL^{4}}{6Z} = \frac{5}{-384} \frac{(0.0|35+0.03|6)(9.167)(1728)}{29,000(0.61)}$ 47.2 = c0.4" (M. dans Juditaly f. 47.2 \$10 42 1 31.6 Beam B-1 - 12 B 19, I= 130,1 T l=20 wd = 13,5x 9,167+19 = 143 \*/ Beam By Beam B-2 Edge Beam w, = 36.8 × 9.167 = 339  $w = 482^{\#}$  $\Delta_{P_{B-1}} = \frac{5}{384} \times \frac{0.482(24)^4(1728)}{29,000(130,1)} = 0.95^{\circ}$ Girder - 12 W = 45,  $I_x = 350.8^{44}$ 4.167 V From B-1,  $P_1 = 482x \frac{24}{2} = 5784$ x2 = 115681=27.5 From B-2,  $\omega = 26.4 \times 9.2 + 14.3 = 3.86^{-41/1}$  $P_2 = 386 \times \frac{24}{2} \times 2 = -9264^{\dagger}$  $A_{6} \cong \underbrace{\frac{(13.568+9.264)}{2}}_{29,000} \times \underbrace{\frac{(9,167\times 12)(3\times 27.5^{2}-4\times 9,167^{2})(104)}{384}}_{29,000} \times \underbrace{\frac{(13.568+9.264)}{29,000}}_{29,000} \times \underbrace{\frac{(13.568+9.264)}{384}}_{29,000} \times \underbrace{\frac{(13.568+9.264)}{29,000}}_{29,000} \times \underbrace{\frac{(13.568+9.264)}$ 1.31 + 0.06

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DWG. NO. 568145 567676

SHEET 12 OF 25 SHEETS ERING DEPARTME CULATION SHEET SUBJECT: Roof fonding of FSB & VB (Structural) DESIGN CALCULATION NO. DC \_\_\_\_9 ΠB 15 DATE 2-3-84 MADE BY T. WANG J.O. NO. 6733 снк. вч\_\_\_ I. ( (ont. ) B. (cont.) At point D,  $H_p = \frac{9.07 + 3.07}{2} = 6.07$  Before deflection = 6.07+2:72 = 8.79 After deflection Live Load increased by Take + WLa = 14.14 = 7.1 #/0' Say 7.5 #/0' mcrease for design, Destyn Loads: (Assume no further secondary deflection occurs) Wu= 47,2 + 7,5 = 54,7 1/2' at Low point  $W_{LH} = 16.0 \pm 7.5 = 23.5 \pm 0^{-1} at High point$ 54.7% 54.7% 49.5 33.9 23.5 33.9 23.5 33.9 23.5 33.9 Edge Beam ( Bearn BT 568145 567676

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	<b>^ ^</b>							<b>.</b> .		
SUBJECT:	Ruot Pona	ling of FS	B & VB (	STRUCTUR	AL)	DESIGN Calculati	ON NO. D	c_99		<u>IV B</u>
J.O. NO	6733	MADE BY	T. Wan	9	DATE 9/12	184 0	нк. вү	48		2-3-8
	- •			· · · · · ·		,	•	;		
I. C	HECK ROO	F DECK 1	AND FR.	AMING	۲DL+	- pondin	g Loa	d)*		
A	VENTILA	TION BLOG.	(SEC	pg. 6)			<b>、</b>		<b>.</b> .	
	UN PORT : 1		- 2							
•	(I) KOGP	BCK.	· • •	. :	•				i in State	•
	CHISC	K TOTAL	LOADS :				· · · · ·		· · · · · · · · · · · · · · · · · · ·	
	· • •	WTotal = 1	3 5+ 30	2= 43.7	#/61	······································				· · · · · ·
س من سبین ، است.		//	50 18 21-		1#/1			· · · ·		
		$M_{d} = \pm 2$	8	<u> </u>	2	· · · · · · · · · · · · · · · · · · ·	۰۰۰ <sub>(</sub> ۰۰۰)		÷	
· · · · · · · · · · · · · · · · · · ·	· · · ·	$f_{1} = 37$	2 × 12	9110	151 - 200	no psi	10.K.	)	· · · · · · · · ·	
	·	10 0.	49			· · · · · · · ·	fi -		 Í	
	and a construction of the second s	5.4			n an	18 1			3	Afri Afrikani Tana Mana Angara ang
1-	) Curk	Prove SR	15-7	IBBIE-	r = ABI	5 Beam	Julia 1	2 m	ine of	3, 4
		<u>BD414 DIJ</u>	<u>,                                     </u>	(0-15				<b>C</b> 10	~> •]	• <b>4 7</b> • •
	For BB	15		A 325	Friction b	olts	per D	wg. 51	67892	-0)
	A = 4	43°, d	= 8.12"	· · · · · · · · · · · · · · · · · · ·				····		
	5 - 1	е m <sup>3</sup> т	= 10 m	4						,,
			40						;jj	
	Asheni	= 8.12 x	0,245 =	- Z -				: بیست میشد : • ت		
		+								
	Loads		· · · · · · · · · · · · · · · · · · ·							
	W	y = 13.5 x	8.25 + 1	5= 12	, #/ı	·				
				210 #/1		5				·
	N	L = 302X	8.23 -	249	CLOW	pomr/				
	· · · · · · · · · · · · · · · · · · ·	= 4.2X	8.25 =	35 11	( High	pom+)			4	
					·····	· ·			i 	
									far tas farre far far tas farre far farre far far far far far	
							· · · · ·	-		
*	Based on	AISC SOL	e, 1,13 3	Stresse	s due +	o nin	1 0 4	essmic	forces	
			- • • • • • • • • • • • • • • • • • • •				4 1		, V - 1	

need not be included in a ponding analysis.

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DWG. NO. 568145 517676

### ENGINEERING DEPARTMENT CALCULATION SHEET

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IBJECT: Roof Ponding of FSB & VB (Structural) DESIGN CALCULATION NO	. DC 99 - TV B
D. NO. 6733 MADE BY T. Wand DATE 9/12/84 CHK. E	NY_45_DATE 12-3-
I. (Conti)	
A (cont.)	
	· · · · · · · · · · · · · · · · · · ·
(2) CHECK Beam 8B15-2 (Cont.)	
$R_{1} = \frac{126 \times 20}{12} + \frac{214 \times 20}{12} + \frac{35 \times 20}{12} = 2323^{+1}$	20' 1
$R_{R} = \frac{10,50}{3} + \frac{514 + 2000}{3} + \frac{155200}{2} = 3037 = 10.66$	214×-114 */
$W_{T} = 5360$	214 #//
werding.	$r = -t = -35 5^{249}$
Location of Max, Moment at 0 shear,	
$2323 - (126+35) \times - \frac{2/4}{20} \times (\frac{2}{5}) = 0,$ $2323^{\#}$	*1
$5,35 \times 2+161 \times -2323 = 0$	
//////////////////////////////////////	
$X = \frac{-161 \pm \sqrt{(161) - 7(33)(-23/23)}}{2 \times 5.35} = 10.66$	
	10.66
$M_{max} = 2323(10.66) - (126 + 35)(10.66)(\frac{10.66}{2}) - \frac{114(10.66)}{2}$	$x = \frac{1}{3} = 13450$
f1 = 13,456 x12 = 13,685 PS1 < 0.8 x 36,000 = 28,800	(O,K,)
SHER :	4-3" \$ M,B (5"EMBED)
$V_{100} = \frac{3037}{15185} = 15185$	212"PROj (TYP)
$V_{allow} = 0.40 \times 30,000 = 14,400 7 V_{max} (0, E.)$	
CONNECTION TO WALLS:	1-24×3/2×1/6
$V_{max} = 3.037$	
# = 1100 x A = 2400 (4 - 3 d Azor botte t in 110	
Vallow - 1100 x 4- 1700 T 47 150 Doins 5 M.	
7 V max (0.K.) per UBC Table 24-G)	
Dwg	. NO. 568145

SHEET 15 OF 25

SHEETS

**IA** SUBJECT: Roof Ponding of FSB & VB (Structure) Design Calculation NO. DC 99 - IT B DATE 9/14/84 CHK. BY 45 DATE 2-3-84 6733 T. Wang J.O. NO. I. (cont.) A. (cont.) (3) CHECK MASONRY WALLS · Loads : P' = 3037 @ 644" → 8-3"  $M = 3,037(6) = 18,222''_{6,33} = 28.79^{\#/1}$ Let 6,33 be the width of loaded section WB = - 3037 = 480 (Beam Loads)  $W_{W} = 75 \times 20 = 1500^{4/1}$  (wall D.L.) W = 1980 \*1' say 2000 \*1 7@ 32" VORT. 5@ 48" HORE. Masonry Properties (BPC Cal's Book 5) Hollow Grade A Units, (For Type of C.B) fm = 1350 PSI (U.B.C. Table24+1) fm = 450 psi max fs=20,000 psi (Reinf.)  $E_{\rm S} = 30,000,000 P^{\rm S}$ WALL SECTION Em = 1, 350,000 pri 644 n = 22  $w = 75^{*/0'}$ t=7.625" d = 3.75 V= 25 PSi (W/o inspection, Floxwood) BEAM LOAD DISTRIBUTION

-CE OD 397-B NEW \$/77 (C

OF 2 5 SHEETS

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CALCULATION NO. DC 99 - IV B SUBJECT: Root fonding of FSB & VB (Structural) DATE 9/17/84 CHK. BY A DATE 12-3-84 T. Wang 6733 V. (cont.) A. ( Cont.) (3) (conti) Axial Stress:  $f_a = \frac{W}{bt} = \frac{2000}{12(7.65)} = 22 \frac{\#/0''/1}{12}$  $F_{a} = 0.2 f'_{m} \left[ 1 - \left(\frac{h}{40t}\right)^{3} \right] = 0.2 (1350) \left[ 1 - \left(\frac{20 \times 1^{2}}{40 \times 7.625}\right)^{3} \right]$ = 138 psi 7 fa Bending stress: Reinf. Vertical #7@32" O.C.  $p = \frac{A_s}{bd} = \frac{-0.60}{32(3.75)} = 0.005$ np = 22(0.005) = 0.11 From Table NO. 18-B, " plan Review Manual" by ICBO, 1977 k = 0.3718, j = 0.8761 $\frac{2}{4} = 6.14$  $\frac{1c_{j}}{f_{s} = \frac{M}{A_{s}jd} = \frac{2879}{\frac{0.60}{32}} = 3,895^{\text{Psi}} = 3,895^{\text{Psi}} = 3,895^{\text{Psi}} = 20,000^{\text{Psi}}$ < 20,000 psi = Fa  $f_{b} = \frac{M}{bq^{2}} \left(\frac{z}{k_{j}}\right) = \frac{2879}{12(375)^{2}} \left(6.14\right) = 105 \text{ psi}$  $F_3 = 0.166 f_m = 0.166(13.50) = 225 psi$ Combined stress;  $\frac{f_a}{F_a} + \frac{f_b}{F_b} \in 1.0$ <u>-,22...</u> 128  $\frac{105}{235} = 0.16 + 0.47 = 0.63 < 1.0 (0, k.)$ 

CE OD 397-B NEW 8/77 (C

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SUBJECT:	Root Pon	ding of FS	BEVBLST	ruitural)	DESIGI CALCU	N LATION NO. DC	99 -	TV B
J.O. NO	6733	J ' made by	T. Wang	DATE_	9/17/84	СНК. ВҮ		12-3-84
V. (6)	nti)	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·		· · ·	
A	(cont.)		· · · ·	•	•	ан сайта. - Д <b>ан</b> А	· ·	
	(4) <u>CHECK</u>	- DUCT OPE	NING REINFOR	KING		· · · ·		
	LOAD	SAT TOP 0	F OPGNING:		7-8" BL10"	4'-8" *	•	
- 1400 - 170 - 1400 - 170 - 1	From	ρ,						
· · · · · · · · · · · · · · · · · · ·	ωp	$=\frac{3037}{3,5x2}=$	434 ; 					2-5
	From						450	·····
	Ww	=75×475=	356	· · · ·		DUCT		
	w :	= 434+356=	= 790''			OPENING (WEST WALL)		
	Sai	1 w= 800"				•	K	
							-2-#5	(τγρ)
	Ched	stress:		J				
	7	= ± (800)(	(4.75) = 190	*	cun Let d=	der P>2 3-6"5=	-7.625"	
	ፈ	$= - \overline{\nabla}$	= 1900		16.77 P	51		
		ja b	0.8761 (42)	)[7,6x3) <	$v_a = 25$	(0,k)		
,	Μ	= 800(4.75	= 1805''	= 1,80	5 <sup>1</sup> K			
	F	$= \frac{bd}{12010} =$	12000	= 1, 1	12,			
	K	= 4 =	1,12	51.6177				
· · · · · · · · · · · · · · · · · · ·	Fr	m Table E	-4, Reinfor	ced Masonr	Y Engg. Ha	dbook" by J	5, Amrhen	
		p < 0.0001	As to e	0.0001 (7,6	×5)(4=) =	0.0320"		
	wi-	14 2-#5,	$A_5 = 0.62^{-4}$	>> Asreq	(O.K.)	DWG. NO.		

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CE OD 397-B NEW 8/77 (C)



SHEET 19 OF 25 SHEETS

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				ERING DEPAF	SHEET	SHEET	9 OF25 SHEETS
SUBJECT:_	Roof Po.	nding of F	SBEVB (	Strnctural)	DESIGN Çalculatio	DN NO. DC9	9 <u>– IV B</u>
J.O. NO	6733	MADE BY	T. Wan	9DATE_	9/13/84 c	нк. ву	DATE 2-3-84
	(m.+)					• • • • •	
<b>_L</b> , (				· ·			· · · ·
E E	B. (cont.)						
· · · ·	(2) (cor	1.)	•				· · ·
	Be	nding:	,	· · · · · ·	· · · ·	,, , , , , , , ,, ,, , , , , , , , , ,	······································
· · · · ·	: . 	· · · · · · · · · · · · · · · · · · ·	1 3		·	у <b>у .</b> У	
· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	$M_{d} = \frac{5}{2}$	$\frac{49(24)}{8} =$	39,5281#	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·
1 1,112 1,11 1,112 1,11		L = 39.	528 (12)	= 22,165	108826	$p_{00} = 28801$	$p_{si}(o,k,)$
		. ]6	21,4		- 0,0,00,00,0		
·			• • • • • • • • • • • • • • • • • • •	e bij Seren en e			
ана и стана 1 стана и стана 1 стана и стана 1 стана и стана	·····		, i que desembre , que entre é		د به میروند ایند. این در است.		
	na a sudra da mar.			and a second second Second second second Second second		ana atau da se se se ganta ang se se se	
				2 H			
						na man in an in an	
	Сон	inection to	Girder :				
		2 mars	nt 3" d	A325 6017	-s forthan	Type	
······································			*]			+4	
		$V_{all} = 21$	6.5 76	588 (0, K.	) (AIS	C_6 Ed., C	connection Table 1)
			· · · · · · · · · · · · · · · · · · ·				
مقیمی والد روابین از مراجع			na in the second se Second second	n gan di sada nata nata nata Tangga nata nata nata nata nata nata nata			
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	and a second a second a second a second a second a second a			· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
	···· · · · · · · · · · · · · · · · · ·	ه مراد الرابي		م معد المدر على اليري شر عام الع المراجع الم المراجع المتعود المتعود ال		م المتعلق المار المانية. المانية المانية المانية	
	· · · · · · · · · · · · · · · · · · ·	شیب د میشد. به . ۱۰۰۰ - میبینید میب		·····	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
				· · · · · · · · · · · · · · · · · · ·		DWG. NO.	68145
CE OD 397-B	NEW 8/77 (CW)	aless friend and the				l <b>r</b>	67676

#### ENGINEERING DEPARTMENT NCHEET A 1

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		NG DEPART	MENT SHEET	ET 20 OF 25 SHEETS
SUBJECT: Root Ponding 0.	FSB & VB LS	tructural)	DESIGN CALCULATION NO. DC .	99 - TV B
6733 MADE 8	T. Wang		9/13/84 CHK BY	4 by DATE 12-3-85
	•f			
I. (cont.)				
B. (conti)				
12) Paulita	ALL BOOM B-2		. :	· · · · ·
() <u>Reactions</u>	on Deam o E	d=/1		
$W_{L} = 33$	9×9.167 = 311			
	1-113 = 454	4/1	· · · ·	· · · · ·
~~~~~	(wp)		· · · · · ·	
$R_L = R_R$	$= 454 \times \frac{24}{2} =$	5448		
A second se	Ann a		· · · · · · · · ·	
Live load	uny,			- 
$R_{i} = R_{R_{i}}$	= 311 x 2 =	3732		
				· · · · · · · · · · · · · · · · · · ·
· · · · · · · · · · · · · · · · · · ·				, , , , , , , , , , , , , , , , , , ,
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				· · · · · · · · · · · · · · · · · · ·
				· · · · · · · · · · · · · · · · · · ·
			DWG. NO.	568145

RING DEPAR \_CULATION SHEET Αl 99 TV B Root Ponding of FSB & VB LATION NO. DC 1 DATE 2-3-84 9/13/84 снк. вч T. Wang 6733 MADE BY J.O. NO I. (cont.) B. (conti) (4) CHECK GIRDER: 12 WF 45-3 (G-1)  $A = 13.24^{\circ''}$ , d = 12.06'' $S_x = 582^{3}$   $I_x = 350.8^{4}$ 27. 9.167 9.167  $t_{W} = 0,336$ P=13176 P2=10896 Loads : W=45  $W = 45 \times 27.5 = 1238$  $P_1 = 6588 \times 2 = 13176$ P2 = 5448X2 = 10,896 PIL = 4872 × 2 = 97 42 Live load Only  $P_{2L} = 3732 \times 2 = 7464$  $R_{L} = \frac{1238}{2} + \frac{13176 \times 2}{3} + \frac{10896}{3} = 13035^{*}$  $R_{R} = \frac{1238}{2} + \frac{13176}{3} + \frac{10896x^{2}}{5} = \frac{12}{2},275$ W = 25,310DWG. NO. 568145 567676

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ENGINEERING DEPARTMEN CALCULATION SHEET SHEET 22 OF 2.5 SHEETS

Roof Ponding of FSB & VB CALCULATION NO. DC 99 - JD B \_DATE 9/13/84 CHK. BY\_\_\_\_ MADE BY T. Wang 41 DATE 12-3-84 6733 Ј.О. NO. I. (cont.), B. (cont.) (4) (Cont.) Bending  $M_{m_{x}} = 13035(9,167) - 45\frac{(9,167)^{2}}{2} = 117,601^{\prime \#}$  $f_{b} = \frac{117,601 \times 12}{58.2} = 24,248^{PSi} \ge 0,8 \times 36,000 = 28,800 (0.K.)$ Connection to Column 3 rows of 34" \$ A 325 bolts, Vall = 39.8 K > 13.035 (HSC 6"Ed., Connection Table 1) ि रिकारी 568145

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SUBJECT: Roof Ponding of FSB & VB (Structural)	DESIGN CALCULATION NO. DC99	- IB
J.O. NO. 6733 MADE BY T. Wary DA	те <u>9/17/84</u> снк. ву <u>МРА</u> о	ATE 12.3-84
V. Conti)		
B. (cont.)	. "	. *
(5) CHECK CRITICAL COLUMN		
Column (A.g) - (12,8) 6 WF 15	< (see plan on sht.	8)
l = 22	a da a an	·······
$A = 4.62^{D}$ , $r = 1.45$ ,	k=1 (AISC 6 <sup>th</sup> Ed.	
ke = 182	· · · · · · · · · · · · · · · · · · ·	EL. 65-0"
$F_{a} = 4.51$ [5]		
Loads	the second s	
$F_{max} = 12.275$ K		42-0"
	• • • •	
From G-2: 12 W= 45-3		
Reaction on Beam B-5,		
$W_L = 39.1 \times 9.21 = 30.1 \times 10^{-1}$	360 (ser pg.11)	
W = 360 + 143 =	503 (SEE 8-1)	
(WD)		na caranta antanananan di caranta da caranta Caranta caranta da cara
$R_{L} = R_{R} = 503 \times \frac{1}{2}$	= 6036	
Load from crane is not	included since coane	
of room, i.e. the proba	bility of crane	
being on girder at the s	ame time as PMP [6.036 x	2
$\therefore Y_2 = 6.036 + 0.045 (18.42)$	1/2 A N = 45"/	f <sub>P2</sub>
= 6.4.5 <sup>K</sup>	10/2	
	<u>  10-5</u>	
		· · · · · · · · · · · · · · · · · · ·
	DWG. NO.	i i a se

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SHEET 24 OF 25 SHEETS NEERING DEPARTMEN CULATION SHE SUBJECT: Root Ponding of FSB & VB (Structural) DESIGN CALCULATION NO. DC 99 - DB DATE 9/18/84 CHK. BY MAAT DATE 12-3-84 6733 T. Wang J.O. NO. MADE BY I. (conti) B. (conti) (5) (cont.) Loads (cont.) Loading from B-3 and B-4 is directly supported by the wall (see sht 25) i.e.  $W_{L} = \frac{26.1 + 27.4}{2} \times 9.2 = 246$  $w = 246 + 143 = 389^{\#}$ B3 (wo) (SEE BEAM B-1, Sht. 18) = WB-A The total Load on column A.9-12,8 during PMP condition is  $P = P_1 + P_2 = 12,275 + 6,45 = 18,725^k$ say P=19 K (Including Col. Weight and MISC conn.) Stress  $f_a = \frac{19}{462} = 4.1^{K1}$  $= \frac{4.1}{4.51} = 0.91 < 1.0 (0, E.)$ THE OTHER COLUMNS CARRY LESS LOADING AND THEY O.K. PER INSPECTION. DWG. NO

CE OD 397-B NEW 8/77

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ENGINEERING DEPARTMENT CALCULATION SHEET

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л.о. и	o	67	33		MA	DEB	Y	_	Ti	W	in	9			DA	ГЕ	12	3/8	4		снк	. вү	_/	Mo	A-	'	DAT	<u>е /2</u>	-3-	_
<b>V</b> .	(cont	··· · · · · · · · · · · · · · · · · ·		• • • • •	-			• •				ī;	, ,			·* · .	. •		· · ·		··· ,	· · · ·	•		۰.	. ,				
	B. (c	onti)																					•							
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	<u>ر)</u>	<u>ן כ</u>	<u>н</u> б	<u> </u>	up	POR	5	<u>· 0</u>	E	<u>Ke</u>	-1-1	M	<u> </u>	3	AT.		11	501	VR	<u>۲</u>	WA		<u>-</u>	• •	•			· · · ·		
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	<b>. !</b>		V		38	9	<b>X</b>	12	=	51	9		0011		- 1		•			-	:	•	: : :		14	1		: 	 	
	·				-		; ;		۷	ļļ	0	. (	u (79	sc i)	Tab	le i	24-	6)	Ŝ				1	iz.	V V				_5	}
		<b>.</b>		· · · · · · ·		·	÷	i	. (*	•.K				•				· · ·	-,		· · · ·	· ; ·								ן ן
; ;	·	B	endi	ngo	n d	<u> </u>	3x 3	3 ×	1/4	•	·•• •			:	. :		•					<u> </u> ]}	BI	2		++	13	* *		
	·······	4	Μ	I <b>=</b>	381	9 ×	3	38	=	13	513	3″	×	11	2	:  '	75	_// <del>_</del>	160	41			• • • • • 							4
		; ; ;	ĿĴ	5 <u>-</u>	- <u> - ^</u>	<u>v</u> s	- =	2	<u>75</u> 12	1 92	5)2	_	14	,00	59	5i		•• [				; - 		-				.3×3×		
						ייי אייי אייי	: 1. •	<b>7</b> 0	<u>ן</u> זר	6		<b>0</b> 0) <b>1</b>				05		 ;   .		- 	: 			/. 	12	+	<u>₹</u> ]]	-34	4 M.B	5
••••					(0.	KJ	19	(									 		3/16	K	x'@	Z	,	.   .			<u></u>	5	"ЕМВ	= ]
						i F												-	-			-	  }	_	3	8		G	13)   	
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· · · · · · · · · · · ·		· · · · · ·	;† 	D = '	Ŵ	2	31	39	4/		ند نيب ,	· · · · · · ·		2.1			11 12	ted -			- ,:  ^ 				-1 (1)				F.4 <u>\$</u> .	+
		·	<u>اً.</u> ا	P		-	0.	31	36	00)	(	<u>3</u> ./	6Y	5	II	3		7.5	#	7	P:	(0	K.,	)	1					: 
		: 	1	allow	able	1	~1	- (				6.7				*	1	ק					•			-		1		
		Pu	11 0	ut	for	ce	01	1	Bo	1+:	\	(Az	sun	e	÷÷: +:	, , , , , , , , , , , , , , , , , , ,		T				0.8	3"	)	) 					
		* *   		т =	N 0.8	3 =	1	75	3	-	21	10	#/6	•# <u></u>	-44	+								 			. 			
					       			}		<	2,2	50	<b>#</b> (	u	BC	79	, τ	abl	+ Z	6-	-6,	A	ssu	ne	e	nbe	ed ei	d in	Conc	n
										((	9.K	5)	(	 	<u>in</u>	e †1		B	Par	ea	with	9	roul	3	ţ		3000	2 151		+
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#### SECTION PROPERTIES 1.

			1		124. 4	1 ST 10 ST 10 ST	and a state of the
Туре	Gauge	Weight	-In.4.5	Sin 19	Rin 23	後にこれ	
	22(2)	2.00	.18	.21 .27	.54 .65	13.25 13.25	.870 .873
в	18	3.20	.34	.40	.86 1.07	13.25 13.25	.877 .881
	14	4.62	.57 .80	.63 .89	1.32 1.76	$\begin{pmatrix} 1 \\ (1) \end{pmatrix}$	.888 .906
				·			
[	18-18	4.96	.58	.48 .49	1.42 1.57	13.25 13.25	.499 .465
	16-16	6.28	.77	.67	1.77 1.95	13.25 13.25	.540 .506
BF	14.16	7.06	.95	.89	2.02	(1) $(1)$	.615 .581
	12-14	9.14	1.32	1.33	2.64	(1)	.684
BF <sub>2</sub>	18-16	4.90	.572	.48	1.39	13.25	.522
BF	18-16	4.20	.514	.47	1.21	13.25	.599

(1) These sections are not available with Hi-Bond feature. All other sections will be furnished as Hi-Bond Floor Deck only if specified. (2) 22 and 20 gauge material is not recommended for use as floors except as Hi-Bond.

#### TYPE B HI-BOND FLOOR DECK AND TYPE BF HI-BOND CELLUFLOR

Widely used for economy and versatility, these two products are often specified side-by-side for varying requirements on the same building. Used alone, Type BF Celluflor permits complete electrification of a floor with ample cell capacity for many installations. Both types are available in lengths up to 28'6" in galvanized steel, gauges shown below.

#### 3. TOTAL SUPERIMPOSED LOADS FOR TYPES B and BF HI-BOND FLOOR DECK (Do not use shoring)

and the states and shows		31/2	Atter	- 4%
Se Type as	VERA-WEST		和学校89 光带	45.1
and see	MAL MART	1	1600	1800 to
Gauge	Touran William	600	700	<b>***</b> *******
Contraction for weath	Span	Superimpose	d Load, Ibs.	per sq. ft.
	6'-0"	200	233	266
B33#	6'.6"	184	215	249
022	7'.0"	137	200	229
	7'-6"	160	187	214
B20*	81.01	104	175	200
	0' 6"	133	165	188
B18*	0'.0"	119	156	178
	9.0	115	142	160
B16*	10'-0"		128	

° Or BF, BF2, BF3. 18-16 Hi-Bond Floor Deck may be substituted. NOTE — No continuity is assumed at supports. See table 20 for minimum temperature reinforcing.

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							and the state of the	ا شو چونو مید. برد.	- 7-6	A Second Street Street	C.a. 5		
	Snan	Service State	- 6'-6"s	Y of Each and	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		Defl	Str Str		C Defl.	Stre	55	💭 Defl. 🔅
_	Controlled by	Str	255	Defl.	A ASSISTIC	55.09.02	Dent	Sor D	A T.	DorT	Sor D.	C Tost	D or T
туре	Span Condition	S or D	ATAC	TED or Tas	SorD	14 7 J	PM LOAD	lbs per	sq. ft. 76		-		1. s. s. s. s. s. s. s.
	Gauge	1.11	1. a	1		UNIFO	70	94	118	58	82	103	48
	18	125	156	90	107	134	94	119	149	76	104	130	62
	16	159	199	116	13/	1/1	- 120 -	150	188	97	131	164	80
в	14	199	249	149	171	214	167	210	263	136	184	230	112
	12	280	350	207	241	301	10,		J				
							101	114	142	100	100	125	81
	18-18	152	190	151	131	164	121	117	146	105	103	129	86
	18-16	156	195	163	134	10/	150	159	197	133	139	174	109
	16-16	211	264	204	181	226	164	161	201	143	141	176	
BF	16-14	215	269	219	185	231	+ - 1/0		264	163	184	230	135
	14.16	280	350	251	241	301	201	216	270	176	189	236	144
	14-14	288	1	270	248	310				1			
	· · · · · · · · · · · · · · · · · · ·						1 101	1 115	1/3	98	100	126	81
BE2	18-16	153	191	151	131	164	121	1 115	143				
	1 1910	1		· · · · · · · · · · · · · · · · · · ·	-					1 00	00	123	73
DC.	1916	149	186	136	128	160	109	112	140	88	1 30	1 125	1
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#### ALLOWABLE LOADS - NON COMPOSITE DESIGN 2.

### LOAD DATA-REINFORCED SLABS OVER RIBFORM

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RIBFORM ACCESSORIES



### HEBOND, CELLUFLOR

#### 1. Scope

a. Included are all steel subfloors and their accessories. For location, type, and gage of steel subfloors see structural drawings.

b. Not included under this section of the specification (work included under other sections.):

(1) Structural steel columns, girders, beams, and all miscellaneous bracing or supports of any kind for the steel subfloors.

(2) All reinforcing bars and reinforcing mesh.

(3) The cutting of holes in the subfloors for the passage of all materials for other trades.

(4) The cutting or drilling required for the attachment of materials of other trades to the steel subfloor.

(5) The final placement and attachment of welding access-hole covers and butt closure plates which close cells which are to be electrified.

(6) Electrification of the steel subfloor including headers, jump headers, outlets, and any other materials required to carry wires outside of the cellular panel cells.

(7) Concrete fill (Note: for Hi-Bond composite construction a minimum concrete strength of f'c = 3,000psi is required. For other steel sub floor construction a low water cement ratio is recommended to control crazing or temperature relief cracks).

(8) Fireproofing on the underside of steel subfloors.

(9) Any additional holes or cutting not indicated on the erection drawings shall be checked with and authorized in writing by the general contractor, as these holes or cut areas may block vital electrical cells or may be of size or shape requiring additional structural supports.

#### 2. Material

Steel subfloors shall be formed from steel sheet conforming to Zinc Coated Steel Sheets of Structural Quality Coils and Cut Lengths, ASTM designation: A446 and Federal Specification QQ-S-775a, Type 2, Class E. Minimum coating 0.5 oz. per sq. ft. Minimum yield strength 33,000 psi.

#### 3. Construction

a. Steel subfloors shall conform to the Inland Steel Products Company's type(s) ..... as to depth, cell area, cell spacing and design. (refer to page.... for specific characteristics of various Inland profiles. If desired the designer should be specific at this point regarding these points rather than making reference to catalog data).

b. When two sections are combined to form a cellular panel, they shall be structurally resistance welded in accordance with (4) Design.

c. (to be inserted if panels are to be used as electrical raceways). Panels shall be listed and labeled by Underwriters' Laboratories, Incorporated.

d. (to be inserted if panels and concrete fill are designed compositely). Deformations shall be provided in all vertical webs of the steel subfloor adequate to structurally