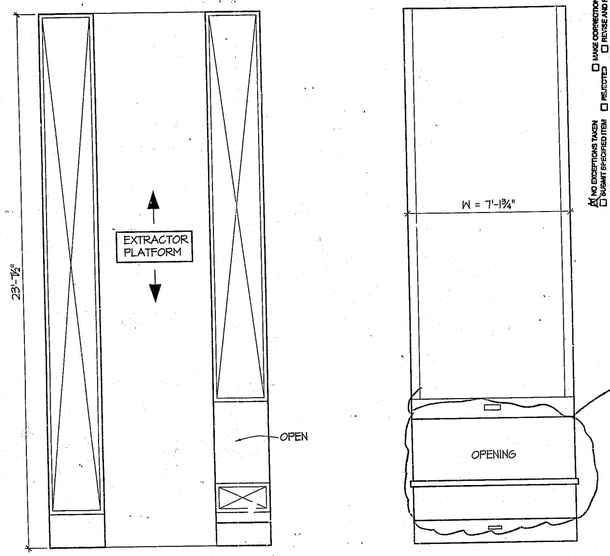


VERTICAL LIFT MODULE - SINGLE UNIT

SECTION

NO SCALE

(1 / S1)

VERTICAL LIFT MODULE - SINGLE UNIT

FRONT ELEVATION

NO SCALE

(2 / S1)

UNIT SPECIFICATION (PER MFR.)

TYPE: REMSTAR 500NT TYPE '2' VERTICAL LIFT MODULE

UNIT HEIGHT: 283.46 IN (23'-7½")

UNIT WIDTH: 85.79 IN (7'-1¾")

UNIT DEPTH: 116.98 IN (9'-9")

CENTER OF GRAVITY: 1/2H (ASSUMED)

NUMBER OF TRAYS: 56 @ 941 LB MAX. WT EA (52,696 LB.)

WT OF UNIT W/ TRAYS & RAILS (DL): 10,061 LB

WT OF LOADED TRAYS (LL): 52,696 LB (MAX.)

WT OF UNIT FULLY LOADED: 62,757 LB

DESIGN SEISMIC WT 62,757 LB

GENERAL NOTES

DESIGN ANCHORAGE OF UNIT TO EXISTING FOUNDATION ARE FOR OVERTURNING FORCES DUE TO SEISMIC LOADS

CODE: 1997 UNIFORM BUILDING CODE (UBC), AISC 9TH EDITION

DESIGN CRITERIA: SEISMIC ZONE 3

$F_p = A_p C_a I_p R_p (1+3 h_x/h_r) W_p$

SOIL PROFILE= S_d (ASSUMED PER UBC)

C_a=0.36, I=1.0, A_p=2.5, R_p=3.0 (h_x/h_r=0), W_p= WEIGHT OF UNIT

ADHESIVE ANCHORS: ANCHORS SHALL BE HIT HY 150 (ICBO #5143) AS MANUFACTURED BY HILTI OR EPOXY -TIE ET (ICBO# 4945) BY SIMPSON STRONG TIE, OR APPROVED EQUAL. SPECIAL INSPECTION IS NOT REQUIRED FOR ANCHOR INSTALLATION.

SOIL BEARING PRESSURE =1500 PSF+1/3 INCREASE FOR SEISMIC. (ASSUMED)

FOOTING SLAB ON GRADE: F'c = 4000 PSI MIN. 15" MIN. THICKNESS. WITH #5 @ 10" O.C. TOP & BOT.

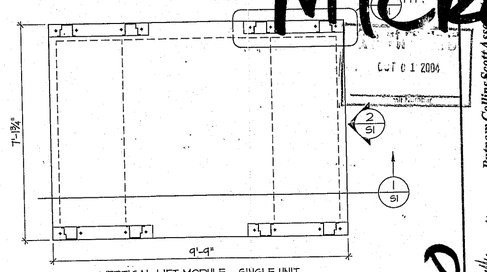
SUBMITTAL # 10670-01

☒ NO EXCEPTIONS TAKEN ☐ MAKE CORRECTIONS NOTED
☐ SUBMIT SPECIFIED ITEM ☐ REJECTED ☐ REVISE AND RESUBMIT

CHECKING IS ONLY TO VERIFY GENERAL CONFORMANCE AND COMPLIANCE WITH THE DESIGN CONCEPT AND THE CONTRACT DOCUMENTS. THE CONTRACTOR OR SUPPLIER IS RESPONSIBLE FOR DIMENSIONS, ERRORS AND OMISSIONS IN THE SHOP DRAWINGS, FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND THE DIMENSIONS WITH THEIR WORK ON FABRICATION AND WITH THAT OF OTHER TRADES AFFECTED THEREBY, FOR PERFORMING ALL WORK IN A SAFE MANNER. ANY DEVIATION FROM THE CONTRACT DOCUMENTS ON THESE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SATISFACTORY COMPLETION OF THEIR WORK.

1500 SW TAYLOR • PORTLAND, OR 97205 (503) 223-7177

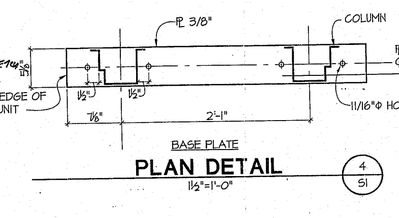
DATE 22 JUNE 04 BY DLH



PLAN

NO SCALE

(3 / S1)

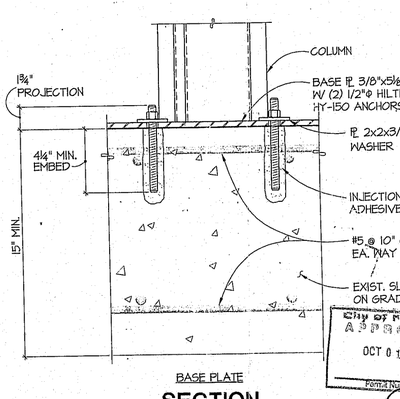


BASE PLATE

PLAN DETAIL

1½"=1'-0"

(4 / S1)



BASE PLATE

SECTION

3"=1'-0"

(5 / S1)

See Attached Sketch ① B-1 PCSA Eng. Dated 9/3/04 For Add'l Bracing in Unit 7.

City of Portland APPROVED OCT 0 1 2004 Permit Number

RECEIVED OCT 0 1 2004

MICRO

04-262-DR-01-CO

04-262-DR

Putnam Collins Scott Associates
950 Pacific Ave., Suite 1000, Tacoma, WA 98402 – (253) 383-2797 – (253) 383-2709
811 1st Ave., Suite 510, Seattle, WA 98104 – (206) 292-5076 – (206) 467-7708

PCSA Structural Solutions

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 17,094 DONALD R. SCOTT
EXPIRATION DATE: 6/30/2004

REMSTAR SHUTTLE 500NT™
VERTICAL LIFT MODULE
RASMUSSEN BMW/MINI
PORTLAND, OR
FOUNDATION ATTACHMENTS

DATE: JUNE 21, 2004
DESIGN BY: ZJD
DRAWN BY: ZJD

S1 OF 1

JOB NO. 04387.00

CO.04.002624.DFS.01.

Y

11

CITY OF
PORTLAND, OREGON
BUREAU OF DEVELOPMENT SERVICES
1900 SW 4th Ave, Suite 5000
Portland, OR 97201

MULTNOMAH COUNTY

STATUS CHECK	Commercial Building Permit	Application # **04-002624-DFS-01-CO**
Status Date: **June 24, 2004**		IVR Number: **2369444**

APPLICANT	GBD ARCHITECTS *John Eidman*	Phone: (503) 224-9656
PROPERTY OWNER	CERVANTES 24 ASSOCIATES L P	Phone:
CONTRACTOR	R & H CONSTRUCTION *DENNIS WOLTERS*	Phone:

PROJECT INFORMATION
Description of Work: **DFS FOR STORAGE RACKS**
Street Address: **2001 SW JEFFERSON ST**

Occupancy Group	Construction Type	Sub Type	Work Proposed
B S1 S3	**III-N**	**Business**	**Alteration**

This report shows those reviews which have been assigned as of June 24, 2004 at 3:11 pm. Technical reviews may trigger additional review assignments.

Review Type/Process	Mandatory	Status	Action Date	Reviewer	Phone
2nd Screen App Set-Up	X	Open			
Intake - DSC	X	Open			
Assign Reviews - CO		Open		DOCUMENT SERVICES	503-823-7357
Process Manager		Open		PROCESS MANAGEMENT	503-823-7357
Point of Contact		Open			
Life Safety Review	X	Open		LIFE SAFETY	
Structural Review	X	Open		Kumar,Amit	503-823-7561
Send Letter of Intent to expire		Open		DOCUMENT SERVICES	503-823-7357

PAID
JUN 2[illegible]
CITY OF PORTLAND, OR

PCSA
Structural Solutions
Putnam Collins Scott Associates
Tacoma • Seattle

Project: REMSTAR (RASMUSSEN) SEISMIC EVAL Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 9 of 9 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ _____ Date: 9/2/04
Originating Office: ☐ Tacoma ☐ Seattle

NOTE: FRAMES SHALL OCCUR @ (2) PLACES TYP. 1 FRAME @ EITHER SIDE OF UNIT & 1 FRAME @ ADJACENT BAY OF CARWASH BELOW ACCESS OPENING

SHUTTLE COL

(3) 3/4"ϕ @ M12 ITW FAST'S @ 4" O.C. MIN.

SHUTTLE OPENING

FRAME (6x)

L2x2x3/16

3/16 TYP

15½" MIN

ELEVATION

No SCALE

3/16 TYP

3/16

3/16

ANGLE LEDGE DIAGONAL

SHUTTLE COL

3/16

CITY OF TACOMA
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OCT 07 2004
Permit Number

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MICRO

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PRINCIPALS

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Lanny J. Flynn, S.E.
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Jim L. Harris, S.E.
Jeffrey S. Klein, S.E.
Ronald E. Beshafer, S.E.

STRUCTURAL CALCULATIONS

FOR

SEISMIC ANALYSIS ON FOUNDATION ATTACHMENT OF REMSTAR SHUTTLE NT500

RASMUSSEN BMW/MINI Portland
PORTLAND, OREGON

PREPARED BY
PUTNAM COLLINS SCOTT ASSOCIATES

04-2624-DFS-01-0

JUNE 21, 2004
04-387

950 Pacific Avenue, Suite 1100 Tacoma, WA 98402-4495 • (253) 383-2797 • (253) 383-1557 fax
811 First Avenue, Suite 510 Seattle, WA 98104-1457 • (206) 292-5070 • (206) 407-7788 fax
www.pcsainc.com • Incorporated 1989

Seismic Analysis on Foundation Attachment of 'REMSTAR SHUTTLE NT500 System Equipment Vertical Lift Module

Code: 1997 Unform Building Code (UBC), AISC 9th Edition, ACI (current edition)

Data:

Unit Specifications

Unit Type		Remstar 500NT Vertical Lift Module	
Unit Height (in.)		$H_x := 283.46in$	
Unit Width (in.)		$w_x := 85.79in$	
Unit Depth (in.)		$d_x := 116.98in$	
Unit Live Load (lb.)	$w_{tray} := 941lb$ $n_{tray} := 56$	$w_{ll} := w_{tray} \cdot n_{tray}$	$w_{ll} = 52696\,lb$
Unit Dead Load (lb.)		$w_{dl} := 10061lb$	
Total Weight Fully Loaded (lb.)		$wt_x := w_{dl} + w_{ll}$	$wt_x = 62757\,lb$

General Specifications

Slab Area	$L := 9.75ft$ $W := 7.15ft$	$A := L \cdot W$	$A = 69.71\,ft^2$
Slab Thickness		$thk := 15in$	
Concrete Strength		$f'_c := 4000psi$	
Soil Bearing (assumed)		$s_p := 1500psf$	
Location		Portland, Oregon	

City of Portland
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Anchorage to Concrete:

bolt spacing s = 8 in. concrete edge distance c = 1.0 ft

Anchor: Hilti HY-150 Epoxy (ICBO ER 5193)
1/2" dia. Thrd. Inserts embed 4 1/4" (min.)

$P'_t := 2555lb$ allowable tension (base value)

$V'_t := 1935lb$ allowable shear (base value)

Adjusted Values

$D := 1.33$ Load Duration (Seismic)

$s' := 1.0$ Less than specified spacing (s) but greater than minimum: $s_{min} = 0.25(s)$

$c' := 1.0$ Less than specified edge distance (c) but greater than minimum: $c_{min} = 0.33(c)$

$P_t := P'_t \cdot D \cdot s' \cdot c'$ $P_t = 3398.15\,lb$ allowable tension (adjusted value)

$V_t := V'_t \cdot D \cdot s' \cdot c'$ $V_t = 2573.55\,lb$ allowable shear (adjusted value)

Total number of bolts (2 per column) $n := 16$

SEISMIC $F_p := \frac{a_p \cdot C_a \cdot I_p}{R_p} \cdot \left(1 + 3 \cdot \frac{h_x}{h_r}\right) \cdot W_p$

Zone — Seismic Zone : 3

$C_a := 0.36$ — Seismic Zone Factor (Table 16-Q)

$I_p := 1.0$ — Importance Factor (Table 16-K)

$a_p := 2.5$ — Per SD Soil Profile (Table 16-O)

$R_p := 3.0$ — Per SD Soil Profile (Table 16-O)

$h_x := 0ft$ — Height of Floor above grade

$h_r := 0ft$ — Height of roof Elevation above grade

$W_p := wt_x$ — Structure Weight

$F_p := \left(\frac{a_p \cdot C_a \cdot I_p}{R_p}\right) \cdot \left(1 + 3 \cdot \frac{h_x}{h_r}\right) \cdot W_p \cdot \left(\frac{1}{1.4}\right)$ $F_p = 13.45k$ (working stress)

F_p Shall not be less than:

$F'_p := 0.7 \cdot C_a \cdot I_p \cdot W_p \cdot \left(\frac{1}{1.4}\right)$ $F'_p = 11.3k$

F_p Shall not exceed:

$F''_p := 4 \cdot C_a \cdot I_p \cdot W_p \cdot \left(\frac{1}{1.4}\right)$ $F''_p = 64.55k$

Overturning Moment: $M_{ot} := F_p \cdot H_x \cdot .5$ $M_{ot} = 1905.97 k \cdot in$

Resisting Moment: $M_{rl} := wt_x \cdot Min_{dim} \cdot .5$ $M_{rl} = 2691.96 k \cdot in$

$P_{uplift} := \text{if}\left[M_{ot} > M_{rl}, \frac{(M_{ot} - M_{rl})}{(Min_{dim} - 8in)}, 0lb\right]$ $P_{uplift} = 0k$

Interaction $\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right)$

Interaction := $\left(\frac{P_{uplift}}{P_t \cdot n \cdot .5}\right) + \left(\frac{F_p}{V_t \cdot n}\right)$ Interaction = 0.33

Therefore = " Hilti bolts OK"

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Check Shear and Tension Anchorages For Threaded Rods In Concrete

$U := 1.32D + 1.1L + 1.7E$ $\omega := 1$ (Special Inspection) $n := 2$ number of bolts per column

$E := 1.7(F_p)$ $E = 22.86\,k$ $sp := 8in$ bolt spacing

$sp_2 := 6in$ row spacing

$V_u := \omega \cdot \frac{E}{n \cdot 8}$ $V_u = 1.43\,k$ $d_h := .5in$ bolt head dia.

$P_u := \frac{\omega \cdot (1.7 \cdot P_{uplift})}{n \cdot 8}$ $P_u = 0\,k$

Anchor Capacity $dia := .5in$ bolt diameter $d_b := dia$ $f_{ut} := 120ksi$

bolt strength in tension

$A_b := .25 \cdot \pi \cdot dia^2$ $A_b = 0.2\,in^2$

$P_{ss} := 0.9 \cdot A_b \cdot f_{ut}$ $P_{ss} = 21.21\,k$

therefore = "OK"

bolt strength in shear

$V_{ss} := 0.75 \cdot A_b \cdot f_{ut}$ $V_{ss} = 17.67\,k$

therefore = "OK"

ratio of anchor spacing to embedment length $d_m := 4.25in$ is $\frac{sp}{d_m} = 1.88$

therefore = "failure surface forms a truncated pyramid"

$A_p = 239.25\,in^2$

ratio of edge dist. $d_e := 8.5in$ to embedment d_m is $\frac{d_e}{d_m} = 2$ greater than 1

concrete capacity in tension $f'_c := 2500\,psi$ $\phi := 0.65$ $\lambda := 1.0$ (normal wt. conc.)

$A_o := (\sqrt{2}) d_m \cdot \pi \cdot (d_m + d_b)$ $A_o = 89.69\,in^2$

$\phi P_c := \phi \cdot \lambda \cdot 2.8 \cdot A_o \cdot \sqrt{f'_c} \cdot psi$ $\phi P_c = 8.16\,k$

therefore = "OK"

ratio of edge dist.to bolt dia. is $\frac{d_e}{d_b} = 17$ greater than 10

concrete capacity in shear $\phi := .85$

$\phi V_c := \phi \cdot 2 d_m \cdot sp \cdot \sqrt{f'_c} \cdot psi$ $\phi V_c = 2.89\,k$

therefore = "O.K."

Use 1/2" diameter threaded inserts embed 4 1/4"

Check Slab for Soil Bearing:

Per Owner, slab is 4000 psi 15" thick slab with #5 @ 10" O.C. each way top and bottom

$P_{col} := \frac{wt_x}{8}$ $P_{col} = 7.84\,k$

$P_{seismic} := \frac{M_{ot}}{(w_x - 8in)\cdot 4}$ $P_{seismic} = 6.13\,k$

$P_{max} := P_{col} + P_{seismic}$ $P_{max} = 13.97\,k$

$BRG_{allow} := s_p \cdot 1.33$ $BRG_{allow} = 1995\,lb\,ft^{-2}$

$Req_{area} := \frac{P_{max}}{BRG_{allow}}$ $Req_{area} = 7\,ft^2$ $Req_{length} := \frac{Req_{area}}{3ft}$ $Req_{length} = 2.33\,ft$

$M_{slab} := 1.4 \cdot 1.7 BRG_{allow} \cdot 1ft \cdot \frac{Req_{length}^2}{2}$ $M_{slab} = 12934.66\,lb\,ft$

Assume 3" clear at reinforcing #5 @ 10" O.C. $As := .372in^2$ $d := 12in$ $fy := 40000psi$

$f'_c := 4000psi$

$a := \frac{(As \cdot fy)}{.85 \cdot f'_c \cdot 12 \cdot in}$ $a = 0.36\,in$ $\phi Mn := .9 \cdot As \cdot fy \cdot \left(d - \frac{a}{2}\right)$ $\phi Mn = 13188.49\,lb\,ft$

Therefore "Slab Adequate"

Reinforced Slab In Adequate to spread out vertical loads for units

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Check Base Plate

Base Plate Dimensions $b := 9in$ $d := 5.78in$ $t := .375in$ $b1 := \frac{(b - 6in)}{2}$ $b1 = 1.5in$

$F_y := 36ksi$

$f_a := \frac{P_{max}}{b \cdot d}$ $f_a = 268.55psi$

$M_{base} := \frac{f_a \cdot 1 \cdot in \cdot b1^2}{2}$ $M_{base} = 302.12 lb\,in$

$S_{base} := \frac{1 \cdot in \cdot t^2}{6}$ $S_{base} = 0.02 in^3$

$F_b := .75 \cdot F_y \cdot 1.33$ $F_b = 35.91ksi$

$f_b := \frac{M_{base}}{S_{base}}$ $f_b = 12.89ksi$

$\frac{f_b}{F_b} = 0.36$

Therefore = " O.K. "

Check Foundation: thk = 15 in b = 9 in w_{dl} = 10.06 k Total DL

Puncture (one column) $P := 1.2 \cdot \frac{1}{8} w_{dl} + 1.0 \cdot E' + f_l \cdot w_{ll}$ $E' := \frac{M_{ot}}{(w_x - 8in) \cdot 4}$ E' = 6.13 k $f_l := 1.0$

$P := 1.2 \cdot \frac{1}{8} w_{dl} + 1.0 \cdot E' + f_l \cdot w_{ll} \cdot \left(\frac{1}{8}\right)$ P = 14.22 k Per Column

$F_{punc} := .85 \cdot 4 \cdot \sqrt{f'_c}\,psi$ F_{punc} = 215.03 psi

$A_{punc} := [(b + thk) \cdot 2 + (d + thk) \cdot 2] \cdot thk$ A_{punc} = 1343.4 in^2

$f_{punc} := \frac{P}{A_{punc}}$ f_{punc} = 10.59 psi

$\frac{f_{punc}}{F_{punc}} = 0.05$

Therefore = "OK"

Puncture (2 columns adjacent) $P := 1.2 \cdot \frac{1}{4} w_{dl} + 1.0 \cdot E' + f_l \cdot w_{ll}$ $E' := \frac{M_{ot}}{(w_x - 8in) \cdot 4}$ E' = 6.13 k $f_l := 1.0$

$P := \left(1.2 \cdot \frac{1}{4} w_{dl} + 1.0 \cdot E' + f_l \cdot \frac{1}{1} w_{ll} \cdot \frac{1}{4}\right) 2$ P = 44635.37 lb

$F_{punc} := .85 \cdot 4 \cdot \sqrt{f'_c}\,psi$ F_{punc} = 215.03 psi

$A_{punc} := [(2 \cdot b + thk) \cdot 2 + (d + thk) \cdot 2] \cdot thk$ A_{punc} = 1613.4 in^2

$f_{punc} := \frac{P}{A_{punc}}$ f_{punc} = 27.67 psi

$\frac{f_{punc}}{F_{punc}} = 0.13$

Therefore = " OK "

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PCSA
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TRANSMITTAL

Putnam Collins Scott Associates
Tacoma - Seattle

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SEATTLE, WA 98104
(206) 292-5076 (206) 467-7788 FAX

MICRO

TO: CITY OF PORTLAND

DATE: SEPTEMBER 24, 2004

FROM: ZACH DIEDE

ATTN: AMAD

PROJECT NO.: 04-522

REFERENCE: RASMUSSEN BMW-REMSTAR SEISMIC CALCULATIONS

☒ FAX NO. OF PAGES (INCLUDING COVER SHEET): 2
☐ DELIVER
☐ COURIER
☐ OVERNIGHT DELIVERY
☐ MAIL
☐ ____

FAX NUMBER: 503-823-7692

11

NUMBER OF ITEMS: DESCRIPTION:

☐ FOR YOUR USE
☐ FOR REVIEW
☐ REVISE & RESUBMIT
☐ CONFORMS TO DESIGN
☐ CONFORMS AS NOTED
☐ ____

MESSAGE

ATTACHED IS THE CALCULATION FOR THE ALPHA ANGLE AND SHEAR CAPACITY. PLEASE LET ME KNOW IF YOU NEED ANYTHING ELSE. ALSO, IF THIS IS NOW ACCEPTABLE TO YOU, WOULD YOU LET ME KNOW, PACIFIC INTEGRATED HANDLING ASKED ME TO LET THEM KNOW WHEN WE HAVE RESOLVED EVERYTHING.

THANKS,

ZACH DIEDE

MICRO

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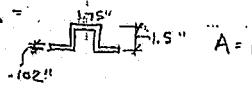
Tacoma • Seattle

Project: REMSTAR SEISMIC EVAL Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 1 of 1 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ Date: 9/24/04
Originating Office: ☐ Tacoma ☐ Seattle

$$\alpha = \tan^{-1}\sqrt[4]{\frac{1+\frac{tL}{2A_c}}{1+th\left(\frac{1}{A_b}+\frac{h^3}{360 I_c L}\right)}}$$

$t = .0591"$
$L = 36"$
$h = 93"$
$I_c = 6.9\ in^4$ (PREV. CALCS)
$A_c = 2.13\ in^2$
$A_b =$ 

$A = 1.75(.102") + (2)(1.5-.102")(.102") = .46 in^2$

$$\varphi = \tan^{-1}\sqrt[4]{\frac{1+\frac{.0591(36)}{2(2.13)}}{1+.0591(93)\left(\frac{1}{.46\ in^2}+\frac{(72")^3}{360(6.9)36}\right)}}$$

$\varphi = 24.8°$

$V = \frac{1}{2}(.0591)36"(33.45\ i)\sin 2(24.8°) = 26.3\ K/2.5 = 10.5\ k/ft/3 = 3.51\ k/ft$
ALLOWABLE

$3.51\ k/ft > 1.12\ k/ft$ REQ'D, 32% CAPACITY

VOK

Pacific Integrated Handling
10215 Portland Avenue
P.O. Box 44188, Tacoma, WA 98444
Ph: (253) 535-5850 Fax: (253) 536-2599

FAX

To: Amit
Company: City of Portland
Fax #: 503 823 7692
Total Pages: 16 (Incl Cover)
Reference: Rasmussen BMW Shuttle

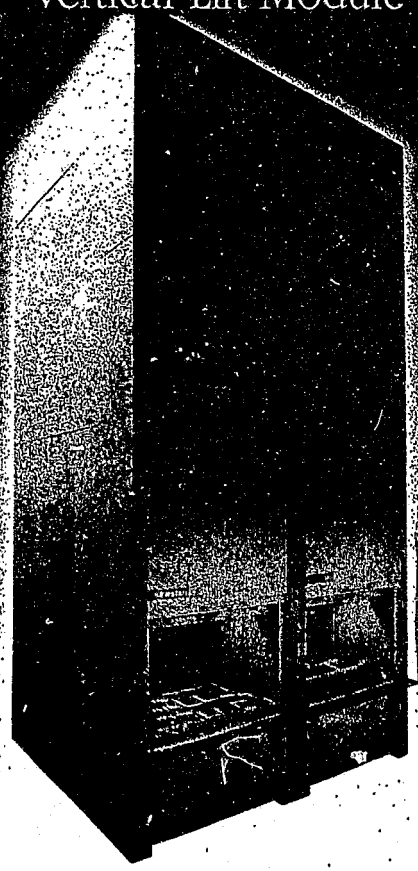
From: Pat Bramell
Fax: 253 536 2599
Date: 7/14/04

Machine documentation per your request. This machine analysis was done for an installation in California.

MICRO

Shuttle™

Vertical Lift Module



automated storage & retrieval system

REMSTAR

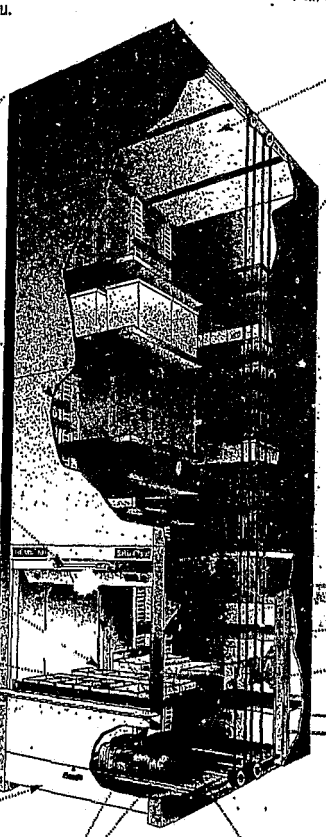
Increases Space Utilization, Productivity and Ergonomics in Automated Storage & Retrieval Solutions

www.Remstar.com

A Compr
Industriehaldin

Remstar Shuttle VLM

Remstar's innovative Shuttle Vertical Lift Module (VLM) is an enclosed system of vertically arranged trays, an extraction platform, and computerized push-button controls. Operators stay in one place as the Shuttle delivers items to an ergonomic workstation; unlike shelving and drawers, the Shuttle does all the locating, retrieving, and recording (when used with software) for you.



Flexible height module design lets you vary the unit height as storage requirements or ceiling heights change.

Stand-alone installation allows strategic placement directly in work centers.

CubeStar technology for fixed or optimized storage.

Intuitively designed / computer interfaceable control system for fast learning and optimal performance.

Light curtain for full access area personal protection.

Locking "tray-hold" feature allows for safe loading and unloading.

Variable extraction speeds can be set for each and every tray in the system to protect fragile items and expedite others. From 10% to 100% of maximum speed can be selected with a simple push of a button.

Lockable electronics drawer and bottom side access panels allow for ease of maintenance.

Two or four chain design on the extractor platform, secured to a bottom-mounted direct drive motor with two chains, handles heavy loads smoothly and reliably; automatic chain-tensioning system eliminates problematic counterweights, top-mounted motors, and fraying cables.

Full light curtain height identification system.

Dust Cover.

Stores up to 550 to 2365 lbs. per tray; total maximum machine payload is up to 88,000 lbs.

Superior delivery speeds, intelligent storage routines, flexible and user friendly controls and advanced inventory control systems help make the Shuttle VLM the number one vertical storage solution in North America.

Optional multiple access openings enables two operators to work from a single unit from the front and back simultaneously, or from different floors of your operation. Ideal for mezzanine applications.

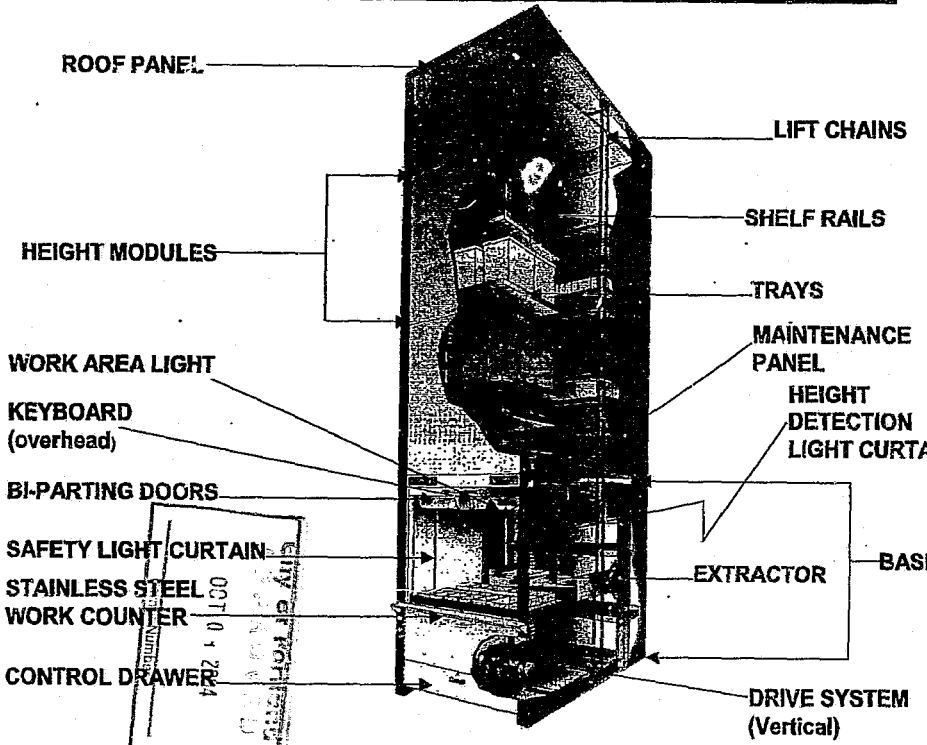
75mm (2.95") minimum tray spacing.

25mm (.98") tray spacing adjustability.

Roller transfer workstation and extractor allows for frictionless extraction of trays.

Part # Number

With its small footprint, a unit can be strategically placed directly in a work area for optimal time savings at point of use.



MICRO

Pacific Integrated Handling
10215 Portland Avenue
P.O. Box 44186, Tacoma, WA 98444
Ph: (253) 535-5888 Fax: (253) 536-2599

299/5000

Date: 9/15/2004

To: City of Portland
Amit Kamaar
Phone: 503-823-7561
Fax: 503-823-7576

From: Merlin van Gelderen, mvangelderen@pacificintegrated.com
Phone: 253-535-5888, Cell: 206-931-3722

Pages: 11

☒ Urgent ☒ For Review ☐ Please Comment ☒ Please Reply ☐ Please Recycle

Subject: Rasmussen, BMW – Structural Calculations

Dear Amit:

I am following up on the project that you are reviewing for us at Rasmussen BMW in Portland. We had submitted a seismic anchoring plan for a Remstar Shuttle (Vertical Lift Module). The old set of calculations did not provide enough information. We had our Structural Engineering firm, PCSA review the design of this equipment for resilience to seismic forces.

Please find attached the calculations and a sketch of the recommended brace for this unit.

Realizing that you are out of the office until Monday, please give me a call at your earliest convenience with your comments.

Thank you, Merlin van Gelderen

Merlin

PCSA Structural Solutions

Putnam Collins Scott Associates
Tacoma • Seattle

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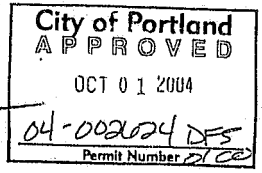
Jeffrey R. Klein, S.E.
Ronald E. Scelzo, S.E.

STRUCTURAL CALCULATIONS

FOR

RASMUSSEN, BMW
REMSTAR SHUTTLE
PORTLAND, OREGON

PREPARED BY
PUTNAM COLLINS SCOTT ASSOCIATES



SEPTEMBER 7, 2004
04-522

950 Pacific Avenue, Suite 1100 Tacoma, WA 98402-4493 • (253) 383-4797 • (253) 383-1557 fax
811 First Avenue, Suite 510 Seattle, WA 98104-1457 • (206) 292-8078 • (206) 467-7798 fax
www.pcsainc.com • Incorporated 1969

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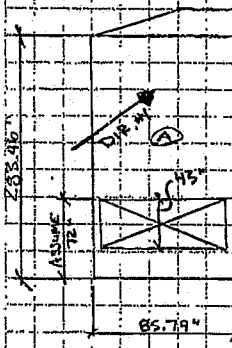
Puinam Collins Scott Associates
Tacoma • Seattle

Project: REMSTAR SEISMIC Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 1 of 9 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ _____ Date: 8/31/04
Originating Office: ☐ Tacoma ☐ Seattle



• PER MATHCAD.

DIR 2 → Fp = 13.45k (ALLOWABLE)

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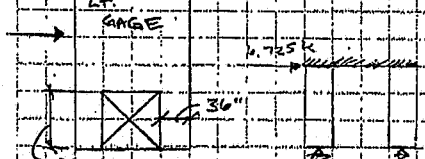
FACE (B) - DIRECTION #1

13.45k / 2 = 6.725 K PER SIDE



6.725k / 2 = 3.362k / PANEL

3.36k / 3' = 1120 #/FT

LT GAGE = 1.5 mm = 0.0591" ≈ 54 MILS (16 GA)

h/w = 2 : 1

CANTILEVERED COLUMN SYSTEM Ω = 2

950 Pacific Avenue, Suite 1100 Tacoma, WA 98402-4495 • (253) 383-2797 • (253) 383-1557 fax
811 First Avenue, Suite 510 Seattle WA 98104-1457 • (206) 292-5078 • (206) 467-7788 fax
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Puttnam Collins Scott Associates
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Project: _____ Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 2 of 9 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ _____ Date: _____
Originating Office: ☐ Tacoma ☐ Seattle

ALLOWABLE LOADS PER IBC TAB 2211.2(3)

.027" FASTENERS @ 4" O.C. = 1000 #/FT

ALLOWABLE = 1000 #/2 = 500 #/FT

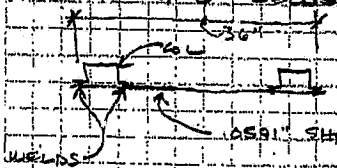
ACTUAL THICKNESS: TE = .059"

.059"/.027" = 2.19

500 #/FT x 2.19 = 1095 #/FT

2.2% OVER STRESSED
W/ OK

ACTUAL FASTENERS ARE NOT SCREWS, IT IS 1/4" ϕ WELDS @ 6" O.C.



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SINCE SIDE PANELS ARE ADEQUATE TO RESIST SEISMIC LOADS, BACK PANEL IS ADEQUATE W/ SHEET METAL TO RESIST 1/2 SEISMIC FORCE

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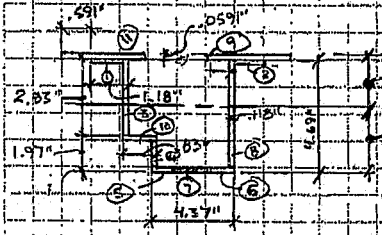
Project: _____ Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 3 of 9 Name: Z-50
☐ Memo ☐ Meeting Minutes ☐ _____ Date: _____
Originating Office: ☐ Tacoma ☐ Seattle

COLUMN SECTION PROPERTIES



- ASSUME ⑦ IS 16 GAUGE
TO ACCOUNT FOR SLATS

	y	A	yA	I	d	d²A	I
①	4.65"	.25	.58 in³	0	2.11	.56	.56
②	4.63"	.25	.58 in³	0	2.11	.56	.56
③	3.38"	.334	1.13 in³	.196	.76"	.193	.389
④	.985"	2.04	2.01 in³	.05	1.52	.471	.52
⑤	.659"	.171	.01 in³	0	2.45	1.02	1.02
⑥	.059"	.171	.01 in³	0	2.45	1.02	1.02
⑦	.059	.087	.005 in³	0	2.39	.497	.497
⑧	2.46	.539	1.327 in³	.99	1.1	.66	.99
⑨	4.72	.14	.659 in³	0	2.21	.68	.68
⑩	2.03	.097	.198	0	.60	.034	.034
⑪	4.72	.14	.659	0	2.21	.68	.68
		2.13	5.36				I = 6.9 in⁴

$\bar{y} = 5.36/2.13 = 2.51$

$A = 2.13\ in^2$ $I = 6.9\ in^4$ $r = \sqrt{6.9/2.13} = 1.8$

$S = I/c = 6.9/2.51 = 2.75\ in^3$

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Project: _____ Job No.: 04-523
☐ Calculations ☐ Phone Record Sheet 4 of 9 Name: ZSA
☐ Memo ☐ Meeting Minutes ☐ _____ Date: _____
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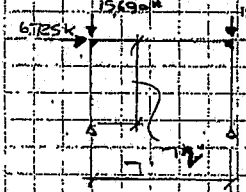
FACE A - DIRECTION #2

ANALYZE AS (4) COL. FRAME - 2 EA. SIDE

LOAD = 6.725k



AXIAL = 62757 #/4 = 15,690#

M = 20,175 #/ft / 2 col = 10,088 #-ft/col

AXIAL = 15690# / 2 col = 7845 #

COL. SECTION PROPERTIES

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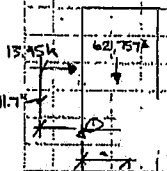
A = 2.13 in²
r = 1.8
I = 6.9 in⁴
S = 2.75 in³

ASSUME A36 STR.

kl/r = .8(179")/1.8" = 85.1 Fa = 19.58 ksi



ΣMo = 0 ↻

= 13.95k(141.7") + 62.757(42.9) + 62.757(a) = 0

a = 75.27"

RATIO "a" TO GET COL. LOADS @ SIDE:

75.27/85.73 (62757#) = 53,600# / 4 col

= 13,400# / col

fa = 13.4k/2.13 in² = 6.29 ksi = 32%

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Project: _____ Job No.: 04-522
☐ Calculation ☐ Phone Record Sheet 5 of 9 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ _____ Date: _____
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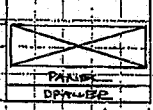

13.45k/8 ea. = 1.68k

M = 1.68k x 79" = 132.8 k-in

Fb = .6(36 ksi) = 21.6 ksi

fb = 132.8 k-in / 2.75 in³ = 48.2 ksi

224-6 7 N/A GOOD

ASSUME PANEL CAN BE STIFFENED TO RESIST MOMENT & USE 49" AS UNBRACED LENGTH OF COL.

M = 49"(1.68k)/2 = 41.16 k-in / 2.75 in³ = 14.97 ksi

Cm = BS FRAME w/ JOINT TRANSLATION

$f_a/F_a = \frac{C_m f_b}{\left(1 - \frac{f_a}{F_e}\right) F_b}$ (Hi-1) $F_e = \frac{12 (\pi)^2 29 \times 10^3}{23 (35.1)^2} = 121.1$

(Hi-1) $\frac{6.92}{19.58} + \frac{.85(14.97)}{\left(1 - \frac{6.92}{121.1}\right) 21.6 ksi} = 0.98 < 1.0$ →

(Hi-2) $\frac{6.92}{.6(36)} + \frac{14.97}{21.6} = 1.01$ OVERSTRESSED BY 1% (SEISMIC LOADS) -OK

COLUMN IS ADEQUATE w/ STIFFENED PANEL BELOW ACCESS OPENING

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☐ Calculation ☐ Phone Record Sheet 6 of 9 Name: ESD
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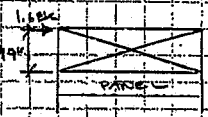
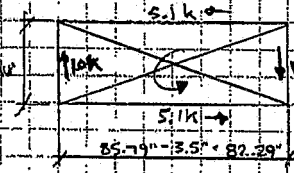
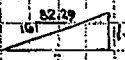
"DESIGN STIFFENER SPACE"



$M_{PANEL} = 1.68k \times 2 \times 49" / 2 = 82.32$ K-in / (85.79" - 3.5")
= 1.0 K UNDER TEP SIDE





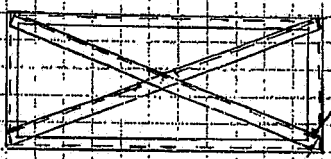
$\frac{1.0}{16} = \frac{x}{83.8"}$ $x = 5.24k$ @ ANGLE

LENGTH = 83.8" + 8" = 91.8" w/ 5.24k/leg

L = 84" k = 1.0

L2x2x3/16 r = .611 kl/r = 137.6 F_a = 8.07 ksi

8.07 ksi x .715 in² = 5.77 k > 5.24k



L2x2x3/16

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3/8"ø A307 BOLT (ONLY) A = .11in² x 18ksi = 1.98k BEA BOLT

USE (3) MIN PER SIDE

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☐ Calculation ☐ Phone Record Sheet 7 of 9 Name: ZSD
☐ Memo ☐ Meeting Minutes ☐ _____ Date: 9/2/04
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CHECK @ BELOW STIFFENED PANEL

1.65K

M = 23.52 k-in

4"

< MOMENT @ ACCESS OPENING (@ MID LENGTH IS SMALLER, THEREFORE @ IS ADEQUATE @ BOTT FOR BENDING @ MID)

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