STRUCTURAL CALCULATIONS
FOR

Shoreline Plaza Apartments Elevated Walkways
Boise, ID

For

CSHQA

Boise, ID

AHJ ENGINEERS, PC
STRUCTURAL CONSULTANTS

5418 N. Eagle Rd. #140
Boise, Idaho 83713
208.323.0199

Project#18097.00

SHORELINE PLAZA APARTMENTS ELEVATED WALKWAY

TABLE OF CONTENTS

PROJECT DESCRIPTION

The "Shoreline Plaza Apartments Elevated Walkway" project is to provide additional support to elevated concrete walkways which have been compromised by rusting metal decks and to repair damaged concrete surfaces on elevated concrete walkways.

DESCRIPTION OF STRUCTURAL ELEMENTS

Floor Framing:
The floor framing repair is to be accomplished by adding new wood joists

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ENGINEERING INFORMATION SHEET

Code:	2015 International Building Code
Risk Category (Table 1604.5):	II

GRAVITY LOADS

Snow Loading
(ASCE 7-10 Chapter 7)

p_g:	20	psf
p_f:	25	psf
I_s:	1.0	

Floor Loading Case #1

Finishes:	43.75	psf
Sheathing/Decking:	3.5	psf
Framing:	2.75	psf
Total	50	psf

Live Loading
(IBC Section 1607)

40	psf

MATERIALS

Concrete f'c:

Footings and Interior slab on grade:	2500	psi
Concrete over steel deck:	3000	psi
Stem walls and tilt-up panels:	4000	psi
Beams and columns:	4000	psi
Exterior Slab on grade:	4000	psi
Reinforcing:	60000	psi

Wood

Grade/Species:	Sawn Lumber DF#2 (or btr.)		Glulam 24F-V4 (DF/DF)		Microlam 1.9 E		Parallam 2.0 E	
F_b:	900	psi	2400	psi	2600	psi	2900	psi
F_c:	1350	psi	1650	psi	2510	psi	2900	psi
F_v:	180	psi	265	psi	285	psi	290	psi
E:	1600000	psi	1800000	psi	1900000	psi	2000000	psi

Design Loads:

Deck Dead Loads:

- 3.5" Concrete Deck: 43.75 psf
- 1½" 20 GA Deck: 2.5 psf

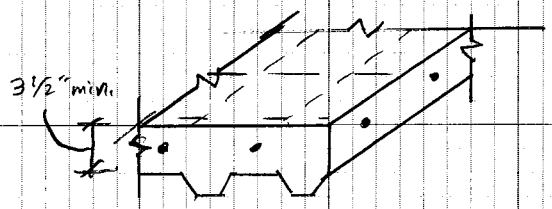
Σ = 46.25 psf ⇒ **50 psf**

Deck Live Load:

LL = 40 psf Residental Walkways

Check Concrete to span w/out rusted out deck.

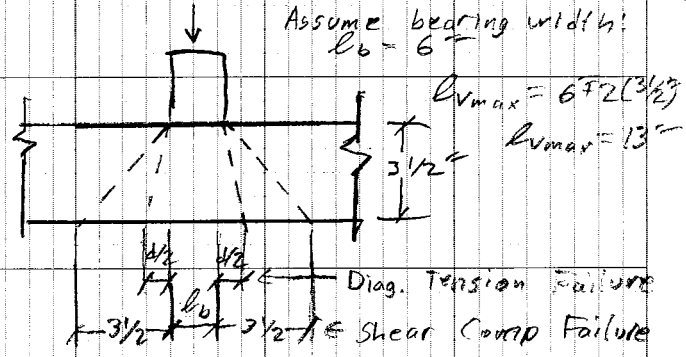
- Plain Concrete w/ no reinforcing Code does not allow for design of unreinforced concrete for flexure of nonfully supported applications. However, if span is short enough, shear will govern.



$\phi V_n = \phi 2 \lambda \sqrt{f'_c}\, b_w d$

$= (0.75)(2)(1.0)\sqrt{3{,}000}\,(13.in)(3.5in)$

$\phi V_n = 3738 \text{ lbs} = 3.738 \text{ kips}$



Punching Shear is not critical. Limit Span to Max Shear Failure Zone before flexure controls.

Because there is no designed slab reinforcement. Slab is not adequate to prevent brittle failure per code. Possibility of brittle (sudden) failure is not ideal for pedestrian traffic.

Where the Steel Deck is rusted, support for the Concrete will be replaced with Plywood supported by 2x's

Use 3/4" Group 1 Plywood

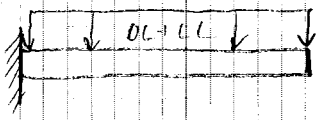
Spanning @ 24" O.C.

Joists: DL = 50psf x 2ft = 100plf Span = 8'-0"
LL = 40psf x 2ft = 80plf

Use 2x8 D.F. No. 1 or Better Placed at 24" O.C.

Cantelever Beam Connect:

Use HSS Steel Placed @ 24" O.C.
DL = 100plf Span = 3'-0"
LL = 80plf

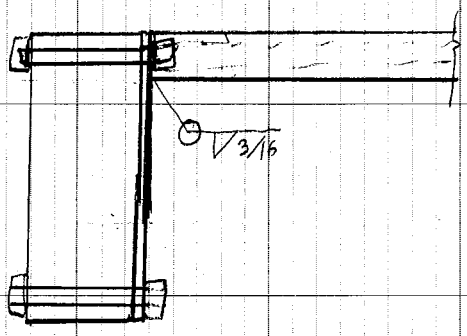


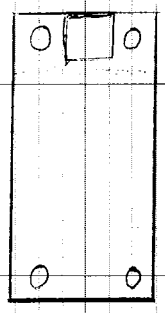
M_u = 0.810 k-ft
V_u = 0.540 kips

Use HSS 2x2x3/16

$T = C = \frac{0.810 \text{ k-ft}}{(10 \text{in}/12 \text{in/ft})} = 0.972$ kips

Use (4) 5/8" ø Thru Bolts on a 8"x12" Steel Plate





AHJ ENGINEERS, PC
STRUCTURAL CONSULTANTS

AHJ NO. 18097
PROJECT Shoreline Plaza

DATE: 10/09/18
BY: BE

SHEET NO. 5

Wood Beam

File = P:\18\18097--1\03-CAL~1\WOODJO~1.EC6
ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31

Lic. # : KW-06001594 — Licensee : AHJ Engineers, P.C.

Description : Wood Joists

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2015

Wood Species : Douglas Fir - Larch
Wood Grade : No.1

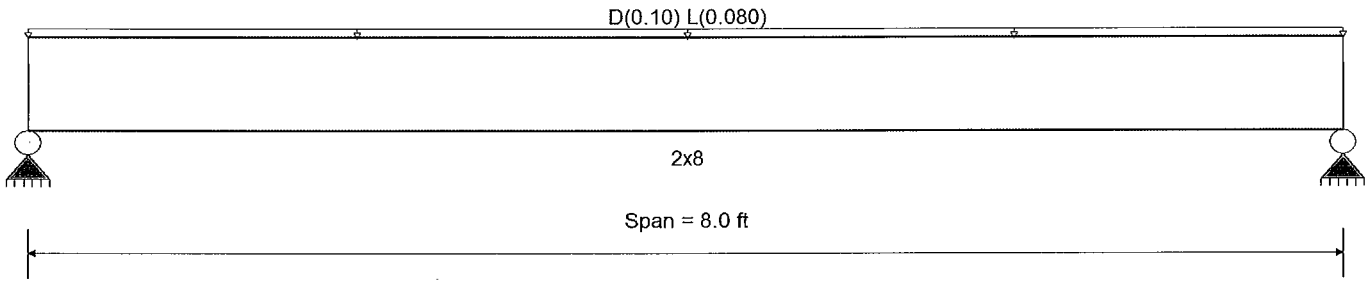
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	1,350.0 psi
Fb -	1,350.0 psi
Fc - Prll	925.0 psi
Fc - Perp	625.0 psi
Fv	170.0 psi
Ft	675.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.20 pcf

Repetitive Member Stress Increase



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Loads on all spans...
Uniform Load on ALL spans : D = 0.050, L = 0.040 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.706 : 1**	Maximum Shear Stress Ratio	=	**0.499 : 1**
Section used for this span		**2x8**	Section used for this span		**2x8**
fb : Actual	=	1,315.01 psi	fv : Actual	=	84.81 psi
FB : Allowable	=	1,863.00 psi	Fv : Allowable	=	170.00 psi
Load Combination		+D+L+H	Load Combination		+D+L+H
Location of maximum on span	=	4.000 ft	Location of maximum on span	=	7.416 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.097 in	Ratio =	986 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.219 in	Ratio =	438 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.436	0.308	0.90	1.200	1.00	1.15	1.00	1.00	1.00	0.80	730.56	1676.70	0.34	47.12	153.00
+D+L+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.706	0.499	1.00	1.200	1.00	1.15	1.00	1.00	1.00	1.44	1,315.01	1863.00	0.61	84.81	170.00
+D+Lr+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.314	0.222	1.25	1.200	1.00	1.15	1.00	1.00	1.00	0.80	730.56	2328.75	0.34	47.12	212.50
+D+S+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.341	0.241	1.15	1.200	1.00	1.15	1.00	1.00	1.00	0.80	730.56	2142.45	0.34	47.12	195.50
+D+0.750Lr+0.750L+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Wood Beam

File = P:\18\18097~~1\03-CAL~1\WOODJO~1.EC6
ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31

Lic. # : KW-06001594
Licensee : AHJ Engineers, P.C.

Description : Wood Joists

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 8.0 ft	1	0.502	0.355	1.25	1.200	1.00	1.15	1.00	1.00	1.00	1.28	1,168.89	2328.75	0.55	75.39	212.50
+D+0.750L+0.750S+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.546	0.386	1.15	1.200	1.00	1.15	1.00	1.00	1.00	1.28	1,168.89	2142.45	0.55	75.39	195.50
+D+0.60W+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.245	0.173	1.60	1.200	1.00	1.15	1.00	1.00	1.00	0.80	730.56	2980.80	0.34	47.12	272.00
+D+0.70E+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.245	0.173	1.60	1.200	1.00	1.15	1.00	1.00	1.00	0.80	730.56	2980.80	0.34	47.12	272.00
+D+0.750Lr+0.750L+0.450W+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.392	0.277	1.60	1.200	1.00	1.15	1.00	1.00	1.00	1.28	1,168.89	2980.80	0.55	75.39	272.00
+D+0.750L+0.750S+0.450W+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.392	0.277	1.60	1.200	1.00	1.15	1.00	1.00	1.00	1.28	1,168.89	2980.80	0.55	75.39	272.00
+D+0.750L+0.750S+0.5250E+H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.392	0.277	1.60	1.200	1.00	1.15	1.00	1.00	1.00	1.28	1,168.89	2980.80	0.55	75.39	272.00
+0.60D+0.60W+0.60H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.147	0.104	1.60	1.200	1.00	1.15	1.00	1.00	1.00	0.48	438.34	2980.80	0.20	28.27	272.00
+0.60D+0.70E+0.60H					1.200	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1	0.147	0.104	1.60	1.200	1.00	1.15	1.00	1.00	1.00	0.48	438.34	2980.80	0.20	28.27	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.2189	4.029		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.720	0.720
Overall MINimum	0.320	0.320
+D+H	0.400	0.400
+D+L+H	0.720	0.720
+D+Lr+H	0.400	0.400
+D+S+H	0.400	0.400
+D+0.750Lr+0.750L+H	0.640	0.640
+D+0.750L+0.750S+H	0.640	0.640
+D+0.60W+H	0.400	0.400
+D+0.70E+H	0.400	0.400
+D+0.750Lr+0.750L+0.450W+H	0.640	0.640
+D+0.750L+0.750S+0.450W+H	0.640	0.640
+D+0.750L+0.750S+0.5250E+H	0.640	0.640
+0.60D+0.60W+0.60H	0.240	0.240
+0.60D+0.70E+0.60H	0.240	0.240
D Only	0.400	0.400
Lr Only		
L Only	0.320	0.320
S Only		
W Only		
E Only		
H Only		

Steel Beam

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ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31
Lic. # : KW-06001594
Licensee : AHJ Engineers, P.C.

Description : Steel Supports for Stair Landing

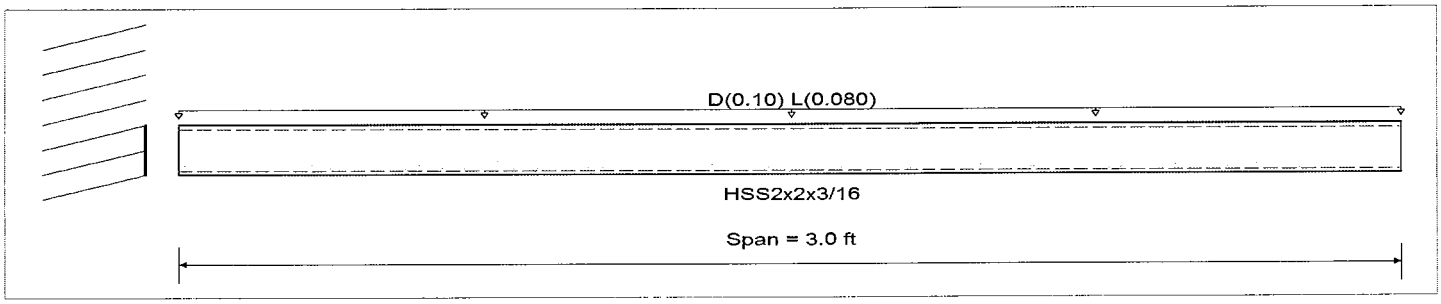
CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : D = 0.050, L = 0.040 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.407 : 1**	Maximum Shear Stress Ratio =	**0.058 : 1**
Section used for this span	**HSS2x2x3/16**	Section used for this span	**HSS2x2x3/16**
Ma : Applied	0.810 k-ft	Va : Applied	0.540 k
Mn / Omega : Allowable	1.989 k-ft	Vn/Omega : Allowable	9.240 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	0.000ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.075 in	Ratio =	958 >=360
Max Upward Transient Deflection	0.075 in	Ratio =	958 >=360
Max Downward Total Deflection	0.169 in	Ratio =	426 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 3.00 ft	1	0.226	0.032		-0.45	0.45	3.32	1.99	1.00	1.00	0.30	15.43	9.24
+D+L+H													
Dsgn. L = 3.00 ft	1	0.407	0.058		-0.81	0.81	3.32	1.99	1.00	1.00	0.54	15.43	9.24
+D+Lr+H													
Dsgn. L = 3.00 ft	1	0.226	0.032		-0.45	0.45	3.32	1.99	1.00	1.00	0.30	15.43	9.24
+D+S+H													
Dsgn. L = 3.00 ft	1	0.226	0.032		-0.45	0.45	3.32	1.99	1.00	1.00	0.30	15.43	9.24
+D+0.750Lr+0.750L+H													
Dsgn. L = 3.00 ft	1	0.362	0.052		-0.72	0.72	3.32	1.99	1.00	1.00	0.48	15.43	9.24
+D+0.750L+0.750S+H													
Dsgn. L = 3.00 ft	1	0.362	0.052		-0.72	0.72	3.32	1.99	1.00	1.00	0.48	15.43	9.24
+D+0.60W+H													
Dsgn. L = 3.00 ft	1	0.226	0.032		-0.45	0.45	3.32	1.99	1.00	1.00	0.30	15.43	9.24
+D+0.70E+H													
Dsgn. L = 3.00 ft	1	0.226	0.032		-0.45	0.45	3.32	1.99	1.00	1.00	0.30	15.43	9.24
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 3.00 ft	1	0.362	0.052		-0.72	0.72	3.32	1.99	1.00	1.00	0.48	15.43	9.24
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 3.00 ft	1	0.362	0.052		-0.72	0.72	3.32	1.99	1.00	1.00	0.48	15.43	9.24
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 3.00 ft	1	0.362	0.052		-0.72	0.72	3.32	1.99	1.00	1.00	0.48	15.43	9.24
+0.60D+0.60W+0.60H													

Steel Beam

File = P:\18\18097-~1\03-CAL~1\WOODJO~1.EC6
ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31
Lic. # : KW-06001594
Licensee : AHJ Engineers, P.C.

Description : Steel Supports for Stair Landing

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 3.00 ft	1	0.136	0.019		-0.27	0.27	3.32	1.99	1.00	1.00	0.18	15.43	9.24
+0.60D+0.70E+0.60H													
Dsgn. L = 3.00 ft	1	0.136	0.019		-0.27	0.27	3.32	1.99	1.00	1.00	0.18	15.43	9.24

Overall Maximum Deflections

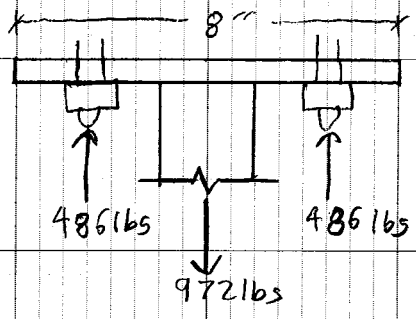
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.1691	3.000		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.540	
Overall MINimum	0.180	
+D+H	0.300	
+D+L+H	0.540	
+D+Lr+H	0.300	
+D+S+H	0.300	
+D+0.750Lr+0.750L+H	0.480	
+D+0.750L+0.750S+H	0.480	
+D+0.60W+H	0.300	
+D+0.70E+H	0.300	
+D+0.750Lr+0.750L+0.450W+H	0.480	
+D+0.750L+0.750S+0.450W+H	0.480	
+D+0.750L+0.750S+0.5250E+H	0.480	
+0.60D+0.60W+0.60H	0.180	
+0.60D+0.70E+0.60H	0.180	
D Only	0.300	
Lr Only		
L Only	0.240	
S Only		
W Only		
E Only		
H Only		

Minimum Steel Plate Thickness



$M_{max} = 2 \times 486\ lbs \times (2.5\ in / 12\ in/ft) = 202.5\ lb\text{-}ft$

$S = \frac{M}{F_b} = \frac{202.5\ lb\text{-}ft\ (12\ in/ft)}{(33000\ psi / 1.67)} = 0.1230\ in^3$

$S = \frac{bd^2}{6}$

$d = \sqrt{\frac{6S}{b}} = \sqrt{\frac{6(0.1230\ in^3)}{8\ in}} =$

$d = 0.3036\ in$

Use 8" x 12" x 3/8" steel plate on each side

AHJ ENGINEERS, PC STRUCTURAL CONSULTANTS	AHJ NO. 18097 PROJECT Shoreline Plaza	DATE: 10/9/18 BY: BE	SHEET NO. 8

Checking the Beam for Torsion

Beam: $6\frac{3}{4}" \times 12"$ GLB

ℓ: 12'-0"

$$M_{max} = \frac{(1.2DL + 1.6LL)\ell^2}{8} = \frac{[1.2(7ft)(50psf) + 1.6(7ft)(40psf)](12ft)^2}{8}$$

$M_{max} = 15,624$ ft-lbs

Properties of Beam: $F_{bx} = 2400$ psi

$E_y = 1,600,000$ psi

Calculate Properties: $F_{bx}' = F_{bx} C_D C_M C_t C_{fu} C_i$

$= (2400psi)(1.15)(1.0)(1.0)(1.0)(1.0) = 2760psi$

$E_{y05} = E_y (1 - 1.645 COV_E)$ (Adjust for Shear free E)$/SF$

$= 1,600,000psi\,(1 - 1.645(0.11))(1.05)/(1.66) = 829,000psi$

$S_x = bd^2/6 = (6.75)(12)^2/6 = 162 in^3$

$I_x = bd^3/12 = (6.75)(12)^3/12 = 972 in^4$

$I_y = db^3/12 = (12)(6.75)^3/12 = 307.55 in^4$

$C_v = (21/\ell)^{1/x}(12/d)^{1/x}(5.125/6)^{1/x}$ where $x = 10$

$= (21/12)^{0.1}(12/12)^{0.1}(5.125/6.75)^{0.1} = 1.0238$

Calculate Buckling Moment Capacity:

$C_b = 1.05$

$C_e = 1.00$

$M_{cr} = 1.3 C_b C_e E_{y05} I_y / \ell_u = 1.3(1.05)(1.00)(829,000psi)(307.55in^4)/24in$

$= 14,500,791$ lb-in

$M_{cr} = 1208,399$ lb-ft

Calculate allowable bending Moment:

$M' = F_b' S_x = (2760psi)(162in^3) = 477120$ lb-in $= 37,260$ lb-ft

$\alpha_b = M_{cr}/M' = 1,208,399$ lb-ft$/37,260$ lb-ft $= 32.43$

$$C_L = \frac{1+\alpha_b}{1.9} - \sqrt{\left(\frac{1+\alpha_b}{1.9}\right)^2 - \left(\frac{\alpha_b}{0.95}\right)} = \frac{1+32.43}{1.9} - \sqrt{\left(\frac{1+32.43}{1.9}\right)^2 - \left(\frac{32.43}{0.95}\right)}$$

$C_L = 0.998$

$M' = M^*$ (lesser of C_s or C_L) = (37,260 lb-ft)(0.998)

$M' = 37,185.5$ lb-ft

$M' \geq M_{max} \Rightarrow 37,185.5$ ft-lbs $> 15,624$ ft-lbs

$6\ 3/4" \times 12"$ GLB Okay

AHJ ENGINEERS, PC STRUCTURAL CONSULTANTS	AHJ NO. 18097 PROJECT Shoreline Plaza	DATE: 10/09/18 BY: BE	SHEET NO. 10

IBC 2015 1609.6 Alternate All-Heights Wind

File = P:\18\18097-~1\03-CAL~1\WOODJO~1.EC6
ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31
Lic. # : KW-06001594
Licensee : AHJ Engineers, P.C.

Description : Wind

Analytical Values

Calculations per IBC 2015 1609.6

User verified these IBC 2015 All-Heights Wind Method Limitations :

1609.6.1 (1) : Total Height <= 75 ft with (Height / Least Width) <= 4
-or- Fundamental frequency >= 1 hertz

1609.6.1 (2) : Not sensitive to dynamic effects

1609.6.1 (3) : Site not affected by channeling/buffeting from upwind items

1609.6.1 (4) : Simple diaphragm building per ASCE 7-10 Sec 26.2

1609.6.1 (5) : Aware of ASCE 7 provisions for open buildings, multispan gable roofs, stepped roofs, sawtooth roofs, domed roofs, roofs with slopes > 45 deg, solid free standing walls & signs.

1609.6.4.1 : Aware of need to check torsion per ASCE 7 Fig. 27.4-8

Analytical Values . . .

Exposure Category, ASCE 7-10 Sect 26.7.3	Exposure B
Mean Roof Height	47.50 ft
Topographic Factor per ASCE 7-10 Sec 26.8.2	
K1 = 0.250 K2 = 1.0 K3 =	1.0
Force Kzt to 1.0 per ASCE 7-10 26.8.2	Yes
Topographic Factor Kzt = (1+K1*K2*K3)^2 =	1.000
V : Basic Wind Speed per ASCE 7-10 26.5.1	115.0 mph

MWFRS Table per IBC 2015 1609.6.2, Section 1

Design Pressure $P = 0.00256\ V^2\ K_z\ C_{net}\ K_{zt}$

WINDWARD WALLS & PARAPETS — WALLS — PARAPETS psf

Kz based on ibc 2015 1609.6.4.2 Item 1

Height	Kz	Enclosed +Internal	Enclosed -Internal	Partially Enclosed +Internal	Partially Enclosed -Internal	Enclosed	Partially Enclosed
0 - 15 '	0.570	8.32	14.13	2.13	20.32	24.77	24.77
20'	0.620	9.05	15.37	2.32	22.10	26.94	26.94
25 '	0.660	9.64	16.36	2.46	23.53	28.68	28.68
30 '	0.700	10.22	17.35	2.61	24.95	30.42	30.42
40 '	0.760	11.09	18.84	2.84	27.09	33.03	33.03
50 '	0.810	11.82	20.07	3.02	28.87	35.20	35.20
60 '	0.850	12.41	21.07	3.17	30.30	36.94	36.94
70 '	0.890	12.99	22.06	3.32	31.73	38.68	38.68
80 '	0.930	13.58	23.05	3.47	33.15	40.41	40.41
90 '	0.960	14.01	23.79	3.59	34.22	41.72	41.72
100 '	0.990	14.45	24.54	3.70	35.29	43.02	43.02

LEEWARD & SIDEWALLS	Enclosed +Internal	Enclosed -Internal	Partially Enclosed +Internal	Partially Enclosed -Internal
Kz based on IBC 2015 1609.6.4.2 Item 2	0.798			
Leeward Wall	-13.81	-5.69	-22.47	2.98
Side Wall	-17.87	-9.48	-26.26	1.08
Parapet Wall : Leeward	*Both Directions*	-23.01	*Both Directions*	-23.01

IBC 2015 1609.6 Alternate All-Heights Wind

File = P:\18\18097-~1\03-CAL~1\WOODJO~1.EC6
ENERCALC, INC. 1983-2018, Build:10.18.1.31, Ver:10.18.1.31

Lic. # : KW-06001594
Licensee : AHJ Engineers, P.C.

Description : Wind

MWFRS per IBC 2015 Table 1609.6.2 Section 1

Kz per IBC 2015 1609.6.4.2 Item 2 = 0.798

Design Pressure $P = 0.00256\ V^2\ K_z\ C_{net}\ K_{zt}$ psf

WIND PERPENDICULAR TO RIDGE

		Enclosed		Partially Enclosed	
		+Internal	-Internal	+Internal	-Internal
Leeward Roof or Flat Roof		-17.87	-9.48	-26.26	-1.08
Windward Roof Slopes					
Slope < 2:12 (10 deg)	Condition 1	-29.51	-21.39	-38.18	-12.73
	Condition 2	-7.58	0.54	-16.25	9.21
Slope < 4:12 (18 deg)	Condition 1	-19.76	-11.37	-28.16	-2.98
	Condition 2	-1.35	6.77	-10.02	15.43
Slope < 5:12 (23 deg)	Condition 1	-15.70	-7.58	-24.37	1.08
	Condition 2	0.81	9.21	-7.85	17.60
Slope < 6:12 (27 deg)	Condition 1	-12.73	-4.33	-21.12	4.06
	Condition 2	1.62	10.02	-6.77	18.41
Slope < 7:12 (30 deg)	Condition 1	-10.02	-1.62	-18.41	-7.04
	Condition 2	1.90	10.02	-6.77	18.68
Slope < 9:12 (37 deg)	Condition 1	-7.31	1.08	-15.70	9.48
	Condition 2	3.79	11.91	-4.87	20.58
Slope < 12:12 (45 deg)		3.79	11.91	-4.87	20.58
WIND PARALLEL TO RIDGE					
All slopes including Flat Roofs		-29.51	-21.39	-38.18	-12.73

Roof & Overhang Components & Cladding per IBC 2015 Table 1609.6.2, Section 2 & 3

Design Pressure $P = 0.00256\ V^2\ K_z\ C_{net}\ K_{zt}$

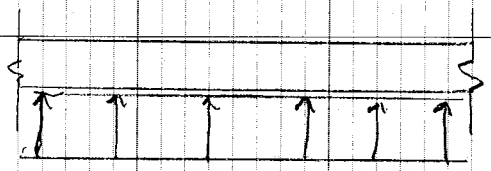
Description	*Continuity*	*Item Type*	Eff. Area ft^2	Kz		Enclosed	Partially Enclosed
	No Discontinuity	Gable, Slope < 6:12	10.00	0.798	+ :	0.00	0.00
					- :	0.00	0.00

Wall & Parapet Components & Cladding per IBC 2015 Table 1609.6.2, Section 4 & 5

Design Pressure $P = 0.00256\ V^2\ K_z\ C_{net}\ K_{zt}$

Description	*Continuity*	*Item Type*	Z, Ht. Above Ground Level, ft	Eff. Area ft^2	Kz		Enclosed	Partially Enclosed
	No Discontinuity	Wall Elements, h<=60 ft	25	10.00	0.66	+ :	22.41	29.58
						- :	-24.42	-31.37

Wind Uplift for Deck:



Uplift = $q_h G C_N$ (psf)

q_h = 26.26 psf

G = 0.85

C_N = 1.2

$p = q_h G C_N = (26.26 psf)(0.85)(1.2)$

p = 26.785 psf

Wind uplift for hangers: $\frac{(26.785 psf)(2 ft)(8 ft)}{2} = 214.28$ lbs

Use Simpson-Strong Tie LUS Hanger

AHJ ENGINEERS, PC
STRUCTURAL CONSULTANTS

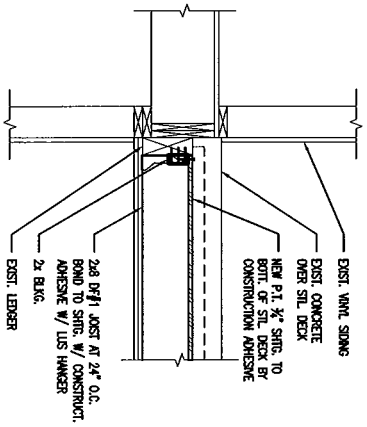
AHJ NO. 18097

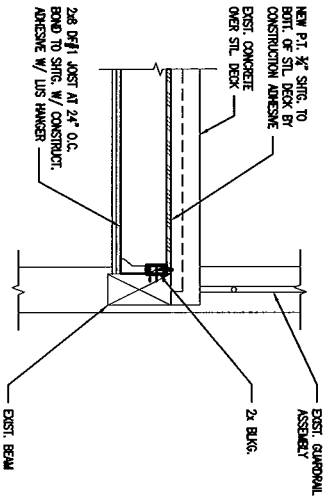
PROJECT Shoreline Plaza

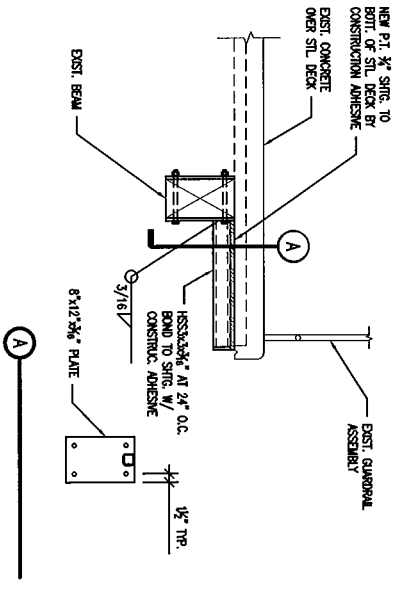
DATE: 10/04/18

BY: BE

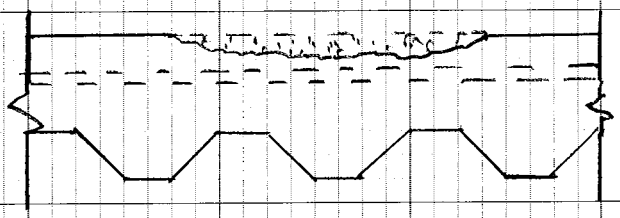
SHEET NO. 13


EXIST. VINYL SIDING
EXIST. CONCRETE OVER STL DECK
NEW P.T. ¾" SHTG. TO BOTT. OF STL. DECK BY CONSTRUCTION ADHESIVE
2x8 DF§1 JOIST AT 24" O.C. BOND TO SHTG. W/ CONSTRUCT. ADHESIVE W/ LUS HANGER
2x BLKG.
EXIST. LEDGER


NEW P.T. ¾" SHTG. TO BOTT. OF STL. DECK BY CONSTRUCTION ADHESIVE
EXIST. CONCRETE OVER STL. DECK
2x8 DF§1 JOIST AT 24" O.C. BOND TO SHTG. W/ CONSTRUCT. ADHESIVE W/ LUS HANGER
EXIST. BEAM
2x BLKG.
EXIST. GUARDRAIL ASSEMBLY


NEW P.T. ¾" SHTG. TO BOTT. OF STL. DECK BY CONSTRUCTION ADHESIVE
EXIST. CONCRETE OVER STL. DECK
EXIST. BEAM
A
3/16
HSS3x3x¼" AT 24" O.C. BOND TO SHTG. W/ CONSTRUC. ADHESIVE
EXIST. GUARDRAIL ASSEMBLY
8"x12"x⅜" PLATE
½" TYP.
A

Concrete Deck Repair Sequence



Use SikaTop 122 Plus Mortar

Summary Procedure (Also see M. R.)

Application of SikaTop Mortar:

- Remove all deteriorated concrete, dirt, oil, and other bond inhibiting materials from surface. Preparation should be done with high pressure water blast, sand blasting, or other mechanical means to expose aggregate surface. Saturate surface to SSD condition with Clean Water.
- Prime Prepared Surface with a brushed coat of Sika Armatec 110 EpoCem, alternatively prime with a brushed coat of SikaTop 122 plus Mortar. The repair mortar must be applied before Primer dries.
- Mix SikaTop 122 Plus Mortar as per mixing instruction
- SikaTop 122 plus must be scrubbed into the substraight, filling all pores and voids. Force material to edge and work towards center. Allow mortar to set to desired thickness. Finish with wood or sponge float and broom for rough finish.
- Cure wet with burlap and polyethylene, a fine mist of water, or water based curing compound. Moist curing should take place immediately after finishing.
- Protect finished material from direct sunlight, wind, rain and frost for first 24 hours.

BUILDING TRUST

PRODUCT DATA SHEET
SikaTop®-122 Plus

TWO-COMPONENT, POLYMER-MODIFIED, CEMENTITIOUS, TROWEL-GRADE MORTAR PLUS SIKA FERROGARD® 901 PENETRATING CORROSION INHIBITOR

PRODUCT DESCRIPTION

SikaTop®-122 Plus is a two-component, polymer-modified, portland cement based, fast-setting, trowel-grade mortar. It is a high performance repair mortar for horizontal and vertical surfaces and offers the additional benefit of Sika FerroGard® 901, a penetrating corrosion inhibitor.

USES

- On grade, above and below grade on concrete and mortar.
- On horizontal surfaces.
- As a structural repair material for parking structures, industrial plants, walkways, bridges, tunnels, dams, ramps, floods, etc.
- To level concrete surfaces.
- As an overlay system for topping/resurfacing concrete.

CHARACTERISTICS / ADVANTAGES

- Extremely low shrinkage **proven by four industry standard test methods**
- High compressive and flexural strengths
- High abrasion resistance
- Increased freeze/thaw durability and resistance to deicing salts
- Compatible with coefficient of thermal expansion of concrete - Passes ASTM C-884
- Increased density - improved carbon dioxide resistance (carbonation) without adversely affecting water vapor transmission (not a vapor barrier)
- Sika FerroGard® 901, a penetrating corrosion inhibitor - reduces corrosion even in the adjacent concrete

APPROVALS / STANDARDS

- USDA certifiable for the food industry
- ANSI/NSF Standard 61 potable water compliant
- Tested per ICRI guidline for inorganic repair material data sheet protocol guidline n°320.3R

PRODUCT INFORMATION

Packaging	**Component A** 1 gal (3.78 L) jug 4/carton	**Component B** 61.5 lb (28.9 kg) bag
Appearance / Color	Concrete gray when mixed	
Shelf Life	12 months from date of production if stored properly in original, unopened and undamaged sealed packaging	
Storage Conditions	Store dry at 40–95 °F (4–35 °C) Protect Component A from freezing. If frozen, discard. Protect Component B from moisture. If damp, discard.	

Density	136 lbs/ft³ (2.18 kg/L)	(ASTM C-138)

TECHNICAL INFORMATION

Compressive Strength	1 day	2,500 psi (17.2 MPa)	(ASTM C-109) 73 °F (23 °C) 50 % R.H.
	7 days	5,300 psi (36.5 MPa)	
	28 days	7,000 psi (48.3 MPa)	
Modulus of Elasticity in Compression	28 days	3.0x10⁶ psi	(ASTM C-469) 73 °F (23 °C) 50 % R.H.
Flexural Strength	28 days	1,500 psi (10.3 MPa)	(ASTM C-293) 73 °F (23 °C) 50 % R.H.
Splitting Tensile Strength	28 days	500 psi (3.4 MPa)	(ASTM C-496) 73 °F (23 °C) 50 % R.H.
Tensile Strength	28 days	2,000 psi (13.8 MPa)	(ASTM C-882 modified)*
	* Mortar scrubbed into substrate at 73 °F (23 °C) and 50 % R.H.		
Pull-Out Resistance	7 days	>300 psi (2.1 MPa)	(ASTM C-1583) 73 °F (23 °C) 50 % R.H.
	28 days	400 psi (2.8 MPa)	
Shrinkage	28 days	1''x1''x11-1/4'' specimen: <0.05 %	(ASTM C-157 modified (mod. ICRI 320.3R)) 73 °F (23 °C) 50 % R.H.
		3''x3''x11-1/4'' specimen: <0.021 %	
Ring Test	Duration	>70 days	(ASTM C-1581) 73 °F (23 °C) 50 % R.H.
	Average Max Strain	-9 µstrain	
	Average Stress Strain	0.49 psi/day	
	Potential for Cracking	Low	
Baenziger Block	90 days	No cracking	
Freeze-Thaw Stability	300 cycles	98 %	(ASTM C-666)
Rapid Chloride Permeability	28 days	< 500 C	(ASTM C-1202 AASHOT T-277)

APPLICATION INFORMATION

Mixing Ratio	Plant-proportioned kit, mix entire unit.	
Fresh Mortar Density	136 lbs/ft³ (2.18 kg/l)	(ASTM C-138)
Coverage	Neat	0.51 ft³ (0.02 m³) per unit
	Extended with 42 lb (19 kg) of 3/8" (9.5 mm) gravel	0.75 ft³ (0.03 m³) per unit
	(Coverage figures do not include allowance for surface profile and porosity or material waste)	

Layer Thickness	**Min.**	**Max. in one lift**
Neat	1/8" (3.2 mm)	1" (25 mm)
Extended	1" (25.4 mm)	4" (101.6 mm)

Product Temperature	65–75 °F (18–24 °C)
Ambient Air Temperature	> 45 °F (7 °C)
Substrate Temperature	> 45 °F (7 °C)
Application Time	~ 30 minutes As the temperature will affect the pot life, application temperature: ▪ Above 73 °F (23 °C) will reduce the pot life and workability ▪ Below 73 °F (23 °C) will extend the pot life and workability
Finishing Time	50–120 minutes Note: All times start after adding Component 'B' to Component 'A' and are highly affected by temperature, relative humidity, substrate temperature, wind, sun and other job site conditions.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

- Concrete, mortar, and masonry products must be clean and sound.
- Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/8" (3.2mm) in depth.
- Preparation work should be done by high pressure water blast, scabbler or other appropriate mechanical means to obtain an exposed aggregate surface profile of ±1/16"-1/8" (1.6-3.2 mm) (CSP-5-6).
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a pull-off test.
- Saw cutting of edges is preferred and a dovetail is recommended.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.

PRIMING

- Reinforcing steel: Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatec® 110 EpoCem (consult PDS).

- Concrete Substrate: Prime the prepared substrate with a brush or sprayed applied coat of Sika® Armatec® 110 EpoCem (consult PDS). Alternately, a scrub coat of SikaTop®-122 Plus can be applied prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.

MIXING

- Pour approximately 7/8 of Component 'A' into the mixing container.
- Add Component 'B' (powder) while mixing continuously.
- Mix mechanically with a low-speed drill (400–600 rpm) and mixing paddle or mortar mixer.
- Add remaining Component 'A' (liquid) to mix if a more loose consistency is desired.
- Mix to a uniform consistency, maximum 3 minutes.
- Thorough mixing and proper proportioning of the two components is necessary.
- Refer to ACI 306 Guidelines when there is a need to place this product in cold & hot temperatures. Thinner application will be more sensitive to the temperature

EXTENSION WITH AGGREGATES

- For applications greater than 1" (25.4 mm) in depth, add 3/8" (9.5 mm) coarse aggregate.
- Pour all of Component 'A' into mixing container.
- Add all of Component 'B' while mixing, then introduce 3/8" (9.5 mm) coarse aggregate at desired quantity.
- Mix to uniform consistency, maximum 3 minutes.
- The aggregate must be non-reactive (reference ASTM C-1260, C-227 and C-289), clean, well graded, Saturated Surface Dry (SSD), have low absorption and high density, and comply with ASTM C-33 size number 8 per Table 2.
- Do not use limestone aggregate.
- Variances in the quality of the aggregate will affect the physical properties of SikaTop®-122 Plus and may result in different strengths.
- The addition rate is 42 lb (19 kg) of aggregate per bag. It is approximately 3.0-4.5 gallons (11.3-17.0 L) by loose volume of aggregate.

APPLICATION

- SikaTop®-122 Plus must be scrubbed into the substrate, filling all pores and voids.
- Force material against edge of repair, working toward center.
- After filling repair, consolidate, then screed.
- Allow mortar or concrete to set to desired stiffness, then finish with wood or sponge float for a smooth surface, or broom or burlap-drag for a rough finish.

CURING TREATMENT

- As per ACI recommendations for Portland cement concrete, curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water or a water based* compatible curing compound meeting ASTM C-309.
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.
- To prevent from freezing, cover with insulating material.

* Pretesting of curing compound is recommended.

LIMITATIONS

- Do not use solvent-based curing compound.
- Size, shape and depth of repair must be carefully considered and consistent with practices recommended by ACI or ICRI. For additional information, contact Technical Service.
- For additional information on substrate preparation, refer to ICRI Guideline No.310.2R Coatings, Polymer Overlays, and Concrete Repair.
- If aggressive means of substrate preparation is employed, substrate strength should be tested in accordance with ACI 503 Appendix A prior to the repair application.
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur 32 Hi-Mod.

BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

LOCAL RESTRICTIONS

See Legal Disclaimer.

ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

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