Live Load Rating Analysis

SIGMADEK SDADBWC Aluminum Deck Board

Report E4533.02-122-34

Rendered to:

SIGMADEK
600 Crowfoot Crescent NW, Suite 260
Calgary, Alberta T3G 0B4
CANADA

Prepared by:

Joseph A. Reed, P.E.
Michael E. Weigner, P.E.

Architectural Testing, Inc.
130 Derry Court
York, Pennsylvania 17406
(717) 764-7700

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COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL ERICH WEIGNER
ENGINEER
No. PE074983

Digitally Signed by: Joseph A. Reed

Joseph A. Reed, P.E.
Director – Engineering

Digitally Signed by: Michael Weigner

Michael E Weigner, P.E.
Senior Project Engineer

2015.02.10 11:46:32 -05'00'

Scope

Architectural Testing, Inc. was contracted by SIGMADEK to perform a design live load analysis for their SDADBWC Aluminum Deck Board. The purpose of the analysis was to determine an allowable design live load for a deck board spanning a maximum of 16" over wood or aluminum joists.

Reference standards utilized in this project include:

2012 International Building Code – IBC, International Code Council, 2012.

Aluminum Design Manual 2010, The Aluminum Association, Inc., 2010.

Product Description

SIGMADEK SDADBWD deck boards are manufactured from extruded 6005-T5 Aluminum. These deck boards are intended to accommodate a ceramic wear surface. The product is intended for use as an exterior deck board placed over wood or aluminum floor joists

Analyses

Deck board strength and stiffness is calculated using allowable design stress methodology of the Aluminum Design Manual. The lower of these two values will be the maximum allowable live load for the SIGMADEK SDADBWC deck board.

Deck board strength is based on the lowest limit states of compression and tension to find a maximum F_b. The maximum bending stress is then used to solve for a maximum Live Load based on the physical properties of the SIGMADEK SDADBWC and a maximum span length of 16 inches.

Deck board is limited to a maximum deflection of L/360 per the IBC codes. The maximum deflection is then used to solve for a maximum Live Load based on the physical properties of the SIGMADEK SDADBWC and a maximum span length of 16 inches.

Determination of the allowable live load is presented on page 4 to page 7.

Conclusion

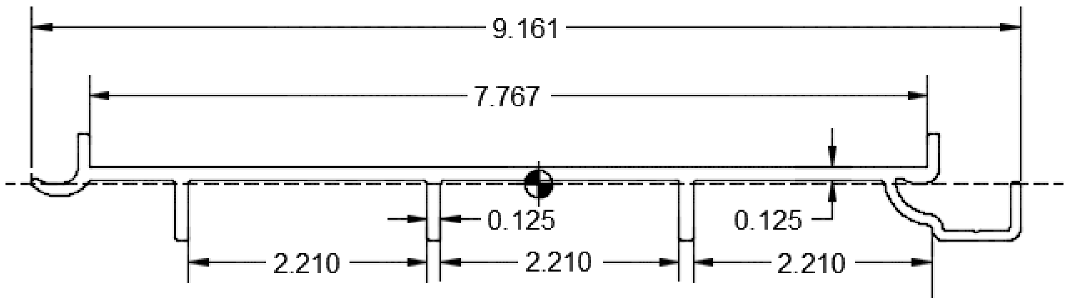
SIGMADEK SDADBWD deck boards, when installed over support framing members spaced at a maximum of 16 inches on center, are capable of supporting a uniform design live load of 488 psf. This analysis is solely based upon classic engineering mechanics.

Attached Drawings

Aluminum Deckboards with Ceramic. Drawing Number SDADBWC. SIGMADECK. Revision D, 11/04/2014. (1 page)

Calculations

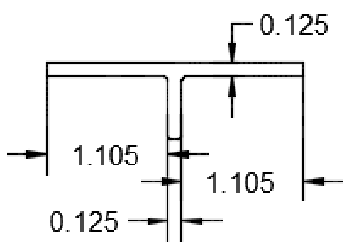
Member SDADBWC



------------ SDADBWC ------------

Area:	1.5167
Bounding box:	X: -4.6967 -- 4.4641 Y: -0.5292 -- 0.4708
Moments of inertia:	X: 0.0596 Y: 11.3416
Radii of gyration:	X: 0.1982 Y: 2.7346

Intermediate Stiffener



---INTERMEDIATE STIFFENER---

Area:	0.3619
Bounding box:	X: -1.1675 – 1.1675 Y: -0.5569 – 0.1281
Moments of inertia:	X: 0.0087 Y: 0.1327
Radii of gyration:	X: 0.1551 Y: 0.6056

Deck Board Uniform Live Load Rating

6005 – T5 Aluminum

F_{tu} = 38 ksi	Aluminum Design Manual Table A3.4
F_{ty} = 35 ksi	Aluminum Design Manual Table A3.4
F_{cy} = 35 ksi	Aluminum Design Manual Table A3.4
F_{su} = 24 ksi	Aluminum Design Manual Table A3.4
E = 10,100 ksi	Aluminum Design Manual Table A3.4
K_t = 1.25	Aluminum Design Manual Table A3.3
$\Omega_{\text{tensile rupture}}$ = 1.95	Aluminum Design Manual F1
$\Omega_{\text{all else}}$ = 1.65	Aluminum Design Manual F1

Find F_b for lowest of limit states:

Tension

Uniform Tension:

$\Omega F_t = F_{ty}/\Omega$

= 35 ksi/1.65 = <u>21.212 ksi</u>

Tensile Rupture

$\Omega F_t = (F_{tu} / K_t) / \Omega$

= (38 ksi/1.25)/1.95 = <u>15.59 ksi</u>

Compression

Flat Elements Supported Both Edges — Aluminum Design Manual B.5.4.2

b/t = S = 2.210"/0.125" = 17.68 < S_1 (20.8)

$\Omega F_{cy} = F_{cy}/\Omega$

= 35 ksi/1.65 = 21.212 ksi

Deck Board Uniform Live Load Rating (Continued)

Compression

Flat Elements Supported on Both Edges with Intermediate Stiffener ADM B.5.4.4

$\lambda_s = 4.62(b/t) * ([1+A_s/(bt)]/[1+(1+(10.67I_o/bt^3))^{1/2})])^{1/2}$

$A_s = 0.56" \times 0.125" = 0.07 \text{ in}^2$

$I_o = 0.0087 \text{ in}^4$ (Intermediate Stiffener)

b = 2.210"

t = 0.125"

$\lambda_s = 38.15 > 17.8\ (S_1)$

$38.15 < 66\ (S_2)$

F/ Ω = 23.9 – 0.149S = 23.9 – 0.1449(38.15) = <u>18.22 ksi</u>

<u>F_b = 15.59 ksi (Tensile Rupture Controls)</u>

Solve for Live Load (Bending Strength)

$F_b = 15.59$ ksi

$F_b = Mc/I \rightarrow M = F_bI/c$

$= (15{,}590 \text{ psi})(0.0596 \text{ in}^4)/0.5292"$

$= 1{,}755.59$ lb. in

$M = wl^2/8 \rightarrow w = 8M/l^2$

$= 8(1{,}755.59 \text{ lb.-in})/16"^2 = 54.9$ pli

= 54.9 pli x 12"/ft. = 658.8 plf

658.8 plf/0.763 ft. = <u>863 psf</u>

<u>Maximum Live Load based on F_b is 863 psf</u>

Deck Board Uniform Live Load Rating (Continued)

Solve for Live Load (Stiffness)

Δ_{max} = l/360 IBC 2012, Table 1604.3

Δ_{max} = 16"/360 = 0.044"

$\Delta_{max} = 5wl^4/384EI \rightarrow w = 384EI\Delta_{max}/5l^4$

$= (384)(10{,}100{,}000 \text{ psi})(0.0596 \text{ in}^4)(0.044")/5(16")^4 = 31 \text{ pli}$

= 31 pli x 12"/ft. = 372 plf

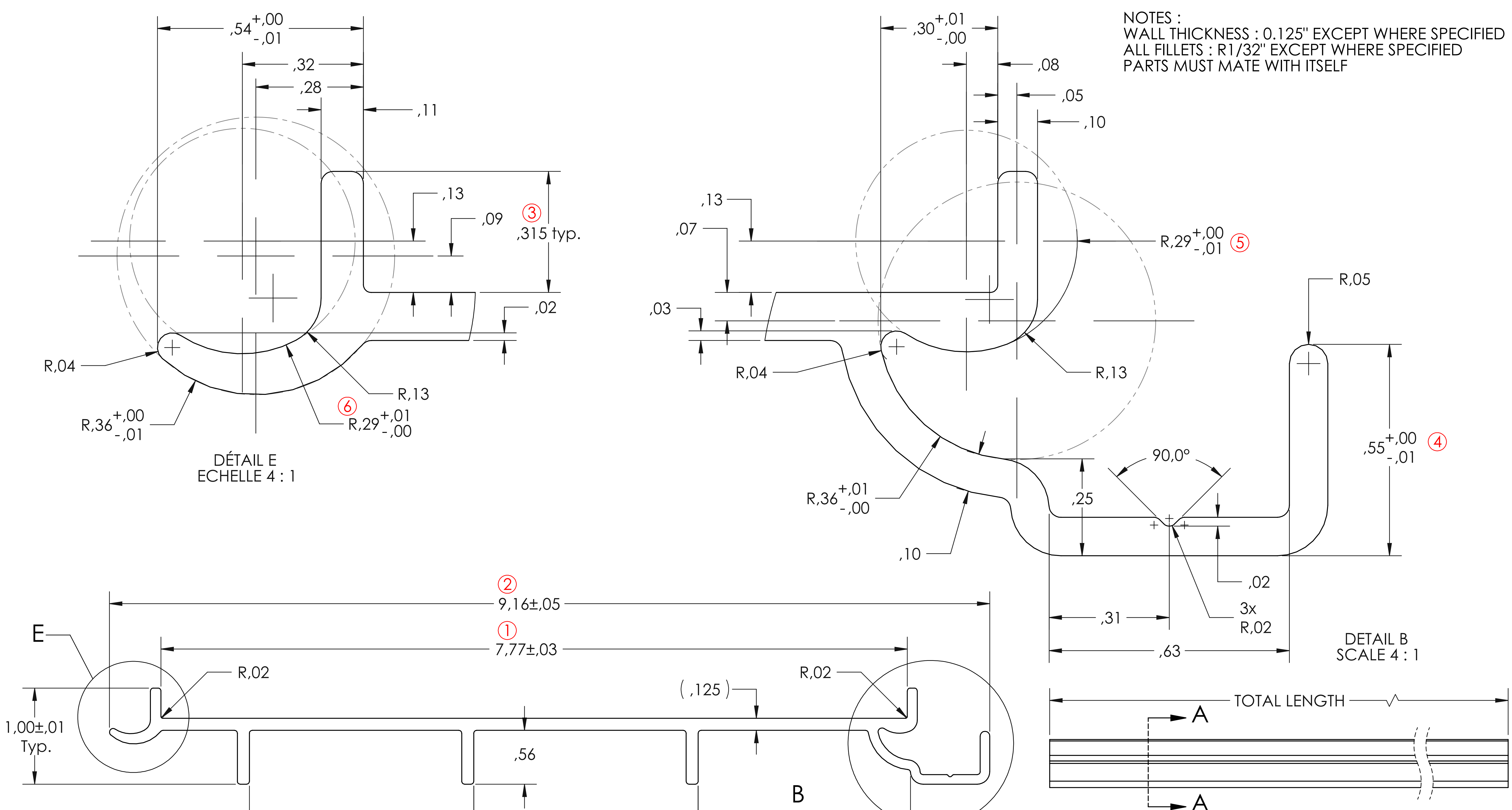
372 plf/0.763 ft. = <u>488 psf</u>

<u>Maximum Live Load based on Δ_{max} = l/360 is 488 psf</u>

<u>Deflection controls: Maximum Live Load is 488 psf for 16" span.</u>

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	01/26/15	N/A	Original report issue



SECTION A-A
SCALE 1 : 1

D	CLIP ADJUSTMENTS	2014-11-04	FP	SL
C	WIDER GAP FOR ASSEMBLY - REMOVE LOCK RIB	2014-08-11	FP	SL
B	PIVOT INSTALLATION - STOCK CERAMIC SIZE - RAIN GUTTER	2014-03-14	FP	SL
A	DRAWING RELEASE	2013-12-20	FP	SL
REV.	DESCRIPTION	DATE	BY	APPROVED

SIGMADEK

Suite 260, 600 Crowfoot Crescent NW,
Calgary, Alberta T3G 0B4
Tel: (403) 239-4448 Fax: (403) 239-7791
www.sigmadek.com

APPROVALS		DATE: (YYYY-MM-DD)
DESIGNED BY:	Precicad	2011-09-20
DRAWN BY:	F.Parenteau	2013-11-05
VERIFIED BY:	S.Lachevrotière	2014-11-06
APPROVED BY:		yyyy-mm-dd

PROJECT: SDK001

DESCRIPTION : Aluminum Deckboards with Ceramic

IMPERIAL SYSTEM

TOLERANCES : (UNLESS OTHERWISE SPEICIFIED)
63 √
X/X ± 1/32
.X ± 0.03   X° ± 1°
.XX ± 0.015   .X° ± .5°
.XXX ± 0.005   .XX°± .25°

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PROCESS:	WEIGHT (LBS):	SCALE:	FORMAT:	SHEET:
Extrusion	24.835	1:2	B	1/1

SURFACE TREATMENT:

MATERIAL: Aluminum 6005T5

DRAWING NUMBER: SDADBWC

REVISION D

FILE NAME: SDADBWC_RevD_Aluminum-DeckBoard-with-Ceramic

SigmaDek Template Revision 01