Campbell STRUCTURAL	JOB NO.:	DATE:	DESIGNED BY: RLC	SHEET 1
Robert L. Campbell Structural Engineer, P.C. **200 E. 16TH Street, Suite 100** **Yuma, AZ 85364**	25032	04/23/25	CHECKED BY: RLC	OF 33

CLIENT: Sternco Engineers, Inc.

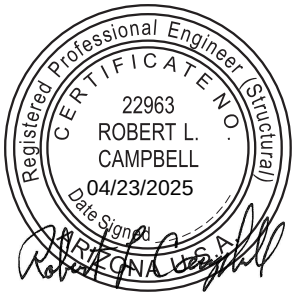
202 S. 1st Ave, Suite 205

Yuma, AZ 85364

PROJECT: Yuma County Foothills Library

HVAC Replacement – Structural Report

13226 E. South Frontage Rd, Yuma AZ 85367



STRUCTURAL CALCULATIONS

DESIGN DATA

CALCULATION SUMMARY

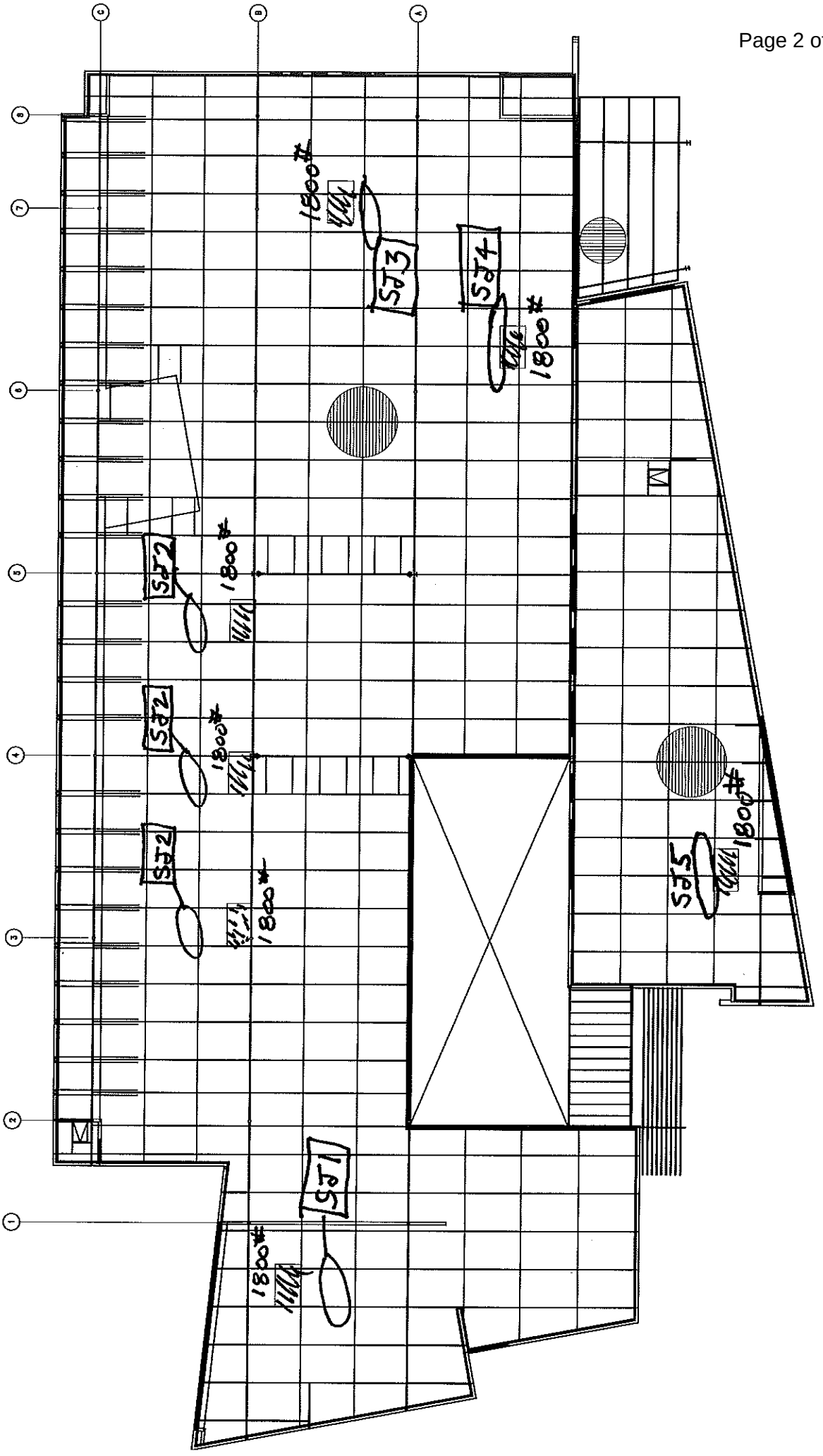
This project consists of replacing the existing roof top HVAC units at the Yuma Co. Foothills Library with new heavier units. The original construction documents show the steel roof joist are scheduled to support 1,500 lb mechanical units. The replacement units are in the range of 1,800 lb.

RCSE performed structural calculations to determine the existing joist shear and moment capacity. The same joists were checked with an actual dead load based on our field observations along with the 1,800 lb mechanical unit weight.

The results of our analysis indicate the existing steel joist capacity exceeds the new demand on the joist. All shear and moment demand/capacity ratio checks are less than 1.0 and consequently, no joist strengthening is required.

CODE DATA

Building Code: 2018 I.B.C.


C
B
A
8
7
6
5
4
3
2
1
SJ3
1800#
SJ4
1800#
SJ2
1800#
SJ2
1800#
SJ2
1800#
SJ5
1800#
SJ1
1800#

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Yuma, AZ 85364
(928) 726-2646

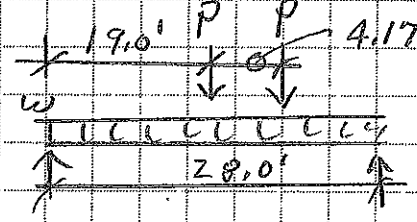
STEEL JOIST ORIGINAL DESIGN CAPACITY

SJ1

DL+LLR / LLR

$w = 255^{PLF} / 135^{PLF}$

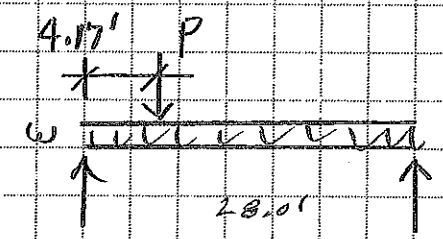
$P = 1500 \left(\frac{1}{4}\right) = 375^{\#}$



SJ2

$w = 255^{PLF} / 135^{PLF}$

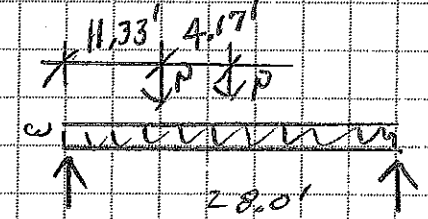
$P = 375^{\#}$



SJ3

$w = 255 / 135^{PLF}$

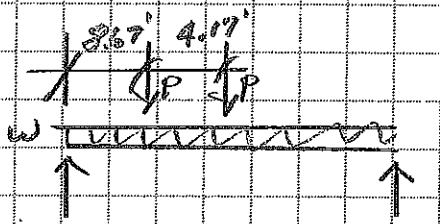
$P = 375^{\#}$



SJ4

$w = 255 / 135^{PLF}$

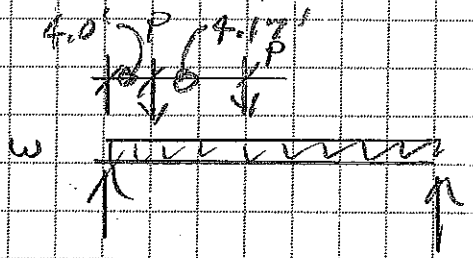
$P = 375^{\#}$



SJ5

$w = 255 / 135^{PLF}$

$P = 375^{\#}$



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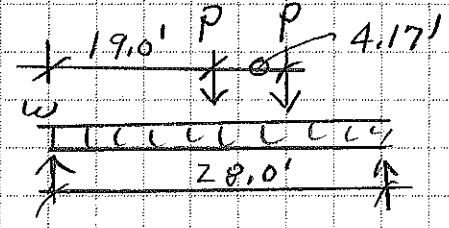
JOB 25032 Yuma Co. Foothills Library
SHEET NO. Page 4 of 33 OF
CALCULATED BY RLC DATE 4/2025
CHECKED BY DATE
SCALE

NEW MECH UNITS
STEEL JOIST PROPOSED DESIGN DEMAND

SJ1

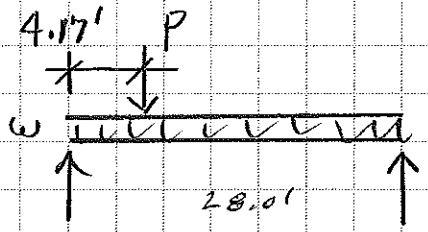
DL+LLR LLR
$\omega = 233^{PLF} / 135^{PLF}$

$P = 1800\left(\frac{1}{4}\right) = 450^{\#}$



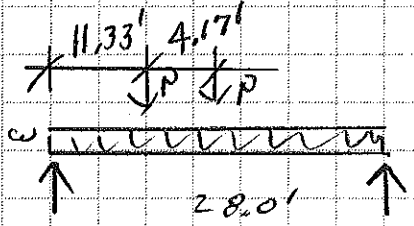
SJ2

$\omega = 233^{PLF} / 135^{PLF}$
$P = 450^{\#}$



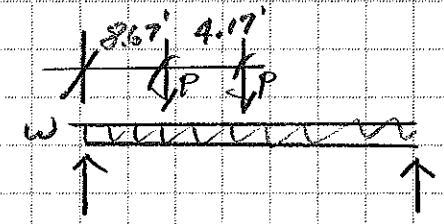
SJ3

$\omega = 233 / 135^{PLF}$
$P = 450^{\#}$



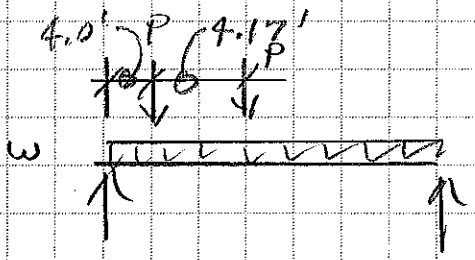
SJ4

$\omega = 233 / 135^{PLF}$
$P = 450^{\#}$



SJ5

$\omega = 233 / 135^{PLF}$
$P = 450^{\#}$



EXISTING VS. NEW UNITS WEIGHTS

MARK	EXISTING UNIT INFORMATION			EXISTING UNIT WEIGHT W/ ACCESSORIES (LBS)	NEW UNIT WEIGHT W/ ACCESSORIES (LBS)				REMARKS
	MAKE	MODEL	SERIAL #		UNIT ONLY	PE ACCESSORY	CURB ADAPTER	TOTAL	
HP-1, 2	TRANE	WSC120A3R0A	820102570L (HP-1, TYP)	941 + 344 = 1285	1286	160	115	1561	1,2
HP-3,4,5,6,7	TRANE	WSC120A3R0A	820102588L (HP-3, TYP)	941 + 344 = 1285	1306	160	115	1581	1,2

REMARKS:

1. EXISTING UNITS INCLUDE CANFAB MODEL 6144-MPE ECONOMIZER AND POWERED EXHAUST ACCESSORIES.
2. ALL (7) UNITS SCHEDULED ARE THE SAME MODEL NUMBER AND A TYPICAL SERIAL NUMBER IS SHOWN.

NEW UNIT DESIGN WT
1581 + 215 = 1,800#

ORIGINAL DESIGN WT.
1285 + 215 (curb) = 1,500#

Robert L. Campbell Structural Engineer, P.C. 183 E. 24th Street, Suite 7 Yuma, AZ 85364	PROJECT Yuma County Library District Foothills Branch Library Yuma, AZ	JOB NO. 07040	SHEET NO.: 3
		DATE: Jun-07	BY: KLB

GRAVITY DESIGN LOADS

2003 INTERNATIONAL BUILDING CODE - Dead and Live Loads

ROOF - High Roof Structure

DEAD LOADS

	Corrugated Metal Roofing	2.0 psf
	6" Polystyrene	3.0 psf
	Steel Accoustic Deck	4.4 psf
	Steel Beams	2.0 psf
	MPE	2.0 psf
	Sprinkler	1.5 psf
	Misc.	1.1 psf
	Total DL	**16.0 psf**
LIVE LOADS	Roof L_r	**20 psf** (reducible)

BUILT UP ROOF - Main Structure

DEAD LOADS

	Roofing		2.5 psf
	6" Polystyrene	1.0 →	3.0 psf
	Steel deck		2.3 psf
	Steel Joists		2.0 psf
	5/8 Gypboard Ceiling	ACOUSTIC CLG. 1.8 →	2.8 psf
	MPE		1.8 psf
	Sprinkler		1.5 psf
	Misc.		2.1 psf
	Total DL	ACTUAL DL = 15 PSF	**18.0 psf**
LIVE LOADS	Roof L_r		**20 psf** (reducible)

CEILING - Vestibule Framing

DEAD LOADS

	Light Gauge Framing	2.0 psf
	Plywood	1.5 psf
	5/8 Gypboard Ceiling	2.8 psf
	MPE	1.8 psf
	Sprinkler	1.9 psf
		10.0 psf
LIVE LOADS	Roof L_r	(reducible)

Robert L. Campbell Structural Engineer, P.C.	PROJECT	JOB NO.	DATE	BY	SHEET NO.
	Foothills Branch Lbr.	07040			

Joist Design / Criteria

DL = 18 psf
LLR = 20 psf

$w = 6.67(18+20)\text{psf} = (120 + 133)\text{plf}$

Used: 16k(255/135) at 23'-2" span

ORIGINAL CAPACITY → 20k(255/135) at 28'-1" span

24k(255/135) at 33'-4" span

26k(255/135) at 40'-2" span

ACTUAL UNIFORM

(233/135)
↑ TL ↑ LLe

OWENS CORNING®
INNOVATIONS FOR LIVING®

FOAMULAR® Extruded Polystyrene (XPS) Insulation
SI and I-P Units for Selected Properties

Technical Bulletin

This bulletin provides thermal conductivity, thermal resistance, density and compressive strength for FOAMULAR® 150, 250, 400, 600 and 1000 insulation in thicknesses of 2", 3" and 4". SI units are provided in the tables, followed by I-P units in parenthesis.

FOAMULAR® 150 Insulation

Thickness, mm	Thermal Conductivity, W/mK, max.	Thermal Resistance, m^2K/W, min.	Density, kg/m^3, min.	Compressive Strength, kPa, min.
100 (4")	0.029 (k=0.20)	3.53 (R-20)	20.8 (1.3 pcf)	103 (15 psi)
75 (3")	0.029 (k=0.20)	2.65 (R-15)	20.8 (1.3 pcf)	103 (15 psi)
50 (2")	0.029 (k=0.20)	1.77 (R-10)	20.8 (1.3 pcf)	103 (15 psi)

FOAMULAR® 250 Insulation

Thickness, mm	Thermal Conductivity, W/mK, max.	Thermal Resistance, m^2K/W, min.	Density, kg/m^3, min.	Compressive Strength, kPa, min.
100 (4")	0.029 (k=0.20)	3.53 (R-20)	24.8 (1.55 pcf)	172 (25 psi)
75 (3")	0.029 (k=0.20)	2.65 (R-15)	24.8 (1.55 pcf)	172 (25 psi)
50 (2")	0.029 (k=0.20)	1.77 (R-10)	24.8 (1.55 pcf)	172 (25 psi)

FOAMULAR® 400 Insulation

Thickness, mm	Thermal Conductivity, W/mK, max.	Thermal Resistance, m^2K/W, min.	Density, kg/m^3, min.	Compressive Strength, kPa, min.
100 (4")	0.029 (k=0.20)	3.53 (R-20)	28.9 (1.8 pcf)	276 (40 psi)
75 (3")	0.029 (k=0.20)	2.65 (R-15)	28.9 (1.8 pcf)	276 (40 psi)
50 (2")	0.029 (k=0.20)	1.77 (R-10)	28.9 (1.8 pcf)	276 (40 psi)

FOAMULAR® 600 Insulation

Thickness, mm	Thermal Conductivity, W/mK, max.	Thermal Resistance, m^2K/W, min.	Density, kg/m^3, min.	Compressive Strength, kPa, min.
100 (4")	0.029 (k=0.20)	3.53 (R-20)	35.3 (2.2 pcf)	414 (60 psi)
75 (3")	0.029 (k=0.20)	2.65 (R-15)	35.3 (2.2 pcf)	414 (60 psi)
50 (2")	0.029 (k=0.20)	1.77 (R-10)	35.3 (2.2 pcf)	414 (60 psi)

FOAMULAR® 1000 Insulation

Thickness, mm	Thermal Conductivity, W/mK, max.	Thermal Resistance, m^2K/W, min.	Density, kg/m^3, min.	Compressive Strength, kPa, min.
100 (4")	0.029 (k=0.20)	3.53 (R-20)	48.1 (3.0 pcf)	690 (100 psi)
75 (3")	0.029 (k=0.20)	2.65 (R-15)	48.1 (3.0 pcf)	690 (100 psi)
50 (2")	0.029 (k=0.20)	1.77 (R-10)	48.1 (3.0 pcf)	690 (100 psi)

Notes:

1. SI, the International System of Units (Metric). I-P, inch-pound units (English).
2. Conversions are approximate, rounded to the nearest significant digit that is customary for a given property as shown in the tables.
3. I-P unit definitions:
   Thermal Conductivity, "k" = Btu•in/ft.²•hr•°F
   Thermal Resistance, "R" = hr•ft²•°F/Btu
   Compressive Strength, "psi" = pounds per square inch
   Density, "pcf" = pounds per cubic foot

$\frac{3}{12} \times 4 = 1.0^{PSF}$

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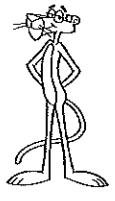
Pub. No. 10015703. Printed in U.S.A. September 2011.



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JOB 25032 Yuma Co. Foothills Library
SHEET NO. OF
CALCULATED BY RLC DATE 4/2025
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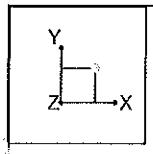
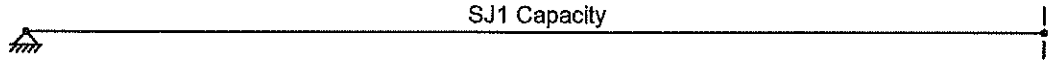
DEMAND / CAPACITY TABLE

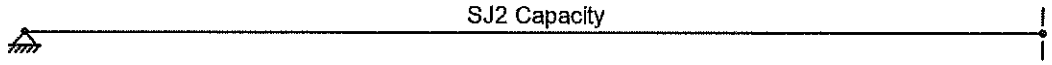
REF: RISA 3d Printout

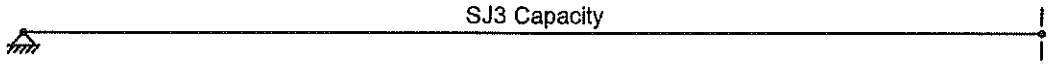
	CAPACITY V (1-C)	CAPACITY M (1-C)	DEMAND V (1-C)	DEMAND M (1-C)	DCR V	DCR M
SJ1	4.135	27.6	3.94	26.05	0.95	0.94
SJ2	3.889	25.78	3.645	23.78	0.94	0.92
SJ3	3.961	29.46	3.73	28.2	0.94	0.96
SJ4	4.03	29.18	3.82	27.92	0.95	0.96
SJ5	4.157	27.3	3.97	25.65	0.96	0.94

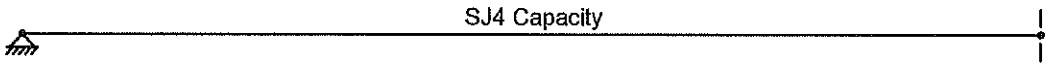
DEMAND ON JOIST IS LESS THAN CAPACITY
THEREFORE JOIST ARE O.K.

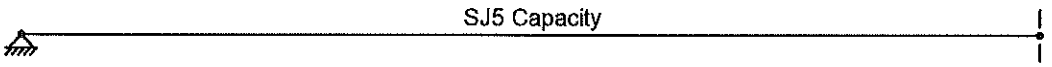


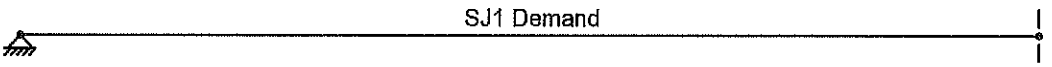


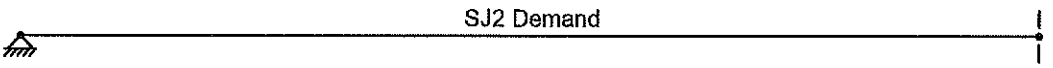


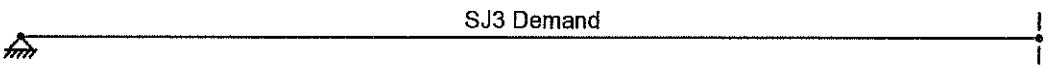


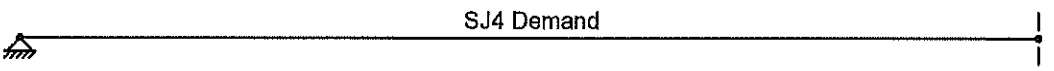


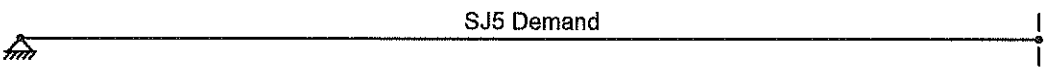




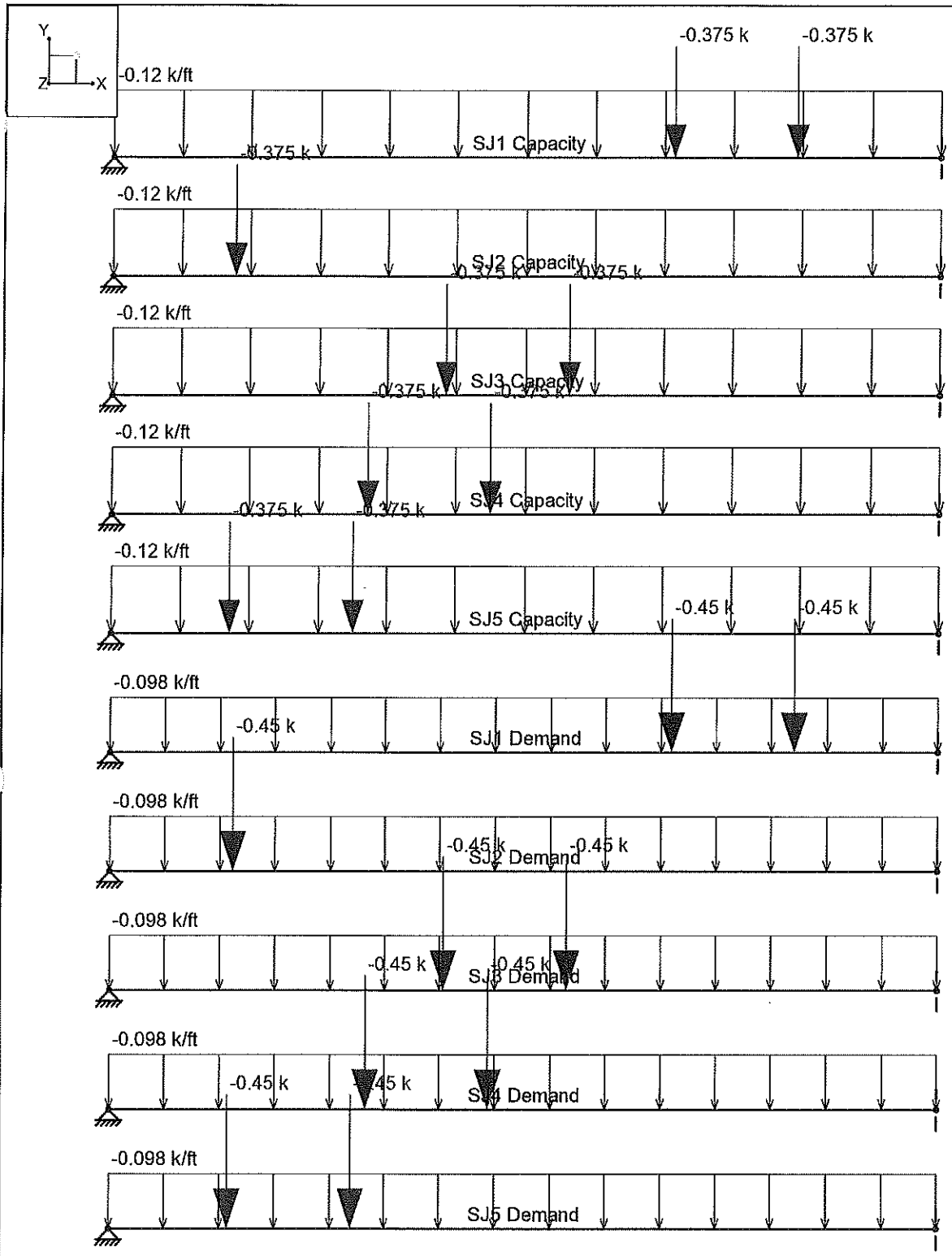






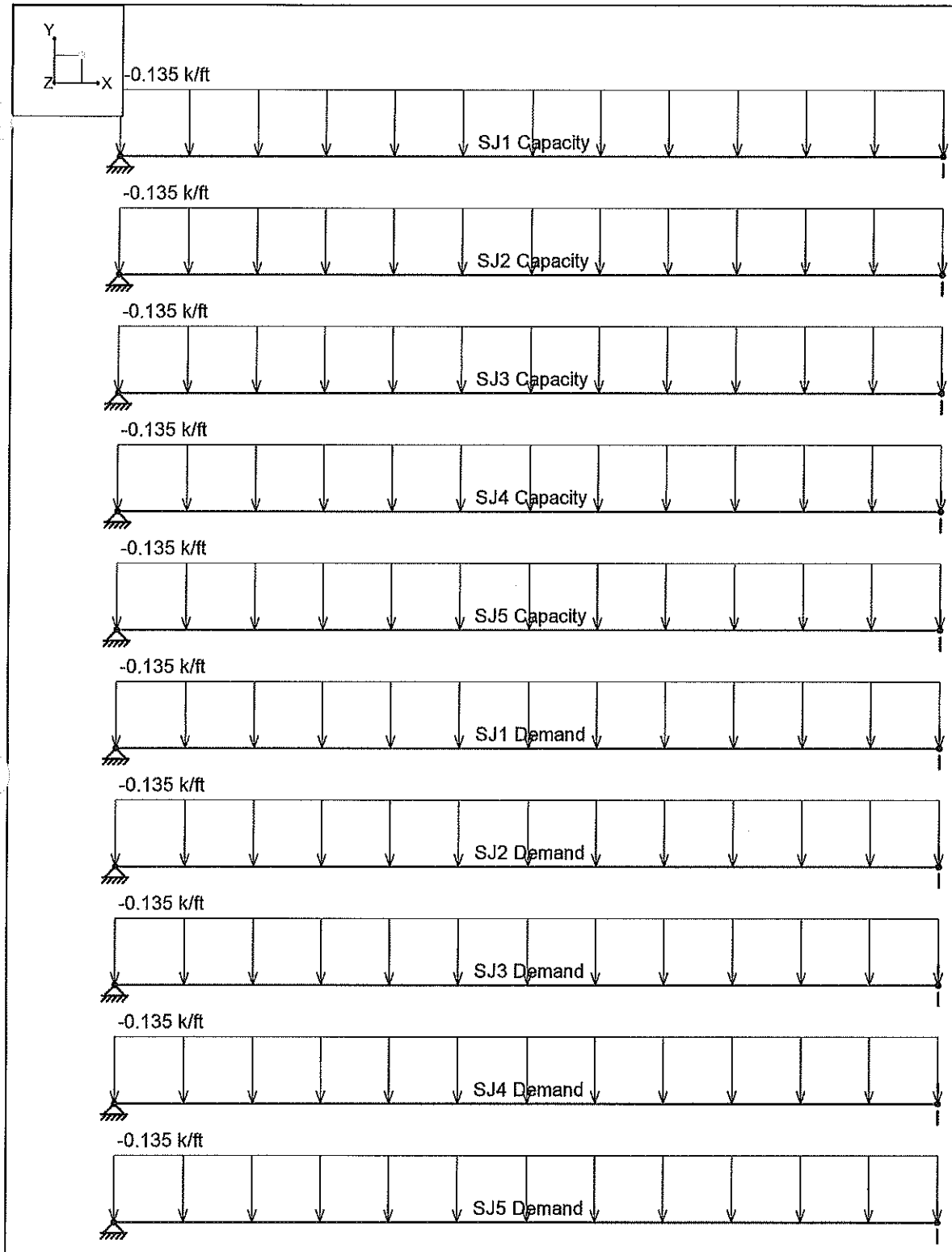


RISA	RCSE	Steel Joist Capacity Check	SK-1
	Rob		Steel Joist Check.r3d
	25032		



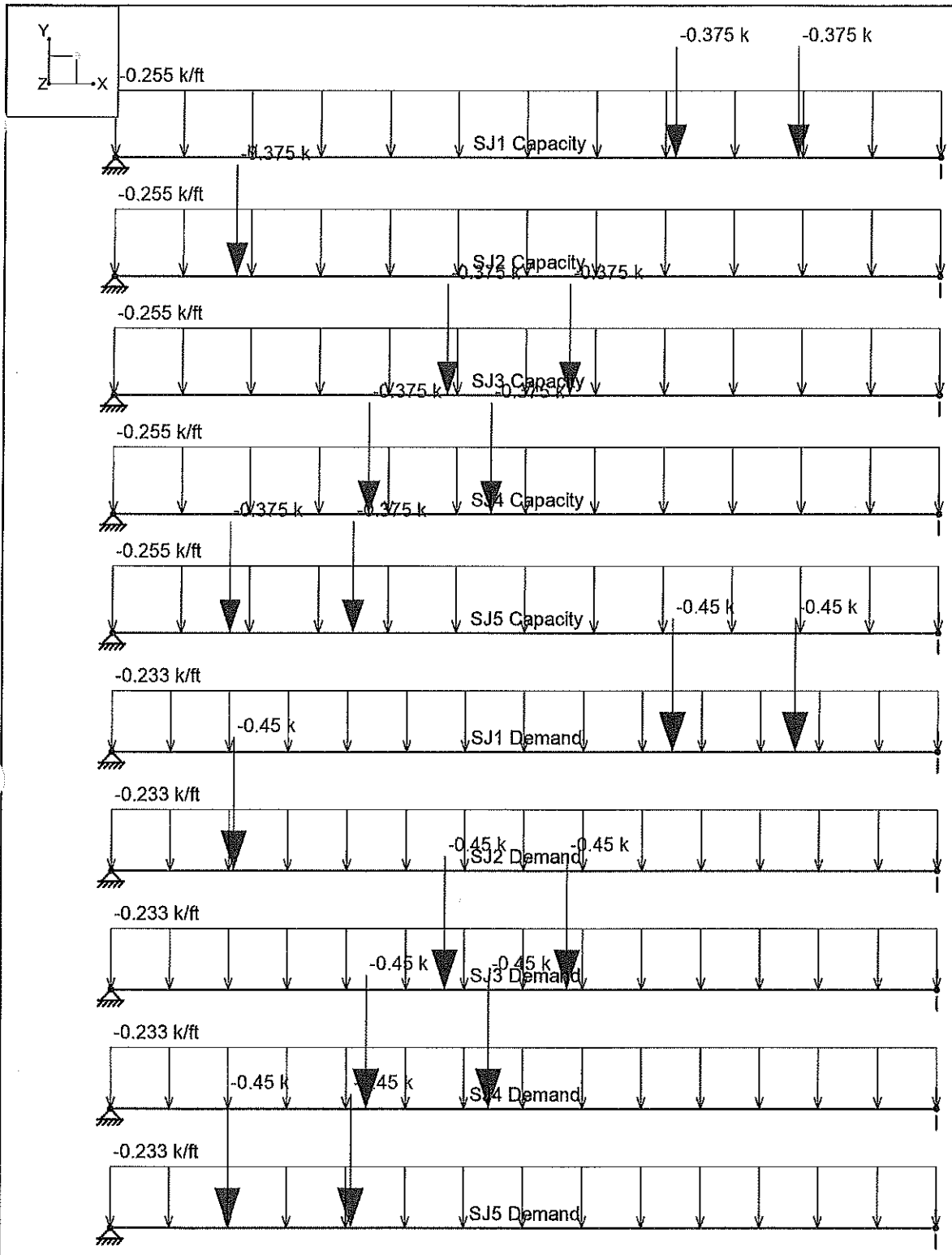
Loads: BLC 1, Dead

RISA	RCSE	Steel Joist Capacity Check	SK-2
	Rob		Steel Joist Check.r3d
	25032		



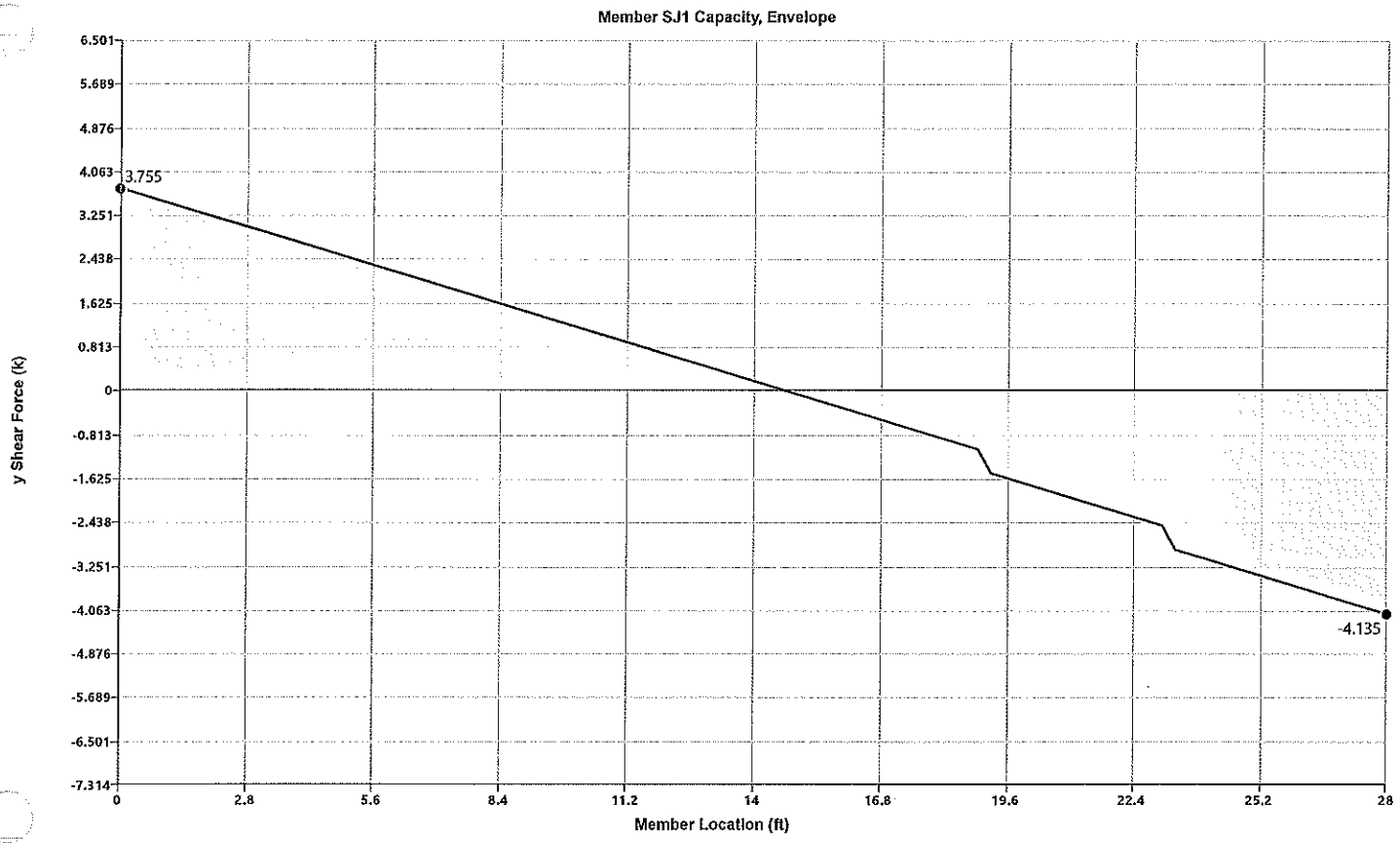
Loads: BLC 2, Roof Live

RISA	RCSE	Steel Joist Capacity Check	SK-3
	Rob		Steel Joist Check.r3d
	25032		



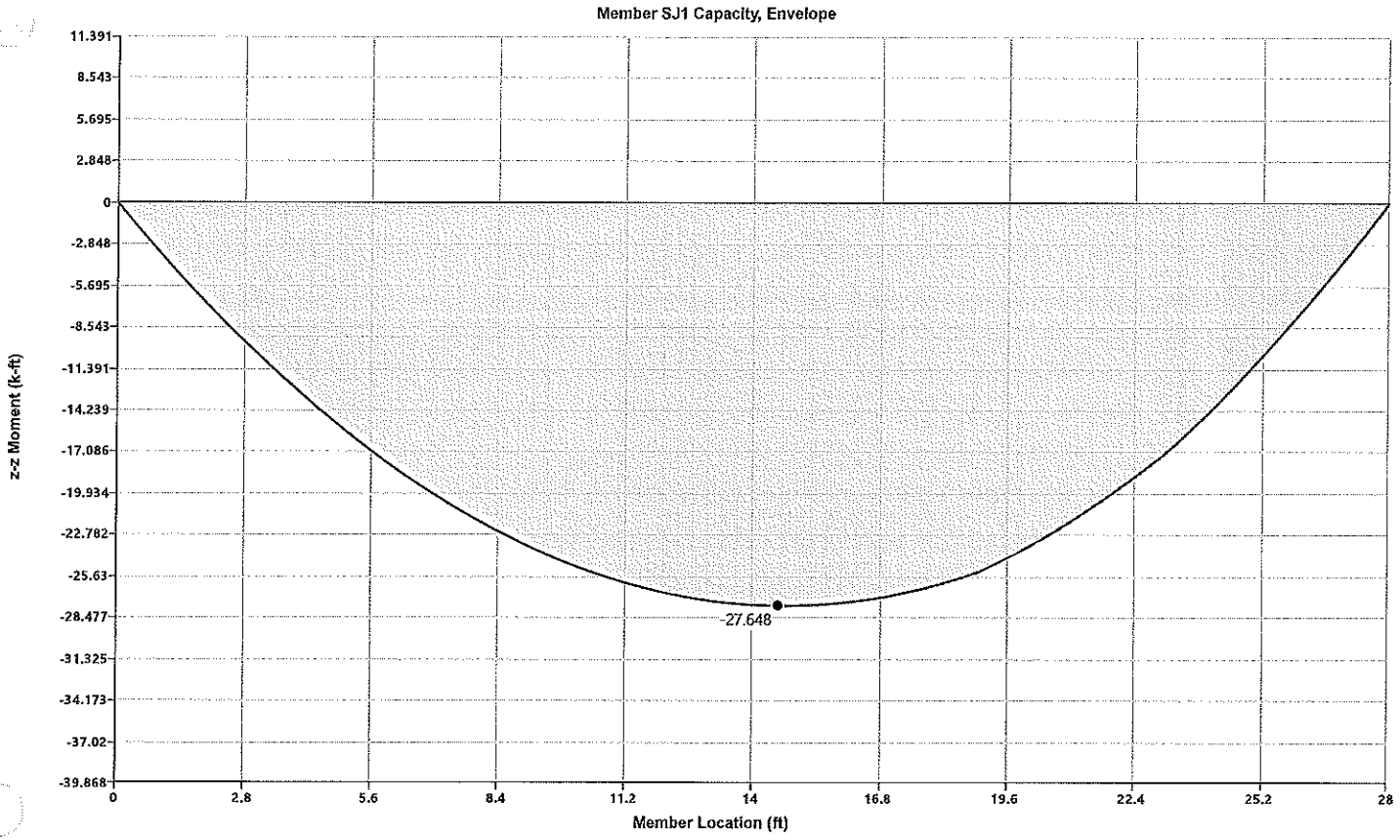
Loads: LC 2, DL+RLL

RISA	RCSE	Steel Joist Capacity Check	SK-4
	Rob		Steel Joist Check.r3d
	25032		



Selected Location Values:

Location: 0 ft
Max Value: 3.755 (LC 2) k
Min Value: 3.755 (LC 2) k

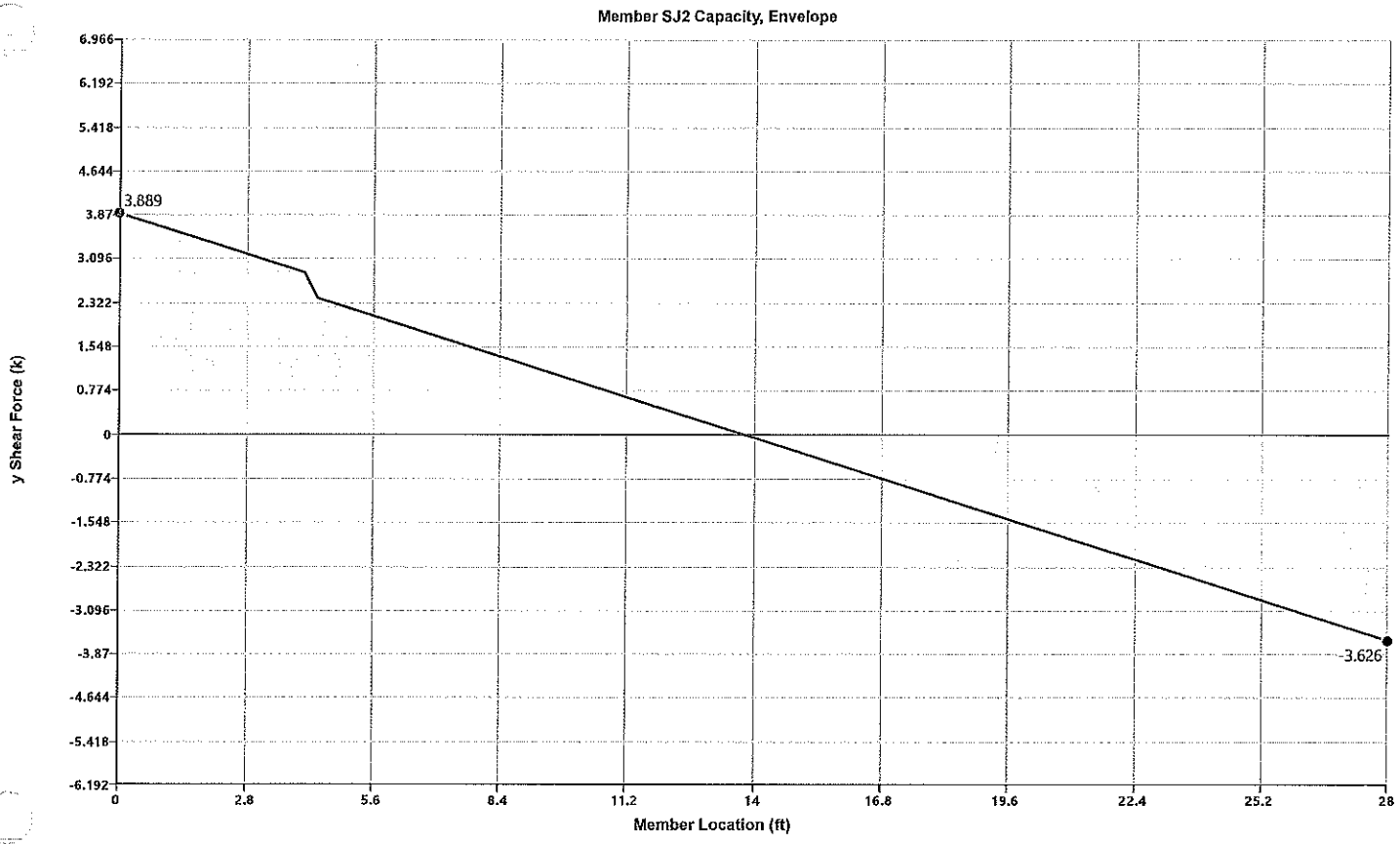


Selected Location Values:

Location: 0 ft

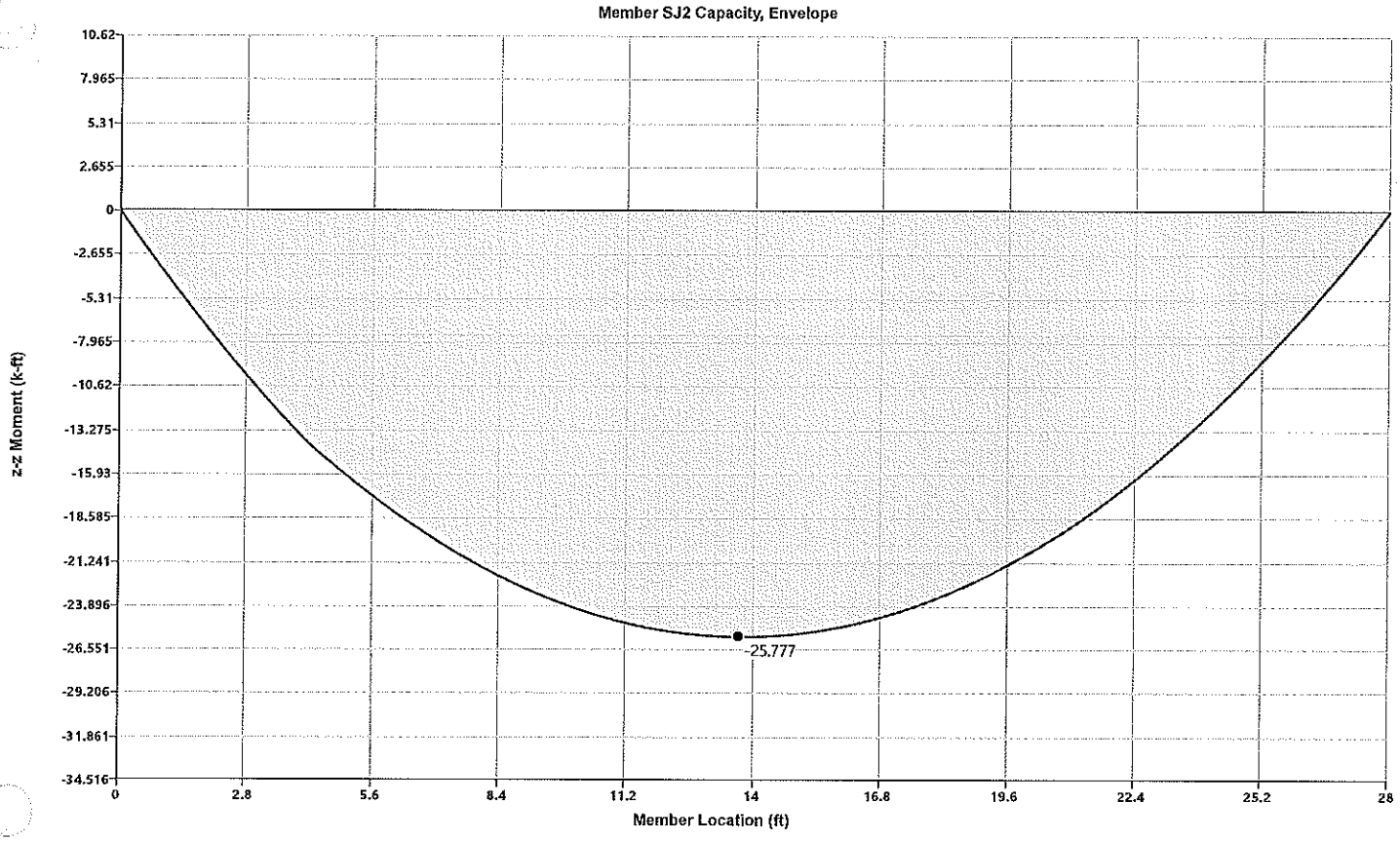
Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft



Selected Location Values:

Location: 0 ft
Max Value: 3.889 (LC 2) k
Min Value: 3.889 (LC 2) k

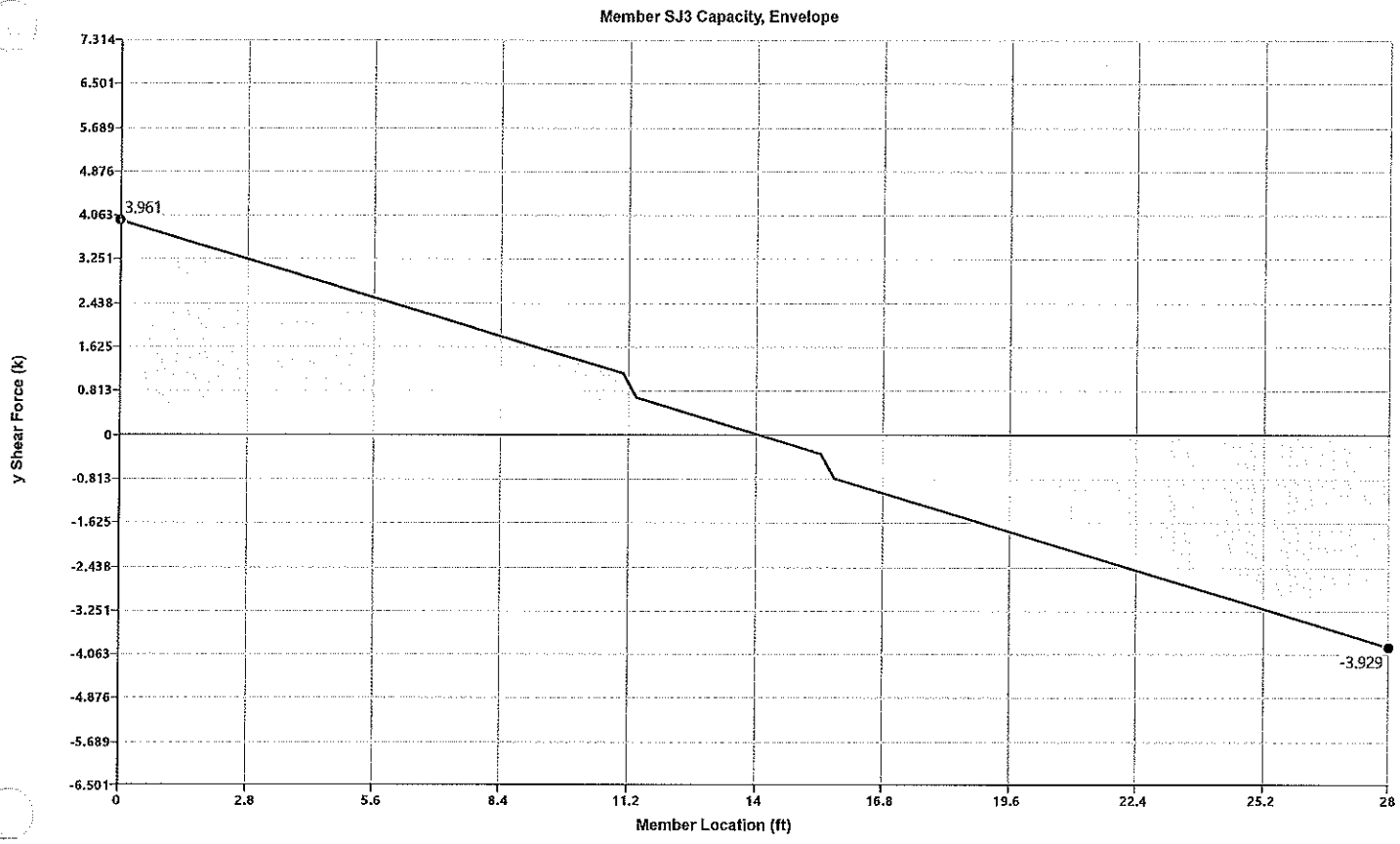


Selected Location Values:

Location: 0 ft

Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft

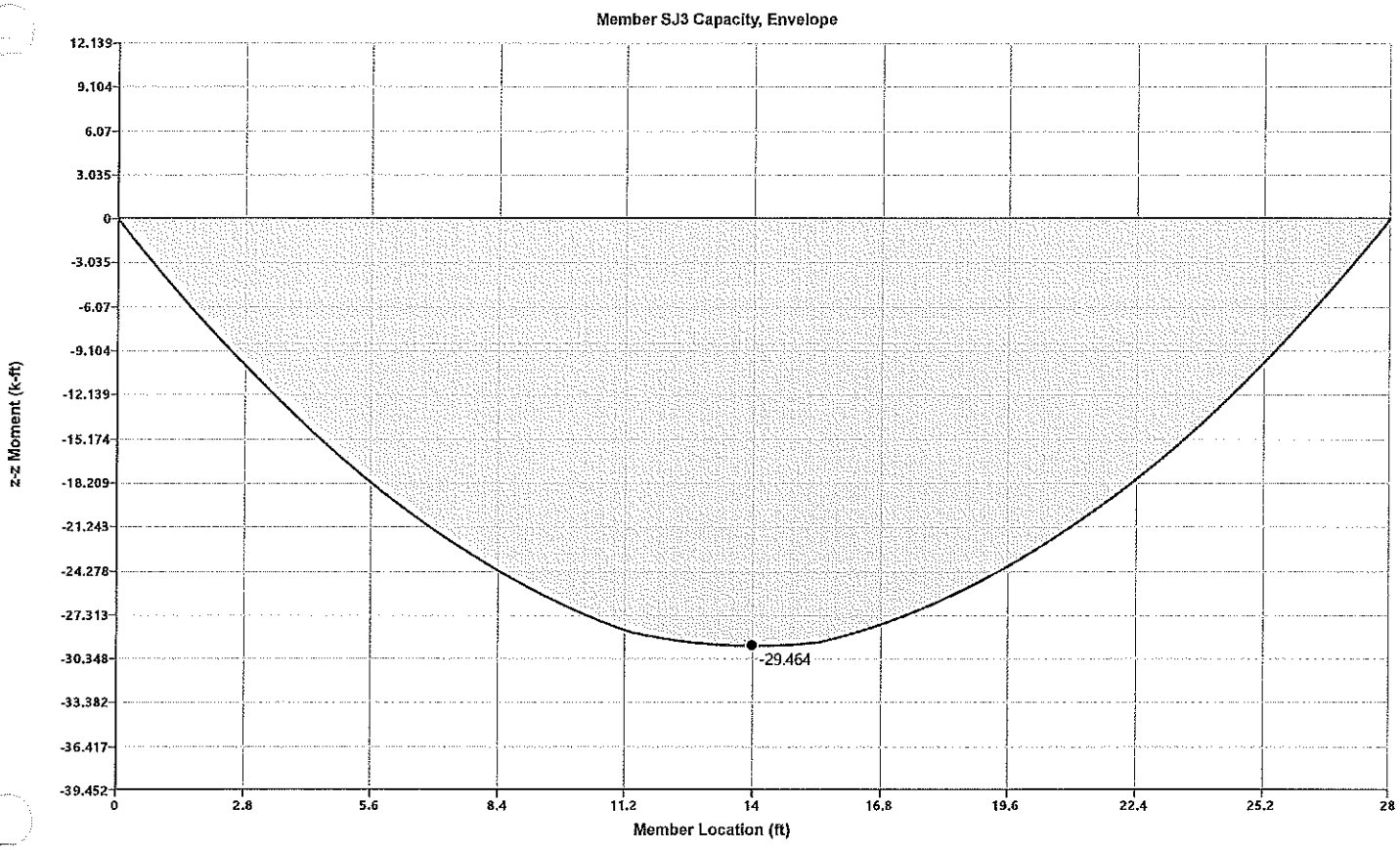


Selected Location Values:

Location: 0 ft

Max Value: 3.961 (LC 2) k

Min Value: 3.961 (LC 2) k

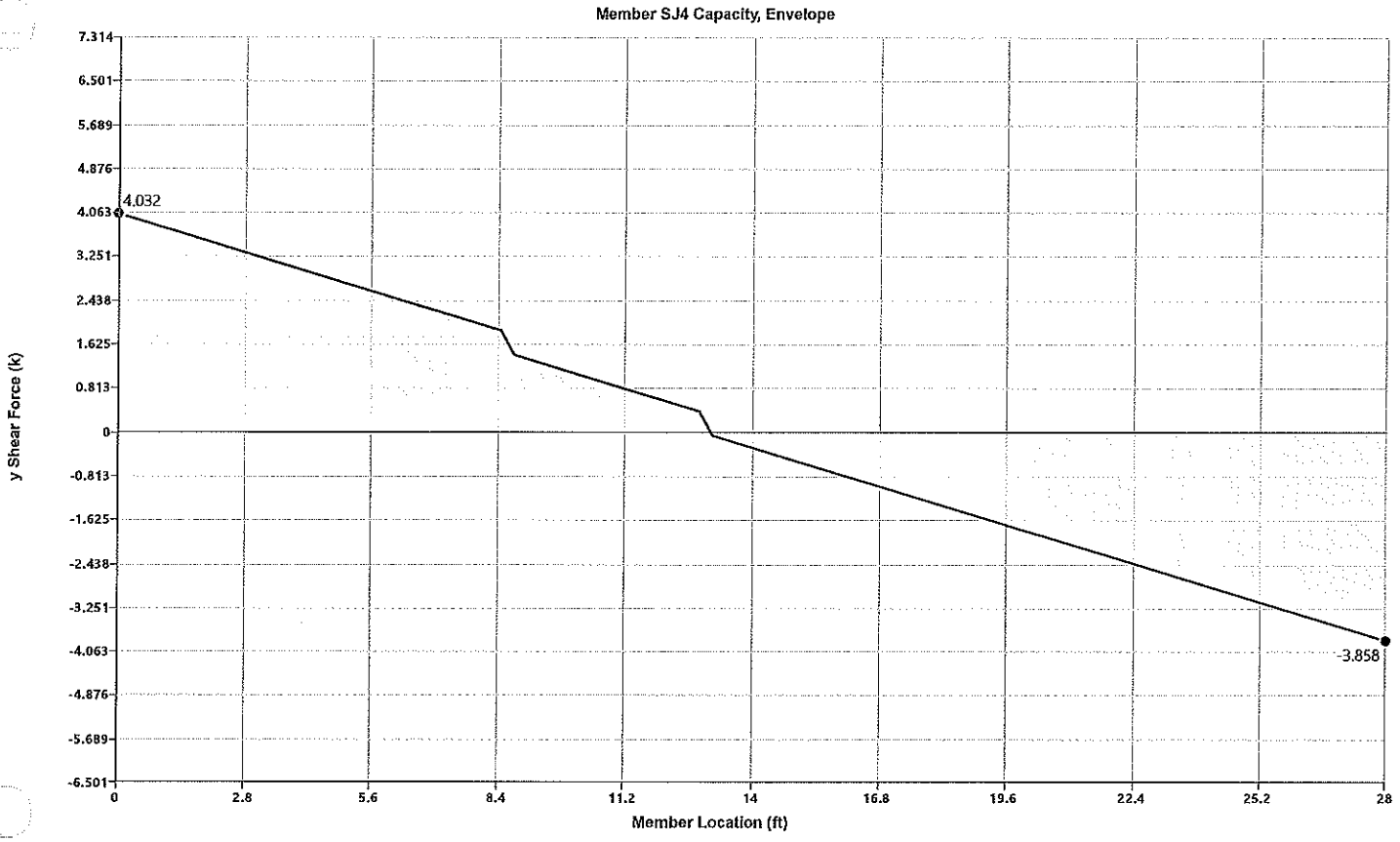


Selected Location Values:

Location: 0 ft

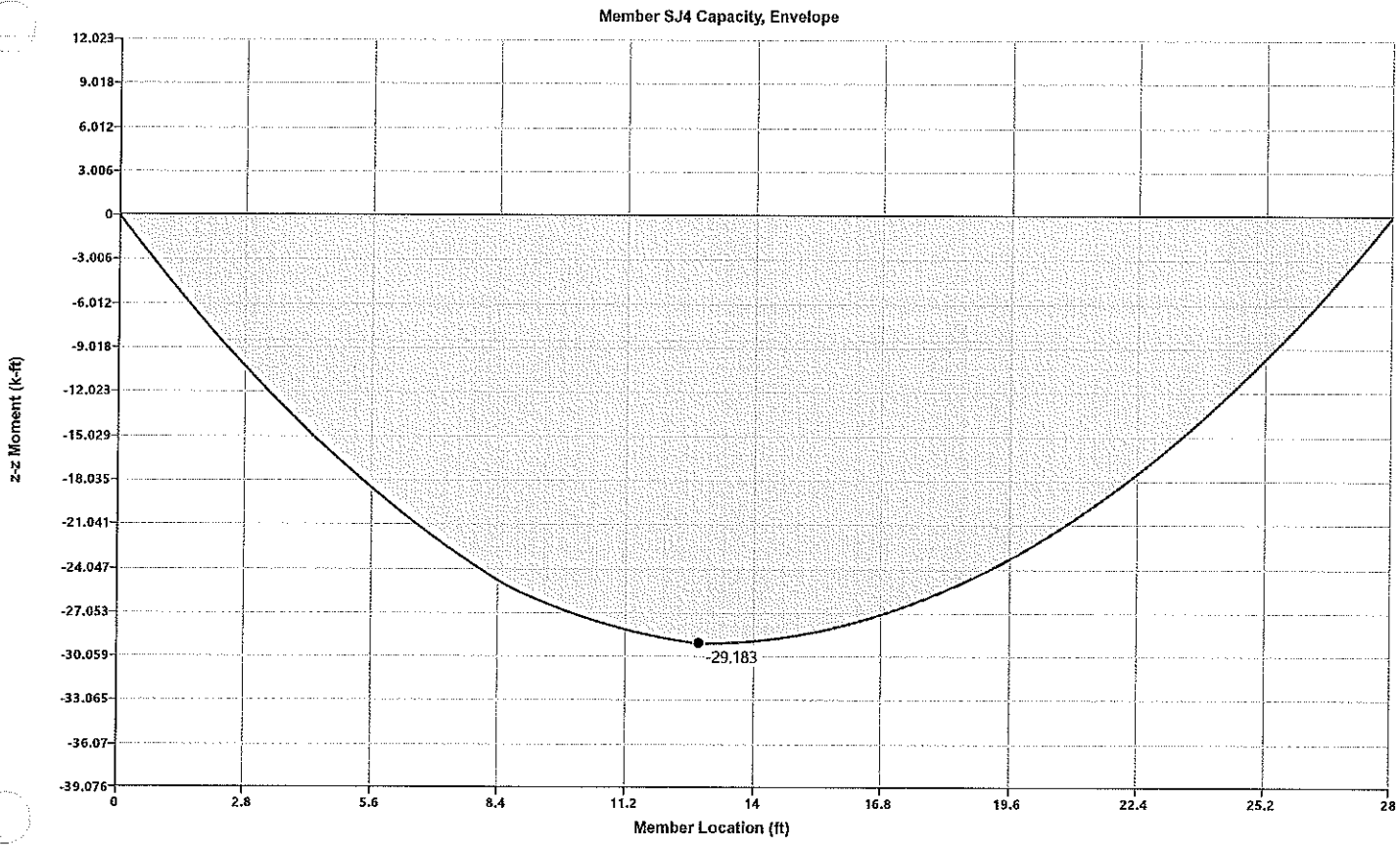
Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft



Selected Location Values:

Location: 0 ft
Max Value: 4.032 (LC 2) k
Min Value: 4.032 (LC 2) k

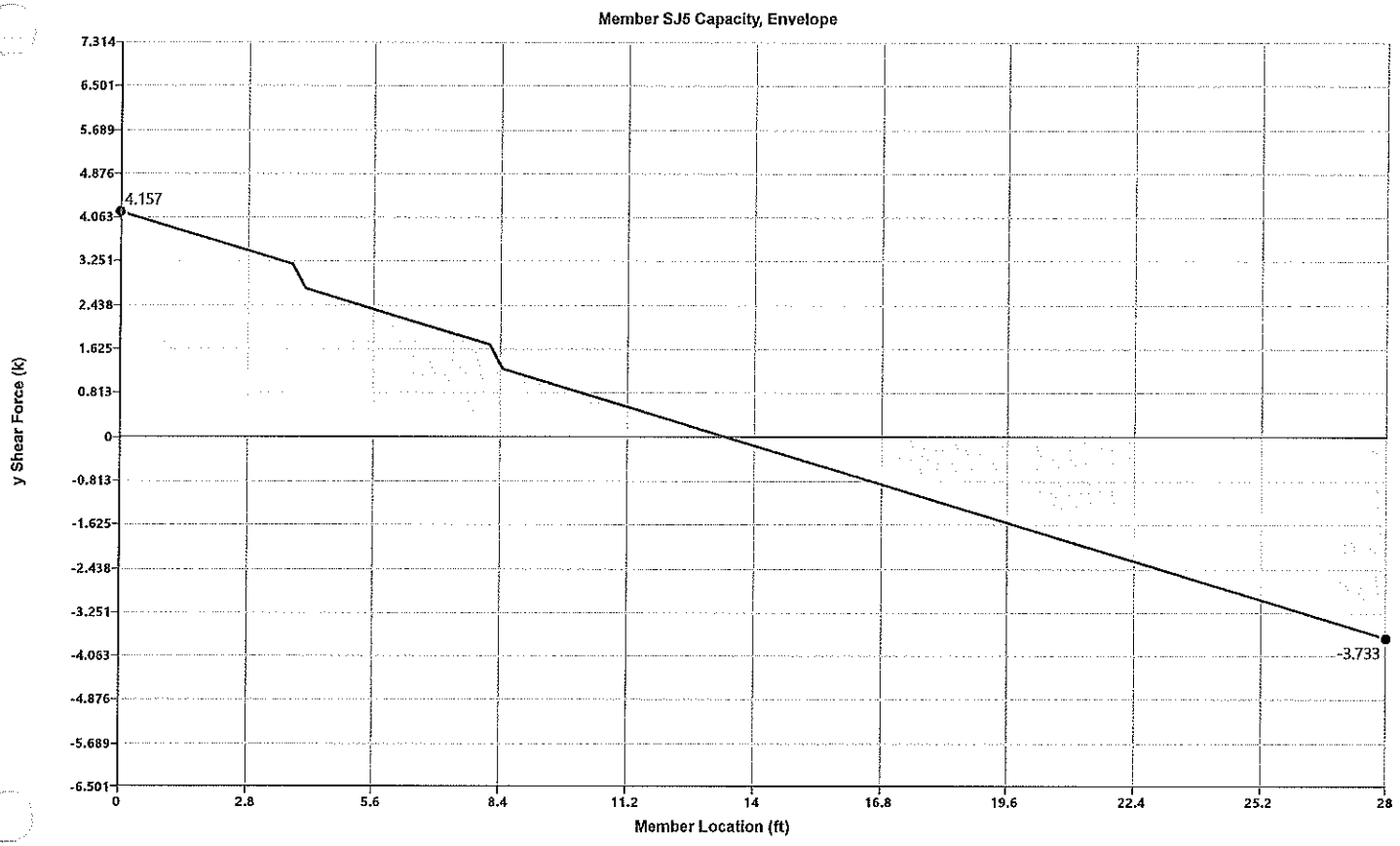


Selected Location Values:

Location: 0 ft

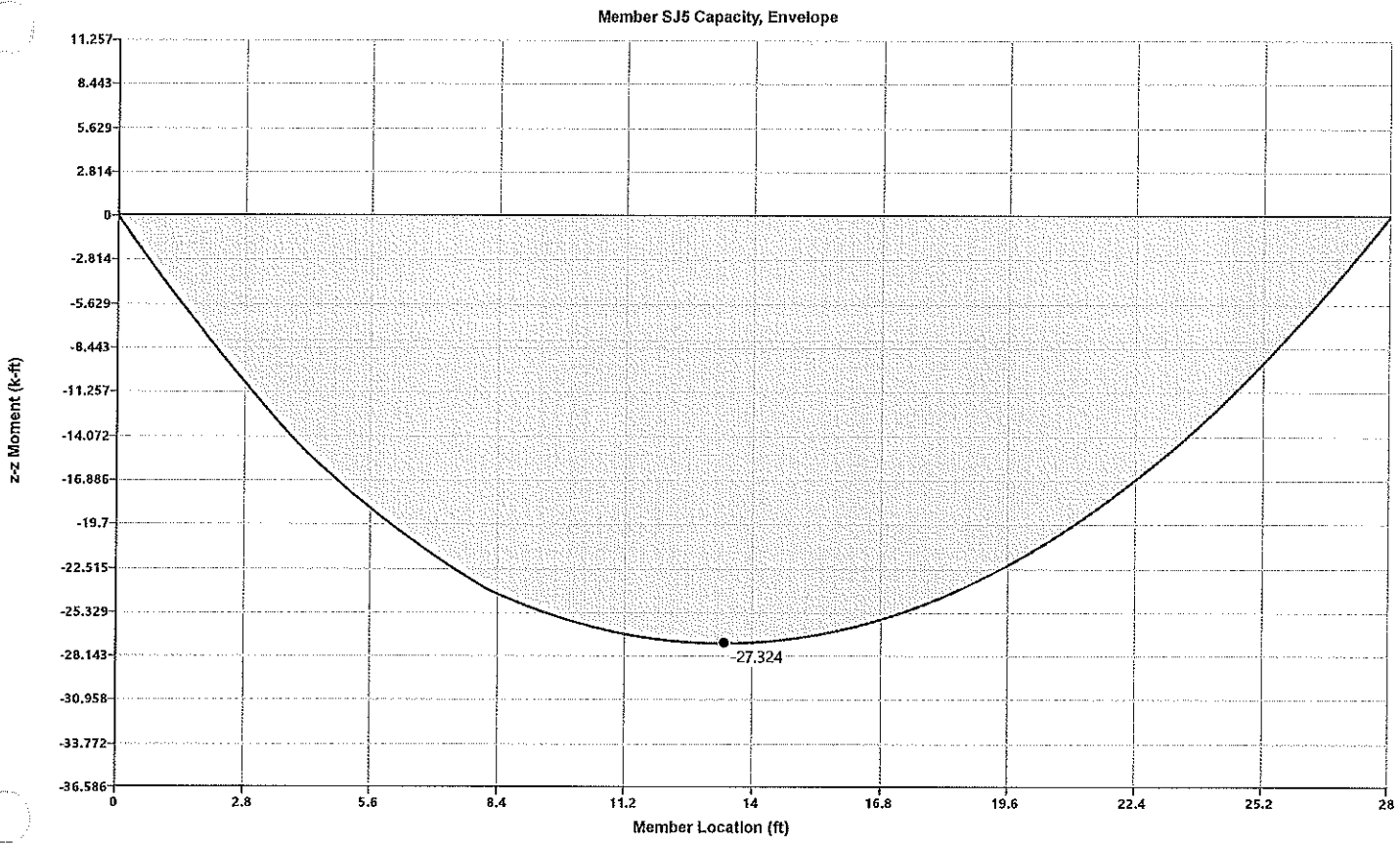
Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft



Selected Location Values:

Location: 0 ft
Max Value: 4.157 (LC 2) k
Min Value: 4.157 (LC 2) k

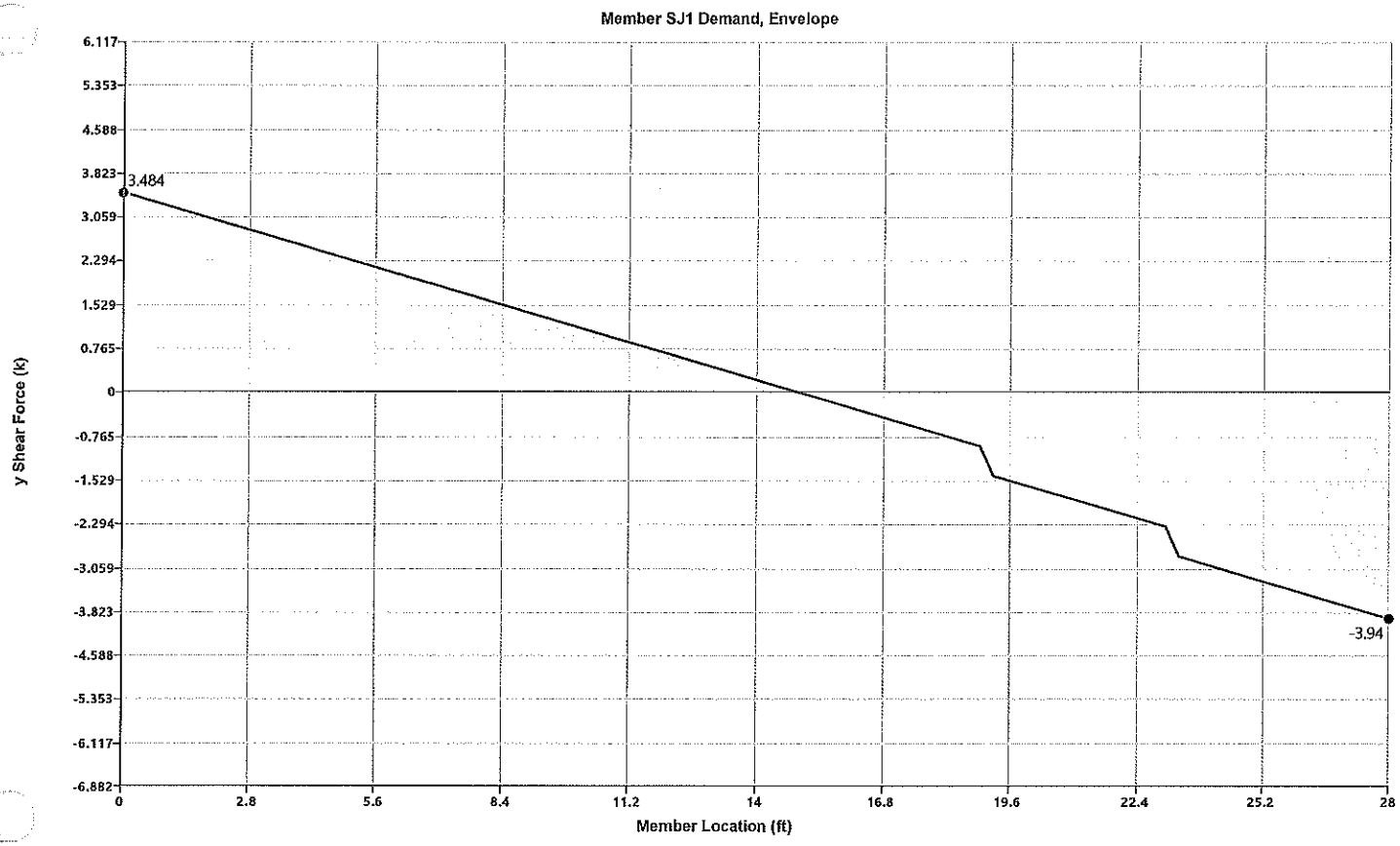


Selected Location Values:

Location: 0 ft

Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft

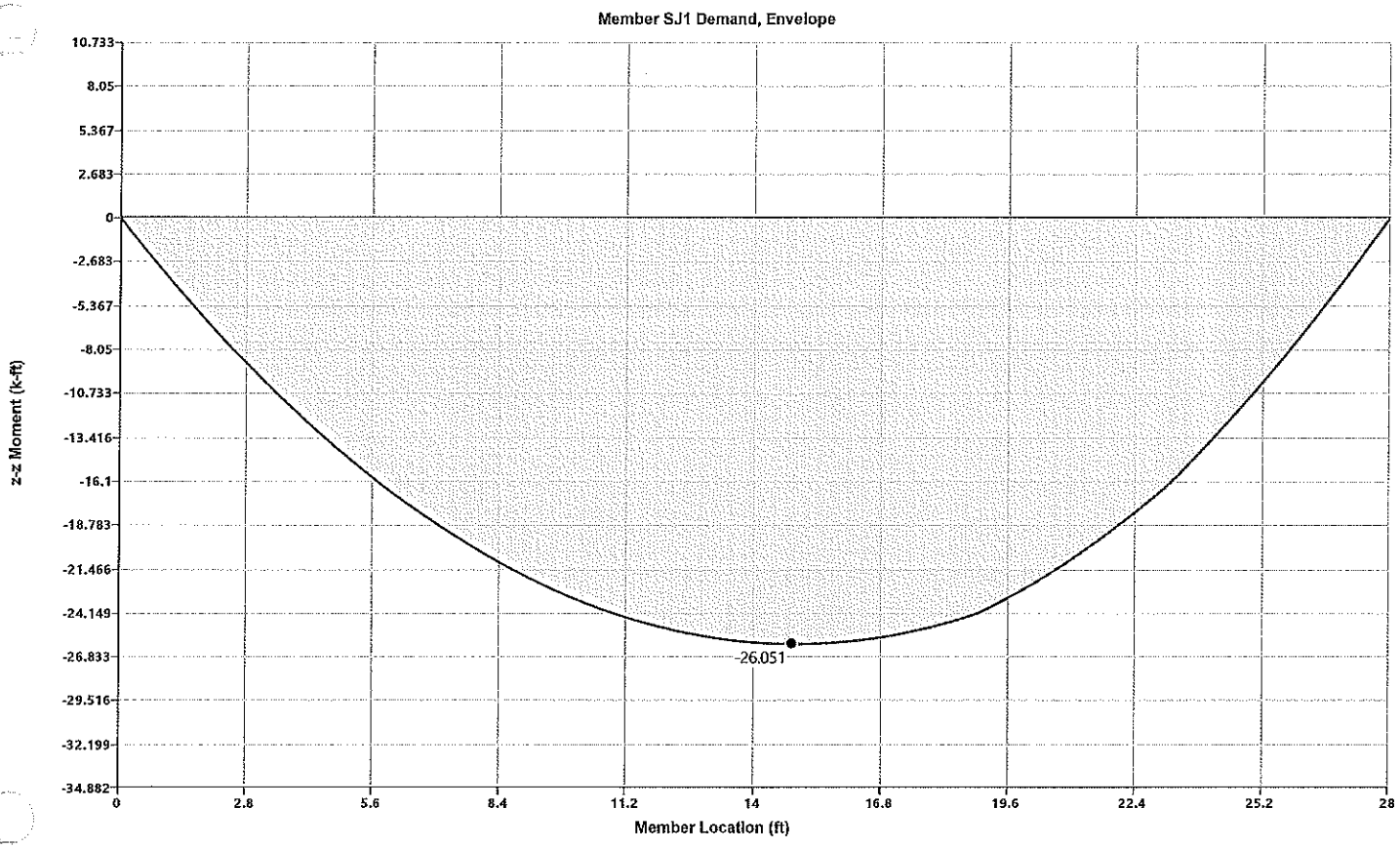


Selected Location Values:

Location: 0 ft

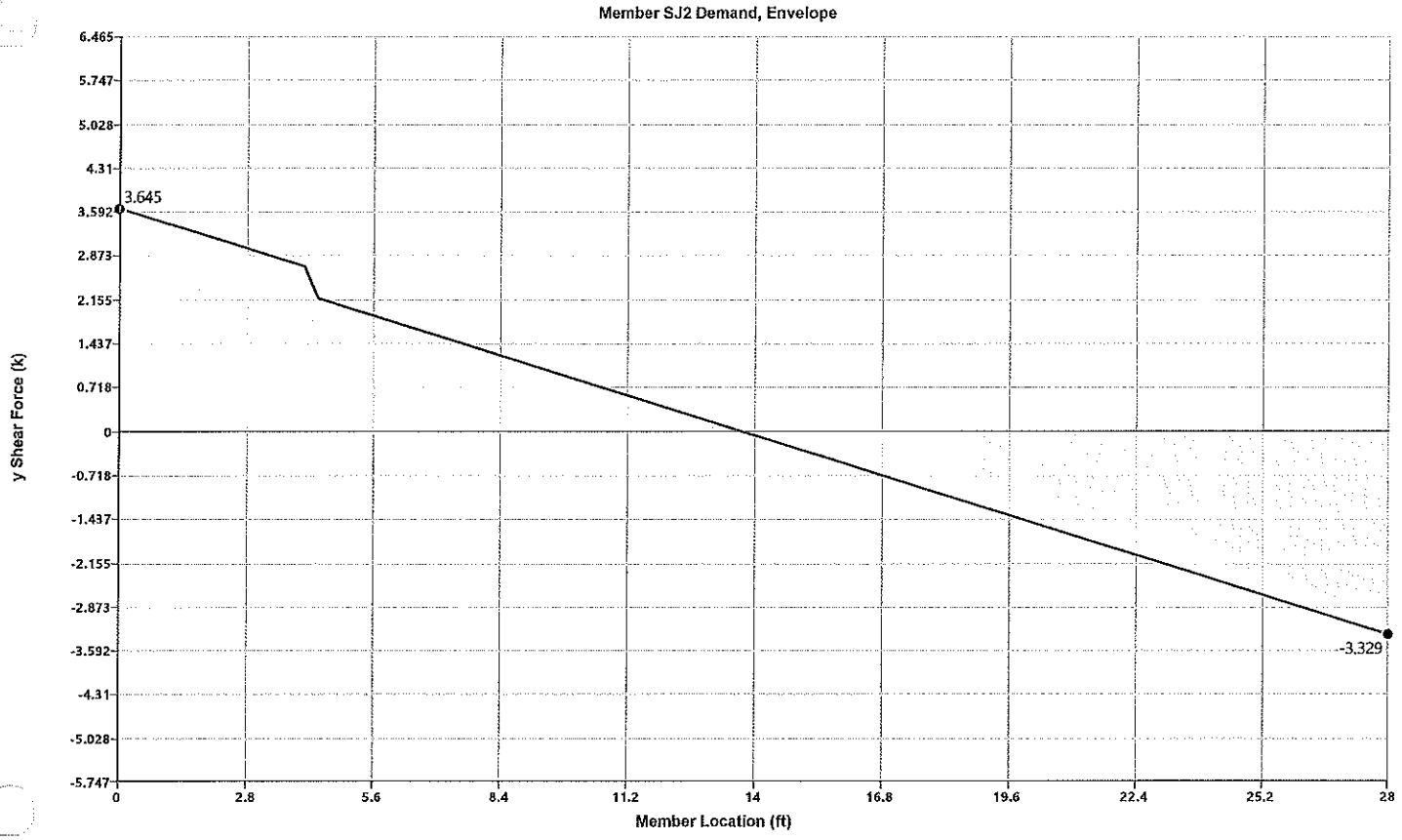
Max Value: 3.484 (LC 2) k

Min Value: 3.484 (LC 2) k



Selected Location Values:

Location: 0 ft
Max Value: 0 (LC 2) k-ft
Min Value: 0 (LC 2) k-ft

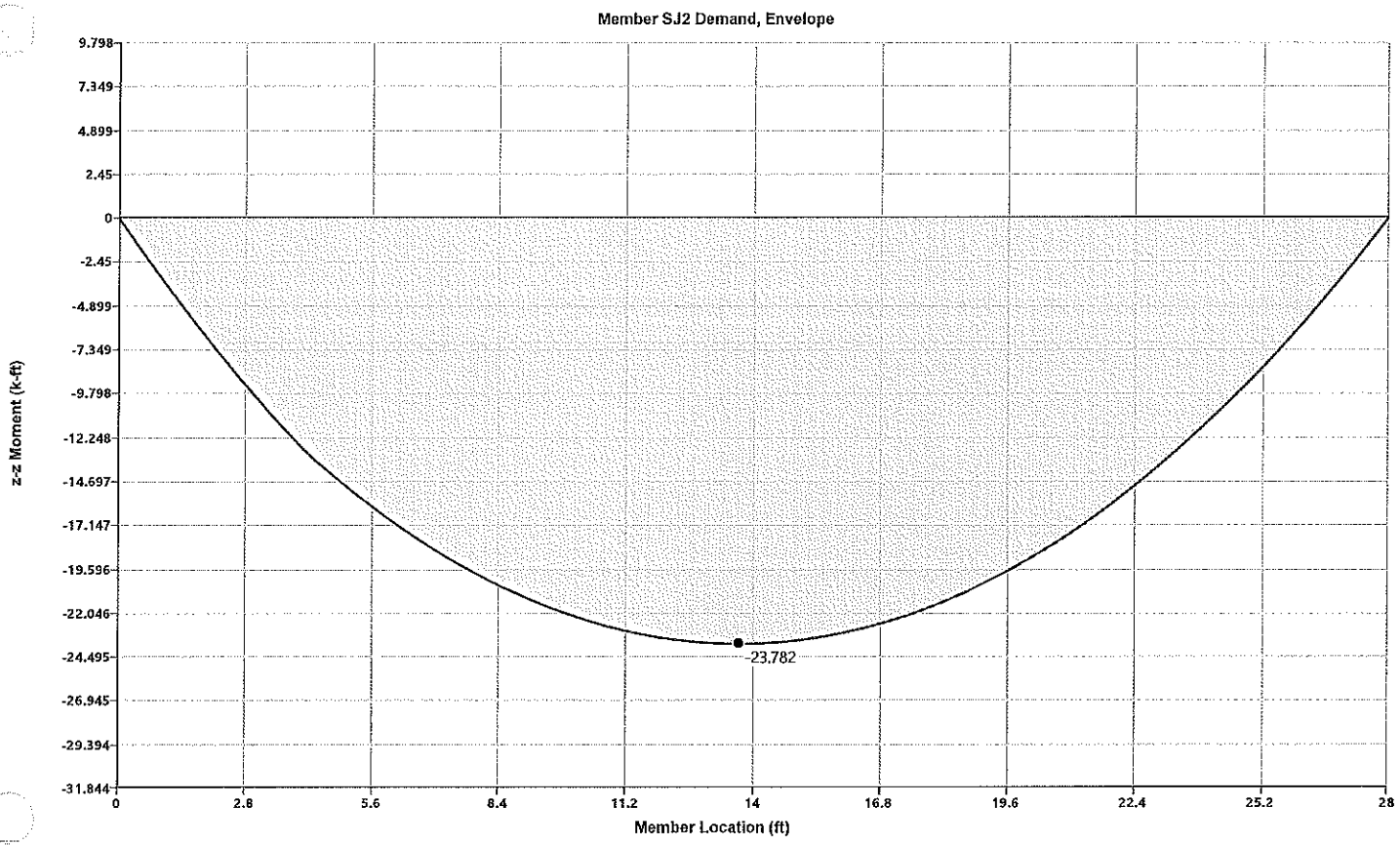


Selected Location Values:

Location: 0 ft

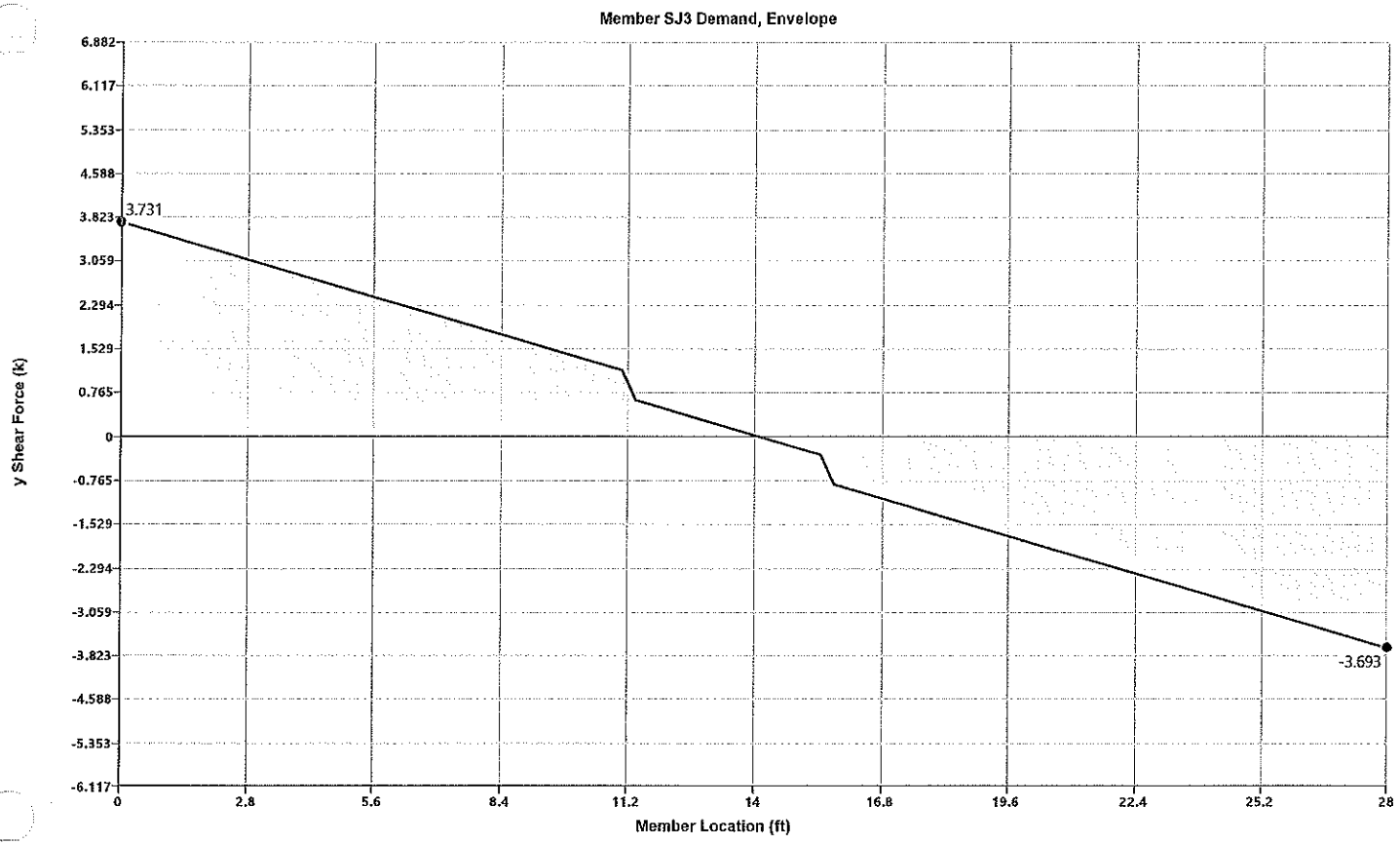
Max Value: 3.645 (LC 2) k

Min Value: 3.645 (LC 2) k



Selected Location Values:

Location: 0 ft
Max Value: 0 (LC 2) k-ft
Min Value: 0 (LC 2) k-ft

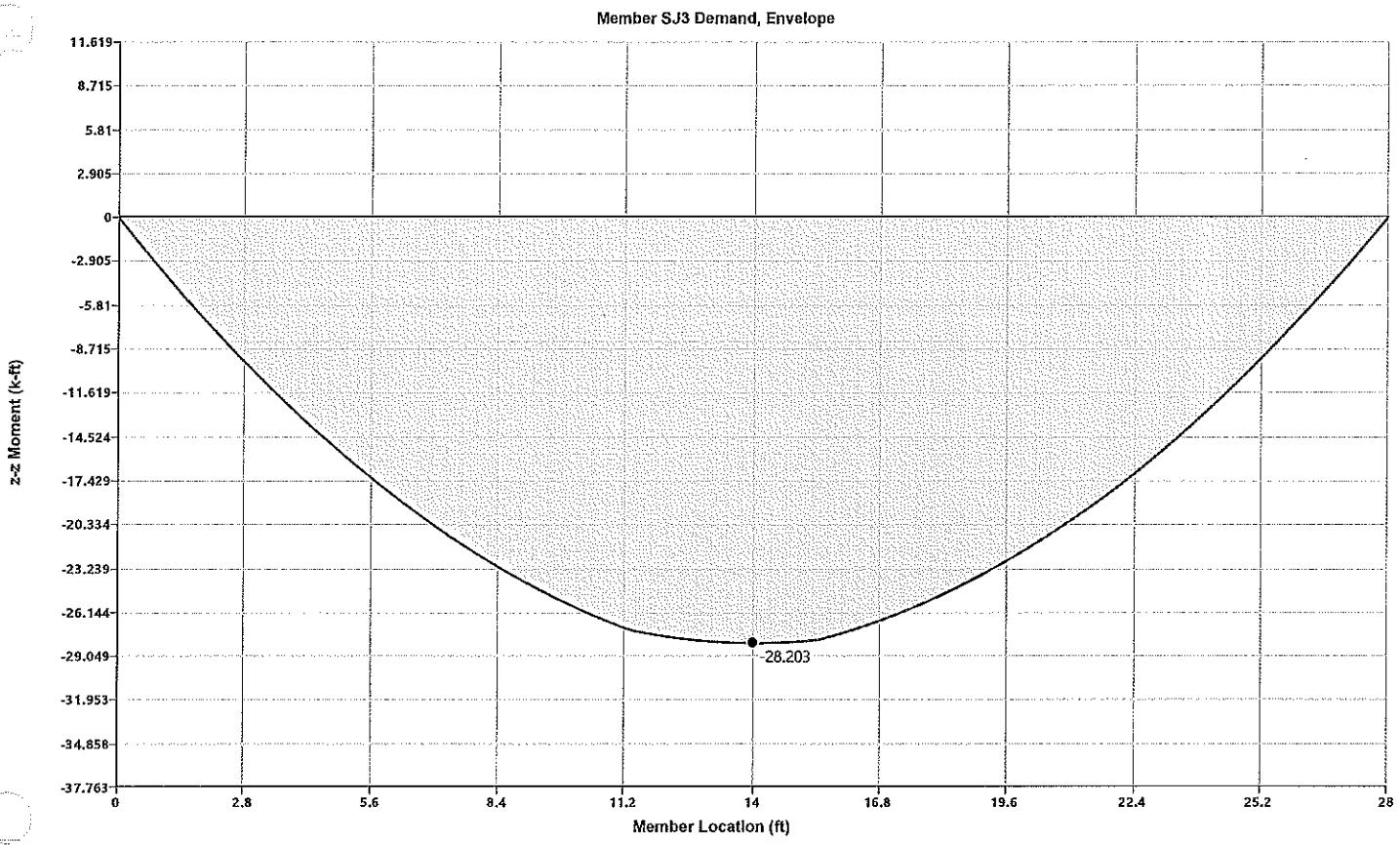


Selected Location Values:

Location: 0 ft

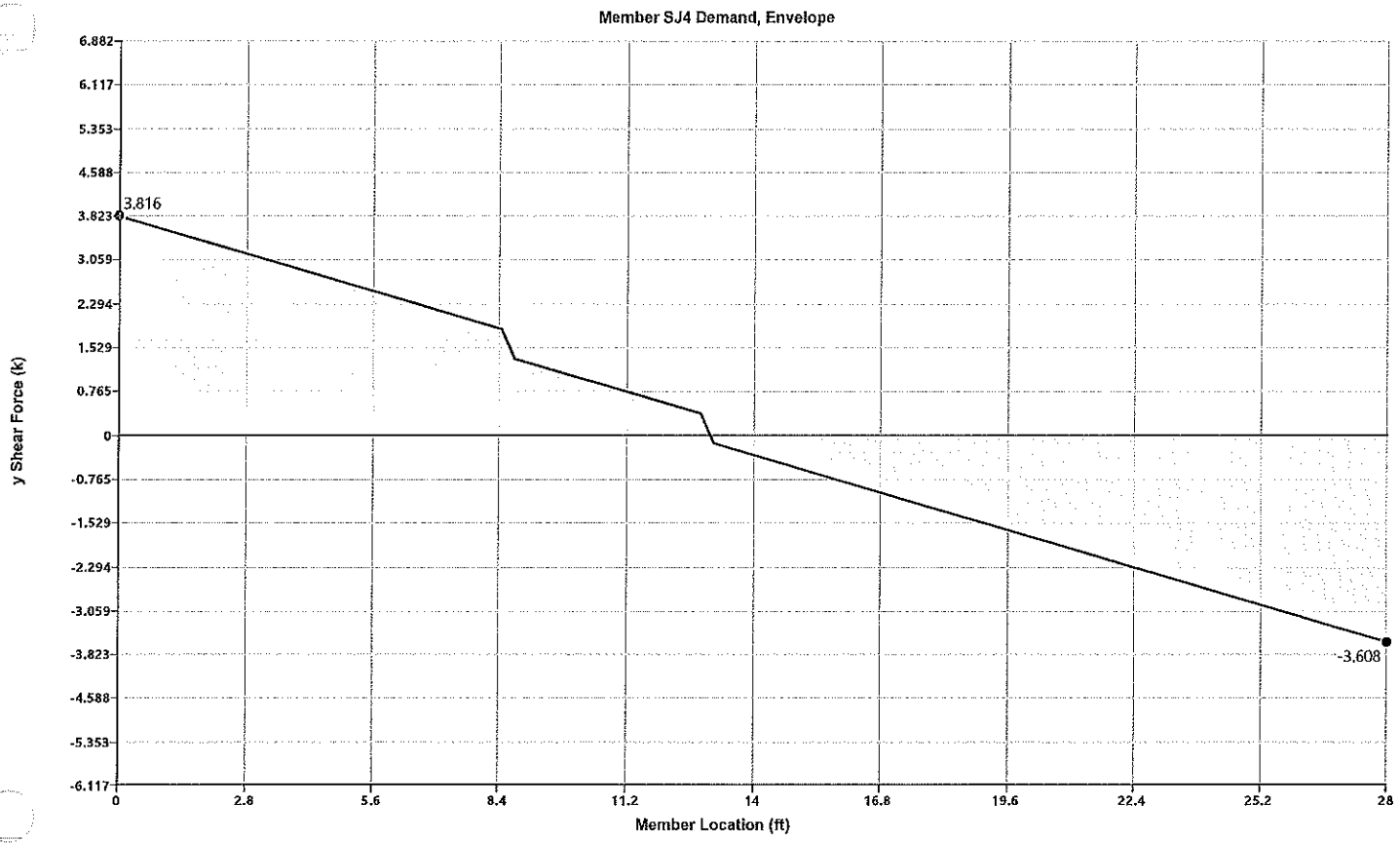
Max Value: 3.731 (LC 2) k

Min Value: 3.731 (LC 2) k



Selected Location Values:

Location: 0 ft
Max Value: 0 (LC 2) k-ft
Min Value: 0 (LC 2) k-ft

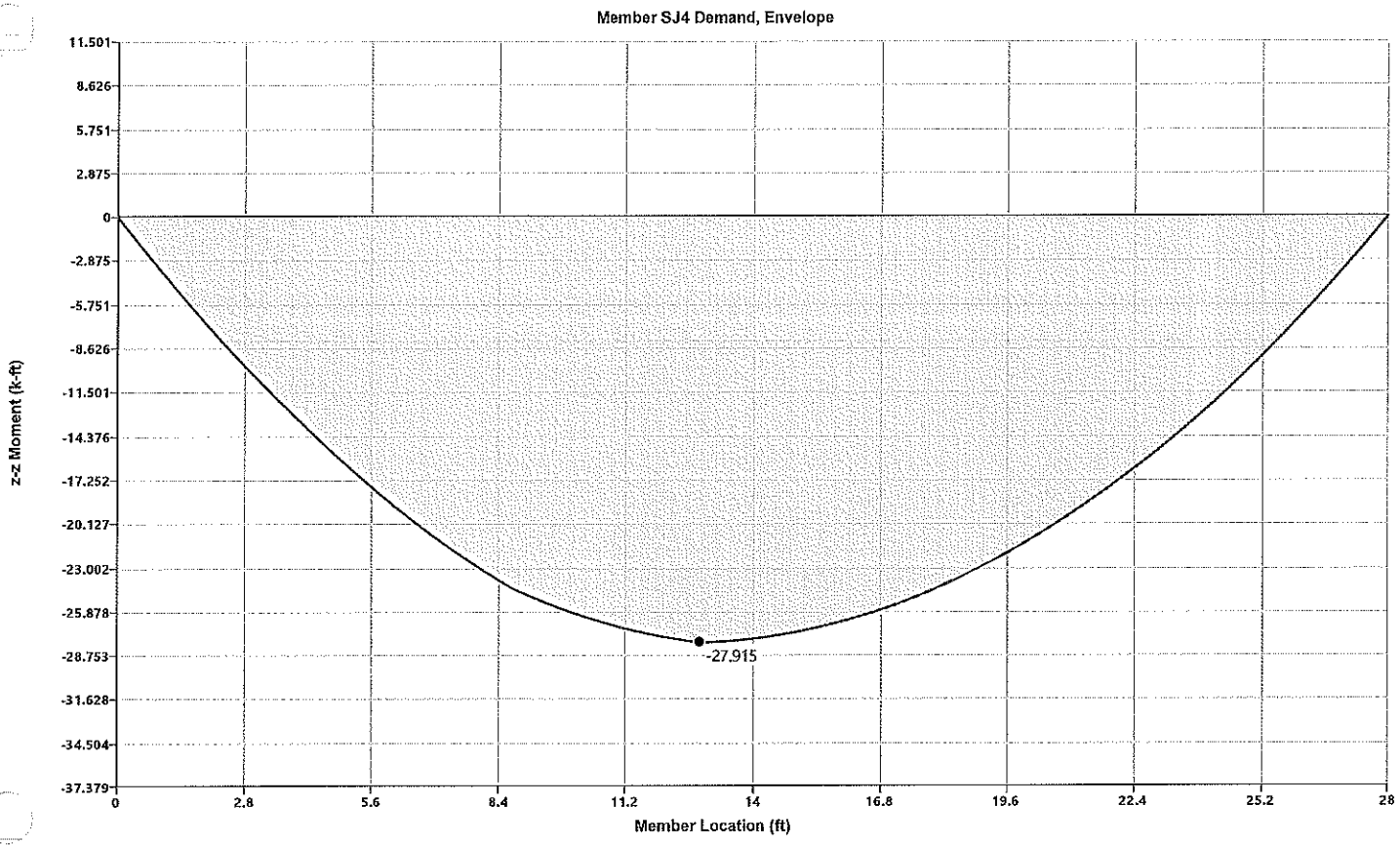


Selected Location Values:

Location: 0 ft

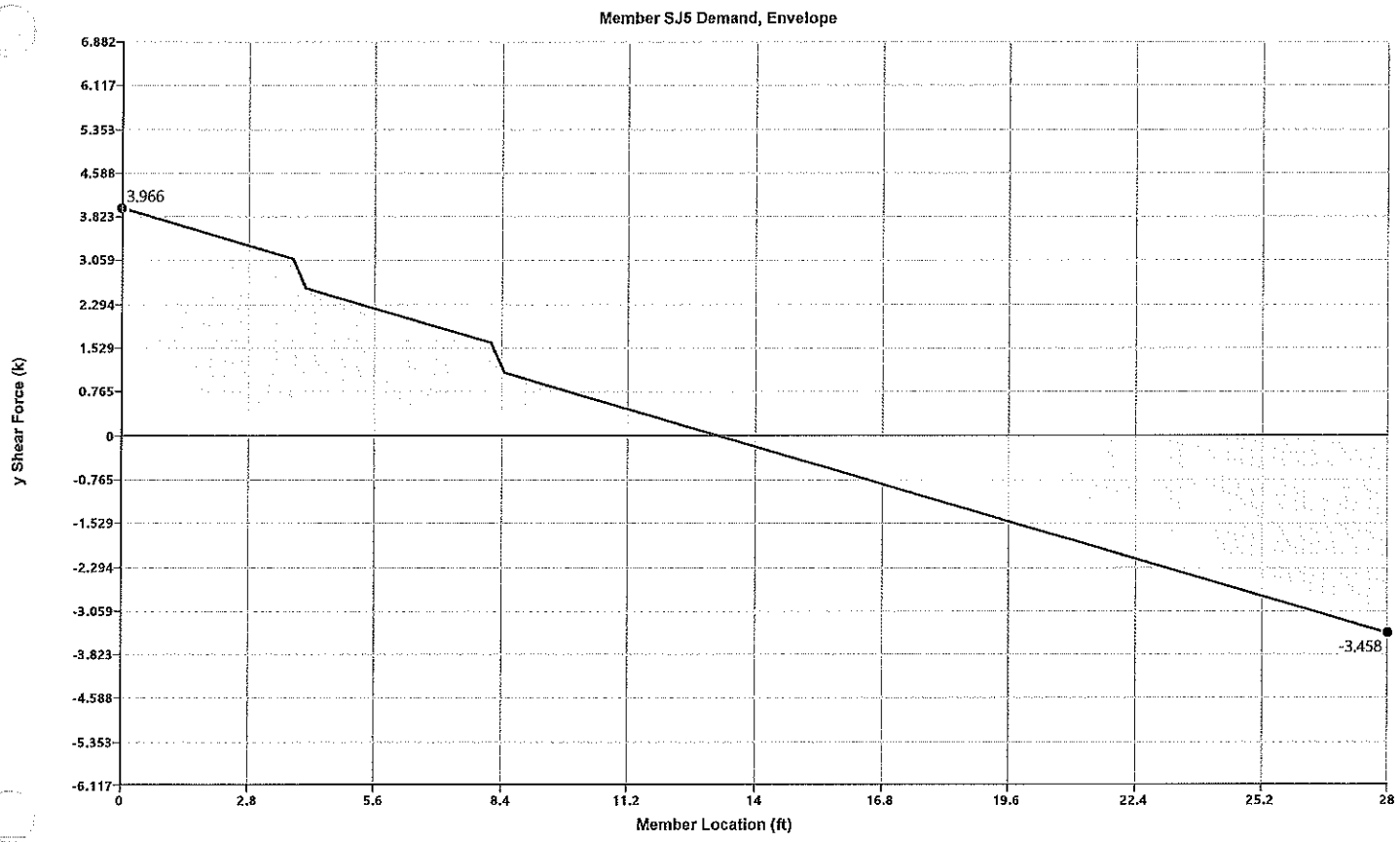
Max Value: 3.816 (LC 2) k

Min Value: 3.816 (LC 2) k



Selected Location Values:

Location: 0 ft
Max Value: 0 (LC 2) k-ft
Min Value: 0 (LC 2) k-ft

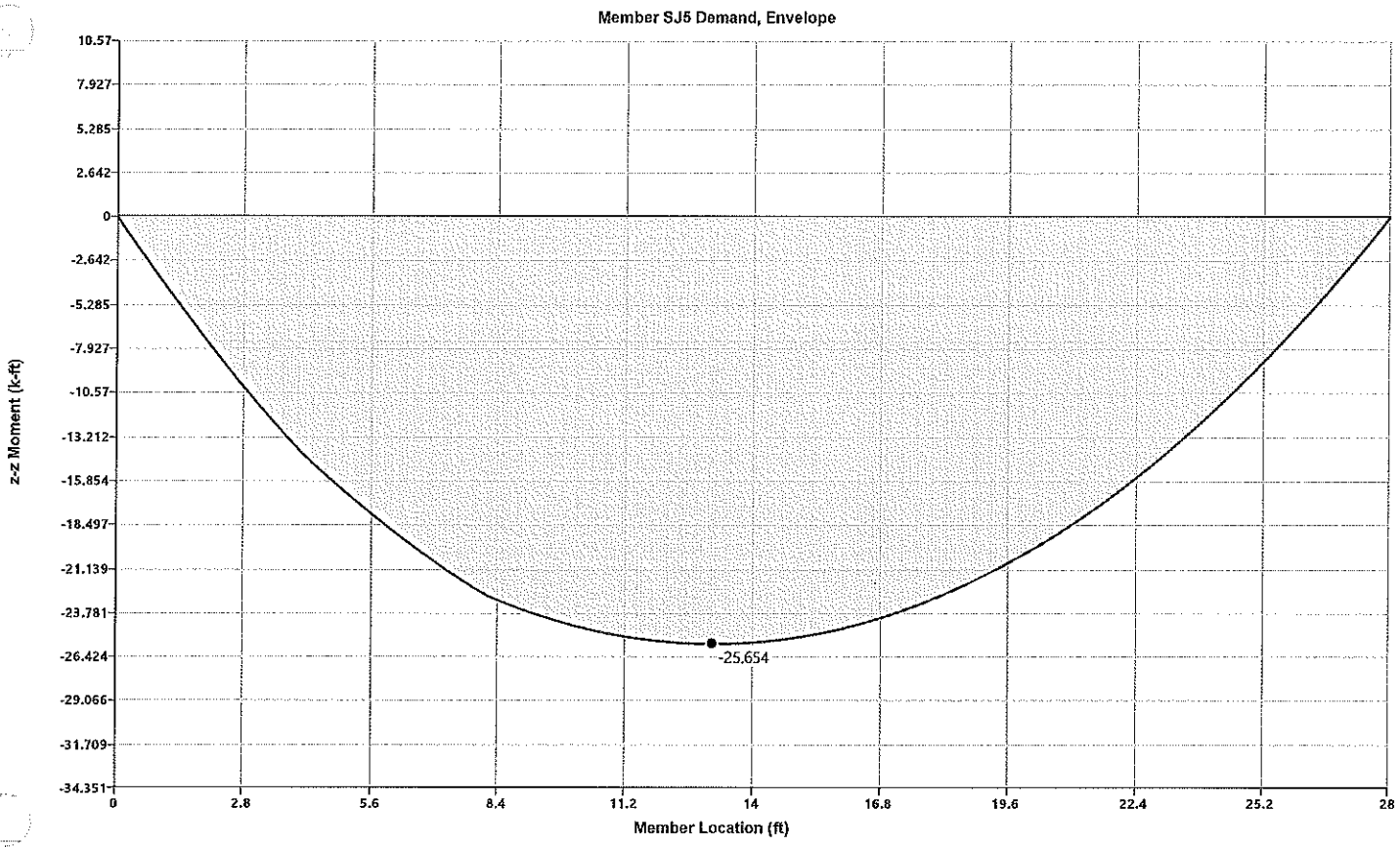


Selected Location Values:

Location: 0 ft

Max Value: 3.966 (LC 2) k

Min Value: 3.966 (LC 2) k



Selected Location Values:

Location: 0 ft

Max Value: 0 (LC 2) k-ft

Min Value: 0 (LC 2) k-ft