### **1a. Horizontal Frame – Load in Negative Z Direction (Moment Diagram in Tension Side)**

### Reference (SAP2000 v15 Help):

- 1. Frame Local Axes
- 2. Frame Element Internal Forces Output Conventions
- 3. Sign Convention
- 4. Moment Diagram on Tension Side

#### Notes:

1. In Options within SAP, there is a "Moment Diagram on Tension Side". The default setting was to show the moment diagram on the tension side, which is not how we do it with hand calculations. Which is why the bending moment is on the bottom for this example. By clicking on "Moment Diagram on Tension Side", the moment diagram will move to the other side.

#### Model:

🔀 Frame Span Loads (DEAD) (As Defined)



**Reactions:** 



### Moment 3-3:

1.1.1	
🛛 💢 Moment 3-3 Diagram	(DEAD)



# Shear 2-2



Frame Results:



### **Tables – Joint Reactions**

le Vi	iew Forma	t-Filter-Sort Se	lect Options							
nits: A	s Noted				Joint Reactions					
	Joint Text	OutputCase Text	CaseType Text	F1 Kip	F2 Kip	F3 Kip	M1 Kip-ft	M2 Kip-ft	M3 Kip-ft	
	1	DEAD	LinStatic	0	0	5	0	0	. (	
<b>-</b>	1 112 200	DEAD	Lin Chatle	0	0	5	0	0	0	

# **Tables – Frame Reactions**

ile V	iew Format-F	ilter-Sort Se	lect Options								
Units: As Noted											
	Frame Text	Station ft	OutputCase Text	CaseType Text	P Kip	V2 Kip	V3 Kip	T Kip-ft	M2 Kip-ft	M3 Kip-ft	S11Max Kip/ft2
•	1	0	DEAD	LinStatic	0	-5	0	0	0	0	0
	1	2	DEAD	LinStatic	0	-5	0	0	0	10	175.71
	1	4	DEAD	LinStatic	0	-5	0	0	0	20	351.42
9	1	6	DEAD	LinStatic	0	-5	0	0	0	30	527.14
9	1	8	DEAD	LinStatic	Ű	-5	0	0	0	40	702.85
	1	10	DEAD	LinStatic	Ű	-5	0	0	0	50	878.56
	1	10	DEAD	LinStatic	Ű i	5	0	0	0	50	878.56
	1	12	DEAD	LinStatic	0	5	0	0	0	40	702.85
	1	14	DEAD	LinStatic	0	5	0	0	0	30	527.14
	1	16	DEAD	LinStatic	0	5	0	0	0	20	351.42
	1	18	DEAD	LinStatic	0	5	0	0	0	10	175.71
6	1	20	DEAD	LinStatic	0	5	0	0	0	2.842E-14	4.994E-13

### VERTICAL FRAME – Load in Negative X Direction (Moment Diagram in Tension Side)

### Reference (SAP2000 v15 Help):

- 1. Frame Local Axes
- 2. Frame Element Internal Forces Output Conventions
- 3. Sign Convention
- 4. Moment Diagram on Tension Side

### Notes:

1. In Options within SAP, there is a "Moment Diagram on Tension Side". The default setting was to show the moment diagram on the tension side, which is not how we do it with hand calculations. Which is why the bending moment is on the left for this example. By clicking on "Moment Diagram on Tension Side", the moment diagram will move to the other side.

### Model:

📜 Frame Concentrated Loads (DEAD)



# **Reactions:**





### Moment 3-3:





**Frame Results:** 

I-End: Jt: 1 0.00000 ft (0.0000 ft) J-End: Jt: 2 0.00000 ft (20.0000 ft) ces in Kip, Concentrated Mome <b>5.00</b>	Scroll for Show Ma     Location     [5.2859 ents in Kip-ft] Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	Values ax ft ) tion	
0.00000 ft (0.0000 ft) J-End: Jt: 2 0.00000 ft (20.0000 ft) ces in Kip, Concentrated Mome 5.00	C Show Ma Location 5.2859 ents in Kip-ft) Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	ft	
J-End: Jt: 2 0.00000 ft (20.0000 ft) ces in Kip, Concentrated Mome 5.00	Location 5.2859 ents in Kip-ft) Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	ft J	
0.00000 ft (20.0000 ft) ces in Kip, Concentrated Mome <u>5.00</u>	5.2859 ents in Kip-ft) Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	ft )	
ces in Kip, Concentrated Mome	ents in Kip-ft) Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	) tion	
5.00	Dist Load (2-dir 0.000 Kip/ft at 5.2859 ft Positive in -2 direct Shear V2	) tion	
5.00	0.000 Kip/ft at 5.2859 ft Positive in -2 direct <b>Shear V2</b>	tion	
T 5.00	at 5.2859 ft Positive in -2 direct Shear V2	tion	
5.00	Shear ¥2		
	Shear V2		
	5.000 Kin		
	at 5.2859 ft		
		Why is t	this not on tr
	Mom <del>ent M</del> 3	that of n	ue, similar ic bade 7
	26.4295 Kip-ft		
	at 5.2859 ft		
	Deflection (2-di	ir)	
	0.004915 ft		
	at 5.2859 ft		
	Positive in -2 direct	tion	
Relative to Beam Ends			
e	Units Kin f	t F 💌	
	<ul> <li>Relative to Beam Ends</li> </ul>	-5.000 Kip at 5.2859 ft Moment M3 26.4295 Kip-ft at 5.2859 ft Deflection (2-di 0.004915 ft at 5.2859 ft Positive in -2 direct e Units Kip, ft	-5.000 Kip at 5.2859 ft Why is a other sig that of p 26.4295 Kip-ft at 5.2859 ft Deflection (2-dir) 0.004915 ft at 5.2859 ft Positive in -2 direction Relative to Beam Ends Units Kip, ft, F

## **Tables – Joint Reactions**

J	oint Re	actions								
	File V	'iew Format-	Filter-Sort Se	lect Options						
	Units: 7	As Noted				Joint Re	actions			-
		Joint	OutputCase	CaseType	F1	F2	F3	M1	M2	M3
		Text	Text	Text	Kip	Kip	Kip	Kip-ft	Kip-ft	Kip-ft
		1	DEAD	LinStatic	6.123E-16	0	-5	0	0	0
		2	DEAD	LinStatic	0	0	-5	0	0	0

# **Tables – Frame Reactions**

ile \	liew Format-F	ilter-Sort Se	lect Options								
Jnits: 7	As Noted								Elen	nent Forces - Fra	imes
	Frame Text	Station ft	OutputCase Text	CaseType Text	P Kip	V2 Kip	V3 Kip	T Kip-ft	M2 Kip-ft	M3 Kip-ft	S11Max Kip/ft2
•	1	0	DEAD	LinStatic	-3.062E-16	-5	0	0	0	0	-2.721E-15
	1	10	DEAD	LinStatic	-3.062E-16	-5	0	0	0	50	878.56
	1	10	DEAD	LinStatic	-3.062E-16	5	0	0	0	50	878.56
2	1	20	DEAD	LinStatic	-3.062E-16	5	0	0	0	2.842E-14	4.967E-13

x