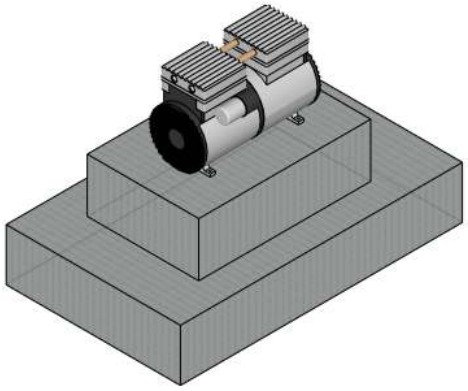
Print Calculation Sheet

Vibrational Analysis of Machine Foundation ACI 351.3R-04 (FEA Method)

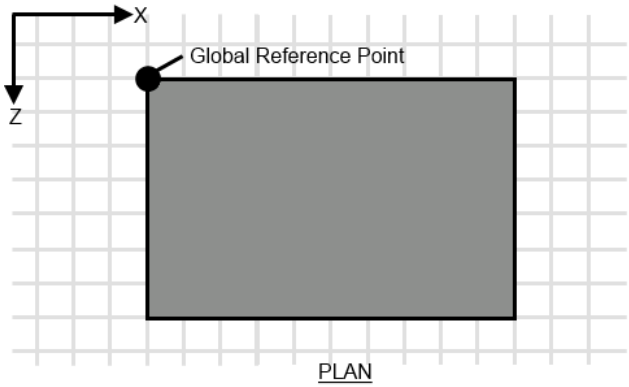


Input Data

Machine Data

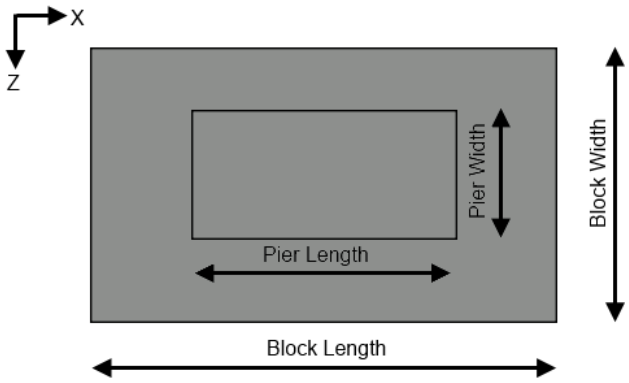
Foundation Type	=	Single Block	
Machine Type	=	Rotating Machine	
Resonance Limit	=	20.00	%

Global Reference Point



Global Reference Point X	=	0.00	m
Global Reference Point Y	=	0.00	m
Global Reference Point Z	=	0.00	m

Machine Block Geometry

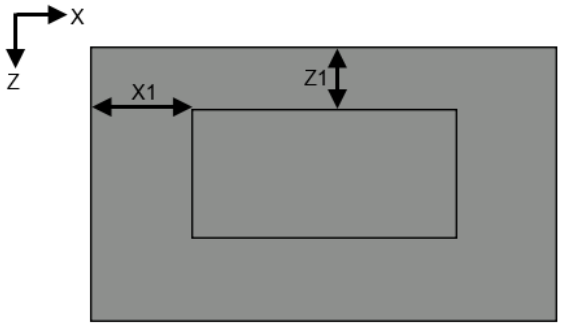


Block Length	=	3.50	m
Block Width	=	1.50	m
Block Thickness	=	0.25	m

Pier Geometry

Pier Length	=	1.00	m
Pier Width	=	0.50	m
Pier Thickness	=	0.10	m

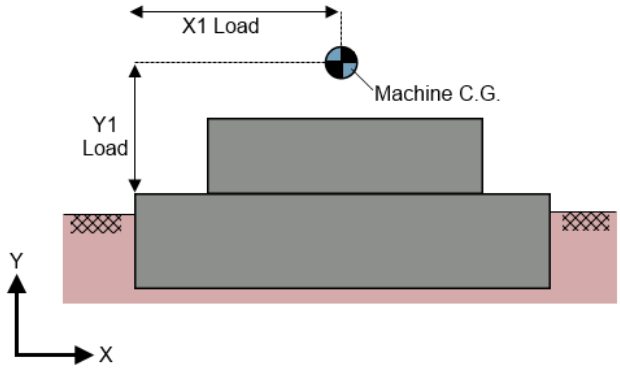
Pier Location



X1	=	1.00	m
Z1	=	0.50	m

Machine Loading

Dynamic Machine Weight	=	1211.00	kgf
Static Machine Weight	=	1235.00	kgf
Primary Speed	=	3000.00	rpm



X Load Location	=	1.75	m
Y Load Location	=	0.10	m
Z Load Location	=	0.75	m
Number of Mode Shapes	=	10	
Loading Type	=	Emperical Method	

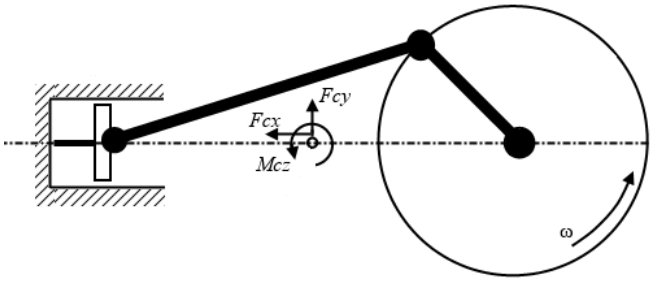
Soil Parameters

Soil Spring Generation Method	=	Direct Input Method	
Consider Embedment Independence	=	Effect Not Considered	
Soil Embedment	=	5.00	ft
Back Fill Shear	=	10.00	ksi
Soil Type	=	Granular	
Consider Damping	=	Effect Considered	
Concrete Damping Percentage	=	0.00	

Soil Springs

Horizontal Spring	=	1250.00	kN/m
Vertical Spring	=	12500.00	kN/m
Horizontal Damping	=	2.00	
Vertical Damping	=	5.00	

Unbalanced Dynamic Load Calculation



Force = $F_o = \frac{W_r \times f_o}{6000}$ = 1.33 kip ...(3-7)

Moment M_x = 0.00 kip-ft

Calculated Modal Frequencies and Mass Participation

Number of Modes Shapes: 10

Mode	Frequency (Hz)	Period (sec)	Participation X (%)	Participation Y (%)	Participation Z (%)	Accumulated X (%)	Accumulated Y (%)	Accumulated Z (%)
1	7.41	0.14	0.00	99.97	0.00	0.00	99.97	0.00
2	7.83	0.13	0.00	0.00	27.81	0.00	99.98	27.82
3	9.42	0.11	7.95	0.01	0.00	7.95	99.99	27.82
4	50.53	0.02	0.42	0.00	0.46	8.37	99.99	28.28
5	54.18	0.02	0.70	0.01	0.07	9.07	100.00	28.34
6	87.48	0.01	47.15	0.00	0.35	56.22	100.00	28.70
7	93.04	0.01	0.54	0.00	7.42	56.76	100.00	36.12
8	102.33	0.01	0.20	0.00	23.42	56.96	100.00	59.54
9	0.00	1000000.00	0.00	0.00	0.00	56.96	100.00	59.54
10	0.00	1000000.00	0.00	0.00	0.00	56.96	100.00	59.54

Dynamic Displacement Summary

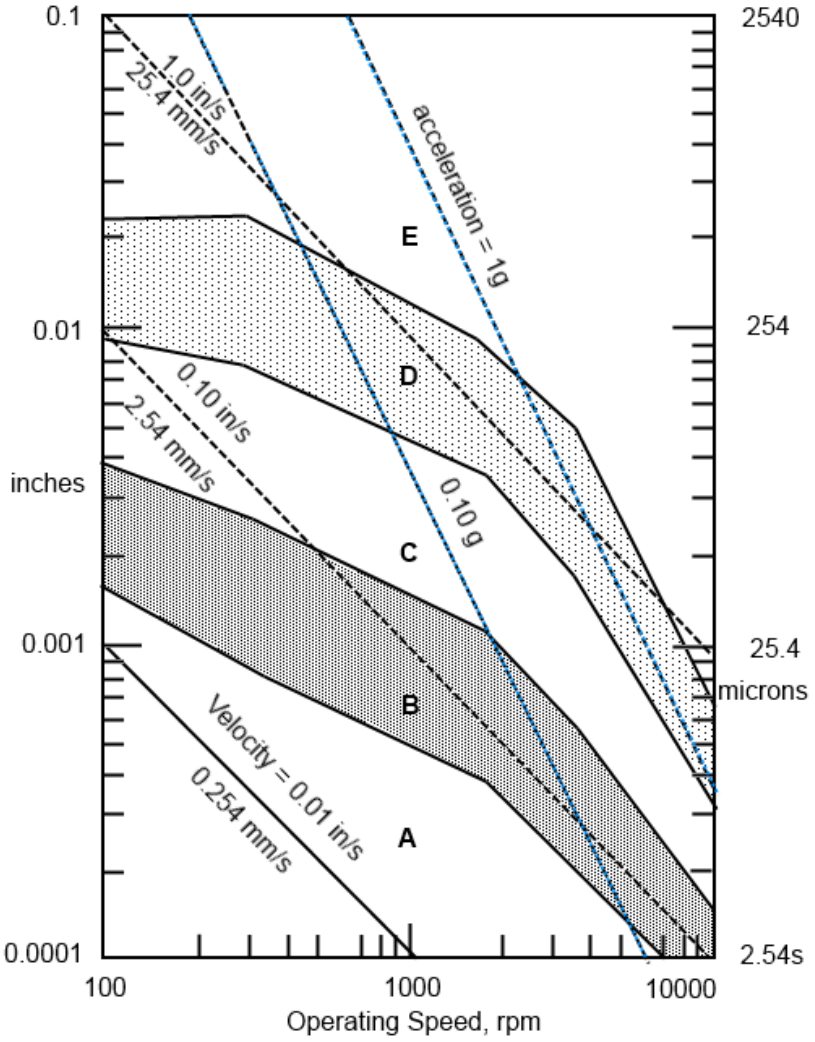
Node	Displacement X (in)	Displacement Y (in)	Displacement Z (in)
53	0.014911	-0.000323	0.000015
181	0.000280	0.146649	0.000330
53	0.000015	0.000065	0.069741
33	-0.001238	0.004249	-0.002201
53	-0.000086	-0.180158	-0.000092
33	-0.001238	0.004249	-0.002201

Mode No	Foundation Frequency (Hz)	Machine Frequency (Hz)	Frequency Check
1	7.41	50.00	Machine Frequency OK
2	7.83	50.00	Machine Frequency OK
3	9.42	50.00	Machine Frequency OK
4	50.53	50.00	Machine Frequency is within 20.00 % of Foundation Frequency
5	54.18	50.00	Machine Frequency is within 20.00 % of Foundation Frequency
6	87.48	50.00	Machine Frequency OK
7	93.04	50.00	Machine Frequency OK
8	102.33	50.00	Machine Frequency OK
9	0.00	50.00	Machine Frequency OK
10	0.00	50.00	Machine Frequency OK

Transverse Amplitude Check

Maximum Transverse Amplitude : 0.000183ft

Vibration Criteria for Rotating Machine ACI 351.3R-04 Fig 3.9



A: No Faults. Foundation is safe for machine vibrations

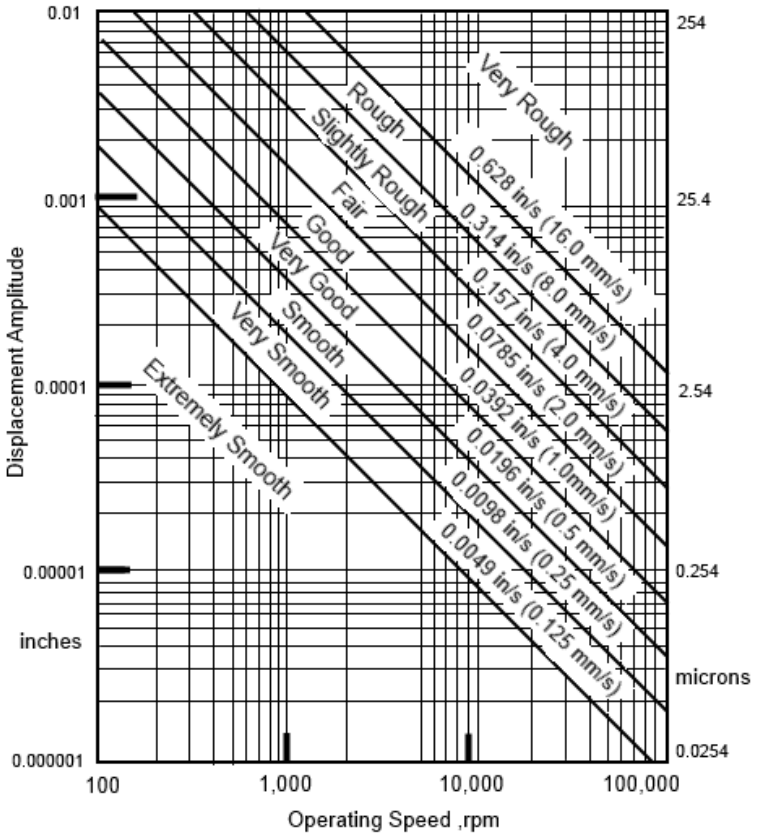
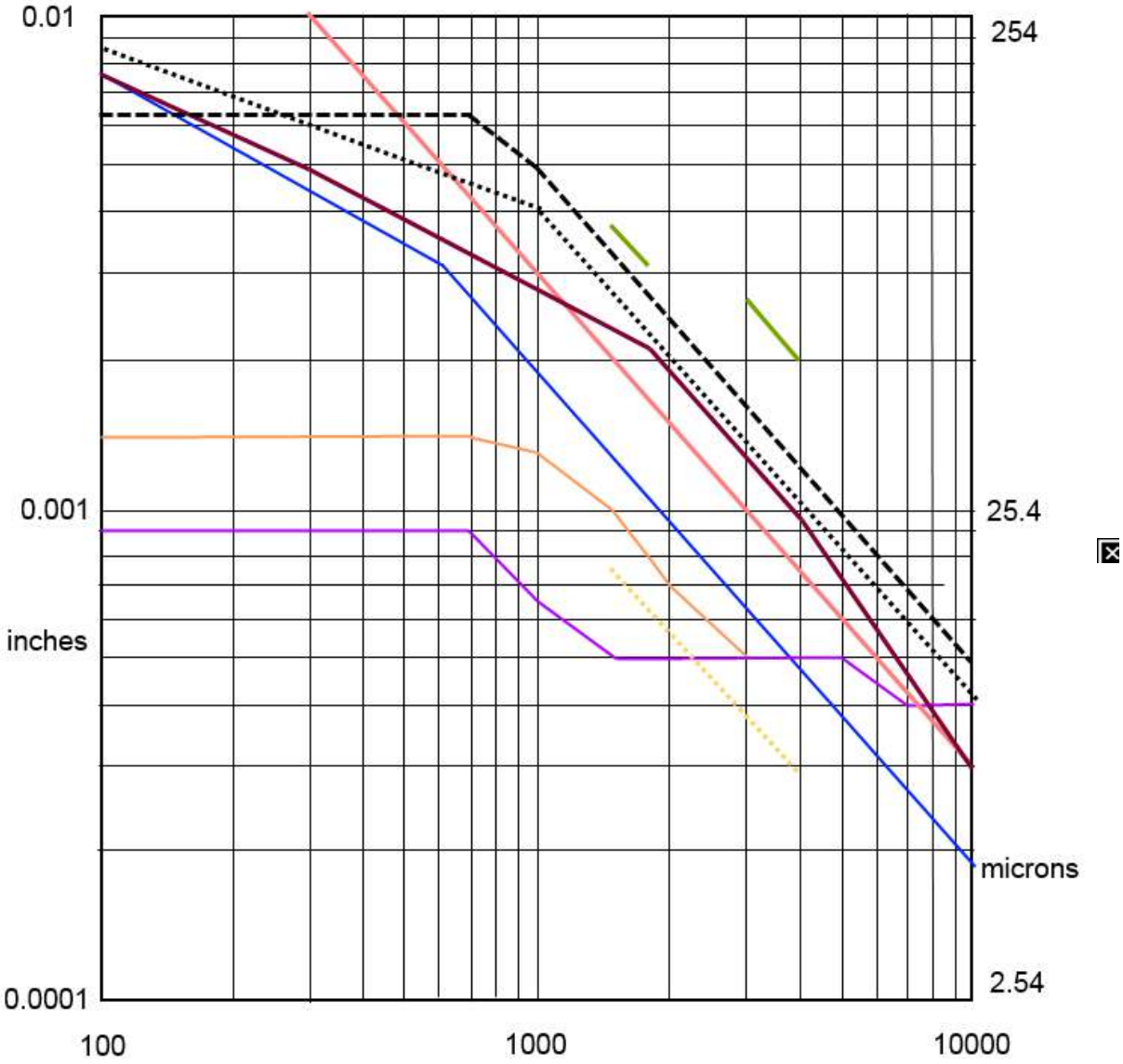
B: Minor Faults. Foundation needs review

C: Faulty. Foundation should be resized

D: Failure is near. Foundation is unsafe for machine vibrations

E: Dangerous. Foundation is unsafe for machine vibrations

Severity Chart ACI 351.3R-04 Fig 3.10



Permissible Displacement ACI 351.3R-04 Fig 3.11