Organization		**Client**	
Designed By		**Project**	Eng-Tips Example
Date	1/10/2011	**Job #**	
		Wall Loc.	

SBWall Report

Soils Data

Soil Friction Angle, phi	30.0 deg
Soil Unit Weight, gamma	120 pcf
Soil Surcharge (uniform), qs	950 psf
Passive Resistance, FSp	1.50
Passive Wedge Width, PW*B	2.00
Backfill Slope Angle, beta	0.0 deg
Ignore Passive Resistance, x	0.0 ft

Geometry

Shored Height, H	6.0 ft
Soldier Beam Spacing, S	6.0 ft
Drill Hole Diameter, B	2.0 ft

Steel Shape — W16x50

Seismic Design

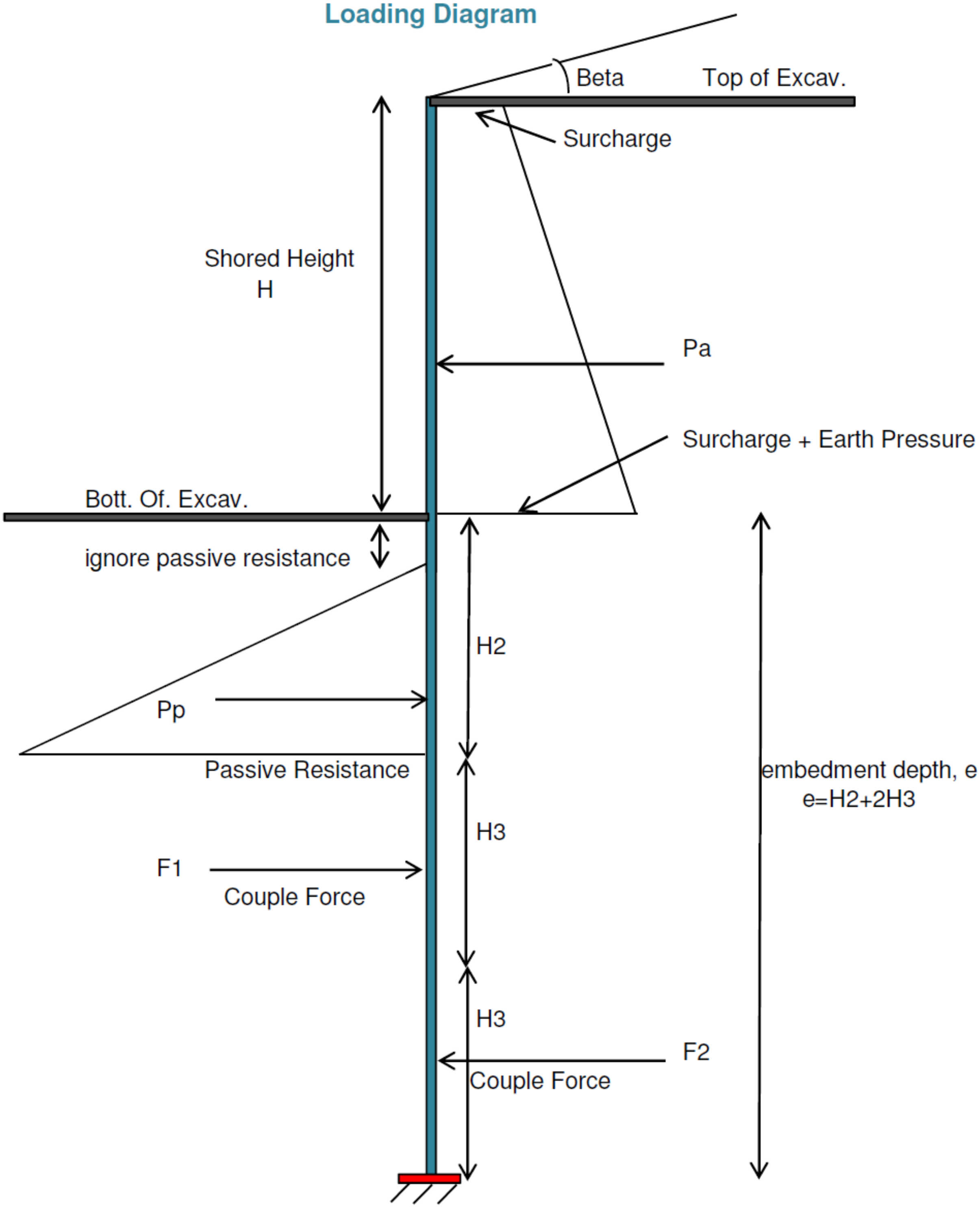
Seismic Load	0.00 kip/ft
Seismic Load Location (from top of shoring)	0.0 ft

Lagging Design — Wood Lagging

Allowable Lagging Bending Stress, Fb	1250 psi
Allowable Horizontal Shear Stress Parallel to Grain, Fv	135 psi
Lagging Size factor, Cd	1.30
Lagging Flat use factor, Cfy	1.50
Allowable Compression Stress Perpendicular to Grain, Cp	560 psi

SBWall Software

Loading Diagram



Design Philosophy

OSHA requires that excavations deeper than 5 feet be laid back or shored temporarily to protect workers. Due to the limited space of developing areas, there is no room to lay back the slopes. Therefore Soldier Beams and Lagging shoring system is selected. If shoring height is less than about 15 feet, cantilever shoring and lagging is selected. For shoring heights greater than 15 feet, tied back soldier piles or soil nail system is often selected. Our TBWall can design tieback walls.

A soldier pile shoring system consists of W or HP beams that are either driven or placed in drilled holes. If placed in drilled holes, the shaft is normally 2 foot in diameter and is filled with 3 ksi concrete from pile tip to bottom of excavation & lean concrete from bottom of excavation to the top of shoring. These vertical piles are often spaced 5 to 10 foot on center. Between the vertical piles, 3x12 to 6x12 pressure treated timber lagging is placed horizontally. The shored soils apply active earth pressures to the lagging, which in turn transfers it to the soldier piles.

A soldier beam is usually designed as temporary retaining structure, and is utilized until the permanent walls can be built and backfilled. On some occasions, soldier piles are also required to resist downward axial loads from existing building foundations in addition to the earth pressures.

The shoring height, H, is subjected to triangular active earth pressure calculated from Rankine method. For example, Soil friction angle of phi=30° gives Ka = 0.33. Due to temporary construction operations it may be necessary to consider 1 to 2 ft of soil surcharge. That surcharge is then converted to pressure along the shoring height with the equation Ps=Kq x s. It is up to the shoring designer to account of any other surcharges such as those resulting from point, line, strip or seismic loadings.

The soldier beam gets its stability from passive resistance in front of the excavation and below the bottom of excavation. It is advised that passive resistance be factored by 1.5 to account for changes in possible soil strength reduction due to saturation. Since Rankine method of passive resistance is conservative and additional FS of 1.5 has been applied, it is not necessary to further reduce passive resistance by ignoring the upper 2 feet below the base of excavation.

Therefore Kp= 1/Ka and Kp' = Kp/F.S. This 1.33 to 2.0 Safety factor is the only "FS". Increasing the depth of embedment by 1.2 to 1.4 is not a safety factor-rather it is a required number to compensate for any errors resulting from the difference between assumed & simplified pressure distributions. When designing soldier piles, it is customary to require that any ground water table be lowered to 2 or 3 feet below the base of excavation. Also it is best practices to allow 1.5" gap between timber lagging (louvre) so as to facilitate drainage. Therefore lateral water pressures are not accounted for wall portion above the base of the excavation if the site is dewatered.

For the buried portion of the soldier beam, the net water pressure is zero, since the water pressure from the active side of the beam is equal but opposite of the water pressure from the passive side of the system.

Lagging Design

Arching of lagging is assumed to act a depth of 0.5L. Where L is the soldier beam spacing - 2(Half drill hole diameters). In cohesionless soils, lagging soil pressure ranges from 150 to 300 psf depending on soldier beam spacing. Maximum moment, M is slightly larger than P*(L^2)/12, where L is Spacing of Soldier piles minus (two x half diameter of drill hole). SBWall computes both wood and steel plate lagging size.

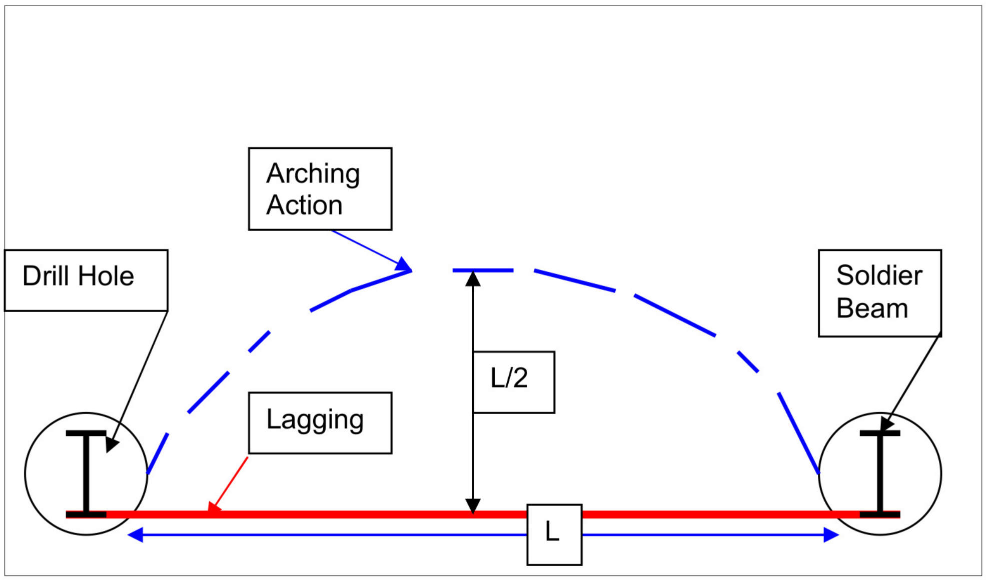


Figure 2: Arching of lagging members

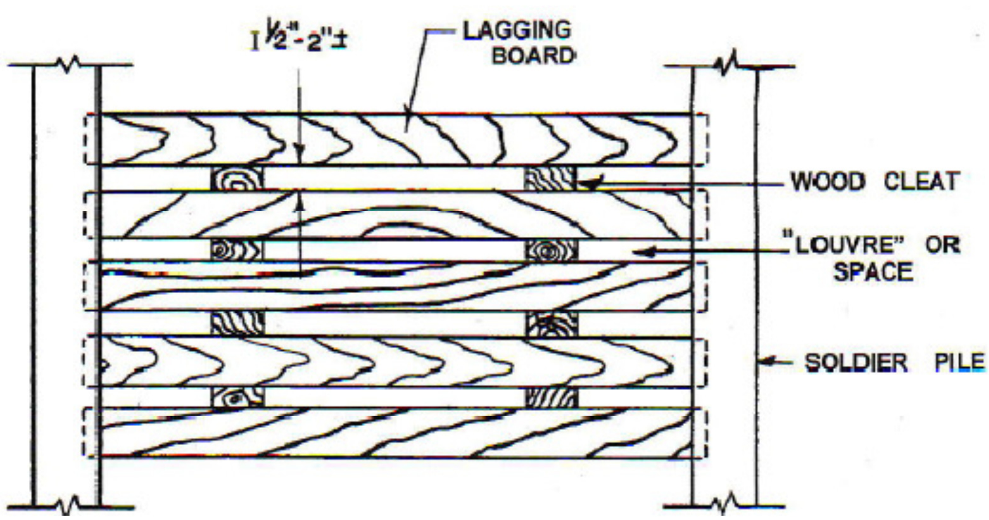


Figure 3: Elevation view of lagging members (Figure from FHWA Publication)

Geotechnical Analysis

Equivalent Active Fluid Pressure	40.0 psf/ft
Equivalent Passive Fluid Pressure	240.0 psf/ft
Active Earth Pressure Thrust, Pa	8.12 K/ft
Resiting Height, H2	4.11 ft
Moment Couple Height, H3	5.22 ft
Embedment Depth, e	14.6 ft
Balancing Couple Force, F1, F2	1.56 kips

Structural Design

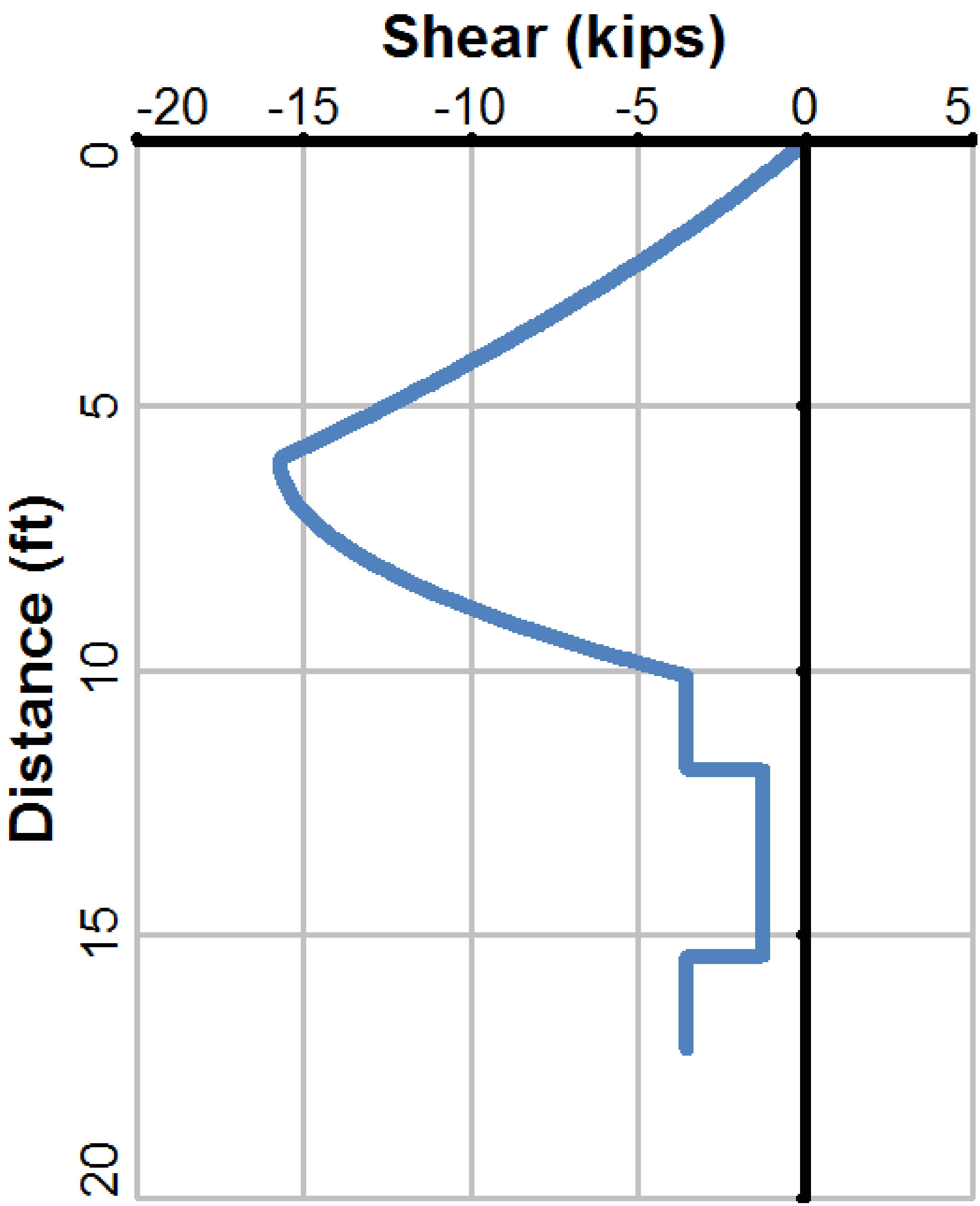
Required Section Modulus, Sx		43.07 in^3
Provided Section Modulus, Sx		81.00 in^3
Maximum Moment		-107.67 ft-kips at 17.17 ft
Maximum Deflection		0.07 in. at 0.00 ft
AISC Code Check for X-Axis Bending:		
	fbx	15.95 ksi
	Fbx	15.95 ksi
	S.R.	1.000
AISC Code Check for Gross Shear:		
	fv	0.57 ksi
	Fv	20.00 ksi
	S.R.	0.029

Lagging Design

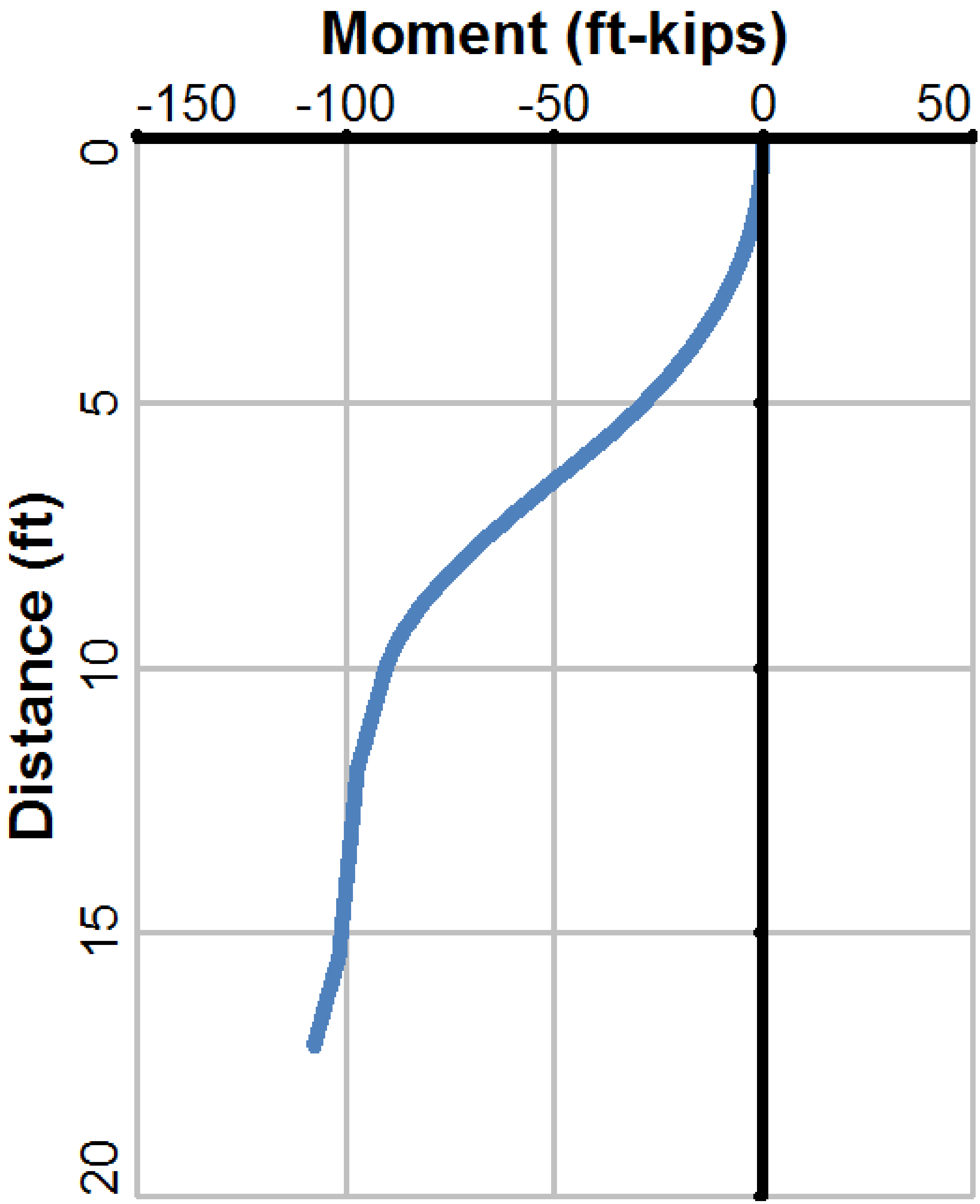
Soil Pressure	160 psf
Maximum Bending Moment	480 lb-ft/ft
Lagging Area Required	4.15 in^2
Section Modulus of Lagging	2.36 in^3
Lagging Size	2x12 Lagging-pessure treated

References

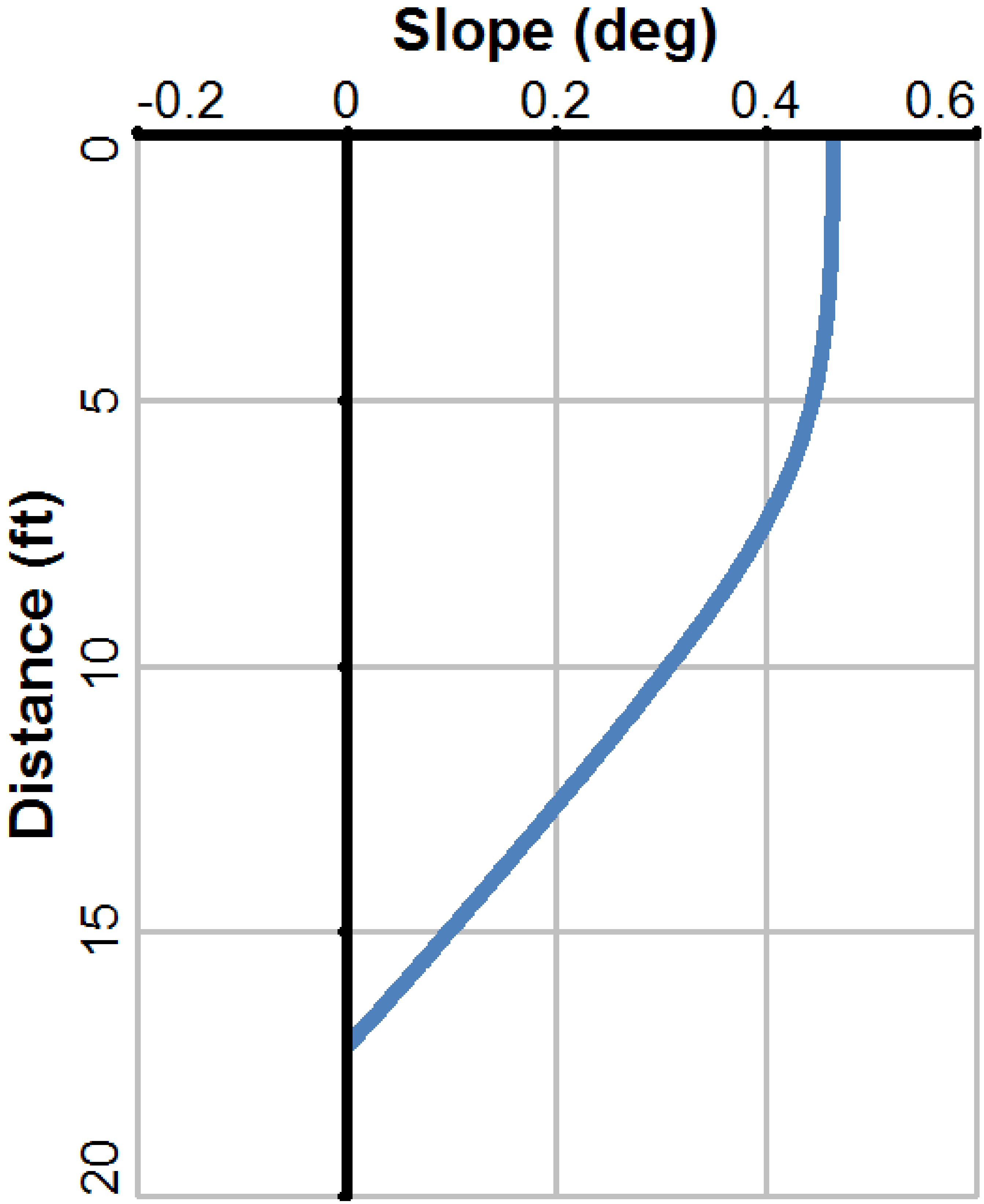
1) Modern Formulas for Statics and Dynamics, Pilkey and Chuang, 1978
2) AISC Steel Construction Manual, 13th ed.2005
3) Design of Cantilever Soldier Beams, Affi, 2009 (unpublished)



Shear (kips)
-20
-15
-10
-5
0
5
Distance (ft)
0
5
10
15
20



Moment (ft-kips)
-150
-100
-50
0
50
Distance (ft)
0
5
10
15
20


Slope (deg)
-0.2
0
0.2
0.4
0.6
Distance (ft)
0
5
10
15
20