

Retaining Wall and Slope Stability Design

5660 East Mercer Way
Mercer Island, Washington 98040

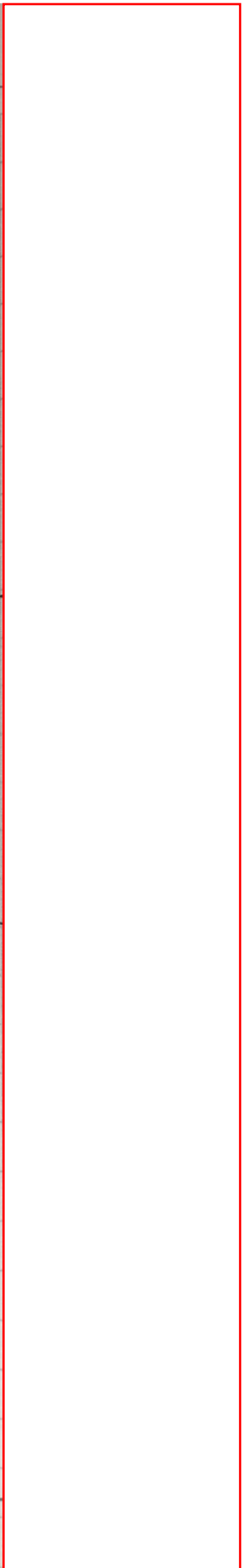
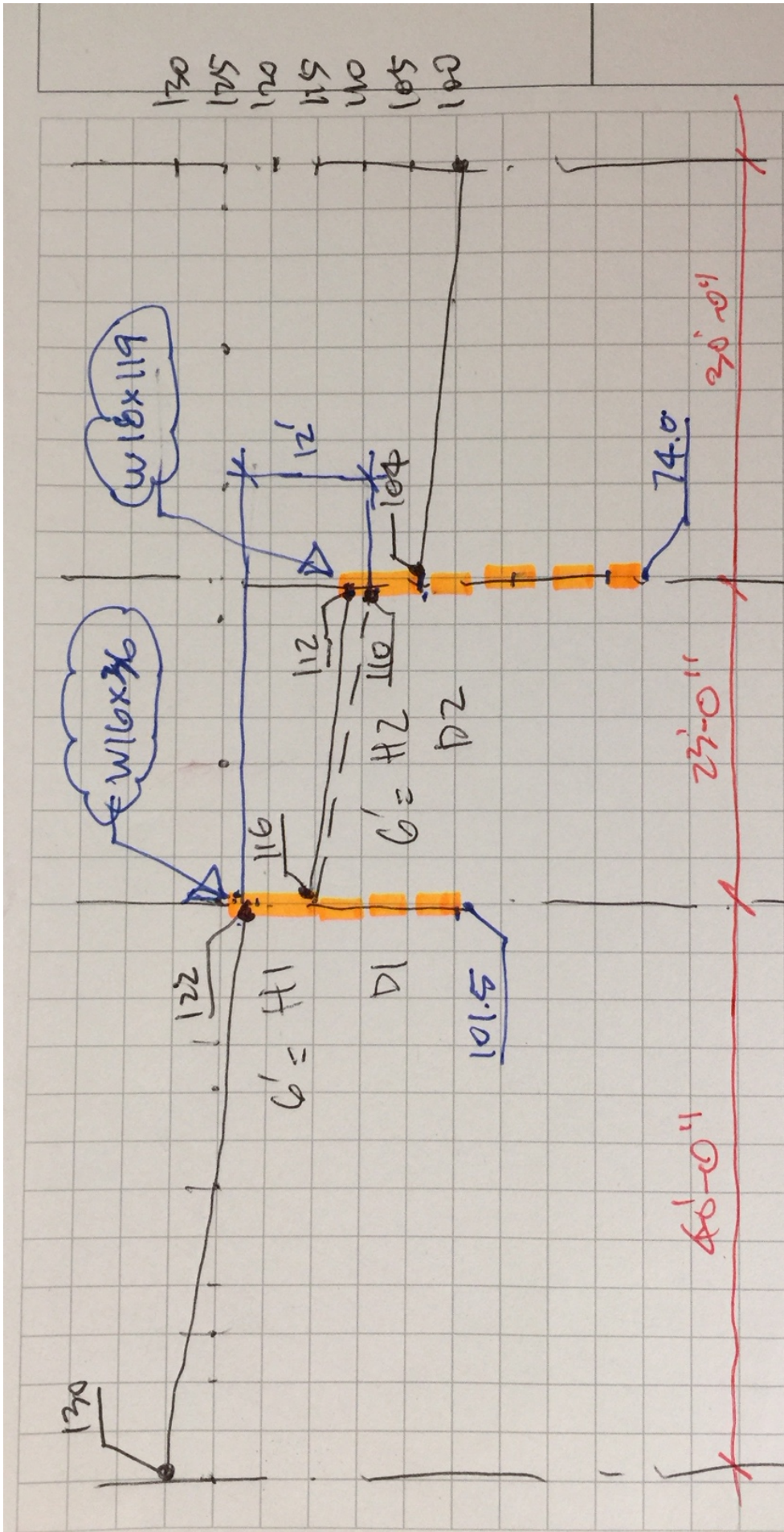
Structural Engineering Calculations



By

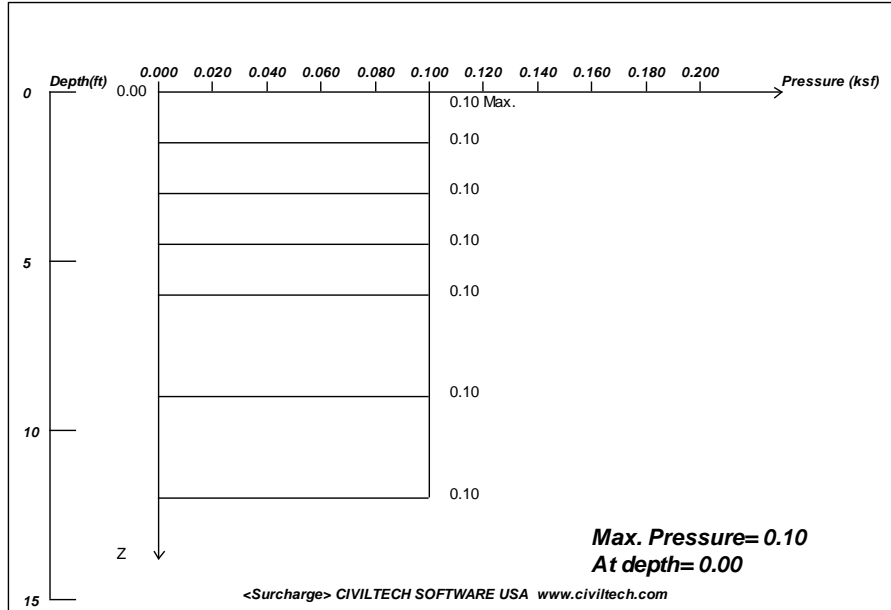
Dihong Shao, SE

September 10, 2018



Design Assumptions:

- | | |
|---|---------|
| 1. Active soil pressure | 35 pcf |
| 2. Equivalent soil pressure due to surface surcharge of 300 psf | 100 psf |
| 3. Seismic soil pressure 8H psf (where H is the retaining wall height) H = 6 ft | 48 psf |
| 4. Passive soil pressure 350 pcf with a SF of 1.0. The top 2 feet of soil ignored. | |
| 5. Design SF | 1.5 |



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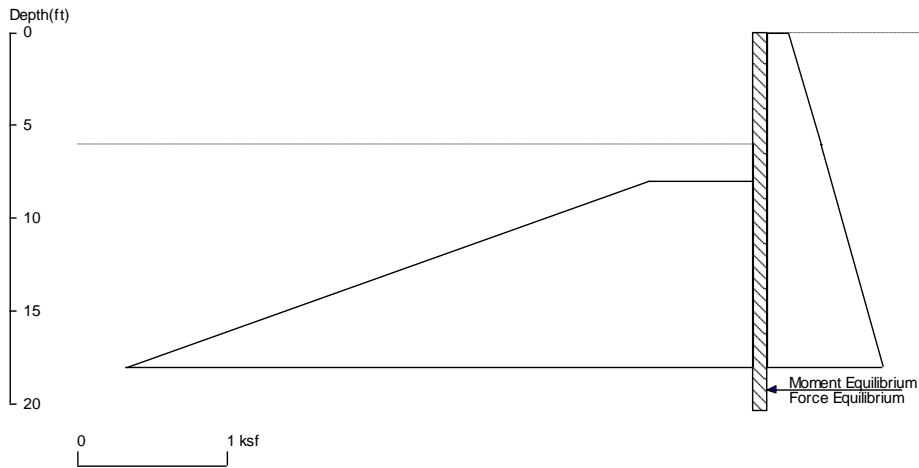
Wall Height, H= 6 Load Depth at Surface, D= 0
 Load Factor of Surcharge Loading = 1
 Flexible Wall Condition -- Movement or deflection are allowed.
Max. Pressure = 0.100 at depth = 0.00

Infinite Surcharge, Q=0.3 Active Wedge Approach * (recommend)

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

Mercer Island Retaining Wall and Slope Stability Design

Two Wall Case, Step 1: Wall 1 Analysis



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Date: 9/10/2018

Wall Height=6.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: **Min. Embedment=14.40 Min. Pile Length=20.40**
 MOMENT IN PILE: Max. Moment=95.60 per Pile Spacing=8.0 at Depth=12.58

PILE SELECTION:

Request Min. Section Modulus = 48.3 in³/pile=791.22 cm³/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66
 -> Piles meet Min. Section Requirements: Top Deflection is shown in (in)
 W8X58 (0.73) HP10X57 (0.56) W10X45 (0.67) HP12X53 (0.42) W12X40 (0.54)
 HP13X60 (0.33) HP14X73 (0.23) **W14X34 (0.49)** **W16X36 (0.37)** HP16X88 (0.15)
 W16X89 (0.13) HP16X101 (0.13) W16X100 (0.11) HP16X121 (0.10)

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	.148	6	0.358	.035
6	.358	20	0.848	.035

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
6	0	8	0.000	
8	0.7	20	4.900	.35

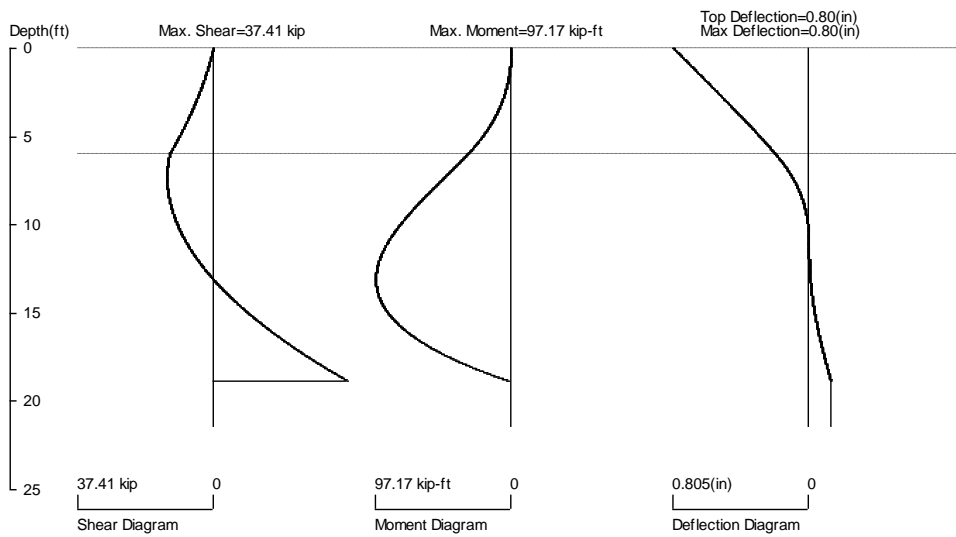
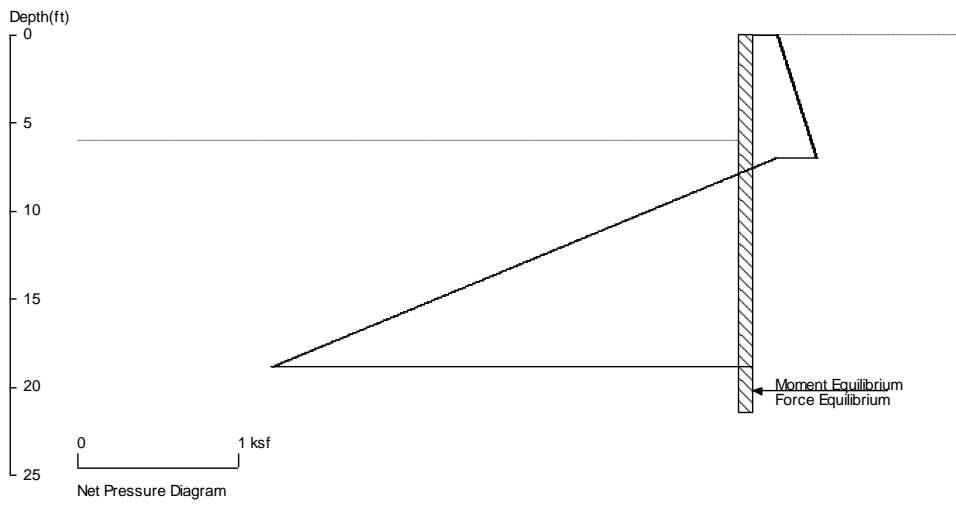
ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	6.00	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	6.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
 Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

First Suitable Pile: W8X58: E (ksi)=29000.0, I (in⁴)/pile=228.0

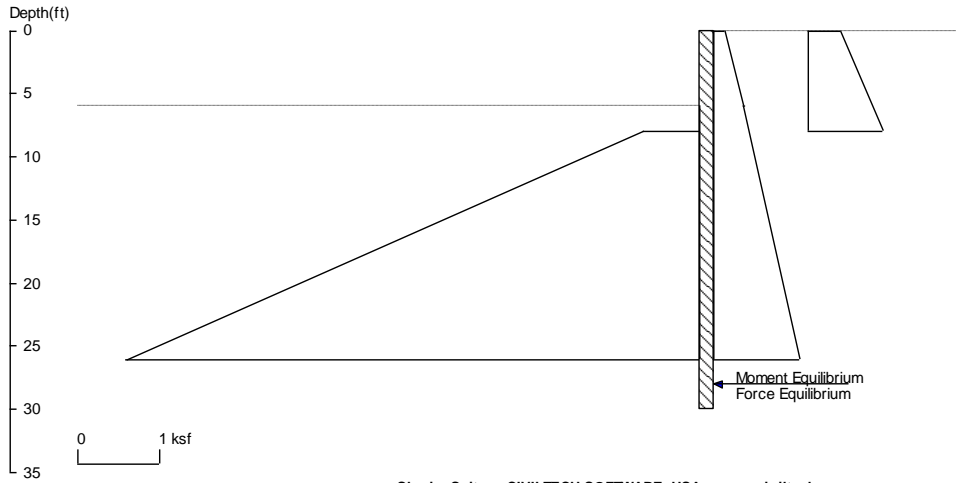
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Mercer Island Retaining Wall and Slope Stability D

Two Wall Case, Step 4: Wall 2 w/ Impact from Wall 1



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Wall Height=6.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=24.02 Min. Pile Length=30.02
 MOMENT IN PILE: Max. Moment=452.37 per Pile Spacing=8.0 at Depth=17.13

PILE SELECTION:
 Request Min. Section Modulus = 228.5 in³/pile=3743.90 cm³/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66
 -> Piles meet Min. Section Requirements: Top Deflection is shown in (in)
 W12X170J (0.80) W14X145 (0.77) HP16X141 (0.70) W18X119 (0.60) HP18X135 (0.60)
 W18X130 (0.53) HP18X157 (0.51) W18X158 (0.43) HP18X181 (0.44) W18X175J (0.38)
 HP18X204 (0.38) W18X192J (0.34) W21X111 (0.49) W24X103 (0.44)

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	.148	6	0.358	.035
6	.358	40	1.548	.035
*	Wall 1	Impact		
0.00	0.39	8.00	0.92	0.065

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
6	0	8	0.000	
8	0.7	40	11.90	.35

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	6.00	2.00

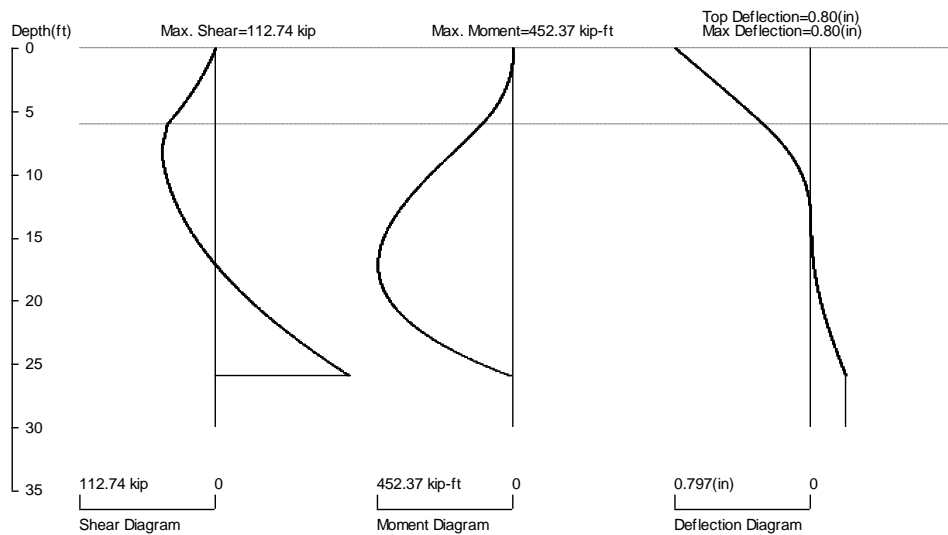
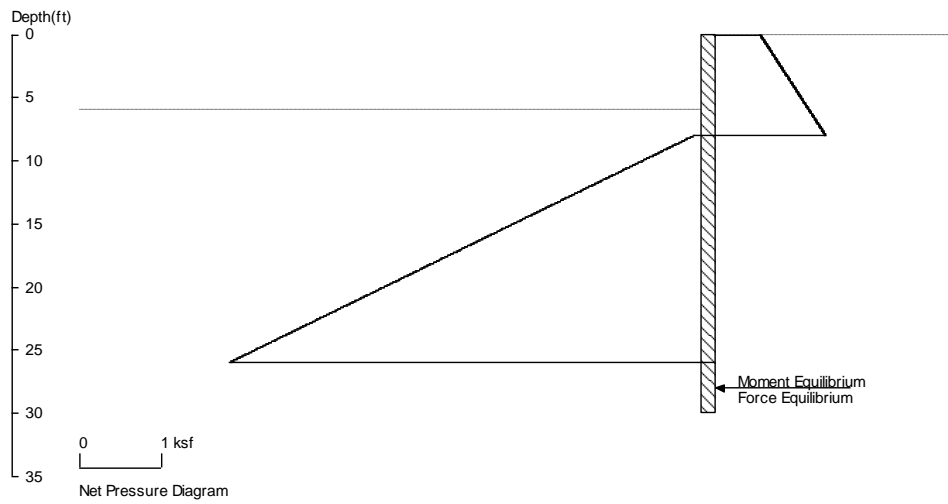
PASSIVE SPACING:

No.	Z depth	Spacing
1	6.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
 Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Mercer Island Retaining Wall and Slope Stability D

Two Wall Case, Step 4: Wall 2 w/ Impact from Wall 1



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

First Suitable Pile: W12X170J: E (ksi)=29000.0, I (in⁴)/pile=1650.0

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