iemisc: Comparing Other Hydraulic Software Output to iemisc's Manningtrap for Critical Conditions

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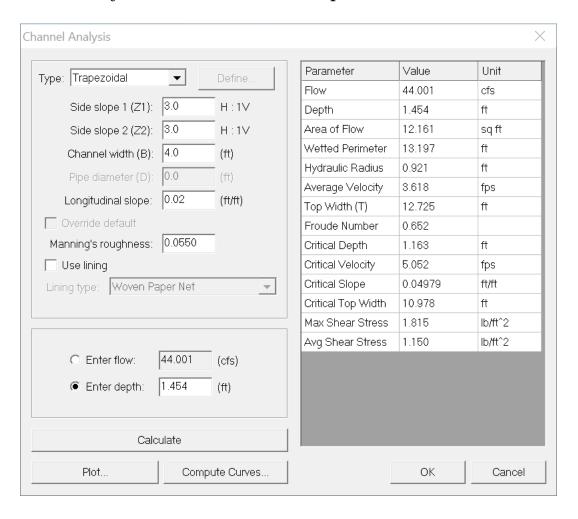
Replicate the R code without the images

Note: If you wish to replicate the R code below, then you will need to copy and paste the following commands in R first (to make sure you have all the of the required packages):

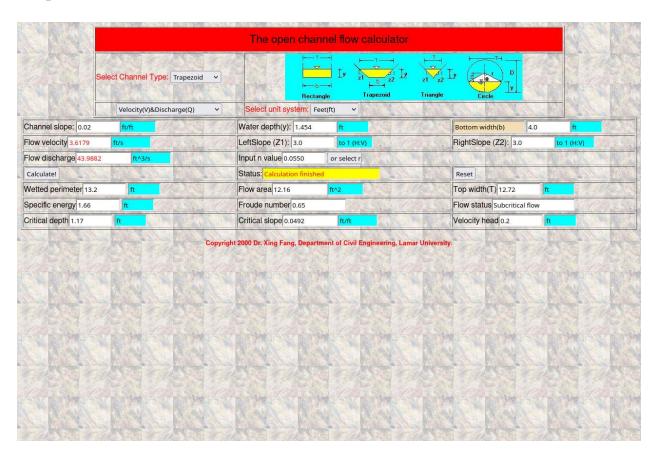
```
install.packages(c("install.load", "iemisc", "pander"))
# install the packages and their dependencies

# load the required package
install.load::load_package("iemisc", "pander")
```

FHWA Hydraulic Toolbox Example 1



Dr. Xing Fang's Open Channel Flow Calculator's Solution of Example 1



iemisc's Manningtrap Solution of Example 1

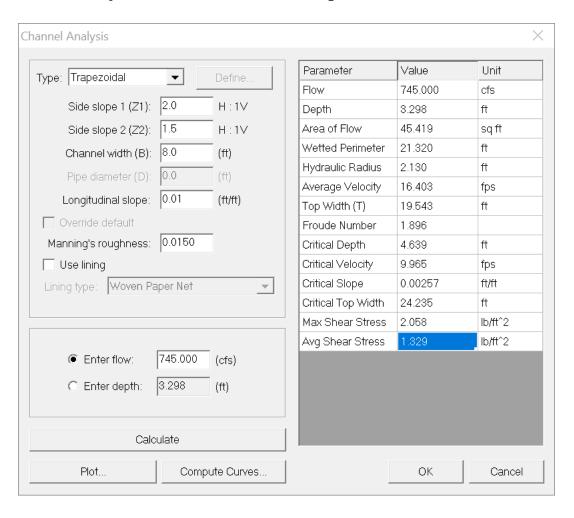
Parameters	Normal Value	Critical Value
Flow depth (y)	1.454	1.551
Flow area (A)	12.158	13.417
Wetted Perimeters (P)	13.196	13.808
Top Width (B)	12.724	13.304

Parameters	Normal Value	Critical Value
Bottom width (b)	4	
Hydraulic Radius (R)	0.921	0.972
Hydraulic Depth (D)	0.956	1.008
Flow Mean Velocity (V)	3.618	7.064
Flow Discharge (Q)	43.986	67.414
Manning's roughness coefficient (n)	0.055	
Slope (Sf)	0.02	0.015
Temperature	68	
Absolute Temperature	293.15	
Saturated Liquid Density	1.937	
Absolute or Dynamic Viscosity	2.092885 e - 05	
Kinematic Viscosity	1.080619 e-05	
Froude number (Fr)	0.652	1
Reynolds number (Re)	308461	
symmetric side slope (m)	3	
non-symmetric side slope (m1)		
non-symmetric side slope (m2)		
Wetted Length (w)	4.598	
Wetted Length for a non-symmetric		
trapezoid (w1)		
Wetted Length for a non-symmetric		
trapezoid (w2)		
Section Factor (Z)	11.512	11.885
conveyance (K)	311.026	
Specific Energy (E)	1.657	1.718
Velocity Head (Vel_Head)	0.203	
Maximum Shear Stress (taud)	1.812	
Average Shear Stress (tau0)	1.148	

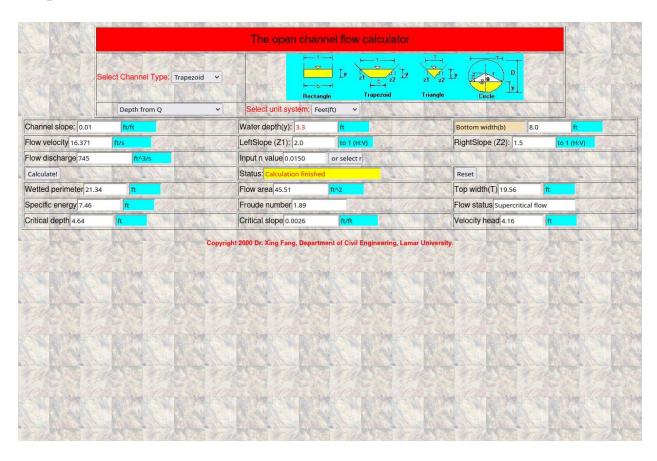
Units
ft
ft^2
ft
ft/sec (fps)
$ft^3/sec (cfs)$
dimensionless
ft/ft
degrees Fahrenheit
Kelvin
slug/ft^3
slug/ft*s
ft^2/s
dimensionless
dimensionless
ft/ft
ft/ft
ft/ft

Units	
ft	
ft	
ft	
ft	
$ft^3/sec (cfs)$	
ft	
ft	
lb/ft^2	
lb/ft^2	

FHWA Hydraulic Toolbox Example 2



Dr. Xing Fang's Open Channel Flow Calculator's Solution of Example 1



iemisc's Manningtrap Solution of Example 2

```
uuc2 <- Manningtrap_critical(Q = 745, b = 8, m1 = 2, m2 = 1.5, Sf = 0.01, n = 0.015,
    units = "Eng", type = "non-symmetrical", critical = "accurate", output = "data.table")

##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
## is acceptable to use.
##
##
##
## This is supercritical flow.
pander(uuc2, missing = "")</pre>
```

Parameters	Normal Value	Critical Value
Flow depth (y)	3.298	6.442
Flow area (A)	45.423	74.086
Wetted Perimeters (P)	21.321	34.019
Top Width (B)	19.544	30.548

Parameters	Normal Value	Critical Value
Bottom width (b)	8	
Hydraulic Radius (R)	2.13	2.178
Hydraulic Depth (D)	2.324	2.425
Flow Mean Velocity (V)	16.401	14.397
Flow Discharge (Q)	745	392.789
Manning's roughness coefficient (n)	0.015	
Slope (Sf)	0.01	0.004
Temperature	68	
Absolute Temperature	293.15	
Saturated Liquid Density	1.937	
Absolute or Dynamic Viscosity	2.092885 e - 05	
Kinematic Viscosity	1.080619 e-05	
Froude number (Fr)	1.897	1
Reynolds number (Re)	3233520	
symmetric side slope (m)		
non-symmetric side slope (m1)	2	
non-symmetric side slope (m2)	1.5	
Wetted Length (w)		
Wetted Length for a non-symmetric	7.375	
trapezoid (w1)		
Wetted Length for a non-symmetric	5.946	
trapezoid (w2)		
Section Factor (Z)	58.585	69.248
conveyance (K)	7449.995	
Specific Energy (E)	7.479	8.014
Velocity Head (Vel_Head)	4.181	
Maximum Shear Stress (taud)	2.055	
Average Shear Stress (tau0)	1.328	

Units
ft
ft^2
ft
ft
ft
ft
ft
ft/sec (fps)
$ft^3/sec (cfs)$
dimensionless
ft/ft
degrees Fahrenheit
Kelvin
slug/ft^3
slug/ft*s
ft^2/s
dimensionless
dimensionless
ft/ft
ft/ft
ft/ft

Units	
ft	
ft	
ft	
ft	
ft^3/sec (cfs)	
ft	
ft	
lb/ft^2	
lb/ft^2	

Works Cited

FHWA Hydraulic Toolbox Version 4.4. https://www.fhwa.dot.gov/engineering/hydraulics/software/toolbox404.cfm

The open channel flow calculator. Dr. Xing Fang, Department of Civil Engineering, Lamar University, 2000. https://eng.auburn.edu/~xzf0001/Handbook/Channels.html

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