Notes on Using Site_Amp programs.

1. **Install the programs into a folder**. In my case, it is *C:\site_amp\programs*. The program that I use most often is *site_amp_batch*; that is the program I use in these notes.

2. **Create an ascii file with the velocity model**. I usually use the extension ".mdl" for this file, but it can be anything. Sometimes I use Excel to make this file, saving it as an ascii file. The file can have an arbitrary number of header lines, the units can be km, km/s or m, m/s. The depths can be thickness (in which case the model is a stack of constant velocity layers) or depth to bottom. If the first depth = 0.0, the program assumes that the model is made up of a series of layers with linear velocity gradients between the specified depth, velocity points. Density can also be specified, although I usually let the program use a value from a velocity-density relation given in Boore (2016). The model file can be placed in any folder. In the example here, the folder is *C:\density_velocity\work*. This is the working folder for a number of results shown in Boore (2016). Here is a model file for the BJ97gr760 velocity model given in Table 1 of Boore (2016).

Filename: *table_1_vel.mdl*

Z(km)	Vs(round)
0.000	0.314
0.001	0.314
0.001	0.427
0.002	0.512
0.003	0.569
0.005	0.649
0.008	0.731
0.011	0.793
0.014	0.843
0.018	0.898
0.022	0.944
0.030	1.020
0.044	1.176
0.064	1.348
0.082	1.474
0.102	1.594
0.126	1.718
0.150	1.826

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0.190     1.984
0.250     2.080
0.300     2.147
0.450     2.308
0.550     2.393
0.650     2.467
0.800     2.561
0.900     2.614
1.000     2.663
1.450     2.839
2.050     3.014
2.400     3.094
2.850     3.180
3.400     3.271
4.000     3.357
5.200     3.418
6.650     3.478
7.850     3.519
```

The column labels can be anything (they are for the convenience of the user). In this case the model has a 0.001 km (1 m) thick constant velocity layer at the top, underlain by a model with linear dependence of velocity on depth, starting from 0.427 km/s at 0.001 km to 0.512 km/s at 0.002 km, then 0.569 km/s at 0.003 km, etc.

3. **Edit the control file for the program *site_amp_batch***. Here is the control file, most conveniently named *site_amp_batch.ctl* and placed in the same folder as the model file (*C:\density_velocity\work* in my case). I used for the site amplifications that were used to create Table 2 in Boore (2016).

```
!Control file for site_amp_batch
! Revision of program involving a change in the control file on this date:
  10/04/10
!Name of summary file:
  site_amp_batch.sum
!Are the velocities from a suspension log survey?
!If yes, assume that the velocity value is at the midpoint of the layer
 N
!Velocity for first layer (0 = use the first velocity of the input)
! Use this for sensitivity studies of vavg for PS log models that do not
! extend to the surface.
  0.0
!Depth to bottom (d2b) or layer thickness (thk) (note: a value of 0.0 for
!the first depth from the model file will signal that the model is a
!piecewise continuous model)?
  d2b
```

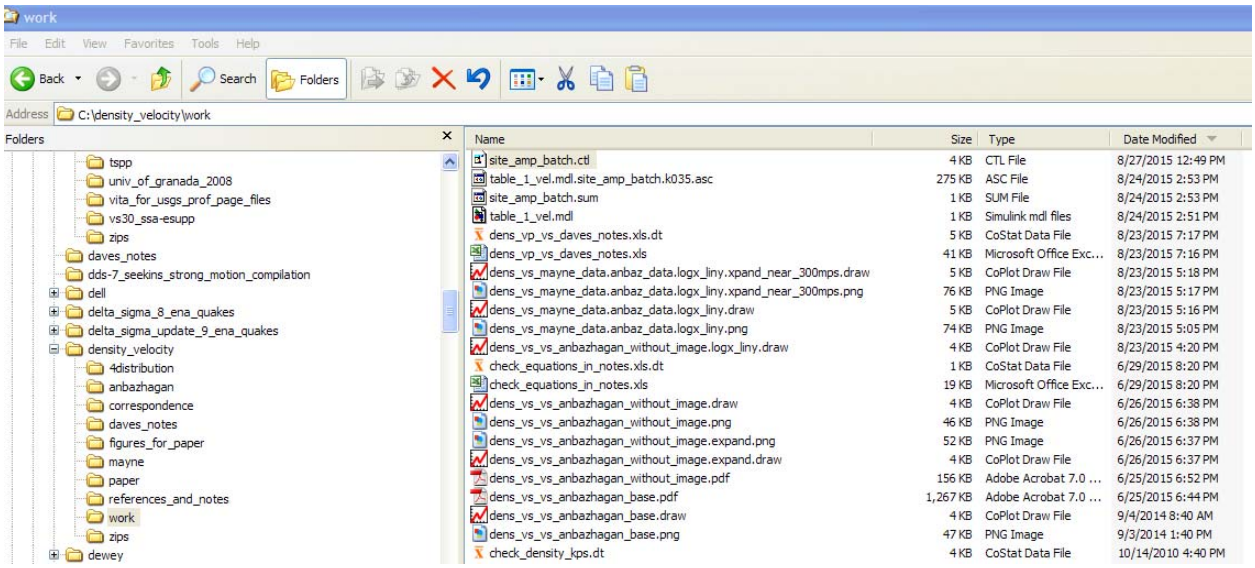
```
! thk
!Lines to skip to reach data (<0, use skipcmnt; 0, skip none; > 0, specify)
   1
!   6
! 4
!Use density in model file?
 n
! y
!dens_default (if layer density = 0.0, either because the densities from the
!  input file are to be used, but these are 0.0, or because the density is not
!  to be obtained from the input file, then use this as the layer density unless it
!  is 0.0, in which case obtain the density from my density--velocity
!  subroutine):
  0.0
!Use Q from model file (note that Q < 1.0 is taken is 1/Q)?
 N
! Y
! kappa for computation (enter 0.0 for no kappa computation):
! 0.025    ! For Fea96, as implemented by Yenier and Atkinson
 0.035    ! BJ97 (I think)
! 0.040    ! Kamai
!Ncolumns to read, column numbers for depth or thickness (allows for the first column
!being an index),velocity, density, and Q (note that if density and/or Q are not read
!from the file, the column numbers for these variables will be ignored.  But dummy
!values need to be included in the control file).
! WARNING: Be careful to maintain consistency between whether density and/or Q
! are read from input file and the entries below.  For example, suppose the input file
! contains thickness, vs, density, and Q.  Then the following table illustrates the
! proper input for Ncolumns, etc:
! Density from input  Q from input  Ncolumns, etc
!         N             N       2 1 2 3 4
!         Y             N       3 1 2 3 4
!         Y             Y       4 1 2 3 4
!         N             Y       4 1 2 3 4 (I'm not sure that this works)
! If specified incorrectly, the program will probably work, but the velocity
! model will be incorrect.  ALWAYS CHECK THE VELOCITY MODEL IN THE OUTPUT FILE!
    2 1 2 0 0
!Enter units of velocity (kps, mps) (depth units are assumed to be consistent
!with the velocity units---km for kps and m for mps):
   kps
!   Mps
!v_ref, dens_ref for amp calculation (dens_ref = 0.0 means that it will be obtained from
! my relation between vel and dens; if dens_ref /= 0.0, then it will be used even if
! "Use density from model file" is N):
  3.5 2.72
!Angle of incidence at source level (in degrees):
 00.0
```

!Enter freqlow, freqhigh, nfreq (if nfreq = 0, then the program will compute
!amplifications at frequencies corresponding to the depths of interfaces, but
!still need placeholders for freqlow and freqhigh):
 0.01 50 1200
!Log-spaced frequencies?
 Y
!Character string to append to end of each input file to create
!the name of the output file (be sure to include the period if wanted):
  .site_amp_batch.k035.asc
!List of input files
!Make sure that there are no blank entries!
!The format of the input are consecutive columns containing the
!depth/thickess and velocity, after header lines starting with "!"
table_1_vel.mdl
stop

4. **Run site_amp_batch**. This is run from the command prompt, and I imagine that it is here that people unfamiliar with command prompt windows and the old days of DOS will encounter difficulties, although the procedure is simple.

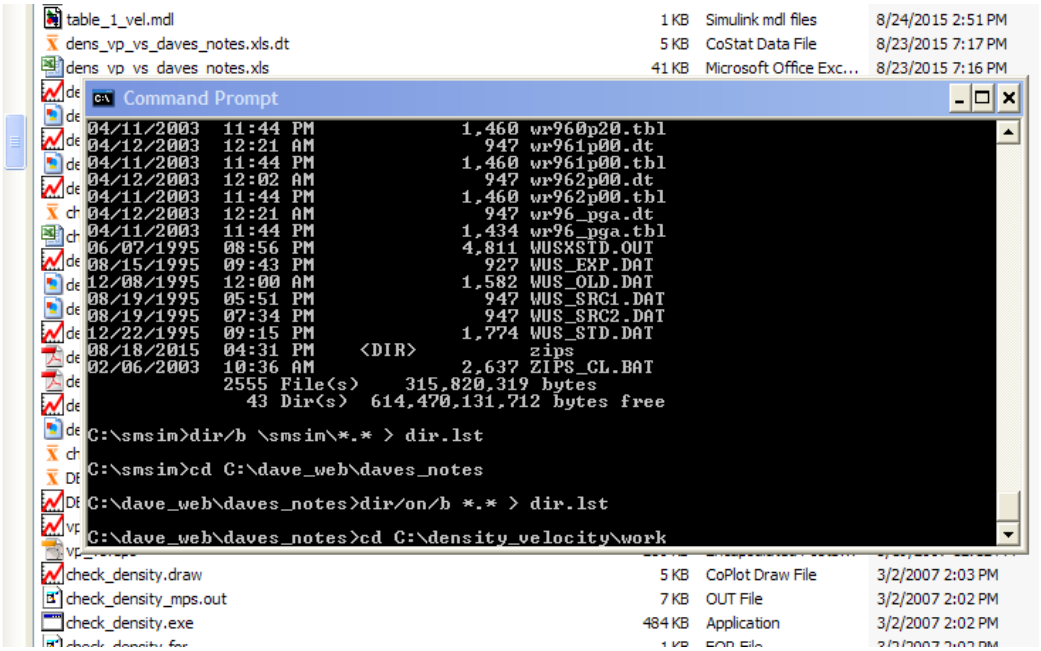
First, open a command prompt in the folder containing the model and control files. I do this by

a) using Windows Explorer to navigate to the desire folder . Here is a screen shot:

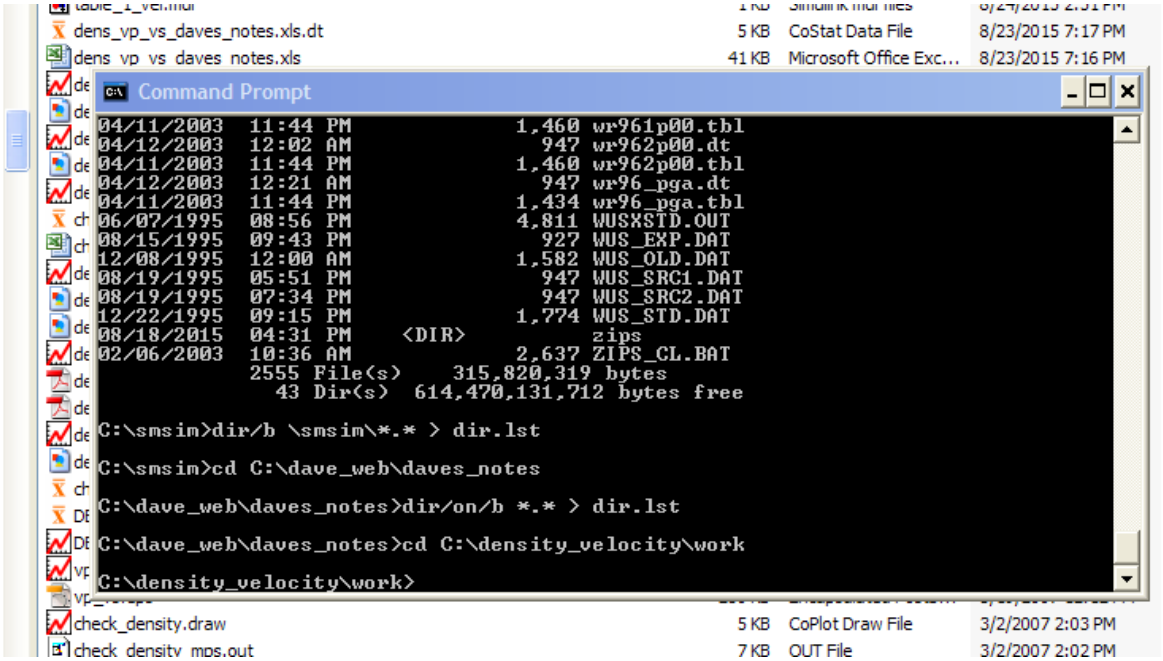


b) I highlight the path in the Address bar, right click, and choose “Copy”.

c) In an open Command Prompt window I type “cd” and then with the cursor in the window, I right click and choose paste. This gives this:



Pressing Enter then changes to the desired folder, as shown here:



Second, run site_amp_batch. Because I can never remember the path to the location of the program, I store it in a file (in my case, C:\site_amp\programs\ command_strings_for_site_amp_programs.txt). Here are the contents of that file:

C:\site_amp\programs\site_amp

C:\site_amp\programs\site_amp_batch

C:\site_amp\programs\layr2plt

C:\site_amp\programs\layr2plt_col2file

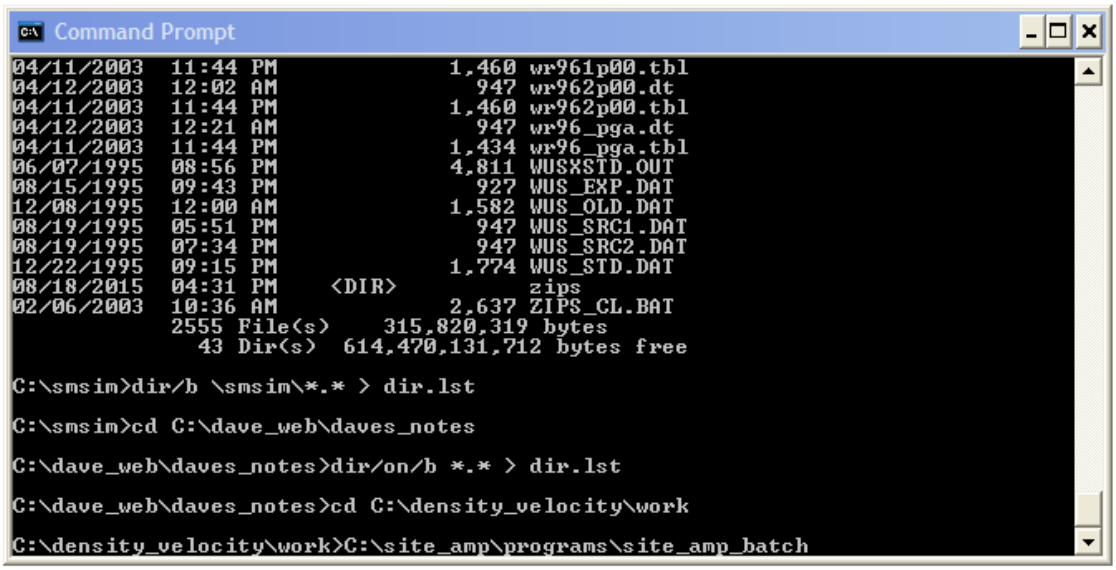
C:\site_amp\programs\f4nrattle

C:\site_amp\programs\pwr2layr

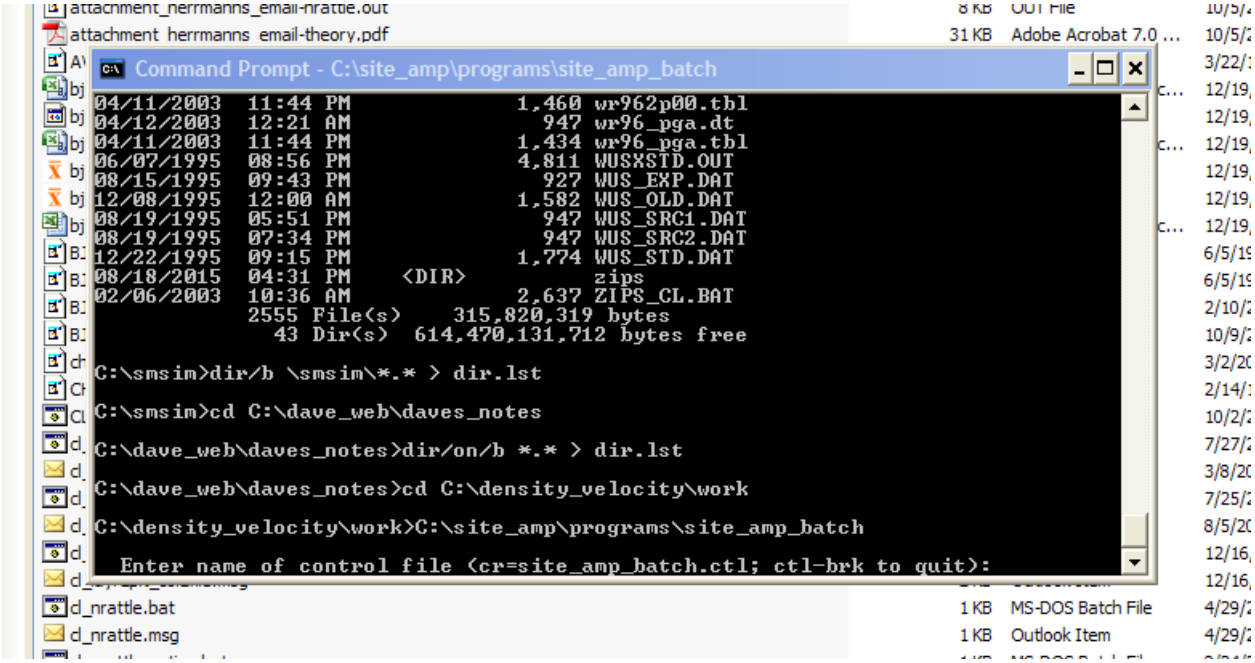
C:\site_amp\programs\nrattle

Using a text editor (NotePad, TextPad, etc) I select C:\site_amp\programs\site_amp_batch and chose copy.

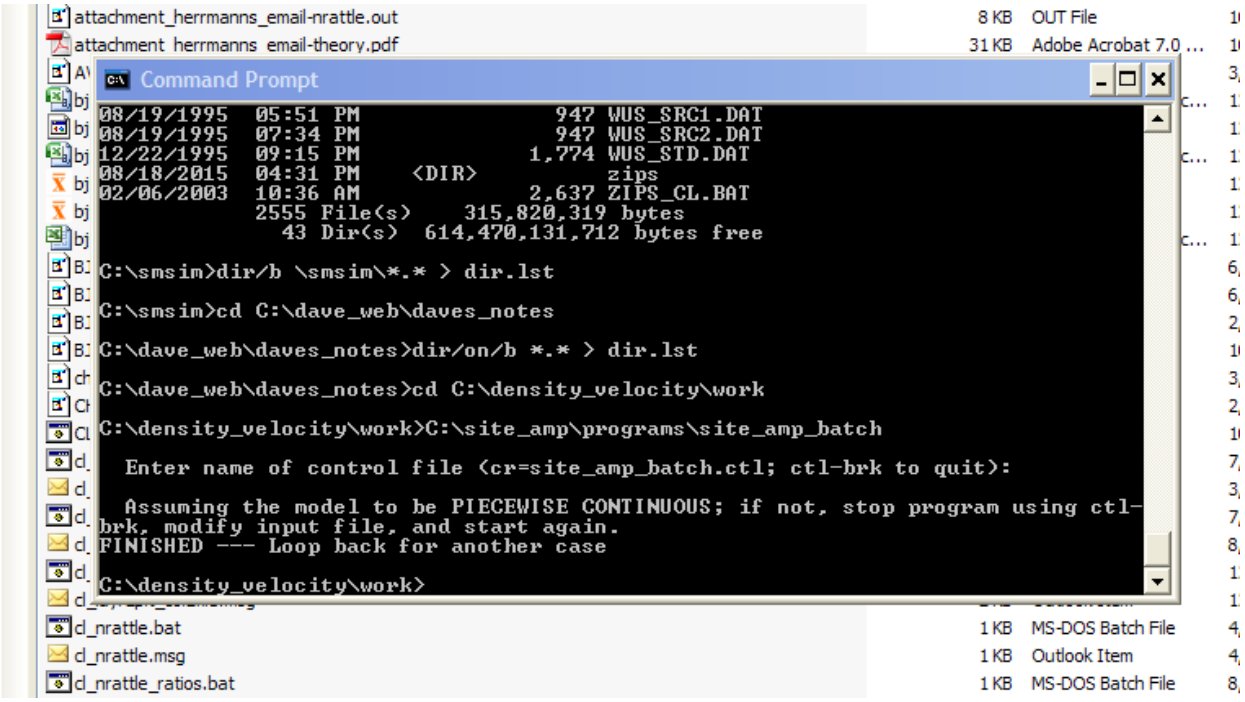
I then paste this into the Command Prompt window, as this shows:



Pressing “Enter” runs the program. The program asks for input, as this screenshot shows.



By naming the control file “site_amp_batch.ctl”, I then only need to press Enter to finish the program execution. Here is what is shown in the Command Prompt window:



The output file that is created by the program (*table_1_vel.mdl.site_amp_batch.k035.asc* in my case) has a lot of information, which I will not take the time to discuss here. I recommend playing around with various options in site_amp_batch, looking at the output. Also consult the SMSIM manual (Boore, 2005); although it is quite out-of-date, it does contain some useful information.

References

Boore, D. M. (2005). SMSIM---Fortran Programs for Simulating Ground Motions from Earthquakes: Version 2.3---A Revision of OFR 96-80-A, U.S. Geological Survey Open-File Report, *U. S. Geological Survey Open-File Report* **00-509**, revised 15 August 2005, 55 pp. Available from the online publications link on http://www.daveboore.com.

Boore, D.M. (2016). Determining generic velocity and density models for crustal amplification calculations: An update, *Bull. Seismol. Soc. Am.* **106**, submitted. Available from the online publications link on http://www.daveboore.com.