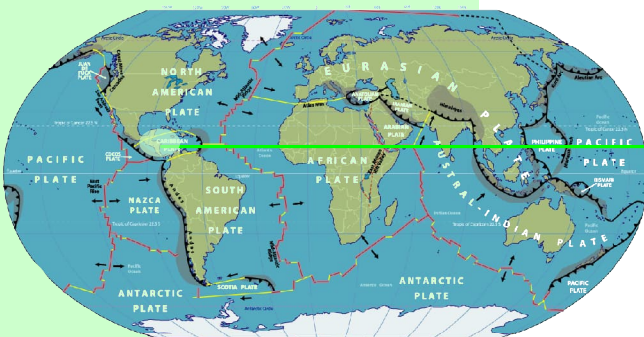
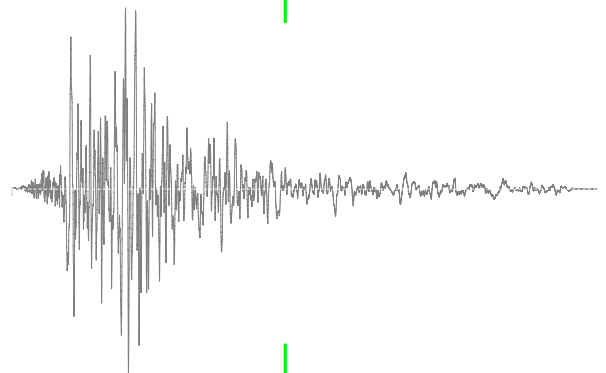
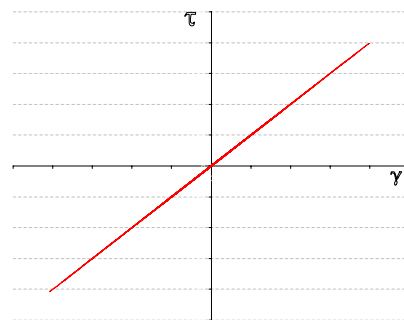
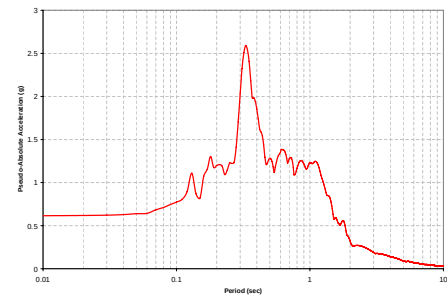


SHAKE2000

A Computer Program
for the 1-D Analysis of
Geotechnical Earthquake
Engineering Problems

Quick Tutorial

Gustavo A. Ordóñez



SHAKE2000

A Computer Program for the 1-D Analysis of Geotechnical Earthquake Engineering Problems

By

Gustavo A. Ordóñez
GeoMotions

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www.geomotions.com

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SHAKE2000

A Computer Program for the 1-D Analysis of Geotechnical Earthquake Engineering Problems

A software application that integrates

SHAKE

A Computer Program for Earthquake Response Analysis of Horizontally Layered Sites

***Per B. Schnabel, John Lysmer, H. Bolton Seed
University of California, Berkeley***

and

SHAKE91

A Modified Version of SHAKE for Conducting Equivalent Linear Seismic Response Analyses of Horizontally Layered Soil Deposits

***I.M. Idriss and J.I. Sun
University of California, Davis***

With

ShakEdit

***A Pre and Postprocessor for SHAKE and SHAKE91
Gustavo A. Ordóñez***

March 2025

SHAKE2000 Quick Tutorial

by:

Gustavo A. Ordonez

GeoMotions
Lacey, Washington



March 2025

SHAKE2000 Quick Tutorial

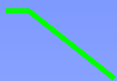
This tutorial is not a teaching tool for seismic site response analysis.

SHAKE2000 Quick Tutorial

Steps

The steps to be followed when entering the data to create a work file for SHAKE, or to perform the different functions to run an analysis, are indicated with colored and numbered text boxes. Step 1 is shown with a green color text box pointing to the cell where a value is entered or where you should click on a command button to perform a function:

1. Enter "Option 2 –
Column 1"



After executing step 1, then move on to Step 2 and so on ...

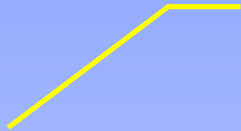
4. Enter "5" in
Thickness



5. Enter "0.125"
for Unit Weight



2. Enter "Col 1" in Identification



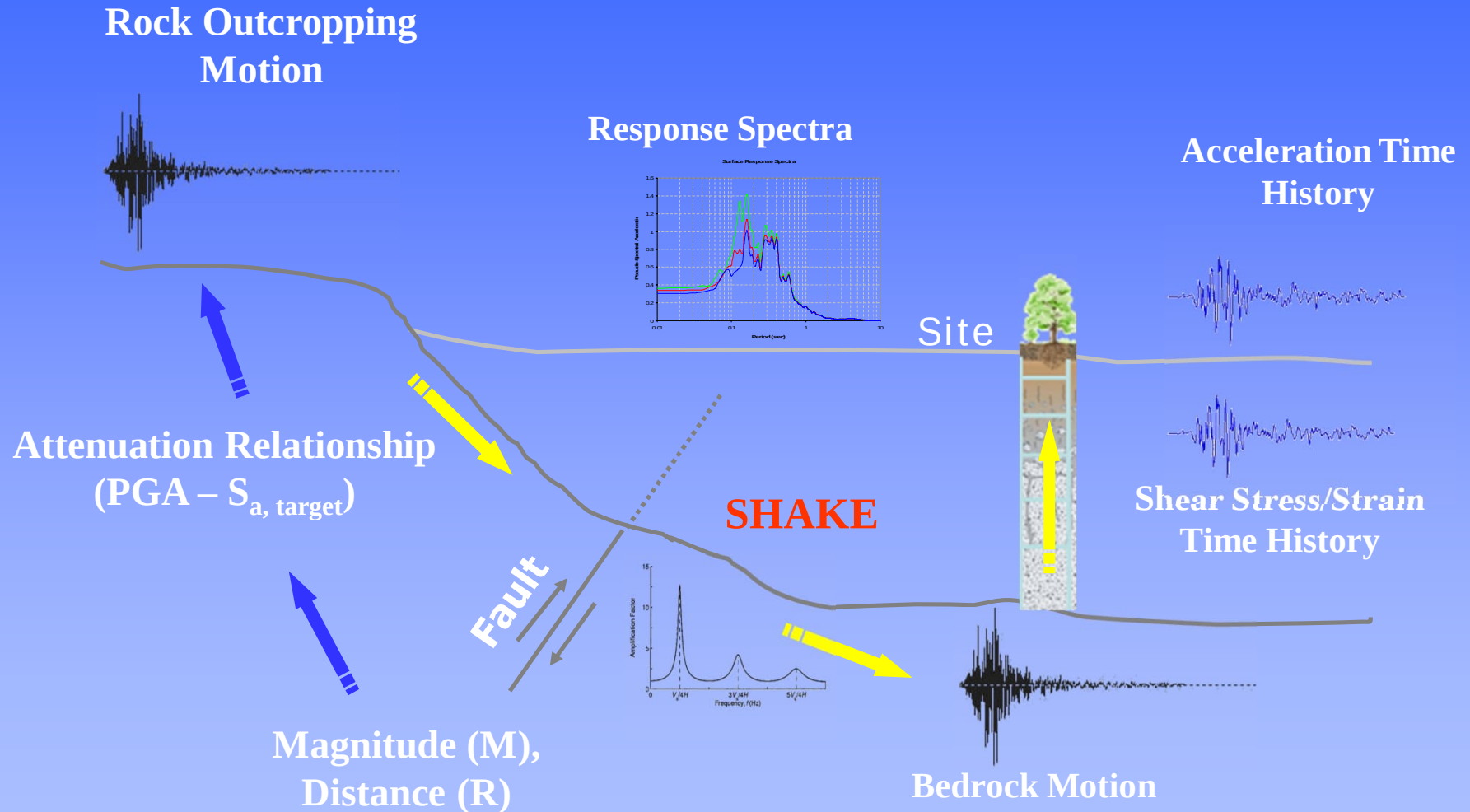
3. Enter "124"
in Surface



6. Enter "573"
in Shear Wave



Site-Specific Seismic Hazard Analysis & Site Response



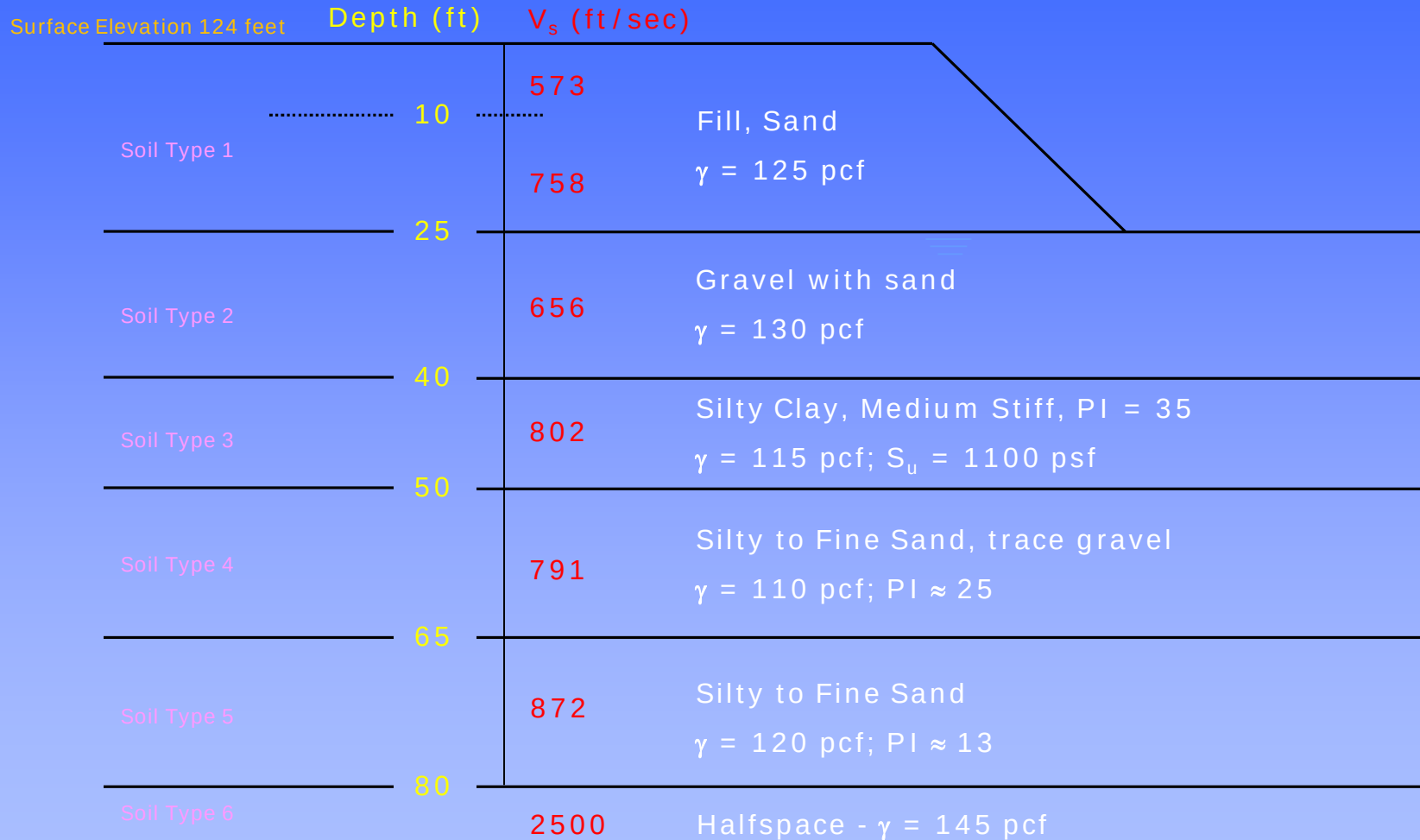
Site-Specific Seismic Hazard Analysis & Site Response

1. Define the subsurface conditions at the site.
2. Define the significant structures and seismogenic source zones in the region that may affect the site.
3. Determine the peak “rock” accelerations at the site corresponding to the different earthquake sources.
4. Develop a target response spectrum for each source mechanism.
5. Select representative time histories of ground motion from similar tectonic environments that would approximately match the target response spectrum.
6. Conduct the seismic site-response analysis (i.e., evaluate the influence of local site conditions on seismic ground motions).

Site-Specific Analysis - Step 1

Define the subsurface conditions at the site

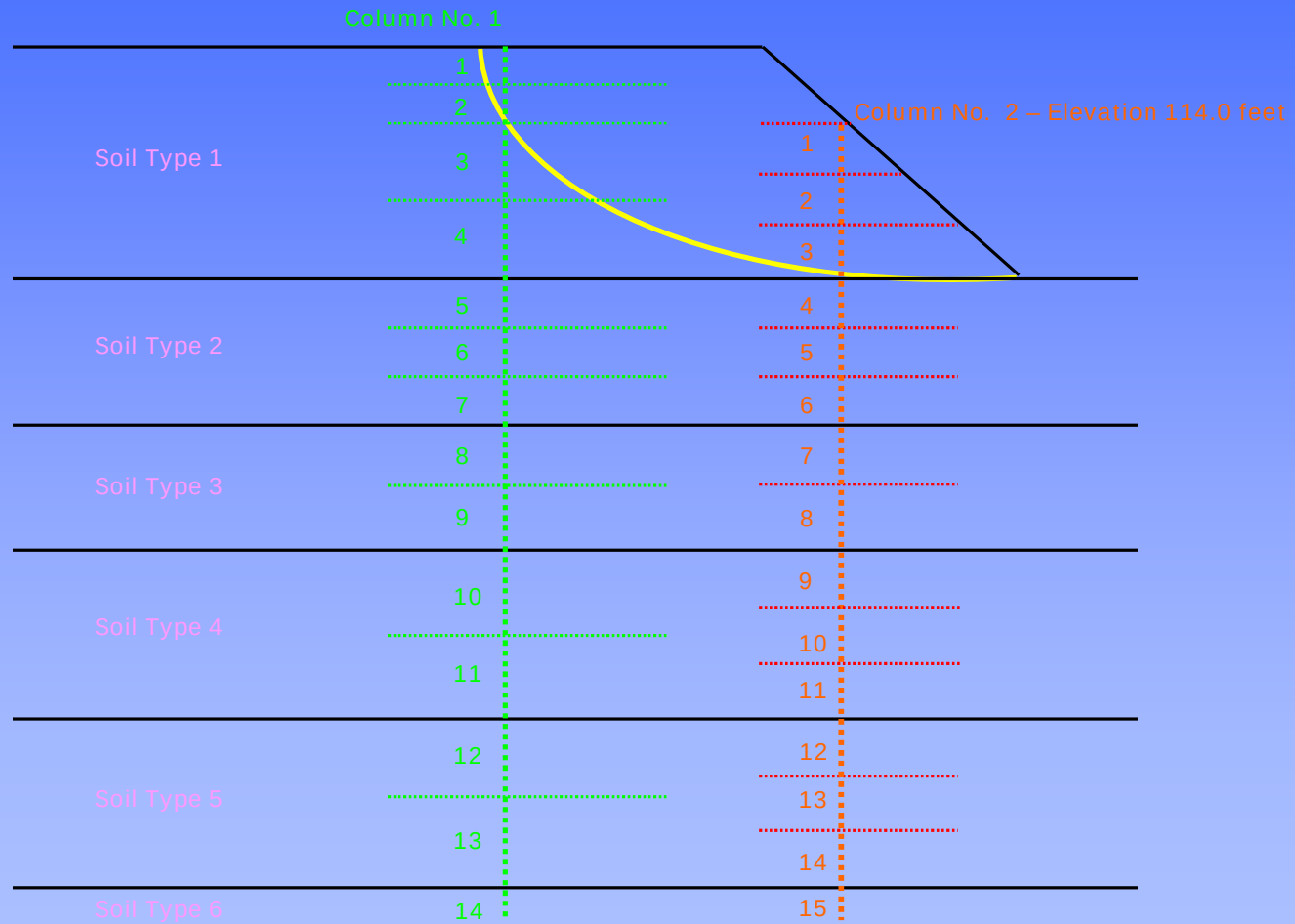
Sample Problem



NTS

Sample Problem

SHAKE Columns



Site-Specific Analysis - Step 2

Define the significant structures and seismogenic source zones in the region that may affect the site

For this tutorial assume:

Source	Fault Type	M_W	R_{RUP} (km)
Crustal Event	Normal+Reverse	7.1	25

Site-Specific Analysis - Step 3

Determine the peak “rock” accelerations at the site corresponding to the different earthquake sources

For this tutorial assume $PGA_{M+1\sigma} = 0.46 \text{ g's}$

Site Specific Analysis - Step 4

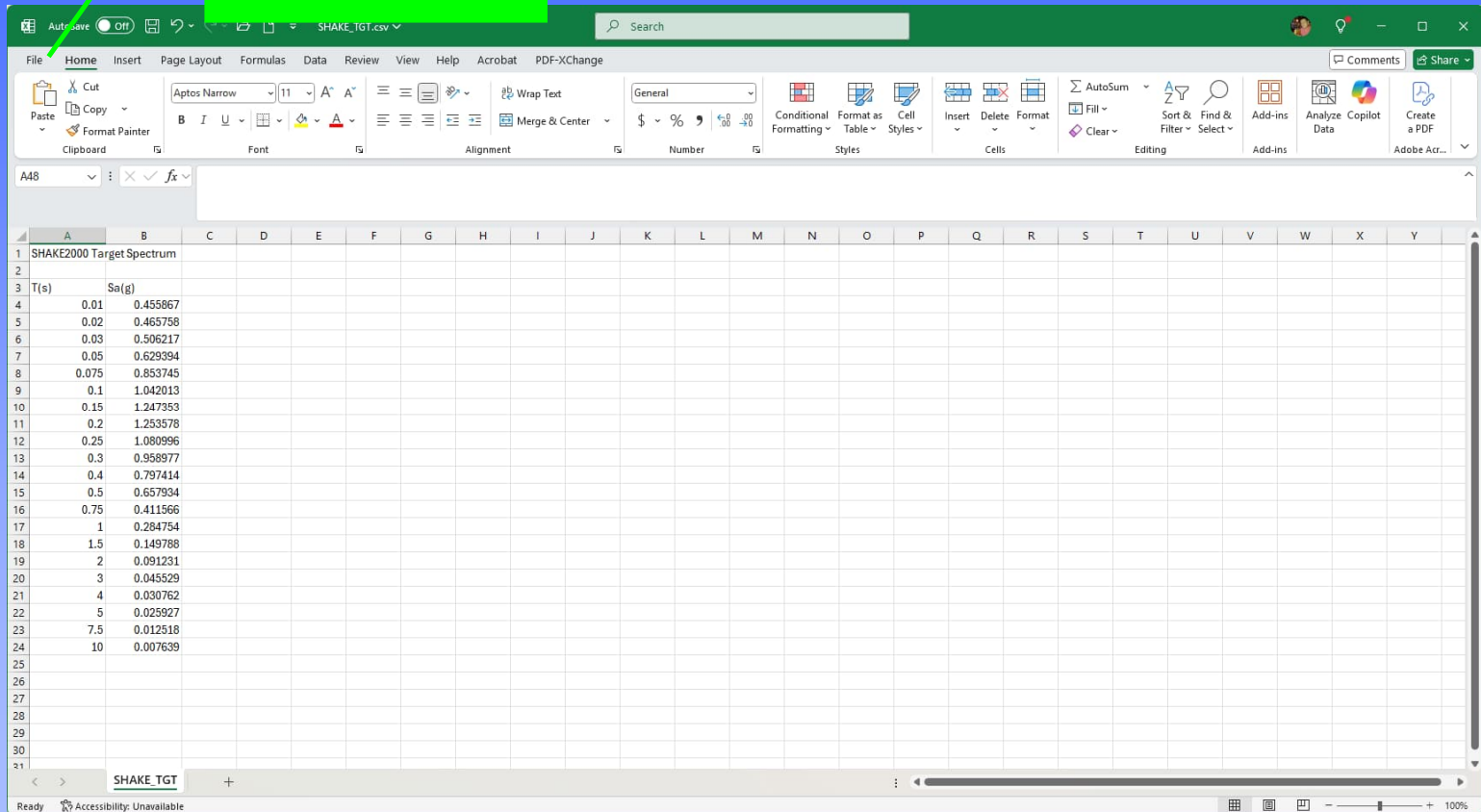
Develop a target response spectrum for each source mechanism

For this tutorial assume Target Response Spectrum

Period (%)	S_a (g's)
0.01	0.455867
0.02	0.465758
0.03	0.506217
0.05	0.629394
0.075	0.853745
0.1	1.042013
0.15	1.247353
0.2	1.253578
0.25	1.080996
0.3	0.958977
0.4	0.797414
0.5	0.657934
0.75	0.411566
1	0.284754
1.5	0.149788
2	0.091231
3	0.045529
4	0.030762
5	0.025927
7.5	0.012518
10	0.007639

Create a new “.csv” Excel file with the target response spectrum values following PEER format

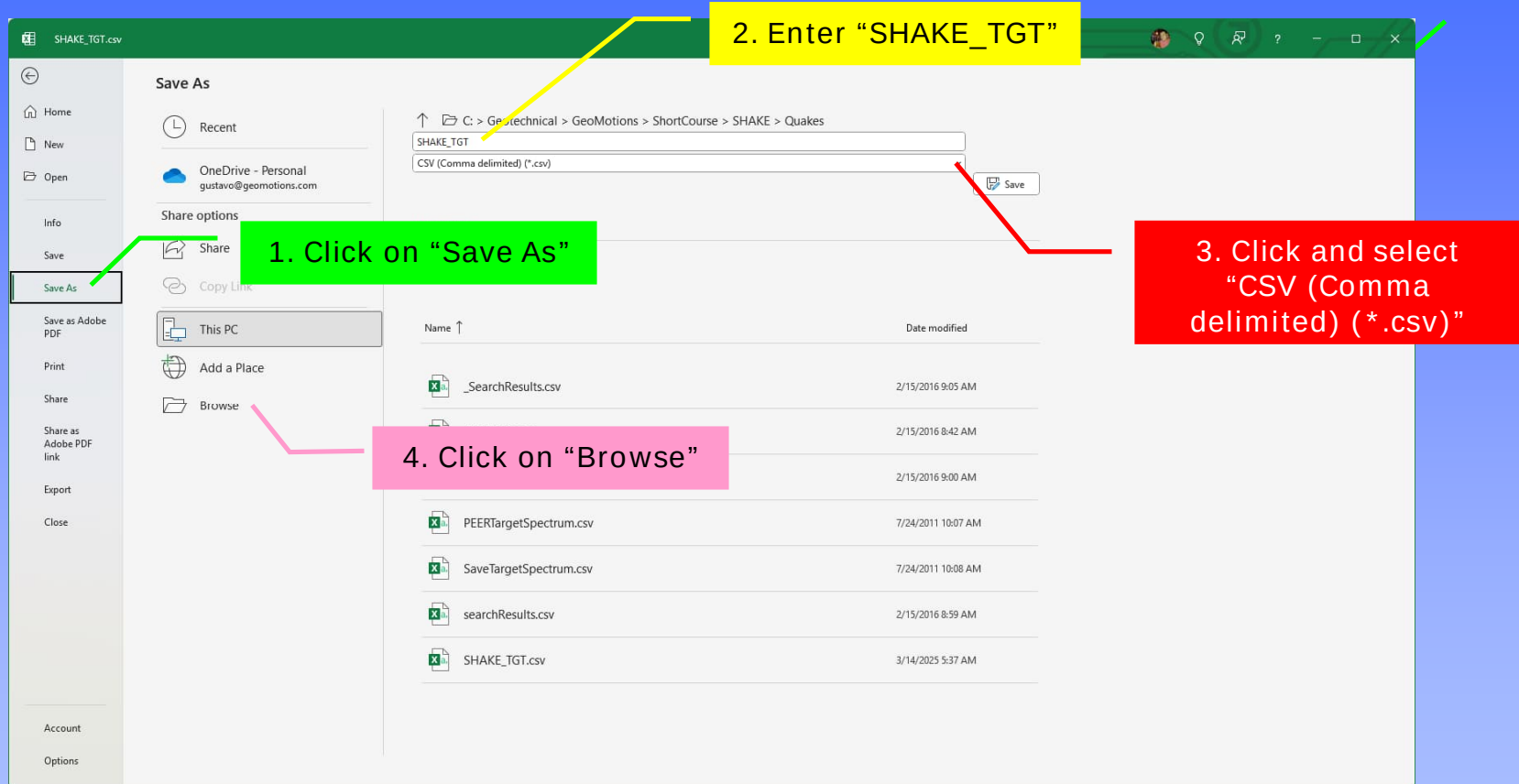
1. Click on “File”



The screenshot shows the Microsoft Excel interface with the 'File' menu highlighted. The spreadsheet contains the following data:

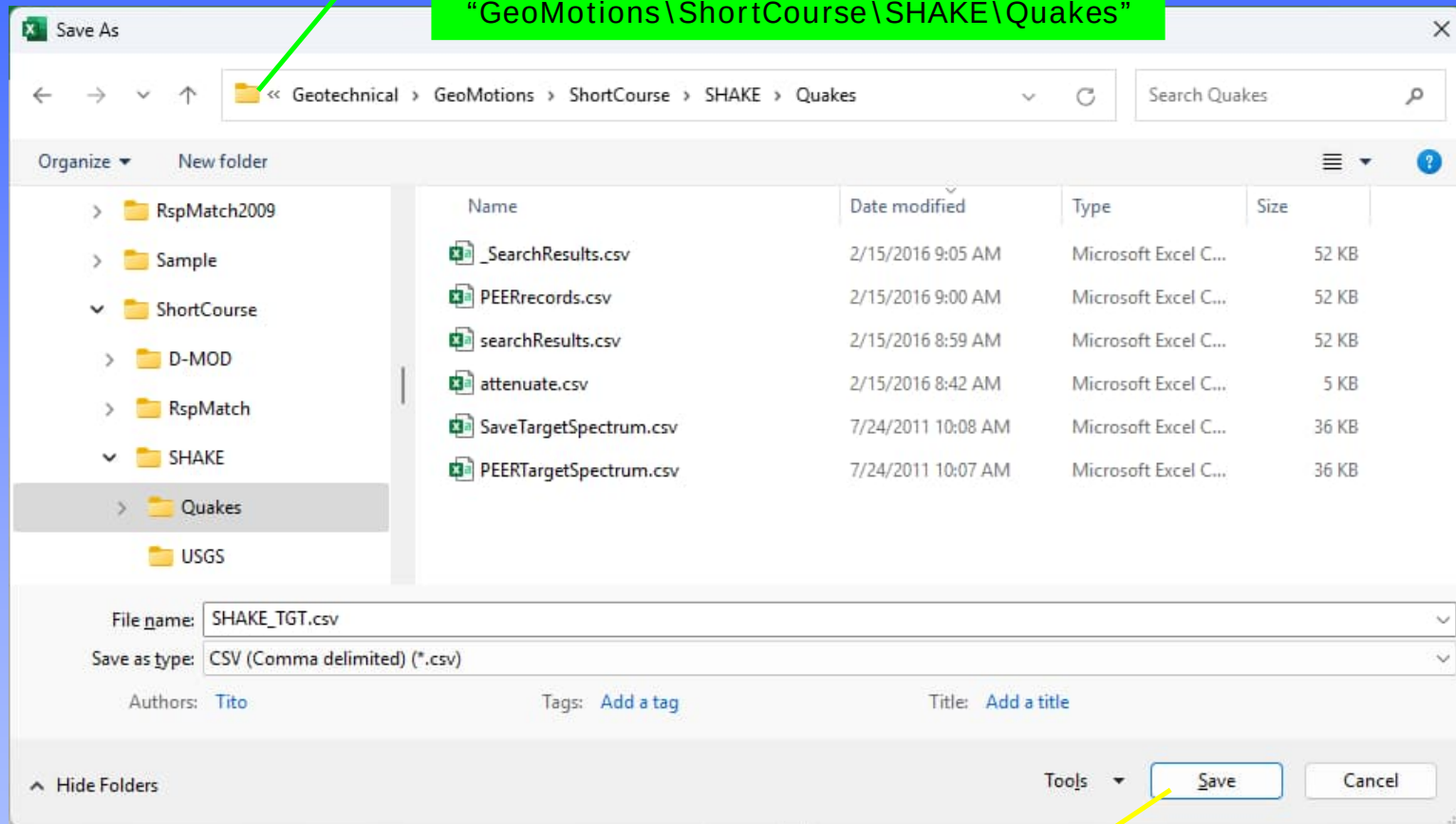
SHAKE2000 Target Spectrum	
T(s)	Sa(g)
0.01	0.455867
0.02	0.465758
0.03	0.506217
0.05	0.629394
0.075	0.853745
0.1	1.042013
0.15	1.247353
0.2	1.253578
0.25	1.080996
0.3	0.958977
0.4	0.797414
0.5	0.657934
0.75	0.411566
1	0.284754
1.5	0.149788
2	0.091231
3	0.045529
4	0.030762
5	0.025927
7.5	0.012518
10	0.007639

Create a new “.csv” Excel file with the target response spectrum values following PEER format



Save Target Response Spectrum

1. Switch folders until you change to
"GeoMotions\ShortCourse\SHAKE\Quakes"



2. Click "Save"

Site-Specific Analysis - Step 5

Select representative time histories of ground motion from similar tectonic environments that would approximately match the target response spectrum

Crustal

PEER Ground Motion Database

<https://ngawest2.berkeley.edu/>

Subduction

NGA-Subduction Portal

<https://www.risksciences.ucla.edu/nhr3/nga-subduction/gmportal>

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

The screenshot shows the homepage of the PEER Ground Motion Database. The header includes the site name and navigation links: HOME, DOCUMENTATION, HELP, SUBSCRIBE, PEER, and SIGN_IN. A red announcement states: "Registration for the NGA Database will be open: Monday 10 am to 3 pm (Pacific Time) Wednesday 2pm to 7pm (Pacific Time)". Below this is a link to "Subscribe to PEER News Alerts" and a "Welcome to the PEER Ground Motion Database" section. The main content area describes the database's purpose and includes sections for "NGA-West2 -- Shallow Crustal Earthquakes in Active Tectonic Regimes" and "NGA-East -- Central & Eastern North-America". A green callout box with the text "1. Click on 'NGA West 2'" points to a button labeled "NGA West2 enter".

PEER Ground Motion Database
Pacific Earthquake Engineering Research Center

HOME DOCUMENTATION HELP SUBSCRIBE PEER
SIGN_IN

Registration for the NGA Database will be open:
Monday 10 am to 3 pm (Pacific Time)
Wednesday 2pm to 7pm (Pacific Time)

[Subscribe to PEER News Alerts](#)

Welcome to the PEER Ground Motion Database

The web-based Pacific Earthquake Engineering Research Center (PEER) ground motion database provides tools for searching, selecting and downloading ground motion data.

ALL downloaded records are UNSCALED and as-recorded (UNROTATED). The scaling tool available on this site is to be used to determine the scale factors to be used in the simulation platform. These scale factors can be found with the record metadata in the download (Scaling the traces within this tool would only cause confusion with file versioning).

Please note that, due to copyright issues, a strict limit has been imposed on the number of records that can be downloaded within a unique time window. The current limit is set at approximately 200 records every two weeks, 400 every month. Abusive downloads will result in further restrictions.

The database and web site are periodically updated and expanded. Comments on the features of this web site are gratefully welcome; please send emails to: peer_center@berkeley.edu

NGA-West2 -- Shallow Crustal Earthquakes in Active Tectonic Regimes

The NGA-West2 ground motion database includes a very large set of ground motions recorded in worldwide shallow crustal earthquakes in active tectonic regimes. The database has one of the most comprehensive sets of meta-data, including different distance measure, various site characterizations, earthquake source data, etc. The current version of the database is similar to the NGA-West2 database, which was used to develop the 2014 NGA-West2 ground motion models (GMMs). peer.berkeley.edu/ngawest2

NGA-East -- Central & Eastern North-America

The objective of NGA-East is to develop a new ground motion characterization (GMC) model for the Central and Eastern North-American (CENA) region. The GMC model consists in a set of new ground motion models (GMMs) for median and standard deviation of ground motions (GMs) and their associated weights in the logic-trees for use in probabilistic seismic hazard analyses (PSHA). peer.berkeley.edu/ngaeast

[Disclaimer and Copyright Notice...](#)

1. Click on "NGA West 2"

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

The screenshot shows the PEER Ground Motion Database sign-in page. The browser address bar displays `ngawest2.berkeley.edu/users/sign_in?unauthenticated=true`. The page header includes the site logo and navigation links: HOME, DOCUMENTATION, HELP, SUBSCRIBE, and PEER. Below the header, the text "SIGN_IN" is centered. A message states: "You need to sign in or sign up before continuing." The sign-in form contains fields for "Email" and "Password", a "Remember me" checkbox, and a "Sign in" button. A green arrow points from a green box to the password field, and a yellow arrow points from a yellow box to the "Sign in" button. The footer contains contact information: "325 Davis Hall, U.C. Berkeley, CA 94720-1780 | Phone: (510) 642-3437 | Fax: (510) 642-1655 | Email: peer_center@berkeley.edu".

PEER Ground Motion Database
Pacific Earthquake Engineering Research Center

HOME DOCUMENTATION HELP SUBSCRIBE PEER

SIGN_IN

You need to sign in or sign up before continuing.

Sign in

Email

Password

Remember me ☐

[Forgot password?](#)

[Confirm Account](#)

325 Davis Hall, U.C. Berkeley, CA 94720-1780 | Phone: (510) 642-3437 | Fax: (510) 642-1655 | Email: peer_center@berkeley.edu

1. Enter your Email and Password

2. Click on "Sign in"

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

PEER Ground Motion Database *NGA-West2*
Pacific Earthquake Engineering Research Center

HOME DOCUMENTATION HELP SUBSCRIBE PEER
SIGN_OUT

Signed in successfully.

Target Spectrum

Select Spectrum Model

Select models to generate target spectrum: **User Defined Spectrum**

[Show/Hide GMM Notation](#)
[Show/Hide GMM Regions](#)
[Show/Hide GMM Flours](#)

User-Defined Spectrum

As shown in the sample file, start spectra data at row 4 of input file. Spectra data consists of rows of T,pSa comma-separated values.

Filename: Upload File

[Download Example file\(.csv\)](#)

Submit

1. Click on down-arrow and select "User Defined Spectrum"

2. Click on "Upload File"

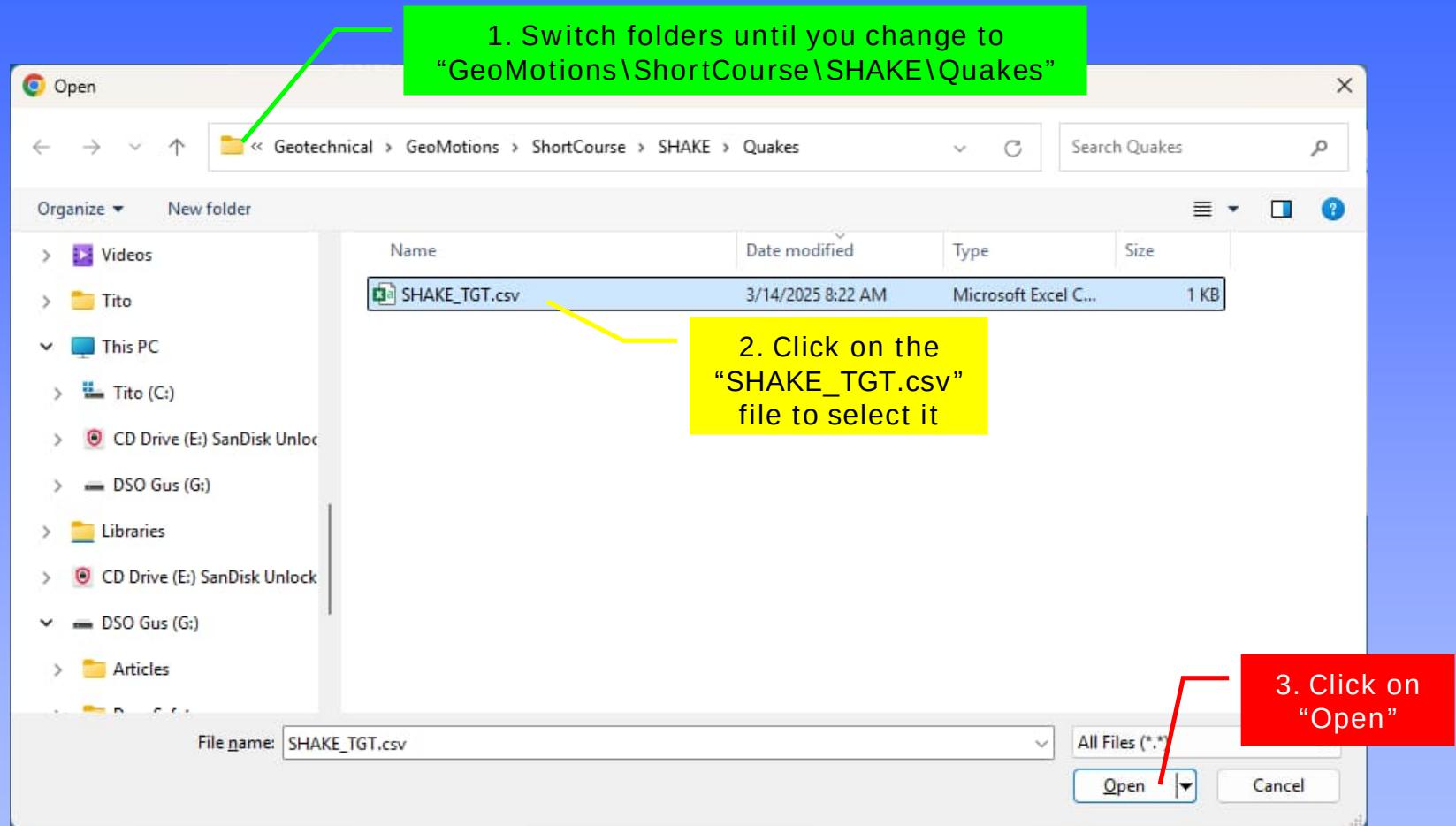
325 Davis Hall, University of California, Berkeley, CA 94720-1792 - Phone: (510) 642-3437 | Fax: (510) 642-1655 | Email: peer_center@berkeley.edu

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

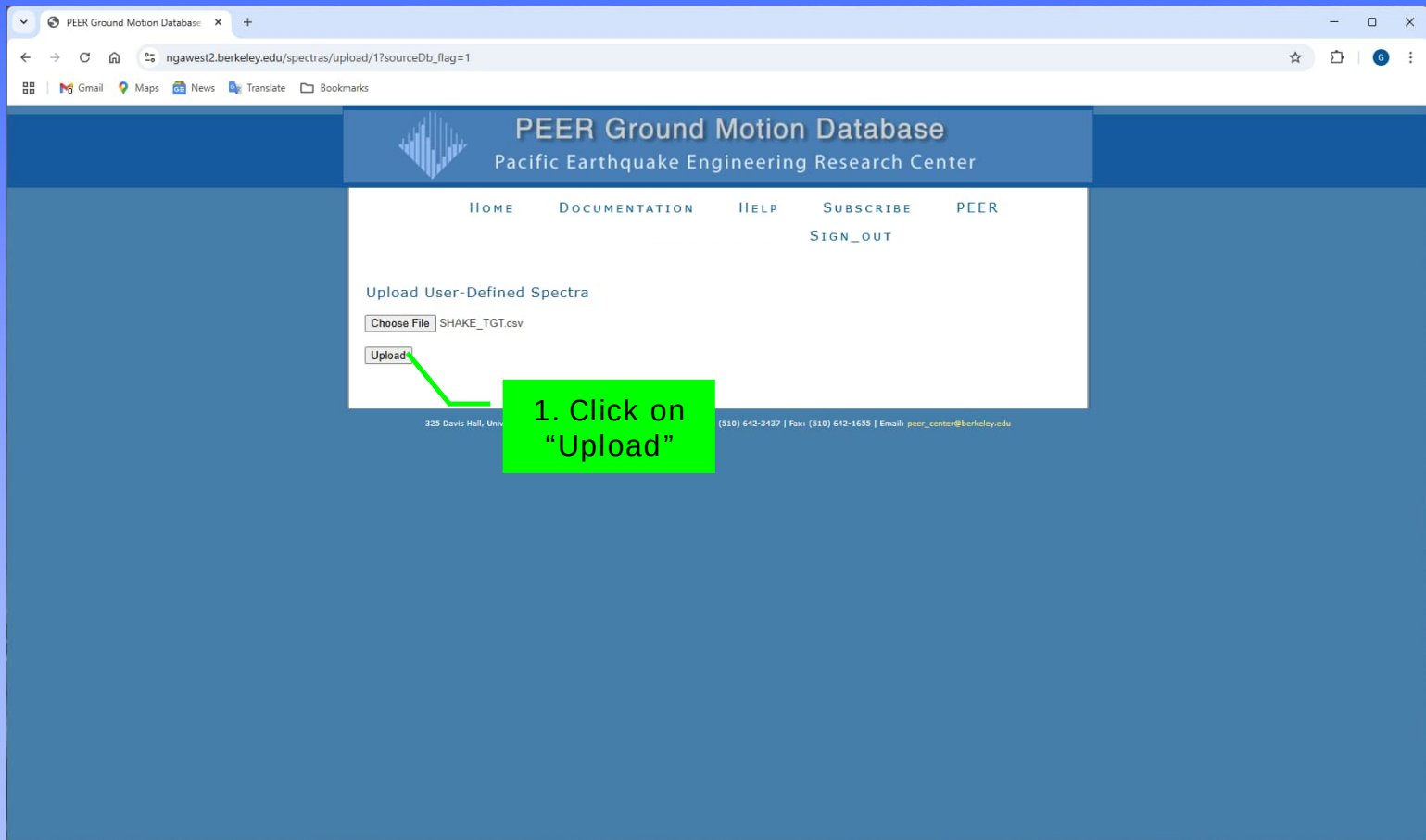


Upload Target Response Spectrum



Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>



Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

PEER Ground Motion Database *NGA-West2*
Pacific Earthquake Engineering Research Center

HOME DOCUMENTATION HELP SUBSCRIBE PEER
SIGN_OUT

File was successfully uploaded.

Target Spectrum

Select Spectrum Model

Select models to generate target spectrum: **User Defined Spectrum**

[Show/Hide GMM Notation](#)
[Show/Hide GMM Regions](#)
[Show/Hide GMM Figures](#)

User-Defined Spectrum

As shown in the sample file, start spectra data at row 4 of input file. Spectra data consists of rows of T,pSa comma-separated values.

Filename: [Upload File](#)

[Download Example file\(.csv\)](#)

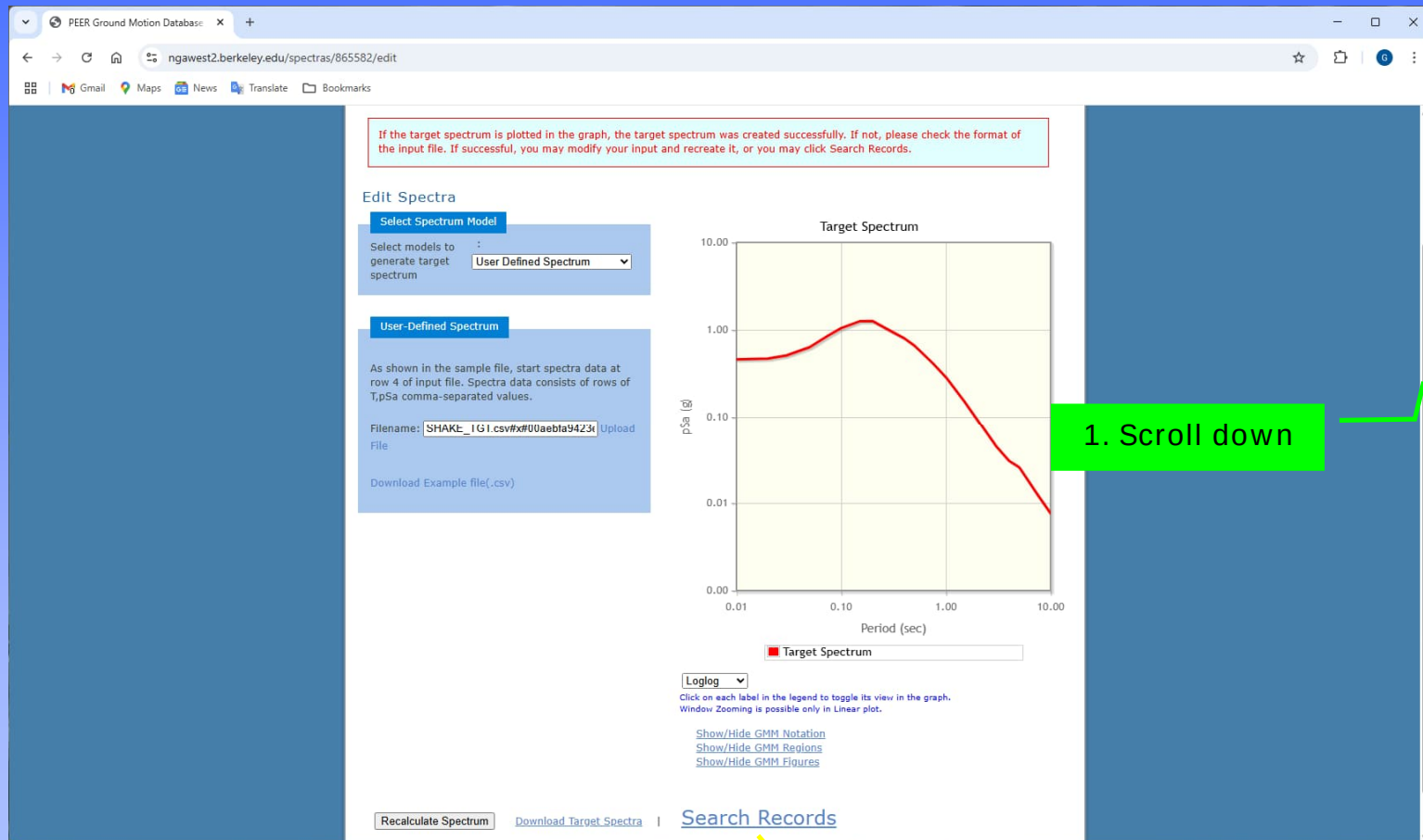
Submit

325 Davis Hall, University of California, Berkeley, CA 94720-1780 | 642-3437 | Fax: (510) 642-1655 | Email: peer_center@berkeley.edu

1. Click on "Submit"

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>



Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

The screenshot shows the PEER Ground Motion Database search page. The browser address bar displays `ngawest2.berkeley.edu/spectras/865582/searches/new`. The page header includes the site logo and navigation links: HOME, DOCUMENTATION, HELP, SUBSCRIBE, PEER, and SIGN_OUT. The main section is titled "New Search" and contains two tabs: "Load Sample Input Values" and "Clear Input Values". The "Search" tab is active, showing a form with the following sections:

- Record Characteristics:** Includes fields for RSN(s), Event Name, and Station Name.
- Search Parameters:** Includes a dropdown for Fault Type (set to "Normal+Reverse"), a text input for Magnitude (set to "6.6,7.6"), and inputs for $R_{JB}(km)$, $R_{rup}(km)$ (set to "5,45"), $V_{s30}(m/s)$ (set to "560,1080"), $D5-95(sec)$, and Pulse (set to "Any Record").
- Additional Characteristics:** Includes fields for Max No. Records (set to " ≤ 100 ") and Initial ScaleFactor.
- Suite:** Includes dropdowns for Spectral Ordinate (set to "SRSS"), Damping Ratio (set to "5%"), and Suite Average (set to "Arithmetic").

Four numbered instructions with colored arrows point to specific form elements:

1. Click and select "Normal+Reverse" (points to the Fault Type dropdown).
2. Enter "6.6,7.6" for Magnitude (points to the Magnitude text input).
3. Enter "5,45" for R_{rup} (points to the $R_{rup}(km)$ text input).
4. Enter "560,1080" for $V_{S,30}$ (points to the $V_{s30}(m/s)$ text input).

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

The screenshot shows the 'New Search' page of the PEER Ground Motion Database. The interface is divided into several sections: 'Record Characteristics', 'Search Parameters', 'Additional Characteristics', 'Suite', 'Scaling', and 'Weight Function'. Three numbered callouts are present:

- 1. Select "Geometric"**: A green box with an arrow pointing to the 'Suite Average' dropdown menu, which is currently set to 'Geometric'.
- 2. Select "Minimize MSE"**: A yellow box with an arrow pointing to the 'Scaling Method' dropdown menu, which is currently set to 'Minimize MSE'.
- 3. Scroll down**: A red box with an arrow pointing to the 'Search Records' button at the bottom of the page.

The 'Search' button is located at the top left of the form. The 'Record Characteristics' section includes fields for RSN(s), Event Name, and Station Name. The 'Search Parameters' section includes fields for Fault Type (Normal+Reverse), Magnitude (6.6, 7.6), R_{JB}(km), R_{rup}(km) (5.45), Vs30(m/s) (560, 1080), D5-95(sec), and Pulse (Any Record). The 'Additional Characteristics' section includes fields for Max No. Records (<=100) and Initial ScaleFactor. The 'Suite' section includes fields for Spectral Ordinate (SRSS), Damping Ratio (5%), and Suite Average (Geometric). The 'Scaling' section includes a field for Scaling Method (Minimize MSE). The 'Weight Function' section includes fields for Period Points (0.1, 1, 10) and Weights (1, 1, 1).

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

The screenshot shows the 'New Search' page of the NGAWest2 database. The interface is divided into several sections: 'Record Characteristics', 'Search Parameters', 'Suite', 'Scaling', 'Weight Function', and 'Controls'. Annotations with colored boxes and arrows point to specific fields:

- 1. Enter "40" for Max. No.**: Points to the 'Max No. Records' field in the 'Additional Characteristics' section.
- 2. Enter "0.5,2" for Initial Scale Factor**: Points to the 'Initial ScaleFactor' field in the 'Additional Characteristics' section.
- 3. Click on "Search Records"**: Points to the 'Search Records' button in the 'Controls' section.

Other visible fields include: RSN(s), Event Name, Station Name, Fault Type (Normal+Reverse), Magnitude (6.6,7.6), RJB(km), Rrup(km) (5,45), Vs30(m/s) (560,1080), D5-95(sec), Pulse (Any Record), Spectral Ordinate (SRSS), Damping Ratio (5%), Suite Average (Geometric), Scaling Method (Minimize MSE), Period Points (0.1,1,10), and Weights (1,1,1).

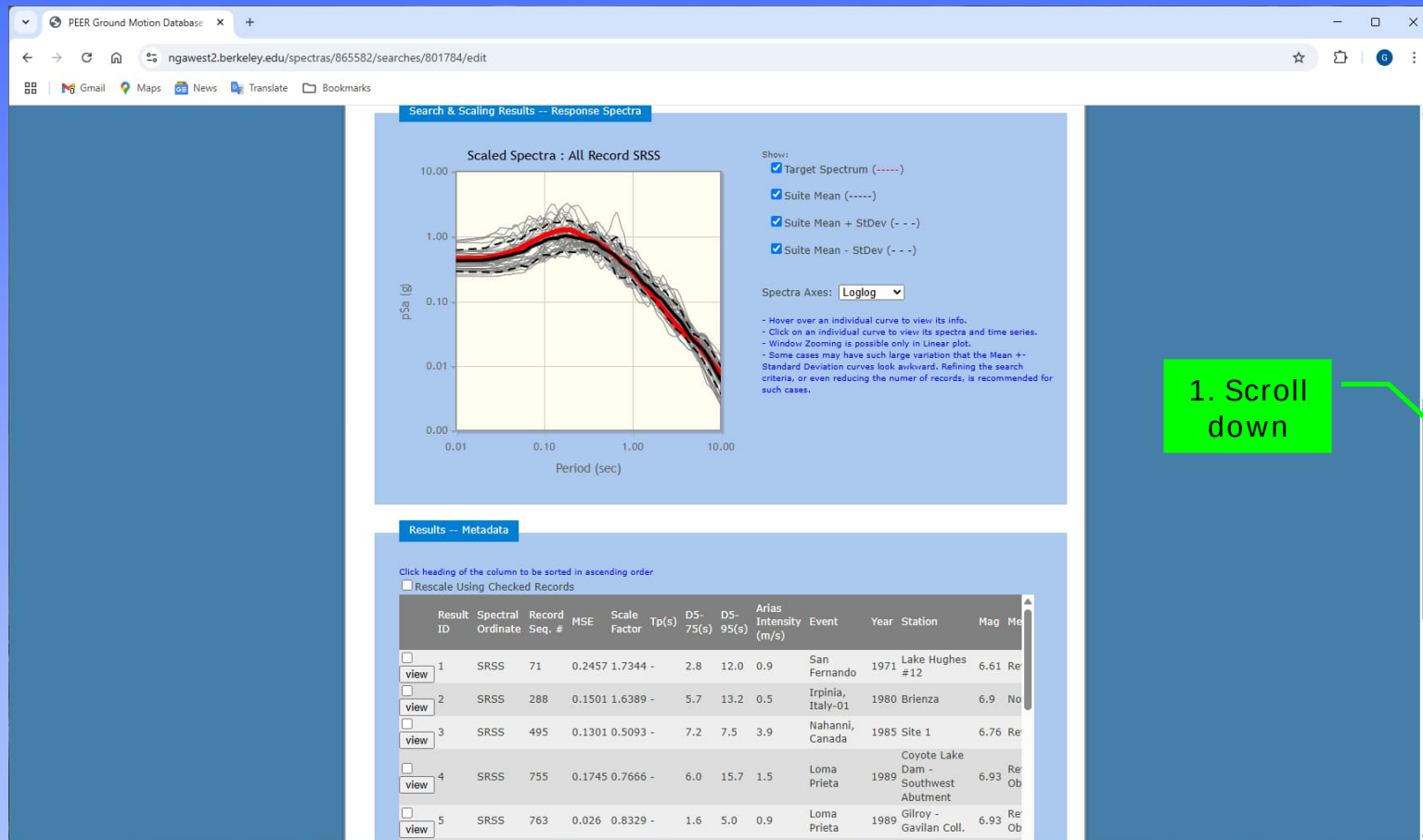
3. Click on
"Search Records"

1. Enter "40" for Max. No.

2. Enter "0.5,2" for Initial
Scale Factor

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>



Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

PEER Ground Motion Database

ngawest2.berkeley.edu/spectras/865582/searches/801784/edit

0.01 0.10 1.00 10.00
Period (sec)

Results -- Metadata

Click heading of the column to be sorted in ascending order
☐ Rescale Using Checked Records

Result ID	Spectral Ordinate	Record Seq. #	MSE	Scale Factor	Tp(s)	D5-75(s)	D5-95(s)	Arias Intensity (m/s)	Event	Year	Station	Mag	Me	
☐ view	1	SRSS	71	0.2457	1.7344	-	2.8	12.0	0.9	San Fernando	1971	Lake Hughes #12	6.61	Re
☐ view	2	SRSS	288	0.1501	1.6389	-	5.7	13.2	0.5	Irpinia, Italy-01	1980	Brienza	6.9	No
☐ view	3	SRSS	495	0.1301	0.5093	-	7.2	7.5	3.9	Nahanni, Canada	1985	Site 1	6.76	Re
☐ view	4	SRSS	755	0.1745	0.7666	-	6.0	15.7	1.5	Loma Prieta	1989	Coyote Lake Dam - Southwest Abutment	6.93	Re Ob
☐ view	5	SRSS	763	0.026	0.8329	-	1.6	5.0	0.9	Loma Prieta	1989	Gilroy - Gavilan Coll.	6.93	Re Ob
☐ view	6	SRSS	769	0.1115	1.3507	-	4.5	13.0	0.4	Loma Prieta	1989	Gilroy Array #6	6.93	Re Ob
☐ view	7	SRSS	801	0.0966	0.8937	-	6.3	10.1	1.3	Loma Prieta	1989	San Jose - Santa Teresa Hills	6.93	Re Ob
☐ view	8	SRSS	809	0.1931	1.531	-	5.6	9.0	1.6	Loma Prieta	1989	UCSC	6.93	Re Ob
☐ view	9	SRSS	810	0.1173	0.9316	-	6.2	9.7	2.7	Loma Prieta	1989	UCSC Lick Observatory	6.93	Re Ob
☐ view	10	SRSS	880	0.1766	1.176	-	5.6	9.0	0.7	Northridge	1994	LA - Chalon	6.80	Re

Download Options

Download Search Results (metadata+spectra) Download Time Series Records (metadata+spectra+traces)

1. Scroll down

2. Click "Download Time Series Records"

Selection of Acceleration Time Histories

<http://ngawest2.berkeley.edu/>

2. Click to close

1. Save "PEERNGARecords_Unscaled.zip" file to
"GeoMotions\ShortCourse\SHAKE\Quakes"

Results -- Metadata

Click heading of the column to be sorted in ascending order
☐ Rescale Using Checked Records

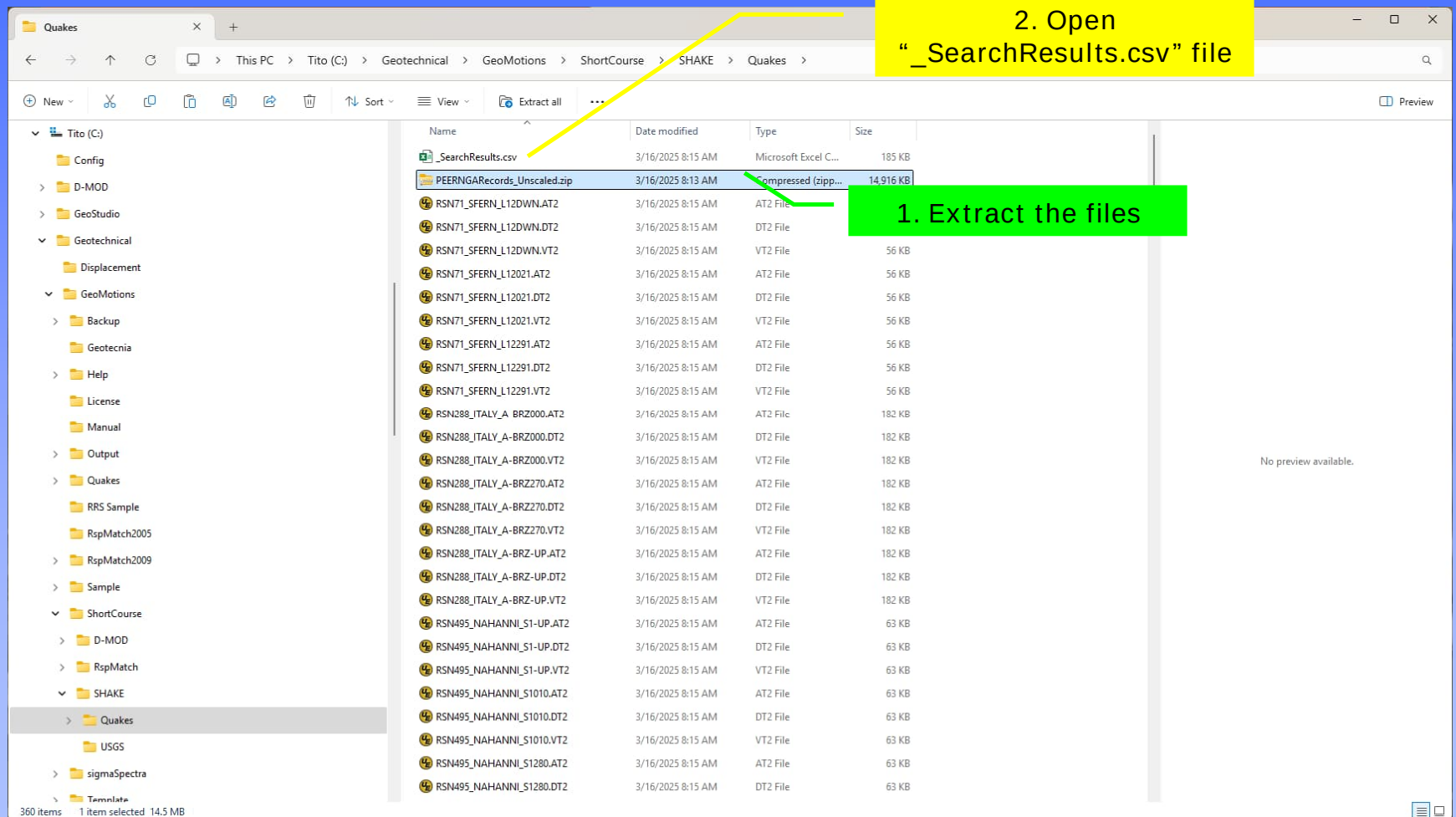
Result ID	Spectral Ordinate	Record Seq. #	MSE	Scale Factor	Tp(s)	D5-75(s)	D5-95(s)	Arias Intensity (m/s)	Event	Year	Station	Mag	Me	
☐ view	1	SRSS	71	0.2457	1.7344	-	2.8	12.0	0.9	San Fernando	1971	Lake Hughes #12	6.61	Re
☐ view	2	SRSS	288	0.1501	1.6389	-	5.7	13.2	0.5	Irpinia, Italy-01	1980	Brienza	6.9	No
☐ view	3	SRSS	495	0.1301	0.5093	-	7.2	7.5	3.9	Nahanni, Canada	1985	Site 1	6.76	Re
☐ view	4	SRSS	755	0.1745	0.7666	-	6.0	15.7	1.5	Loma Prieta	1989	Coyote Lake Dam - Southwest Abutment	6.93	Re Ob
☐ view	5	SRSS	763	0.026	0.8329	-	1.6	5.0	0.9	Loma Prieta	1989	Gilroy - Gavilan Coll.	6.93	Re Ob
☐ view	6	SRSS	769	0.1115	1.3507	-	4.5	13.0	0.4	Loma Prieta	1989	Gilroy Array #6	6.93	Re Ob
☐ view	7	SRSS	801	0.0966	0.8937	-	6.3	10.1	1.3	Loma Prieta	1989	San Jose - Santa Teresa Hills	6.93	Re Ob
☐ view	8	SRSS	809	0.1931	1.531	-	5.6	9.0	1.6	Loma Prieta	1989	UCSC	6.93	Re Ob
☐ view	9	SRSS	810	0.1173	0.9316	-	6.2	9.7	2.7	Loma Prieta	1989	UCSC Lick Observatory	6.93	Re Ob
☐ view	10	SRSS	810	0.1173	0.9316	-	6.2	9.7	2.7	Northridge	1994	LA - Chalon	6.8	Re Ob

Download Options

Download Search Results (metadata+spectra) Download Time Series Records (metadata+spectra+traces)

PEER Search Results

Ground Motion Files in PEERNGARecords_Unscaled.zip File



PEER Search Results

(searchResults Excel CSV file)

AutoSave Off | SearchResults.csv • Saved to this PC | Search

File Home Insert Page Layout Formulas Data Review View Help Acrobat PDF-XChange

Clipboard Font Alignment Number Styles Cells Editing Add-ins

Summary of Metadata of Selected Records

Result ID	Spectral	Record Se	Mean Sq	Scale Fac	Op-Pulse	5-75% Du	5-95% Du	Arias Inte	Earthqua	Year	Station N	Magnitud	Mechanis	Rjb (km)	Rrup (km)	Vs30 (m/s)	Lowest Us	Initial-se	Horizontal	Horizontal	Vertical Acc.	Filename
1	SRSS	71	0.2457	1.7344	2.8	1	1	2.8	1			6.61	Reverse	13.99	19.3	602.1	0.25	1.7344	RSN71_SF	RSN71_SF	RSN71_SFERN_L12DWN.AT2	
2	SRSS	288	0.1501	1.6389	5.7	13	13	5.7	13			6.9	Normal	22.54	22.56	561.04	0.2875	1.6389	RSN288_I	RSN288_I	RSN288_ITALY_A-BRZ-UP.AT2	
3	SRSS	495	0.1301	0.5093	7.2	7	7	7.2	7			6.76	Reverse	2.48	9.6	605.04	0.125	0.5093	RSN495_N	RSN495_N	RSN495_NAHANNI_S1-UP.AT2	
4	SRSS	755	0.1745	0.7666	6	15.7	15.7	6	15.7			6.93	Reverse C	19.97	20.34	561.43	0.1625	0.7666	RSN755_L	RSN755_L	RSN755_LOMAP_CYC-UP.AT2	
5	SRSS	763	0.026	0.8329	1.6	5	5	0.9	"Loma Pri	1989	"Gilroy - C	6.93	Reverse C	9.19	9.96	729.65	0.125	0.8329	RSN763_L	RSN763_L	RSN763_LOMAP_GIL-UP.AT2	
6	SRSS	769	0.1115	1.3507	4.5	13	13	0.4	"Loma Pri	1989	"Gilroy Ar	6.93	Reverse C	17.92	18.33	663.31	0.1625	1.3507	RSN769_L	RSN769_L	RSN769_LOMAP_G06-UP.AT2	
7	SRSS	801	0.0966	0.8937	6.3	10.1	10.1	1.3	"Loma Pri	1989	"San Jose	6.93	Reverse C	14.18	14.69	671.77	0.0375	0.8937	RSN801_L	RSN801_L	RSN801_LOMAP_SJTE-UP.AT2	
8	SRSS	809	0.1931	1.531	5.6	9	9	1.6	"Loma Pri	1989	"UCSC"	6.93	Reverse C	12.15	18.51	713.59	0.125	1.531	RSN809_L	RSN809_L	RSN809_LOMAP_UC2-UP.AT2	
9	SRSS	810	0.1173	0.9316	6.2	9.7	9.7	2.7	"Loma Pri	1989	"UCSC Lic	6.93	Reverse C	12.04	18.41	713.59	0.15	0.9316	RSN810_L	RSN810_L	RSN810_LOMAP_LOB-UP.AT2	
10	SRSS	989	0.2756	1.1276	5.6	9	9	0.7	"Northrid	1994	"LA - Chal	6.69	Reverse	9.87	20.45	740.05	0.2625	1.1276	RSN989_N	RSN989_N	RSN989_NORTH_ CHL-UP.AT2	
11	SRSS	1012	0.2108	1.0739	5.4	8	8	1.1	"Northrid	1994	"LA 00"	6.69	Reverse	9.87	19.07	706.22	0.1625	1.0739	RSN1012_L	RSN1012_L	RSN1012_NORTH_ LA0DWN.AT2	
12	SRSS	1020	0.1676	1.7392	5.4	9.8	9.8	0.5	"Northrid	1994	"Lake Hug	6.69	Reverse	20.77	21.36	602.1	0.12	1.7392	RSN1020_L	RSN1020_L	RSN1020_NORTH_ H12-UP.AT2	
13	SRSS	1078	0.0381	1.0133	4.4	8.3	8.3	0.9	"Northrid	1994	"Santa Su	6.69	Reverse	1.69	16.74	715.12	0.14	1.0133	RSN1078_L	RSN1078_L	-----	
14	SRSS	1091	0.1639	1.6815	4.3	8.3	8.3	0.4	"Northrid	1994	"Vasquez	6.69	Reverse	23.1	23.64	996.43	0.25	1.6815	RSN1091_L	RSN1091_L	RSN1091_NORTH_ VAS-UP.AT2	
15	SRSS	4213	0.044	0.9313	2.6	9.4	9.4	0.6	"Niigata_	2004	"NIG023"	6.63	Reverse	25.33	25.82	654.76	0.075	0.9313	RSN4213_L	RSN4213_L	RSN4213_NIIGATA_NIG023UD.AT2	
16	SRSS	4229	0.0317	0.9496	5.4	10.1	10.1	2.2	"Niigata_	2004	"NIGH12"	6.63	Reverse	9.93	10.72	564.25	0.05	0.9496	RSN4229_L	RSN4229_L	RSN4229_NIIGATA_NIGH12UD.AT2	
17	SRSS	4841	0.1263	1.1083	7.1	15.8	15.8	0.7	"Chuetsu-	2007	"Joetsu Y	6.8	Reverse	20.65	25.52	655.45	0.05	1.1083	RSN4841_L	RSN4841_L	RSN4841_CHUETSU_65004UD.AT2	
18	SRSS	4842	0.0726	0.9221	3.1	12.5	12.5	1.4	"Chuetsu-	2007	"Joetsu U	6.8	Reverse	18.6	22.74	655.45	0.075	0.9221	RSN4842_L	RSN4842_L	RSN4842_CHUETSU_65005UD.AT2	
19	SRSS	4843	0.1672	1.056	7.2	19.9	19.9	0.7	"Chuetsu-	2007	"Matsush	6.8	Reverse	18.16	25.03	640.14	0.05	1.056	RSN4843_L	RSN4843_L	RSN4843_CHUETSU_65006UD.AT2	
20	SRSS	4845	0.1732	0.8783	3	4.8	4.8	2.9	"Chuetsu-	2007	"Joetsu O	6.8	Reverse	15.62	22.48	610.05	0.125	0.8783	RSN4845_L	RSN4845_L	RSN4845_CHUETSU_65008UD.AT2	
21	SRSS	4846	0.1028	0.9033	4.3	10	10	1	"Chuetsu-	2007	"Joetsu Y	6.8	Reverse	28.07	31.43	605.71	0.075	0.9033	RSN4846_L	RSN4846_L	RSN4846_CHUETSU_65009UD.AT2	
22	SRSS	4850	0.2632	0.5787	5.3	16.8	16.8	1.7	"Chuetsu-	2007	"Yoshikav	6.8	Reverse	13.68	16.86	561.59	0.0625	0.5787	RSN4850_L	RSN4850_L	RSN4850_CHUETSU_65013UD.AT2	
23	SRSS	4852	0.0764	1.2898	4.9	14.7	14.7	0.4	"Chuetsu-	2007	"Joetsu_ f	6.8	Reverse	30.26	32.54	605.71	0.0875	1.2898	RSN4852_L	RSN4852_L	RSN4852_CHUETSU_65018UD.AT2	
24	SRSS	4854	0.1743	1.4077	7	21.1	21.1	0.3	"Chuetsu-	2007	"Nadachi	6.8	Reverse	35.79	35.93	570.62	0.1	1.4077	RSN4854_L	RSN4854_L	RSN4854_CHUETSU_65020UD.AT2	
25	SRSS	4858	0.1222	1.0828	4.7	17	17	0.5	"Chuetsu-	2007	"Tokamak	6.8	Reverse	25.35	30.65	640.14	0.0625	1.0828	RSN4858_L	RSN4858_L	RSN4858_CHUETSU_65028UD.AT2	
26	SRSS	4864	0.1521	0.6737	7.7	15.8	15.8	1.9	"Chuetsu-	2007	"Yoitamai	6.8	Reverse	4.69	16.1	655.45	0.1	0.6737	RSN4864_L	RSN4864_L	RSN4864_CHUETSU_65037UD.AT2	
27	SRSS	4865	0.1171	0.7195	12.5	24.2	24.2	1.6	"Chuetsu-	2007	"Tani Koz	6.8	Reverse	5	13.75	561.59	0.1125	0.7195	RSN4865_L	RSN4865_L	RSN4865_CHUETSU_65038UD.AT2	

Ready | Accessibility: Unavailable

PEER Record Number

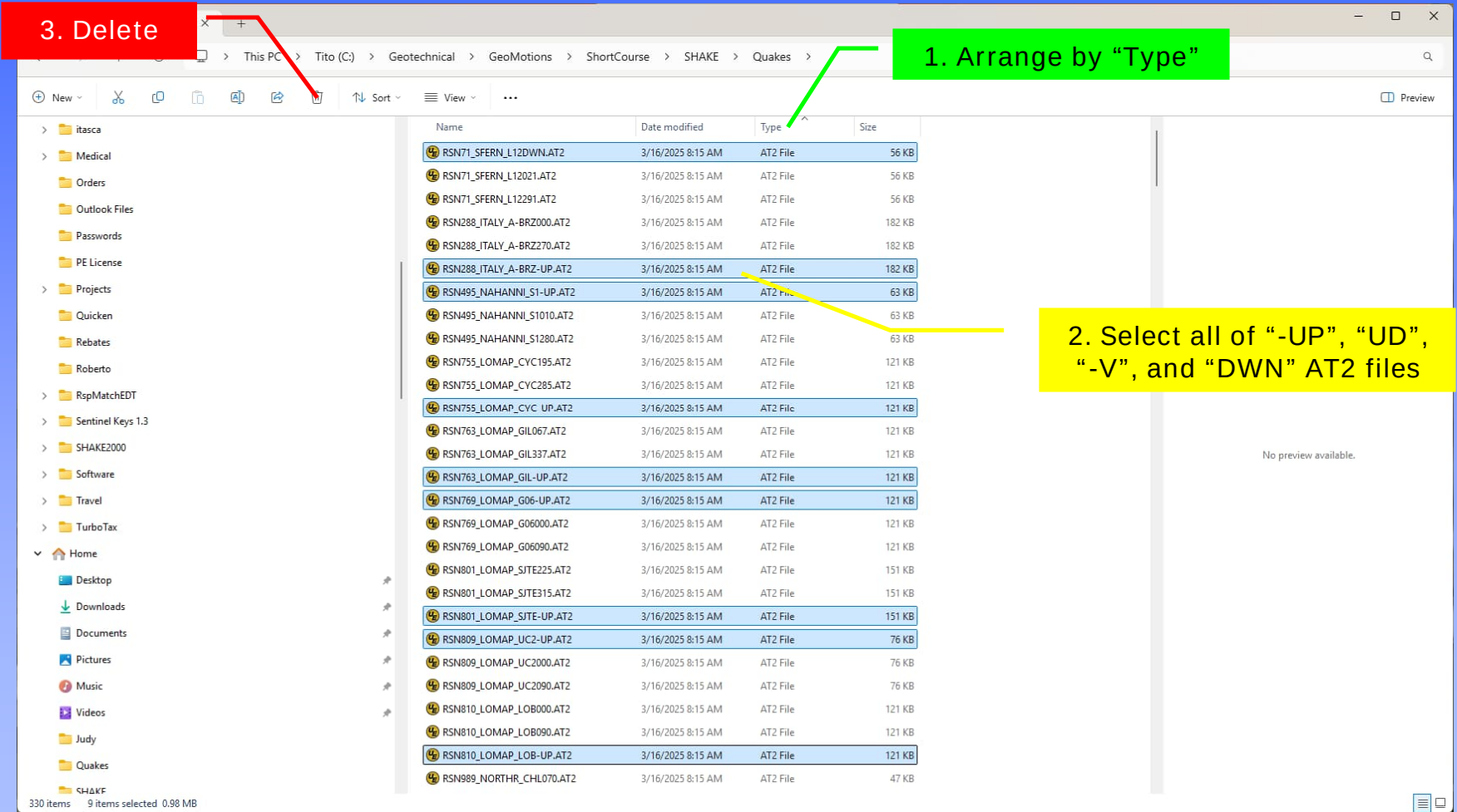
PEER Search Results

Delete vertical component to avoid loading these files later

3. Delete

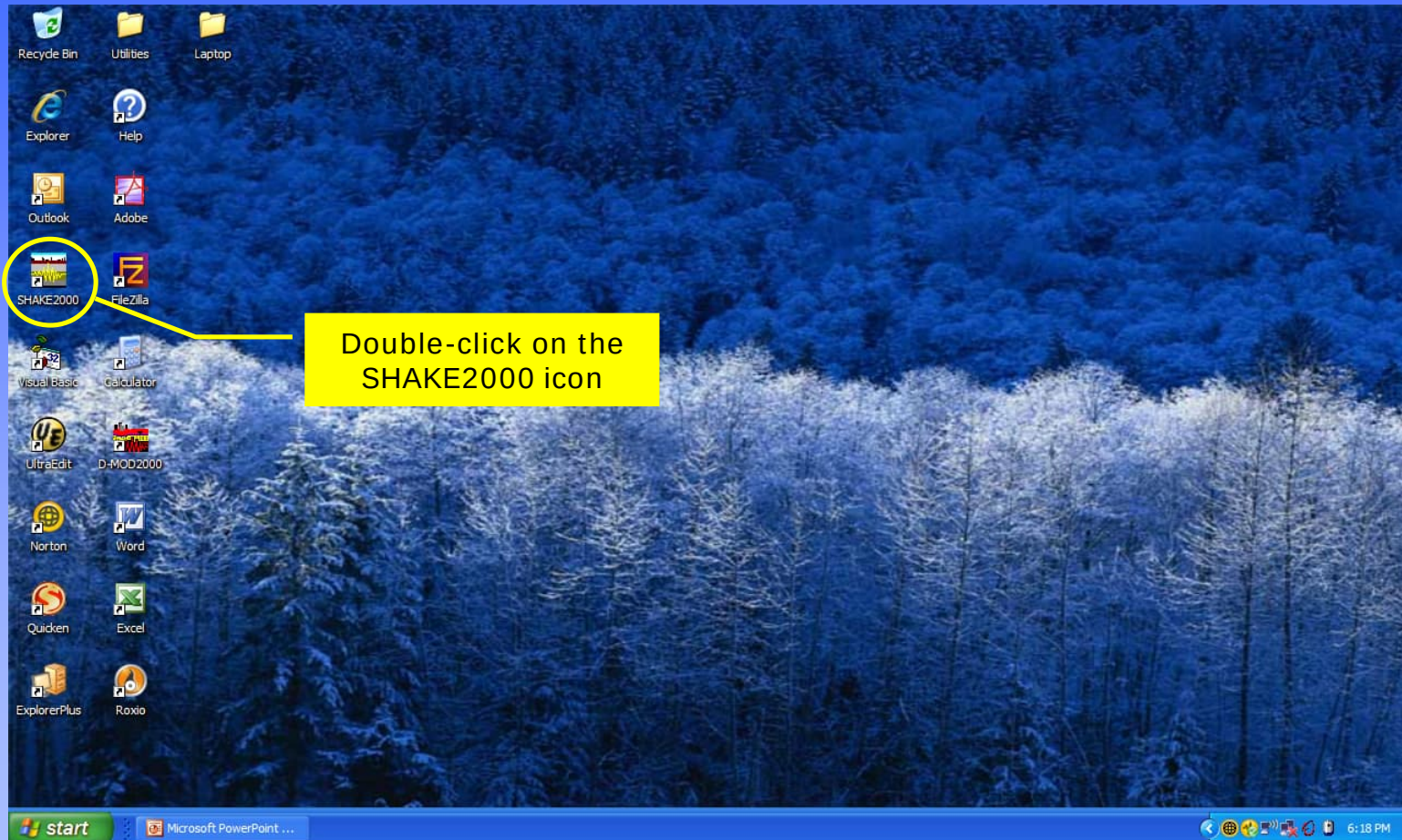
1. Arrange by "Type"

**2. Select all of "-UP", "UD",
"-V", and "DWN" AT2 files**

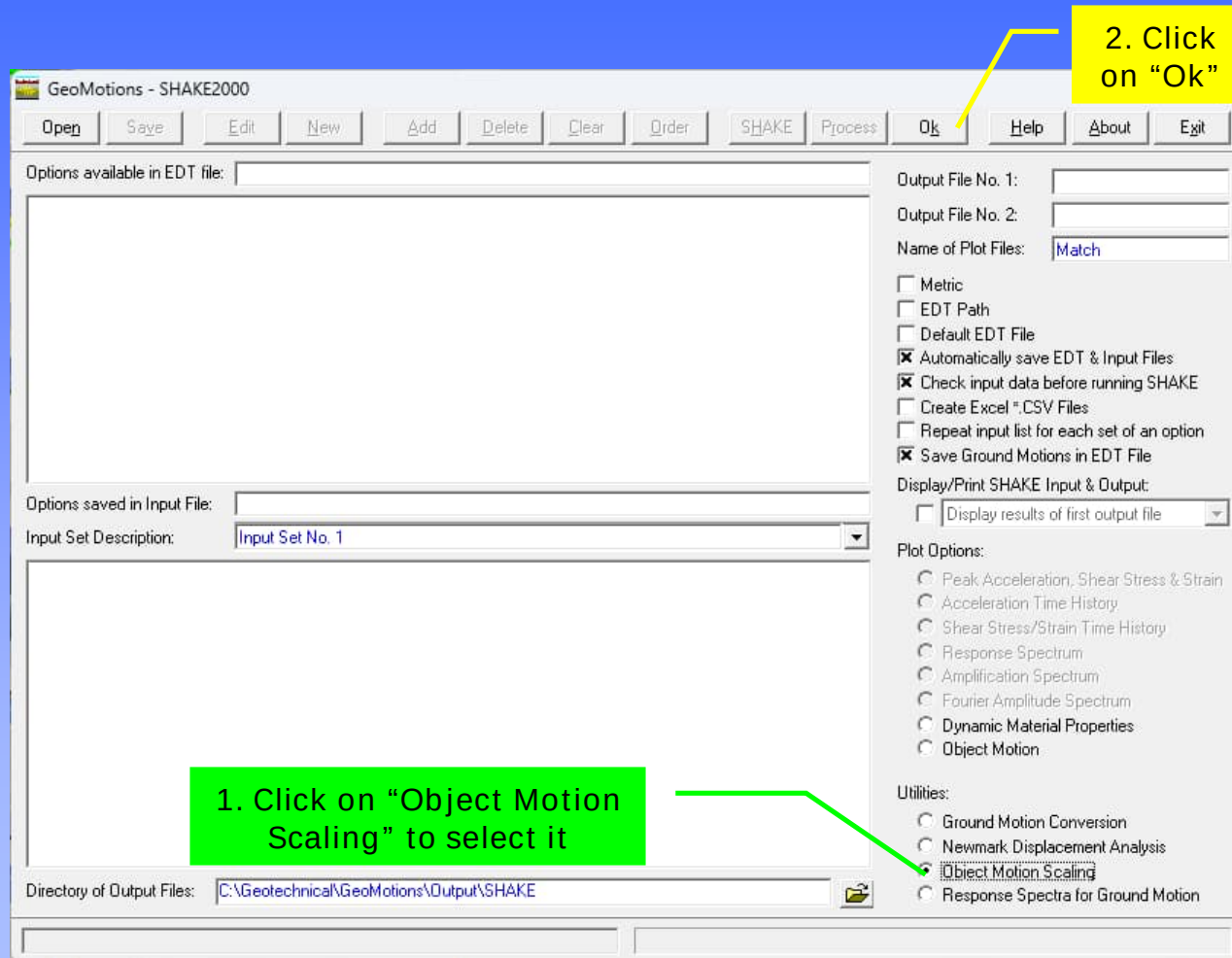


Name	Date modified	Type	Size
RSN71_SFERN_L12DWN.AT2	3/16/2025 8:15 AM	AT2 File	56 KB
RSN71_SFERN_L12021.AT2	3/16/2025 8:15 AM	AT2 File	56 KB
RSN71_SFERN_L12291.AT2	3/16/2025 8:15 AM	AT2 File	56 KB
RSN288_ITALY_A-BRZ000.AT2	3/16/2025 8:15 AM	AT2 File	182 KB
RSN288_ITALY_A-BRZ270.AT2	3/16/2025 8:15 AM	AT2 File	182 KB
RSN288_ITALY_A-BRZ-UP.AT2	3/16/2025 8:15 AM	AT2 File	182 KB
RSN495_NAHANNI_S1-UP.AT2	3/16/2025 8:15 AM	AT2 File	63 KB
RSN495_NAHANNI_S1010.AT2	3/16/2025 8:15 AM	AT2 File	63 KB
RSN495_NAHANNI_S1280.AT2	3/16/2025 8:15 AM	AT2 File	63 KB
RSN755_LOMAP_CYC195.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN755_LOMAP_CYC285.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN755_LOMAP_CYC_UP.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN763_LOMAP_GIL067.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN763_LOMAP_GIL337.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN763_LOMAP_GIL-UP.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN769_LOMAP_G06-UP.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN769_LOMAP_G06000.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN769_LOMAP_G06090.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN801_LOMAP_SJTE225.AT2	3/16/2025 8:15 AM	AT2 File	151 KB
RSN801_LOMAP_SJTE315.AT2	3/16/2025 8:15 AM	AT2 File	151 KB
RSN801_LOMAP_SJTE-UP.AT2	3/16/2025 8:15 AM	AT2 File	151 KB
RSN809_LOMAP_UC2-UP.AT2	3/16/2025 8:15 AM	AT2 File	76 KB
RSN809_LOMAP_UC2000.AT2	3/16/2025 8:15 AM	AT2 File	76 KB
RSN809_LOMAP_UC2090.AT2	3/16/2025 8:15 AM	AT2 File	76 KB
RSN810_LOMAP_LOB000.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN810_LOMAP_LOB090.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN810_LOMAP_LOB-UP.AT2	3/16/2025 8:15 AM	AT2 File	121 KB
RSN989_NORTHR_CHL070.AT2	3/16/2025 8:15 AM	AT2 File	47 KB

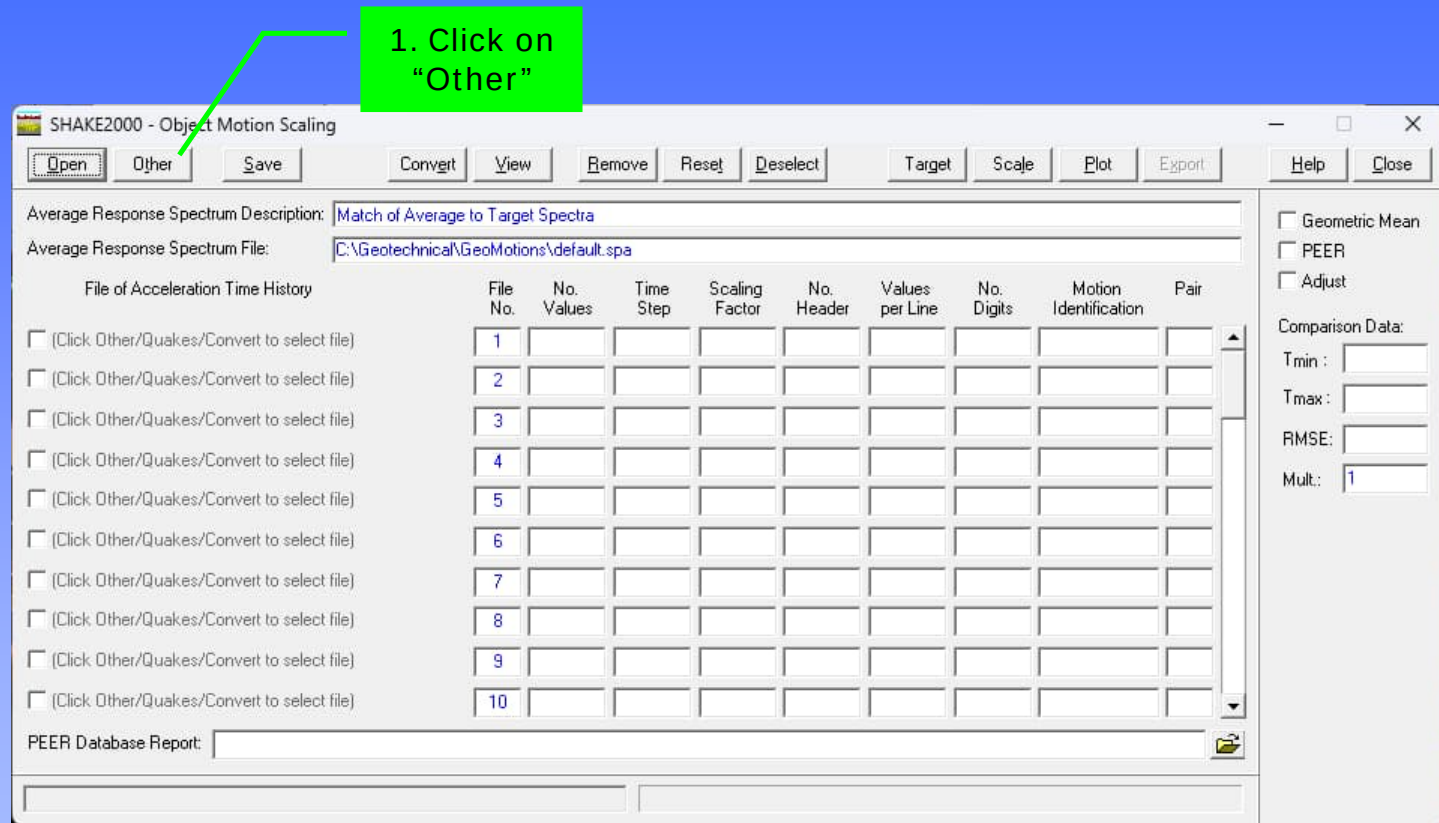
SHAKE2000



Selection of Acceleration Time Histories

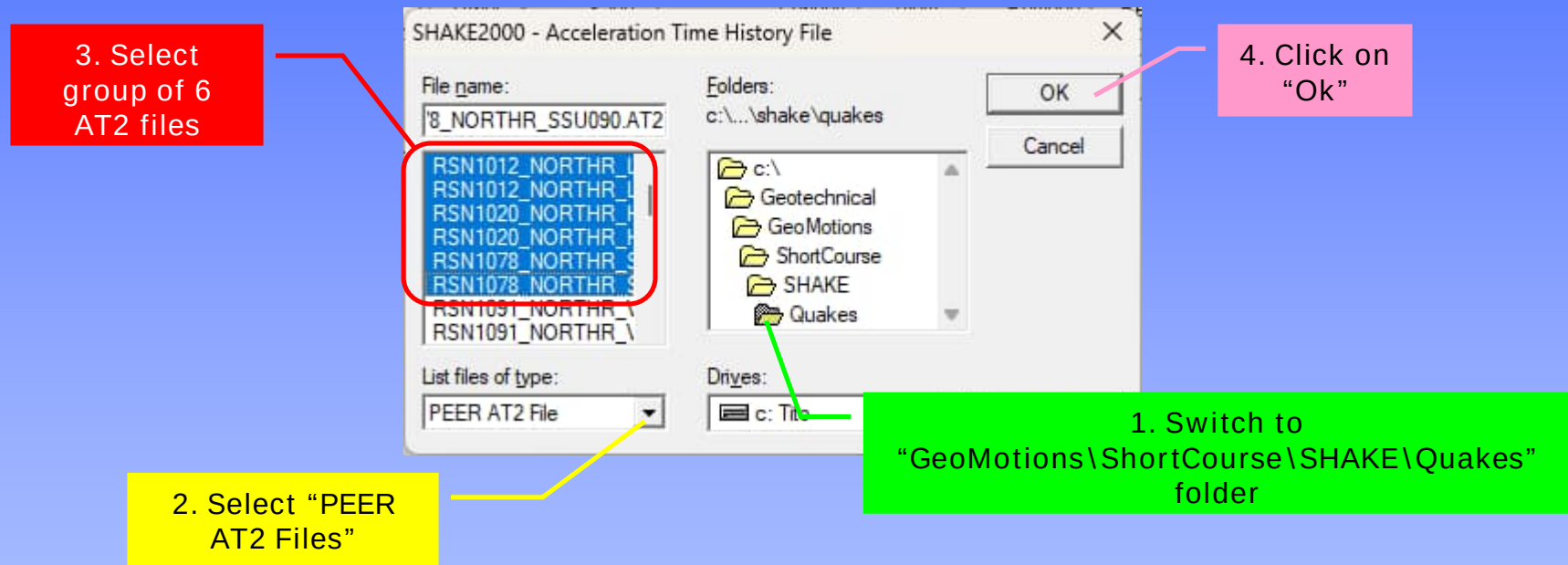


Selection of Acceleration Time Histories

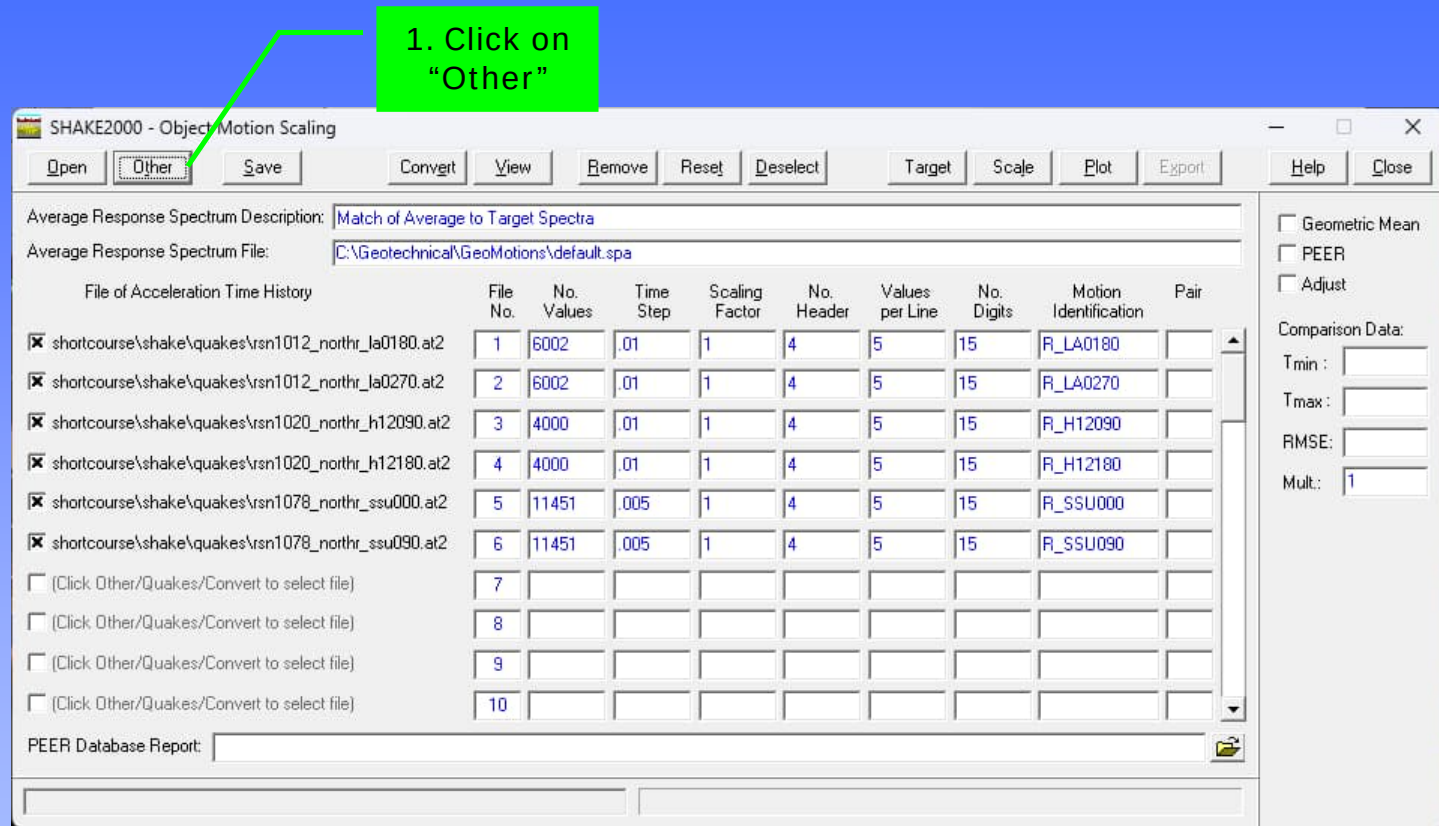


Selection of Acceleration Time Histories

Select both horizontal components

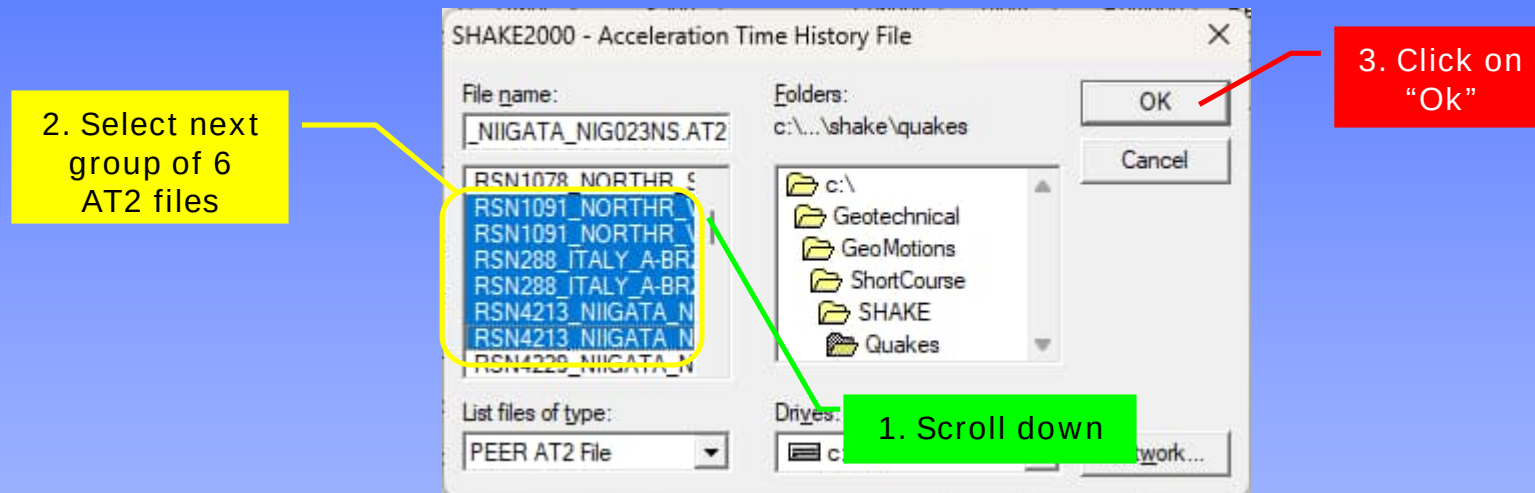


Selection of Acceleration Time Histories



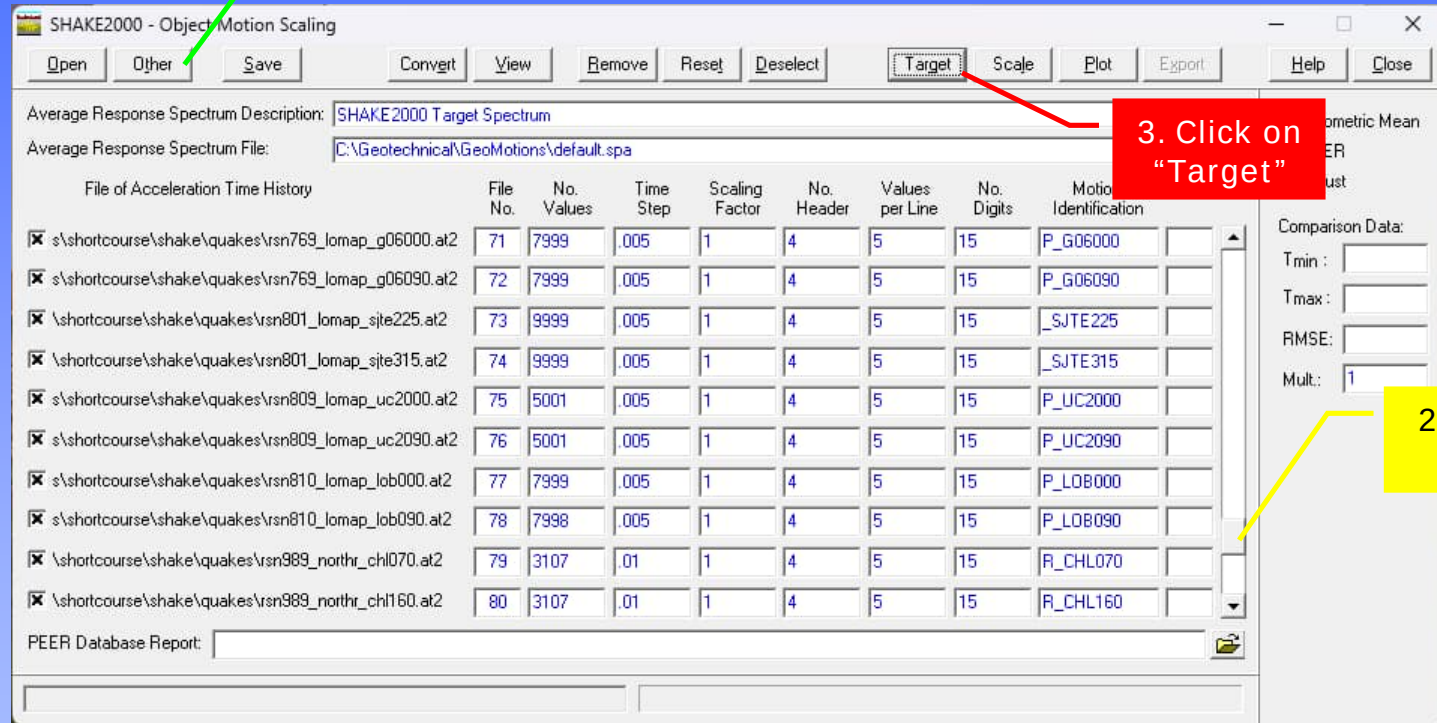
Selection of Acceleration Time Histories

Select both horizontal components



Selection of Acceleration Time Histories

1. Use "Other" to load the other 68 AT2 files



Enter Target Response Spectrum Values

1. Enter the first 15 values of the target spectrum

SHAKE2000 - Target Response Spect...

Ok Save Open Help Cancel

No.	Period (sec)	Sa (g's)
1	0.01	0.455867
2	0.02	0.465758
3	0.03	0.506217
4	0.05	0.629394
5	0.075	0.853745
6	0.1	1.042013
7	0.15	1.247353
8	0.2	1.253578
9	0.25	1.080996
10	0.3	0.958977
11	0.4	0.797414
12	0.5	0.657934
13	0.75	0.411566
14	1	0.284754
15	1.5	0.149788

Add Remove Reset

Target Response Spectrum:

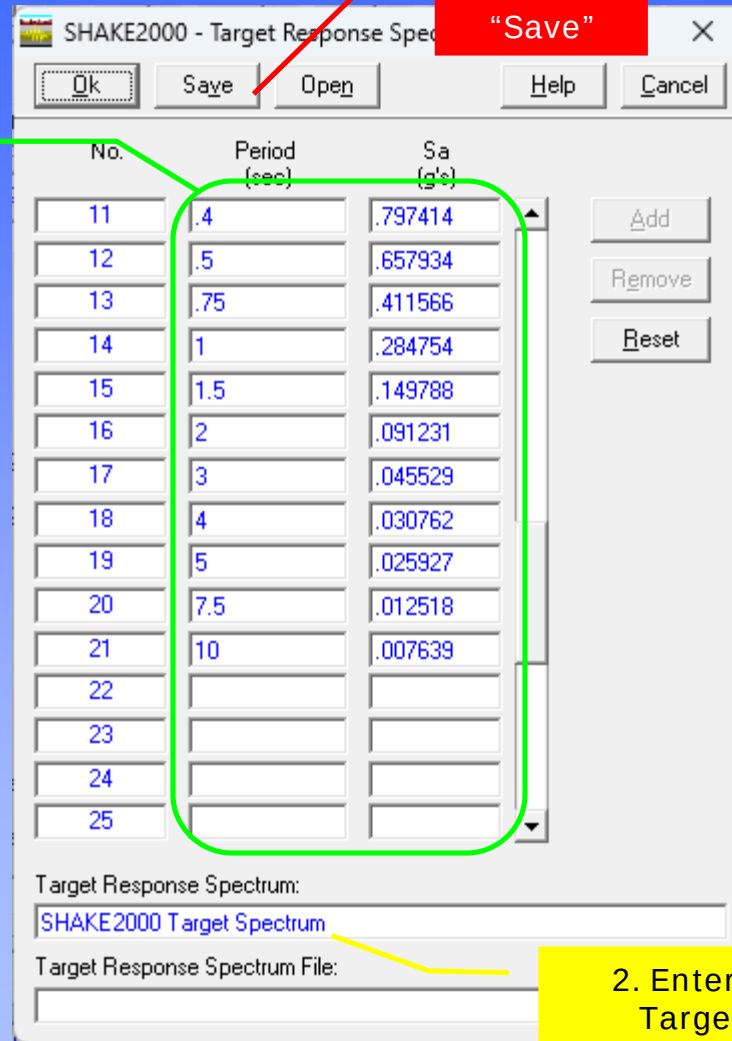
Target Response Spectrum File:

2. Click on "Add" to add more cells

Enter Target Response Spectrum Values

1. Enter the last 6 values of the USHA Spectrum

3. Click on "Save"



The dialog box titled "SHAKE2000 - Target Response Spectrum" contains a table with three columns: "No.", "Period (sec)", and "Sa (g's)". The table lists values for periods from 0.4 to 10 seconds. A green box highlights the last six rows (No. 16-21). To the right of the table are buttons for "Add", "Remove", and "Reset". At the bottom, there are two text fields: "Target Response Spectrum:" and "Target Response Spectrum File:". The first field contains the text "SHAKE2000 Target Spectrum". A red arrow points from the "Save" button to a red instruction box, and a yellow arrow points from the "SHAKE2000 Target Spectrum" text to a yellow instruction box.

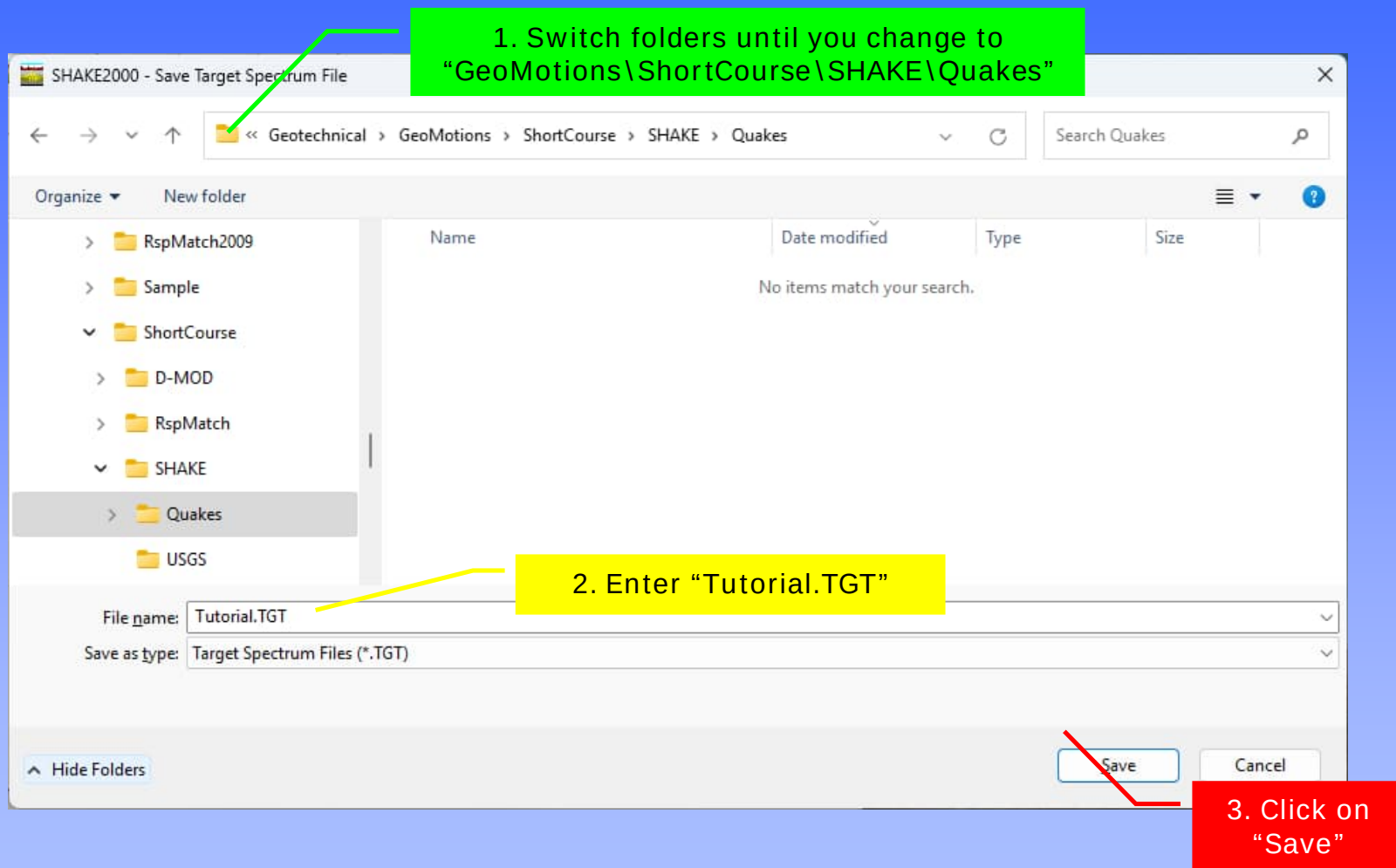
No.	Period (sec)	Sa (g's)
11	.4	.797414
12	.5	.657934
13	.75	.411566
14	1	.284754
15	1.5	.149788
16	2	.091231
17	3	.045529
18	4	.030762
19	5	.025927
20	7.5	.012518
21	10	.007639
22		
23		
24		
25		

Target Response Spectrum:
SHAKE2000 Target Spectrum

Target Response Spectrum File:

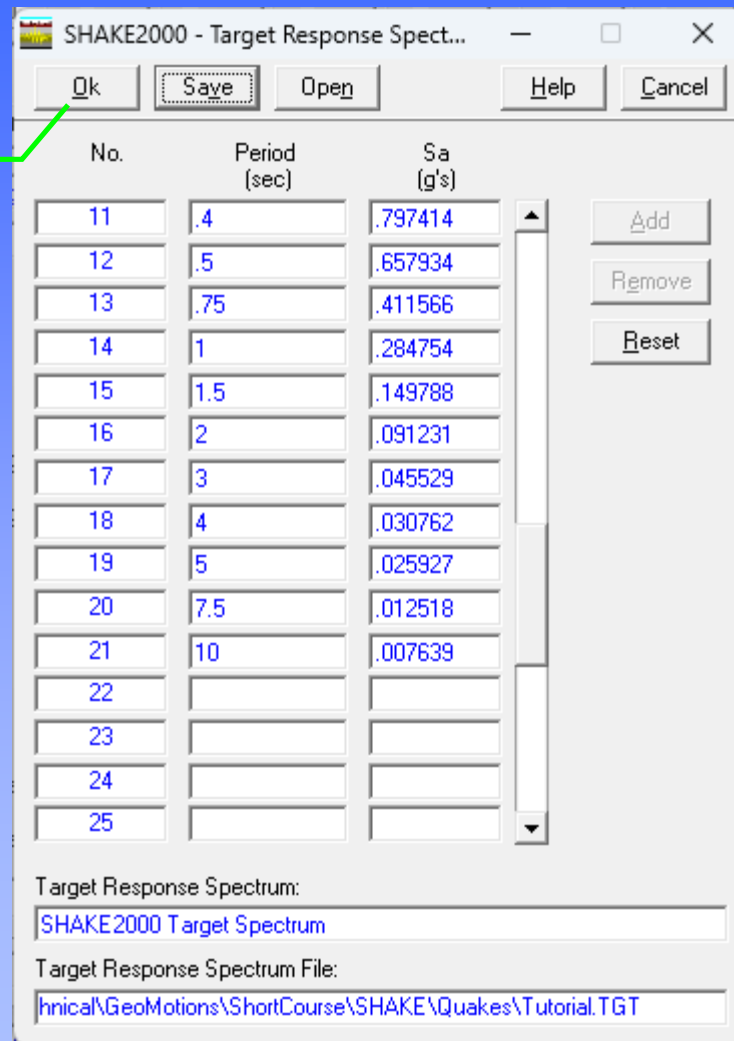
2. Enter "SHAKE2000 Target Spectrum"

Save Target Response Spectrum File



Select Target Response Spectrum

1. Click on
"Ok"



The dialog box titled "SHAKE2000 - Target Response Spect..." contains a table with 3 columns: "No.", "Period (sec)", and "Sa (g's)". It also includes buttons for "Ok", "Save", "Open", "Help", and "Cancel" at the top, and "Add", "Remove", and "Reset" on the right. A green arrow points from the text "1. Click on 'Ok'" to the "Ok" button.

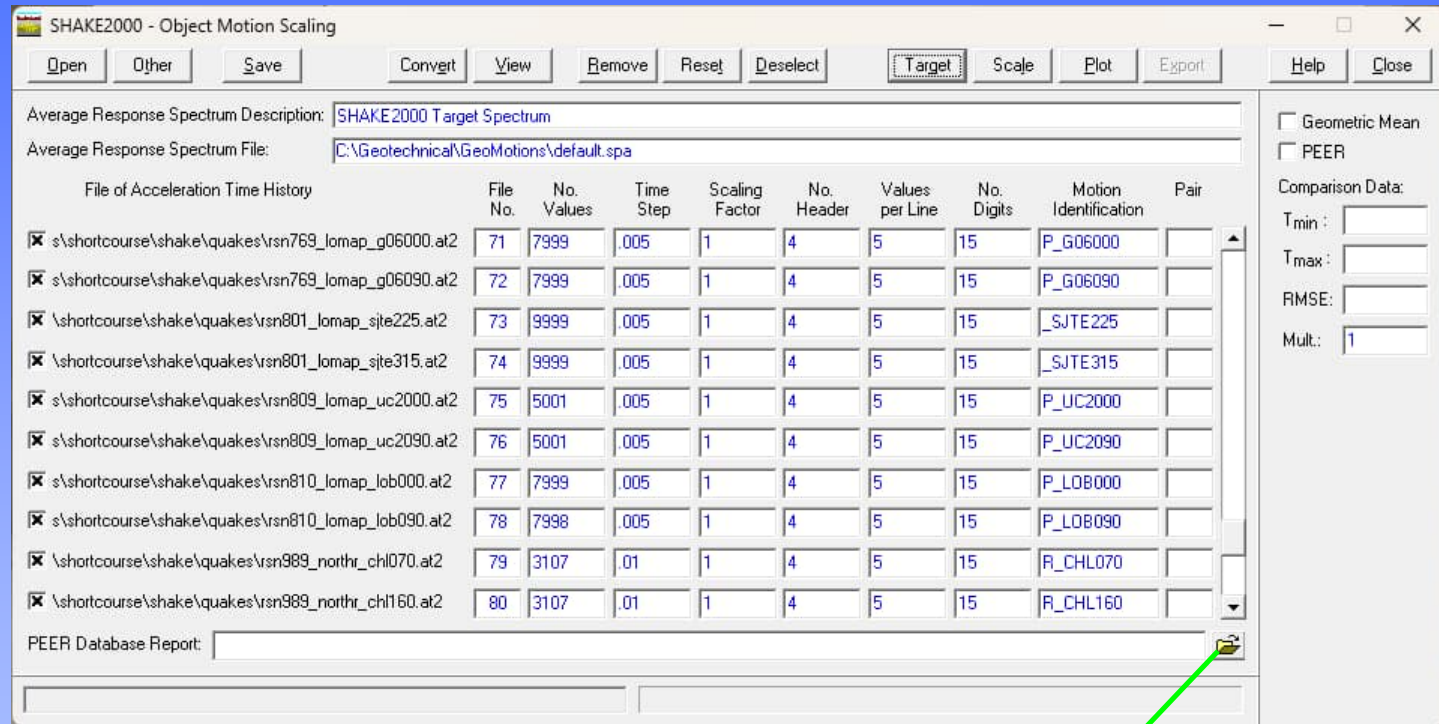
No.	Period (sec)	Sa (g's)
11	.4	.797414
12	.5	.657934
13	.75	.411566
14	1	.284754
15	1.5	.149788
16	2	.091231
17	3	.045529
18	4	.030762
19	5	.025927
20	7.5	.012518
21	10	.007639
22		
23		
24		
25		

Target Response Spectrum:
SHAKE2000 Target Spectrum

Target Response Spectrum File:
lnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.TGT

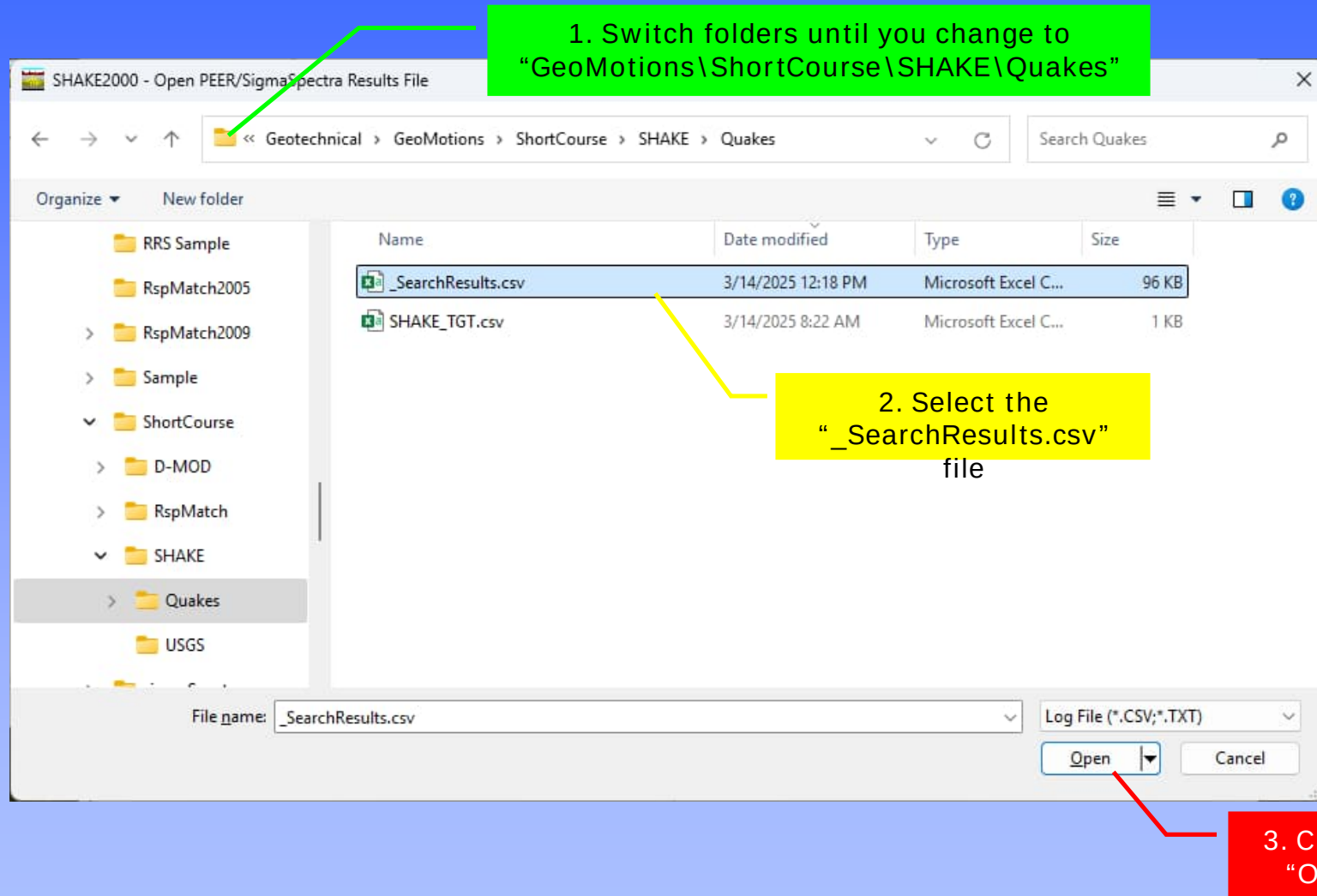
Selection of Acceleration Time Histories

Compare to Target Response Spectrum



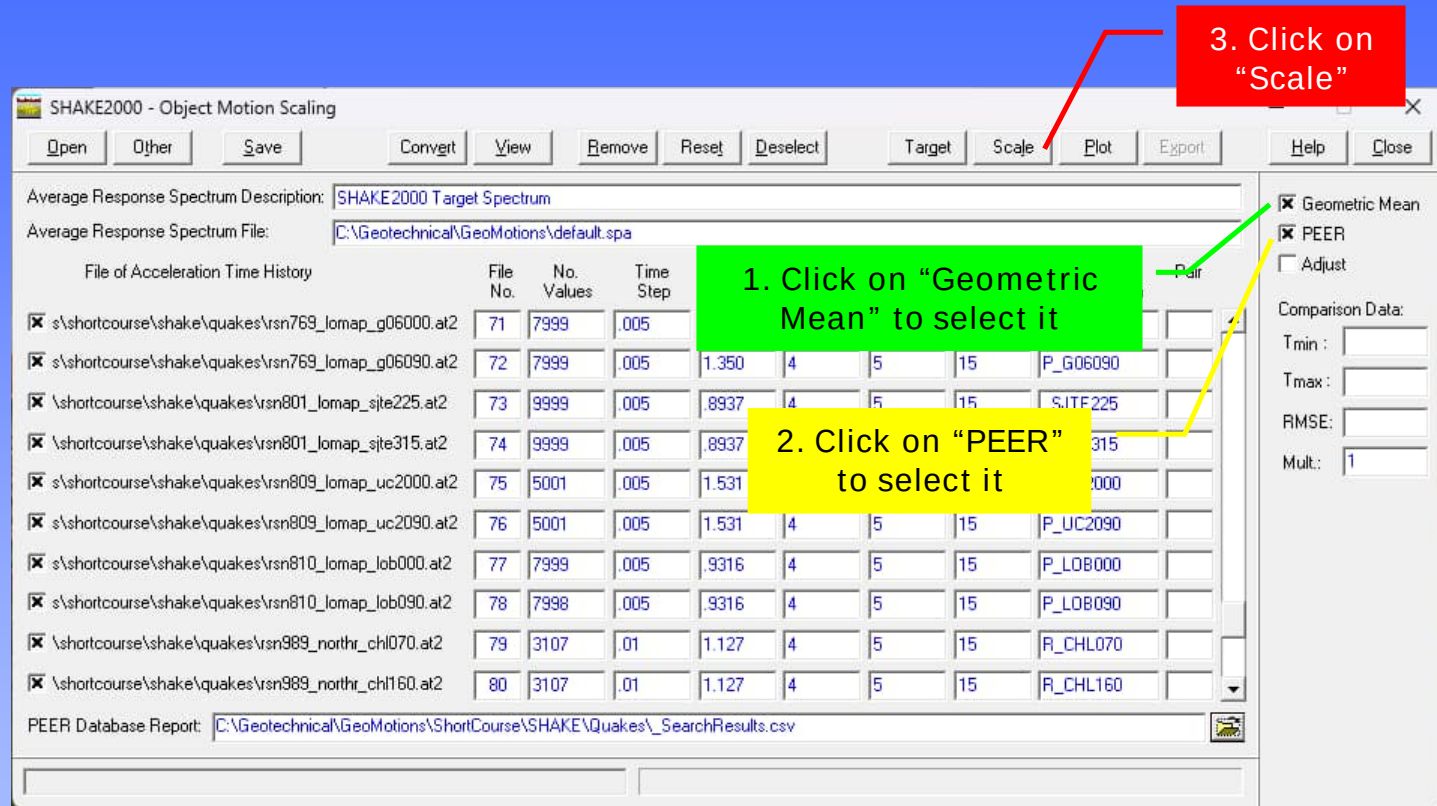
1. Click on open folder icon to open log file from PEER search

Open PEER Search Results File



Selection of Acceleration Time Histories

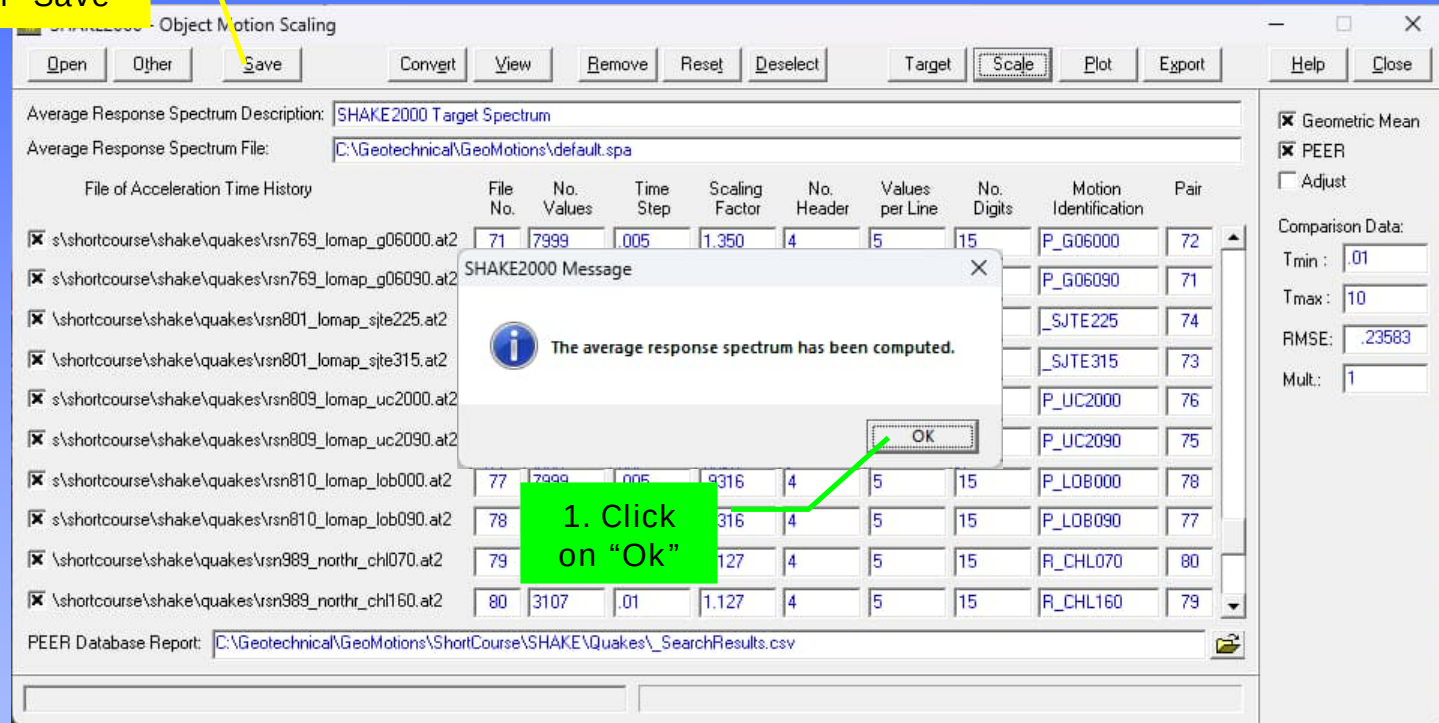
Compare to Target Response Spectrum



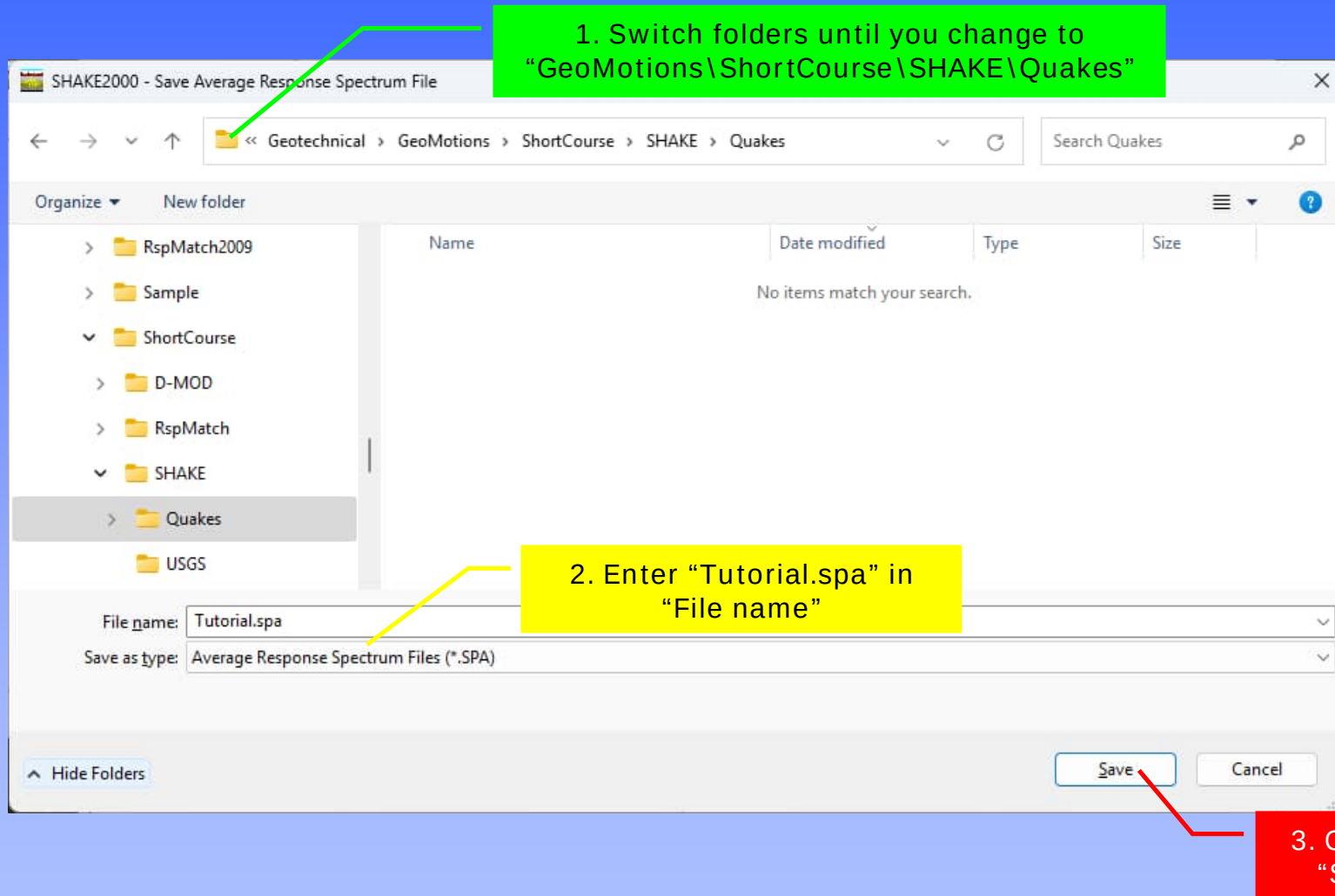
Selection of Acceleration Time Histories

Compare to Target Response Spectrum

2. Click
on "Save"



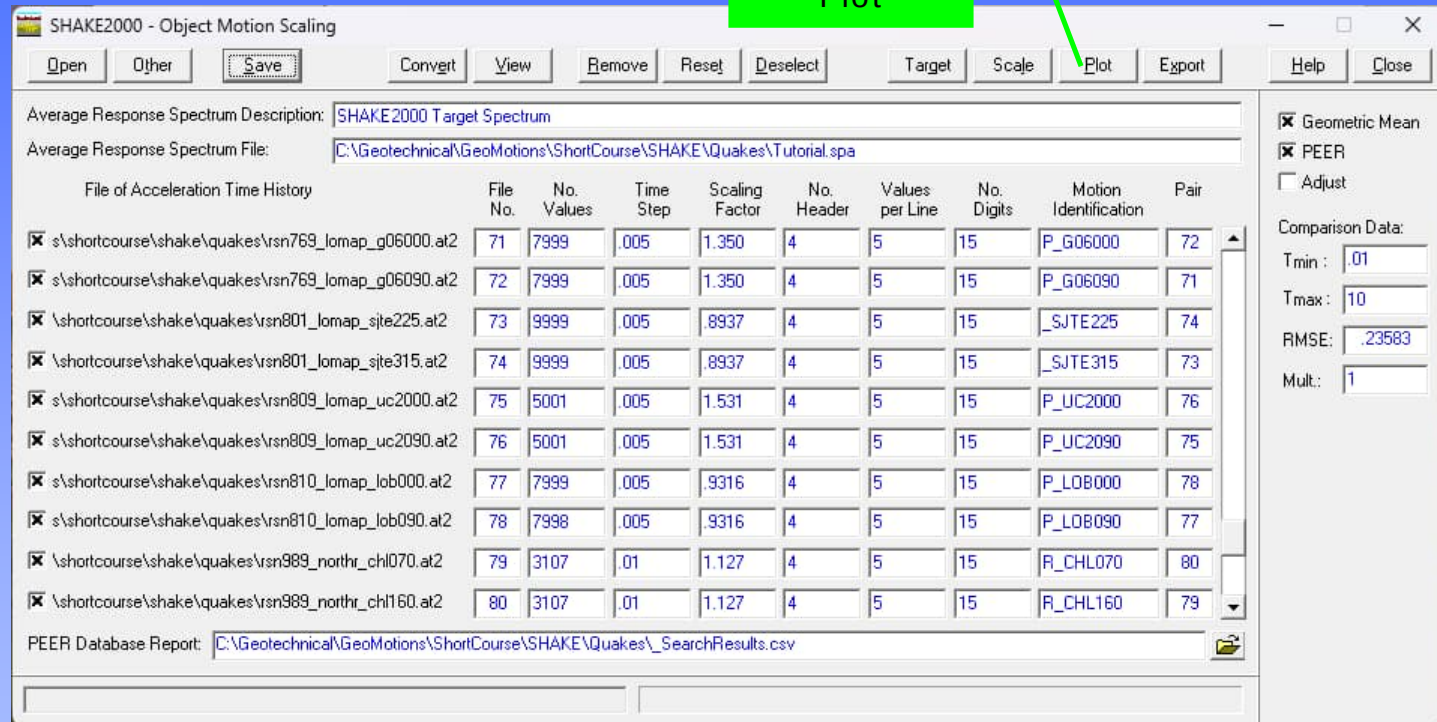
Save Ground Motion Scaling Data



Selection of Acceleration Time Histories

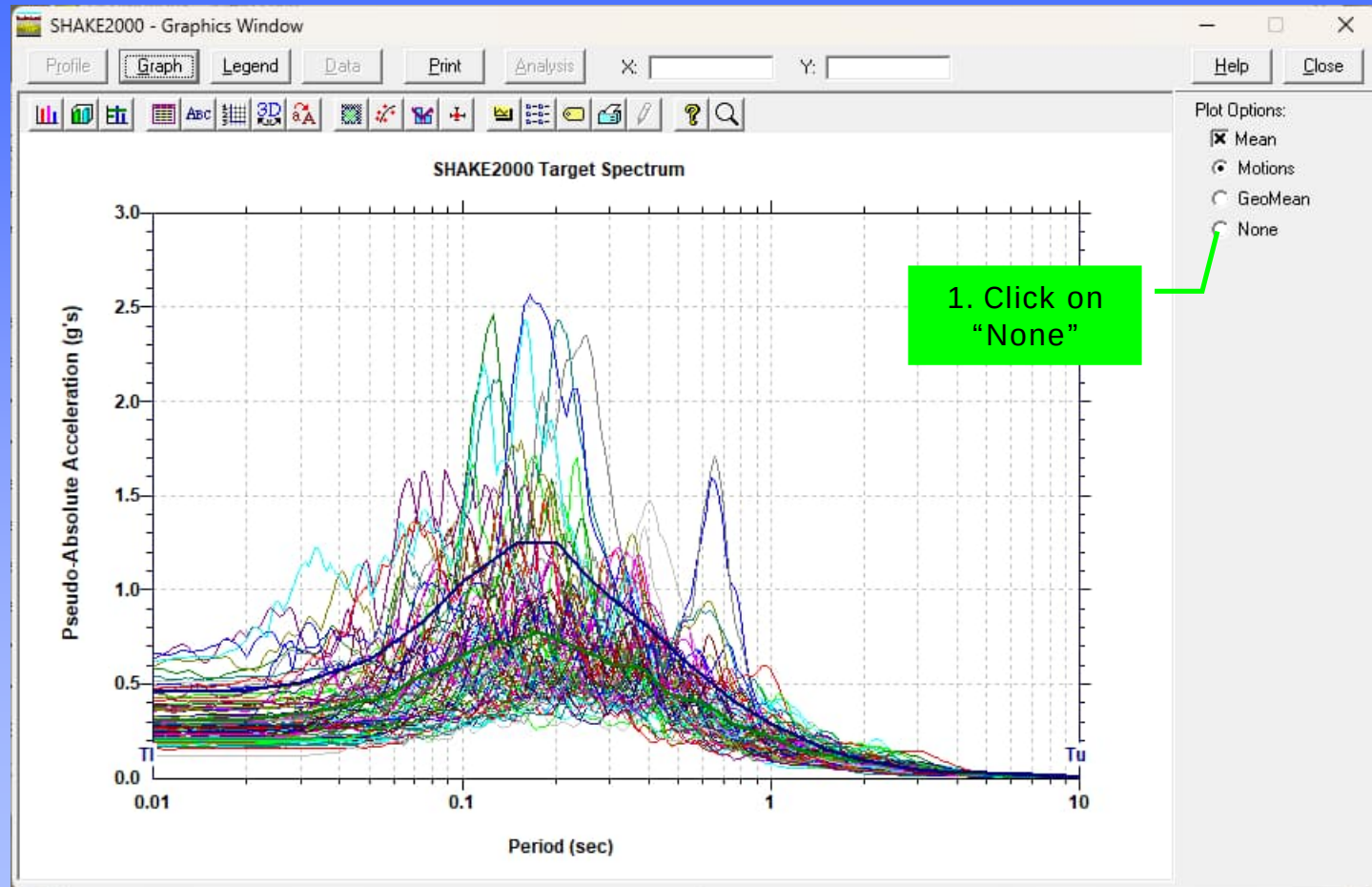
Save Chosen Motions to SHAKE2000 EDT File

1. Click on
"Plot"



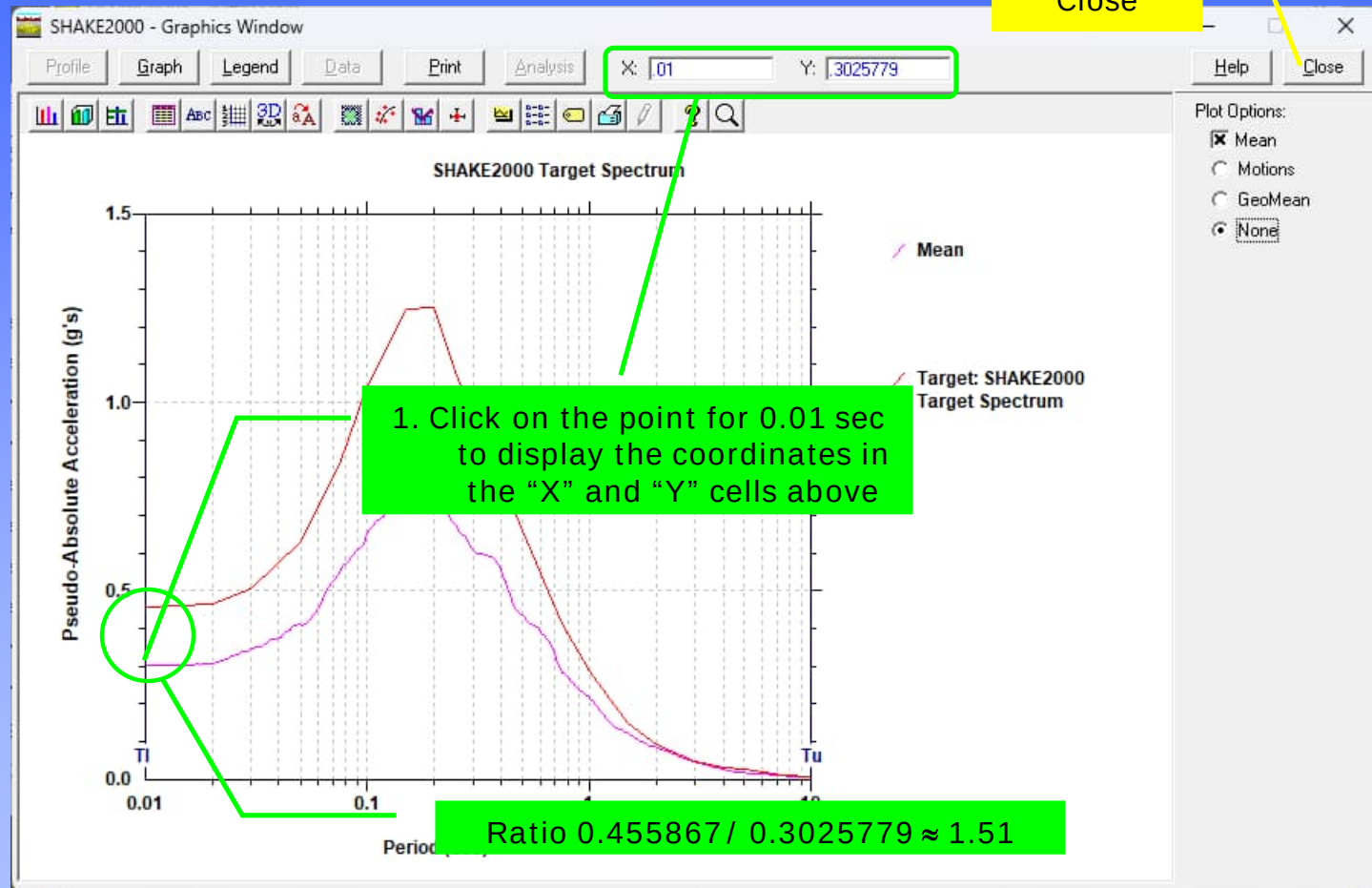
Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

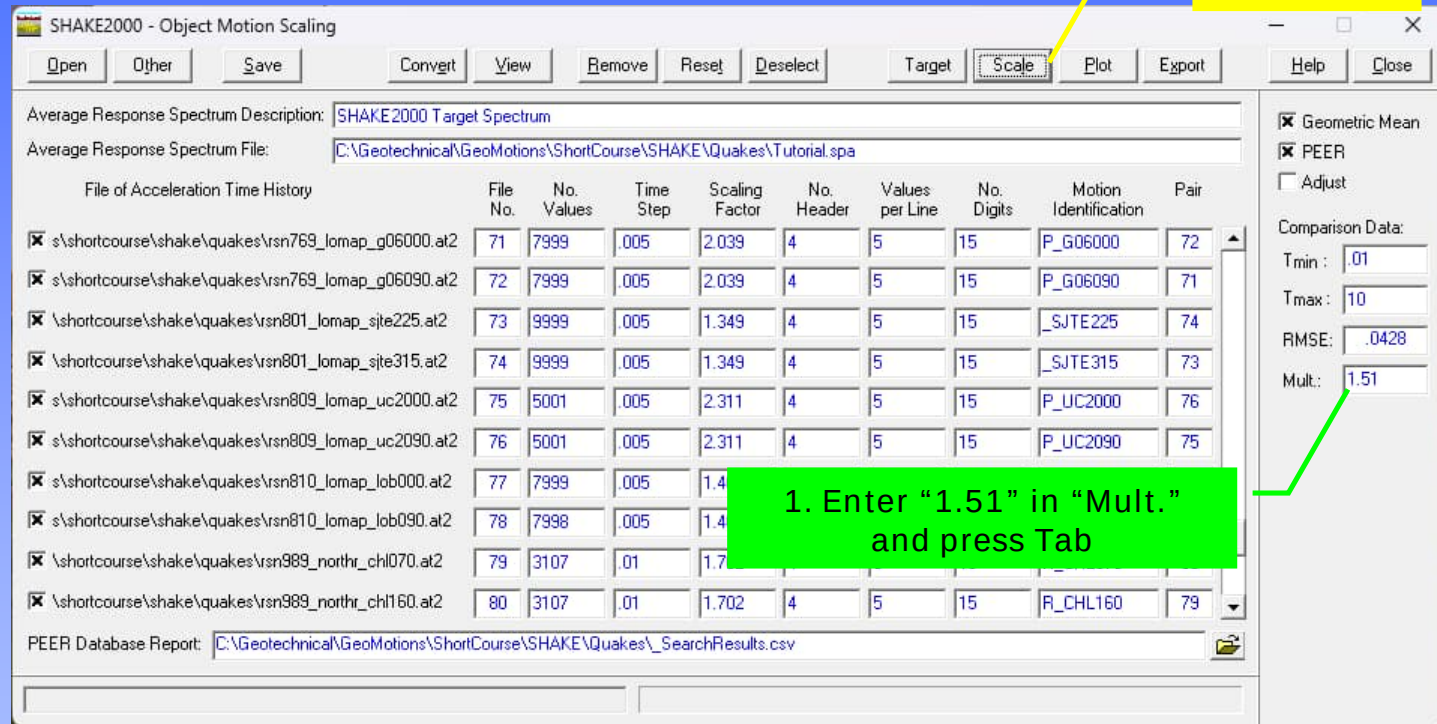
Compare Mean to Target Response Spectrum



Target PGA = 0.455867 g's

Selection of Acceleration Time Histories

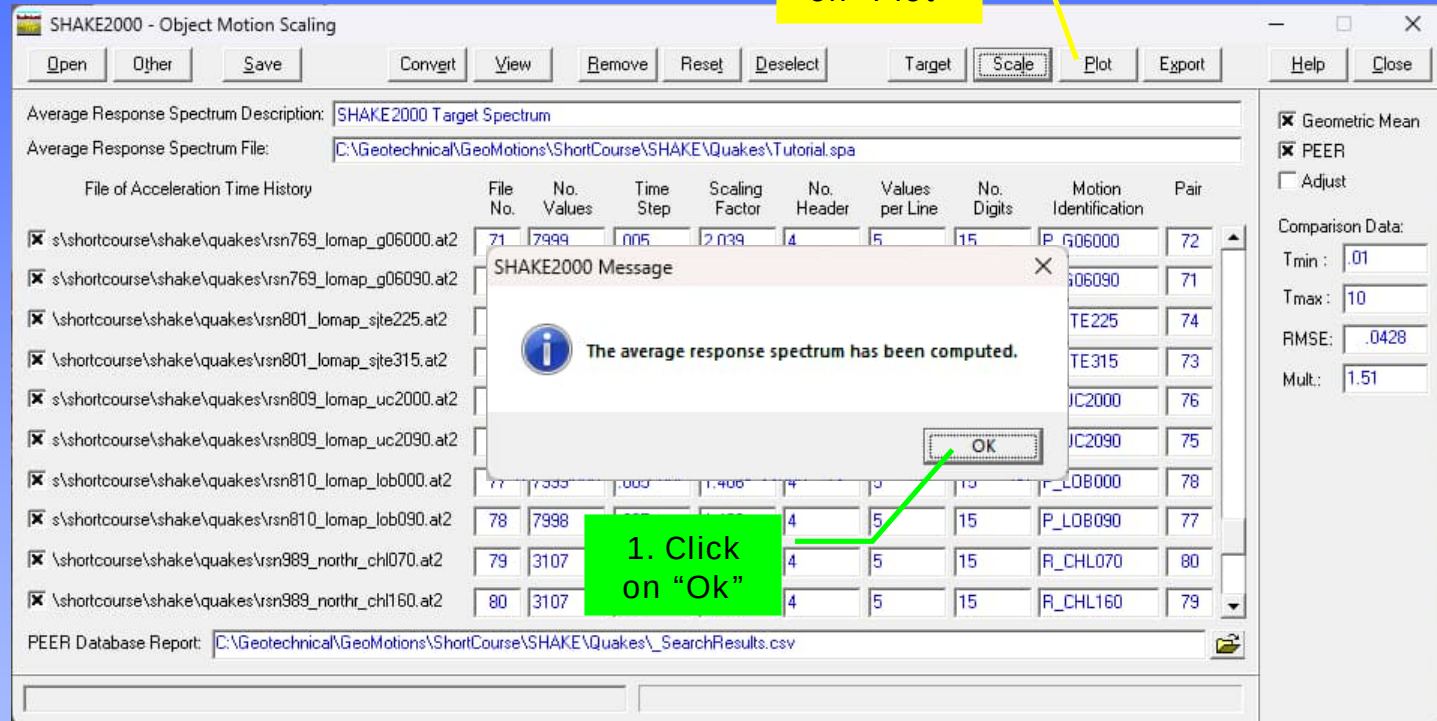
Compare to Target Response Spectrum



Selection of Acceleration Time Histories

Compare to Target Response Spectrum

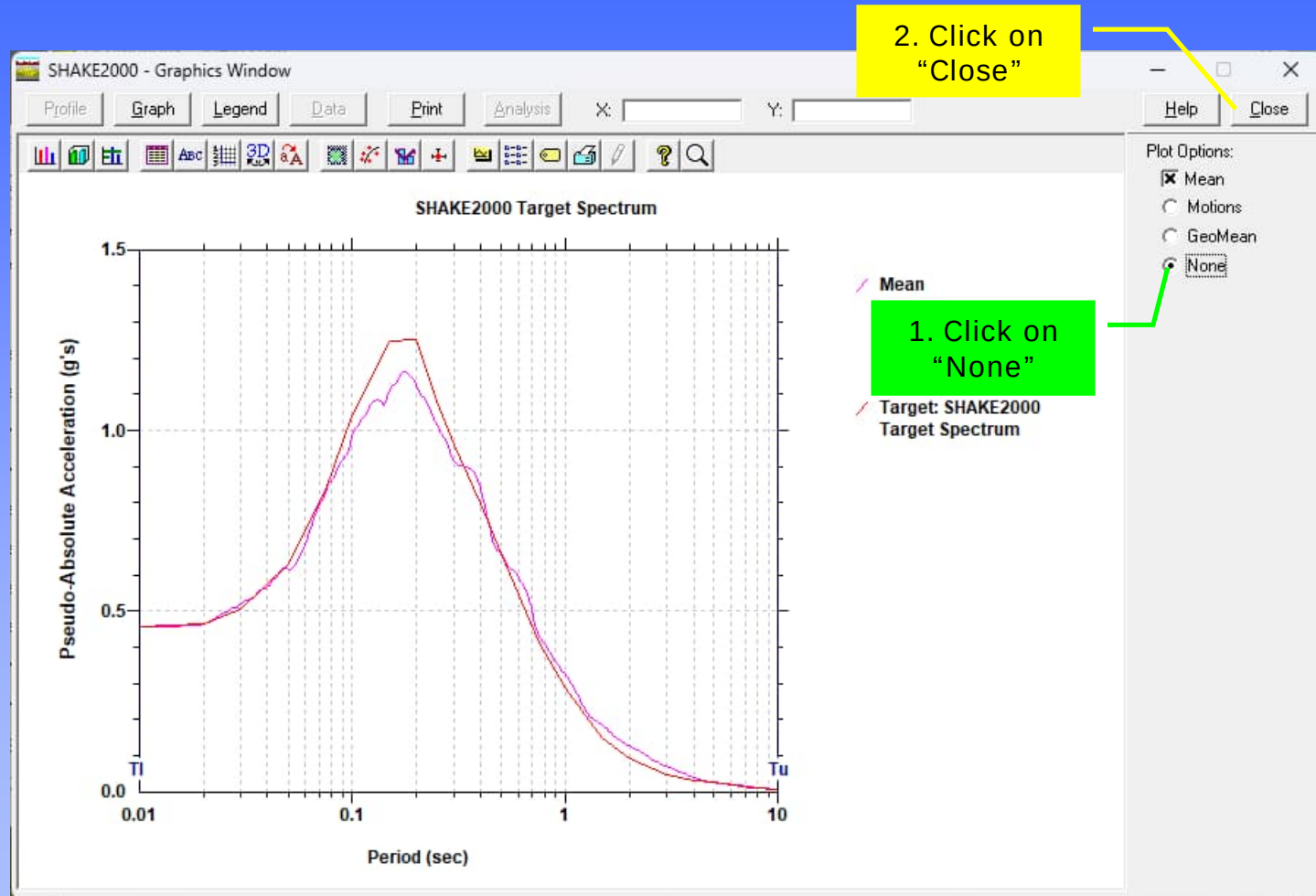
2. Click
on "Plot"



1. Click
on "Ok"

Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Trial and Error

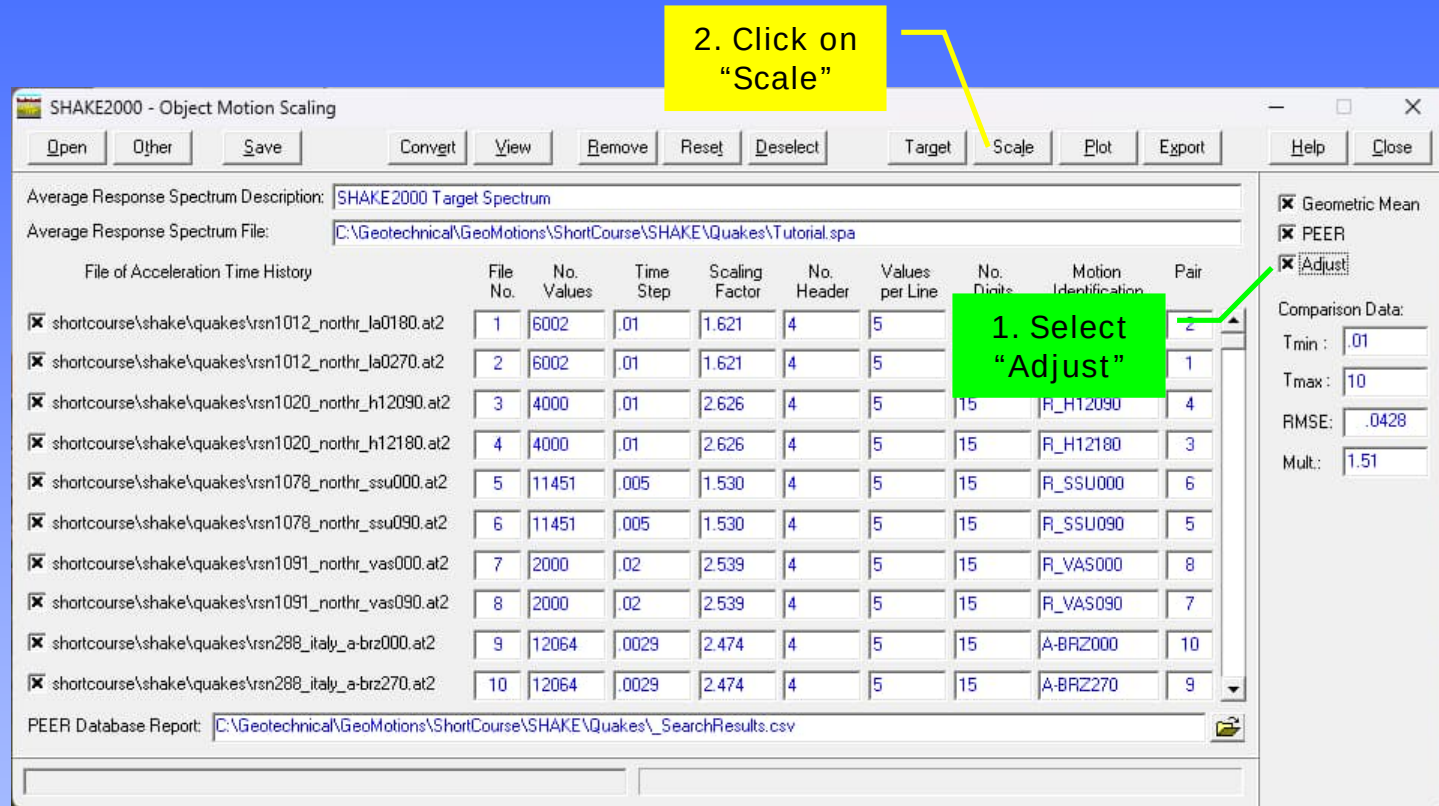
Typically, select a set of seven 2-component motions for the analysis.

To this end, first select the “Adjust” check box and let the program automatically select the factor to match the motion’s PGA to the target PGA.

Then, by trial and error select seven 2-component motions that provide the best match.

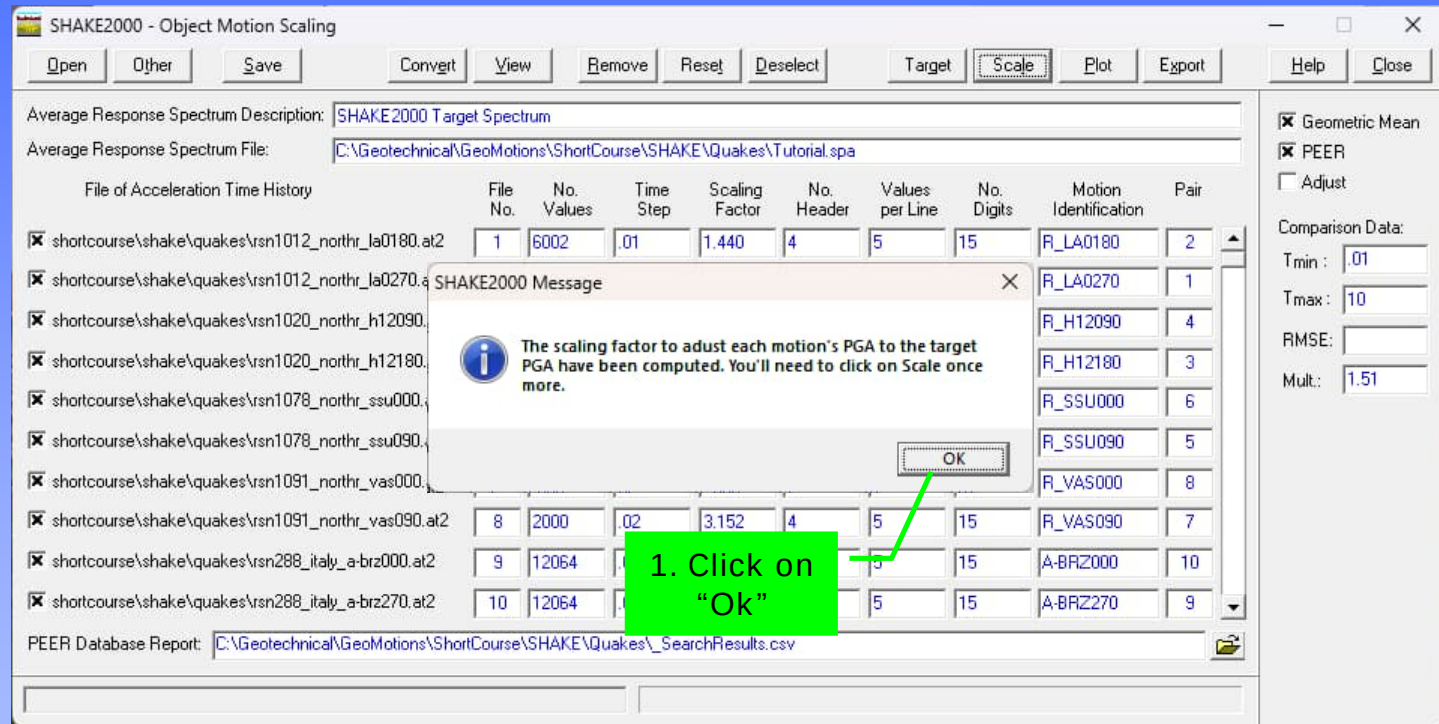
Selection of Acceleration Time Histories

Update Scaling Factor



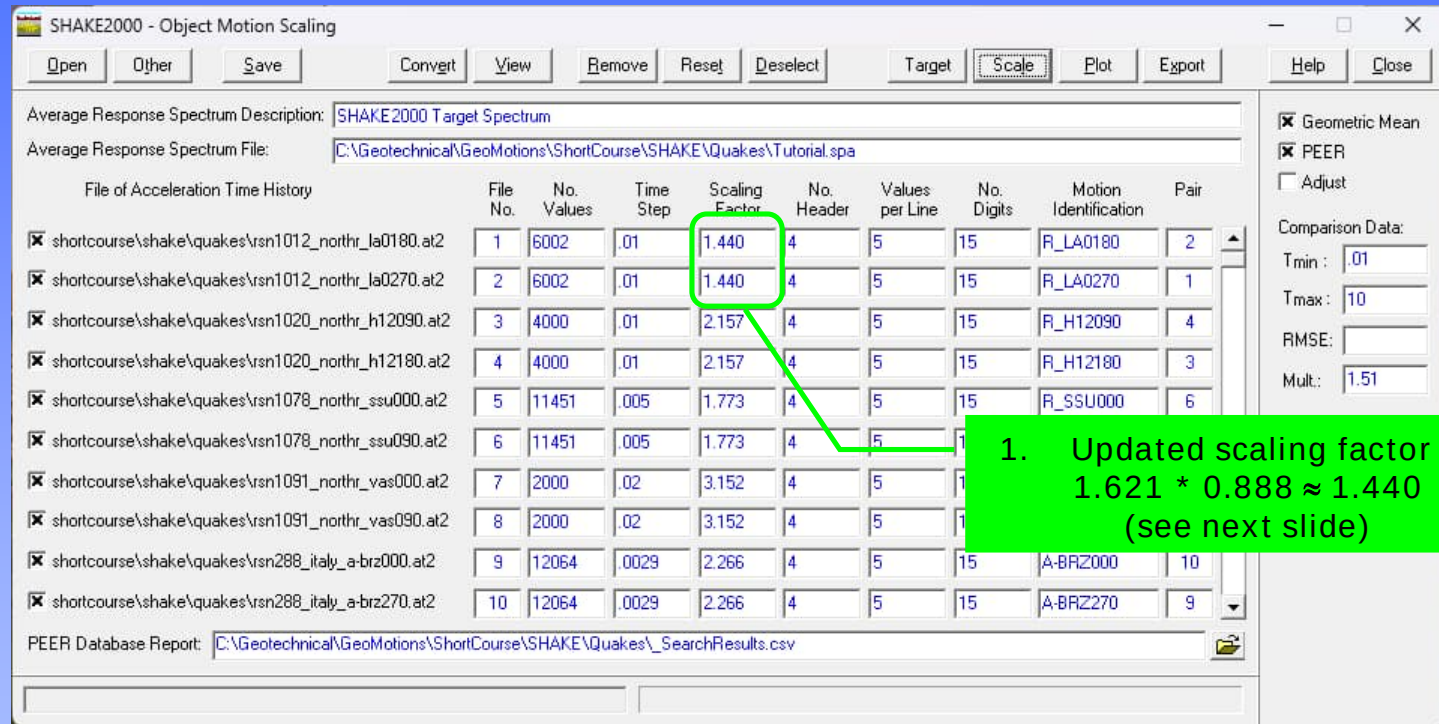
Selection of Acceleration Time Histories

Update Scaling Factor



Selection of Acceleration Time Histories

Update Scaling Factor



SHAKE2000 - Object Motion Scaling

Open Other Save Convert View Remove Reset Deselect Target **Scale** Plot Export Help Close

Average Response Spectrum Description: SHAKE2000 Target Spectrum

Average Response Spectrum File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.spa

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☒ shortcourse\shake\quakes\rsn1012_northr_la0180.at2	1	6002	.01	1.440	4	5	15	R_LA0180	2
☒ shortcourse\shake\quakes\rsn1012_northr_la0270.at2	2	6002	.01	1.440	4	5	15	R_LA0270	1
☒ shortcourse\shake\quakes\rsn1020_northr_h12090.at2	3	4000	.01	2.157	4	5	15	R_H12090	4
☒ shortcourse\shake\quakes\rsn1020_northr_h12180.at2	4	4000	.01	2.157	4	5	15	R_H12180	3
☒ shortcourse\shake\quakes\rsn1078_northr_ssu000.at2	5	11451	.005	1.773	4	5	15	R_SSU000	6
☒ shortcourse\shake\quakes\rsn1078_northr_ssu090.at2	6	11451	.005	1.773	4	5	15	R_SSU090	5
☒ shortcourse\shake\quakes\rsn1091_northr_vas000.at2	7	2000	.02	3.152	4	5	15	R_VAS000	4
☒ shortcourse\shake\quakes\rsn1091_northr_vas090.at2	8	2000	.02	3.152	4	5	15	R_VAS090	3
☒ shortcourse\shake\quakes\rsn288_italy_a-brz000.at2	9	12064	.0029	2.266	4	5	15	A-BRZ000	10
☒ shortcourse\shake\quakes\rsn288_italy_a-brz270.at2	10	12064	.0029	2.266	4	5	15	A-BRZ270	9

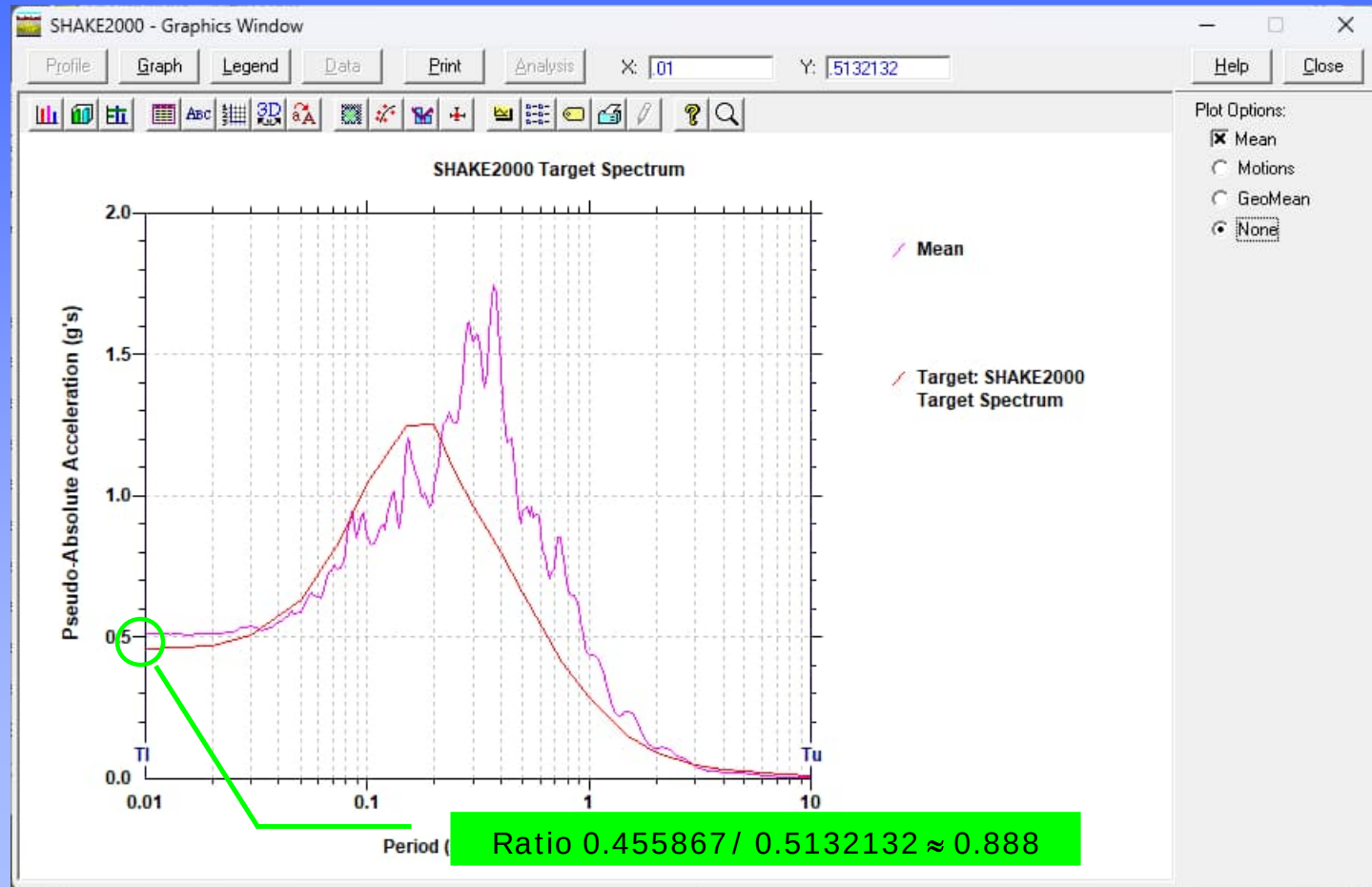
PEER Database Report: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes_SearchResults.csv

☒ Geometric Mean
☒ PEER
☐ Adjust

Comparison Data:
Tmin: .01
Tmax: 10
RMSE:
Mult: 1.51

1. Updated scaling factor to:
 $1.621 * 0.888 \approx 1.440$
(see next slide)

Selection of Acceleration Time Histories For Motions Sets 1 & 2



0.455867 g's is the target PGA, and 0.5132132 g's is the GeoMean PGA for Motions 1 & 2 when previously scaled by a factor of 1.621

Selection of Acceleration Time Histories

Update Scaling Factor

1. Click on
"Scale"

2. Click on
"Plot"

SHAKE2000 - Object Motion Scaling

Open Other Save Convert View Remove Reset Deselect Target **Scale** Plot Export Help Close

Average Response Spectrum Description: SHAKE2000 Target Spectrum

Average Response Spectrum File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.spa

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☒ shortcourse\shake\quakes\rsn1012_northr_la0180.at2	1	6002	.01	1.440	4	5	15	R_LA0180	2
☒ shortcourse\shake\quakes\rsn1012_northr_la0270.at2	2	6002	.01	1.440	4	5	15	R_LA0270	1
☒ shortcourse\shake\quakes\rsn1020_northr_h12090.at2	3	4000	.01	2.157	4	5	15	R_H12090	4
☒ shortcourse\shake\quakes\rsn1020_northr_h12180.at2	4	4000	.01	2.157	4	5	15	R_H12180	3
☒ shortcourse\shake\quakes\rsn1078_northr_ssu000.at2	5	11451	.005	1.773	4	5	15	R_SSU000	6
☒ shortcourse\shake\quakes\rsn1078_northr_ssu090.at2	6	11451	.005	1.773	4	5	15	R_SSU090	5
☒ shortcourse\shake\quakes\rsn1091_northr_vas000.at2	7	2000	.02	3.152	4	5	15	R_VAS000	8
☒ shortcourse\shake\quakes\rsn1091_northr_vas090.at2	8	2000	.02	3.152	4	5	15	R_VAS090	7
☒ shortcourse\shake\quakes\rsn288_italy_a-brz000.at2	9	12064	.0029	2.266	4	5	15	A-BRZ000	10
☒ shortcourse\shake\quakes\rsn288_italy_a-brz270.at2	10	12064	.0029	2.266	4	5	15	A-BRZ270	9

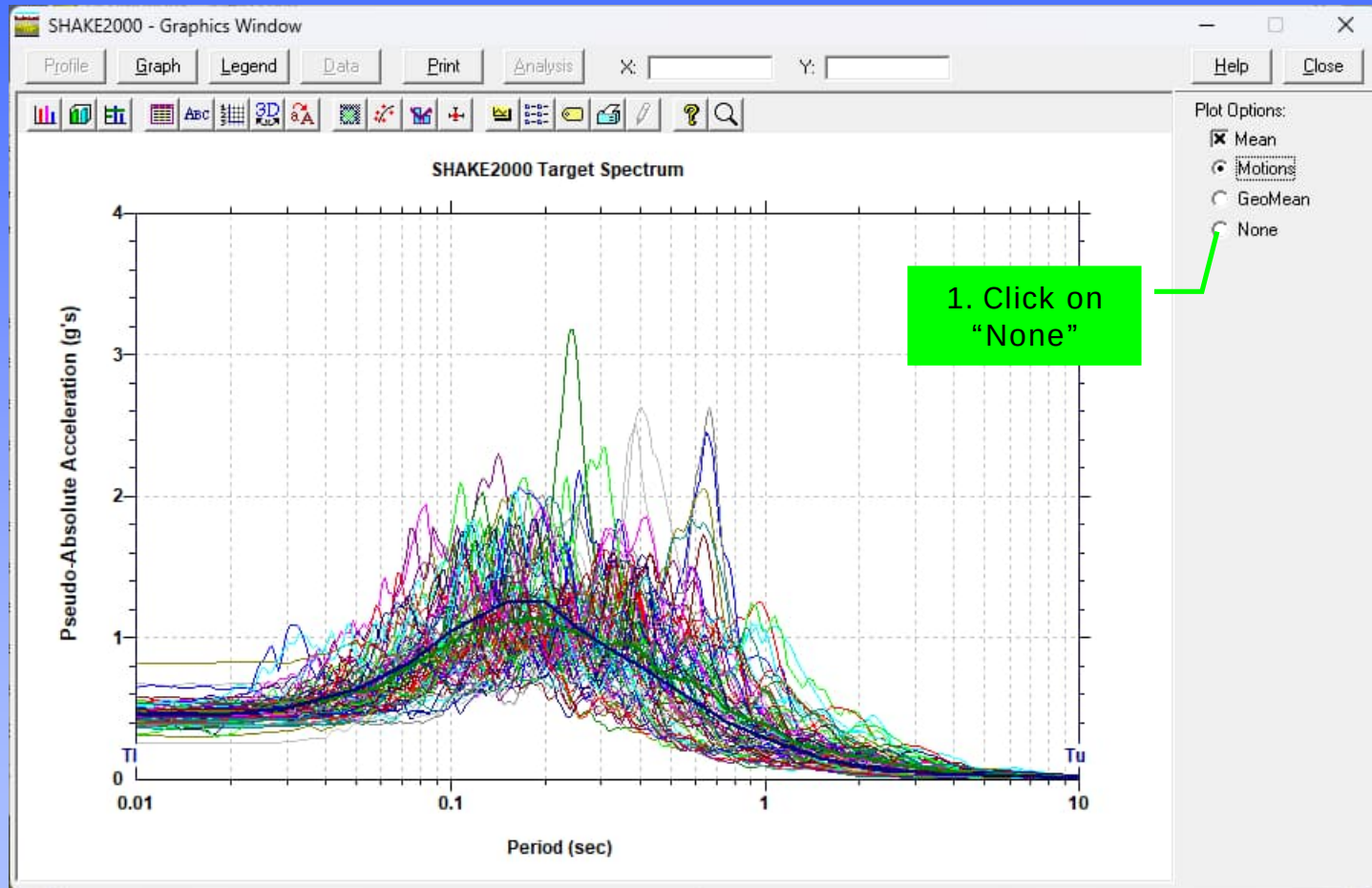
PEER Database Report: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes_SearchResults.csv

☒ Geometric Mean
☒ PEER
☐ Adjust

Comparison Data:
Tmin: .01
Tmax: 10
RMSE: .06352
Mult: 1.51

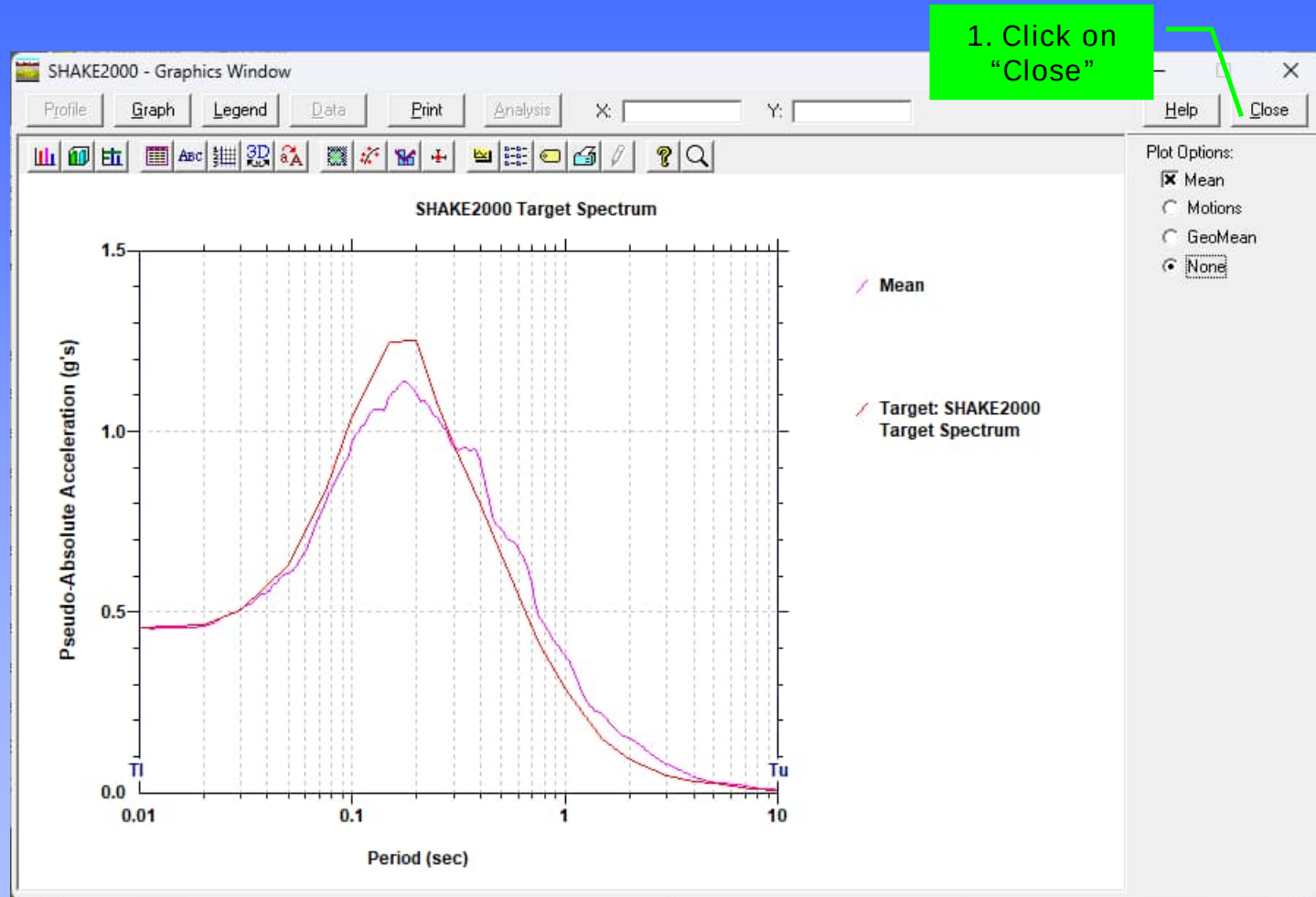
Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Trial and Error

For first trial, select the first seven 2-component sets from seven different seismic events with scaling factors ≥ 0.5 and ≤ 2

Motion	Sets
Northridge	1 & 2
Niigata	11 & 12
Chuetsu	17 & 18
Nahanni	49 & 50
Iwate	53 & 54
San Fernando	65 & 66
Loma Prieta	67 & 68

Selection of Acceleration Time Histories

Trial and Error

1. Click on "Deselect"

2. Select motions 1 & 2

3. Scroll down

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☒ shortcourse\shake\quakes\rsn1012_northr_la0180.at2	1	6002	.01	1.440	4	5	15	R_LA0180	2
☒ shortcourse\shake\quakes\rsn1012_northr_la0270.at2	2	6002	.01	1.440	4	5	15	R_LA0270	1
☐ shortcourse\shake\quakes\rsn1020_northr_h12090.at2	3	4000	.01	2.157	4	5	15	R_H12090	4
☐ shortcourse\shake\quakes\rsn1020_northr_h12180.at2	4	4000	.01	2.157	4	5	15	R_H12180	3
☐ shortcourse\shake\quakes\rsn1078_northr_ssu000.at2	5	11451	.005	1.773	4	5	15	R_SSU000	6
☐ shortcourse\shake\quakes\rsn1078_northr_ssu090.at2	6	11451	.005	1.773	4	5	15	R_SSU090	5
☐ shortcourse\shake\quakes\rsn1091_northr_vas090.at2	8	2000	.02	3.152	4	5	15	R_VAS090	7
☐ shortcourse\shake\quakes\rsn288_italy_a-brz000.at2	9	12064	.0029	2.266	4	5	15	A-BRZ000	10
☐ shortcourse\shake\quakes\rsn288_italy_a-brz270.at2	10	12064	.0029	2.266	4	5	15	A-BRZ270	9

PEER Database Report:

Comparison

☒ Geometric Mean

☒ PEER

Adjust

Tmin: .01

Tmax: 10

RMSE: .06352

Mult: 1.51

Selection of Acceleration Time Histories

Trial and Error

1. Click on "Deselect"

2. Select motions 11 & 12 and 17 & 18

3. Scroll down

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☒ rcourse\shake\quakes\rsn4213_niigata_nig023ew.at2	11	16588	.01	1.355	4	5	15	NIG023EW	12
☒ rcourse\shake\quakes\rsn4213_niigata_nig023ns.at2	12	16588	.01	1.355	4	5	15	NIG023NS	11
☐ rcourse\shake\quakes\rsn4229_niigata_nigh12ew.at2	13	36000	.005	1.192	4	5	15	NIGH12EW	14
☐ rcourse\shake\quakes\rsn4229_niigata_nigh12ns.at2	14	36000	.005	1.192	4	5	15	NIGH12NS	13
☐ rcourse\shake\quakes\rsn4842_chuetsu_65004ew.at2	15	6000	.01	2.457	4	5	15	_65004EW	16
☐ rcourse\shake\quakes\rsn4842_chuetsu_65004ns.at2	16	6000	.01	2.457	4	5	15	_65004NS	15
☒ rcourse\shake\quakes\rsn4842_chuetsu_65005ew.at2	17	6000	.01	1.197	4	5	15	_65005EW	18
☒ rcourse\shake\quakes\rsn4842_chuetsu_65005ns.at2	18	6000	.01	1.197	4	5	15	_65005NS	17
☐ rcourse\shake\quakes\rsn4843_chuetsu_65006ew.at2	19	6000	.01	2.413	4	5	15	_65006EW	20
☐ rcourse\shake\quakes\rsn4843_chuetsu_65006ns.at2	20	6000	.01	2.413	4	5	15	_65006NS	19

Comparison

☒ Geometric Mean

☒ PEER

Adjust

Tmin : .01

Tmax : 10

RMSE : .06352

Mult : 1.51

Selection of Acceleration Time Histories

Trial and Error

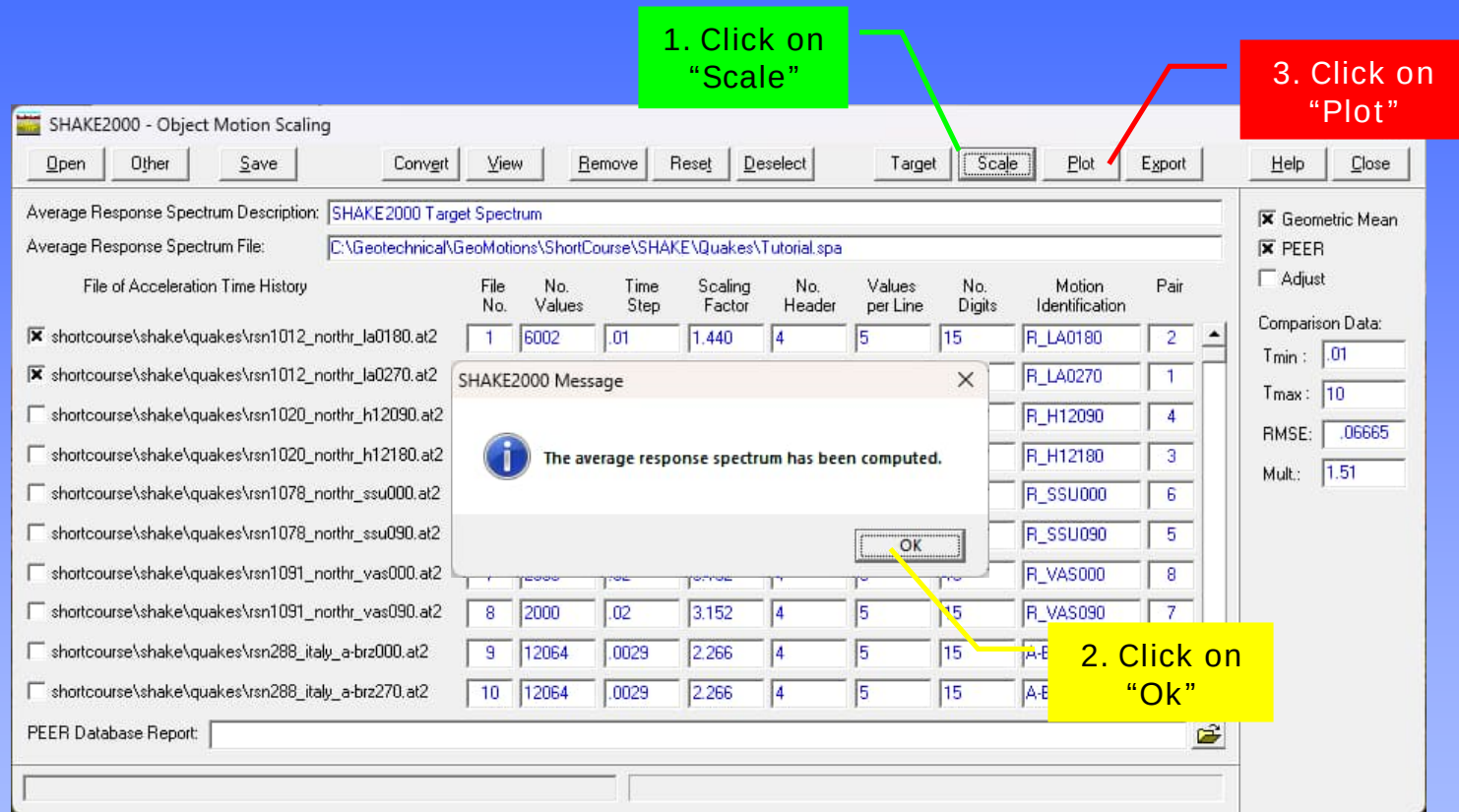
Scroll Down, use “Deselect” on every screen to clear the check boxes, and then select the remaining motions:

Motion	Sets
Nahanni	49 & 50
Iwate	53 & 54
San Fernando	65 & 66
Loma Prieta	67 & 68

After selecting the motions, scroll up to the first screen with motions 1 to 10.

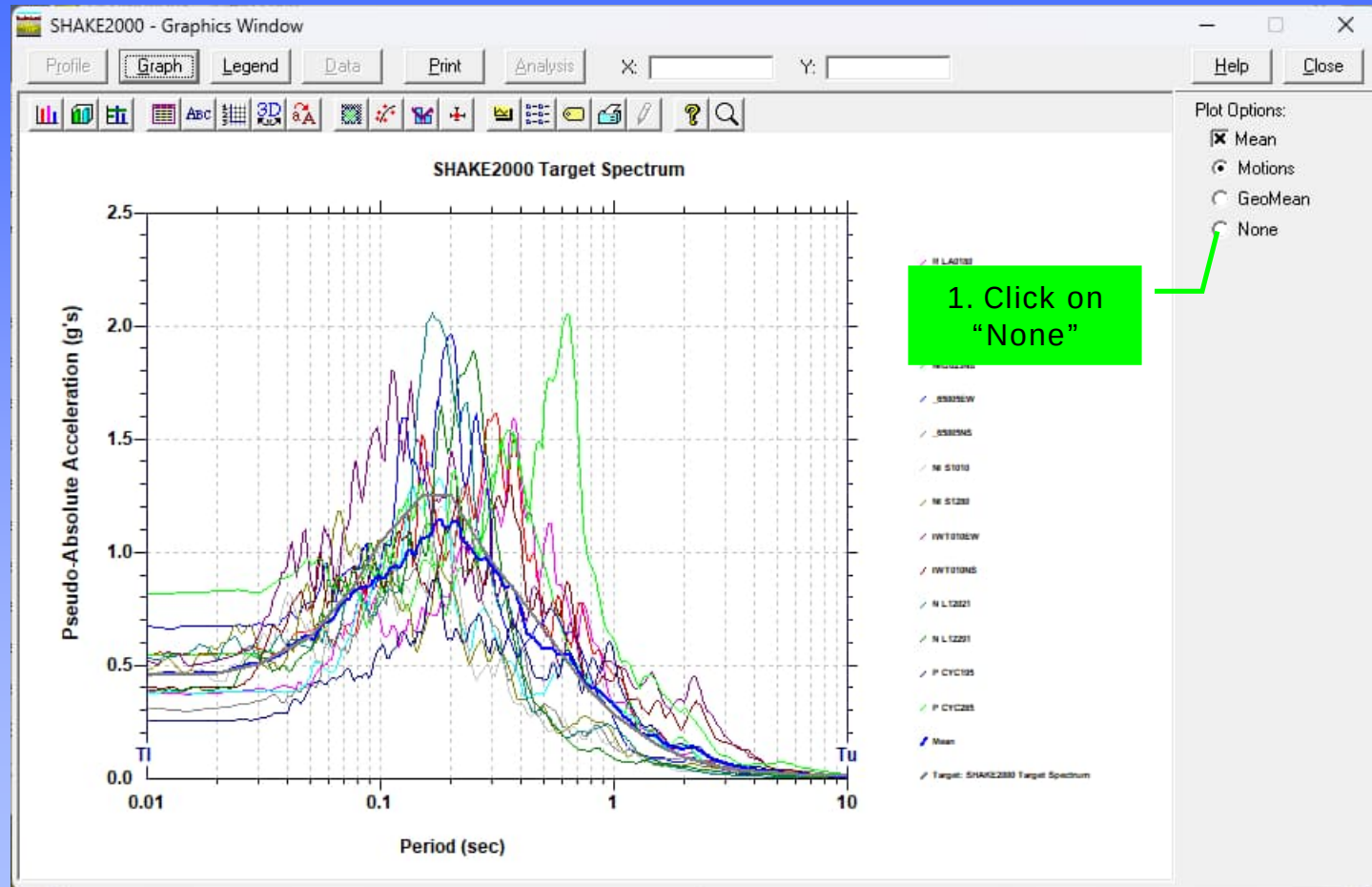
Selection of Acceleration Time Histories

Update Scaling Factor



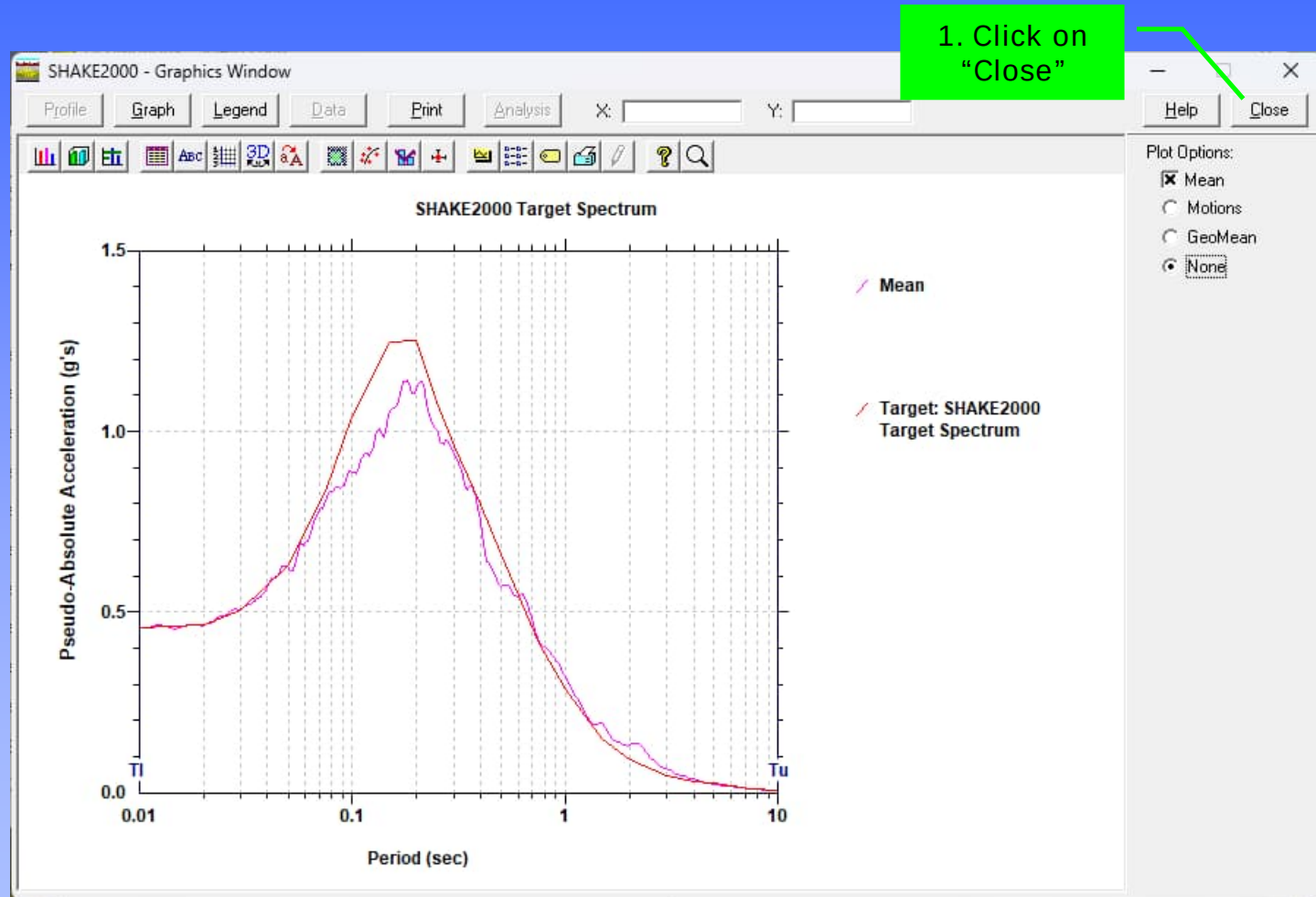
Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



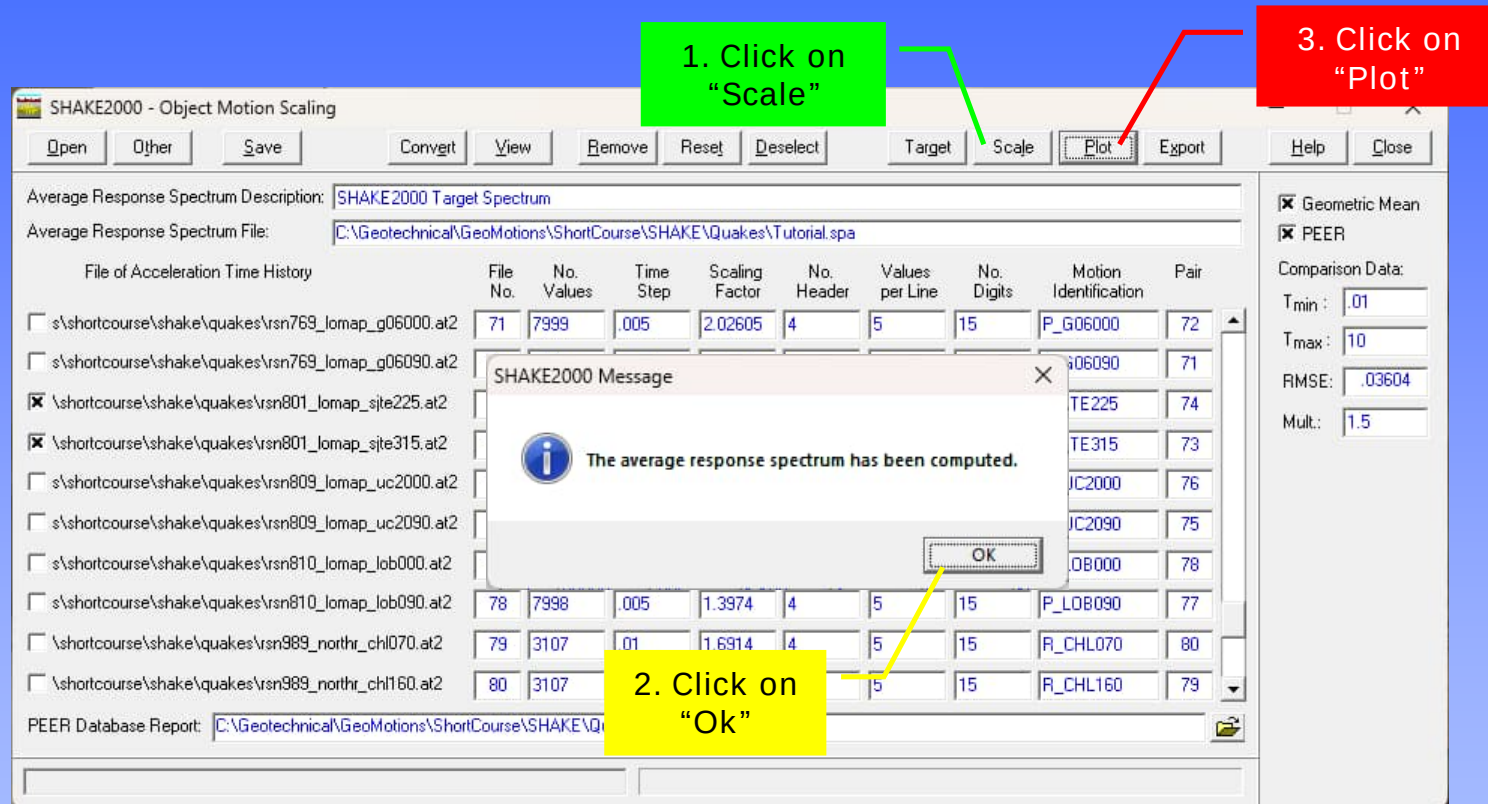
Selection of Acceleration Time Histories

After a few trials

Event	Motion Set	Scaling Factor
Northridge	5 & 6	1.775
Italy	9 & 10	2.0
Niigata	11 & 12	1.45
Chuetsu	17 & 18	1.201
Iwate	53 & 54	1.787
San Fernando	65 & 66	1.392
Loma Prieta	73 & 74	1.703

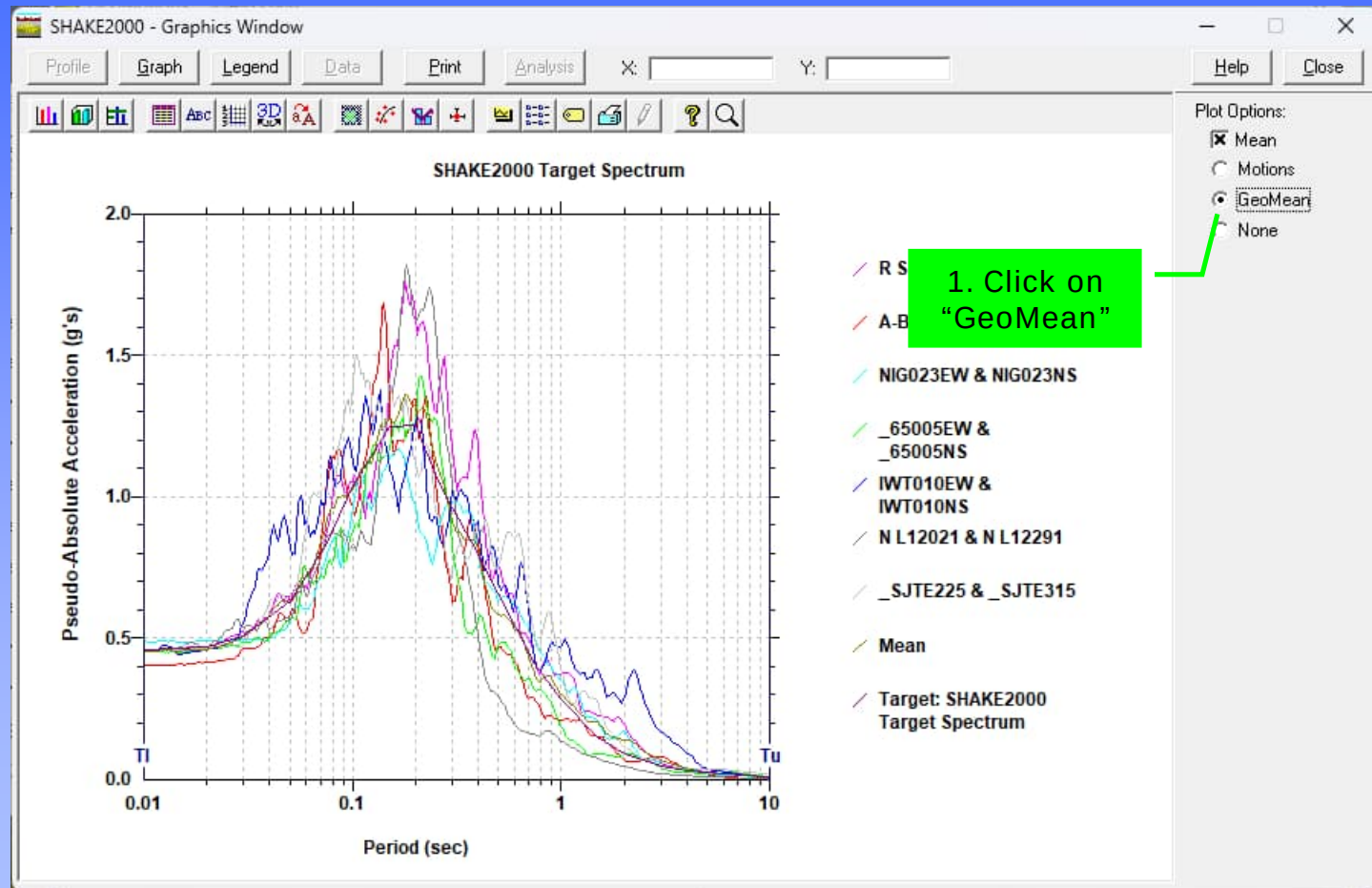
Selection of Acceleration Time Histories

Trial and Error Motion Selection



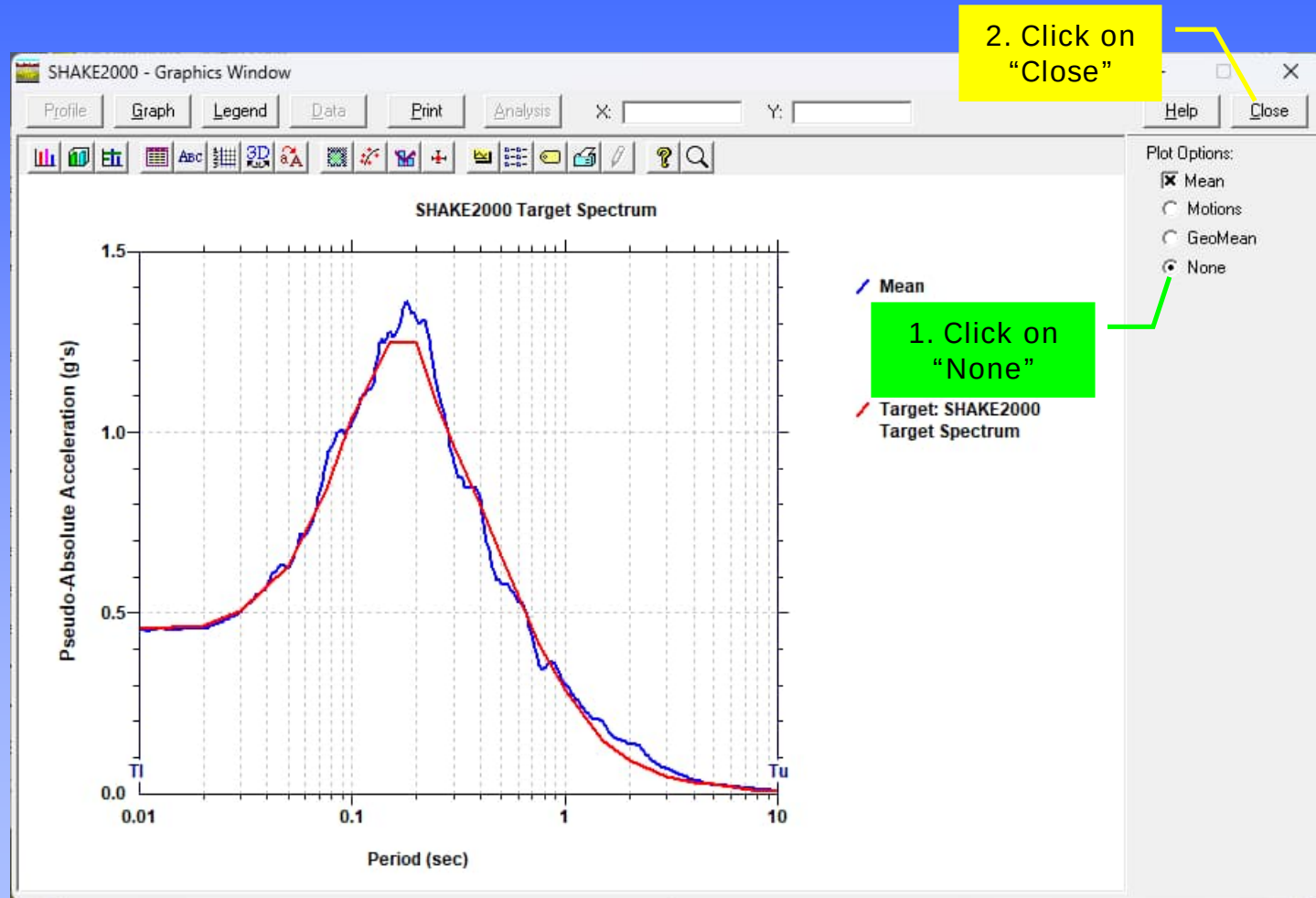
Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Trial and Error Motion Selection

1. Click on
"Save"

- Object Motion Scaling

Open Other **Save** Convert View Remove Reset Deselect Target Scale Plot Export Help Close

Average Response Spectrum Description: SHAKE2000 Target Spectrum

Average Response Spectrum File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.spa

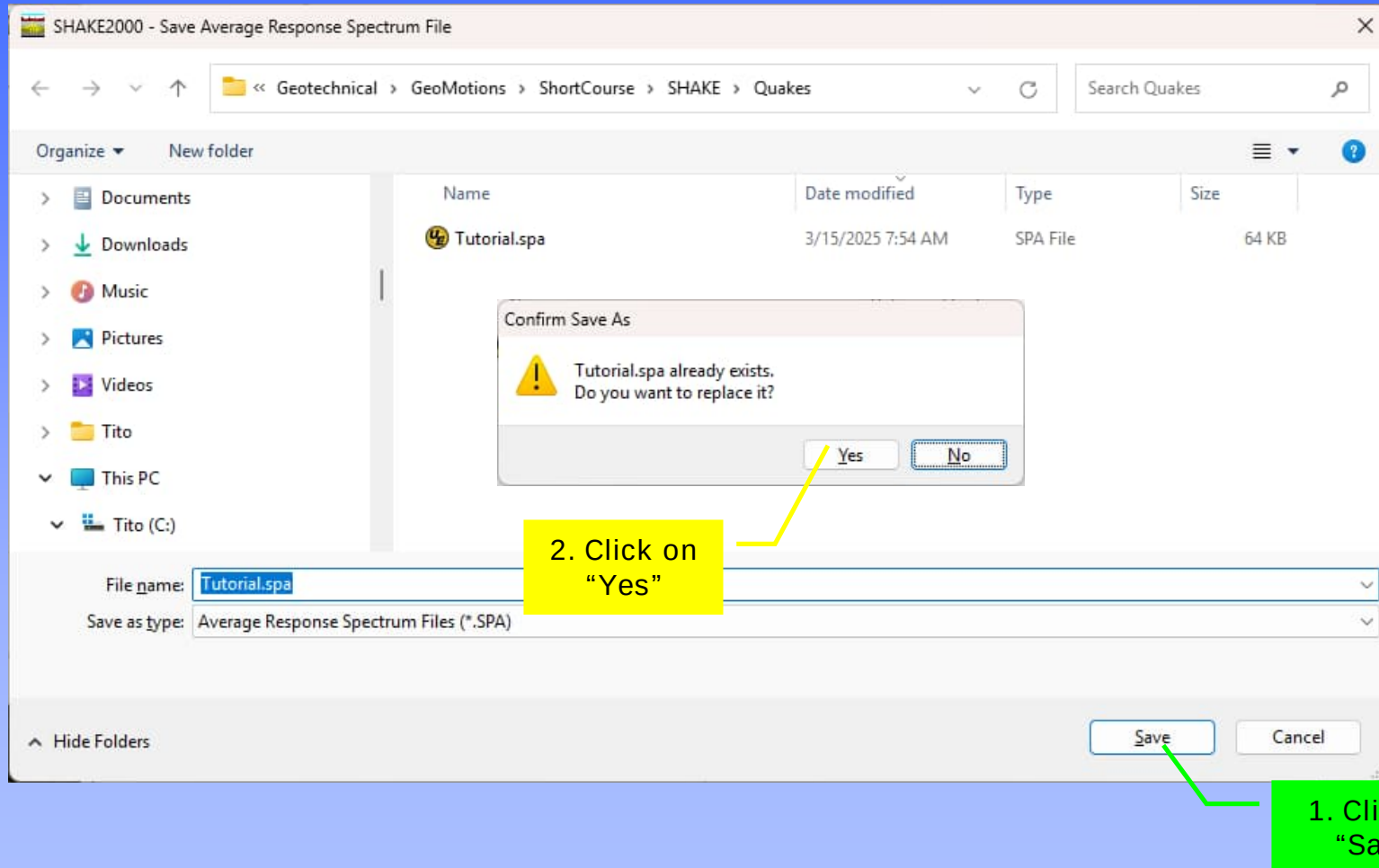
File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06000.at2	71	7999	.005	3.113	4	5	15	P_G06000	72
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06090.at2	72	7999	.005	3.113	4	5	15	P_G06090	71
☒ s:\shortcourse\shake\quakes\rsn801_lomap_site225.at2	73	9999	.005	1.703	4	5	15	_SJTE225	74
☒ s:\shortcourse\shake\quakes\rsn801_lomap_site315.at2	74	9999	.005	1.703	4	5	15	_SJTE315	73
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2000.at2	75	5001	.005	1.281	4	5	15	P_UC2000	76
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2090.at2	76	5001	.005	1.281	4	5	15	P_UC2090	75
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob000.at2	77	7999	.005	1.041	4	5	15	P_LOB000	78
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob090.at2	78	7998	.005	1.041	4	5	15	P_LOB090	77
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl070.at2	79	3107	.01	2.298	4	5	15	R_CHL070	80
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl160.at2	80	3107	.01	2.298	4	5	15	R_CHL160	79

PEER Database Report: 

☒ Geometric Mean
☒ PEER
☐ Adjust

Comparison Data:
Tmin: .01
Tmax: 10
RMSE: .03545
Mult: 1.51

Save Chosen Motions to SHAKE2000 EDT File



Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File

1. Click on
"Export"

SHAKE2000 - Object Motion Scaling

Open Other Save Convert View Remove Reset Deselect Target Scale Plot **Export** Help Close

Average Response Spectrum Description: SHAKE2000 Target Spectrum

Average Response Spectrum File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.spa

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06000.at2	71	7999	.005	3.113	4	5	15	P_G06000	72
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06090.at2	72	7999	.005	3.113	4	5	15	P_G06090	71
☒ s:\shortcourse\shake\quakes\rsn801_lomap_sj225.at2	73	9999	.005	1.703	4	5	15	_SJTE225	74
☒ s:\shortcourse\shake\quakes\rsn801_lomap_sj315.at2	74	9999	.005	1.703	4	5	15	_SJTE315	73
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2000.at2	75	5001	.005	1.281	4	5	15	P_UC2000	76
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2090.at2	76	5001	.005	1.281	4	5	15	P_UC2090	75
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob000.at2	77	7999	.005	1.041	4	5	15	P_LOB000	78
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob090.at2	78	7998	.005	1.041	4	5	15	P_LOB090	77
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl070.at2	79	3107	.01	2.298	4	5	15	R_CHL070	80
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl160.at2	80	3107	.01	2.298	4	5	15	R_CHL160	79

PEER Database Report:

Comparison Data:
Tmin: .01
Tmax: 10
RMSE: .03545
Mult: 1.51

Save Ground Motion Scaling Data

The screenshot shows the 'SHAKE2000 - Create EDT File' dialog box. The file path is set to 'Tito (C:) > Geotechnical > GeoMotions > ShortCourse > SHAKE'. The left sidebar shows a tree of folders, with 'SHAKE' selected. The main pane shows a table of folders: 'Quakes' (modified 3/14/2025 4:33 PM) and 'USGS' (modified 10/5/2024 11:27 AM). The 'File name' field contains 'SHAKE_Tutorial' and the 'Save as type' is 'Edit File (*.EDT)'. The 'Save' button is highlighted.

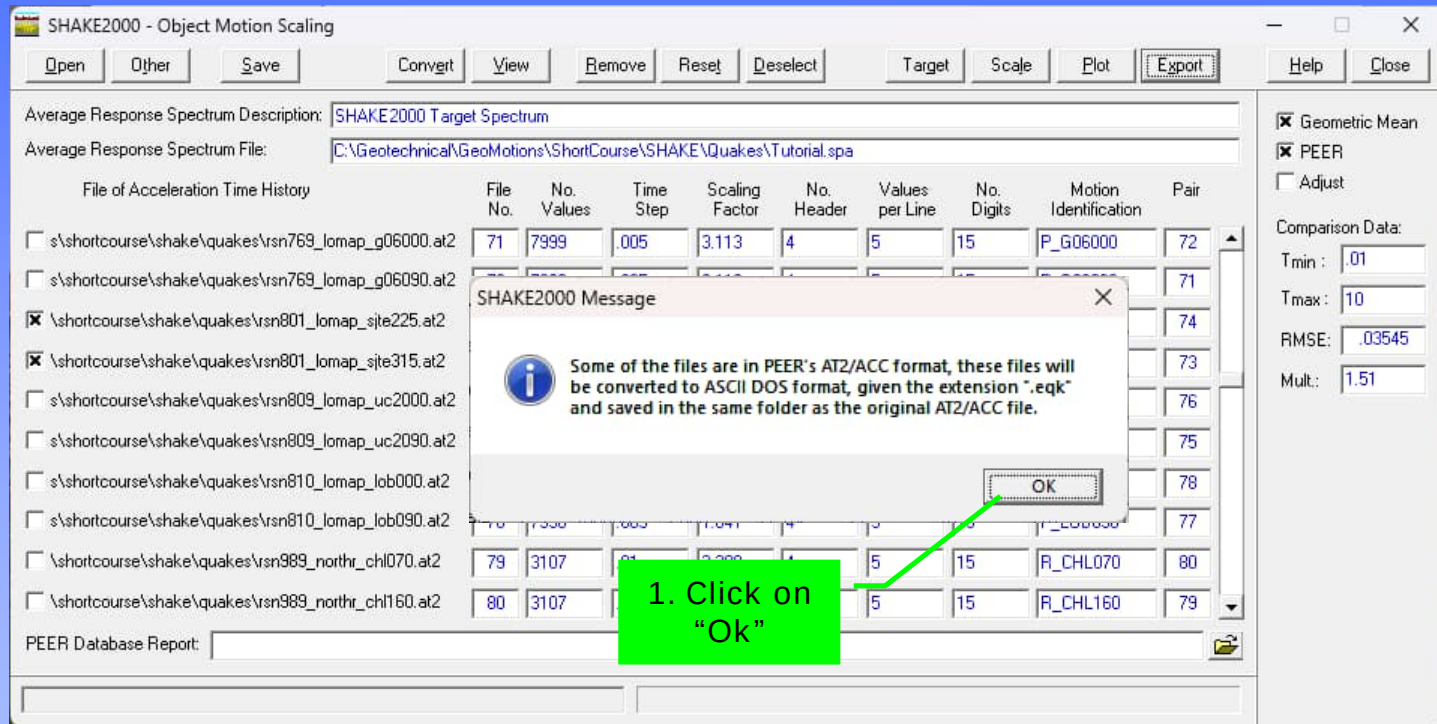
1. Switch folders until you change to "GeoMotions\ShortCourse\SHAKE"

2. Enter "SHAKE_Tutorial" in "File name"

3. Click on "Save"

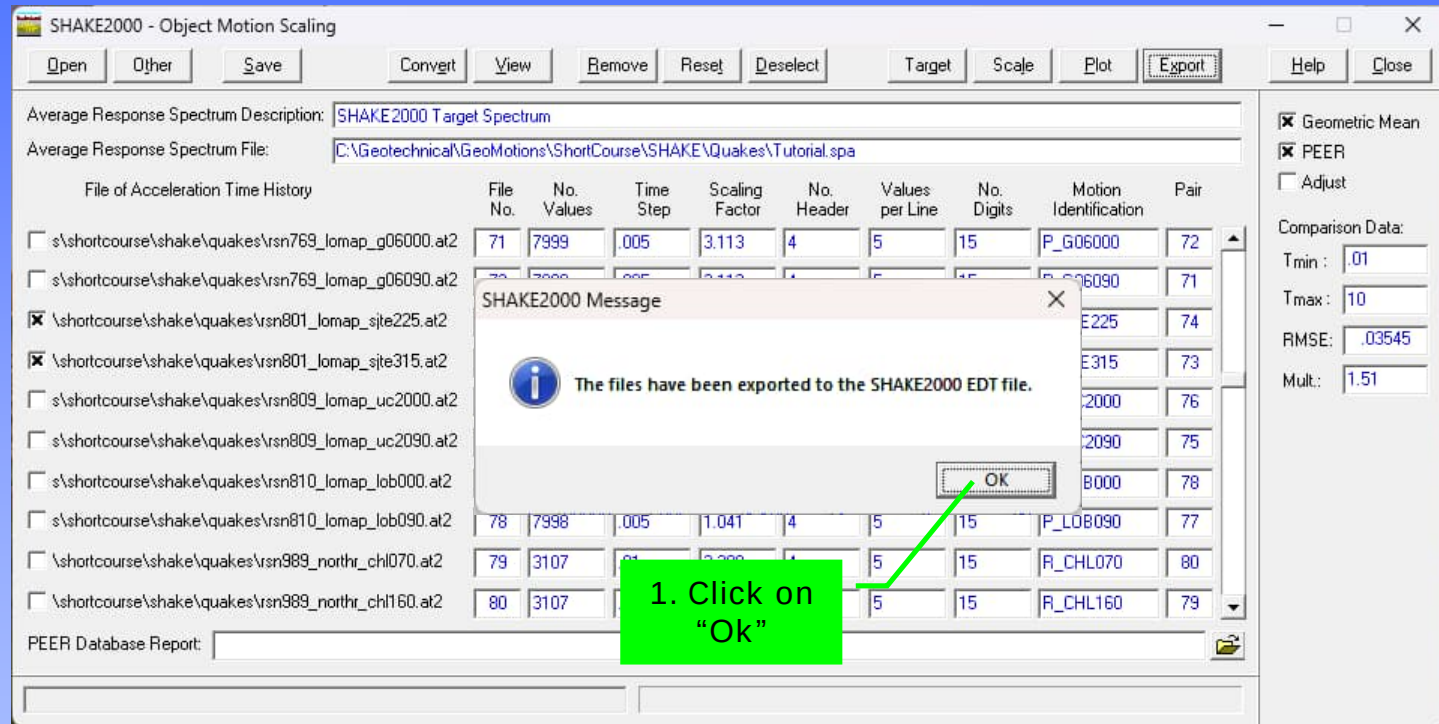
Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File



Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File



Selection of Acceleration Time Histories

1. Click on
"Close"

SHAKE2000 - Object Motion Scaling

Open Other Save Convert View Remove Reset Deselect Target Scale Plot Export Help Close

Average Response Spectrum Description: SHAKE2000 Target Spectrum

Average Response Spectrum File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.spa

File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06000.at2	71	7999	.005	3.113	4	5	15	P_G06000	72
☐ s:\shortcourse\shake\quakes\rsn769_lomap_g06090.at2	72	7999	.005	3.113	4	5	15	P_G06090	71
☒ s:\shortcourse\shake\quakes\rsn801_lomap_site225.at2	73	9999	.005	1.703	4	5	15	_SJTE225	74
☒ s:\shortcourse\shake\quakes\rsn801_lomap_site315.at2	74	9999	.005	1.703	4	5	15	_SJTE315	73
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2000.at2	75	5001	.005	1.281	4	5	15	P_UC2000	76
☐ s:\shortcourse\shake\quakes\rsn809_lomap_uc2090.at2	76	5001	.005	1.281	4	5	15	P_UC2090	75
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob000.at2	77	7999	.005	1.041	4	5	15	P_LOB000	78
☐ s:\shortcourse\shake\quakes\rsn810_lomap_lob090.at2	78	7998	.005	1.041	4	5	15	P_LOB090	77
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl070.at2	79	3107	.01	2.298	4	5	15	R_CHL070	80
☐ s:\shortcourse\shake\quakes\rsn989_northr_chl160.at2	80	3107	.01	2.298	4	5	15	R_CHL160	79

PEER Database Report:

☒ Geometric Mean
☒ PEER
☐ Adjust

Comparison Data:

Tmin: .01

Tmax: 10

RMSE: .03545

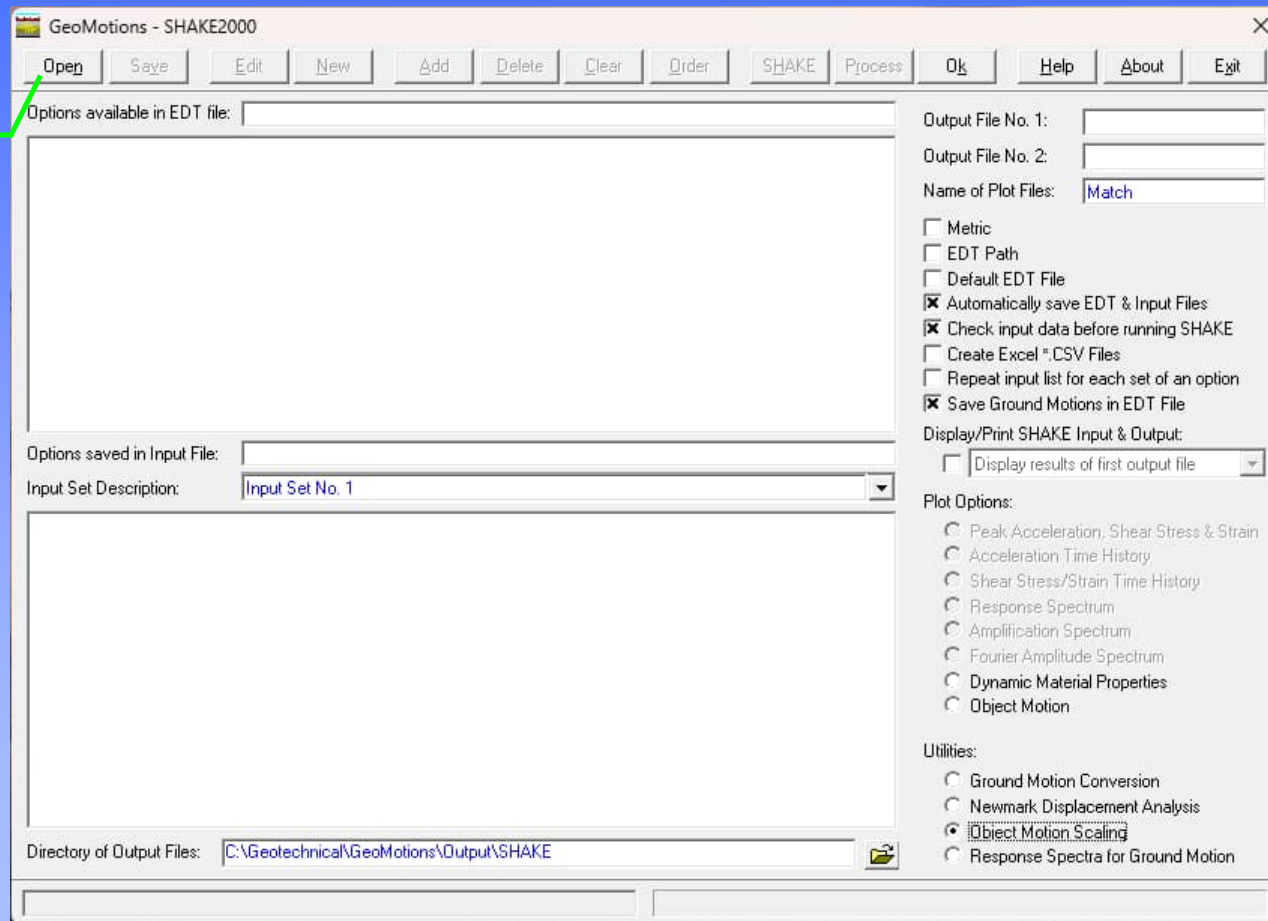
Mult: 1.51

Site-Specific Analysis - Step 6

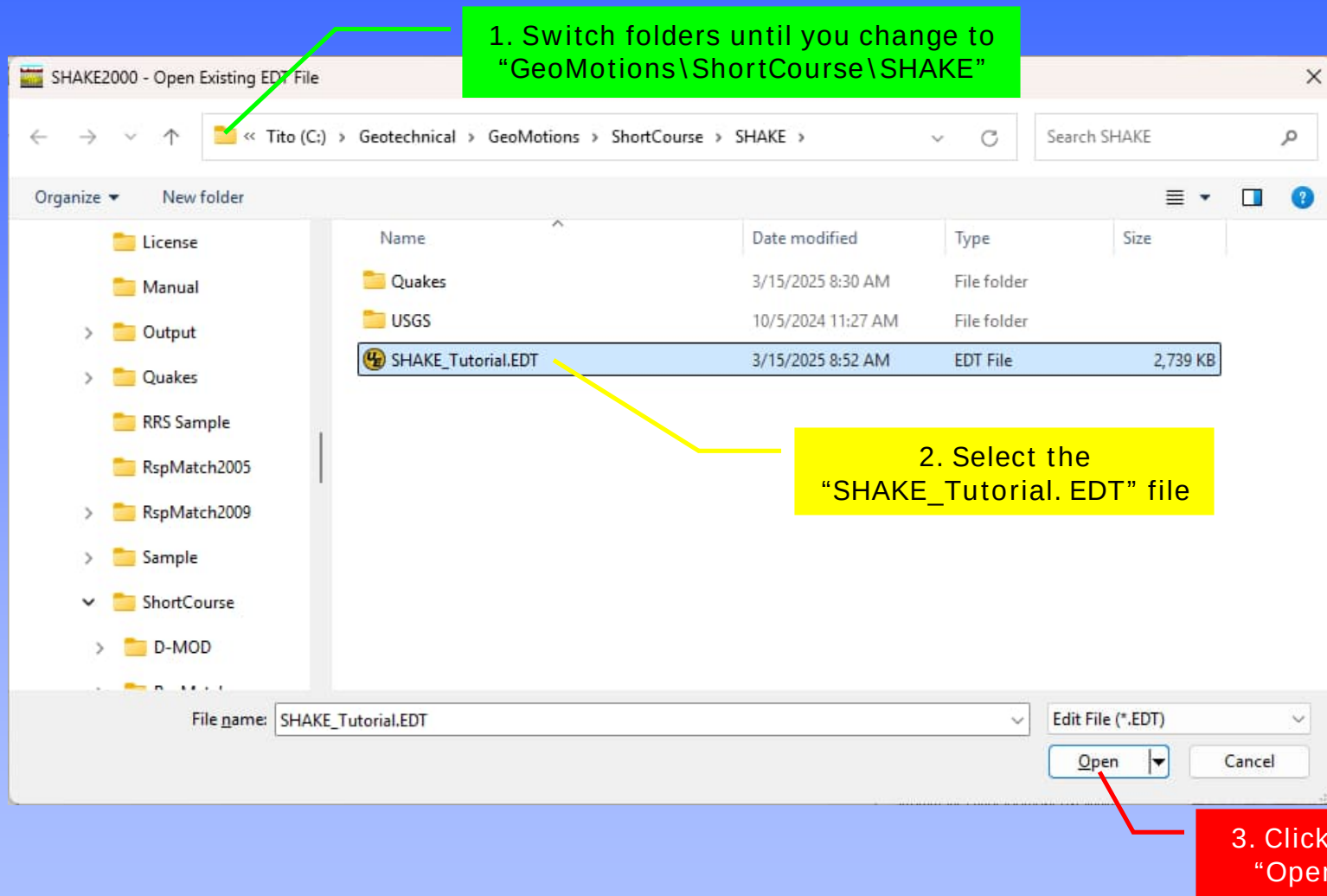
Use SHAKE to conduct the site-response analysis

Site Specific Response Analysis

1. Click on
"Open"

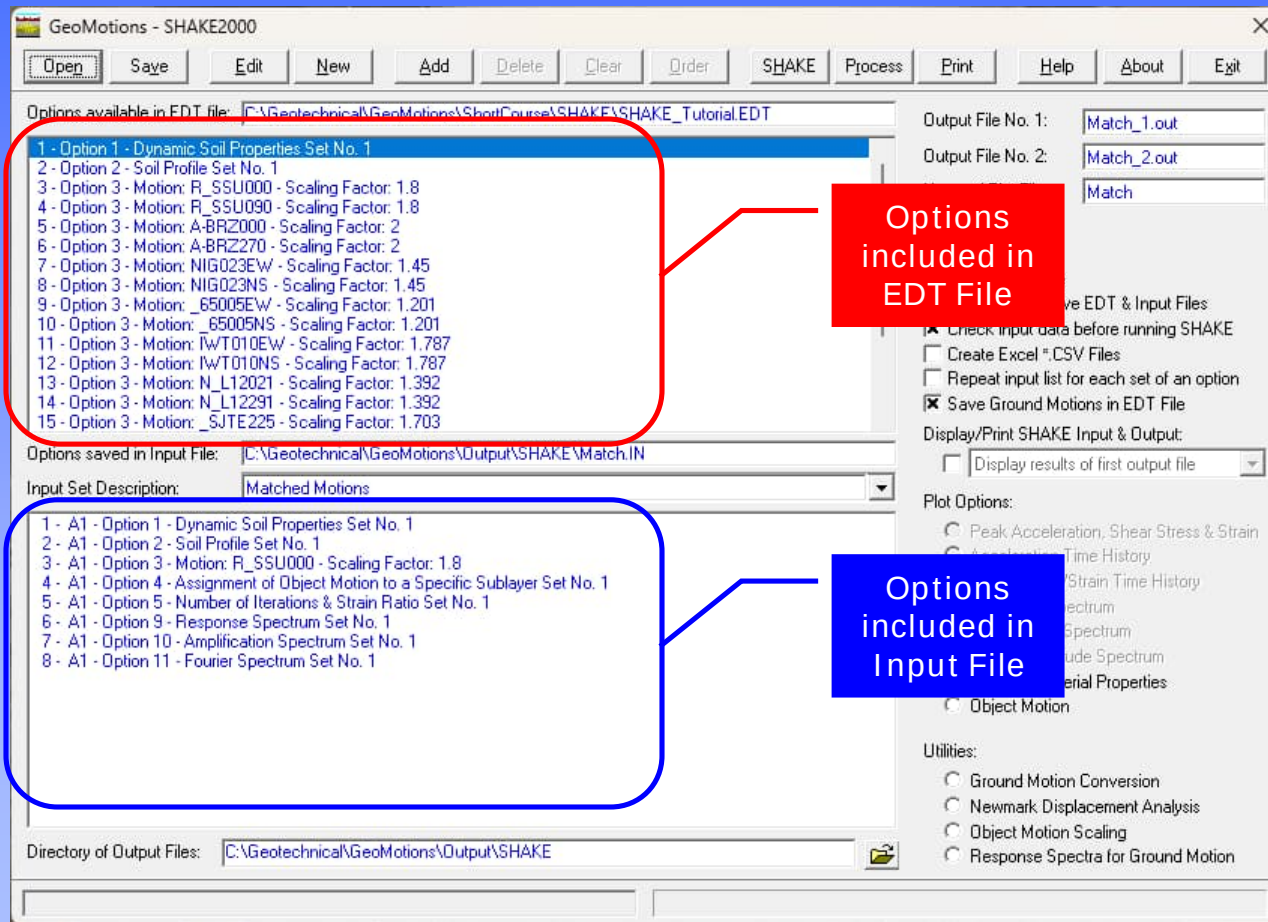


Open Existing SHAKE2000 EDT File



Site Specific Response Analysis

Create SHAKE Options



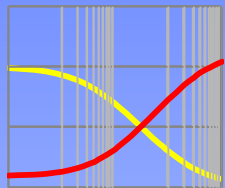
Site Specific Response Analysis

SHAKE Options

Option	Input	Analysis	Description
1	x		Dynamic Soil Properties
2	x		Soil Profile
3	x		Input (Object) Motion
4	x		Assignment of Object Motion
5	x		No. Iterations & Strain Ratio
6		x	PGA & Time Histories
7		x	Stress & Strain Time Histories
9		x	Response Spectra
10		x	Amplification Spectra
11		x	Fourier Spectra

Site Specific Response Analysis

SHAKE Column Options



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, Thickness,
Damping, γ_{total} , G_{max} or V_s

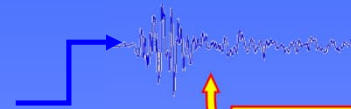
Option 2

Soil Layer n-1

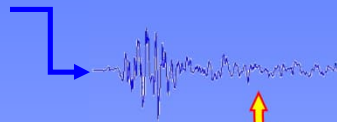
Soil Layer n

Halfspace Layer

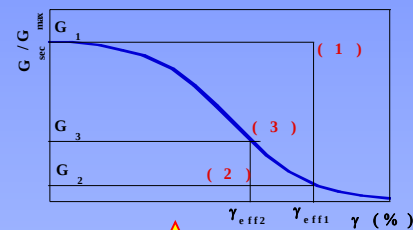
Option 4



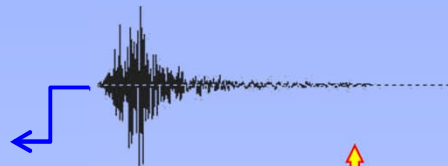
Option 6



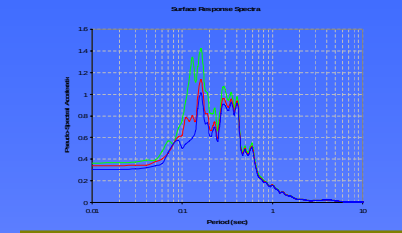
Option 7



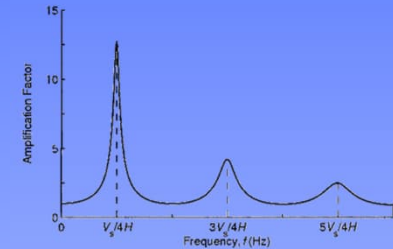
Option 5



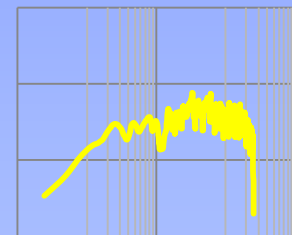
Option 3



Option 9



Option 10



Option 11

EDT and Input Data Files

- An EDT file is a database file that stores the data for the different SHAKE options. These options are used by SHAKE2000 to create an input file.
- A maximum of 32,000 options can be saved in the EDT file.
- The options are saved sequentially.
- Files used in SHAKE91 can be read as EDT files.
- Listing of options used in the input file are saved in the EDT file.
- The input file stores the different options that will be executed by SHAKE.

SHAKE2000 EDT & Input Files

EDT File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 2 – Column No. 2
Option 3 – Input Motion: LomaPrieta.eq
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 4 – Column No. 2 – Layer 13
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 6 – Layers 1-13 – Column 3
Option 7 – Layer 4 – Column 1
Option 7 – Layer 3 – Column 3
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 10 – Layers 13-1 – Column 3
Option 11 – Layers 21-1 – Column 1
Option 11 – Layers 13-1 – Column 3

Input File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 3 – Input Motion: LomaPrieta.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

SHAKE2000 EDT & Input Files

EDT File

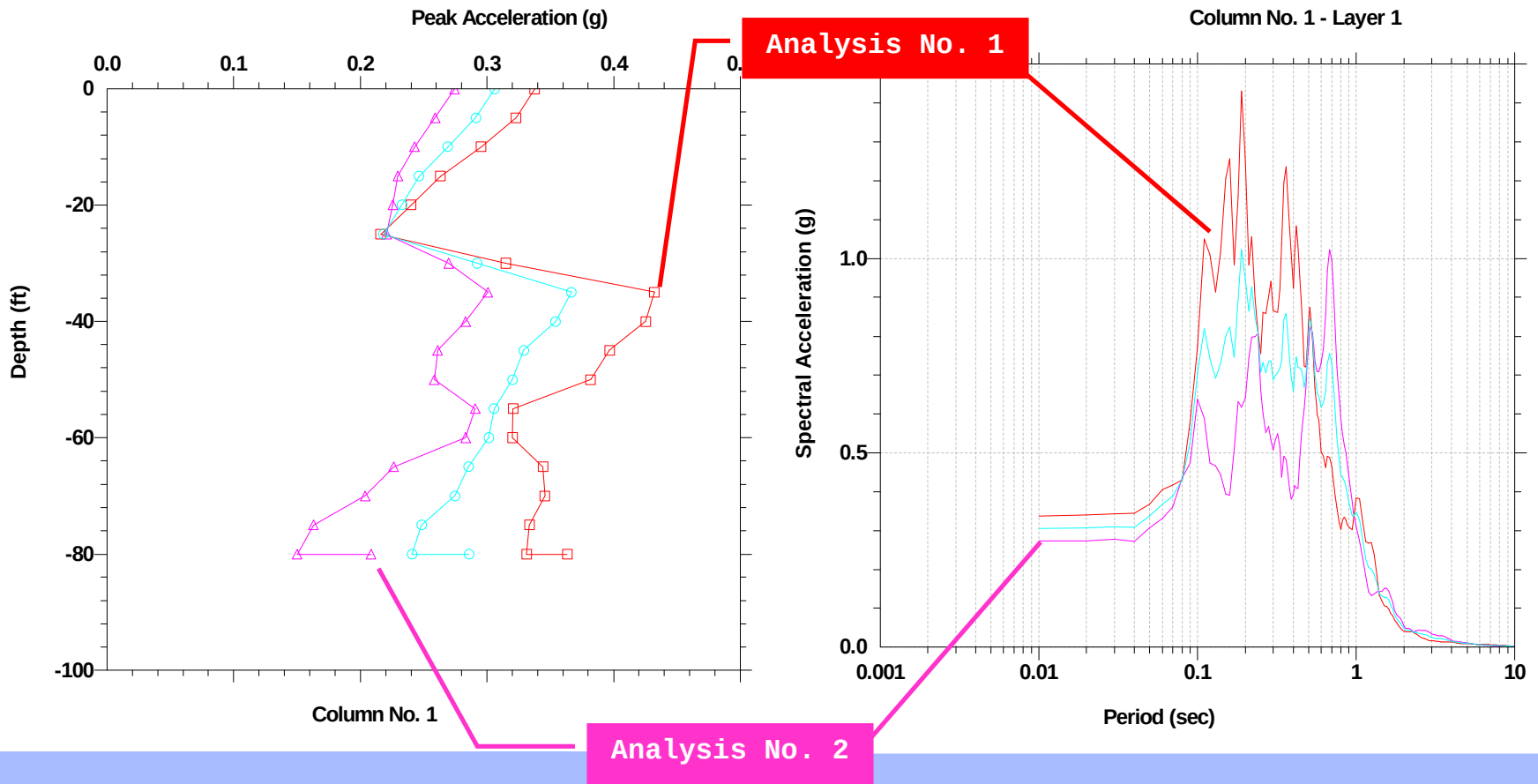
Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1 **Analysis No. 1**
Option 2 – Column No. 2
Option 3 – Input Motion: LomaPrieta.eq
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 4 – Column No. 2 – Layer 13
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 6 – Layers 1-13 – Column 2
Option 7 – Layer 4 – Column 1 **Analysis No. 2**
Option 7 – Layer 3 – Column 3
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 10 – Layers 13-1 – Column 3
Option 11 – Layers 21-1 – Column 1
Option 11 – Layers 13-1 – Column 3

Input File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 3 – Input Motion: LomaPrieta.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

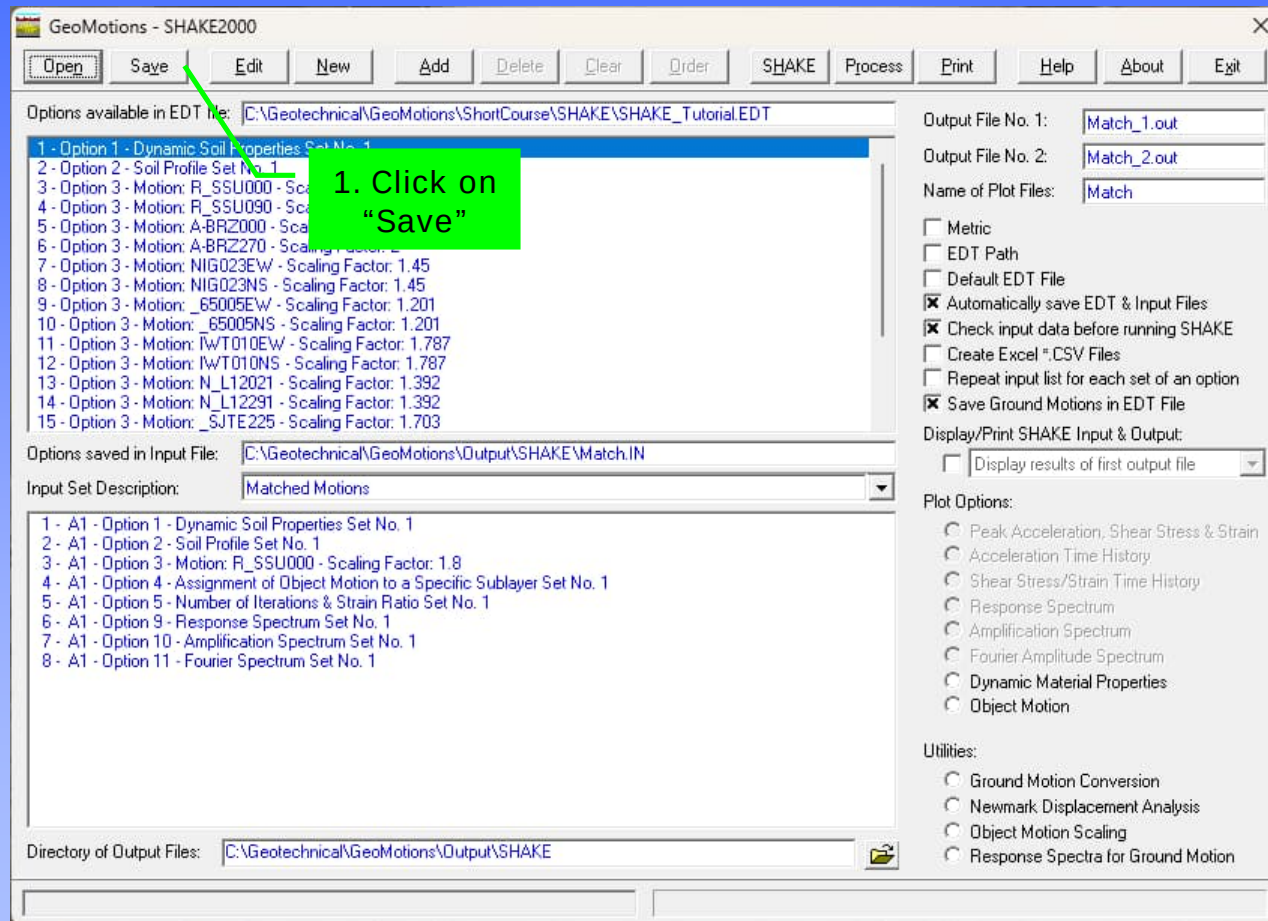
Option 2 – Column No. 1
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

SHAKE Analyses



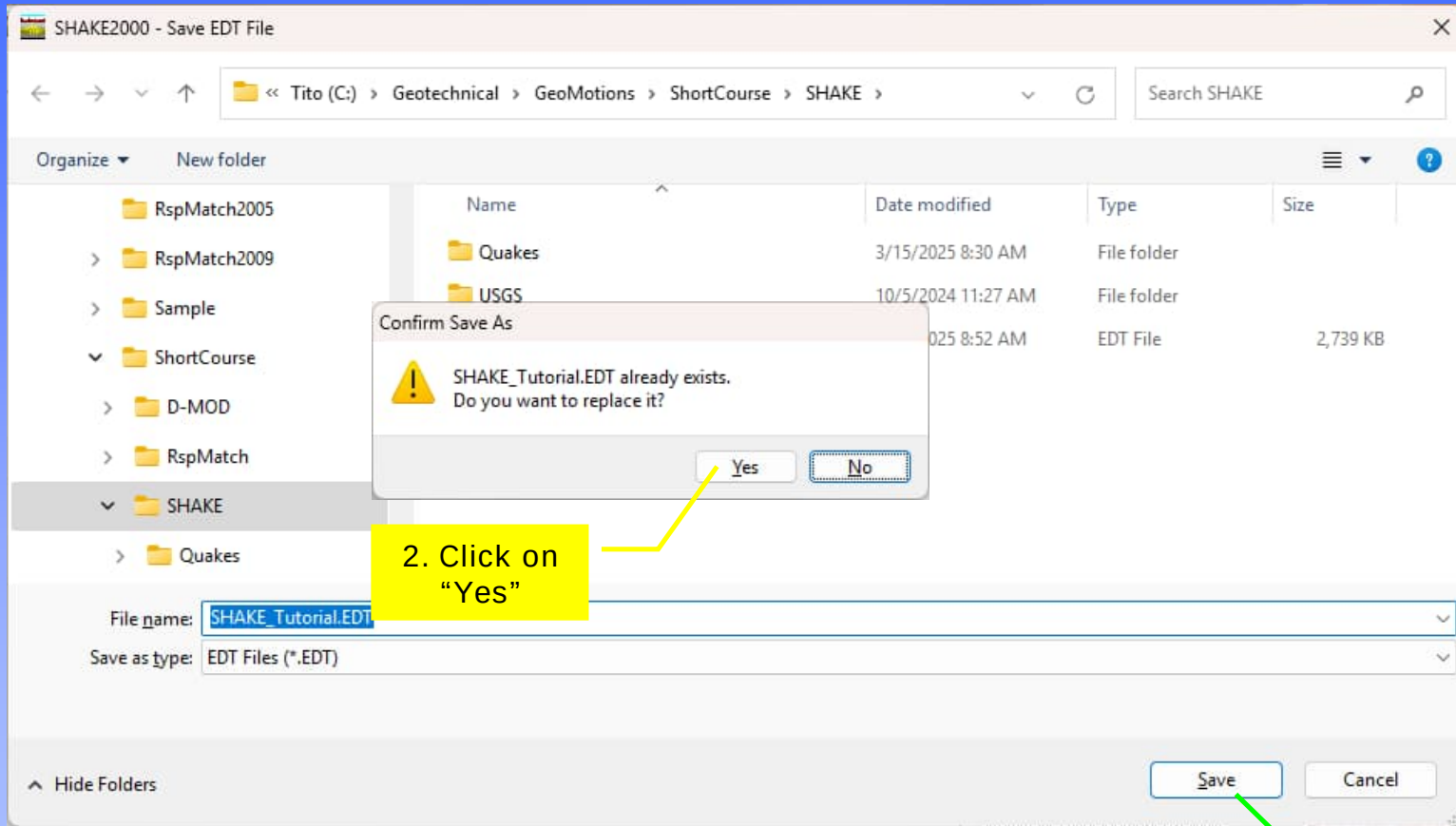
Site Specific Response Analysis

Create Input File



Site Specific Response Analysis

Save EDT File

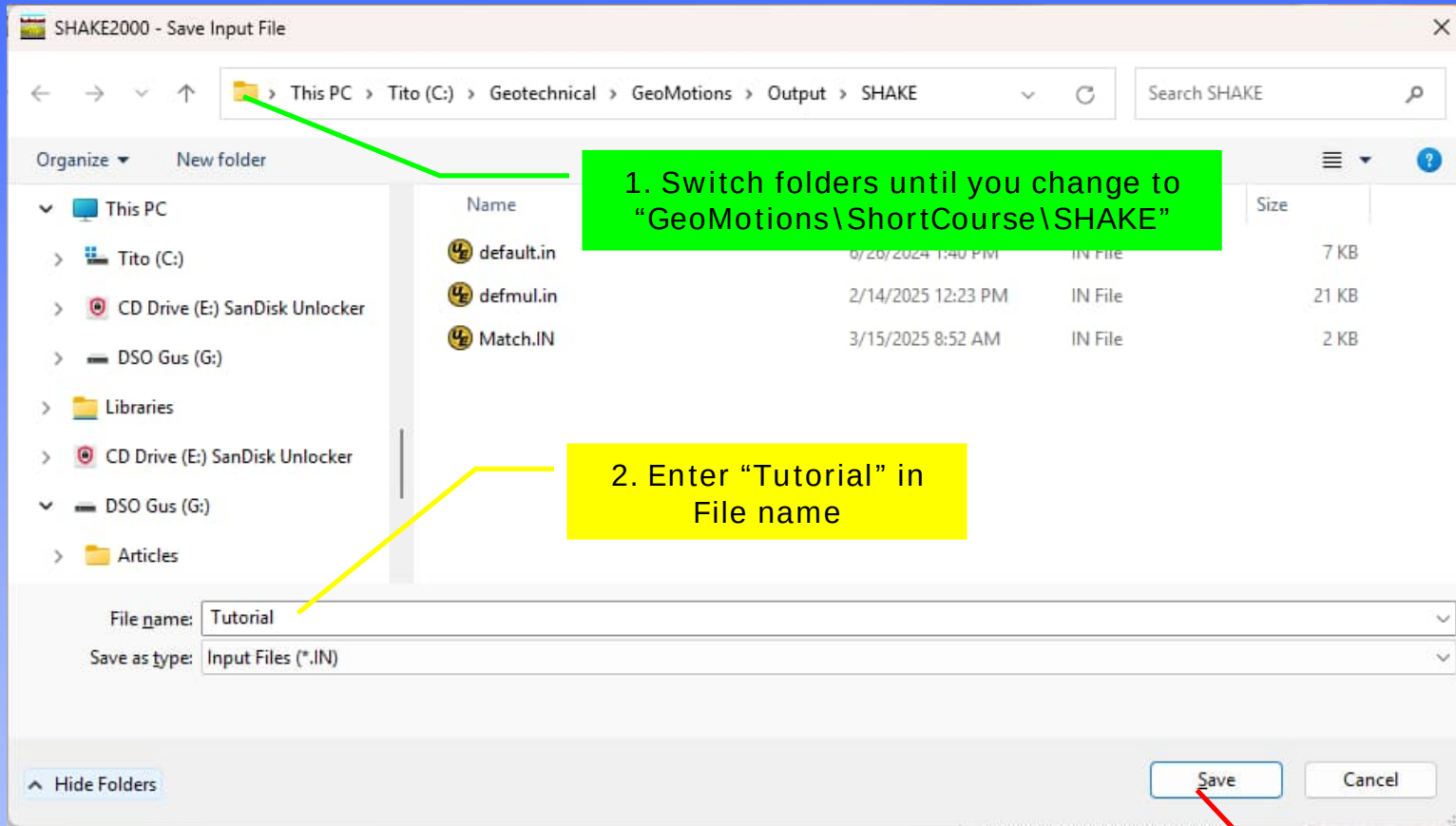


2. Click on
"Yes"

1. Click on
"Save"

Site Specific Response Analysis

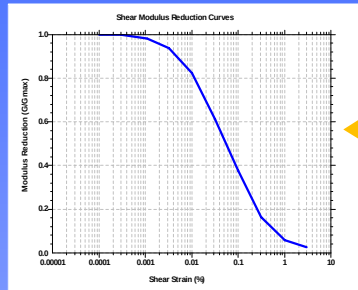
Create Input File



Site Specific Response Analysis

SHAKE Column Option 1 – G/Gmax & Damping vs. Strain

Soil Type 1, e.g., SAND



Option 1 assigns a soil type and corresponding dynamic material properties to each Soil Stratum

Ground Level

Layer No. 1

Layer No. 2

Layer No. 3

Soil Stratum j

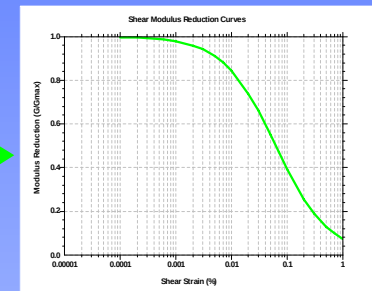
Layer No. i

Layer No. i+1

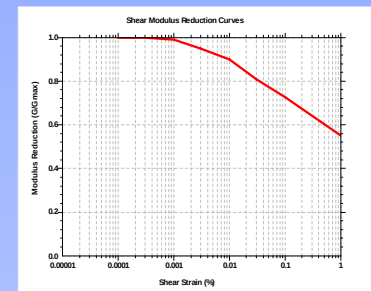
Soil Stratum n

Layer n+1: Halfspace Layer

Soil Type j, e.g., CLAY

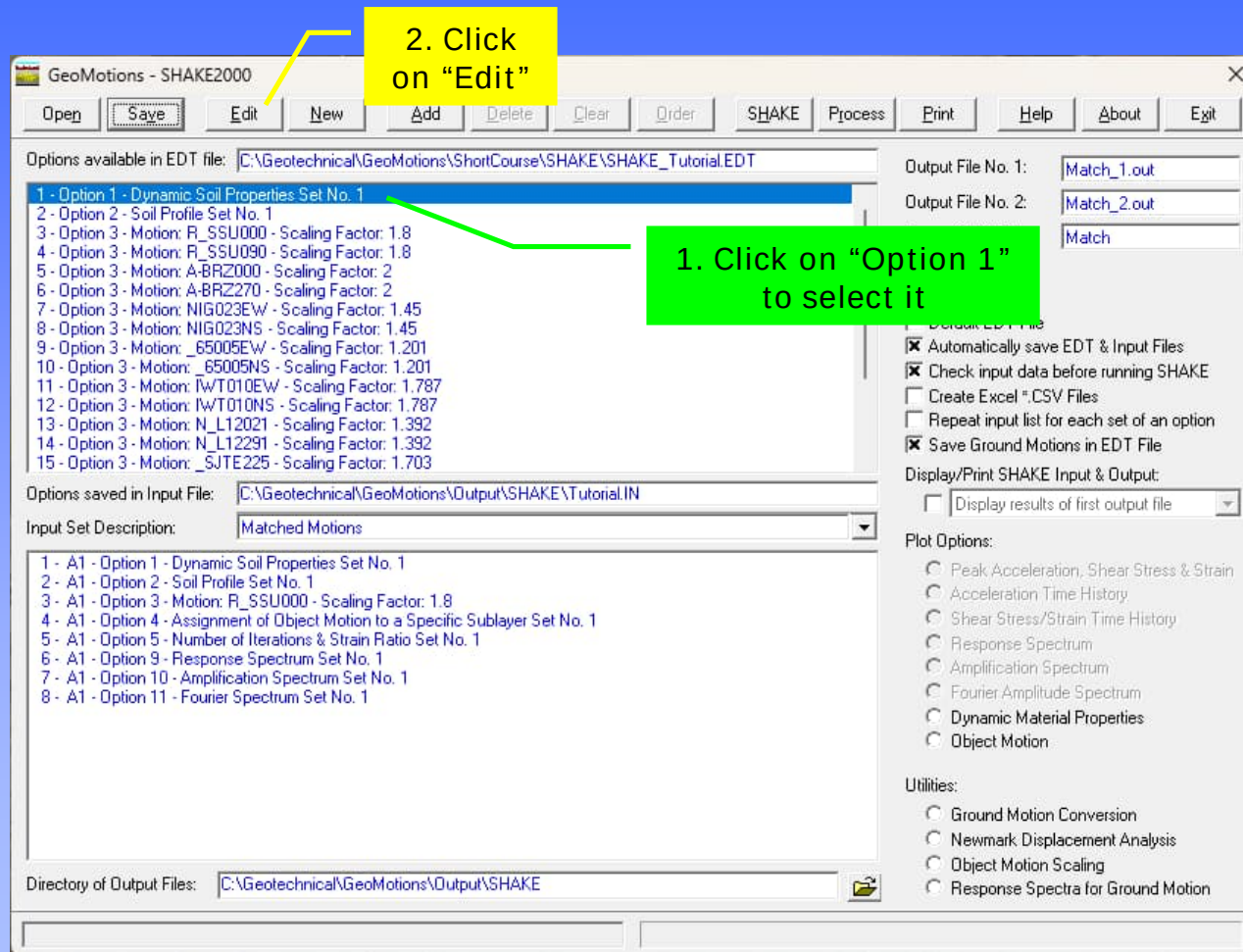


Soil Type n+1: Halfspace



Site Specific Response Analysis

Edit SHAKE Options – Option 1



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

1. Click on
"MAT"

SHAKE2000 - Option 1 Editor: Dynamic Material Properties

Next Save Damping **MAT** New Replace Delete Model Darendeli, M.B. Dbase Help Return

Set No.: Dynamic Material Properties - Set Identification:
1 Option 1 - Dynamic Soil Properties Set No. 1

No. Materials: Material No.: Material Name: List of Materials:
1 1 Material 1 No. 1 - Material 1

No. Strain: Identification for this set of Modulus Reduction Values:
1 Moduli values for Material No. 1

Strain values (in percent):

.0001				

Values of Modulus Reduction (G/Gmax):

1				

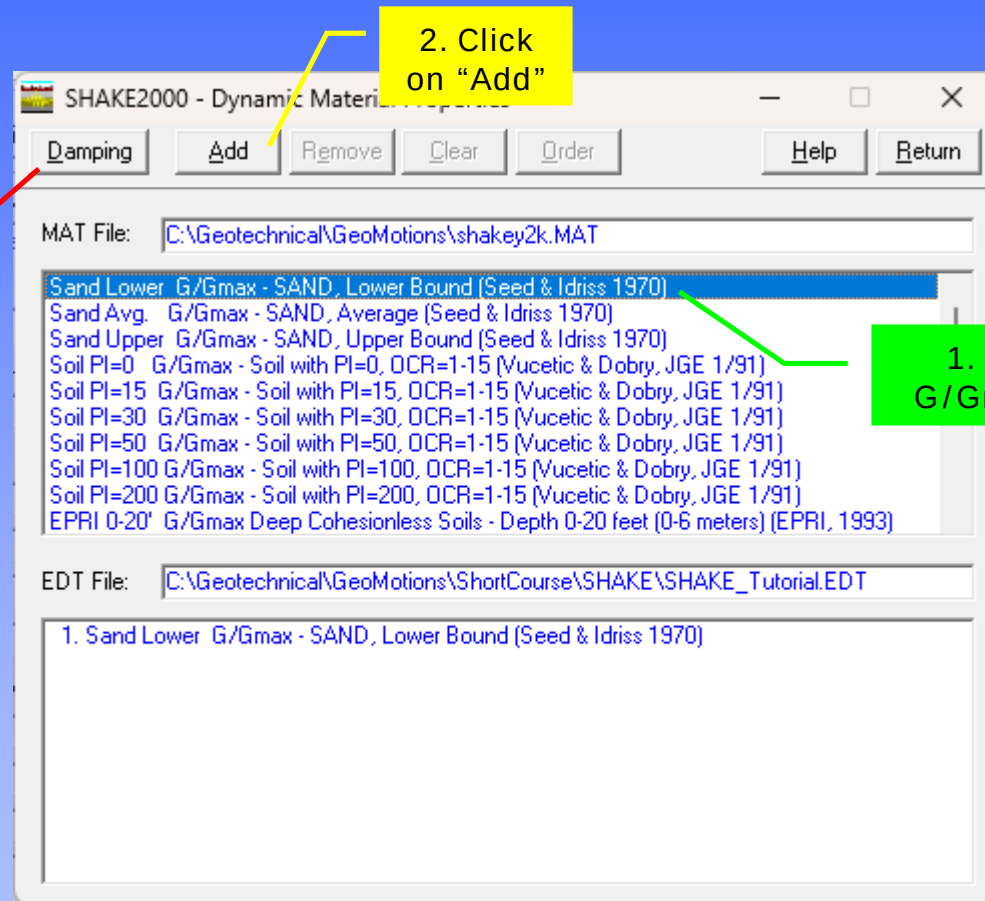
Shear Modulus Reduction Curve

Modulus Reduction (G/Gmax)

Shear Strain (%)

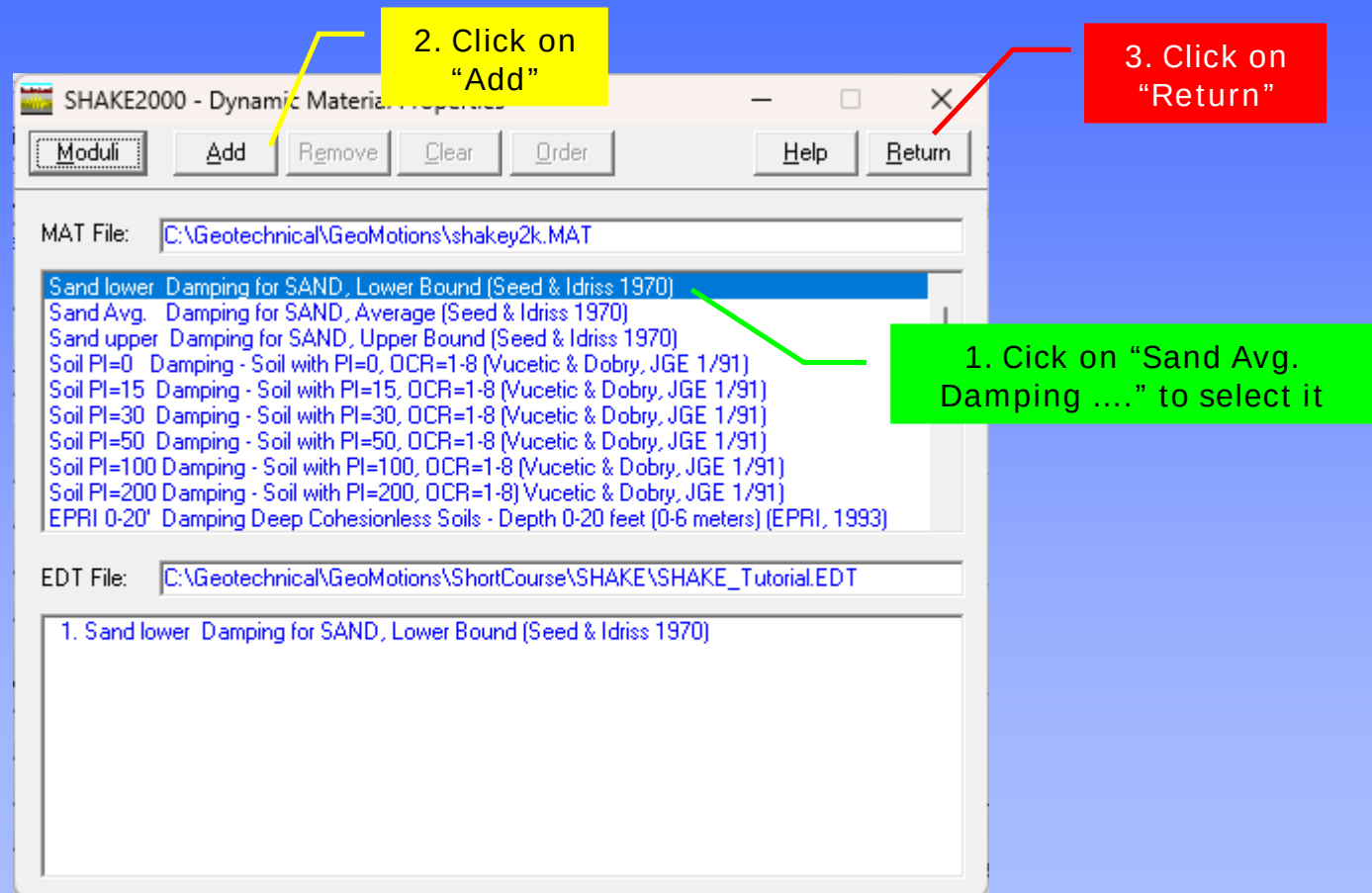
Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



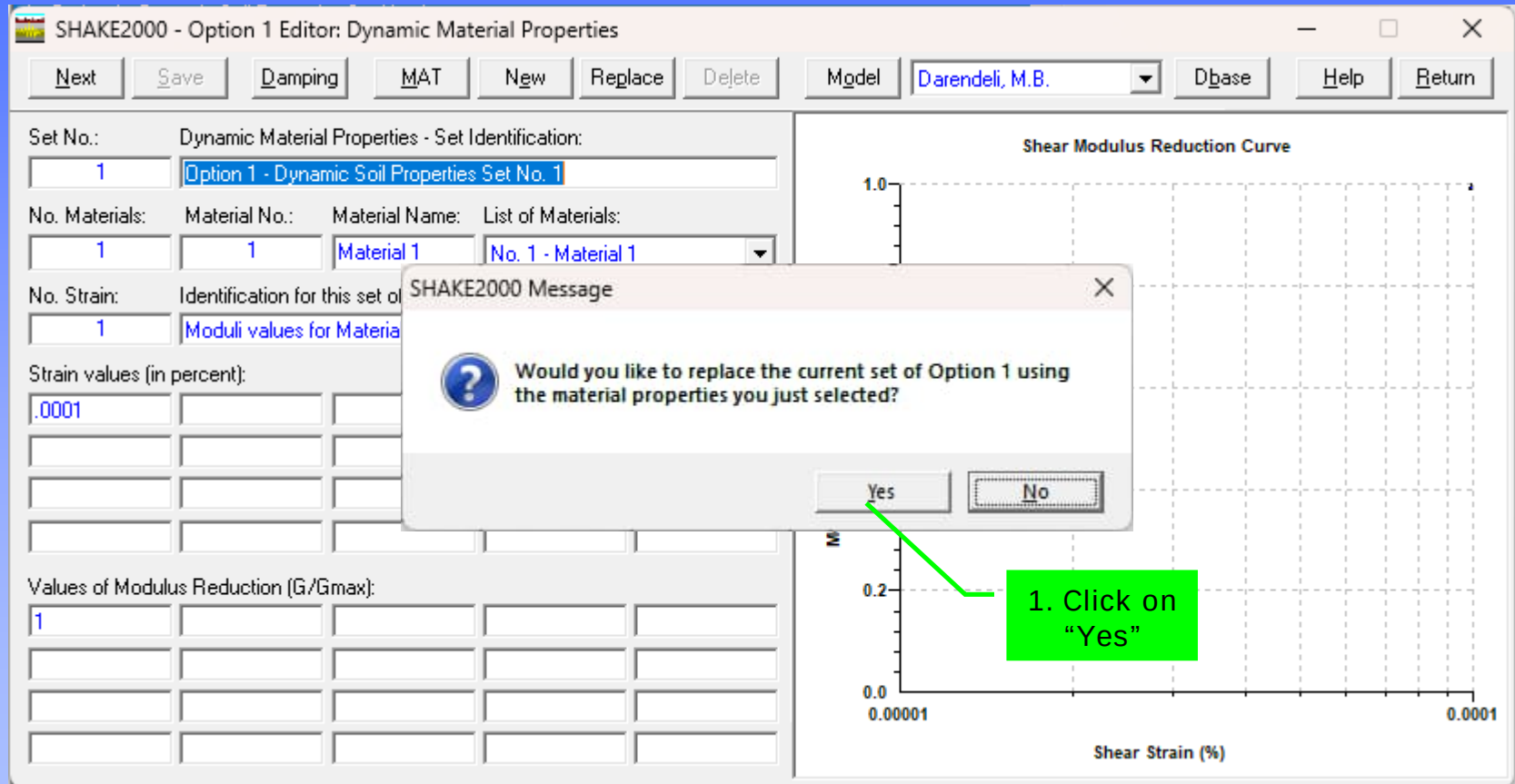
Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



Site Specific Response Analysis

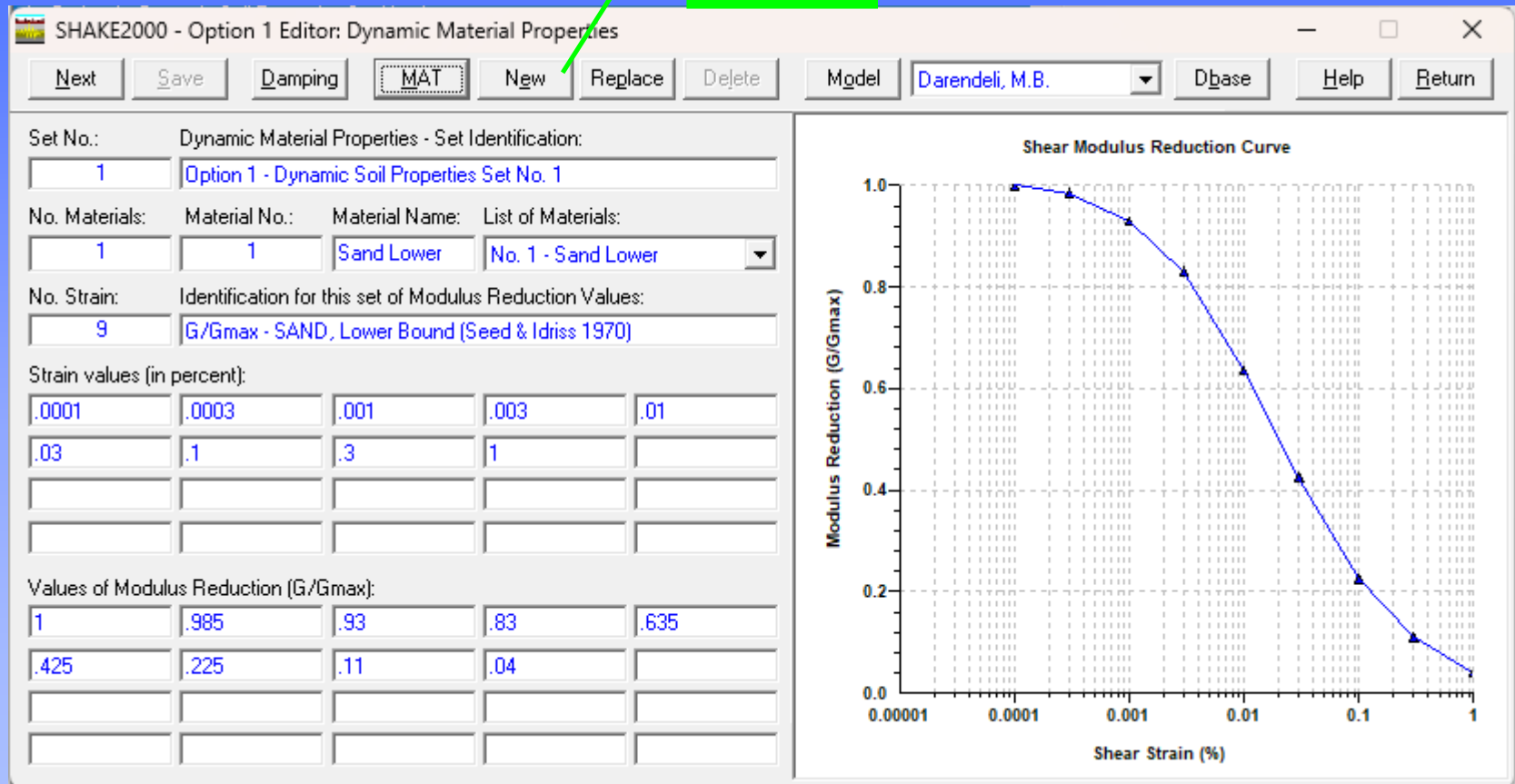
Create Input Data - Option 1: Dynamic Material Properties



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

1. Click on
"New"



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

SHAKE2000 - Option 1 Editor: Dynamic Material Properties

Next Save Damping MAT New Replace Delete Model Darendeli, M.B. Dbase Help Cancel

Set No.: Dynamic Material Properties - Set Identification:
1 Option 1 - Dynamic Soil Properties Set No. 1

No. Materials: Material No.: Material Name: List of Materials:
1 2 Gravel Avg. No. 1 - Sand Lower

No. Strain: Identification for this set of Modulus Reduction Values:
2 G/Gmax - Gravel Avg. (Seed et al. 1986)

Strain values (in percent):

.0001	0.0003			

Values of Modulus Reduction (G/Gmax):

1	0.97			

1. Enter "Gravel Avg." for "Material Name"

2. Enter "G/Gmax - Gravel Avg. (Seed et al. 1986)" for ID

3. Enter "0.0003" for second strain value

4. Enter "0.97" for second G/Gmax value

Modulus Reduction (G/Gmax) vs. Strain (%)

Site Specific Response Analysis

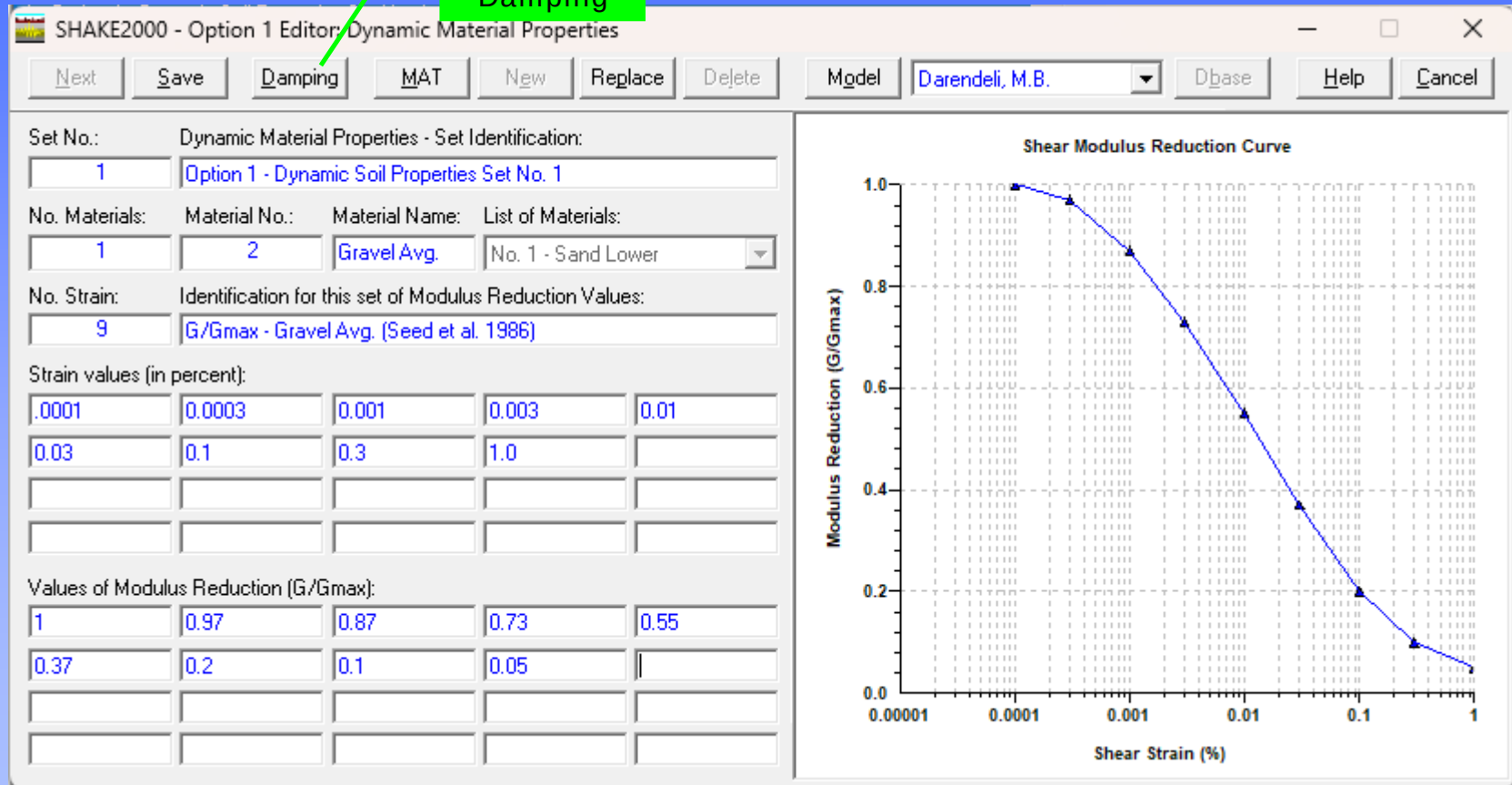
Enter the other Strain vs G/Gmax values

Strain (%)	G/Gmax
0.001	0.87
0.003	0.73
0.01	0.55
0.03	0.37
0.1	0.20
0.3	0.1
1.0	0.05

Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

1. Click on
"Damping"



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

SHAKE2000 - Option 1 Editor: Dynamic Material Properties

Next Save Moduli MAT New Replace Delete Model Darendeli, M.B. Dbase Help Cancel

Set No.: Dynamic Material Properties - Set Identification:
1 Option 1 - Dynamic Soil Properties Set No. 1

No. Materials: Material No.: Material Name: List of Materials:
1 2 Gravel Avg. No. 1 - Sand Lower

No. Strain: Identification for this set of Damping Values:
1 Damping - Gravel Avg. (Seed et al. 1986)

Strain values (in percent):
.0001

Values of Damping (%):
0.8

1. Enter "Gravel Avg." for "Material Name"

2. Enter "Damping – Gravel Avg. (Seed et al. 1986)" for ID

3. Enter "0.8" for second damping value

Damping Ratio (%)

Shear Strain (%)

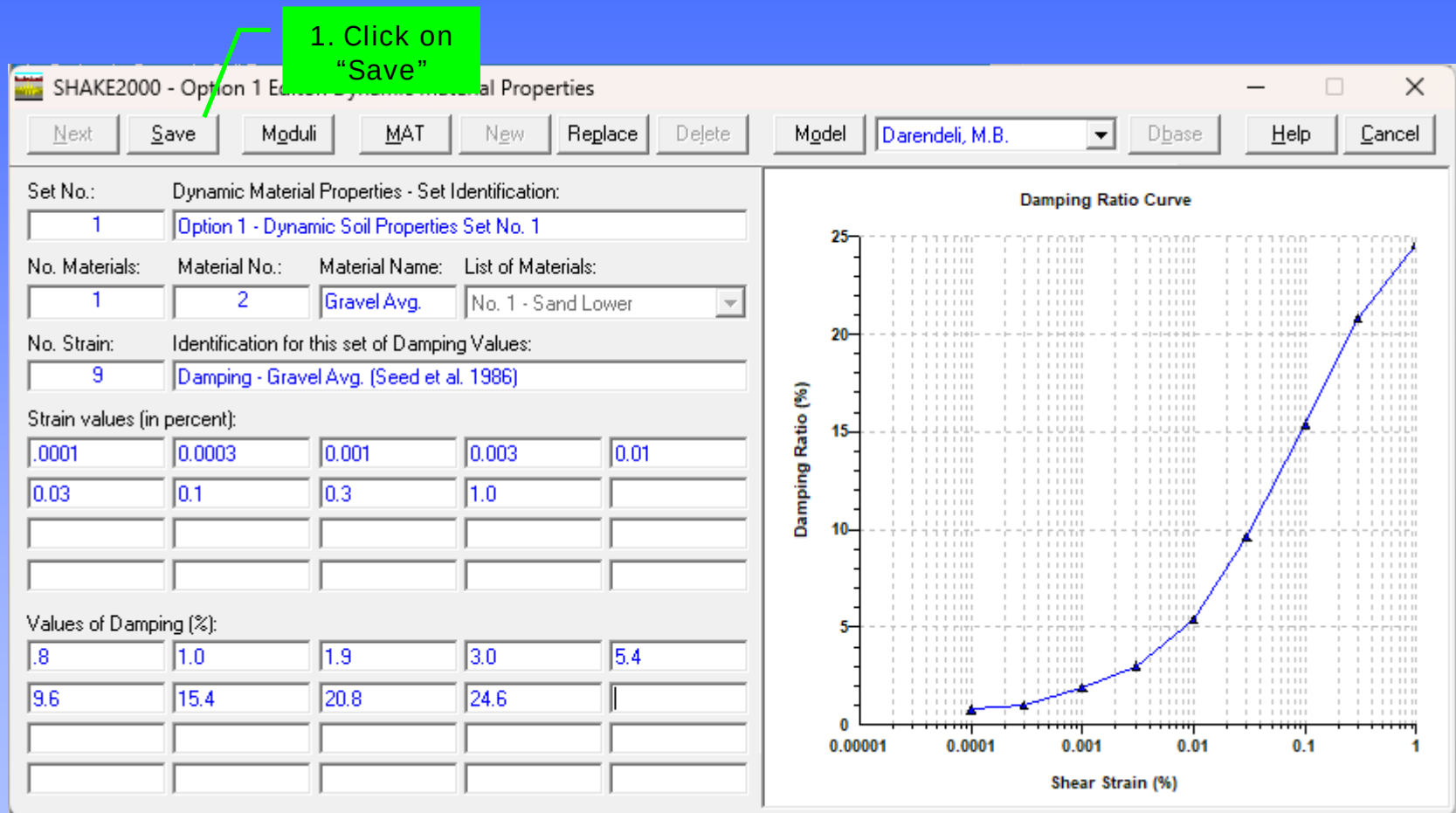
Site Specific Response Analysis

Enter the other Strain vs Damping values

Strain (%)	Damping (%)
0.0003	1.0
0.001	1.9
0.003	3.0
0.01	5.4
0.03	9.6
0.1	15.4
0.3	20.8
1.0	24.6

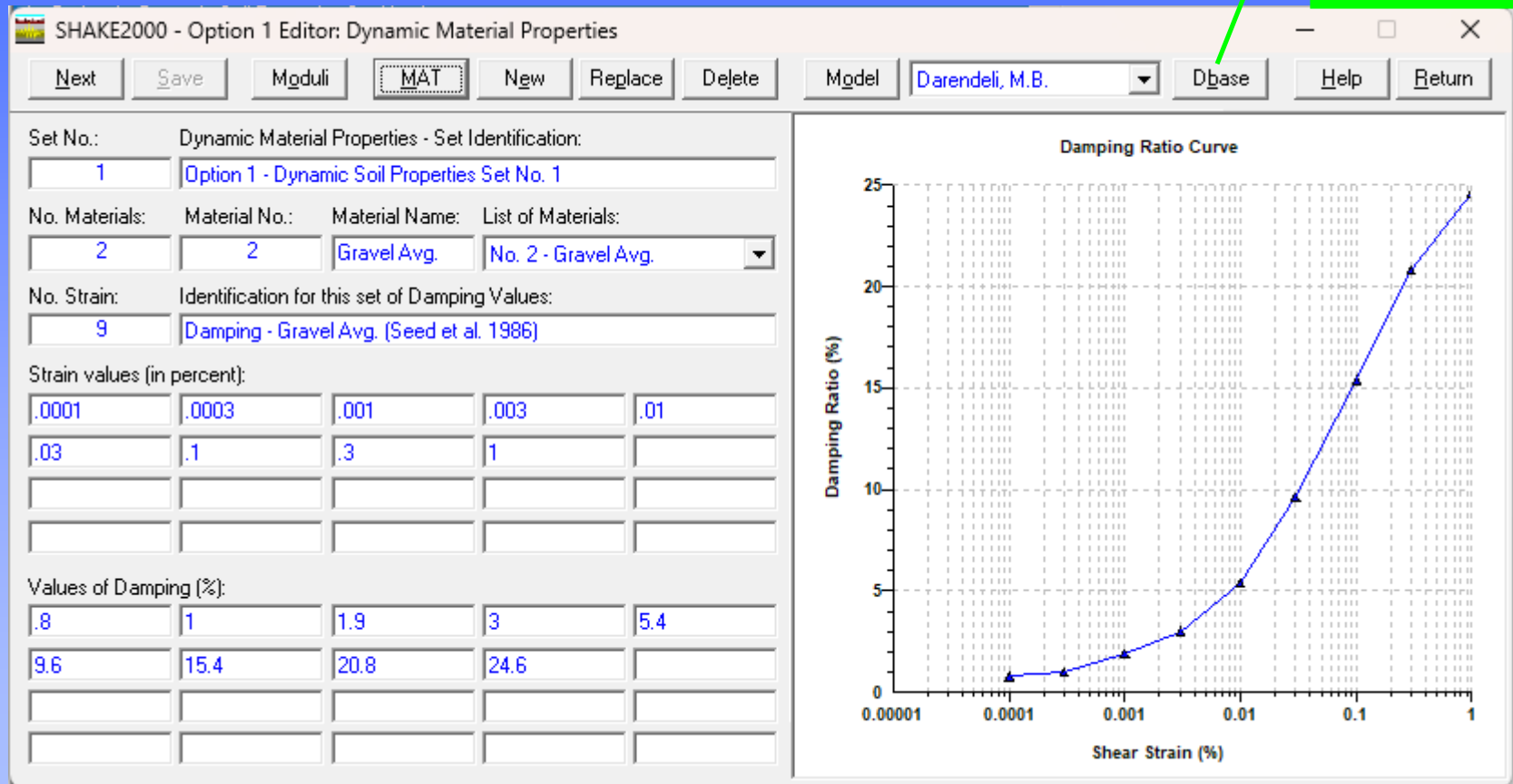
Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



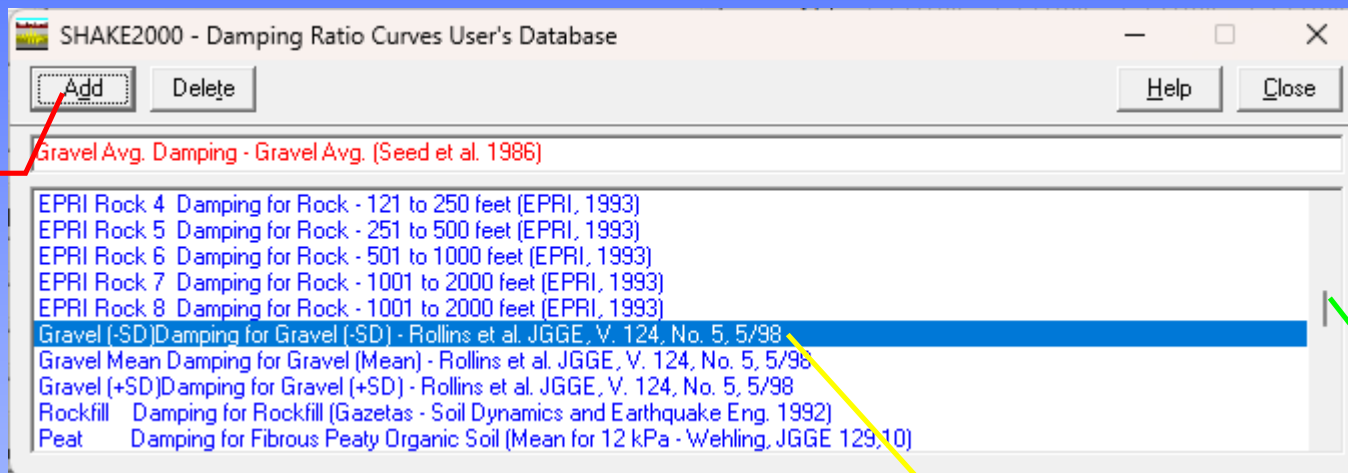
Site Specific Response Analysis

Save new material in Database of materials file



Site Specific Response Analysis

Save new material in Database of materials file



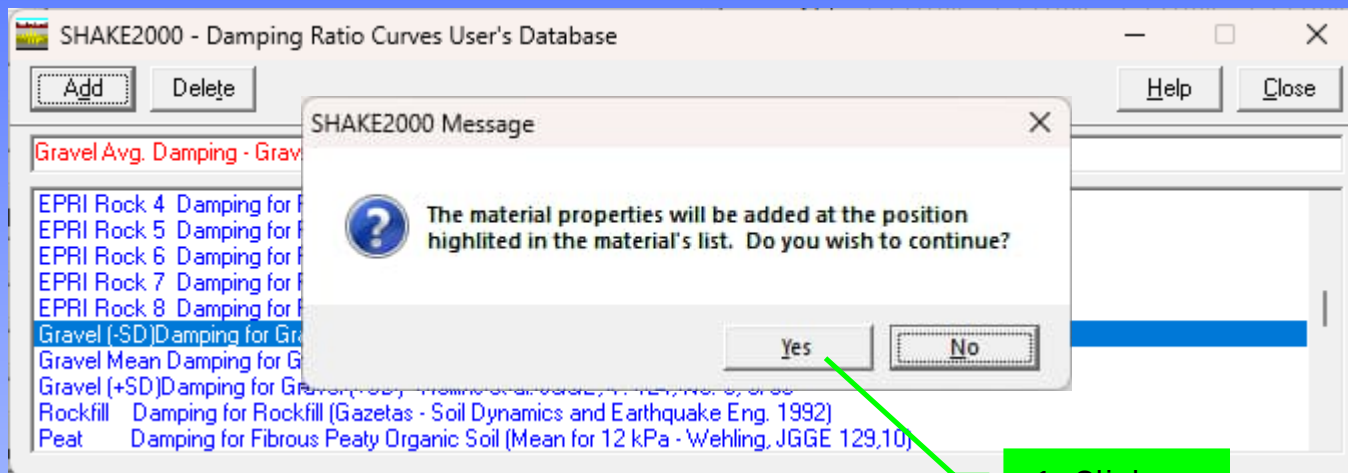
3. Click on
"Add"

1. Scroll
down

2. Select "Gravel (-
SD) Damping ..."

Site Specific Response Analysis

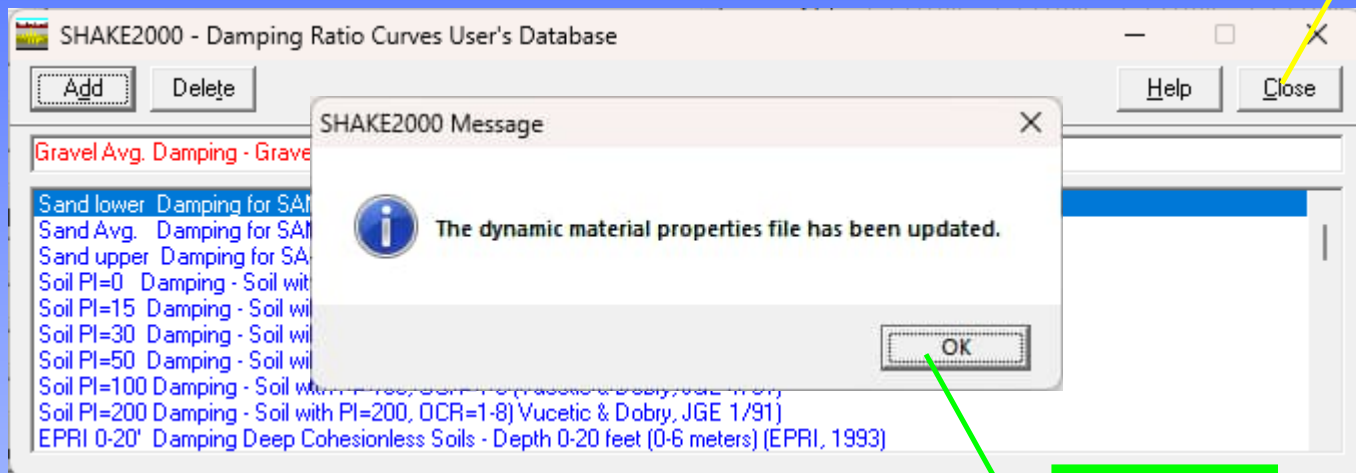
Save new material in Database of materials file



1. Click on
"Yes"

Site Specific Response Analysis

Save new material in Database of materials file



2. Click on
"Close"

1. Click on
"Ok"

Site Specific Response Analysis

Save new material in Database of materials file

1. Click on "Moduli"

2. Click on "Dbase"

The screenshot shows the SHAKE2000 - Option 1 Editor: Dynamic Material Properties window. The window has a menu bar with Next, Save, Moduli, MAT, New, Replace, Delete, Model, Dbase, Help, and Return. The Moduli button is highlighted with a green box and a green arrow pointing to it. The Dbase button is highlighted with a yellow box and a yellow arrow pointing to it. The window contains input fields for Set No., Dynamic Material Properties, No. Materials, Material No., Material Name, List of Materials, No. Strain, Identification for this set of Damping Values, Strain values (in percent), and Values of Damping (%). The graph on the right shows Damping Ratio (%) on the y-axis (0 to 25) and Shear Strain (%) on the x-axis (0.00001 to 1). The graph shows a curve that starts at (0.00001, 0) and increases to (1, 25).

Set No.	Dynamic Material Properties	No. Materials	Material No.	Material Name	List of Materials
1	Option 1 - Dynamic Soil Prop	2	2	Gravel Avg.	No. 2 - Gravel Avg.

No. Strain	Identification for this set of Damping Values
9	Damping - Gravel Avg. (Seed et al. 1986)

Strain values (in percent):				
.0001	.0003	.001	.003	.01
.03	.1	.3	1	

Values of Damping (%):				
.8	1	1.9	3	5.4
9.6	15.4	20.8	24.6	

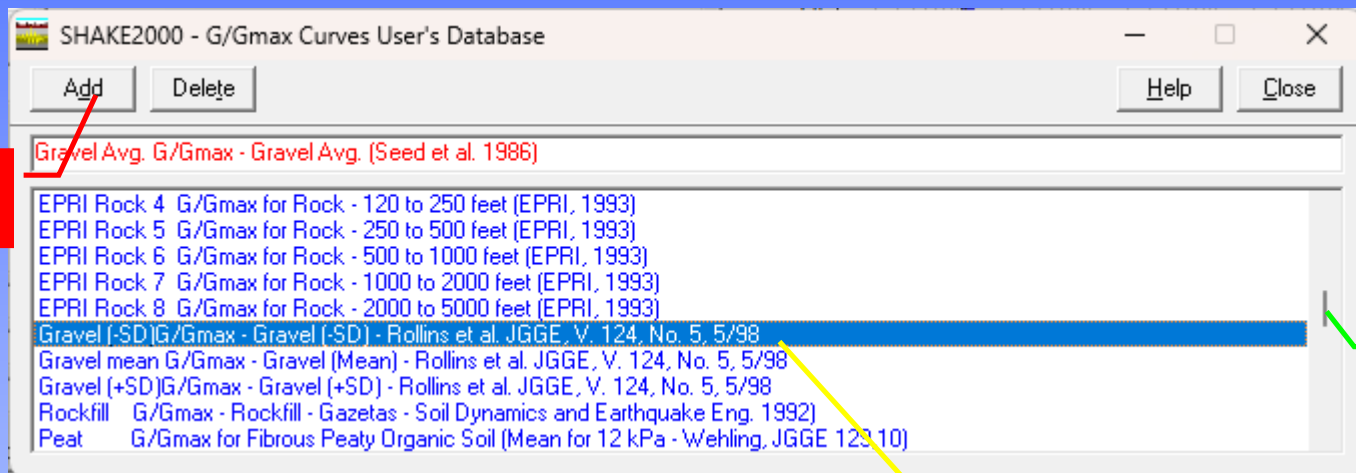
Damping Ratio Curve

Damping Ratio (%)

Shear Strain (%)

Site Specific Response Analysis

Save new material in Database of materials file



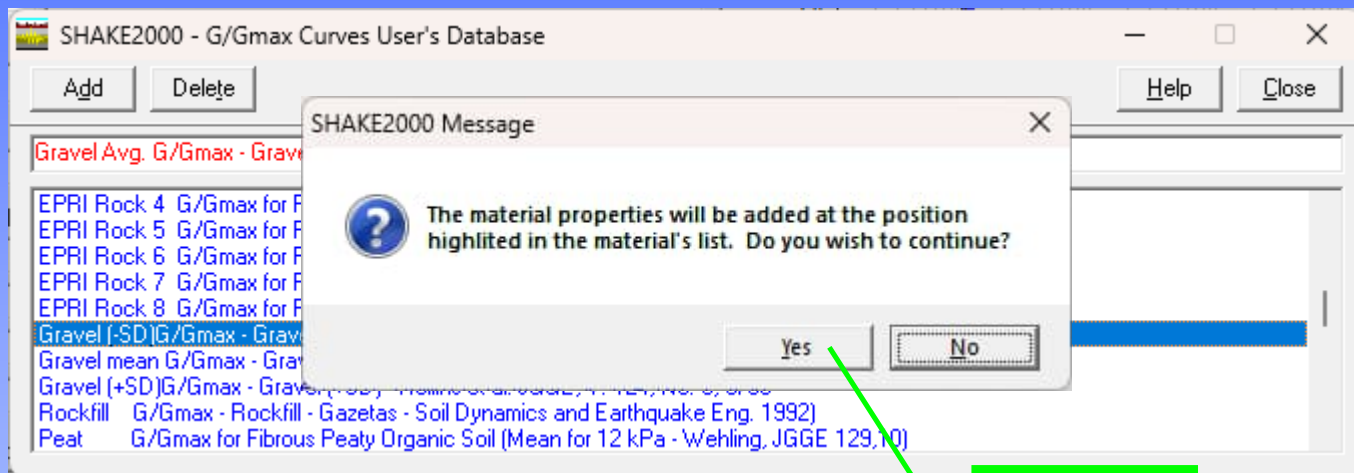
3. Click on
"Add"

1. Scroll
down

2. Select "Gravel (-
SD)Damping ..."

Site Specific Response Analysis

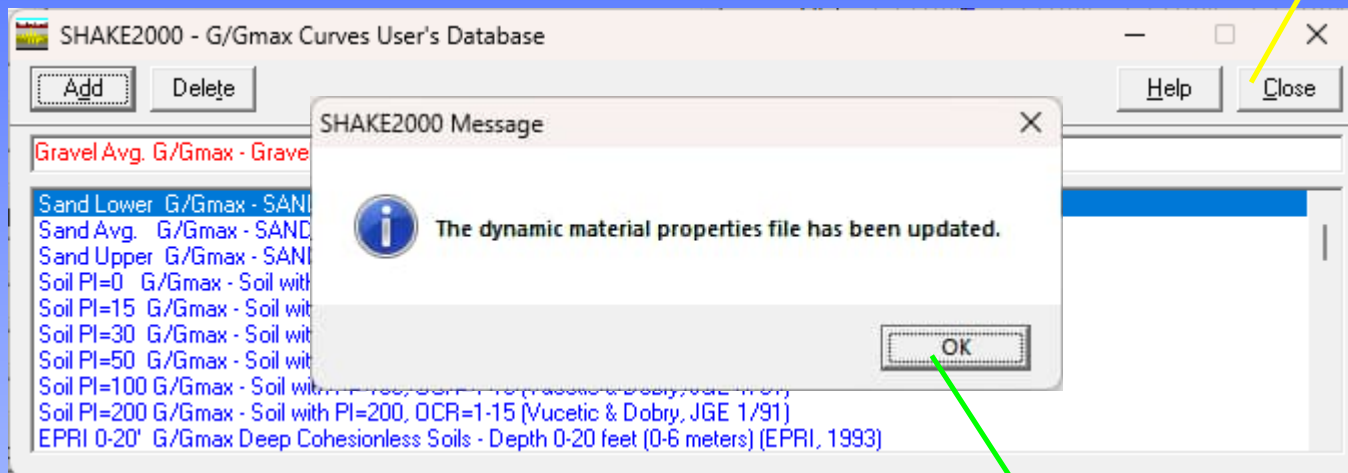
Save new material in Database of materials file



1. Click on
"Yes"

Site Specific Response Analysis

Save new material in Database of materials file

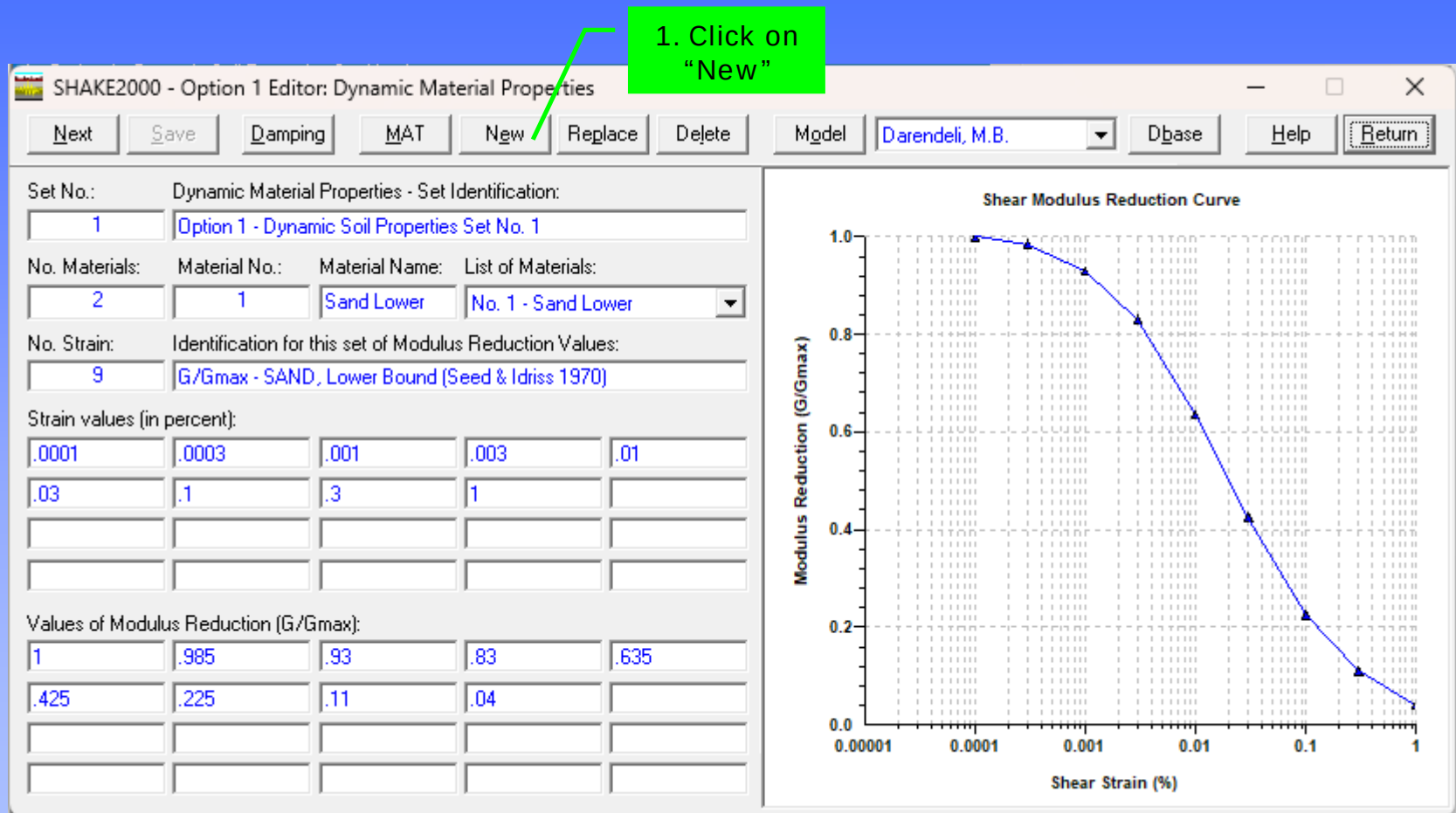


2. Click on
"Close"

1. Click on
"Ok"

Site Specific Response Analysis

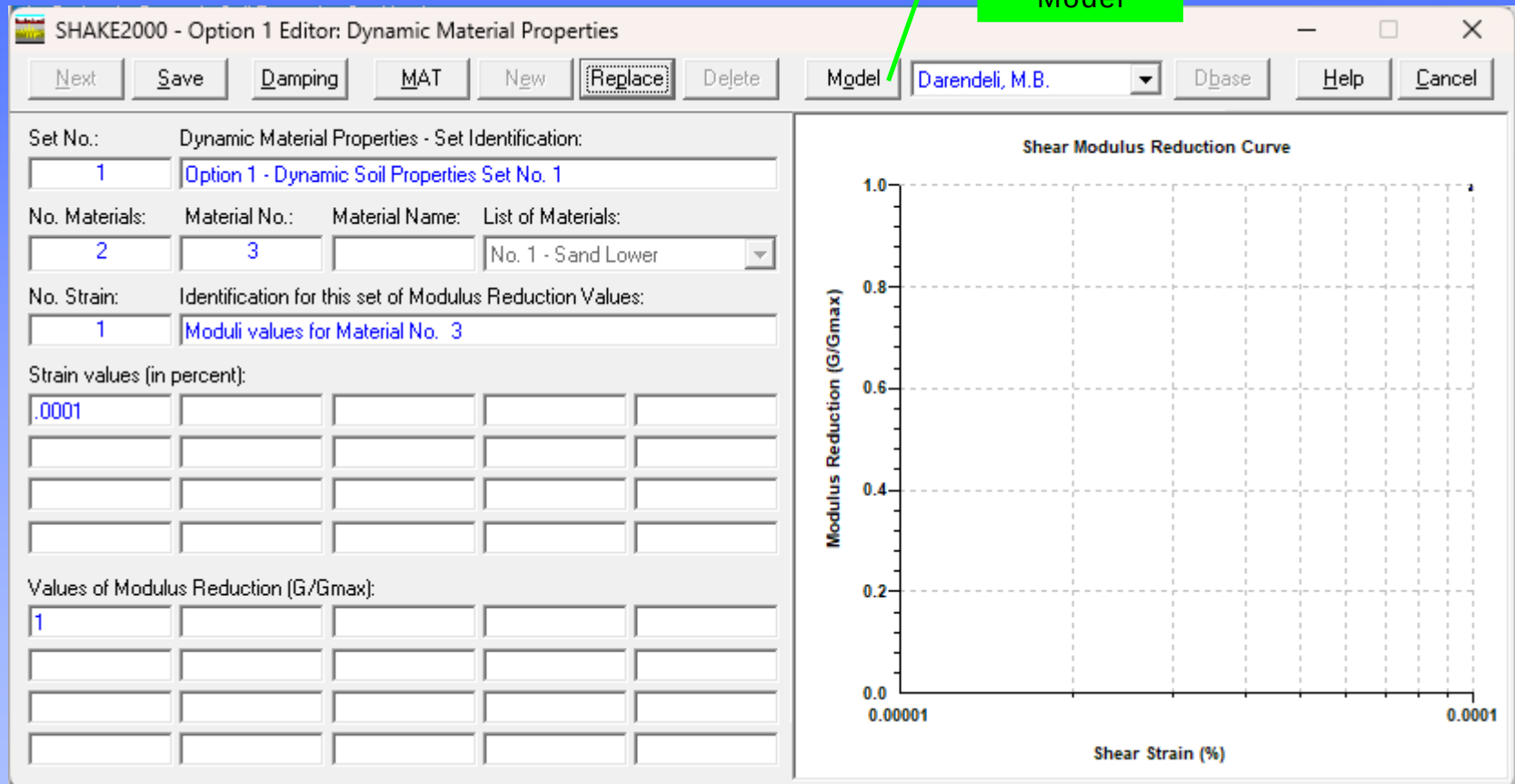
Use Model to generate curves



Site Specific Response Analysis

Use Model to generate curves

1. Click on
"Model"



Site Specific Response Analysis

Use Model to generate curves

4. Click on
"Plot"

SHAKE2000 - Dynamic Material Properties Model

Ok Plot Help Cancel

Darendeli, M.B. Model:

Plot Property Curve:

☐ Shear Modulus

☒ Damping

Curve:

☐ Mean - Std. Dev.

☒ Mean

☐ Mean + Std. Dev.

Mean Effective Confining Stress (atm): 2.08

Soil Plasticity (%): 35

Overconsolidation Ratio: 15

Loading Frequency (Hz): 1

Number of Loading Cycles: 10

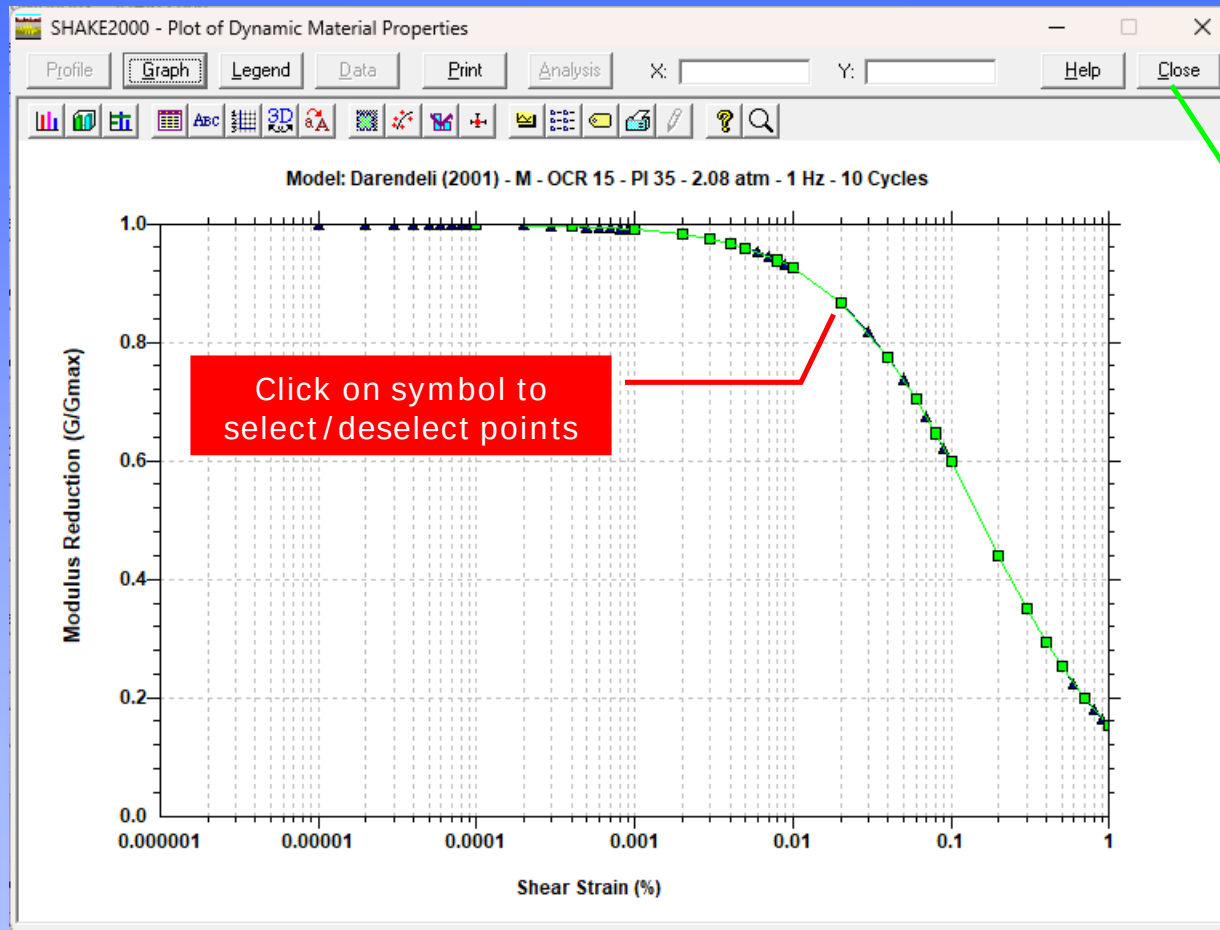
1. Enter
"2.08" for σ'_o

2. Enter
"35" for PI

3. Enter "15"
for OCR

Site Specific Response Analysis

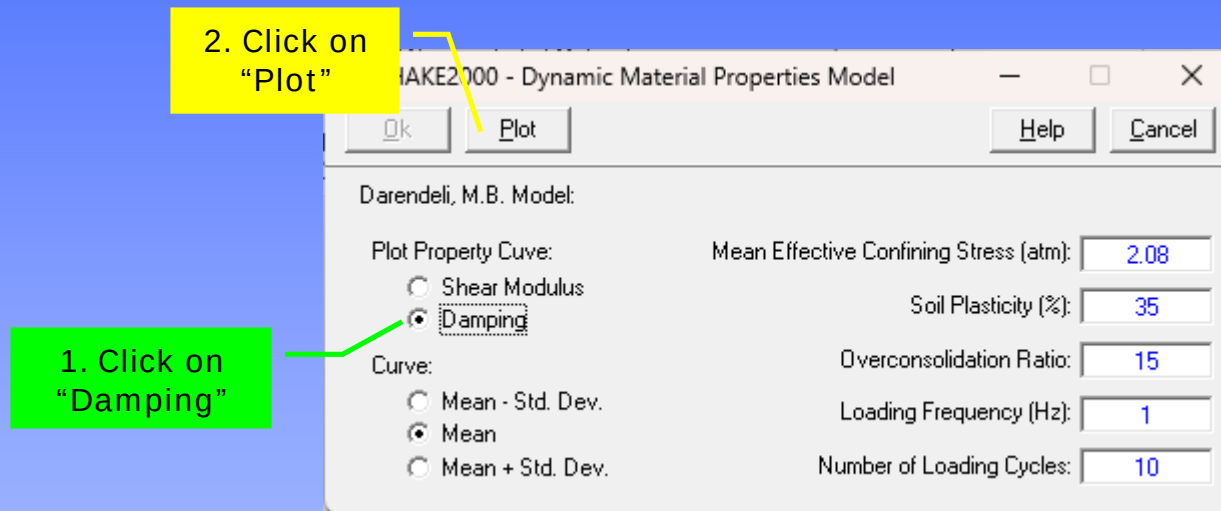
Use Model to generate curves



1. Click on "Close"

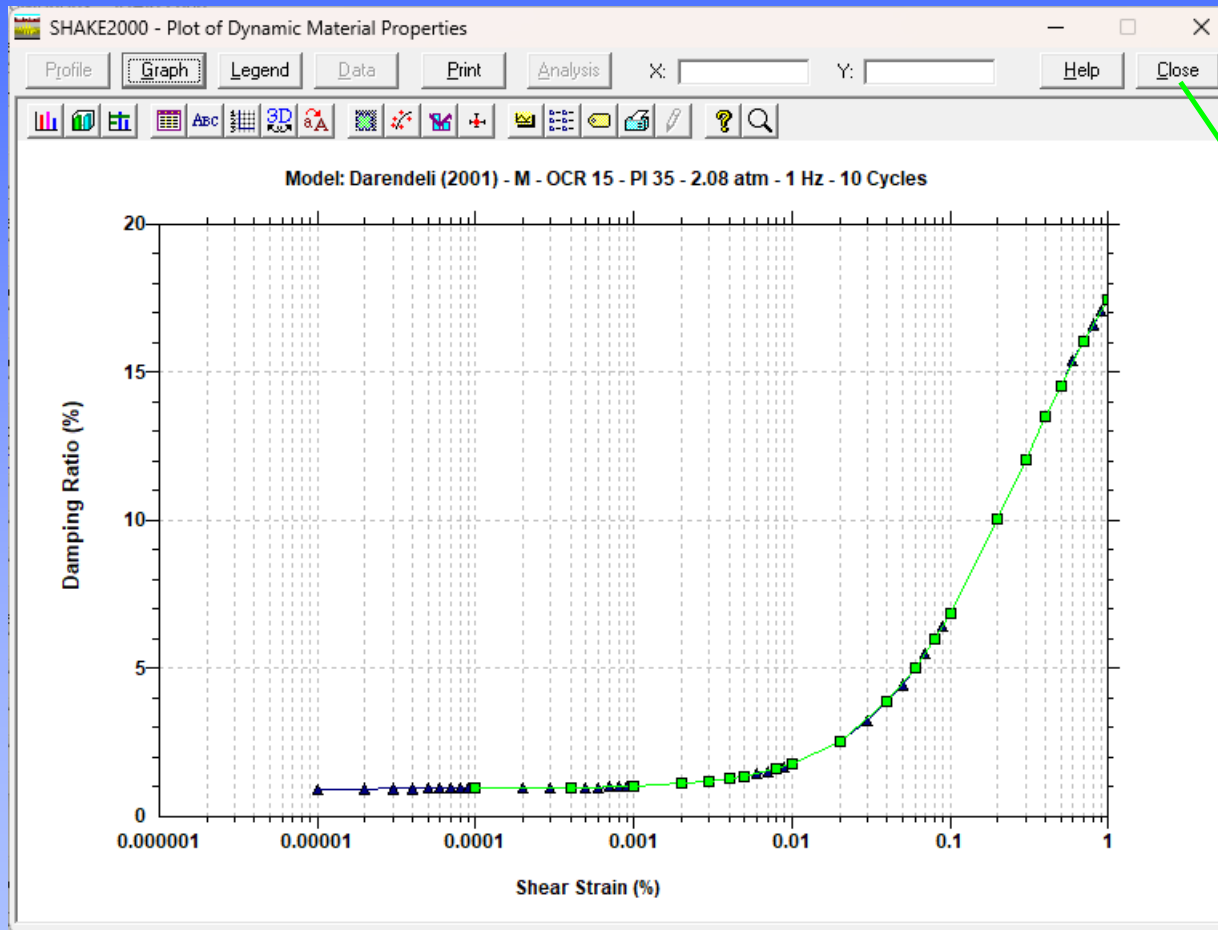
Site Specific Response Analysis

Use Model to generate curves



Site Specific Response Analysis

Use Model to generate curves

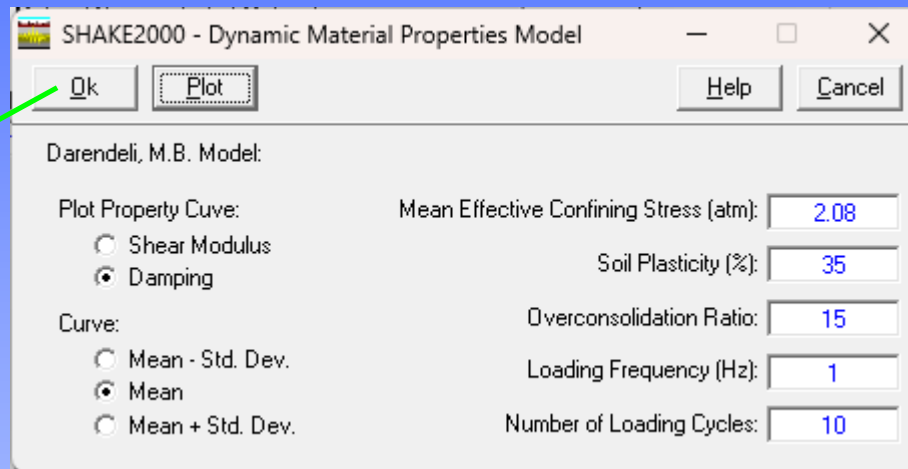


1. Click on
"Close"

Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

1. Click on
"OK"



SHAKE2000 - Dynamic Material Properties Model

Ok Plot Help Cancel

Darendeli, M.B. Model:

Plot Property Curve:

- ☐ Shear Modulus
- ☒ Damping

Curve:

- ☐ Mean - Std. Dev.
- ☒ Mean
- ☐ Mean + Std. Dev.

Mean Effective Confining Stress (atm): 2.08

Soil Plasticity (%): 35

Overconsolidation Ratio: 15

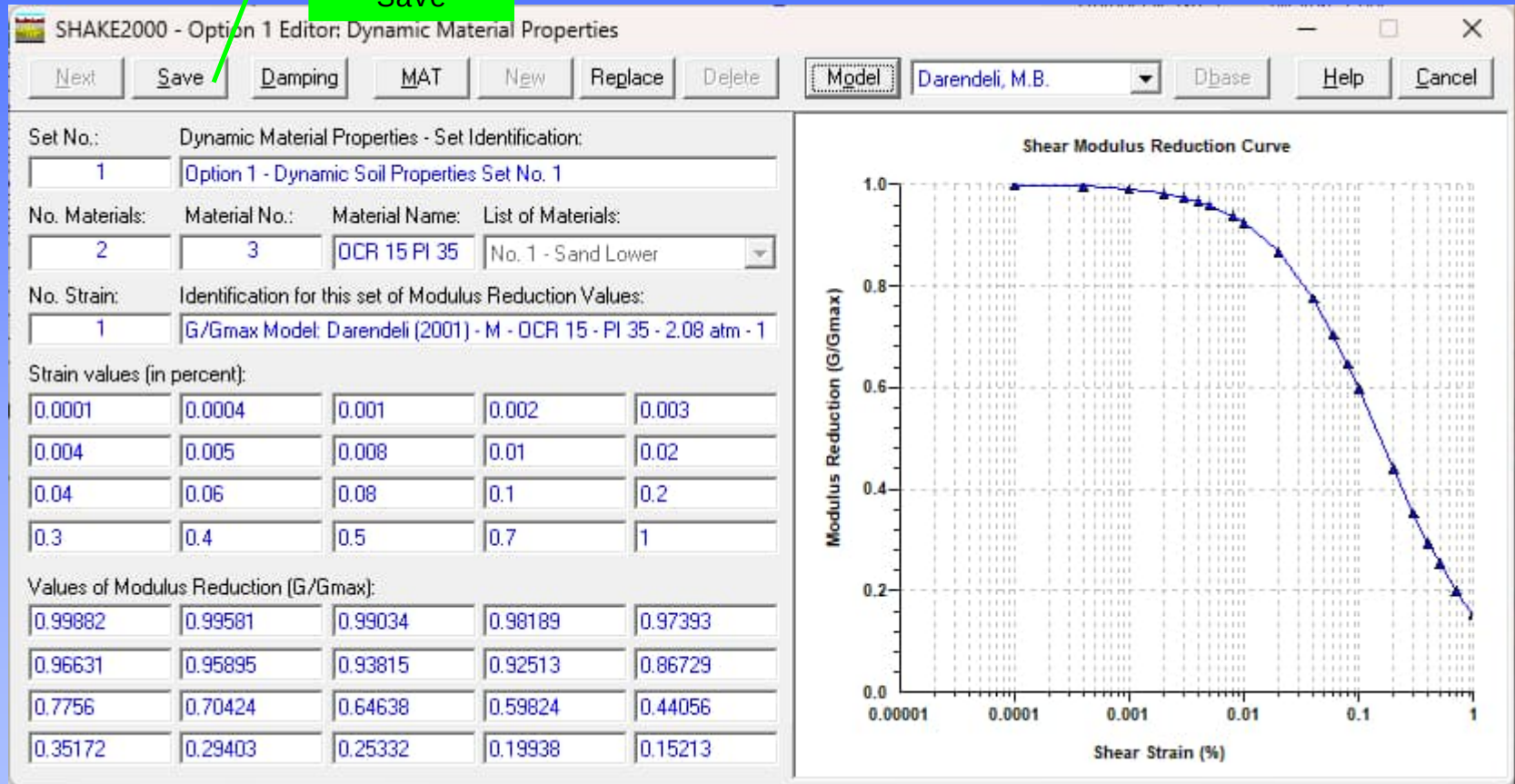
Loading Frequency (Hz): 1

Number of Loading Cycles: 10

Site Specific Response Analysis

Use Model to generate curves

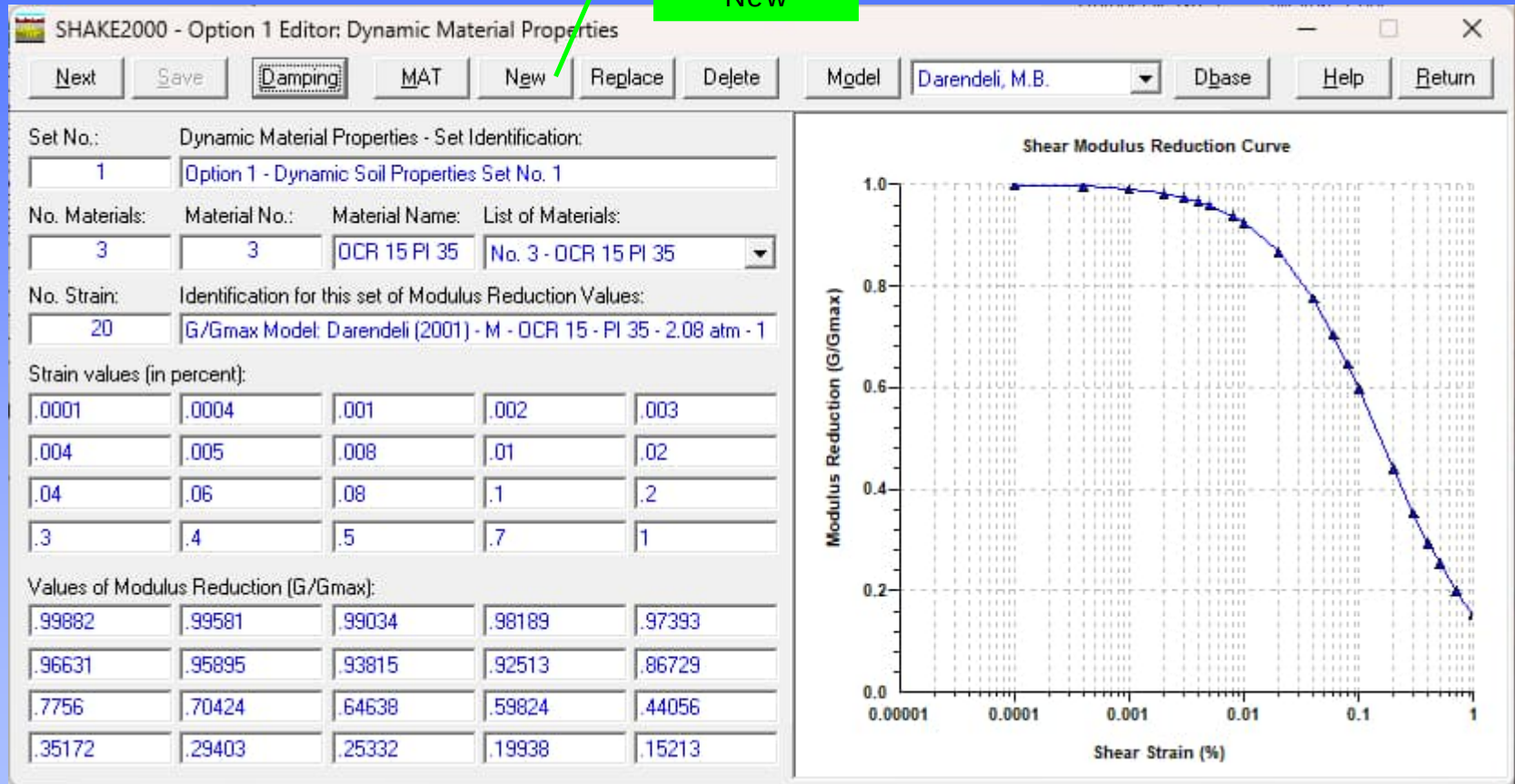
1. Click on
"Save"



Site Specific Response Analysis

Obtain curves from database of materials

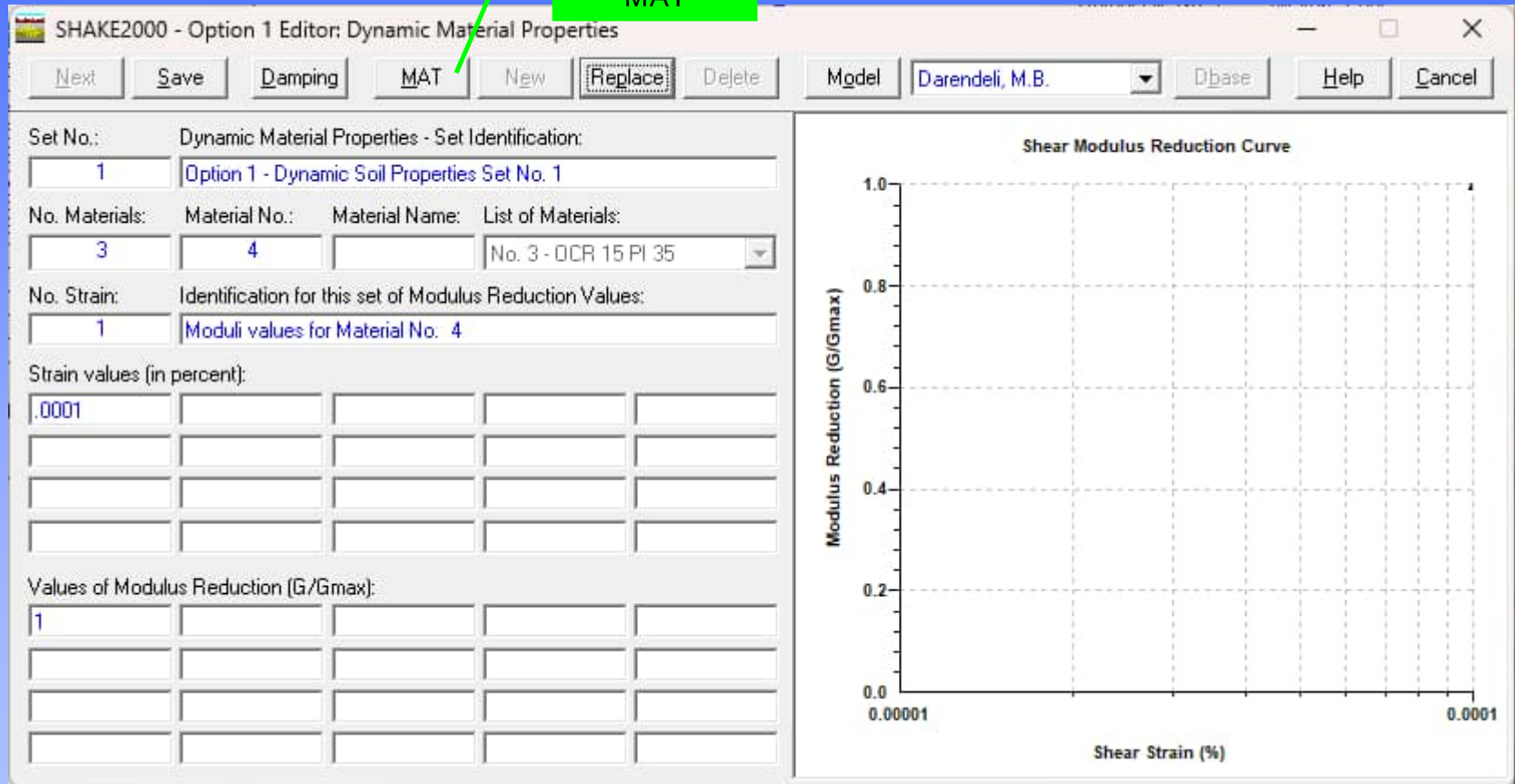
1. Click on
"New"



Site Specific Response Analysis

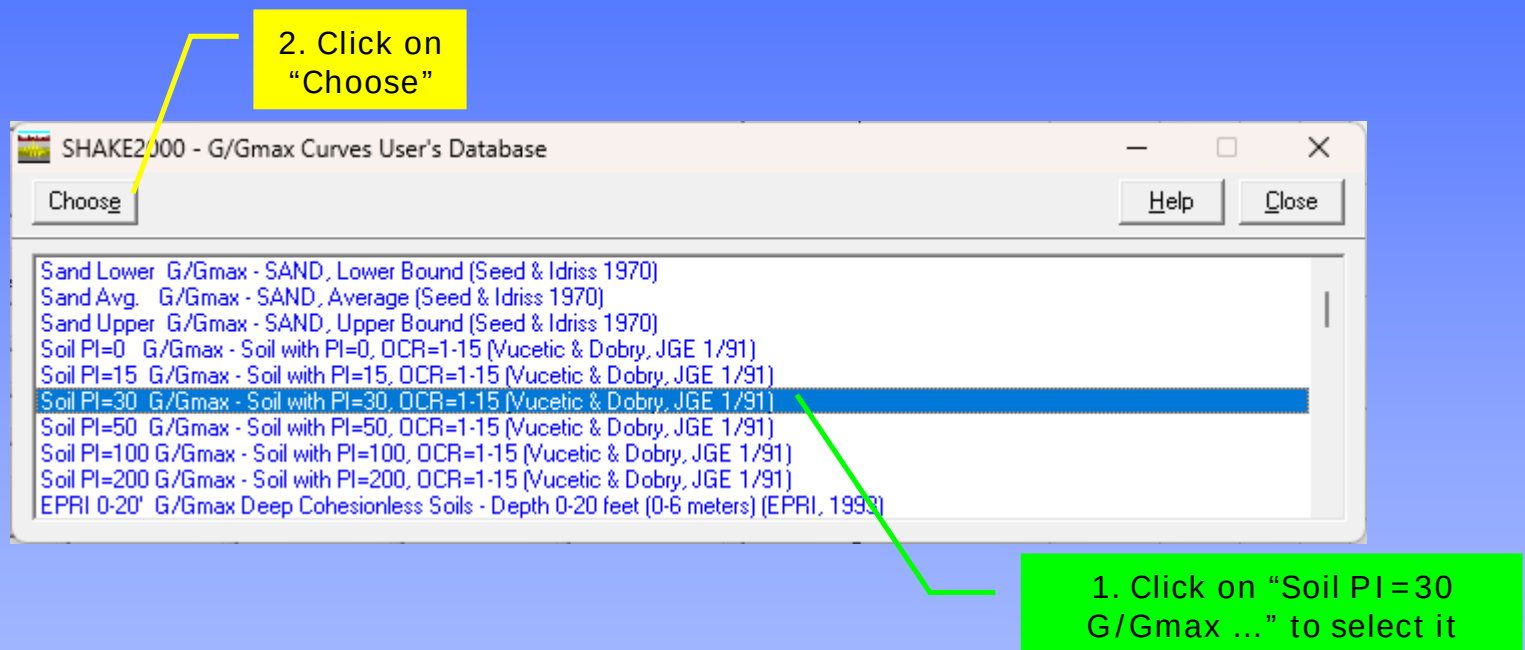
Obtain curves from database of materials

1. Click on
"MAT"



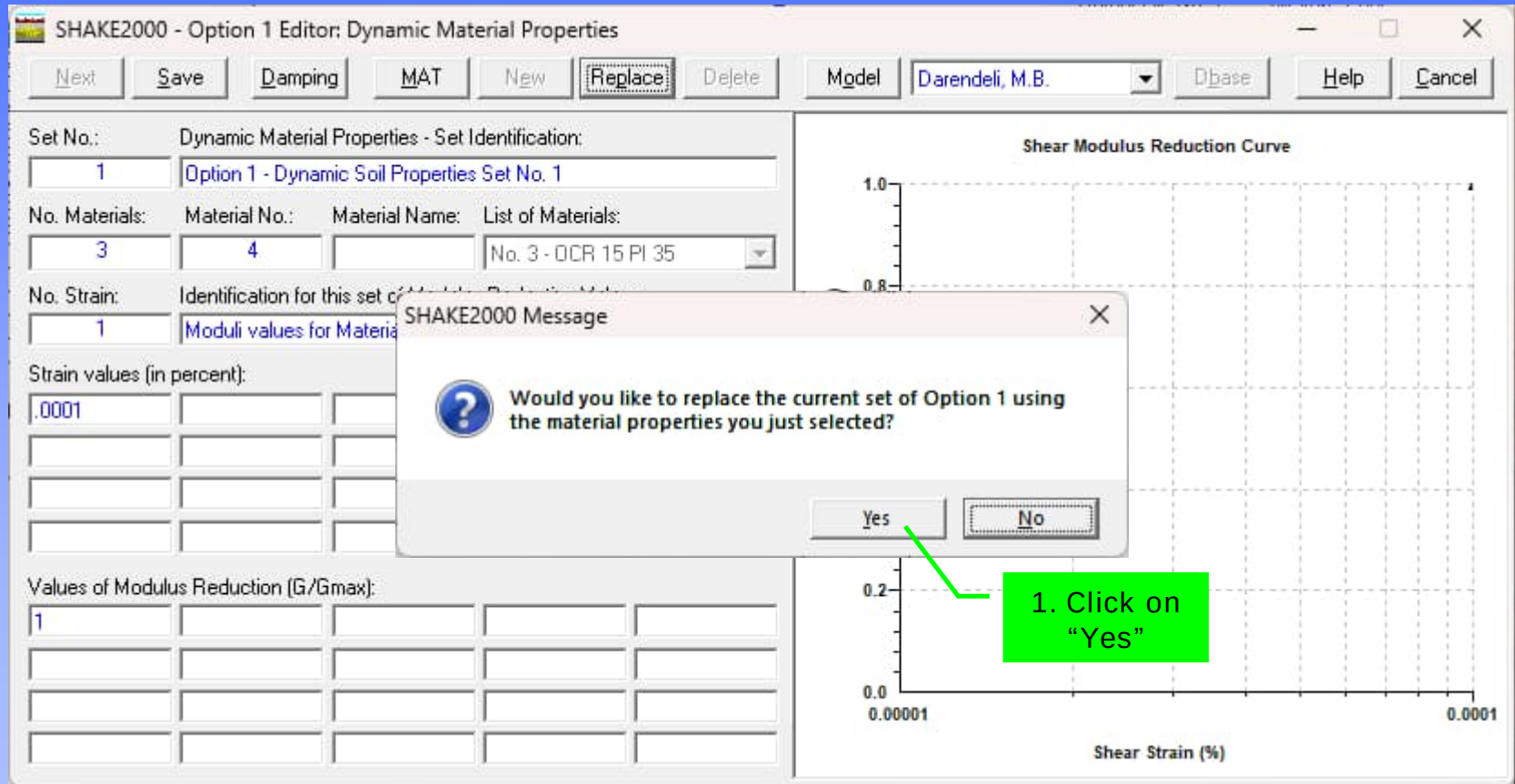
Site Specific Response Analysis

Obtain curves from database of materials



Site Specific Response Analysis

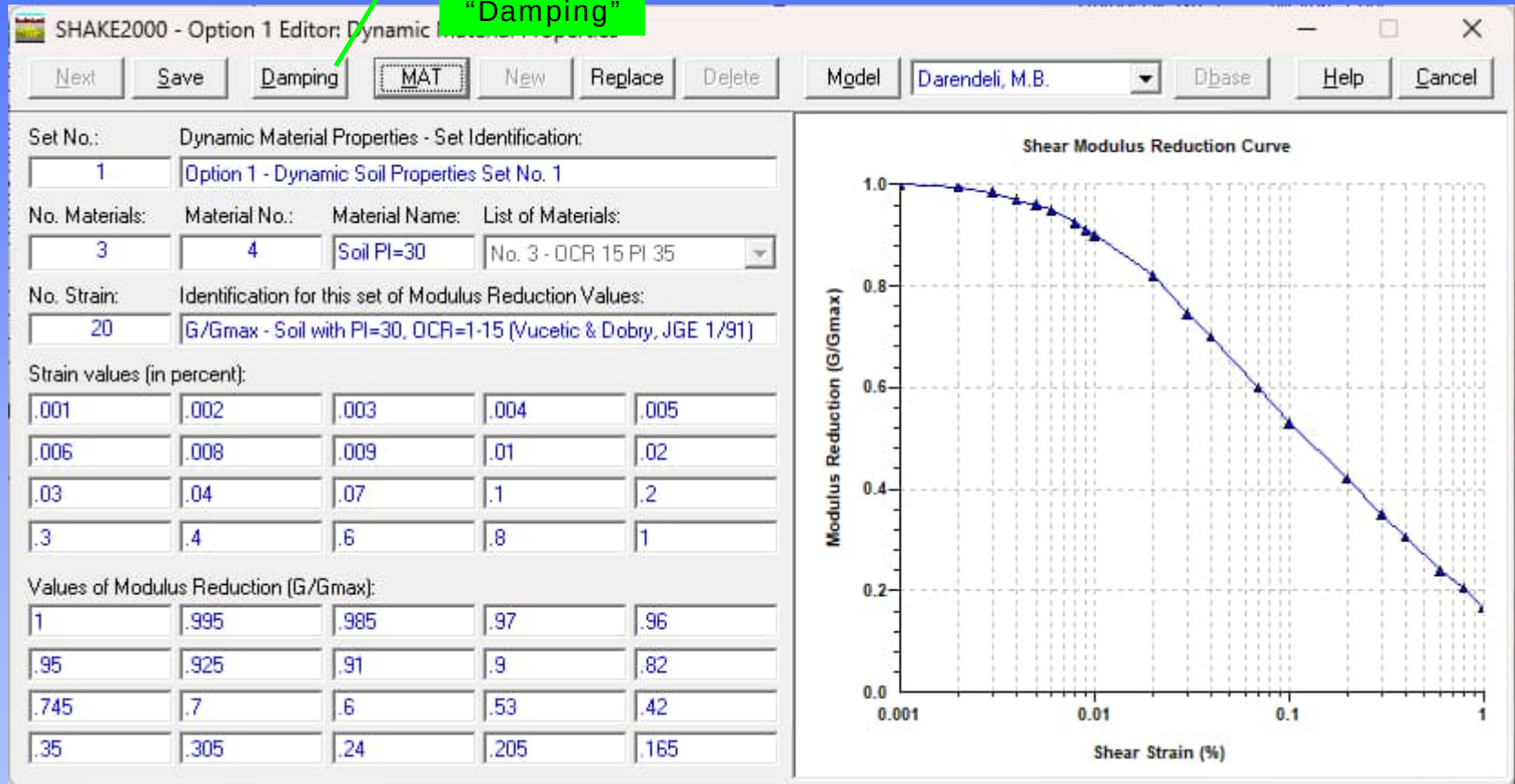
Obtain curves from database of materials



Site Specific Response Analysis

Obtain curves from database of materials

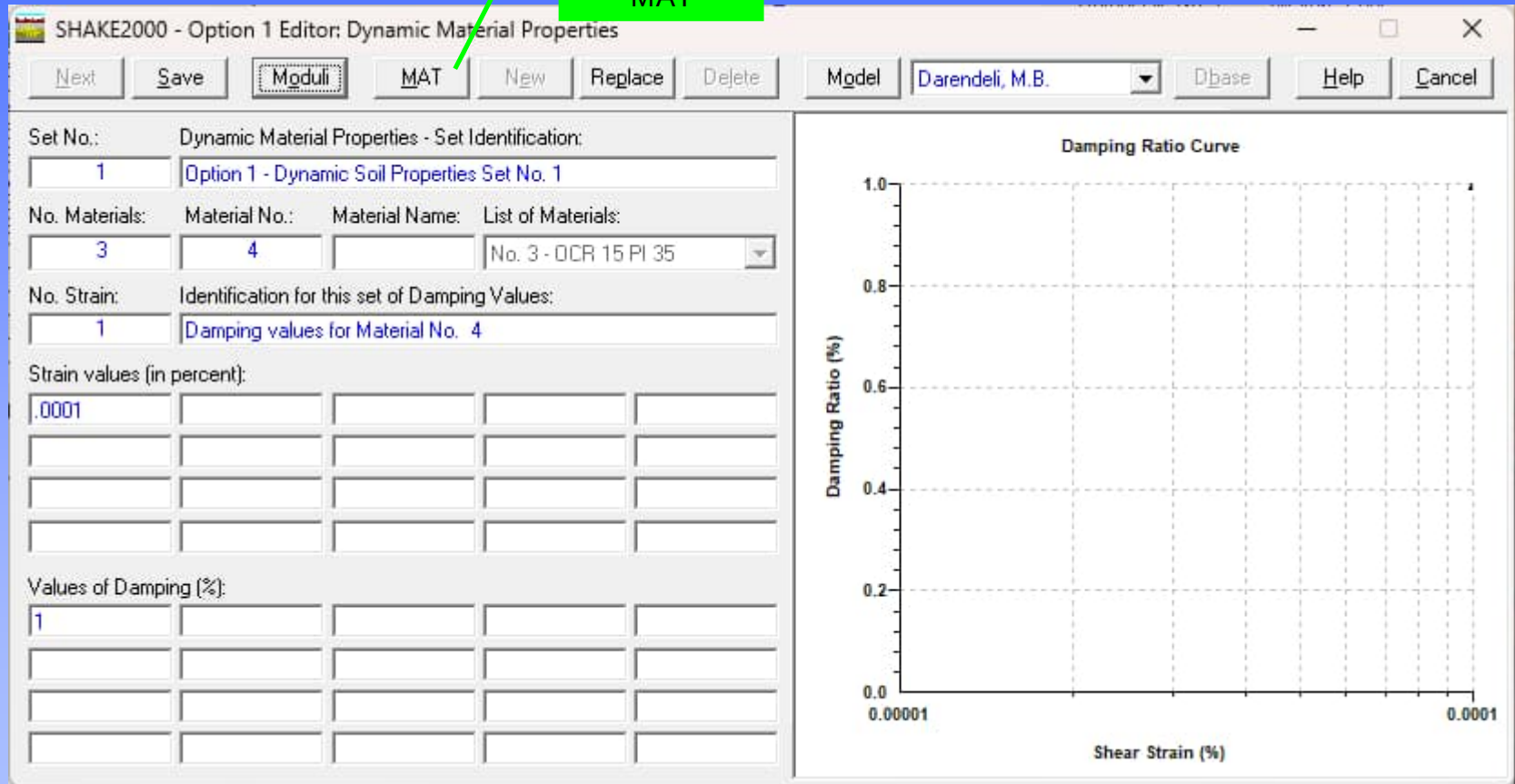
1. Click on
"Damping"



Site Specific Response Analysis

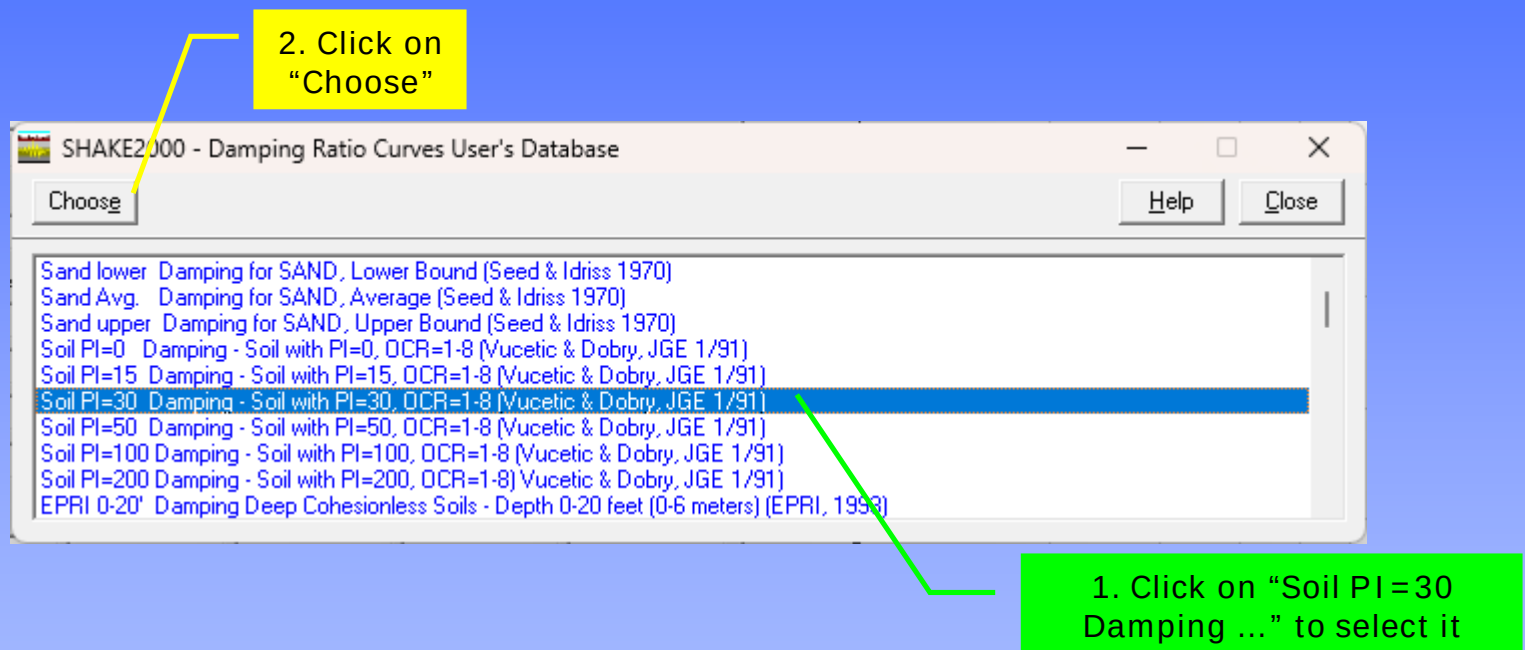
Obtain curves from database of materials

1. Click on
"MAT"



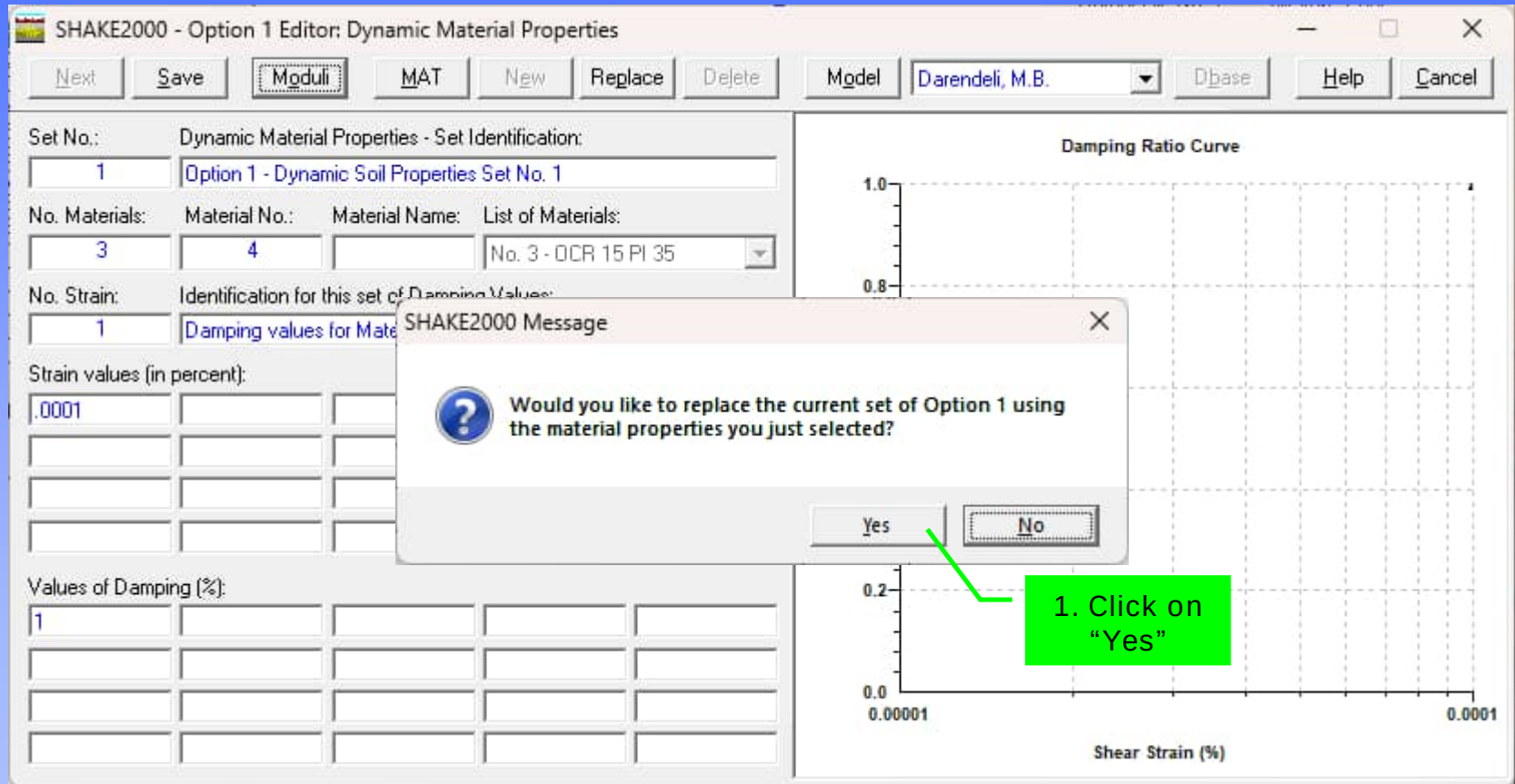
Site Specific Response Analysis

Obtain curves from database of materials



Site Specific Response Analysis

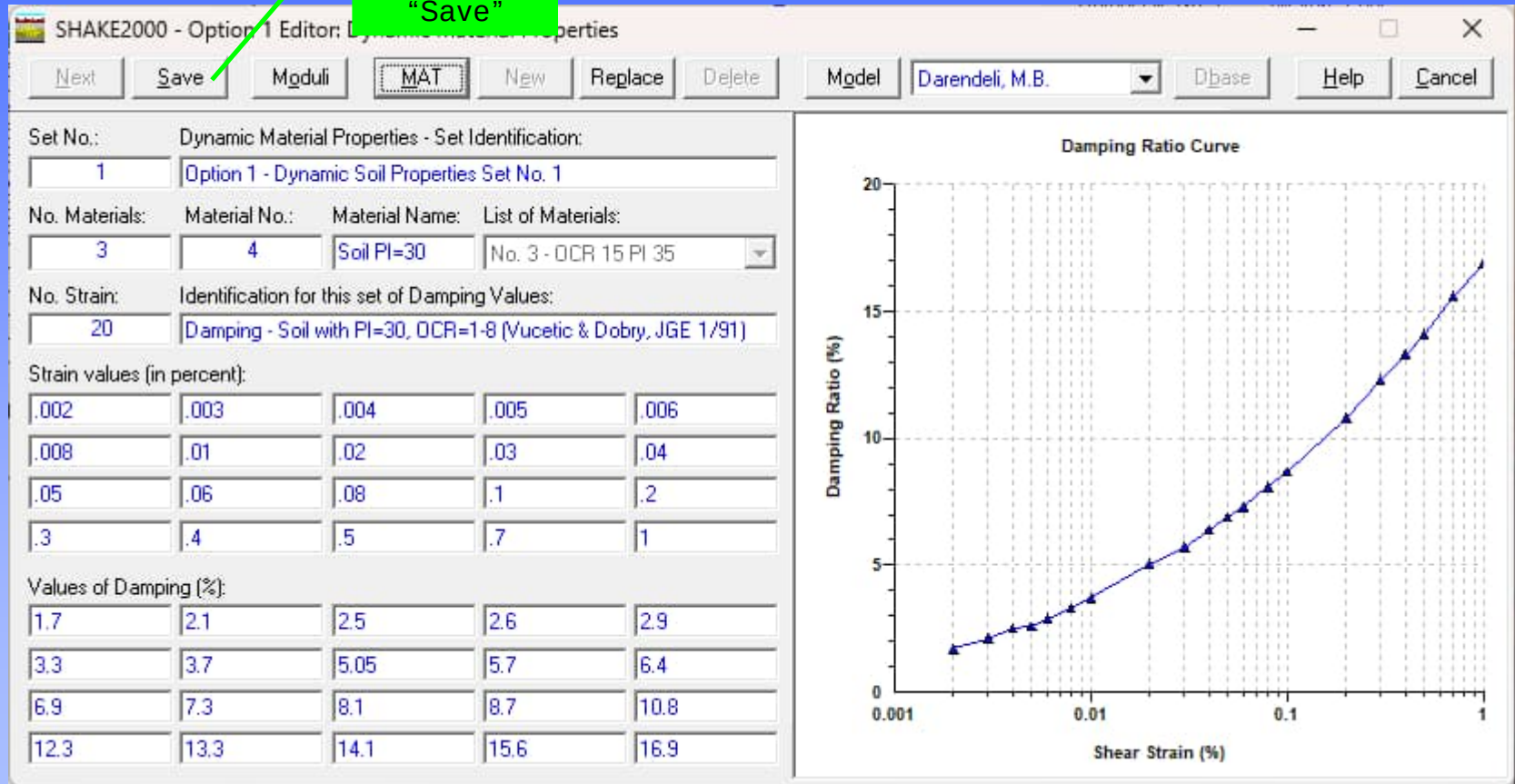
Obtain curves from database of materials



Site Specific Response Analysis

Obtain curves from database of materials

1. Click on
"Save"



Site Specific Response Analysis

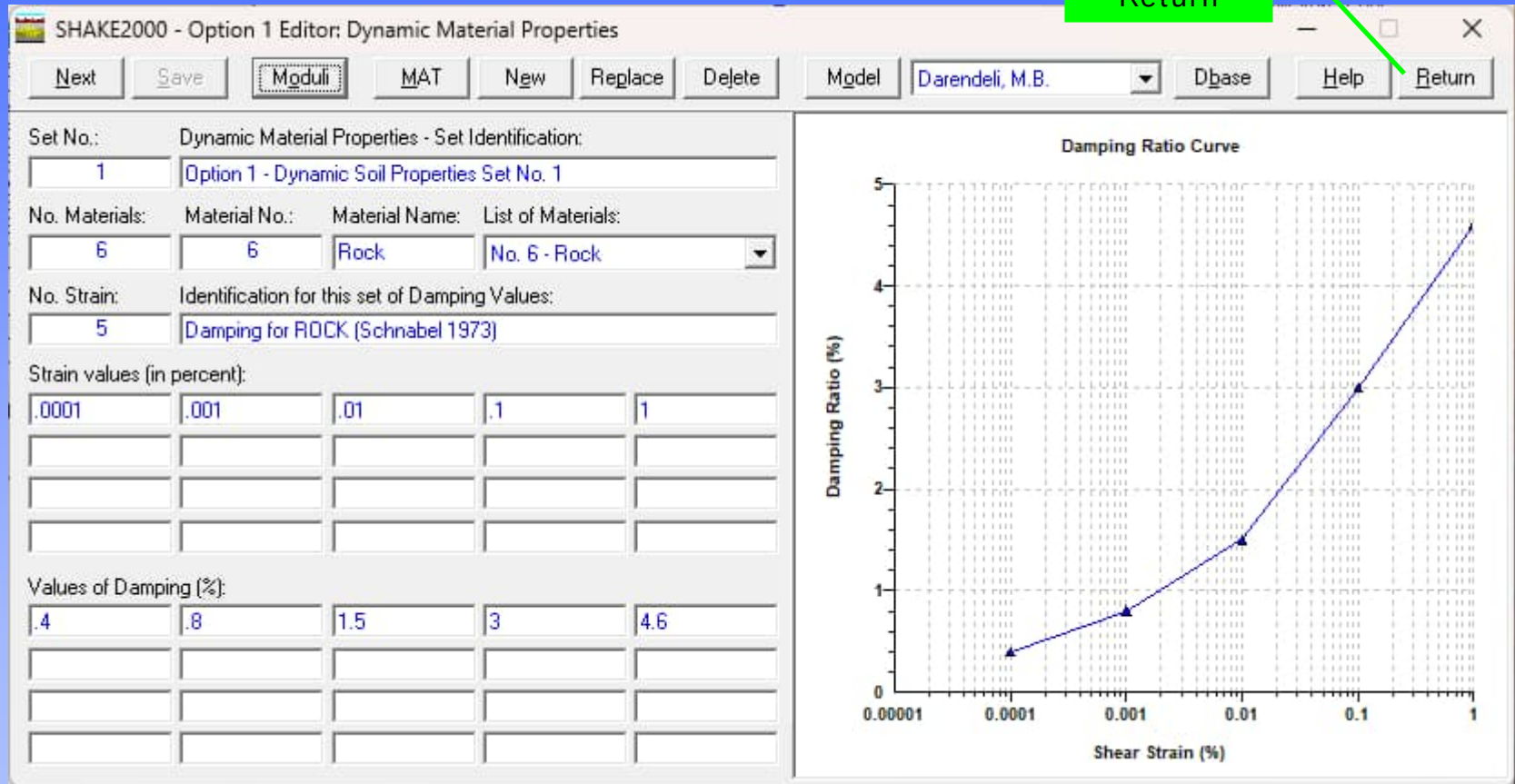
Use the database of materials to get soil types 5 and 6

Mat.	Description
5	Soil $PI=15$ G/G_{max} – Soil with $PI=15$, OCR 1-15 (Vucetic & Dobry, JGE 1/91)
6	Rock G/G_{max} – ROCK (Schnabel 1973)

Site Specific Response Analysis

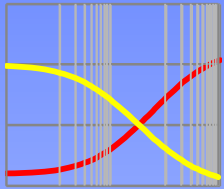
Obtain curves from database of materials

1. Click on
"Return"



Site Specific Response Analysis

SHAKE Column Option 2 – Soil Profile



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, Thickness
Damping, γ , $G_{\max}$ or V_s

Option 2

Soil Layer n-1

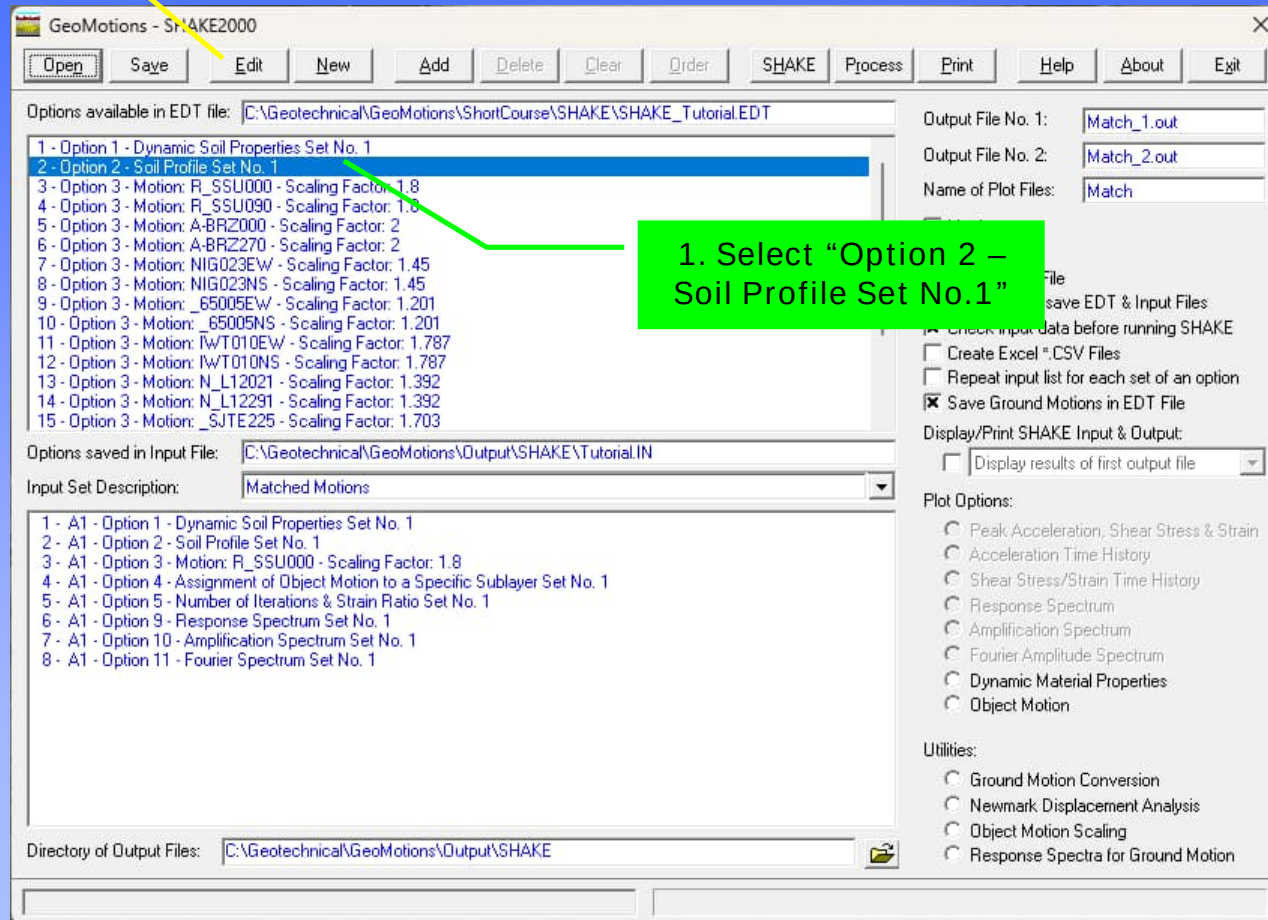
Soil Layer n

Half-Space Layer

Site Specific Response Analysis

Edit SHAKE Options – Option 2

2. Click on “Edit”



Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile

SHAKE2000 - Option 2 Editor: Soil Profile

1. Enter "Option 2 – Column 1"

2. Enter "Col 1" in Identification

3. Enter "124" in Surface

4. Enter "5" in Thickness

5. Enter "0.125" for Unit Weight

6. Enter "573" in Shear Wave

Soil Profile No.	No. Sublayers	Identification for Soil Profile:	Surface
1	2	Col 1	124 ft

Layer Number	Soil Type	Thickness (ft)	Shear Moduli (ksf)	Damping (decimal)	Unit Weight (kcf)	Shear Wave (fps)
1	1	5		.05	0.125	573
2	1			.02	.145	2500
3						
4						
5						
6						
7						
8						
9						
10						

Site Specific Response Analysis

Option 2 – Enter the data for the other layers

Layer No.	Soil Type	Thickness (feet)	Damping	Unit Weight (kcf)	V _s (fps)
2	1	5	0.05	0.125	573
3	1	7.5	0.05	0.125	758
4	1	7.5	0.05	0.125	758
5	2	5	0.05	0.130	656
6	2	5	0.05	0.130	656
7	2	5	0.05	0.130	656
8	3	5	0.05	0.115	802
9	3	5	0.05	0.115	802
10	4	7.5	0.05	0.110	791
11	4	7.5	0.05	0.110	791
12	5	7.5	0.05	0.120	872
13	5	7.5	0.05	0.120	872
14	6		0.02	0.145	2500

*

*After entering the V_s value for layer 10 press "Tab" to move out of the cell and then you'll be able to scroll down

Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile

SHAKE2000 - Option 2 Editor: Soil Profile

Print Plot Add Reset Repeat Layers GmaxEq Gmax Help Return

Set No.: 1 Soil Profile - Set Identification: Option 2 - Column 1 ☒ Option 6

Soil Profile No. 1 No. Sublayers: 14 Identification for Soil Profile: Col 1 Surface 124 ft

1. Click on "Option 6"

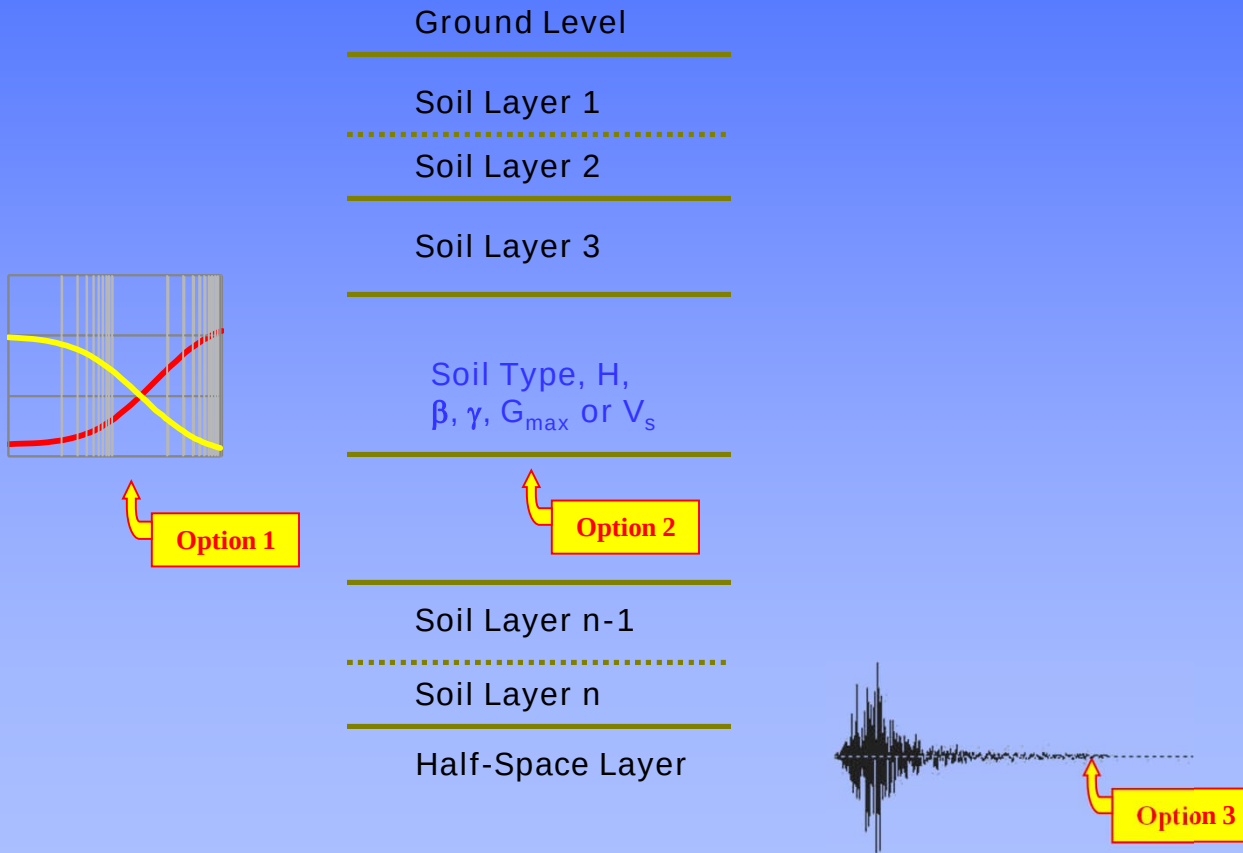
Layer Number	Soil Type	Thickness (ft)	Shear Moduli (ksf)	Damping (decimal)	Unit Weight (kcf)	Shear Wave (fps)
6	2	5		.05	.13	656
7	2	5		.05	.13	656
8	3	5		.05	.115	802
9	3	5		.05	.115	802
10	4	7.5		.05	.11	791
11	4	7.5		0.05	0.110	791
12	5	7.5		0.05	0.120	872
13	5	7.5		0.05	0.120	872
14	6			0.02	0.145	2500
15						

Halfspace Layer

2. Click on "Return"

Site Specific Response Analysis

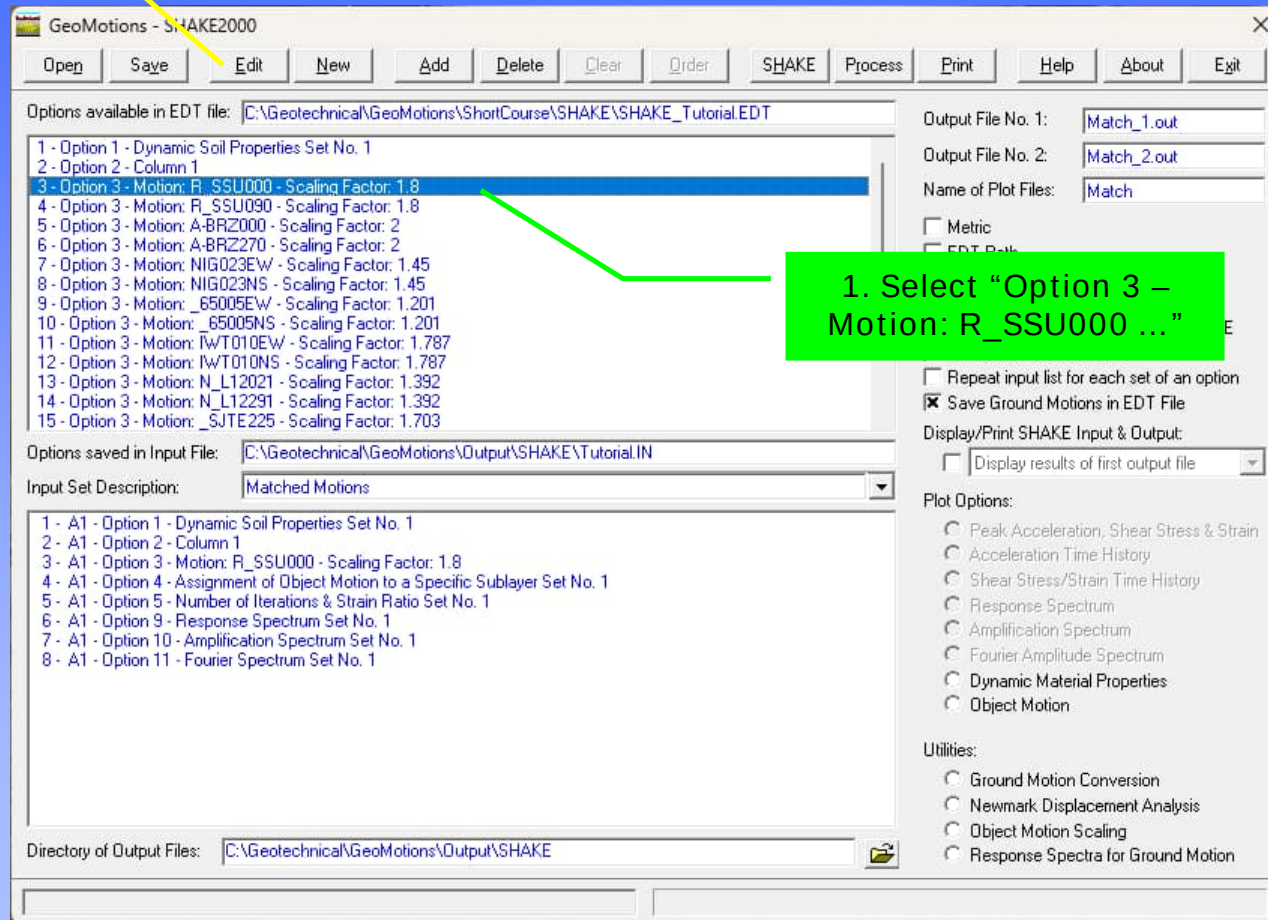
SHAKE Column Option 3 – Ground Motion Files



Site Specific Response Analysis

Edit SHAKE Options – Option 3

2. Click on “Edit”



Site Specific Response Analysis

Create Input Data – Option 3: Input Motion

The screenshot shows the 'SHAKE2000 - Option 3 Editor: Input (Object) Motion' dialog box. It features a menu bar with 'Quakes', 'Other', 'Convert', 'Restore', 'View', 'Plot', 'Help', and 'Return'. The 'Plot' button is highlighted with a green box and an arrow pointing to it, with the text '1. Click on "Plot"'. Below the menu bar, there are several input fields and labels. A pink box with the text 'Quiet zone: >= 10% difference' points to the 'Acceleration Values' field, which contains '11448'. The 'No. Fourier Values' field contains '16384'. The 'Time Interval' field contains '.005'. The 'Format of Object Motion File' field contains '(4E15.6E2)'. The 'Earthquake Identification' field contains 'R_SSU000'. The 'Name and Path of Source Object Motion File' field contains 'C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN1078_NORTH_R_SSU000.eqk'. At the bottom, there are five more input fields: 'Multiplication Factor' (1.8), 'Maximum Acceleration' (empty), 'Maximum Frequency' (25), 'No. Header Lines' (8), and 'Acceleration Values/Line' (4). A red box with the text 'Either multiplication factor or maximum acceleration' points to the 'Multiplication Factor' and 'Maximum Acceleration' fields.

SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 1 Input: Option 3 Acceleration Values: 11448 No. Fourier Values: 16384 Time Interval: .005 Format of Object Motion File: (4E15.6E2) Earthquake Identification: R_SSU000

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN1078_NORTH_R_SSU000.eqk

Multiplication Factor: 1.8 Maximum Acceleration: Maximum Frequency: 25 No. Header Lines: 8 Acceleration Values/Line: 4

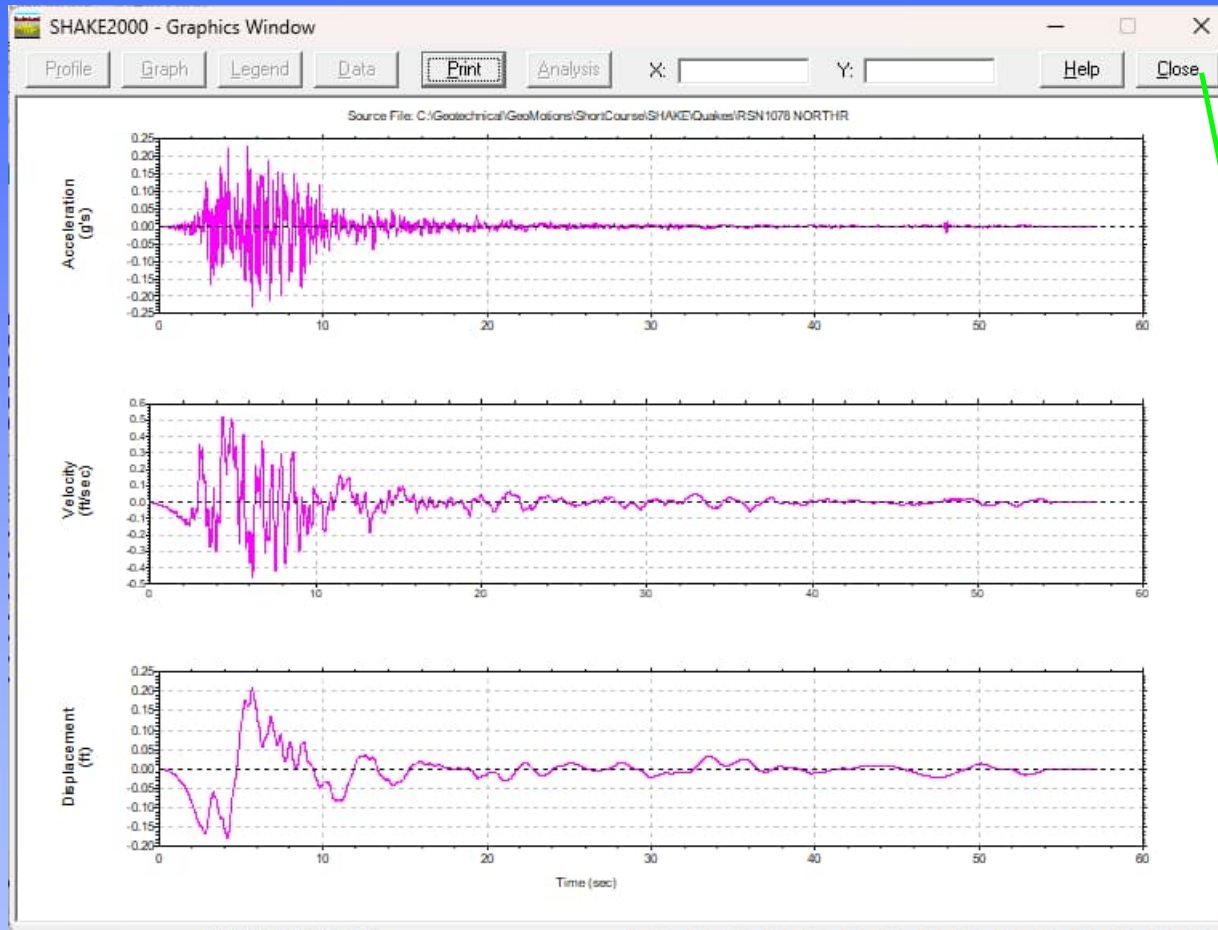
1. Click on "Plot"

Quiet zone: >= 10% difference

Either multiplication factor or maximum acceleration

Site Specific Response Analysis

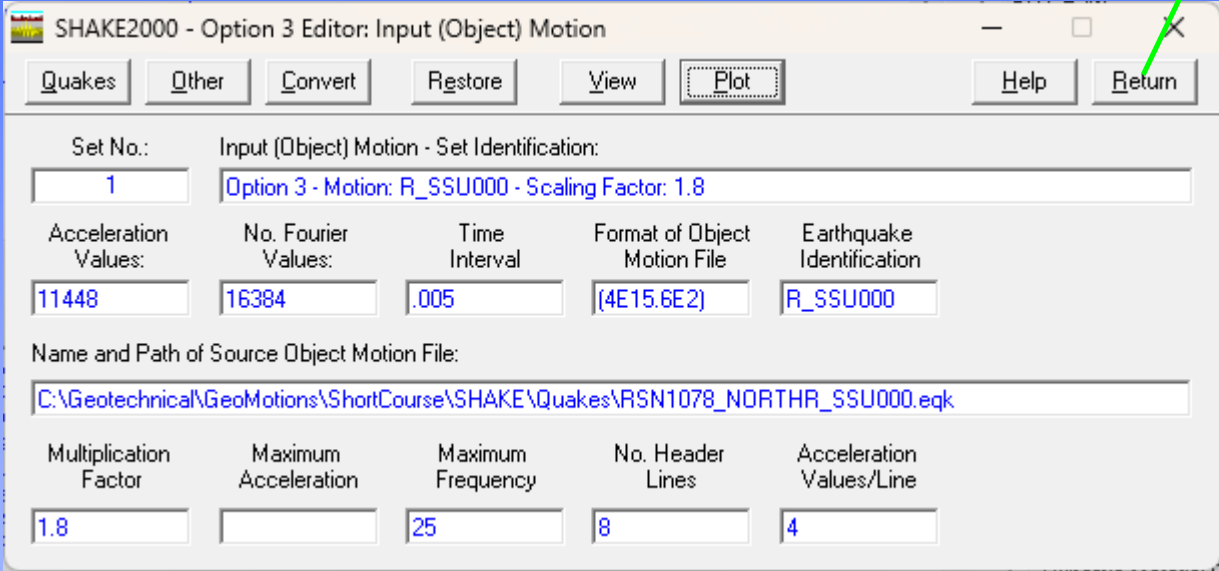
Create Input Data – Check Input Motion



1. Click on
"Close"

Site Specific Response Analysis

Create Input Data – Option 3: Input Motion



The dialog box is titled "SHAKE2000 - Option 3 Editor: Input (Object) Motion". It features a toolbar with buttons: Quakes, Other, Convert, Restore, View, Plot, Help, and Return. The "Return" button is highlighted with a green arrow pointing to a green callout box.

Set No.: 1

Input (Object) Motion - Set Identification: Option 3 - Motion: R_SSU000 - Scaling Factor: 1.8

Acceleration Values:	No. Fourier Values:	Time Interval	Format of Object Motion File	Earthquake Identification
11448	16384	.005	(4E15.6E2)	R_SSU000

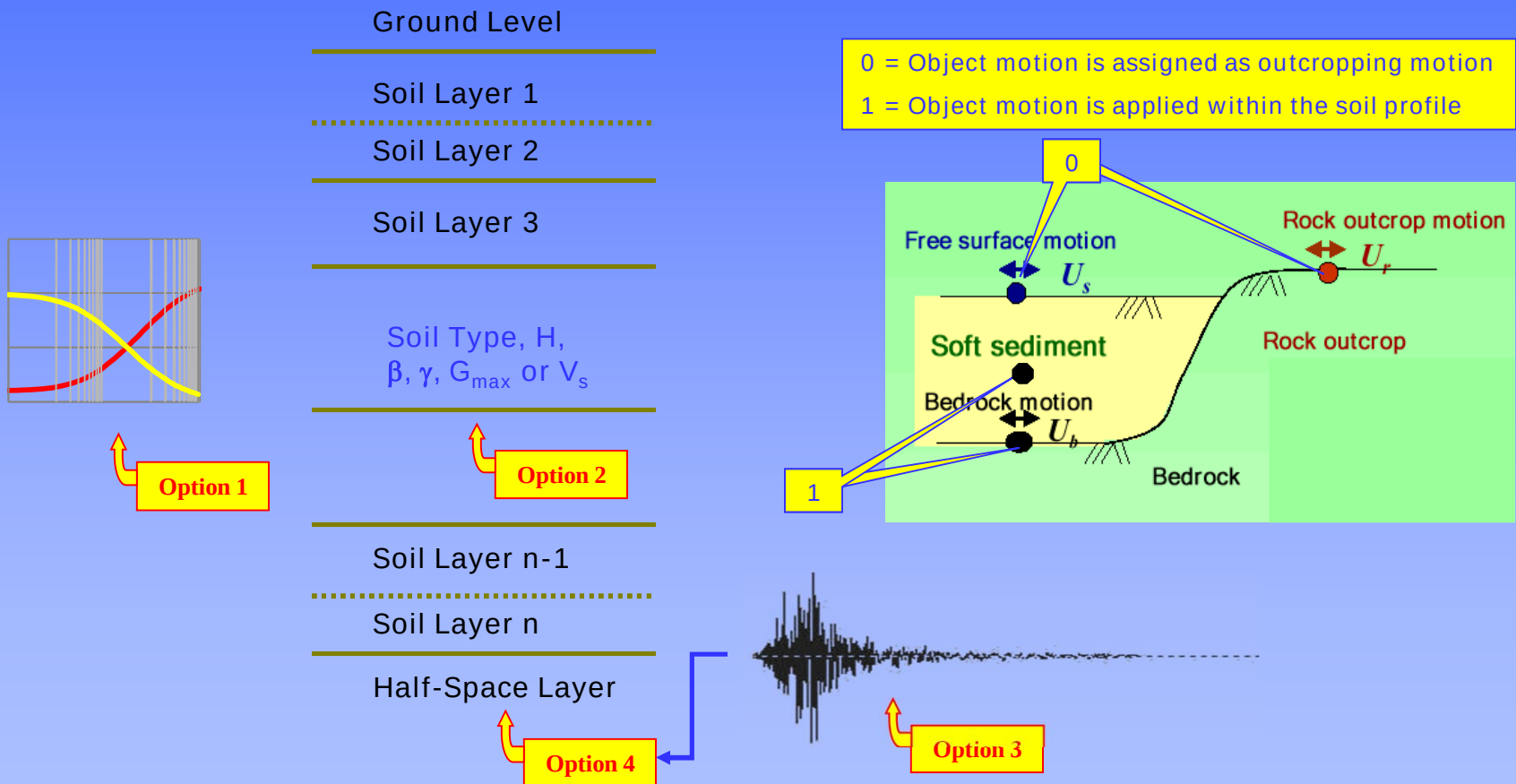
Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN1078_NORTHR_SSU000.eqk

Multiplication Factor	Maximum Acceleration	Maximum Frequency	No. Header Lines	Acceleration Values/Line
1.8		25	8	4

1. Click on
"Return"

Site Specific Response Analysis

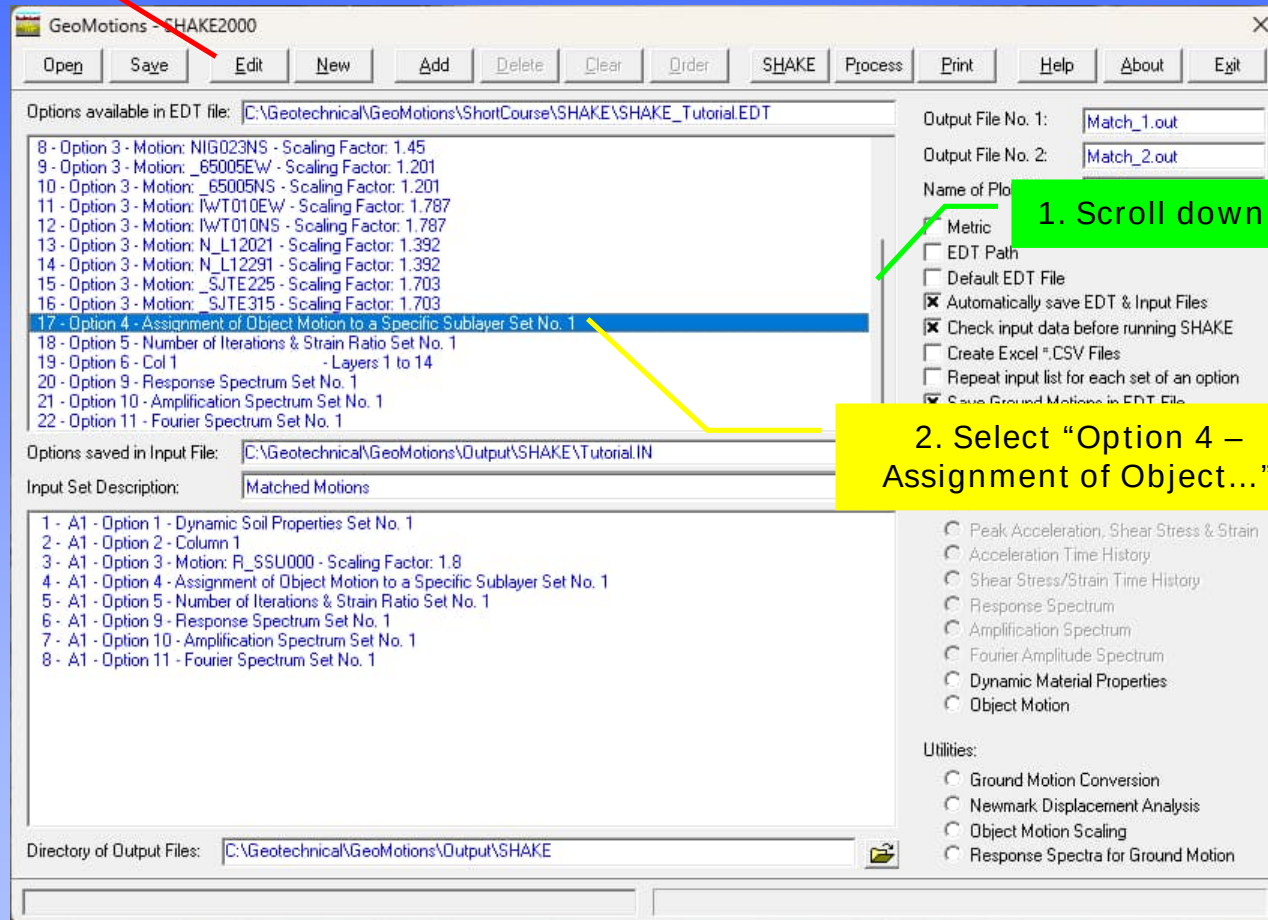
SHAKE Column Option 4 – Assign Input Motion to Layer



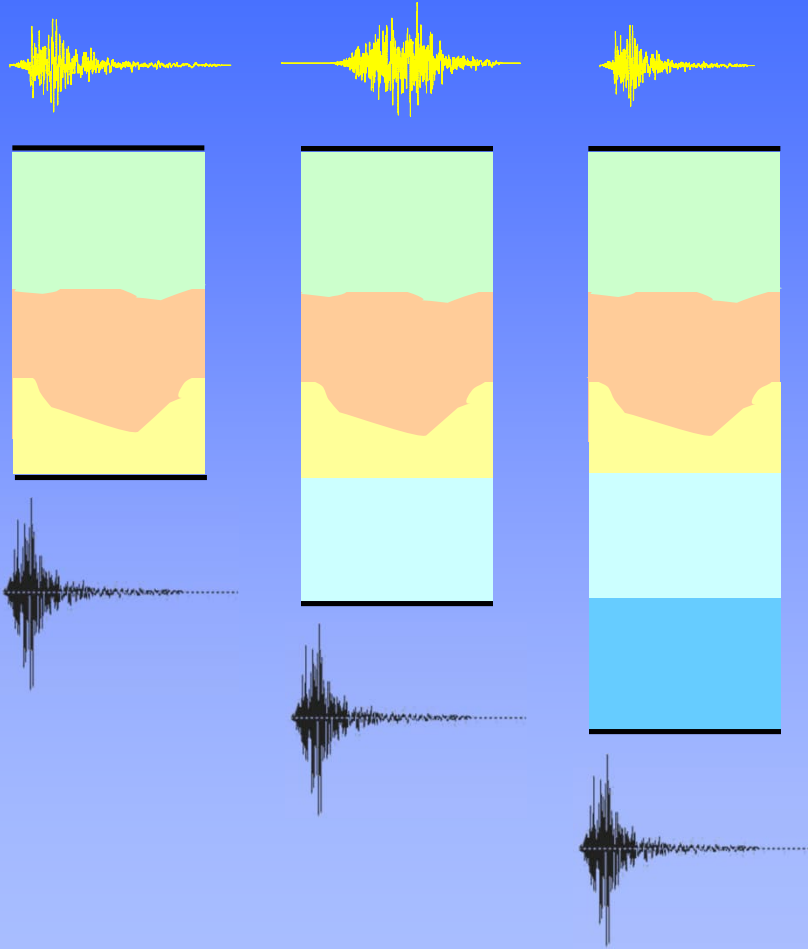
Site Specific Response Analysis

Edit SHAKE Options – Option 4

3. Click on "Edit"



Where is the Halfspace Layer?



Halfspace: *A mathematical model bounded by a planar surface but otherwise infinite. Properties within the model are commonly assumed to be homogeneous and isotropic, unlike the Earth itself, which is heterogeneous and anisotropic.* (Seismologist's Dictionary at <http://www.uwm.edu/Dept/Geosciences>)

Soft rock $\Rightarrow V_s \geq 2,500$ ft/sec ?

A halfspace implies that V_s does not increase with depth.

Site Specific Response Analysis

Create Input Data – Option 4: Assignment of Object Motion

The screenshot shows the 'SHAKE2000 - Option 4 Editor: Assignment of Object Motion' dialog box. It contains the following fields and controls:

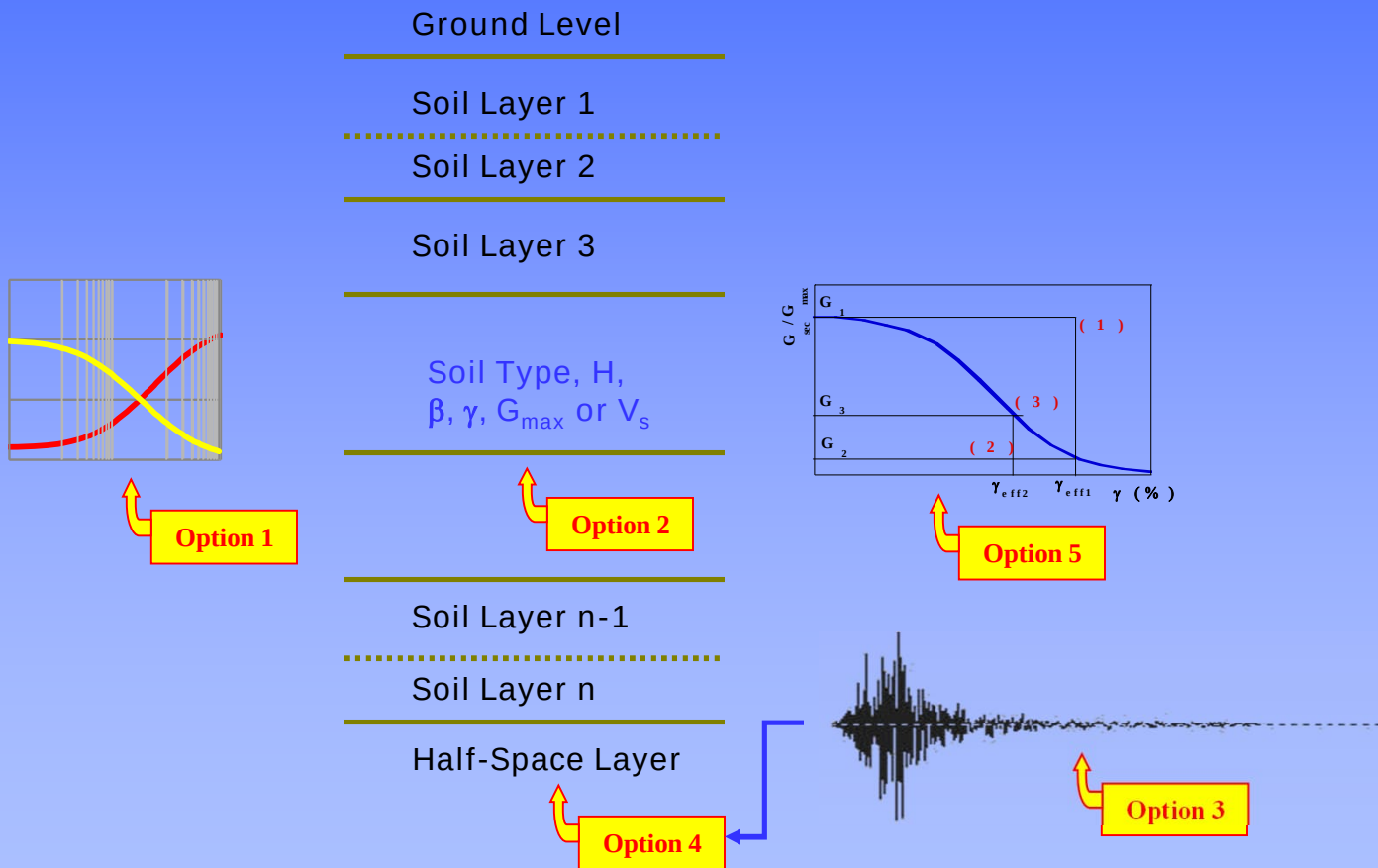
- Set No.:** A text box containing the value '1'.
- Assignment of Object Motion to Sublayer - Set Identification:** A text box containing the text 'Option 4 - Motion at Layer 14 - Outcrop'.
- No. of Sublayer:** A text box containing the value '14'.
- Outcrop or Within Profile:** A text box containing the value '0'.
- Option 2 Deconvolved Profile (Silva et al., 1988):** An unchecked checkbox.
- Buttons:** 'Help' and 'Return' buttons are located in the top right corner.

Four instructional callouts are present:

- 1. Enter "Option 4 – Motion at Layer 14 – Outcrop"** (green box) points to the 'Set Identification' text box.
- 2. Enter "14" for No. of Sublayer** (yellow box) points to the 'No. of Sublayer' text box.
- 3. Click on "Return"** (red box) points to the 'Return' button.
- 0 = Outcrop
1 = Within** (blue box) points to the 'Outcrop or Within Profile' text box.

Site Specific Response Analysis

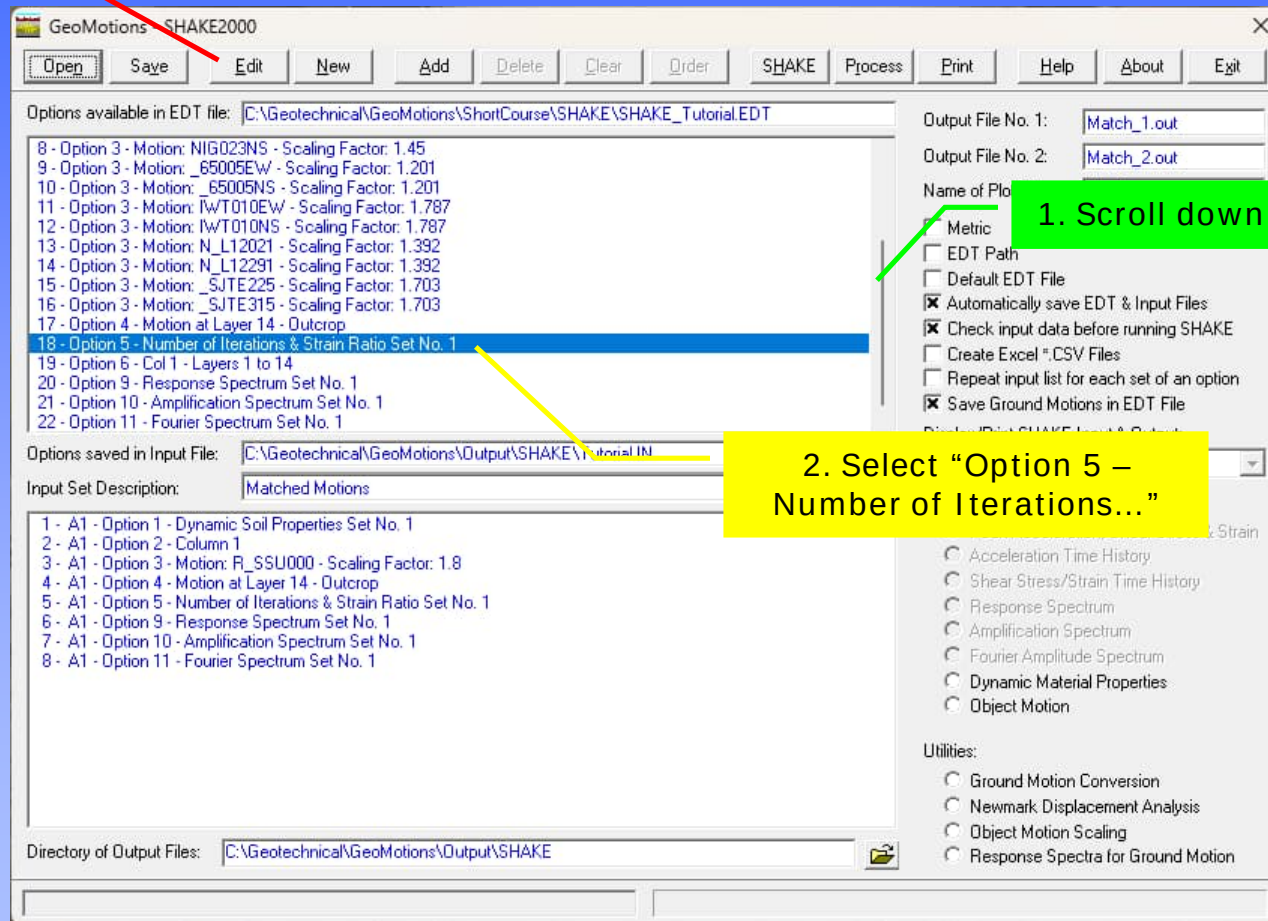
SHAKE Column Option 5 – No. of Iterations & Strain Ratio



Site Specific Response Analysis

Edit SHAKE Options – Option 5

3. Click
on “Edit”



Site Specific Response Analysis

Create Input Data – Option 5: No. Iterations & Strain Ratio

1. Enter "Option 5 – No. Iterations:
10 – Strain Ratio: 0.65" for ID

SHAKE2000 - Option 5 Editor: Number of Iterations and Strain Ratio

Help Return

Set No.: 1

Iteration and Strain Ratio - Set Identification
Option 5 - No. Iterations: 10 - Strain Ratio: 0.65

Save Strain Compatible

Number of Iterations: 10

Strain Ratio: 0.65

3. Click on
"Return"

2. Enter "0.65"
for Strain Ratio

SHAKE Analysis

- Equivalent loading $\Rightarrow$ 50% - 70% (Kramer, 1996).
- Equivalent loading $\Rightarrow$ 40% - 75% (Idriss & Sun, 1992)

ratio = $(M - 1) / 10$ where M = earthquake magnitude

- Carlton (2015) indicates that using 0.65 gives a 2-10% better fit than using $(M-1) / 10$

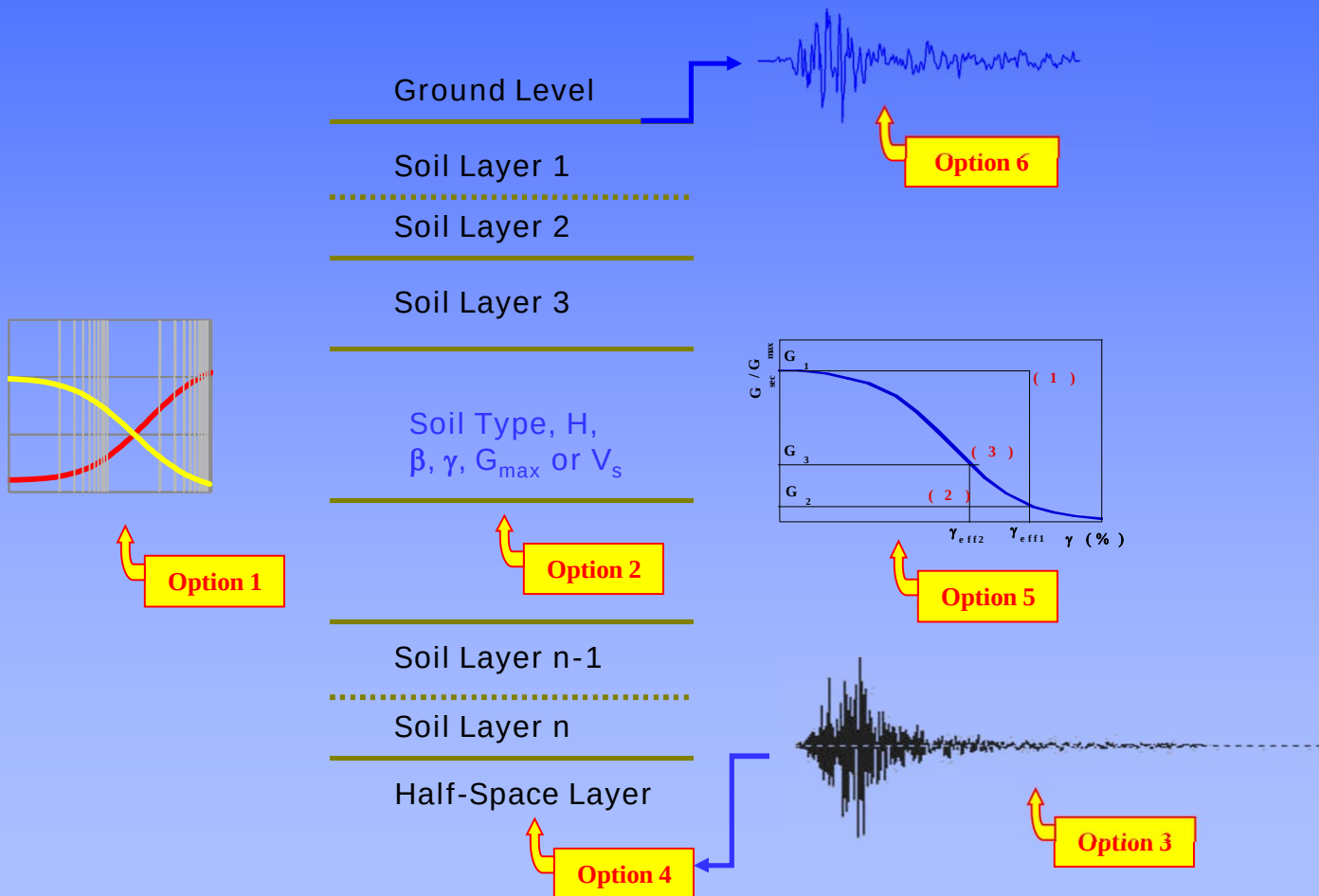
Kramer, S.L. (1996). Geotechnical Earthquake Engineering, Prentice Hall, Inc., Upper Saddle River, New Jersey, 653 pp.

Idriss, I.M. and Joseph I. Sun (1992). *User's Manual for SHAKE91, A Computer Program for Conducting Equivalent Linear Seismic Response Analyses of Horizontally Layered Soil Deposits*. Center for Geotechnical Modeling, Department of Civil & Environmental Engineering, University of California, Davis, California.

Carlton, Brian (2015). *Ground Motion Parameter Sensitivity to Shear Strain Ratio in Equivalent Linear Analyses*. Earthquake Spectra In-Press.

Site Specific Response Analysis

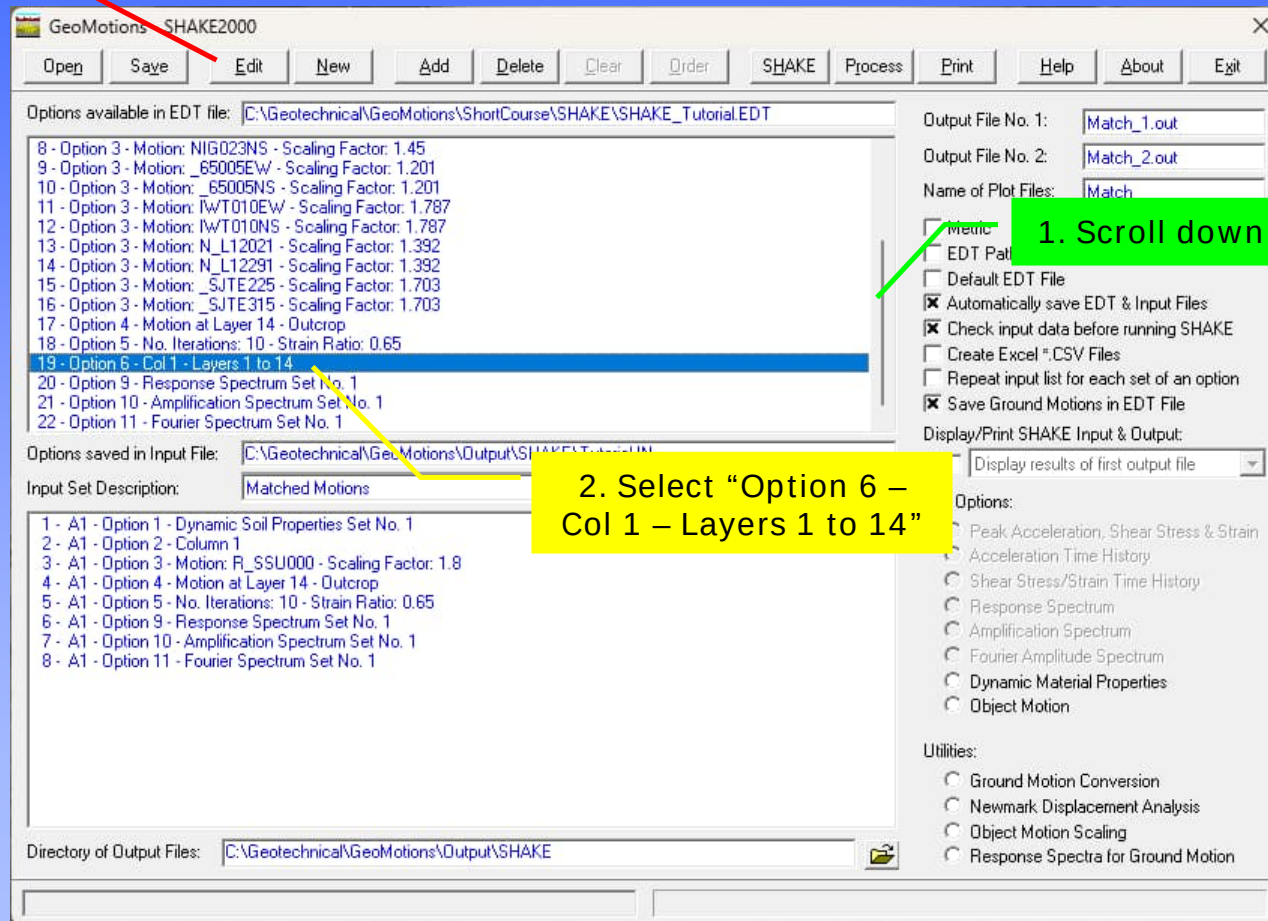
SHAKE Column Option 6 – Acceleration Time Histories



Site Specific Response Analysis

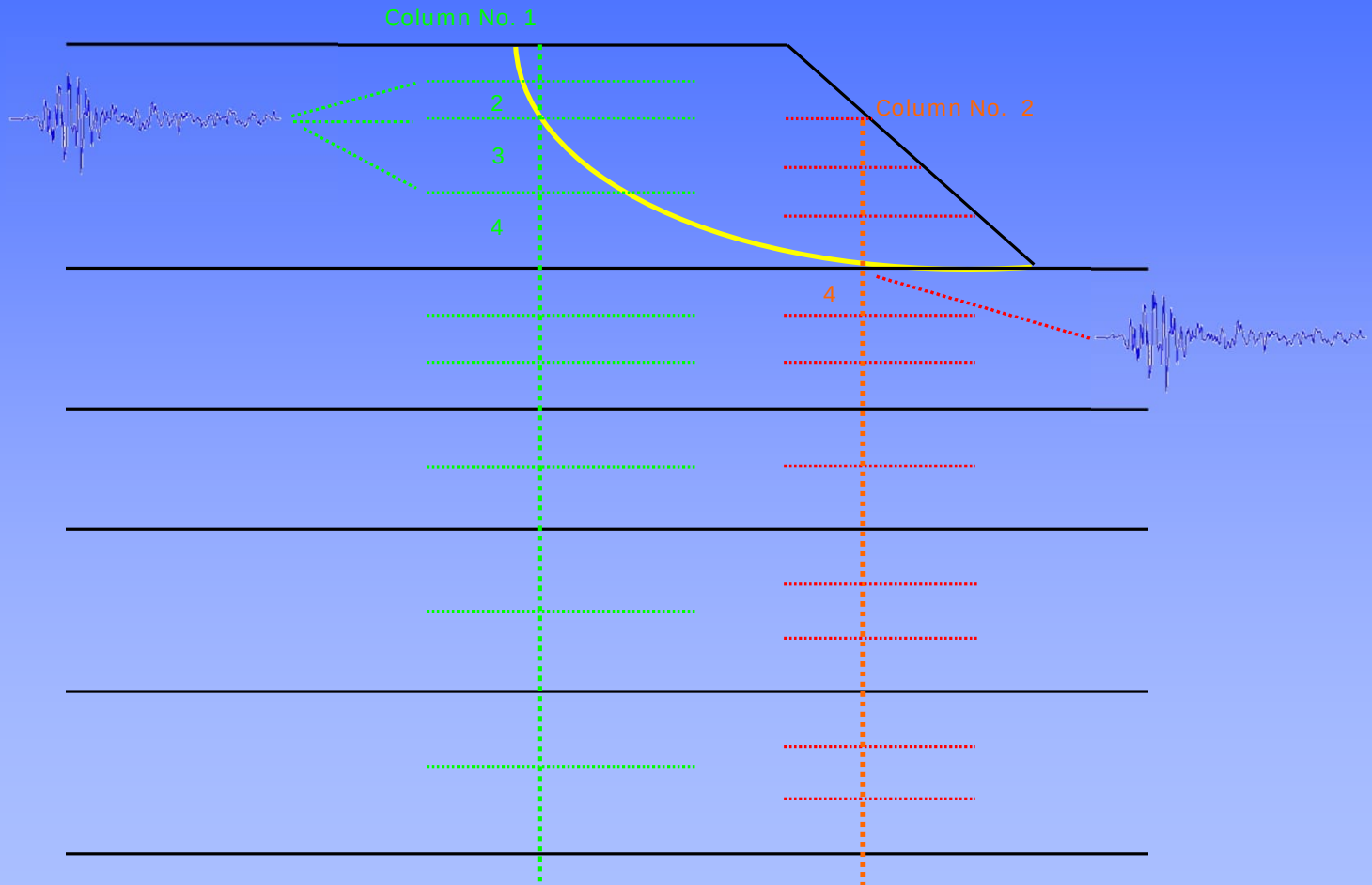
Create Input Data

3. Click
on "Edit"



Sample Problem

Acceleration Time Histories for Newmark Analysis



Acceleration time histories at the top of layers 2, 3, and 4 for Column 1, and at the top of layer 4 for Column 2 will be used in the Newmark Displacement Analysis.

Site Specific Response Analysis

Create Input Data – Option 6: Acceleration Time Histories

SHAKE2000 - Option 6 Editor: Acceleration at Top of Sublayers

Repeat

Set No.: 1

Acceleration at Top of Sublayers - Set Identification: Option 6 - Col 1 - Layers 1 to 14

HEA - Option 7 ☒

Sublayers for which acceleration time histories are computed:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 14

Type of each sublayer: 0 (zero) for outcrop, 1 (one) for within soil profile, or 2 (two) for incident:

0 1 1 1 1 1 1 1 1 1 1 1 1 1 0

Output mode for computed accelerations: 0 if only maximum acceleration; or 1 for maximum acceleration and time history:

0 1 1 1 0 0 0 0 0 0 0 0 0 0 0

5. Click on "Return"

4. Click on "HEA - Option 7"

2. Enter "14" for Layer No.

3. Enter "0" for Type **

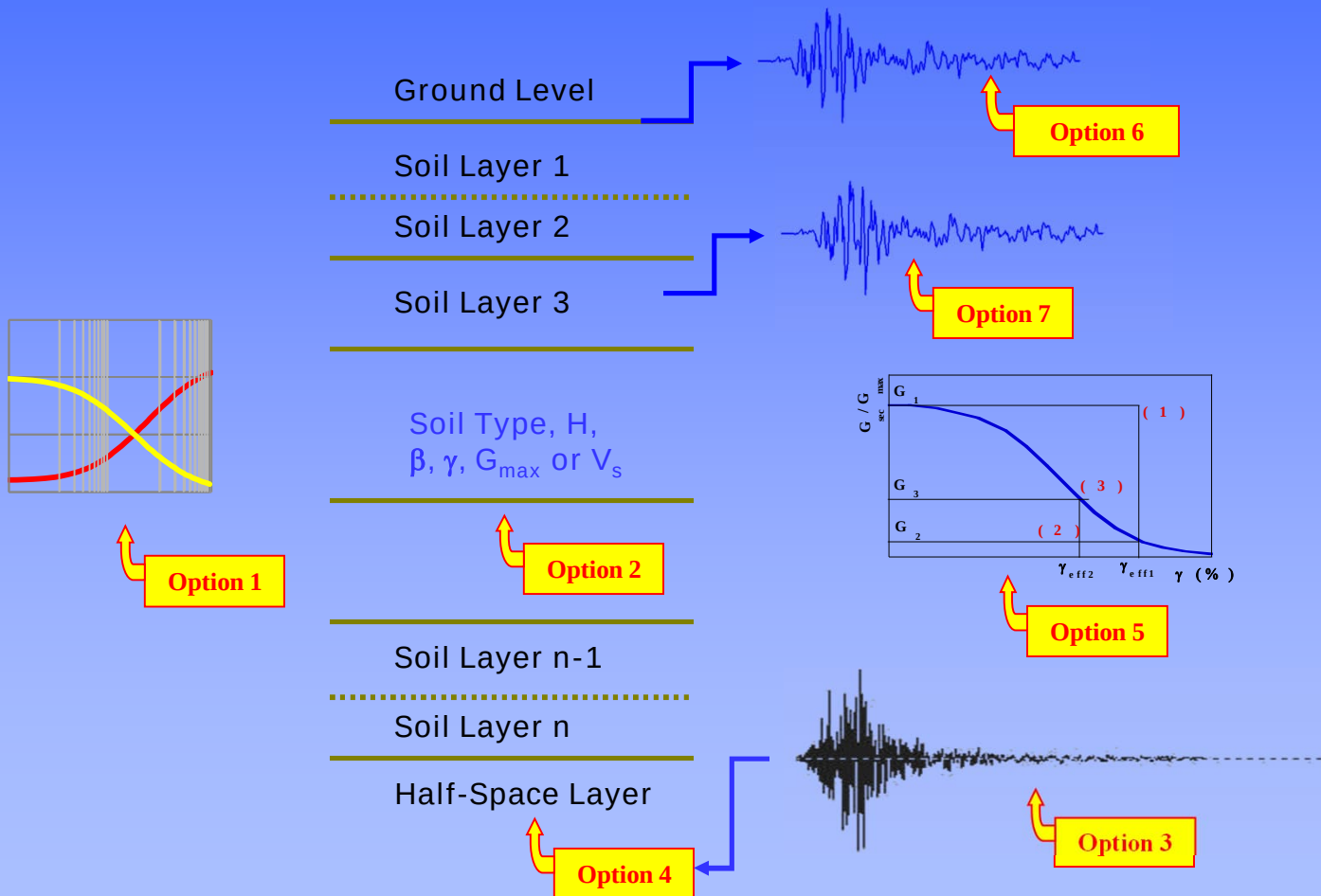
1. Enter "1" for Output mode... for Layers 2, 3, and 4 ^^

** The second set of values for Layer 14 will just output the input data for the motion assigned as outcrop in Layer 14; the first set will output the results of the analysis at Layer 14, i.e., for the within layer.

^^ Acceleration time histories at the top of layers 2, 3, and 4 will be used in the Newmark Displacement Analysis.

Site Specific Response Analysis

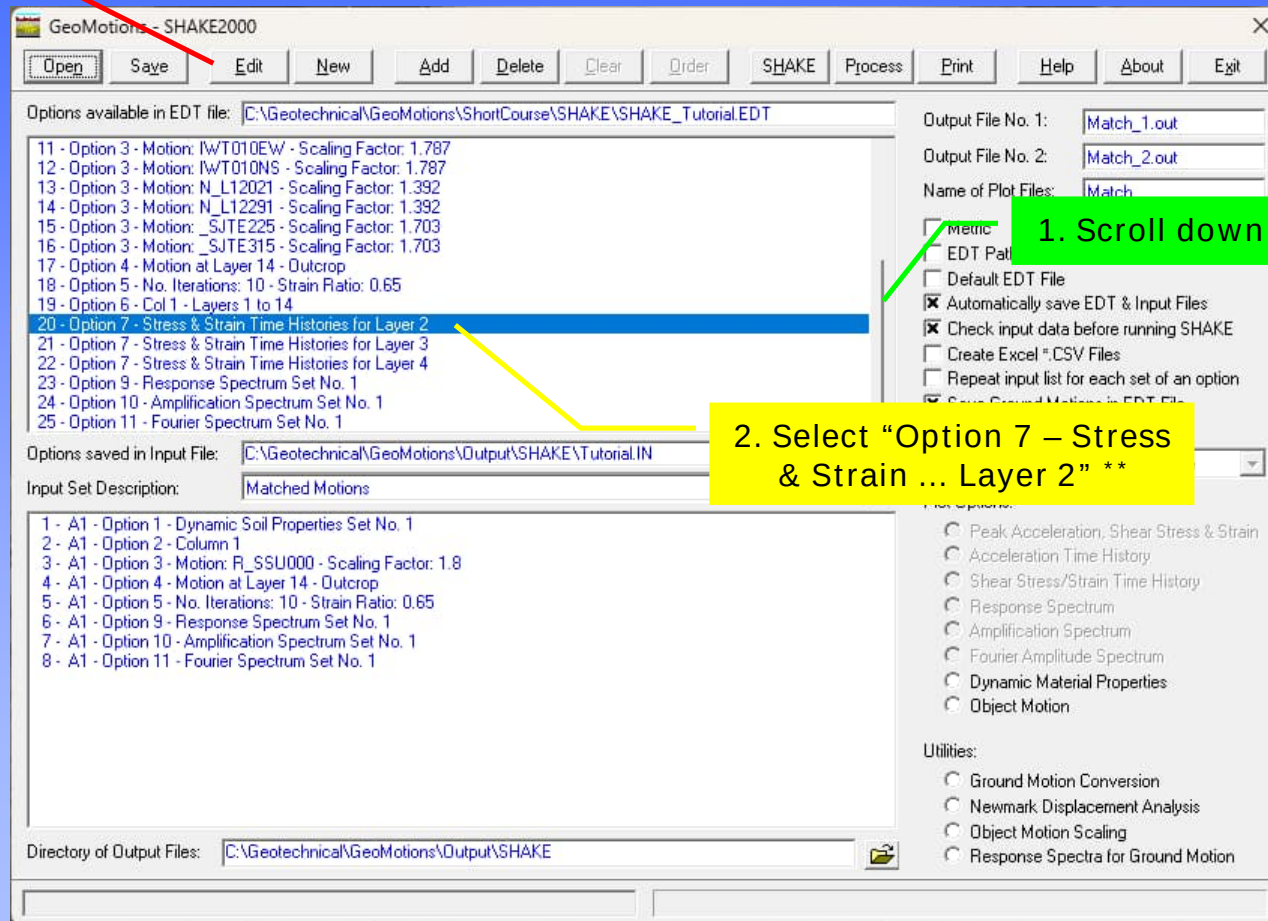
SHAKE Column Option 7 – Stress & Strain Time Histories



Site Specific Response Analysis

Create Input Data

3. Click
on "Edit"



1. Scroll down

2. Select "Option 7 – Stress
& Strain ... Layer 2" **

** Option 7 for layers 2, 3, and 4 were automatically created when you selected the "HEA – Option 7" check box in Option 6.

Site Specific Response Analysis

Create Input Data – Option 7: Shear Strain & Shear Stress

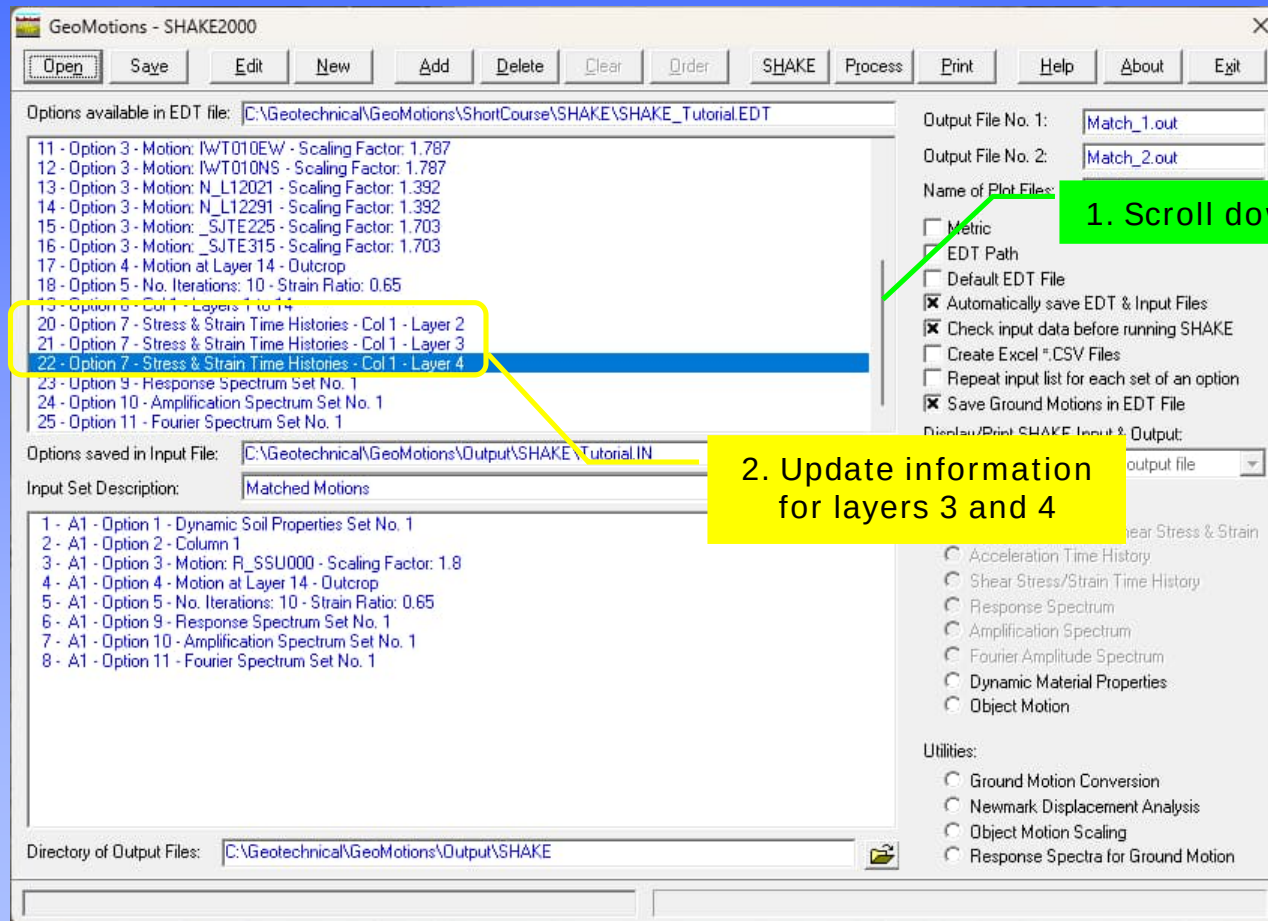
The screenshot shows the 'SHAKE2000 - Option 7 Editor: Shear Strain or Stress History' dialog box. It contains the following fields and instructions:

- 1. Enter "Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2"**: Points to the 'Set Identification' field.
- 2. Enter "Stress – Col 1 – Layer 2"**: Points to the 'Identification' field for the first sublayer.
- 3. Enter "Strain – Col 1 – Layer 2"**: Points to the 'Identification' field for the second sublayer.
- 4. Click on "Return"**: Points to the 'Return' button.

Set No.:	Shear Strain or Stress History - Set Identification:				
1	Option 7 - Stress & Strain Time Histories - Col 1 - Layer 2				
Sublayer No.:	Stress/Strain:	Save History:	No. Values:	Identification:	
2	1	1	2048	Stress - Col 1 - Layer 2	
2	0	1	2048	Strain - Col 1 - Layer 2	

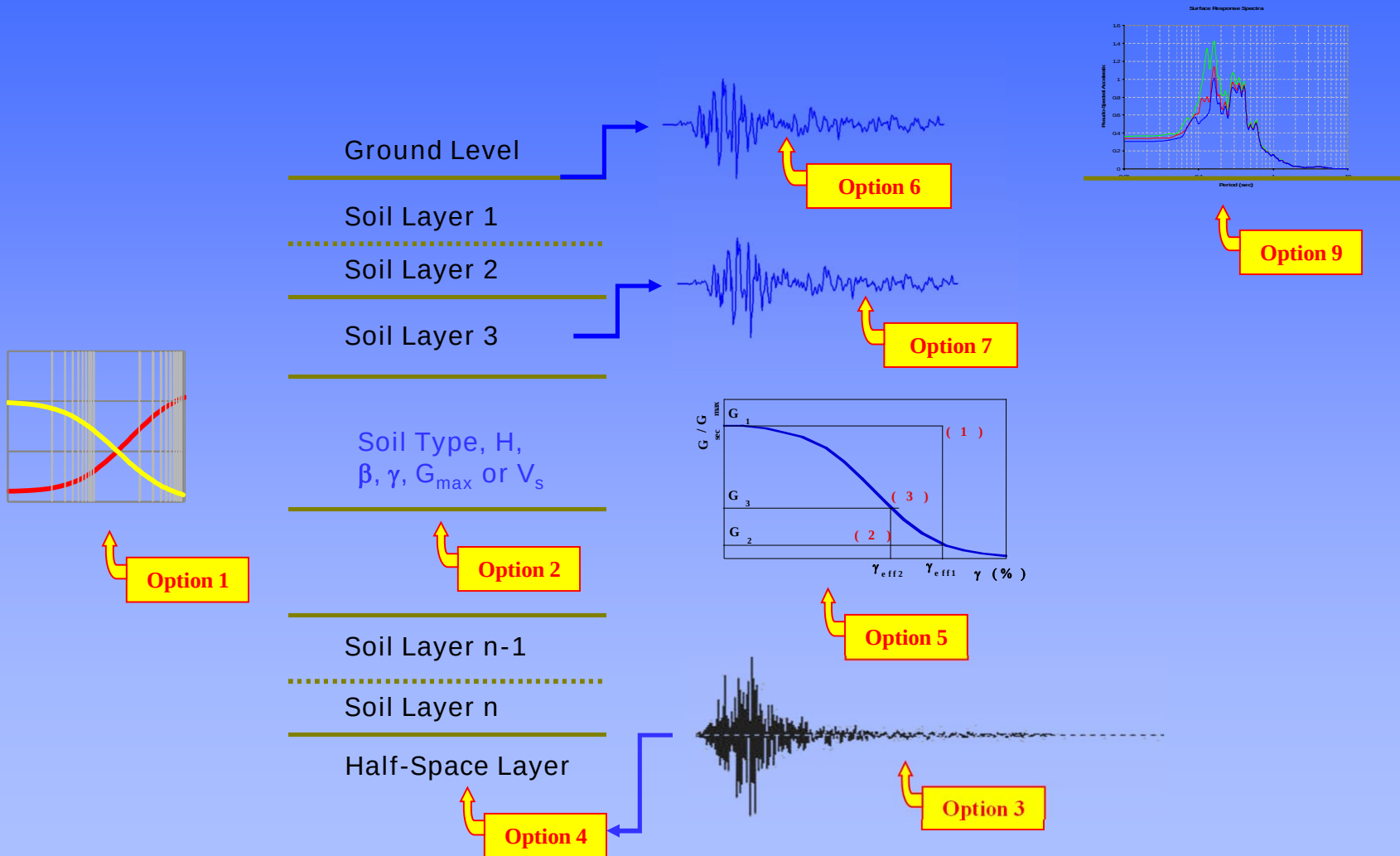
Site Specific Response Analysis

Create Input Data



Site Specific Response Analysis

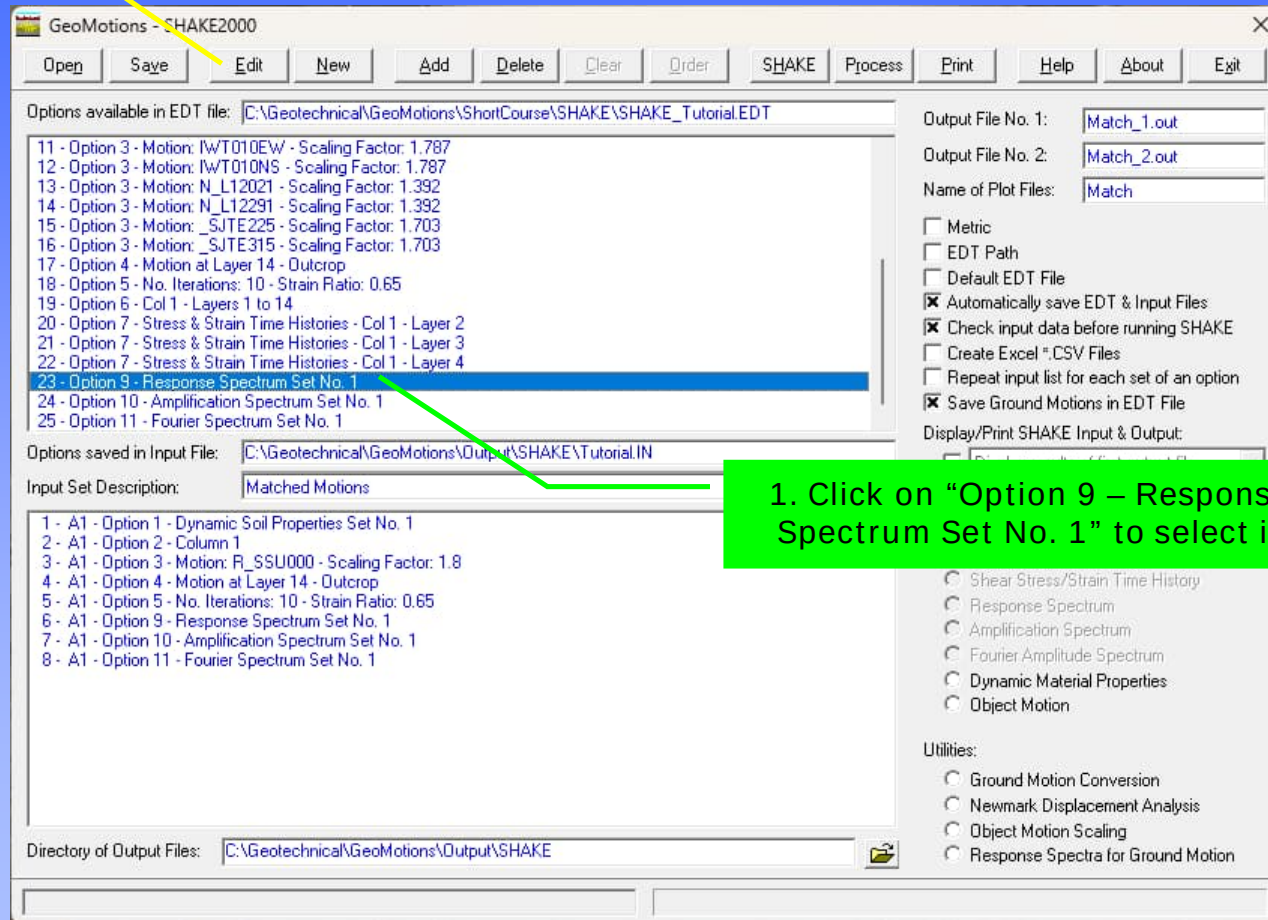
SHAKE Column Option 9 – Response Spectrum



Site Specific Response Analysis

Create Input Data

2. Click
on "Edit"



1. Click on "Option 9 – Response
Spectrum Set No. 1" to select it

Site Specific Response Analysis

Create Input Data – Option 9: Response Spectrum

1. Enter "Option 9 – Response Spectrum at Surface"

2. Click on "Return"

SHAKE2000 - Option 9 Editor: Response Spectrum

Help Return

Set No.: Response Spectrum - Set Identification:

1 Option 9 - Response Spectrum at Surface

Sublayer No.: Outcrop/Within

1 0

No. Damping: Null Gravity

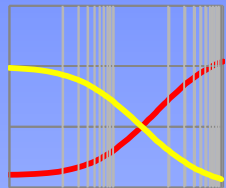
3 0 32.2

Damping Ratios (in decimal):

.05 .1 .2

Site Specific Response Analysis

SHAKE Column Option 10 – Amplification Spectrum



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, H,
 β , γ , G_{max} or V_s

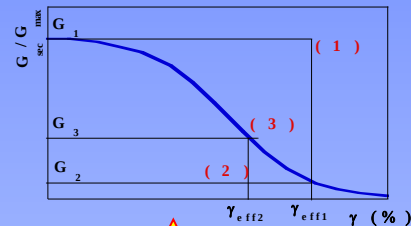
Option 2

Soil Layer n-1

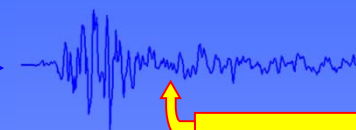
Soil Layer n

Half-Space Layer

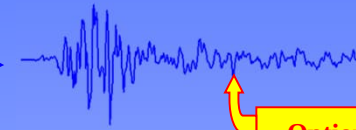
Option 4



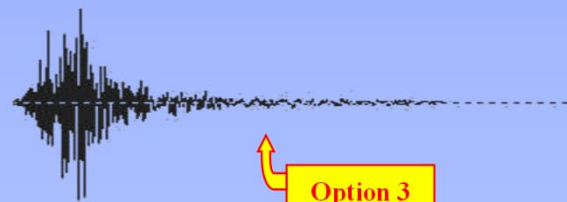
Option 5



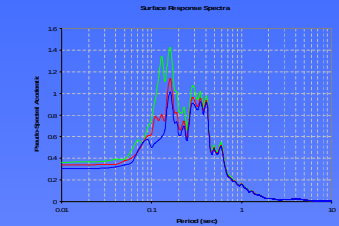
Option 6



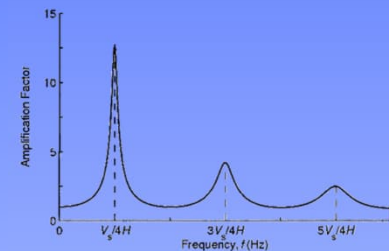
Option 7



Option 3



Option 9

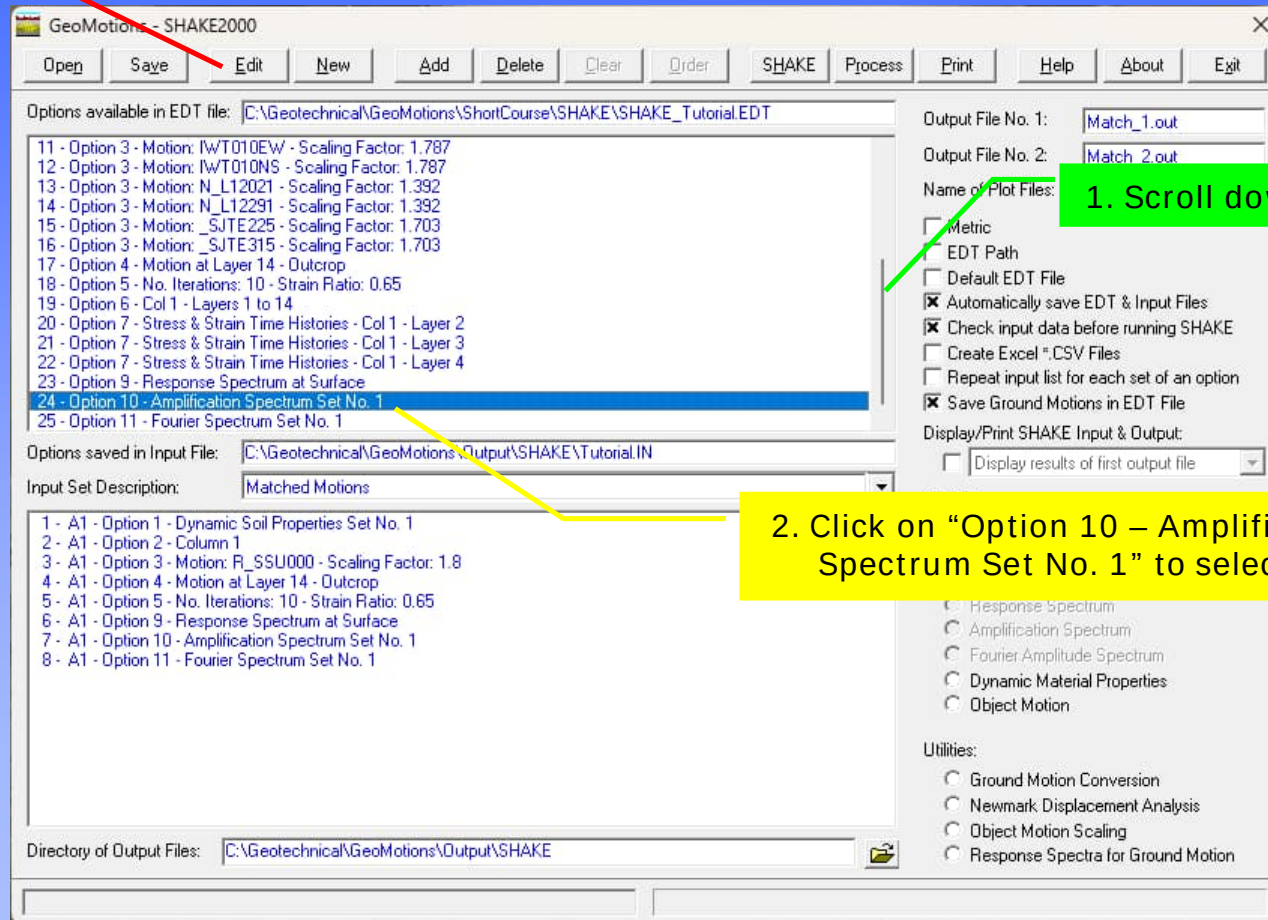


Option 10

Site Specific Response Analysis

Create Input Data

3. Click
on "Edit"



1. Scroll down

2. Click on "Option 10 – Amplification
Spectrum Set No. 1" to select it

Site Specific Response Analysis

Create Input Data – Option 10: Amplification Spectrum

1. Enter “Option 10 – Amplification Spectrum – Layers 14-1”

4. Click on
“Return”

SHAKE2000 - Option 10 Editor: Amplification Spectrum

Help Return

Set No.: 1 Amplification Spectrum - Set Identification: Option 10 - Amplification Spectrum - Layers 14-1

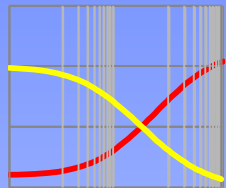
First Layer: 14 Outcrop Within: 1 Second Layer: 1 Outcrop Within: 0 Frequency Step: .125 Amplification Spectrum Identification: Amplification Layers 14-1

2. Enter “14”
in First Layer

3. Enter
“Amplification
Layers 14-1”

Site Specific Response Analysis

SHAKE Column Option 11 – Fourier Spectrum



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, H,
 β , γ , $G_{\max}$ or V_s

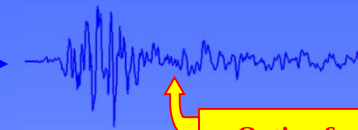
Option 2

Soil Layer n-1

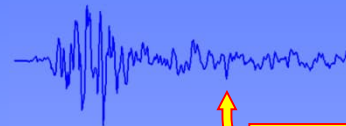
Soil Layer n

Half-Space Layer

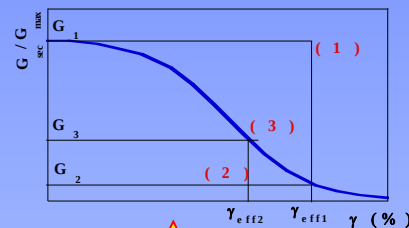
Option 4



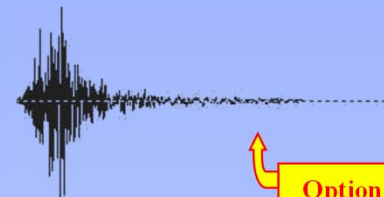
Option 6



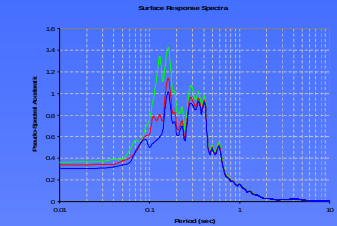
Option 7



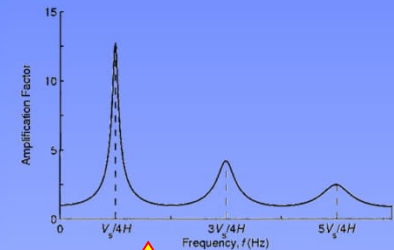
Option 5



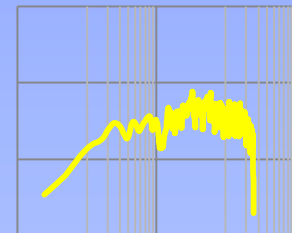
Option 3



Option 9



Option 10



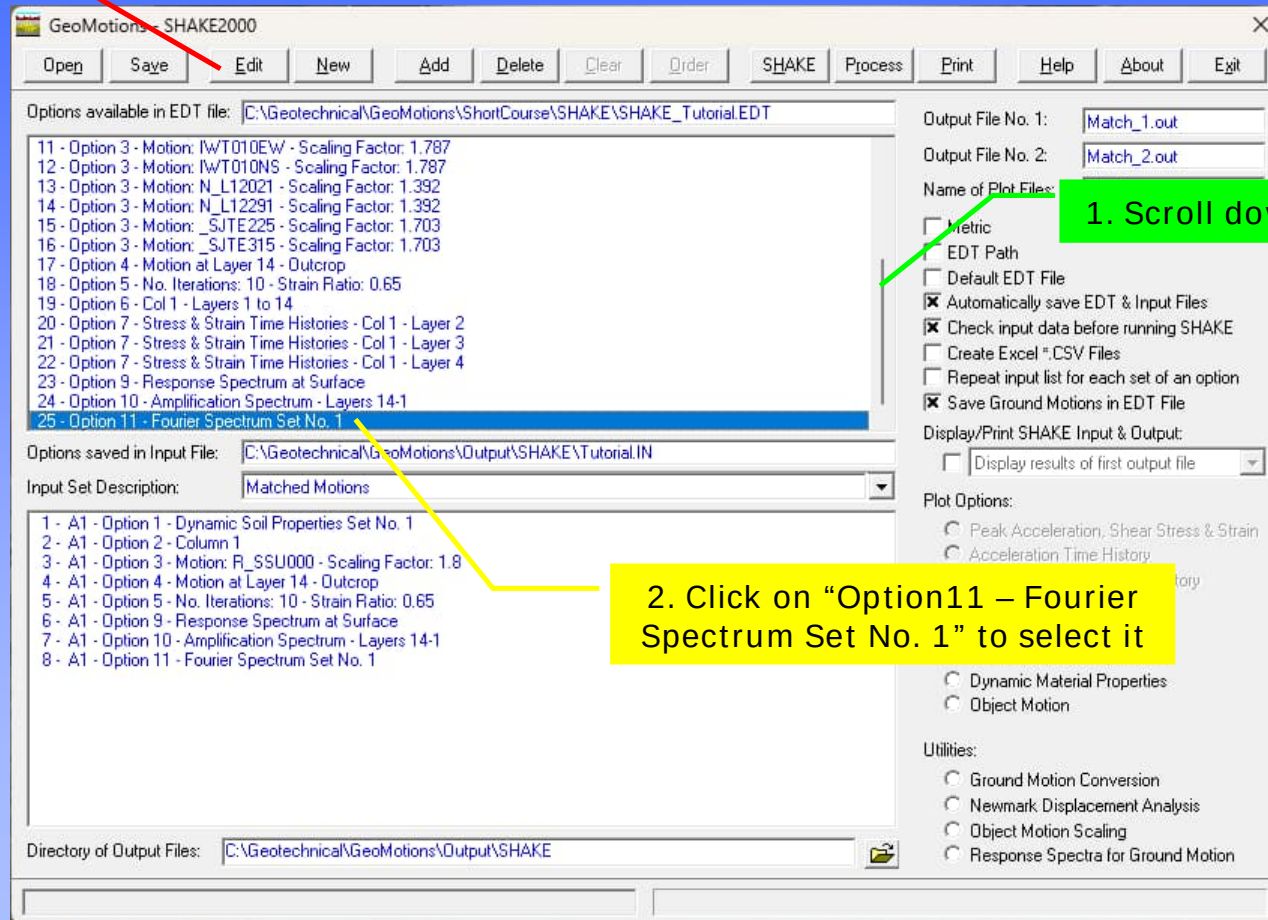
Option 11

Create Input Data

3. Click on “Edit”

1. Scroll down

2. Click on “Option11 – Fourier Spectrum Set No. 1” to select it



Site Specific Response Analysis

Create Input Data – Option 11: Fourier Spectrum

1. Enter "Option 11 – Fourier Spectra at Layers 1 & 14"

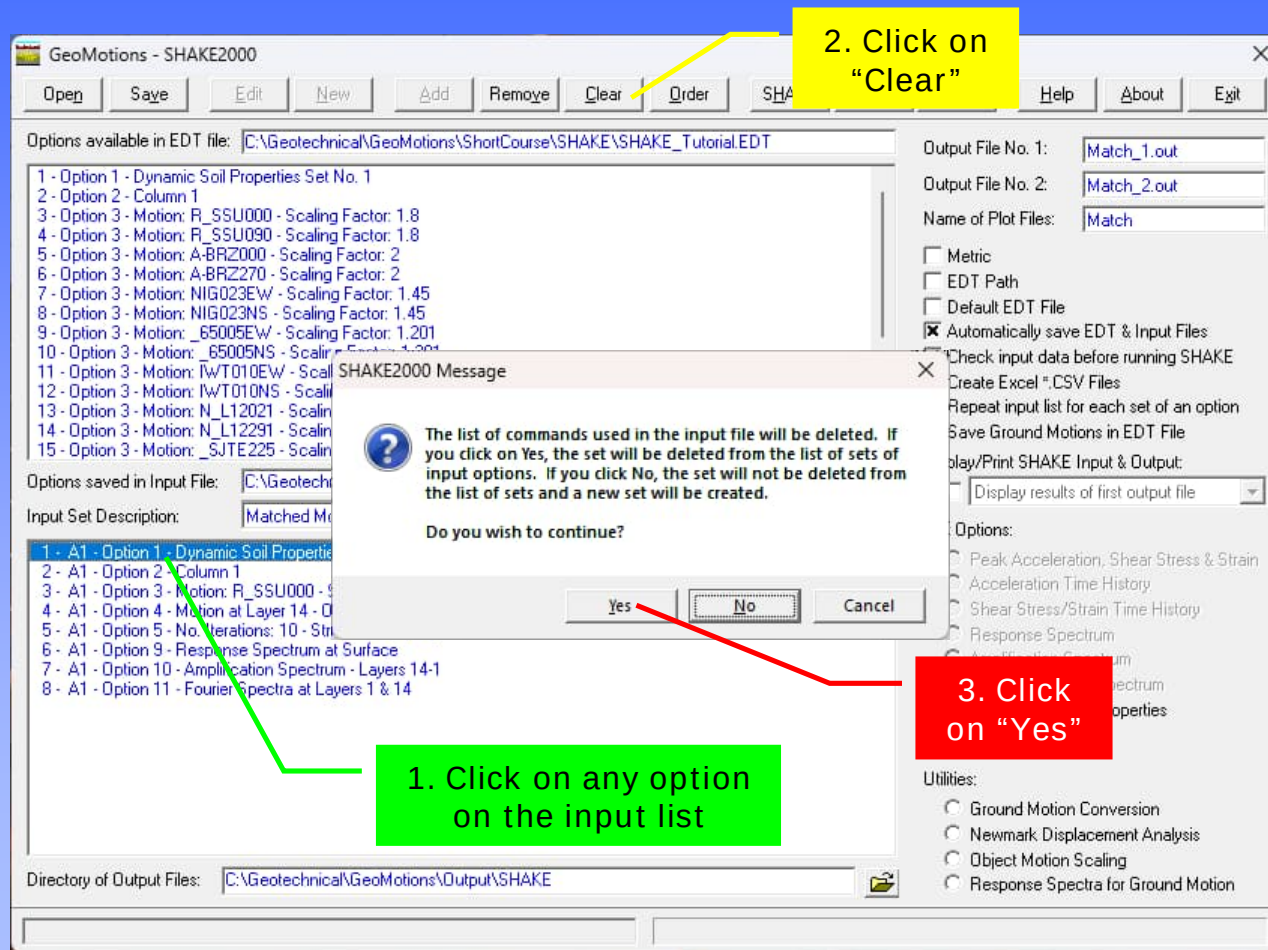
3. Click on "Return"

Set No.:	Fourier Spectrum - Set Identification:				
1	Option 11 - Fourier Spectra at Layers 1 & 14				
Sublayer Number:	Outcrop Within	Save to File:	No. Times to Smooth:	No. Values to Save:	
1	0	2	3	2048	
14	1	2	3	2048	

2. Enter "14" in second cell of Sublayer Number

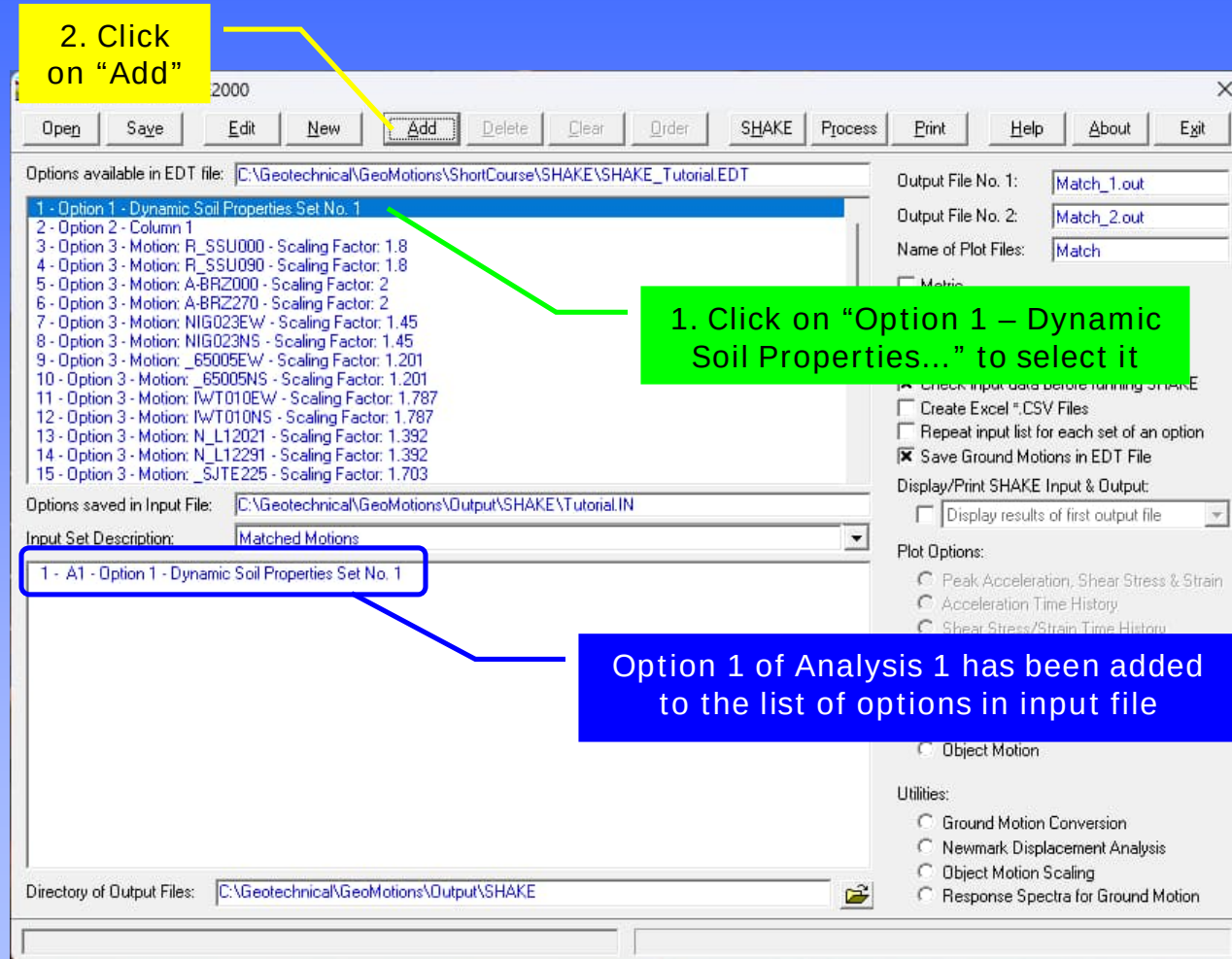
Site Specific Response Analysis

Add Options to Create Input File



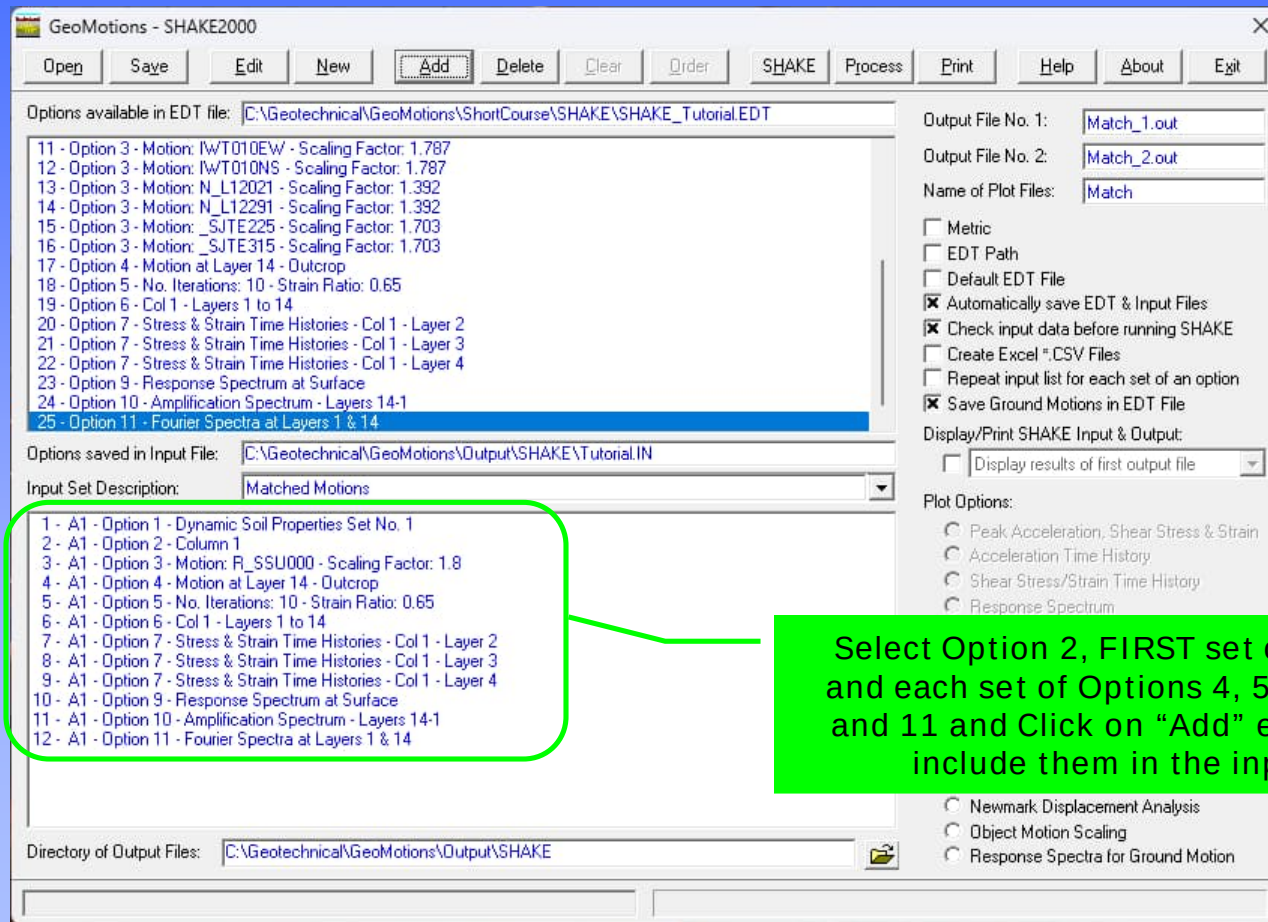
Site Specific Response Analysis

Add Options to Create Input File



Site Specific Response Analysis

Add Options to Create Input File



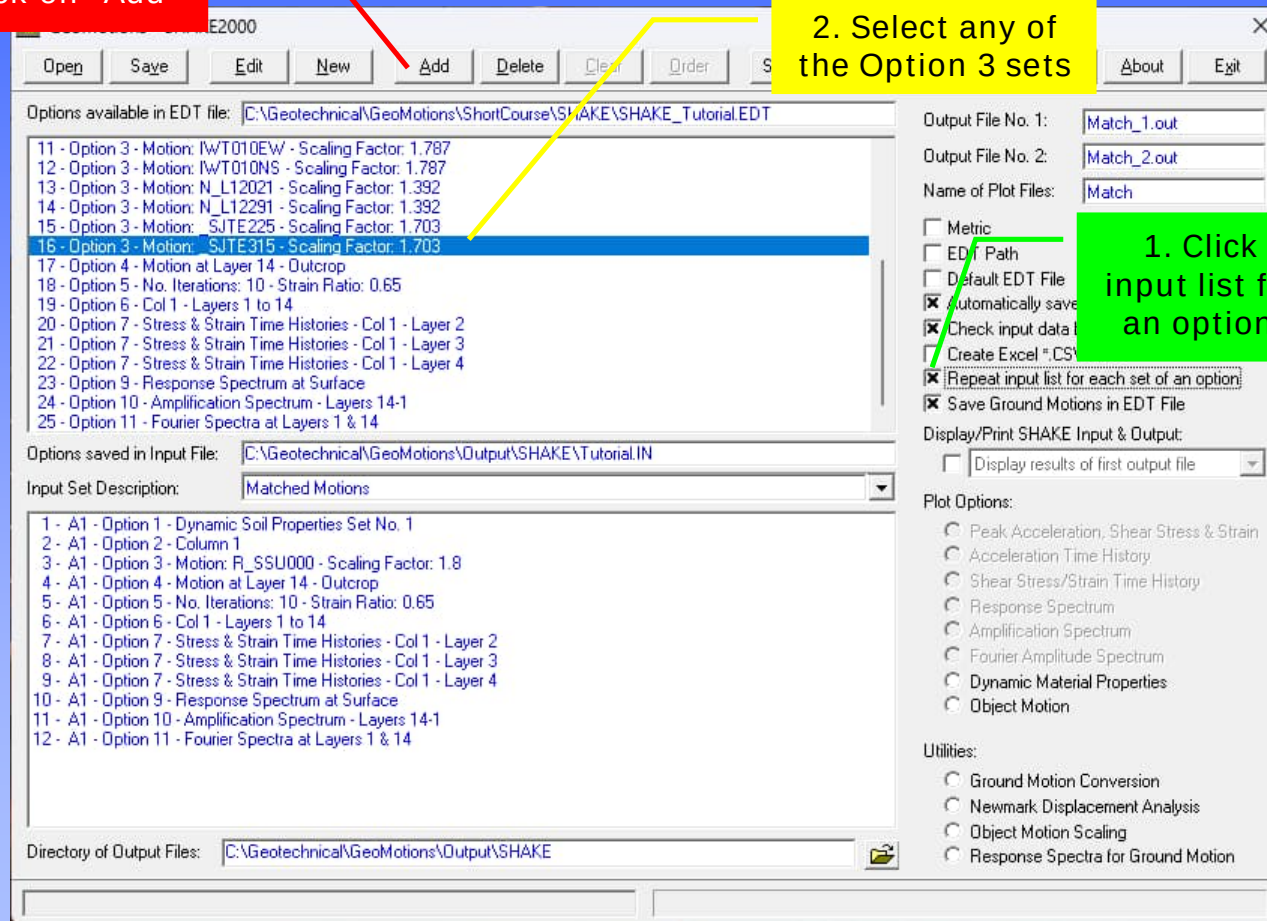
Site Specific Response Analysis

Define Input Options for Multiple Analyses

3. Click on "Add"

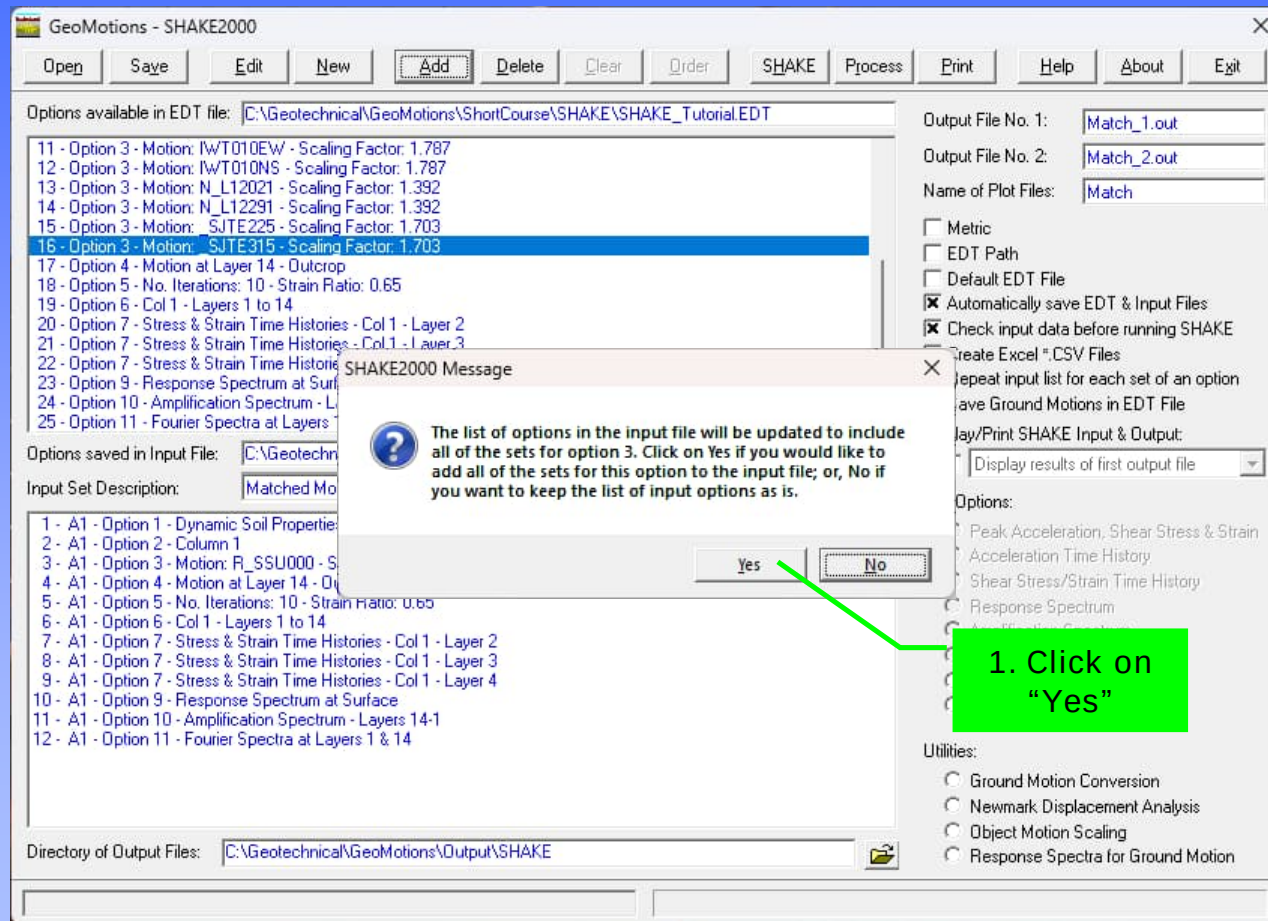
2. Select any of the Option 3 sets

1. Click on "Repeat input list for each set of an option" to select it



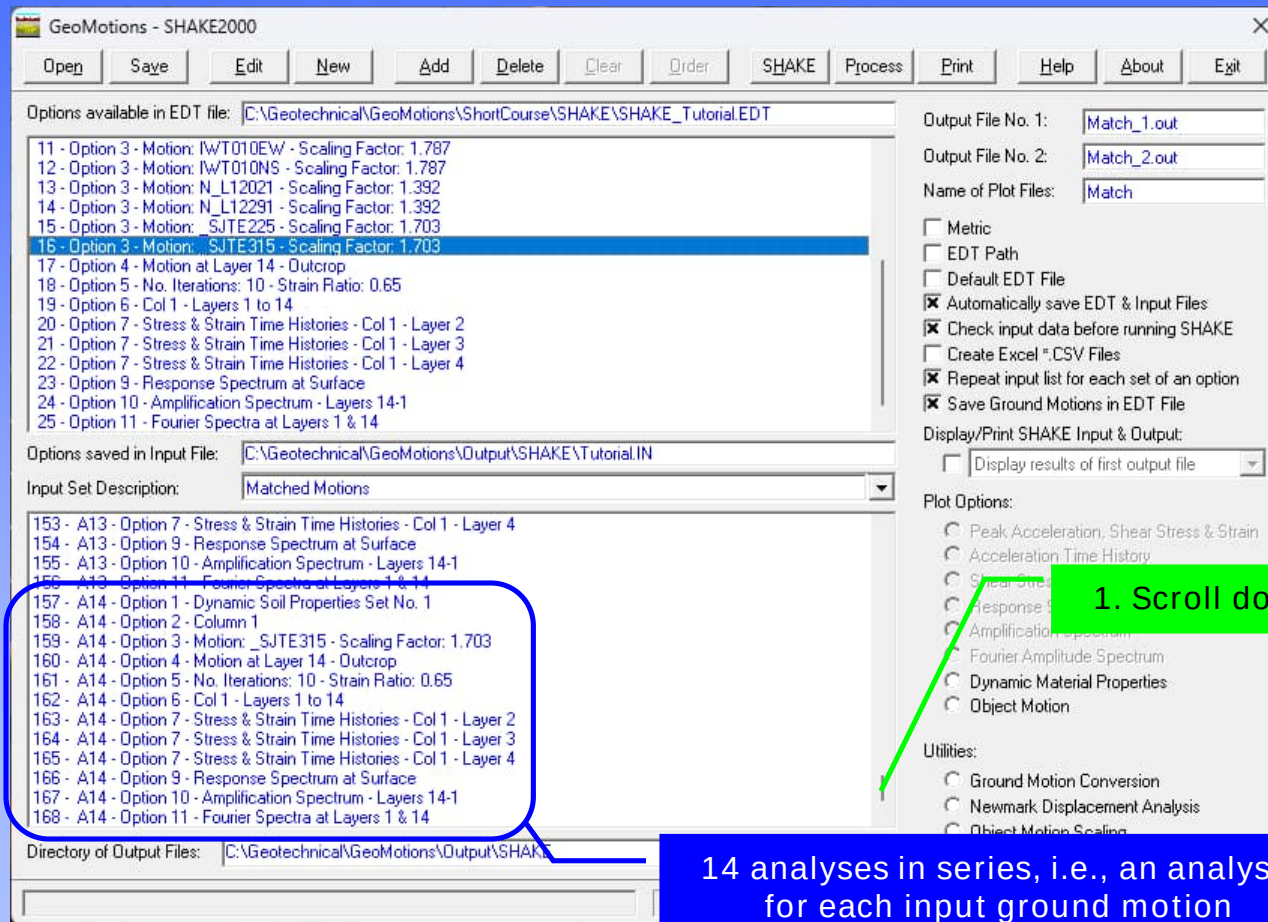
Site Specific Response Analysis

Define Input Options for Multiple Analyses



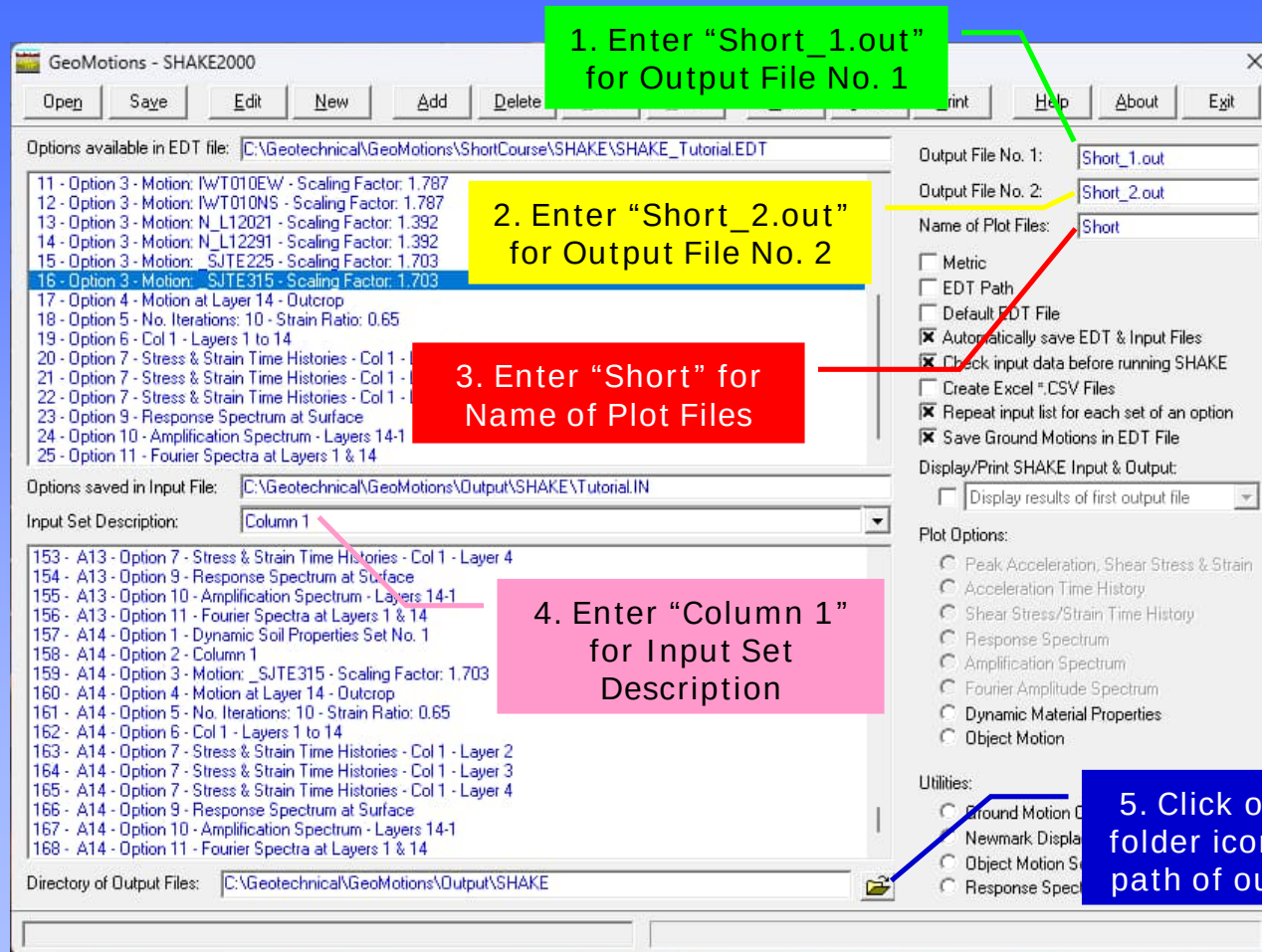
Site Specific Response Analysis

Define Input Options for Multiple Analyses



Site Specific Response Analysis

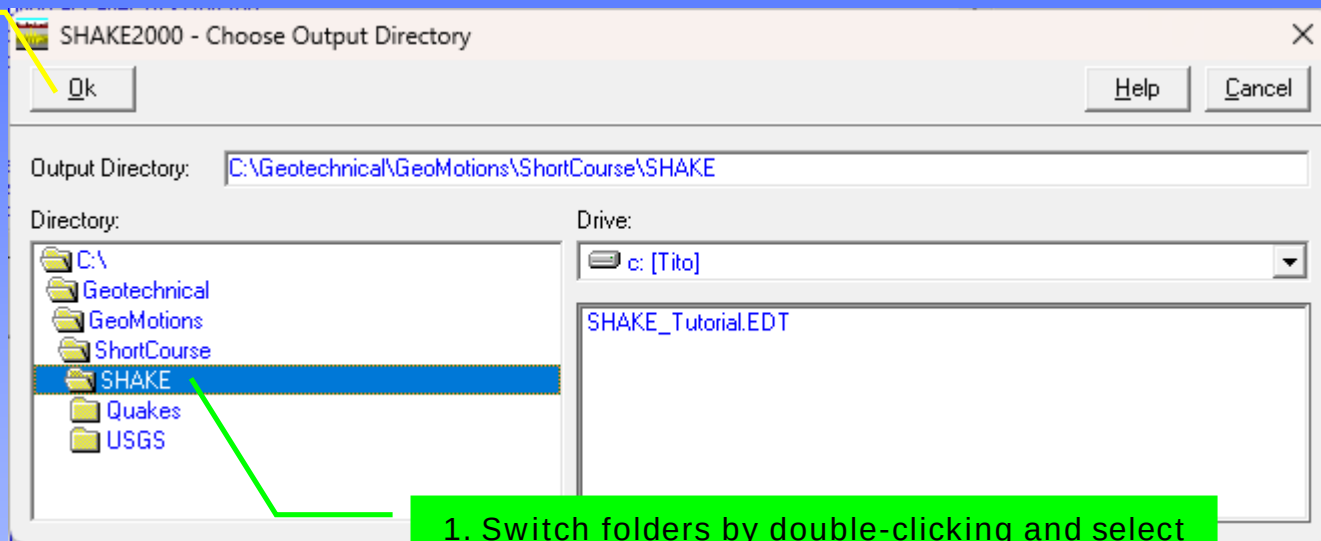
Rename SHAKE's Output Files and Plot Files



Site Specific Response Analysis

Change Path of Output Folder

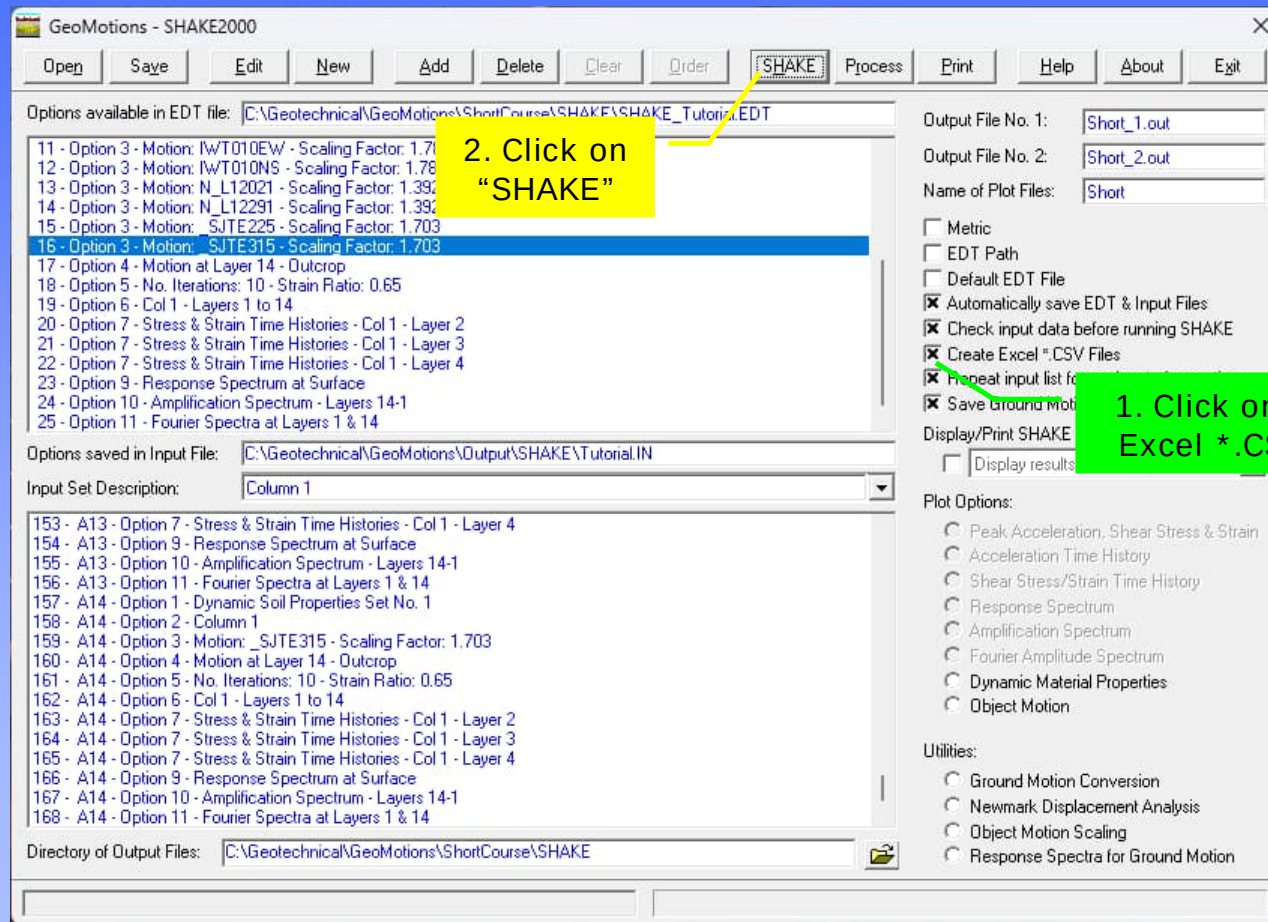
2. Click
on "Ok"



1. Switch folders by double-clicking and select
"GeoMotions\ShortCourse\SHAKE" folder

Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

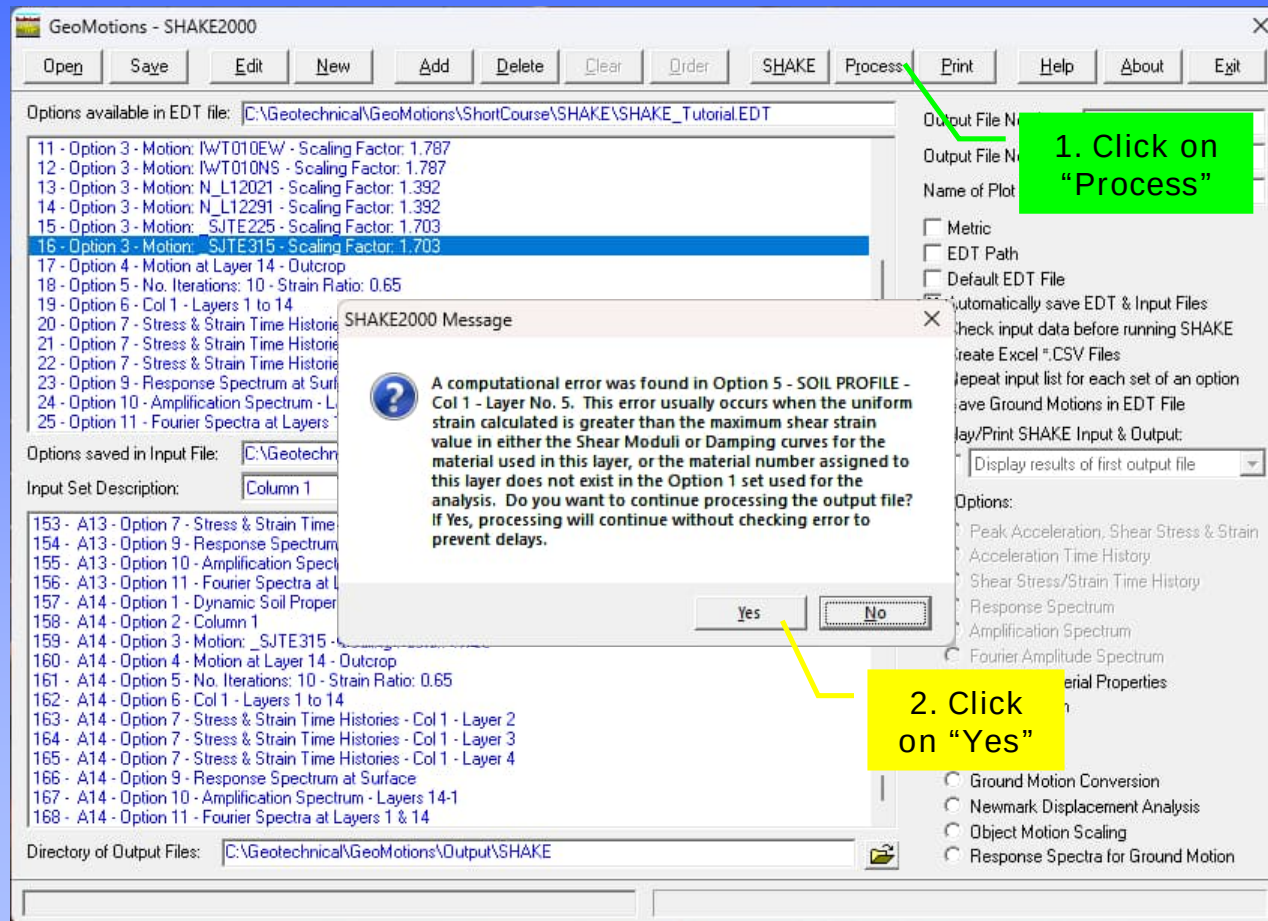
Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v

*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified *
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   ponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE 3/15/2025 *
*   RUN TIME 16:40 *
*****
```

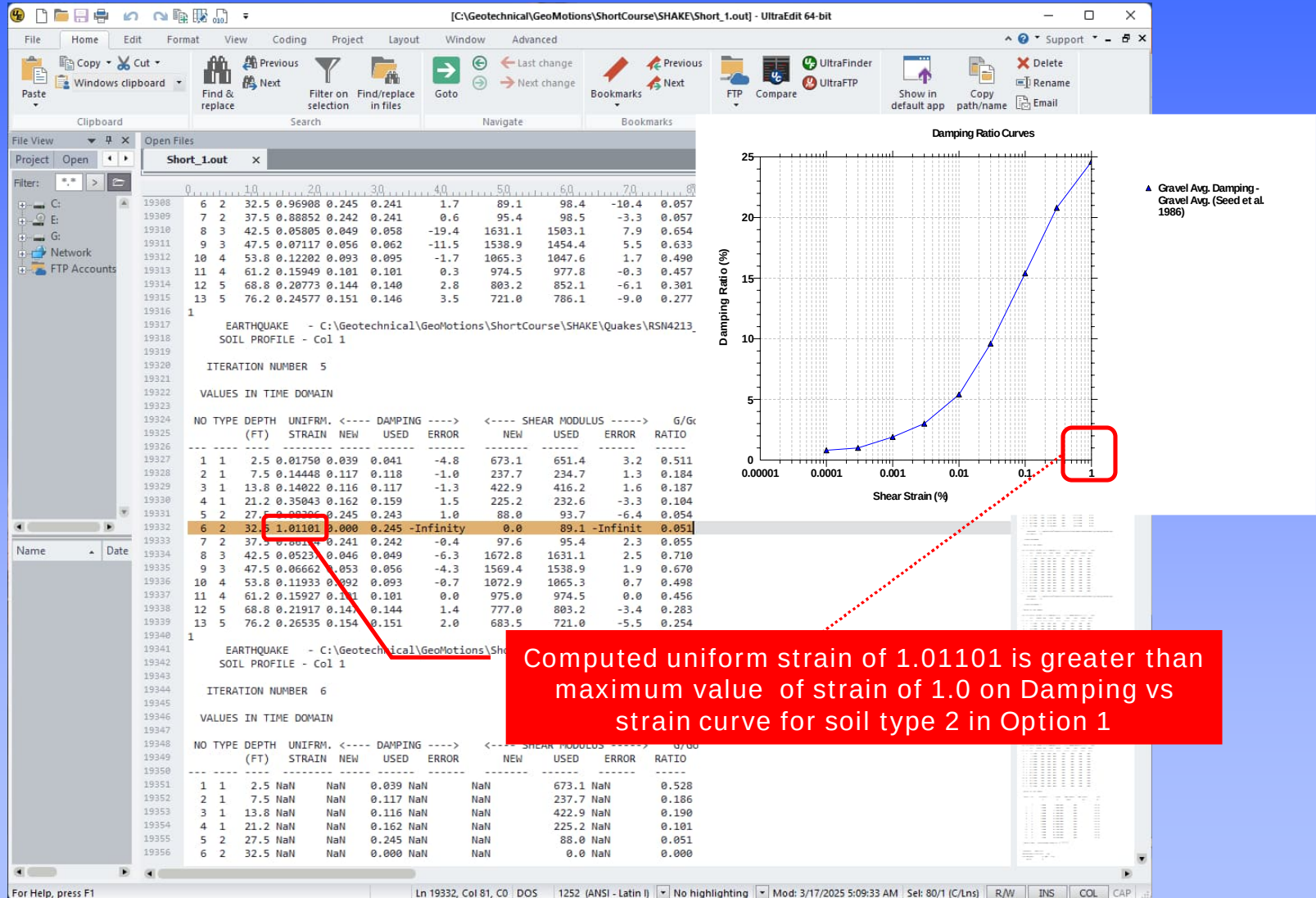

Site Specific Response Analysis

Process SHAKE's Output Files



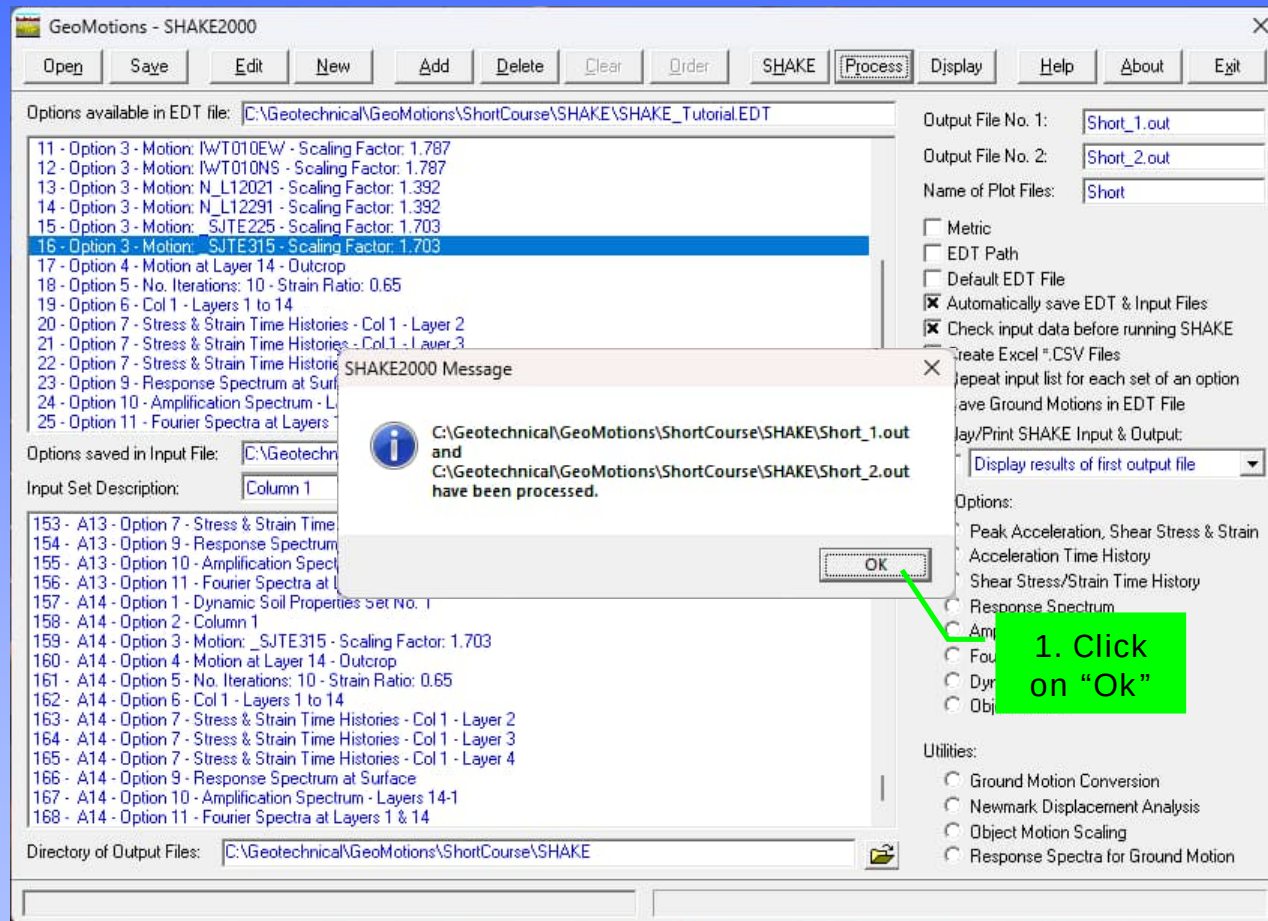
Site Specific Response Analysis

Most Common Error when Processing Output Files



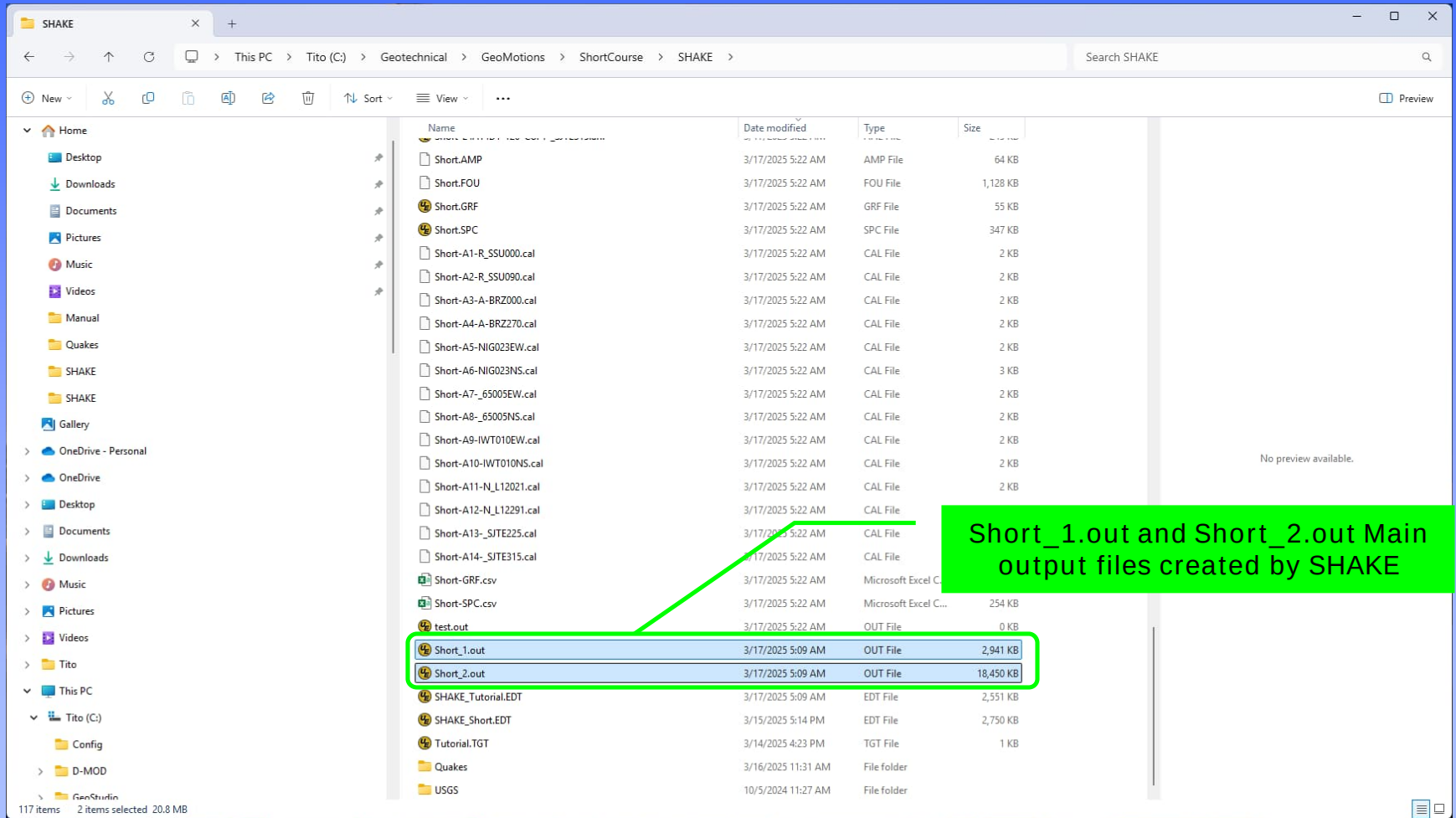
Site Specific Response Analysis

Process SHAKE's Output Files



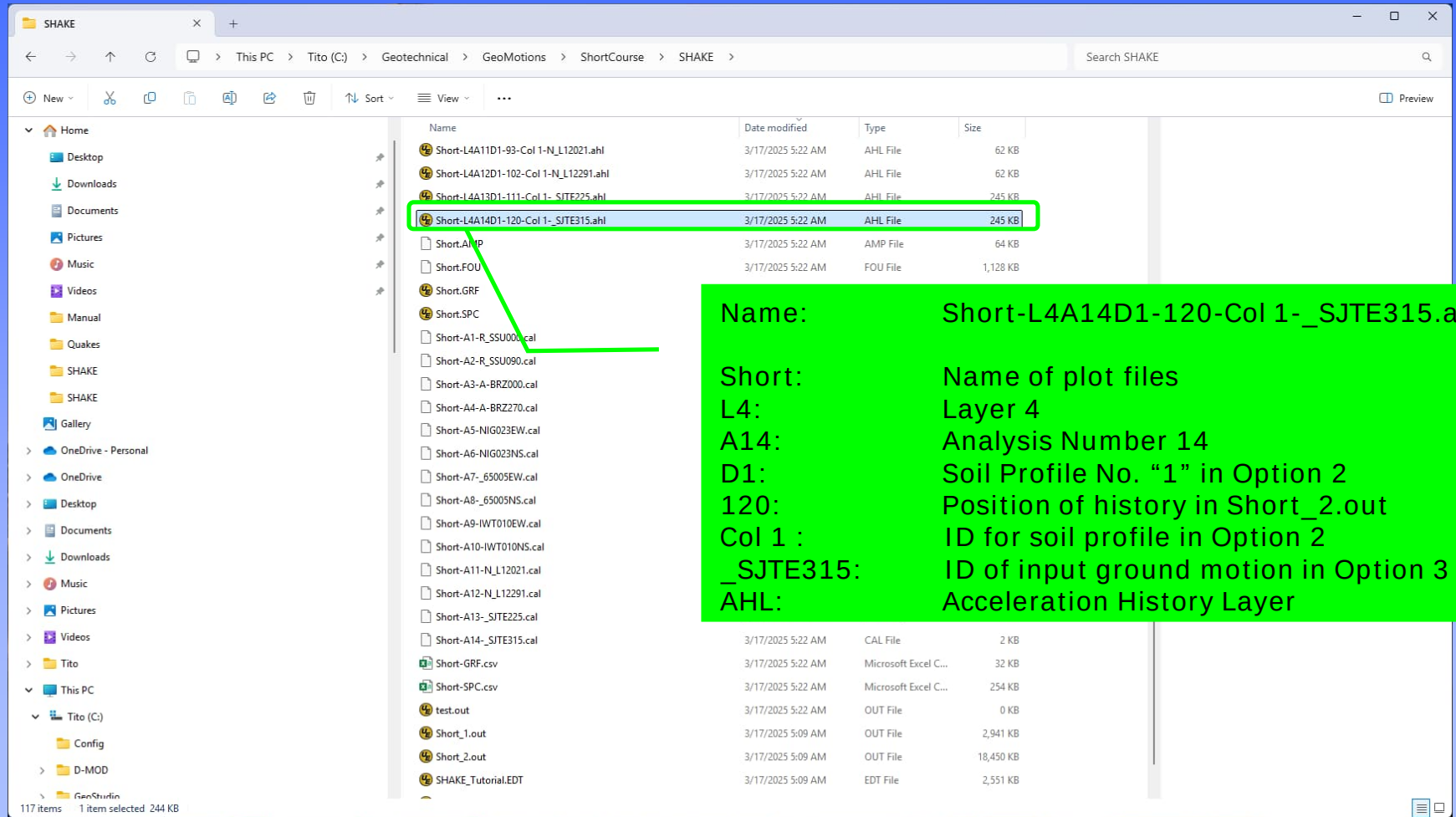
Site Specific Response Analysis

SHAKE2000 Output Files



Site Specific Response Analysis

SHAKE2000 Output Files - Nomenclature



The screenshot shows a Windows File Explorer window titled 'SHAKE' with the address bar path: This PC > Tito (C:) > Geotechnical > GeoMotions > ShortCourse > SHAKE. The left sidebar shows the 'This PC' view with 'Tito (C:)' selected. The main pane displays a list of files and folders. The file 'Short-L4A14D1-120-Col 1- _SJTE315.ahl' is highlighted with a green box. A green arrow points from this file to a green callout box explaining the nomenclature.

Name	Date modified	Type	Size
Short-L4A11D1-93-Col 1-N_L12021.ahl	3/17/2025 5:22 AM	AHL File	62 KB
Short-L4A12D1-102-Col 1-N_L12291.ahl	3/17/2025 5:22 AM	AHL File	62 KB
Short-L4A13D1-111-Col 1- _SJTE225.ahl	3/17/2025 5:22 AM	AHL File	245 KB
Short-L4A14D1-120-Col 1- _SJTE315.ahl	3/17/2025 5:22 AM	AHL File	245 KB
Short.AMP	3/17/2025 5:22 AM	AMP File	64 KB
Short.FOU	3/17/2025 5:22 AM	FOU File	1,128 KB
Short.GRF			
Short.SPC			
Short-A1-R_SSU000.cal			
Short-A2-R_SSU090.cal			
Short-A3-A-BRZ270.cal			
Short-A4-A-BRZ270.cal			
Short-A5-NIG023EW.cal			
Short-A6-NIG023NS.cal			
Short-A7-_65005EW.cal			
Short-A8-_65005NS.cal			
Short-A9-IWT010EW.cal			
Short-A10-IWT010NS.cal			
Short-A11-N_L12021.cal			
Short-A12-N_L12291.cal			
Short-A13- _SJTE225.cal			
Short-A14- _SJTE315.cal			
Short.GRF.csv	3/17/2025 5:22 AM	CAL File	2 KB
Short.SPC.csv	3/17/2025 5:22 AM	Microsoft Excel C...	32 KB
test.out	3/17/2025 5:22 AM	Microsoft Excel C...	254 KB
Short_1.out	3/17/2025 5:09 AM	OUT File	0 KB
Short_2.out	3/17/2025 5:09 AM	OUT File	2,941 KB
SHAKE_Tutorial.EDT	3/17/2025 5:09 AM	OUT File	18,450 KB
	3/17/2025 5:09 AM	EDT File	2,551 KB

Name: Short-L4A14D1-120-Col 1- _SJTE315.ahl

Short: Name of plot files

L4: Layer 4

A14: Analysis Number 14

D1: Soil Profile No. "1" in Option 2

120: Position of history in Short_2.out

Col 1 : ID for soil profile in Option 2

_SJTE315: ID of input ground motion in Option 3

AHL: Acceleration History Layer

Site Specific Response Analysis

Output Files Generated by SHAKE2000 – Text Files

SHAKE2000 GRF File - EN - Version 10.2

No of Analyses: 14

SHAKE2000 Flags: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Soil Profile Identification: Col 1

Soil Deposit Number: 1

Period for Soil Column: .697 sec

Average Shear Wave Velocity for Soil Column: 459 ft/sec

Analysis No.: 1 - Col 1-R SSU000

Earthquake: C:\GEO TECHNICAL\GEO MOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTH_SSU000.EQK

No. of Soil Layers: 14

No. of Peak Acceleration Values: 15

CSR GWT (ft): ---

Surface Elevation (ft): 124

Layer	Depth (ft)	Unit Weight (ksf)	Damping (%)	Shear Modulus (ksf)	Max Strain (%)	Max Stress (psf)	Shear Wave Vel. (fps)	Depth Max Acc (ft)	Max Acc (g)	G/Gmax Curve	Damping Curve	Motion Type	Depth (ft)	Input Vs (fps)	Gmax (ksf)	Average PGA (g)
1	2.5	.125	2.6	826	.01418	117.12	461.2782	0	.37741	Sand Lower	Sand lower	Outcrop	2.5	573	1275	.374784
2	7.5	.125	7.3	422	.08095	341.64	329.7078	5	.36891	Sand Lower	Sand lower	Within	7.5	573	1275	.364416
3	13.75	.125	7.2	742.7	.08012	595.04	437.4009	10	.32883	Sand Lower	Sand lower	Within	13.75	758	2230	.3462051
4	21.25	.125	11	449.5	.19245	865.14	340.2811	17.5	.29718	Sand Lower	Sand lower	Within	21.25	758	2230	.3256998
5	27.5	.13	22.3	140.3	.73508	1031.4	186.4168	25	.24272	Gravel Avg.	Gravel Avg.	Within	27.5	656	1737	.2989565
6	32.5	.13	22.4	137	.7683	1052.33	184.2114	30	.36515	Gravel Avg.	Gravel Avg.	Within	32.5	656	1737	.2566659
7	37.5	.13	22.3	140.5	.73011	1025.88	186.5497	35	.47811	Gravel Avg.	Gravel Avg.	Within	37.5	656	1737	.2159747
8	42.5	.115	3.9	1772	.06304	1117.11	704.3862	40	.48591	OCR 15 PI 35	OCR 15 PI 35	Within	42.5	802	2297	.2083189
9	47.5	.115	4.3	1716.7	.07226	1240.58	693.308	45	.46619	OCR 15 PI 35	OCR 15 PI 35	Within	47.5	802	2297	.2089398
10	53.75	.11	7.7	1287	.10638	1369.1	613.7915	50	.42946	Soil PI=30	Soil PI=30	Within	53.75	791	2137	.2062674
11	61.25	.11	8.2	1214.9	.12657	1537.71	596.3509	57.5	.38238	Soil PI=30	Soil PI=30	Within	61.25	791	2137	.2060583
12	68.75	.12	11.6	1137.4	.15735	1789.73	552.4512	65	.36997	Soil PI=15	Soil PI=15	Within	68.75	872	2834	.2149826
13	76.25	.12	12.5	1036.6	.19502	2021.64	527.4034	72.5	.33058	Soil PI=15	Soil PI=15	Within	76.25	872	2834	.219148
14	Base							80	.37768			Within				
14	Outcrop							80	.42198			Outcrop				

Soil Profile Identification: Col 1

Soil Deposit Number: 1

Period for Soil Column: .716 sec

Average Shear Wave Velocity for Soil Column: 447 ft/sec

Analysis No.: 2 - Col 1-R SSU090

Earthquake: C:\GEO TECHNICAL\GEO MOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTH_SSU090.EQK

No. of Soil Layers: 14

No. of Peak Acceleration Values: 15

CSR GWT (ft): ---

Surface Elevation (ft): 124

Layer	Depth	Unit	Damping	Shear	Max	Max	Shear	Depth	Max	G/Gmax	Damping	Motion	Depth	Input	Gmax	Average
-------	-------	------	---------	-------	-----	-----	-------	-------	-----	--------	---------	--------	-------	-------	------	---------

Site Specific Response Analysis

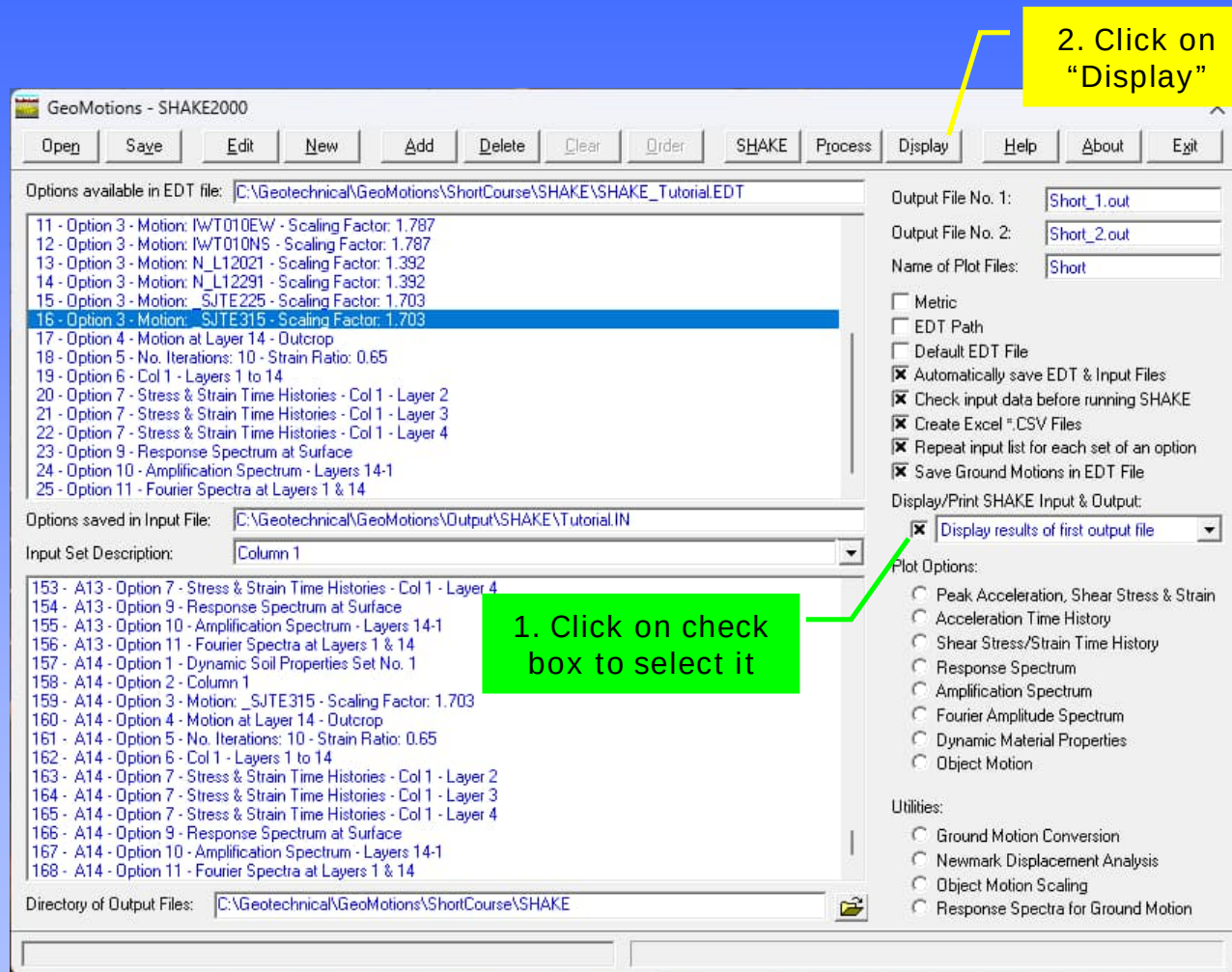
Output Files Generated by SHAKE2000 – Excel CSV Files

SHAKE2000 Calculated Results with Depth File

Layer	Depth	Unit	Damping	Shear	Max	Max	Shear	Depth	Max	G/Gmax	Damping	Motion	Depth	Input	Gmax	Average	CSR
	(ft)	(kcf)	(%)	Modulus	Strain	Stress	Wave Vel.	Max Acc	Acc	Curve	Curve	Type	(ft)	Vs	(ksf)	PGA	
				(ksf)	(%)	(psf)	(fps)	(ft)	(g)					(ft/s)		(g)	
1	-2.5	0.125	2.6	826	0.01418	117.12	461.2782	0	0.37741	Sand Lower	Sand lower	Outcrop	-2.5	573	1275	0.374784	-----
2	-7.5	0.125	7.3	422	0.08095	341.64	329.7078	-5	0.36891	Sand Lower	Sand lower	Within	-7.5	573	1275	0.364416	-----
3	-13.75	0.125	7.2	742.7	0.08012	595.04	437.4009	-10	0.32883	Sand Lower	Sand lower	Within	-13.75	758	2230	0.346205	-----
4	-21.25	0.125	11	449.5	0.19245	865.14	340.2811	-17.5	0.29718	Sand Lower	Sand lower	Within	-21.25	758	2230	0.3257	-----
5	-27.5	0.13	22.3	140.3	0.73508	1031.4	186.4168	-25	0.24272	Gravel Avg.	Gravel Avg.	Within	-27.5	656	1737	0.298957	-----
6	-32.5	0.13	22.4	137	0.7683	1052.33	184.2114	-30	0.36515	Gravel Avg.	Gravel Avg.	Within	-32.5	656	1737	0.256666	-----
7	-37.5	0.13	22.3	140.5	0.73011	1025.88	186.5497	-35	0.47811	Gravel Avg.	Gravel Avg.	Within	-37.5	656	1737	0.215975	-----
8	-42.5	0.115	3.9	1772	0.06304	1117.11	704.3862	-40	0.48591	OCR 15 PI 35	OCR 15 PI 35	Within	-42.5	802	2297	0.208319	-----
9	-47.5	0.115	4.3	1716.7	0.07226	1240.58	693.308	-45	0.46619	OCR 15 PI 35	OCR 15 PI 35	Within	-47.5	802	2297	0.20894	-----
10	-53.75	0.11	7.7	1287	0.10638	1369.1	613.7915	-50	0.42946	Soil PI=30	Soil PI=30	Within	-53.75	791	2137	0.206267	-----

Site Specific Response Analysis

Display Results



Site Specific Response Analysis

Display Results – Analysis 1

SHAKE2000 - Summary of Results of First Output File

Next Print

File: C:\GEO TECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\SHORT.GRF

Project: Col 1

Deposit: Analysis No. 1 - Project 1000

Earthquake: C:\GEO TECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTH

Soil column data:

Period: .697 sec

Vs: 459 ft/sec

1. Click on "Print"

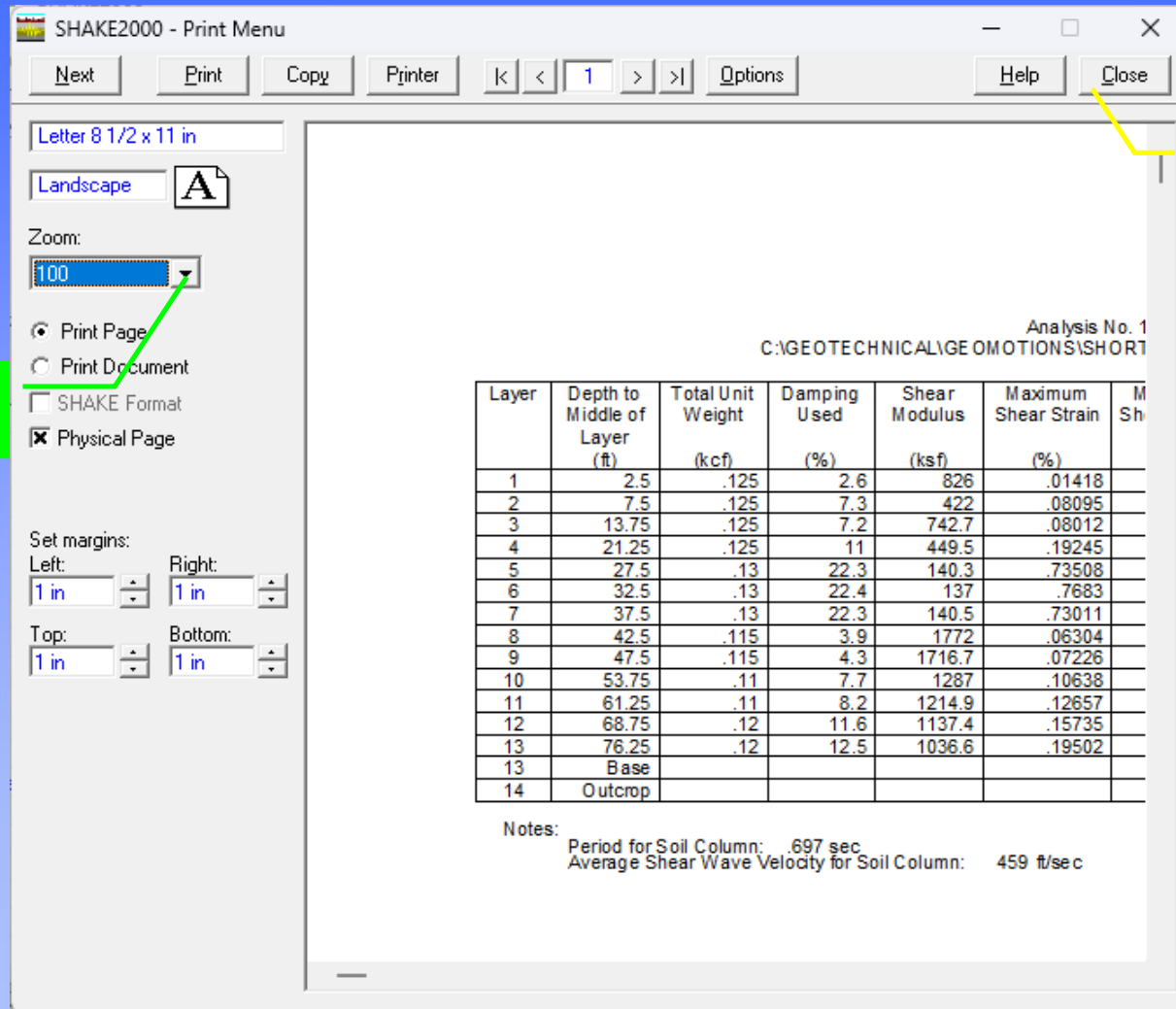
Soil Column Period

Strain-compatible V_s

Layer No.	Depth (ft)	Unit Weight (kcf)	Damping Used (%)	Shear Modulus (ksf)	Maximum Strain (%)	Maximum Stress (psf)	Shear Wave Velocity (fps)	Depth to Acceleration (ft)	Peak Acceleration (g)	G/Gmax Curve	Soil Type	Soil Motion
1	2.5	.125	2.6	826	.01418	117.12	461.2782	0	.37741	Sand Lower	Sand lower	Outcrop
2	7.5	.125	7.3	422	.08095	341.64	329.7078	5	.36891	Sand Lower	Sand lower	Within
3	13.75	.125	7.2	742.7	.08012	595.04	437.4009	10	.32883	Sand Lower	Sand lower	Within
4	21.25	.125	11	449.5	.19245	865.14	340.2811	17.5	.29718	Sand Lower	Sand lower	Within
5	27.5	.13	22.3	140.3	.73508	1031.4	186.4168	25	.24272	Gravel Avg.	Gravel Avg.	Within
6	32.5	.13	22.4	137	.7683	1052.33	184.2114	30	.36515	Gravel Avg.	Gravel Avg.	Within
7	37.5	.13	22.3	140.5	.73011	1025.88	186.5497	35	.47811	Gravel Avg.	Gravel Avg.	Within
8	42.5	.115	3.9	1772	.06304	1117.11	704.3862	40	.48591	OCR 15 PI 35	OCR 15 PI 35	Within
9	47.5	.115	4.3	1716.7	.07226	1240.58	693.308	45	.46619	OCR 15 PI 35	OCR 15 PI 35	Within
10	53.75	.11	7.7	1287	.10638	1369.1	613.7915	50	.42946	Soil PI=30	Soil PI=30	Within
11	61.25	.11	8.2	1214.9	.12657	1537.71	596.3509	57.5	.38238	Soil PI=30	Soil PI=30	Within
12	68.75	.12	11.6	1137.4	.15735	1789.73	552.4512	65	.36997	Soil PI=15	Soil PI=15	Within
13	76.25	.12	12.5	1036.6	.19502	2021.64	527.4034	72.5	.33058	Soil PI=15	Soil PI=15	Within
14	Base							80	.37768			Within
	Outcrop							80	.42198			Outcrop

Site Specific Response Analysis

Display Results



1. Select a zoom factor

2. Click on "Close"

Site Specific Response Analysis

Display Results – Analysis 2

SHAKE2000 - Summary of Results of First Output File

Next Print

File: C:\GEO\TECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\SHORT.GRF
 Project: Col 1
 Deposit: Analysis No. 2 - Profile No. 1 - Col 1-R_S\$SU090
 Earthquake: C:\GEO\TECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTH

Soil column data:
 Period: .716 sec
 Vs: 447 ft/sec

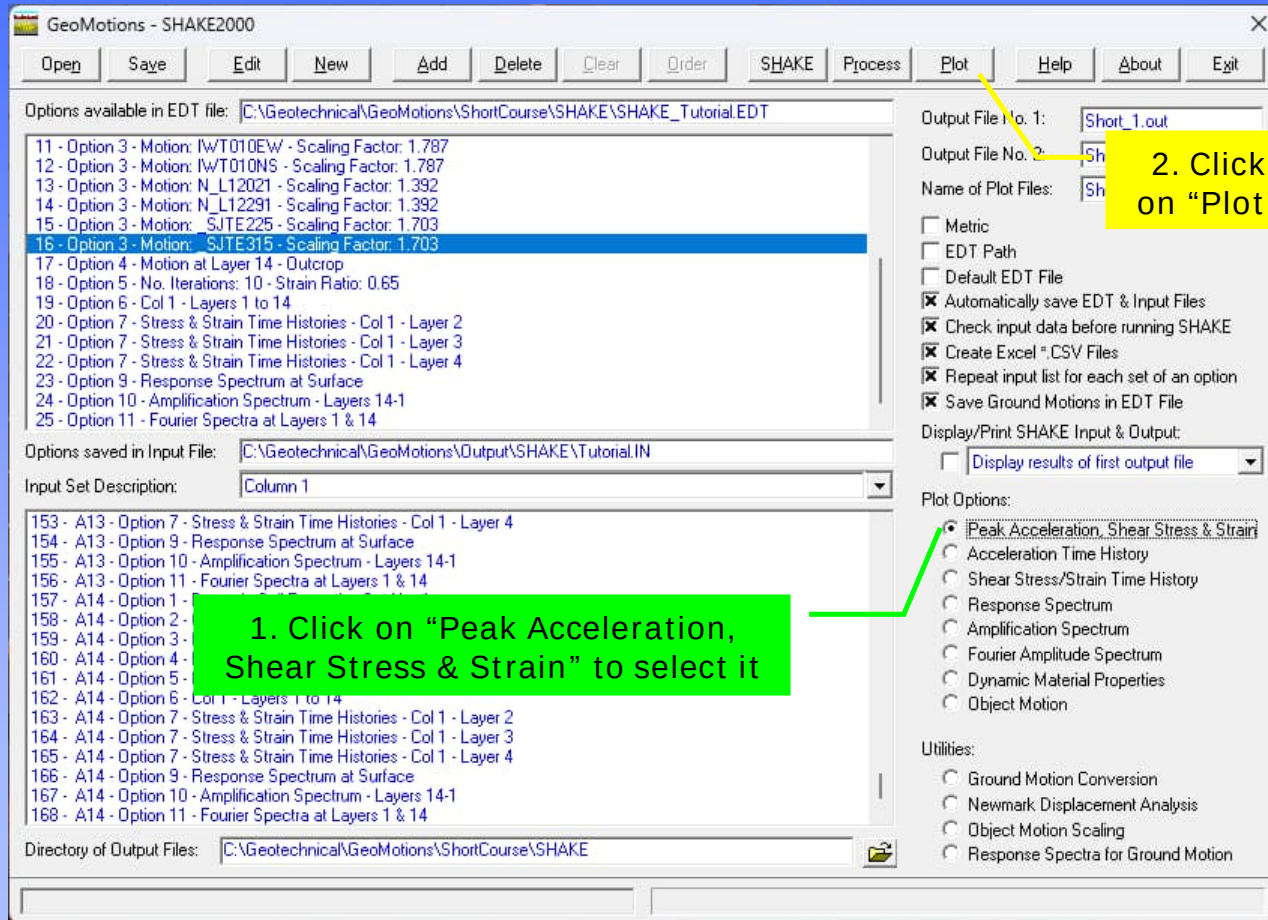
2. Click on "Return"

1. Click on "Next"

Layer No.	Depth (ft)	Unit Weight (kcf)	Damping Used (%)	Shear Modulus (ksf)	Maximum Strain (%)	Maximum Stress (psf)	Shear Wave Velocity (fps)	Depth to Acceleration (ft)	Peak Acceleration (g)	G/Gmax Curve	Damping Curve	Type of Motion
1	2.5	.125	2.7	811.8	.0152	123.42	457.2961	0	.39186	Sand Lower	Sand lower	Outcrop
2	7.5	.125	7.900001	387.1	.09571	370.47	315.7799	5	.38479	Sand Lower	Sand lower	Within
3	13.75	.125	7.8	685.1	.09379	642.5	420.0973	10	.3487	Sand Lower	Sand lower	Within
4	21.25	.125	11.6	419.3	.21939	919.95	328.6513	17.5	.32132	Sand Lower	Sand lower	Within
5	27.5	.13	22.5	134.6	.79708	1072.61	182.5908	25	.27519	Gravel Avg.	Gravel Avg.	Within
6	32.5	.13	22.7	131.1	.83496	1094.83	180.2012	30	.46417	Gravel Avg.	Gravel Avg.	Within
7	37.5	.13	22.5	134.5	.7938	1067.62	182.5229	35	.52036	Gravel Avg.	Gravel Avg.	Within
8	42.5	.115	3.9	1774.6	.06262	1111.18	704.9028	40	.57289	OCR 15 PI 35	OCR 15 PI 35	Within
9	47.5	.115	4.4	1702.8	.07482	1274.03	690.4955	45	.54708	OCR 15 PI 35	OCR 15 PI 35	Within
10	53.75	.11	8.1	1222.5	.12431	1519.67	598.2133	50	.48612	Soil PI=30	Soil PI=30	Within
11	61.25	.11	8.8	1119.5	.16012	1792.51	572.458	57.5	.45465	Soil PI=30	Soil PI=30	Within
12	68.75	.12	12.4	1042.8	.1926	2008.39	528.9783	65	.40713	Soil PI=15	Soil PI=15	Within
13	76.25	.12	13	967.4	.2261	2187.33	509.4955	72.5	.37968	Soil PI=15	Soil PI=15	Within
14	Base							80	.46413			Within
	Outcrop							80	.52538			Outcrop

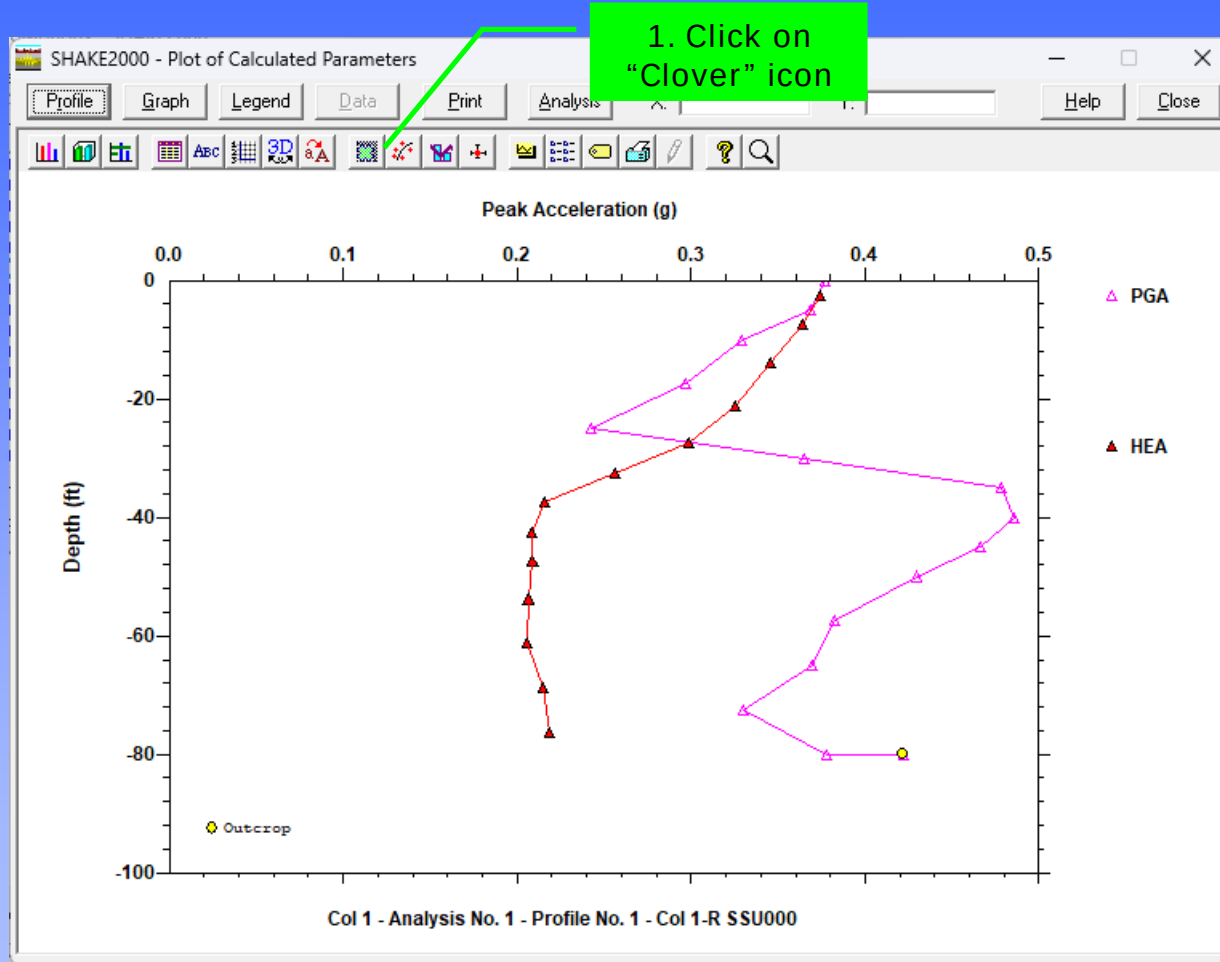
Site Specific Response Analysis

Plot Results



Site Specific Response Analysis

Plot Results



** The "Outcrop" symbol (i.e., a yellow circle) is not shown for the surface values, only for those layers denoted as outcrop in Option 6, other than layer number 1.

Site Specific Response Analysis

Change Graph Properties

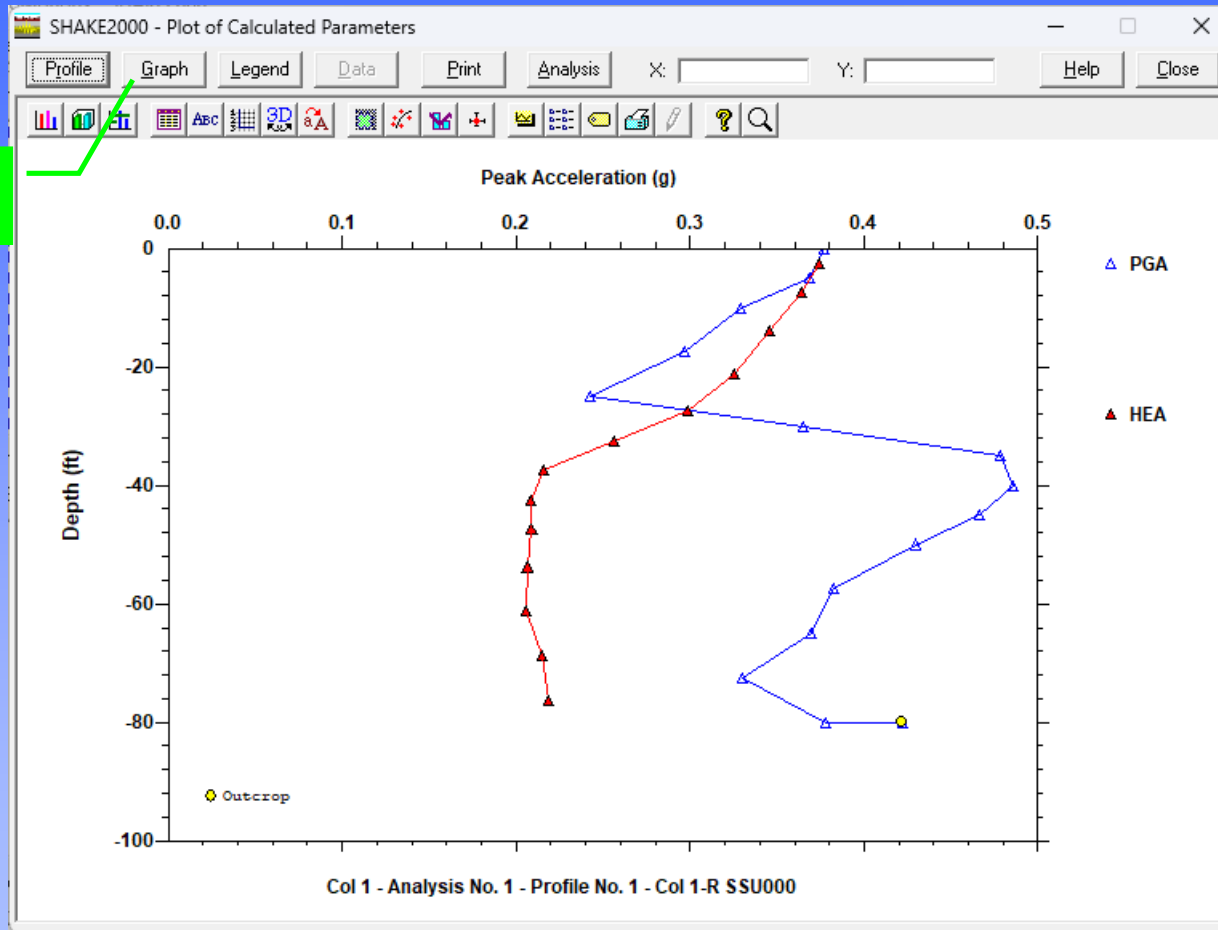


1. Click on down-arrow and select a different color

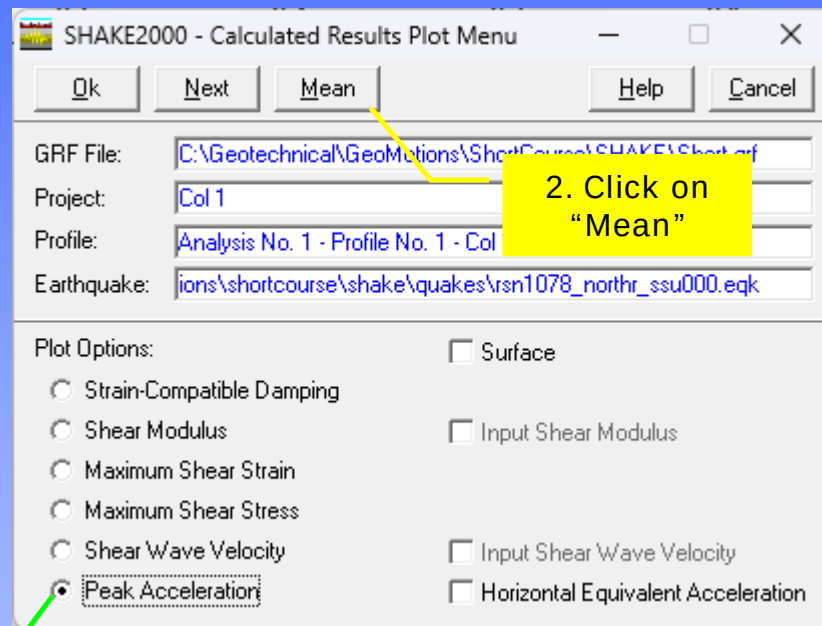
2. Click on "Ok"

Site Specific Response Analysis Plot Results

1. Click on
"Graph"



Site Specific Response Analysis Plot Results

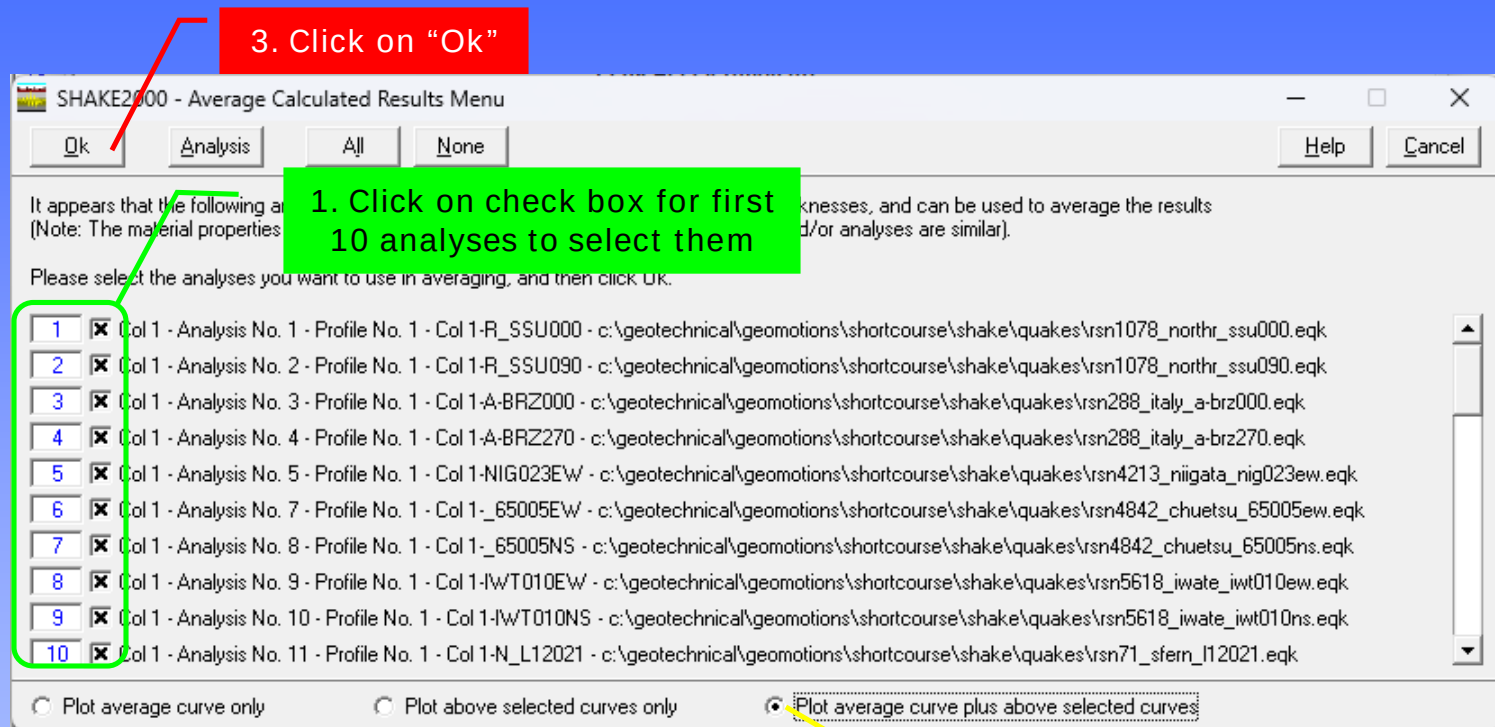


1. Click on "Peak Acceleration" to select it

2. Click on "Mean"

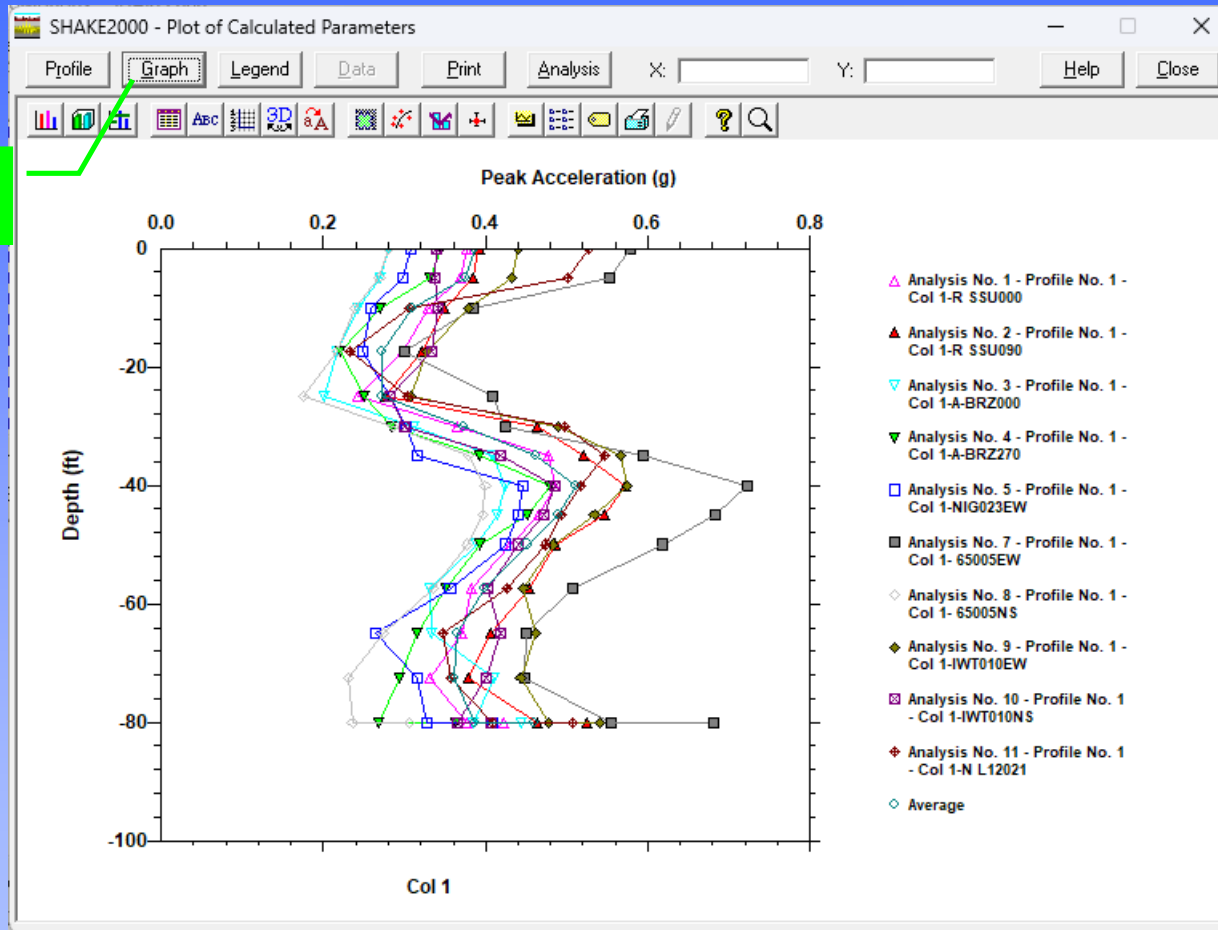
Site Specific Response Analysis

Plot Results

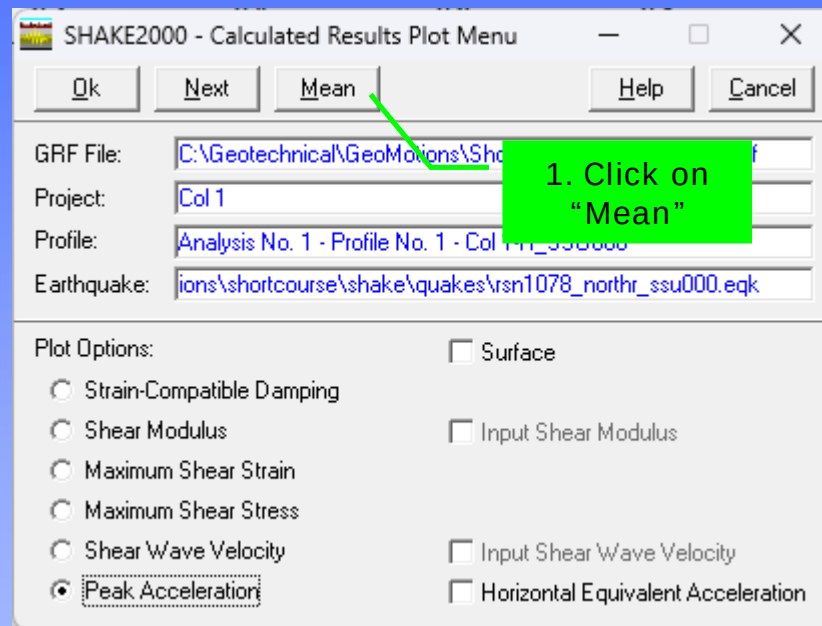


Site Specific Response Analysis Plot Results

1. Click on
"Graph"

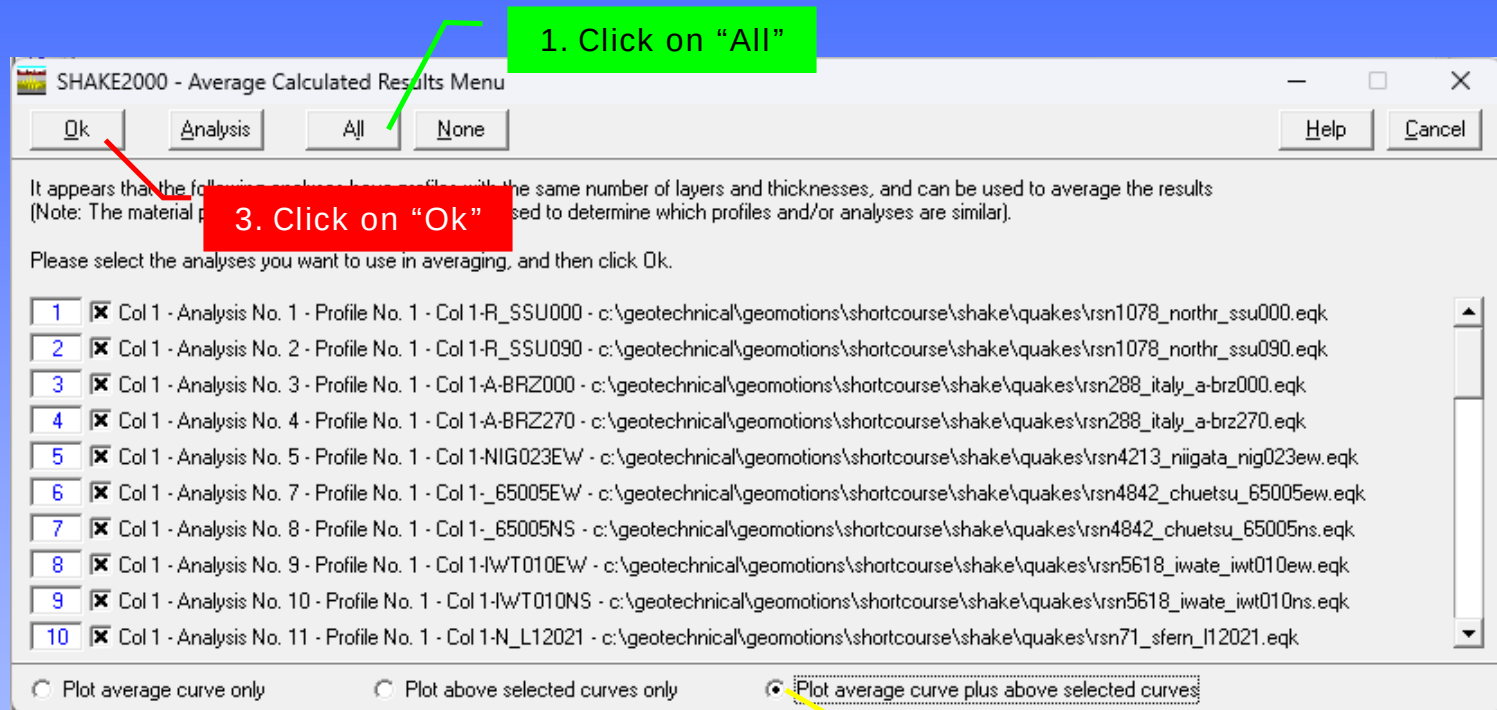


Site Specific Response Analysis Plot Results

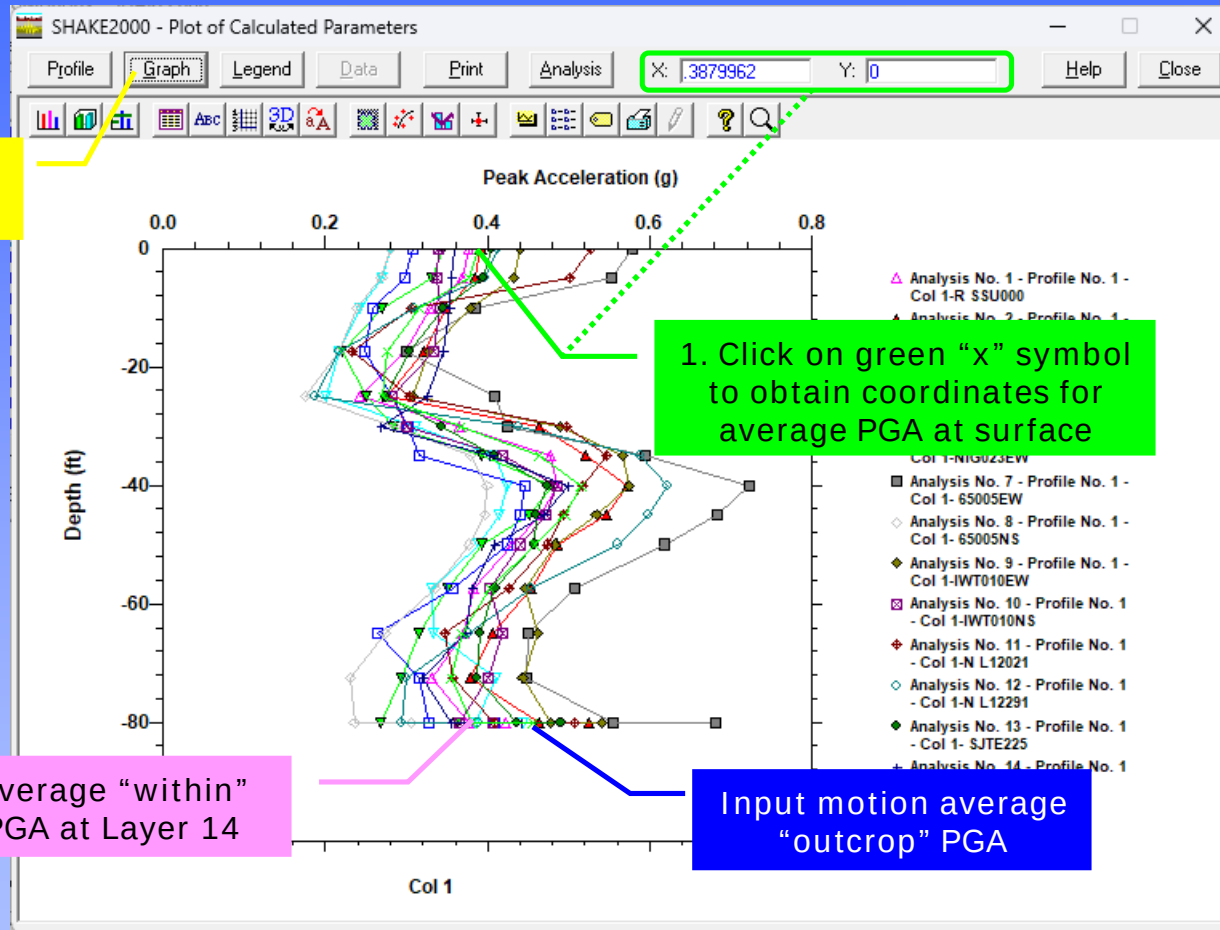


Site Specific Response Analysis

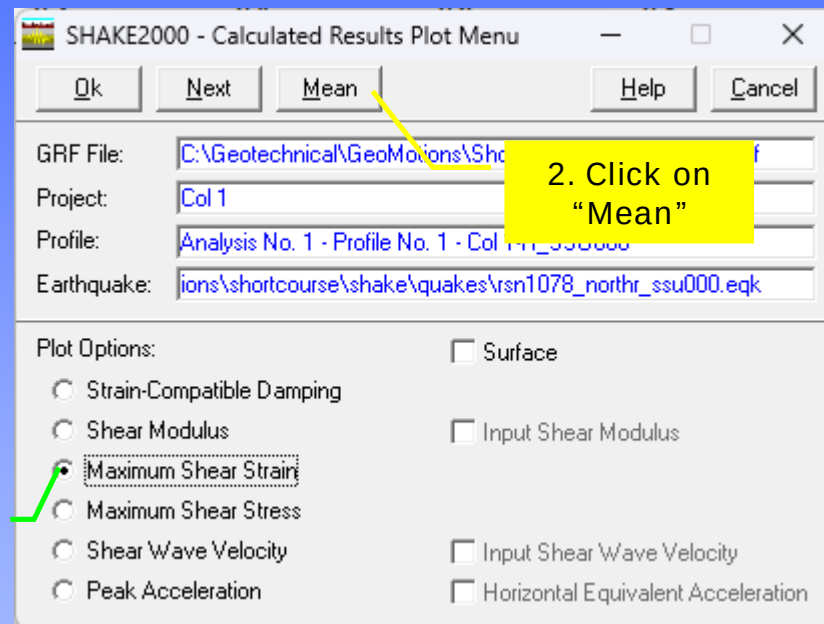
Plot Results



Site Specific Response Analysis Plot Results



Site Specific Response Analysis Plot Results

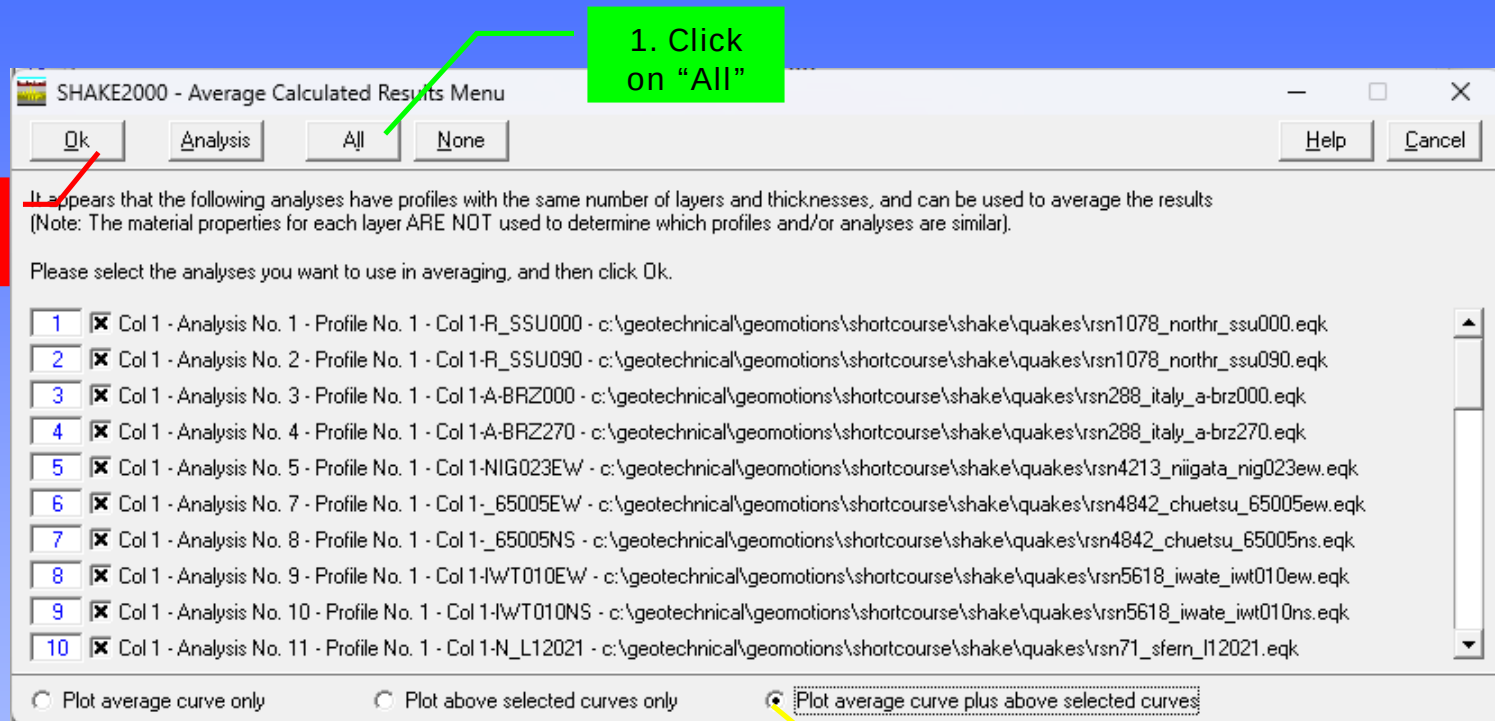


1. Click on "Maximum Shear Strain"

2. Click on "Mean"

Site Specific Response Analysis

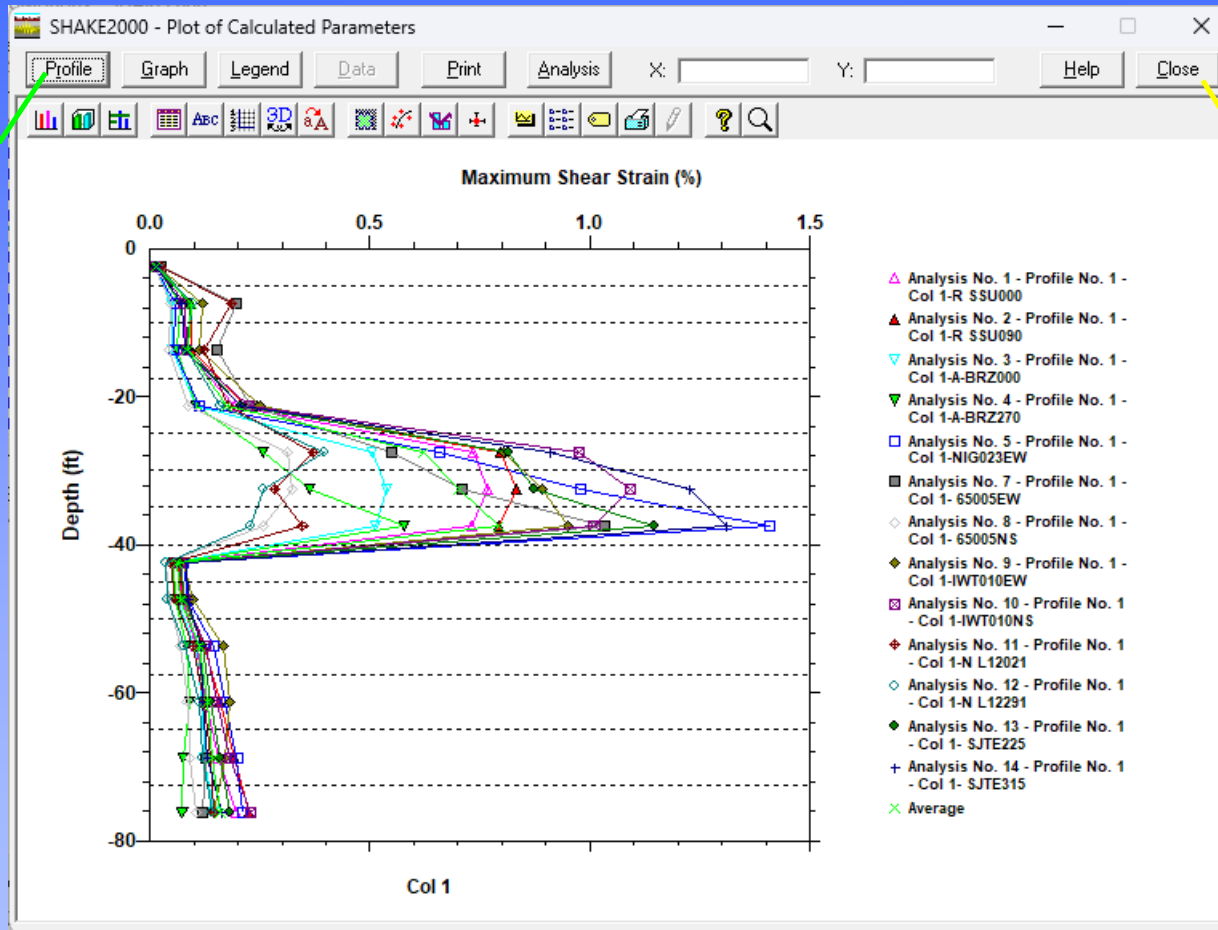
Plot Results



2. Click on "Plot average curve plus above selected curves" to select it

Site Specific Response Analysis Plot Results

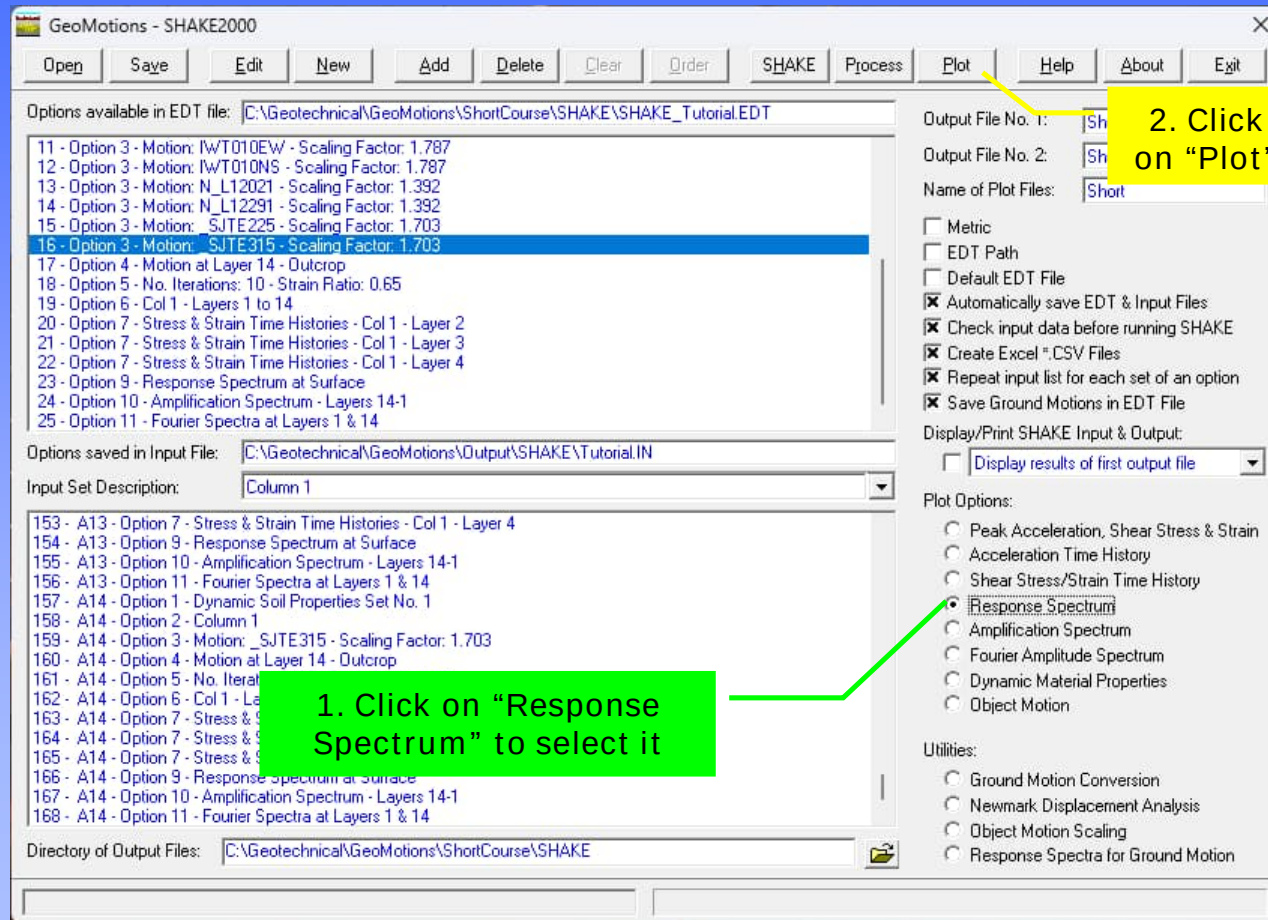
1. Click on
"Profile"



2. Click on
"Close"

Site Specific Response Analysis

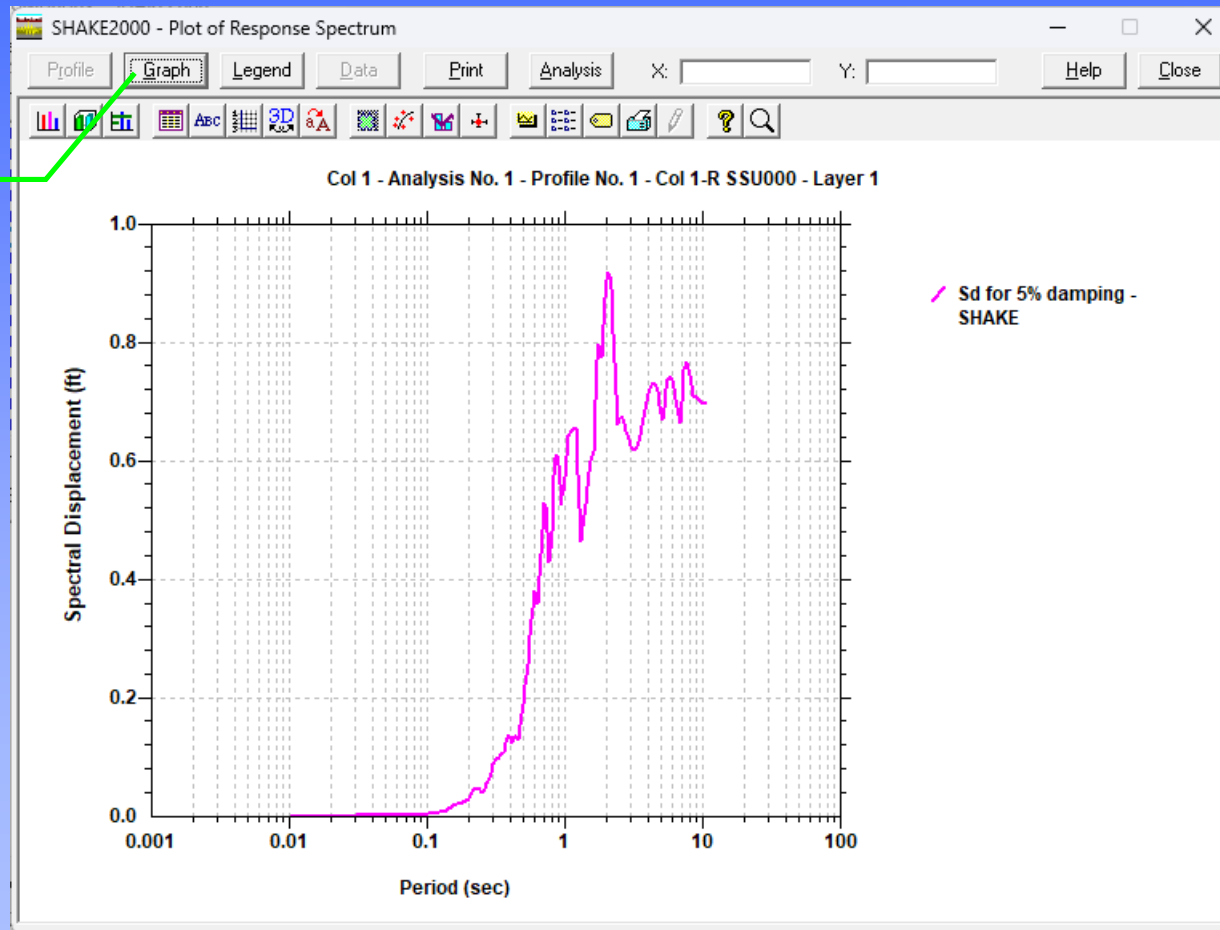
Plot Results



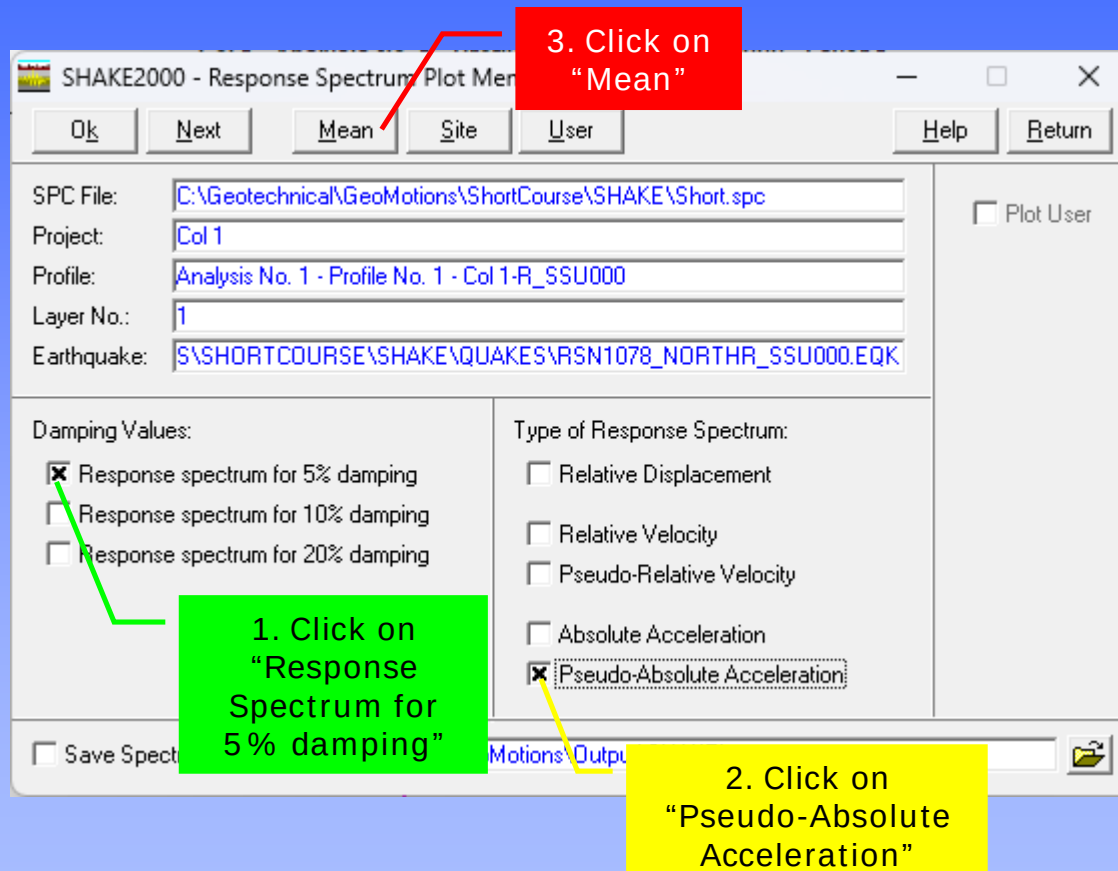
Site Specific Response Analysis

Plot Results

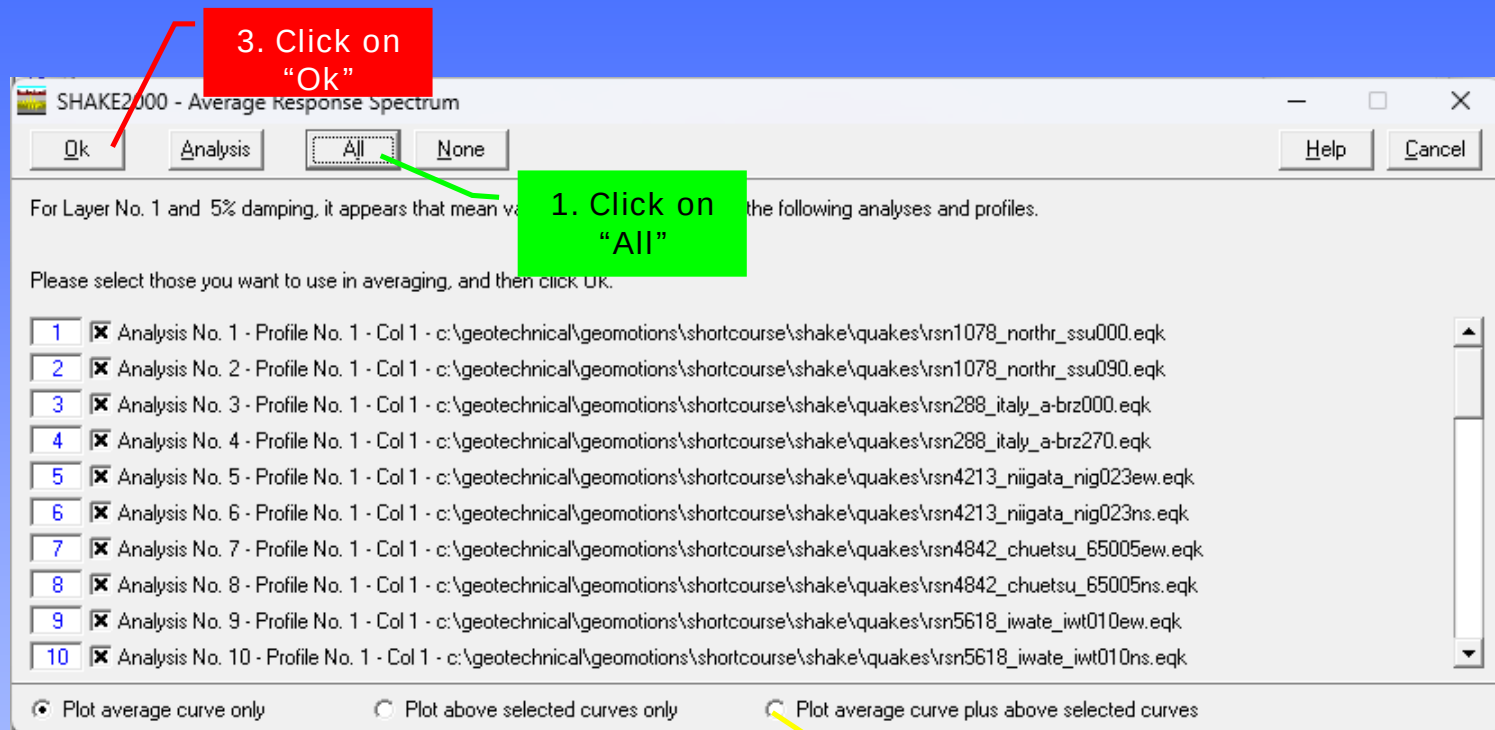
1. Click on
"Graph"



Site Specific Response Analysis Plot Results

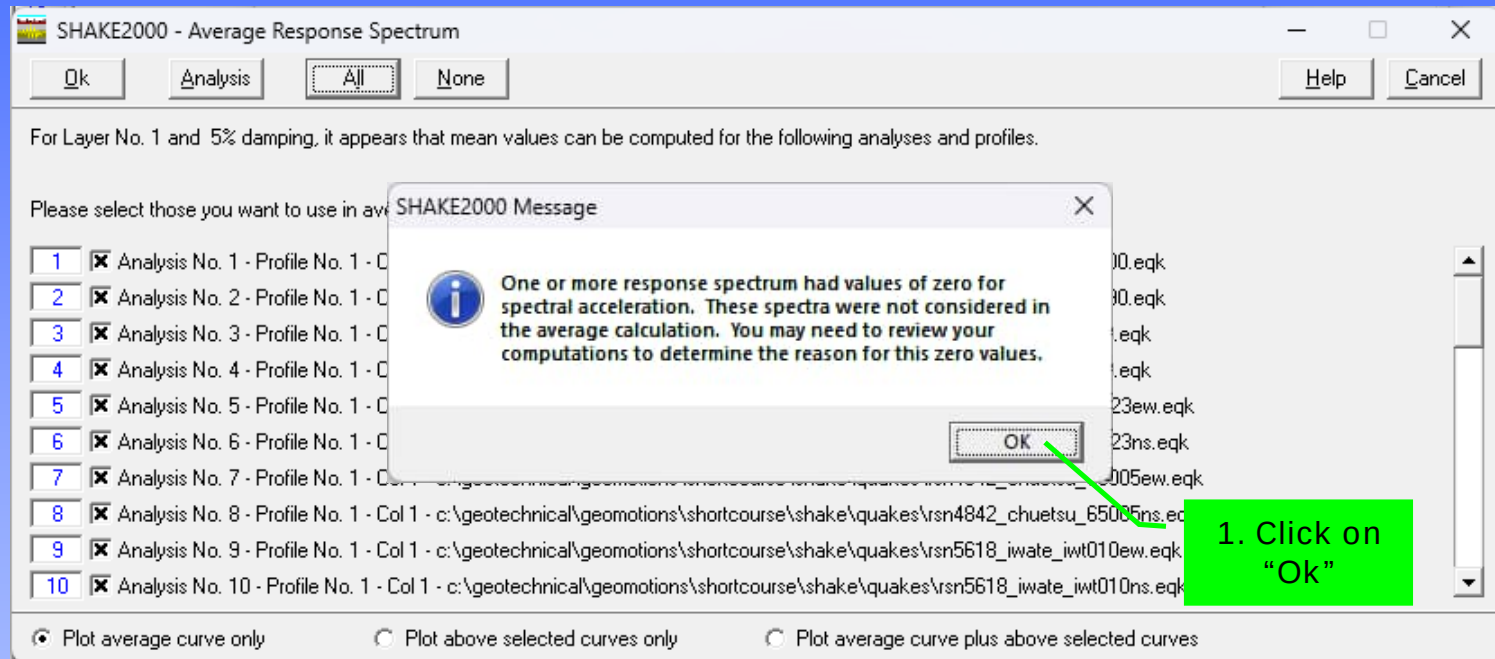


Site Specific Response Analysis Plot Results



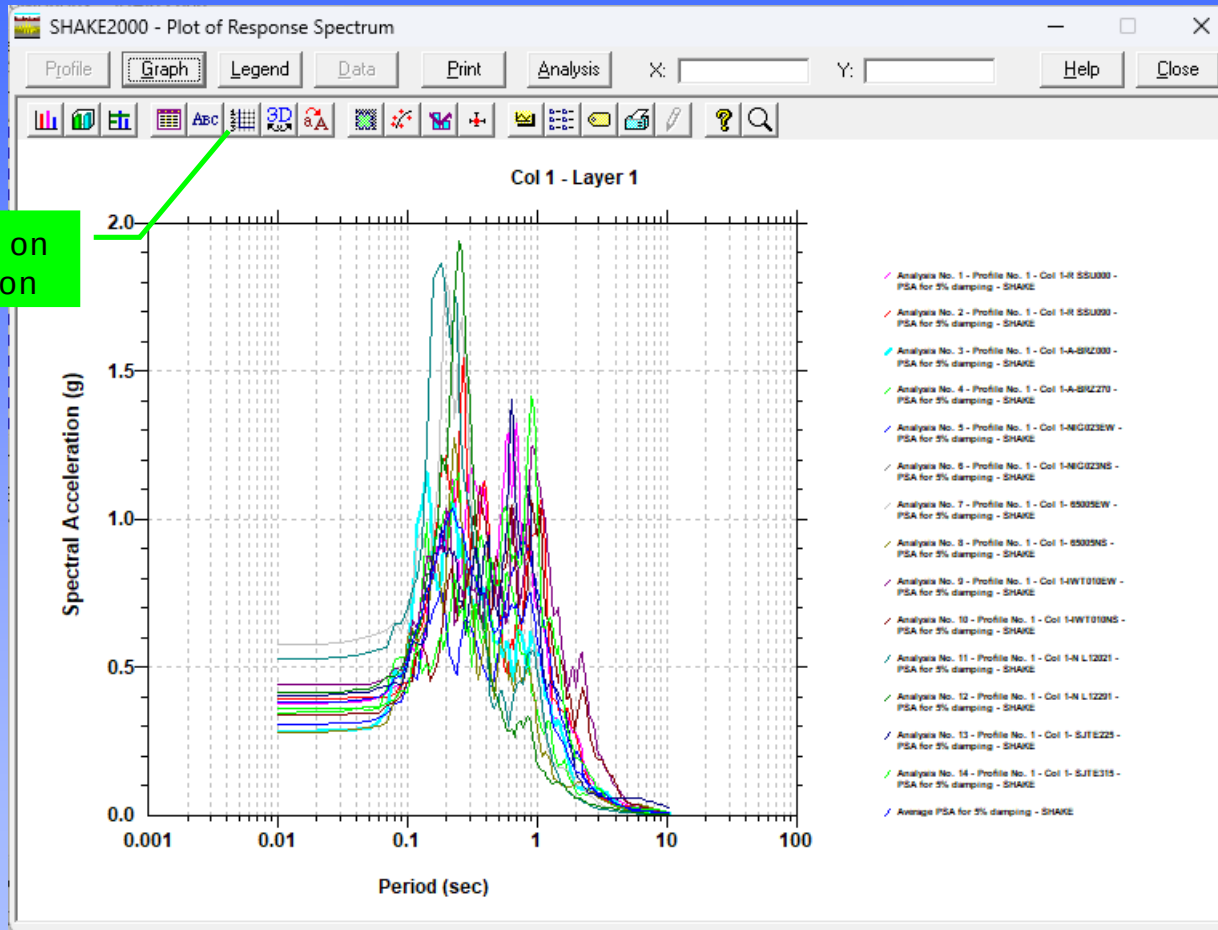
Site Specific Response Analysis

Plot Results



Site Specific Response Analysis

Plot Results



Site Specific Response Analysis

Change Graph Properties

The screenshot shows the 'Graph Control' dialog box with the 'Axis' tab selected. The 'Apply to Axis' section has the 'X' checkbox checked. The 'Position' section has 'Bottom' selected. The 'Scale' section has 'User-Defined' selected. The 'Range' section has 'Max' set to 10 and 'Min' set to 0.01. The 'Grids' section has 'Show' checked. The 'OK' button is at the bottom left.

1. Click on "X"

2. Click on "User-Defined"

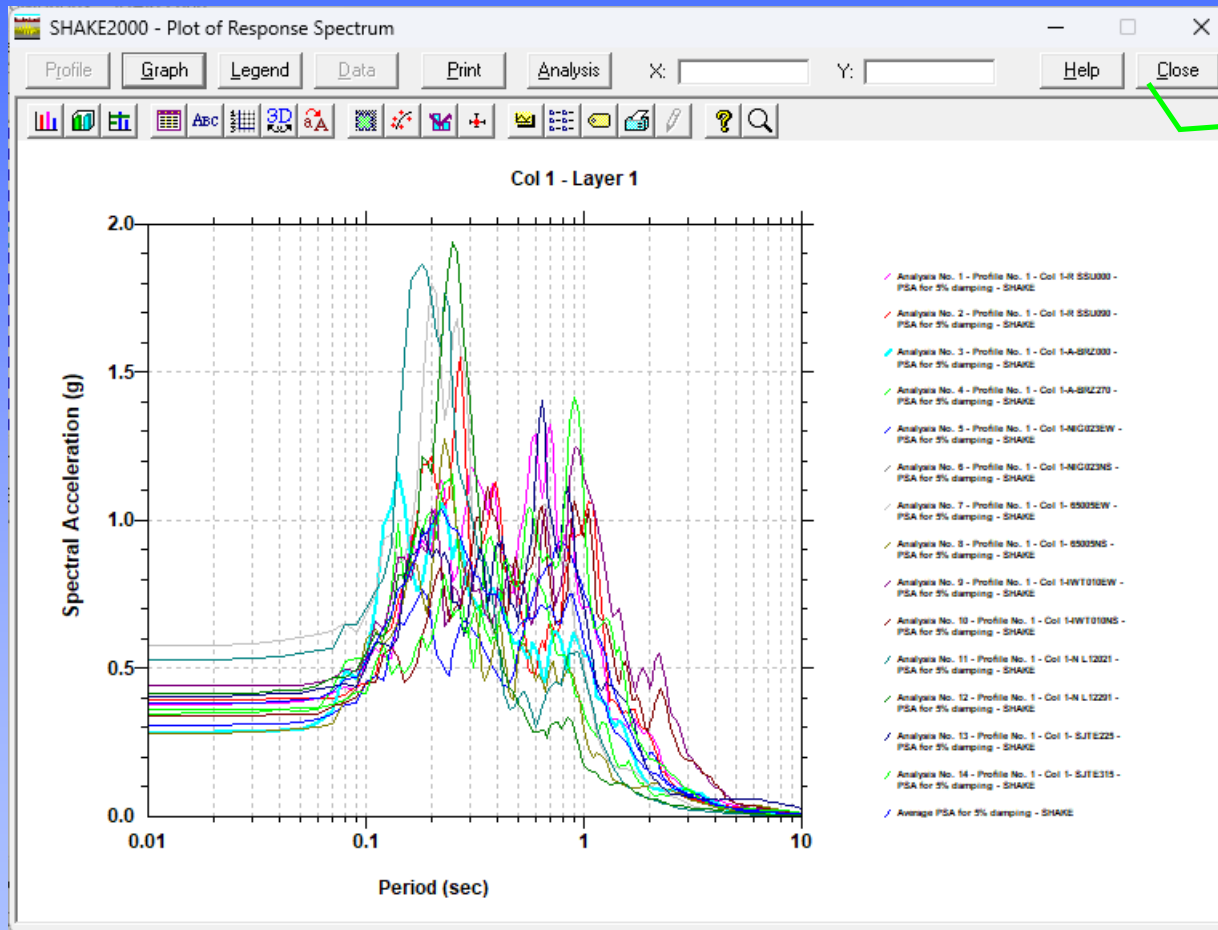
3. Enter "10" for Max

4. Enter "0.01" for Min

5. Click on "Ok"

Site Specific Response Analysis

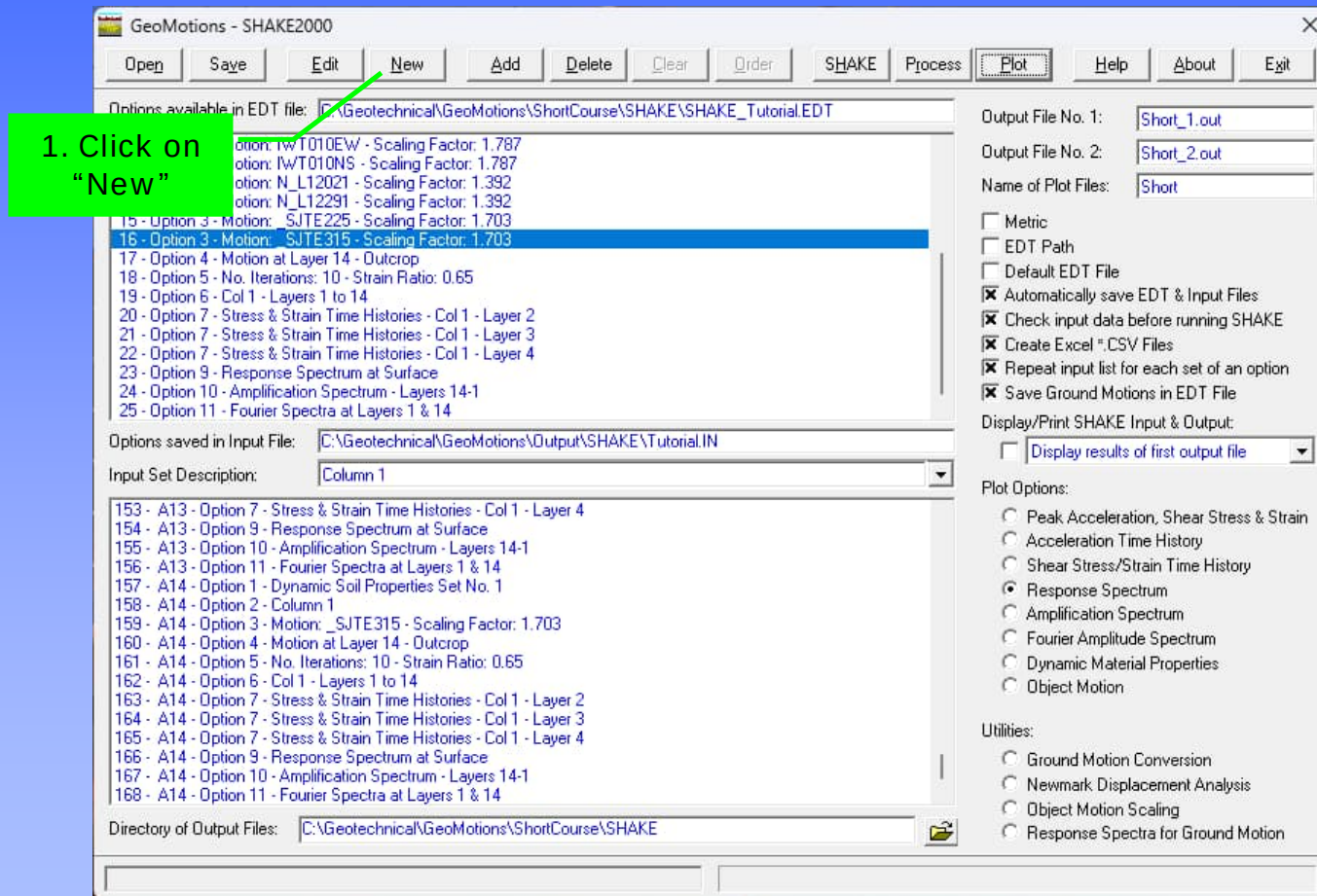
Plot Results



1. Click on
"Close"

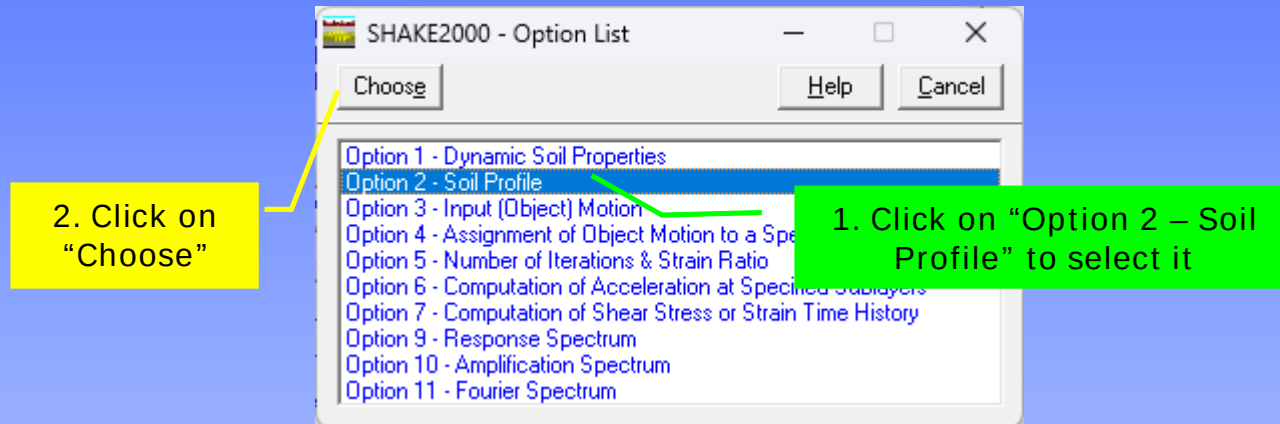
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

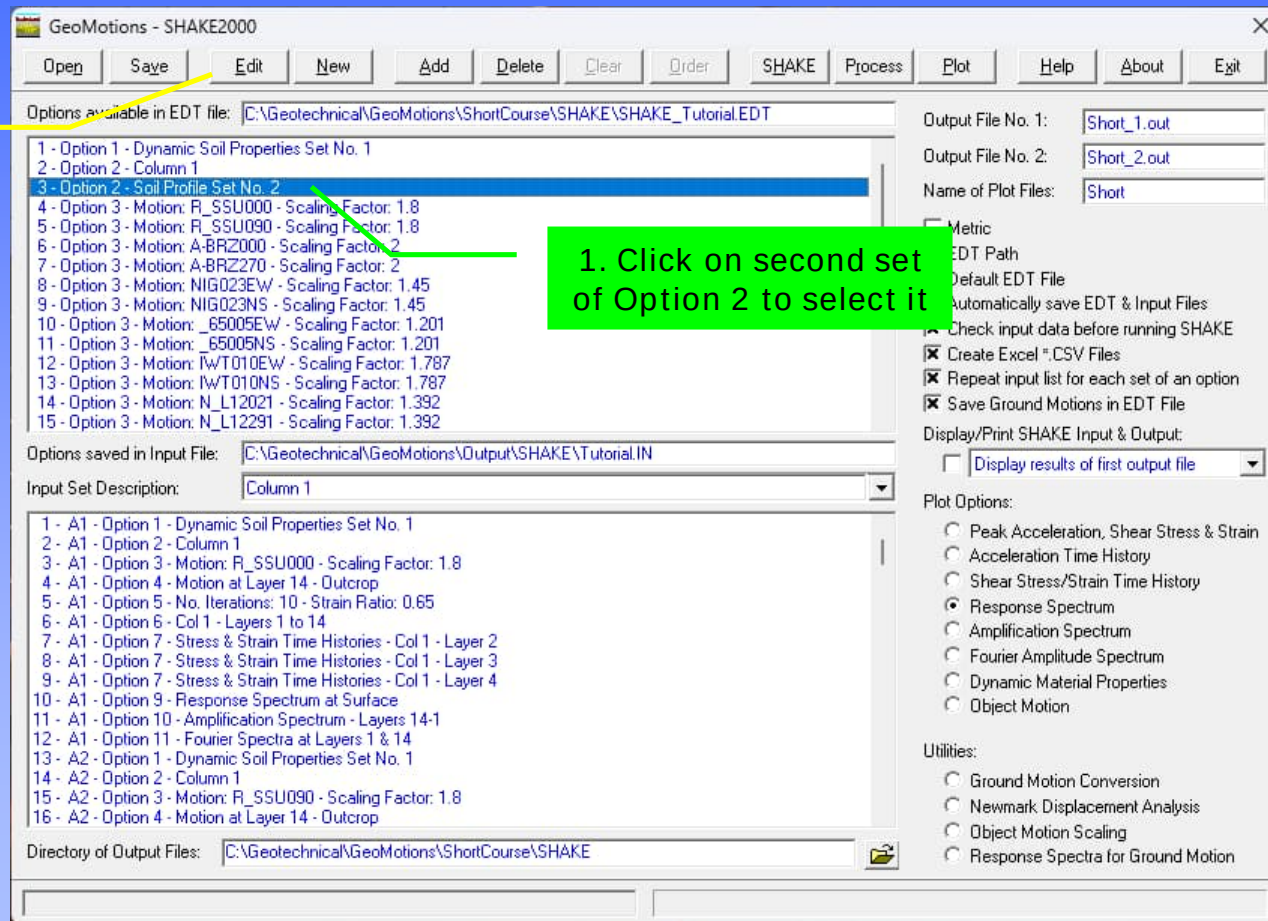


Site Specific Response Analysis

Create Input Data for Column No. 2

2. Click on "Edit"

1. Click on second set of Option 2 to select it



Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile – Column 2

SHAKE2000 - Option 2 Editor: Soil Profile

1. Enter "Option 2 – Column 2"

2. Enter "Col 2" in Identification

3. Enter "114" in Surface

4. Enter "5" in Thickness

5. Enter "0.125" for Unit Weight

6. Enter "758" in Shear Wave

Soil Profile No.	No. Sublayers:	Identification for Soil Profile:	Surface
2	2	Option 2 - Column 2	114 ft
1	1	Col 2	758
2	1		2500
3			
4			
5			
6			
7			
8			
9			
10			

Layer Number	Soil Type	Thickness (ft)	Shear Moduli (ksf)	Damping (decimal)	Unit Weight (kcf)	Shear Wave (fps)
1	1	5		.05	0.125	758
2	1			.02	.145	2500
3						
4						
5						
6						
7						
8						
9						
10						

Site Specific Response Analysis

Option 2 – Enter the data for Column No. 2

Layer No.	Soil Type	Thickness (feet)	Damping	Unit Weight (kcf)	V _s (fps)
2	1	5	0.05	0.125	758
3	1	5	0.05	0.125	758
4	2	5	0.05	0.130	656
5	2	5	0.05	0.130	656
6	2	5	0.05	0.130	656
7	3	5	0.05	0.115	802
8	3	5	0.05	0.115	802
9	4	5	0.05	0.110	791
10	4	5	0.05	0.110	791*
11	4	5	0.05	0.110	791
12	5	5	0.05	0.120	872
13	5	5	0.05	0.120	872
14	5	5	0.05	0.120	872
15	6		0.02	0.145	2500

*After entering the V_s value for layer 10 press "Tab" to move out of the cell and then you'll be able to scroll down

Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile – Column 2

SHAKE2000 - Option 2 Editor: Soil Profile

Print Plot Add Reset Repeat Layers GmaxEq Gmax Help Return

Set No.: 2 Soil Profile - Set Identification: Option 2 - Column 2

Soil Profile No.: 2 No. Sublayers: 15 Identification for Soil Profile: Col 2

☒ Option 6 Surface 114 ft

Layer Number	Soil Type	Thickness (ft)	Shear Moduli (ksf)	Damping (decimal)	Unit Weight (kcf)	Shear Wave (fps)
6	2	5		.05	.13	656
7	3	5		.05	.115	802
8	3	5		.05	.115	802
9	4	5		.05	.11	791
10	4	5		.05	.11	791
11	4	5		.05	.11	791
12	5	5		.05	.12	872
13	5	5		.05	.12	872
14	5	5		.05	.12	872
15	6			.05	.145	2500

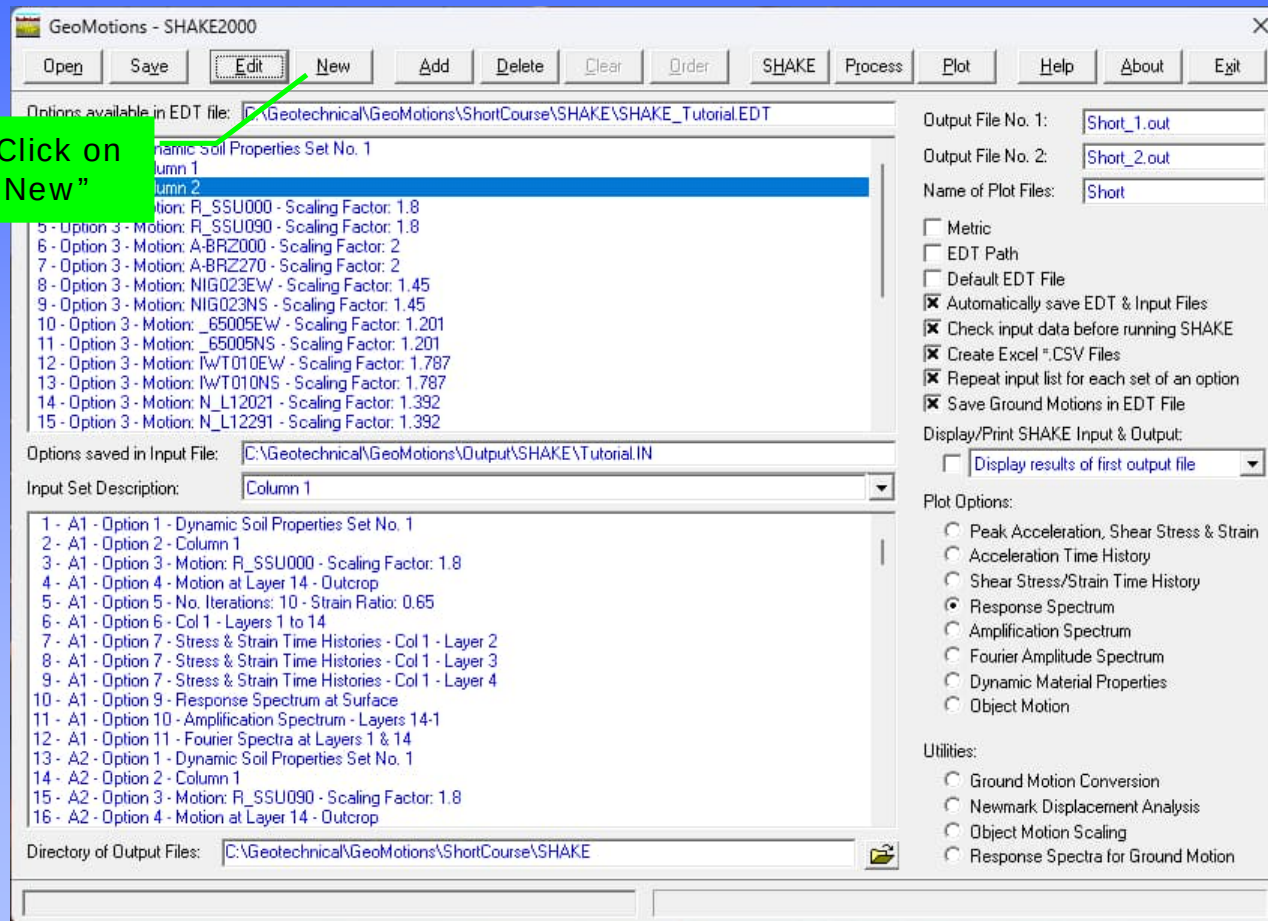
2. Click on "Return"

1. Click on "Option 6"

Halfspace Layer

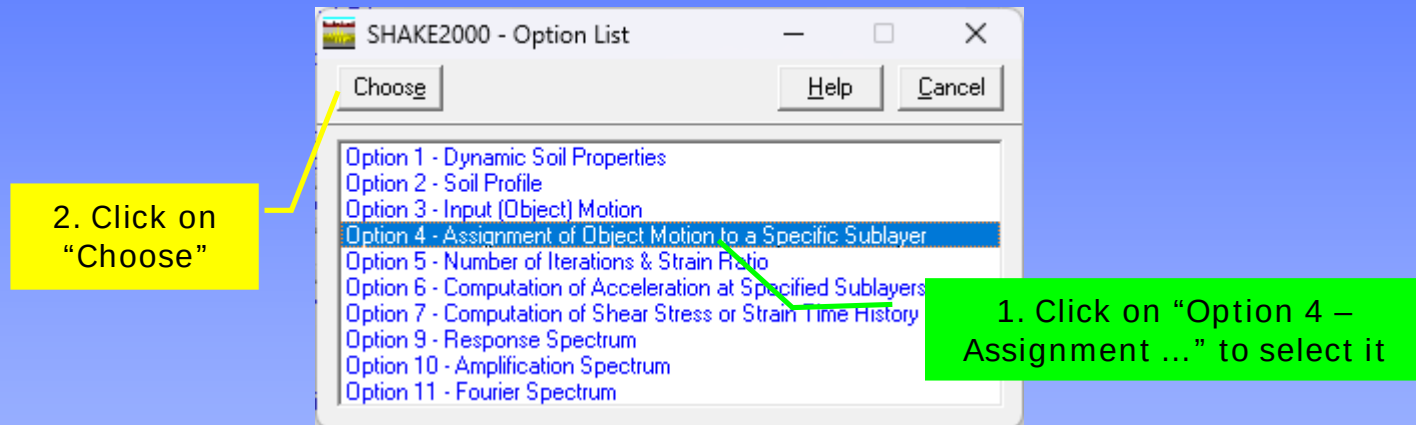
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



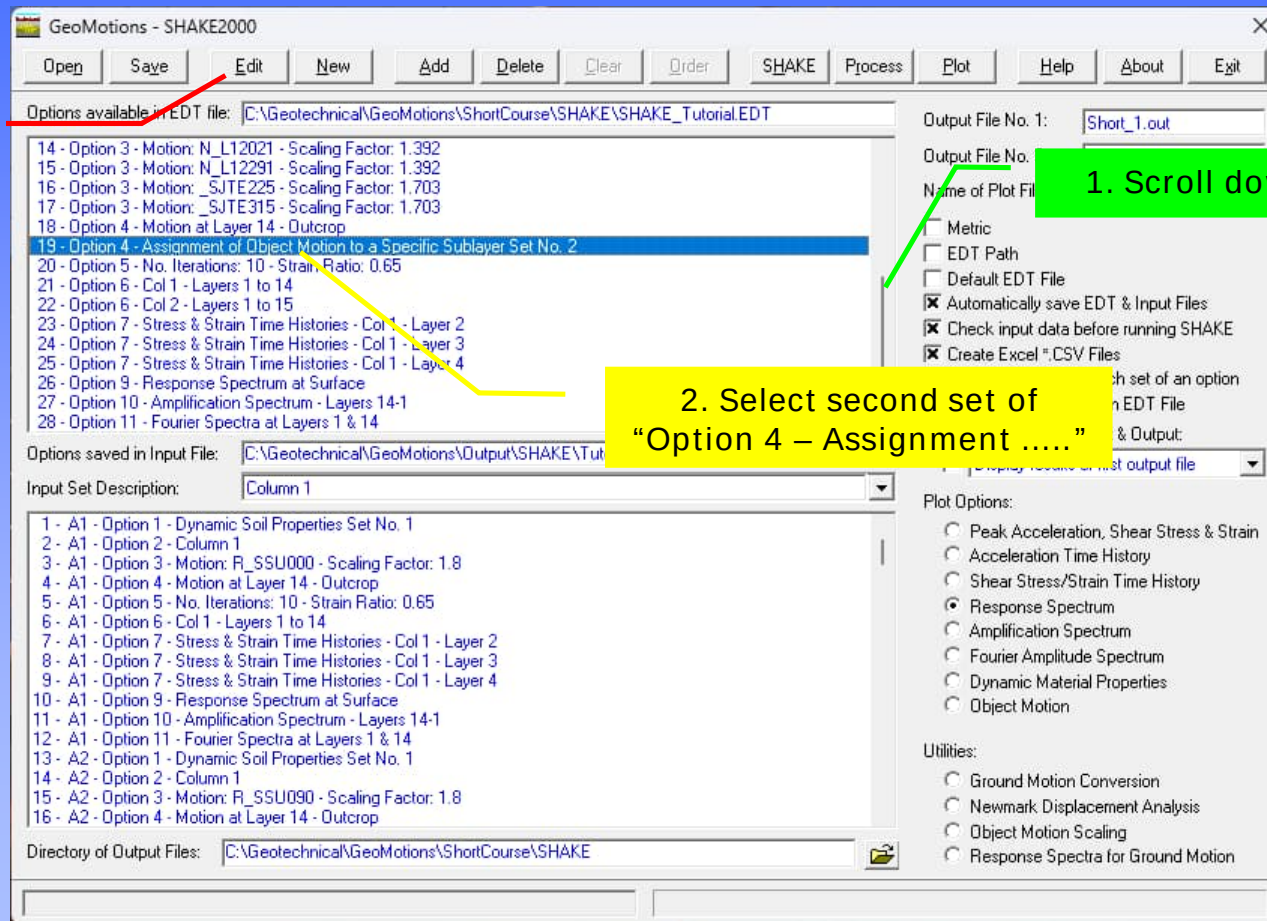
Site Specific Response Analysis

Create Input Data for Column No. 2

3. Click on "Edit"

1. Scroll down

2. Select second set of "Option 4 – Assignment"



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 4: Assignment of Object Motion

The screenshot shows the 'SHAKE2000 - Option 4 Editor: Assignment of Object Motion' dialog box. It contains the following fields and controls:

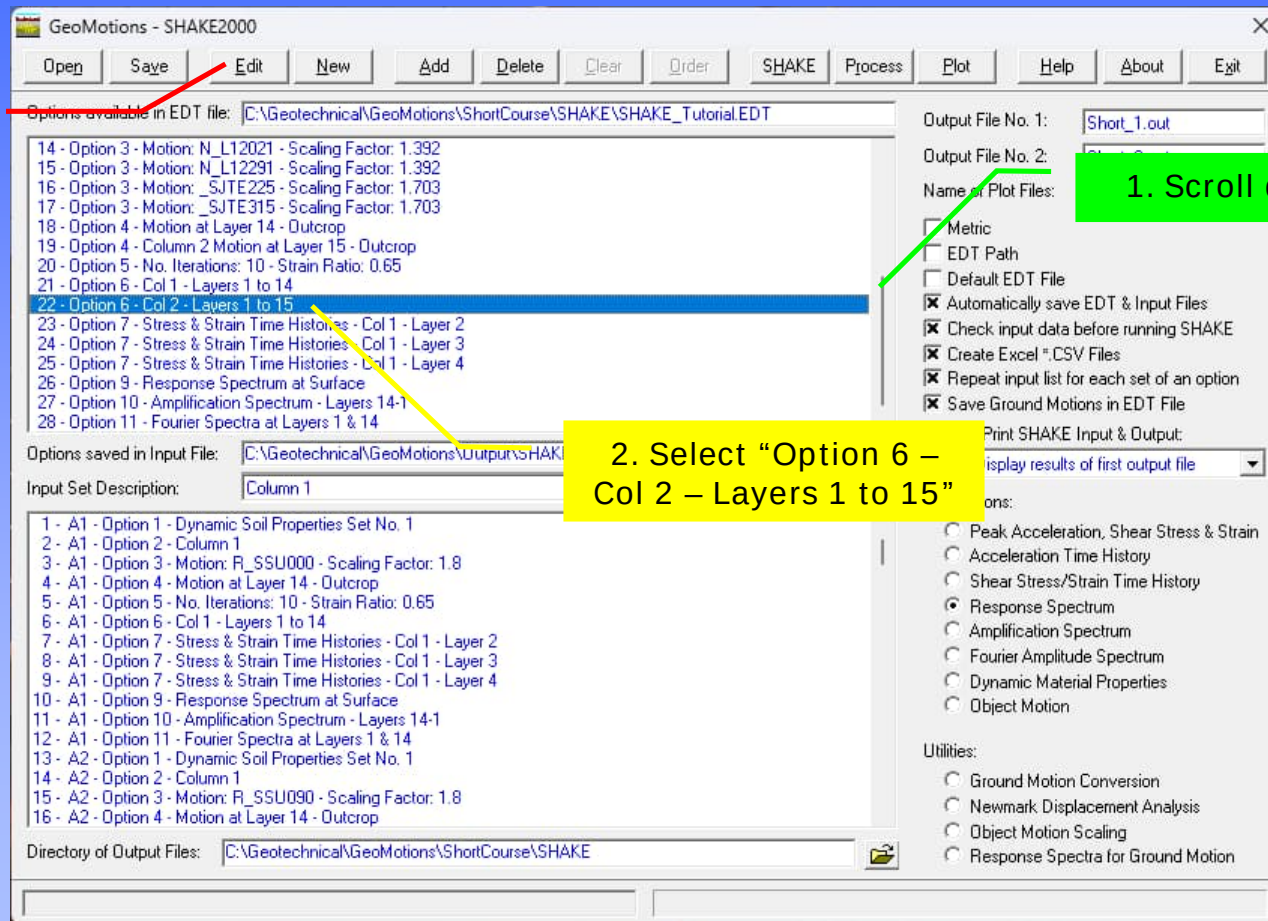
- Set No.:** A text box containing the value '2'.
- Assignment of Object Motion to Sublayer - Set Identification:** A text box containing the text 'Option 4 - Column 2 Motion at Layer 15 - Outcrop'.
- No. of Sublayer:** A text box containing the value '15'.
- Outcrop or Within Profile:** A text box containing the value '0'.
- Option 2 Deconvolved Profile (Silva et al., 1988):** An unchecked checkbox.
- Buttons:** 'Help' and 'Return' buttons are located in the top right corner.

Four instructional callouts are present:

- A green box with the text '1. Enter "Option 4 – Column 2 Motion at Layer 15 – Outcrop"' has a green line pointing to the 'Set Identification' text box.
- A yellow box with the text '2. Enter "15" for No. of Sublayer' has a yellow line pointing to the 'No. of Sublayer' text box.
- A blue box with the text '0 = Outcrop
1 = Within' has a blue line pointing to the 'Outcrop or Within Profile' text box.
- A red box with the text '3. Click on "Return"' has a red line pointing to the 'Return' button.

Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 6: Acceleration Time Histories

SHAKE2000 - Option 6 Editor: Acceleration at Top of Sublayers

Repeat

Set No.: Acceleration at Top of Sublayers - Set Identifier: ☒ HEA - Option 7

Sublayers for which acceleration time histories are computed:

Sublayer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type of each sublayer: 0 (zero) for outcrop, 1 (one) for within soil profile	0	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Output mode for computed accelerations: 0 if only maximum acceleration; or 1 for maximum acceleration and time history:	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1

1. Enter "1" for "Output mode..." for Layers 4 & 15

2. Enter "2" for Type for Layer 15*

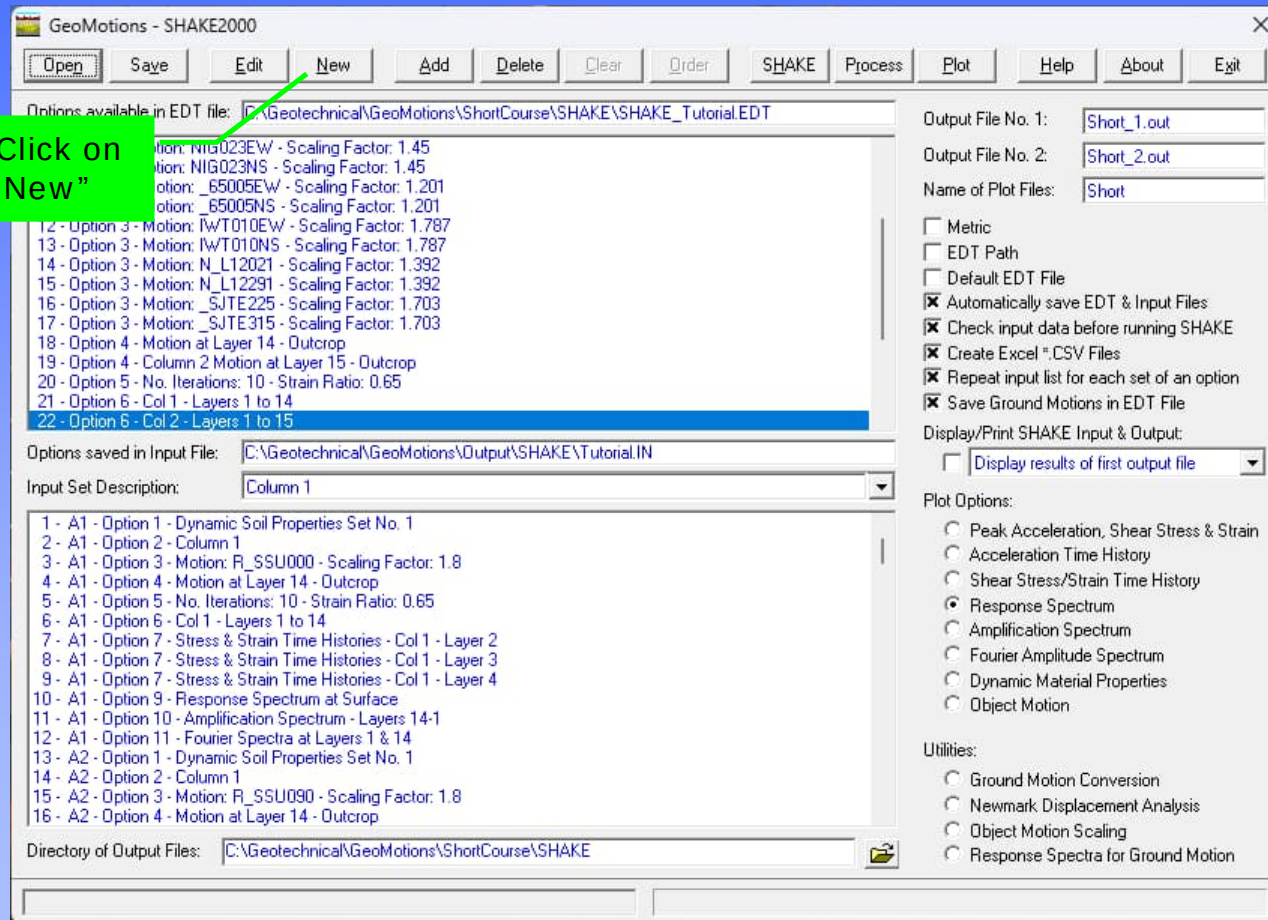
3. Select check box

4. Click on "Return"

** Acceleration time history at layer 15 will compute the "incident" component of the resultant acceleration time history.

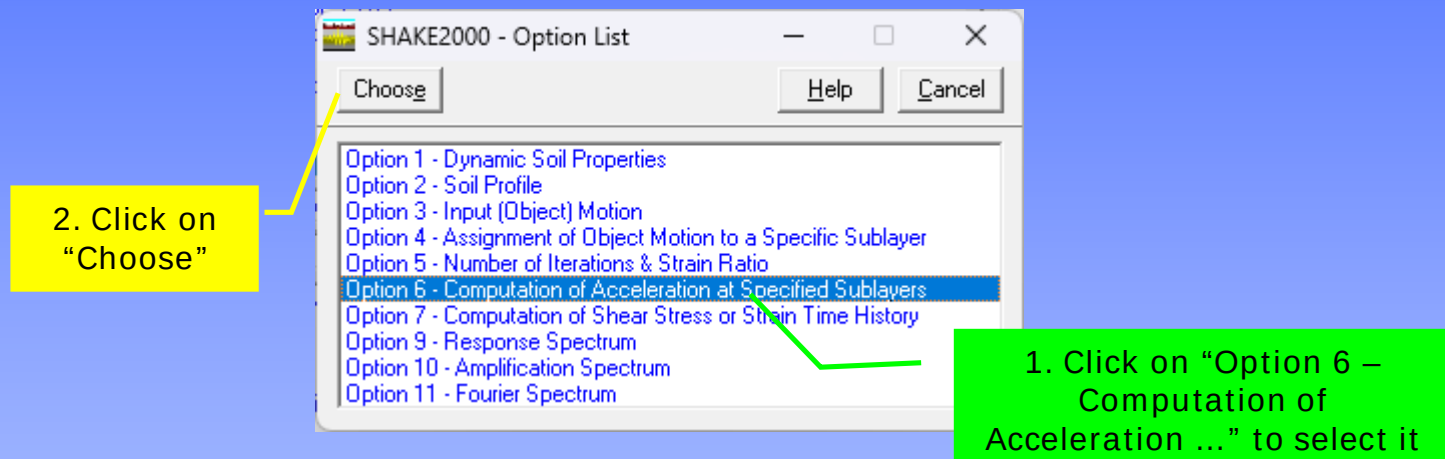
Site Specific Response Analysis

Create Input Data for Column No. 2



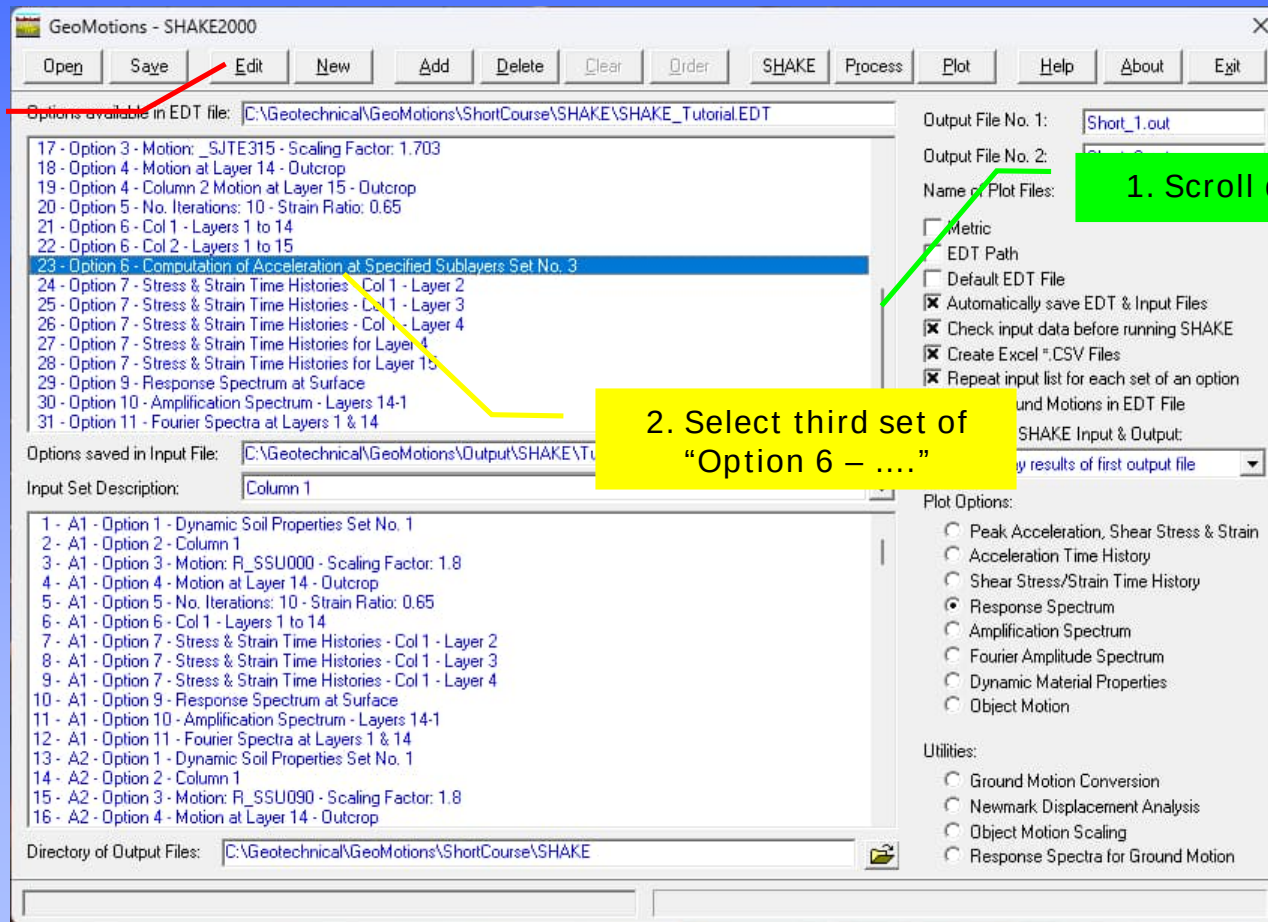
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 6: Acceleration Time Histories

SHAKE2000 - Option 6 Editor: Acceleration at Top of Sublayers

Repeat Help Return

Set No.: 3 Acceleration at Top of Sublayers - Set Identification: Option 6 - Computation of Acceleration at Specified Sublayers Set No. 3 ☐ HEA - Option 7

Sublayers for which acceleration time histories are computed:

1 2 2

Type of each sublayer: 0 (zero) for outcrop, 1 (one) for within soil profile, or 2 (two) for incident:

0 1 0

Output mode for computed accelerations: 0 if only maximum acceleration; or 1 for maximum acceleration and time history:

1 0 0

1. Delete data on these two columns

** Acceleration time history at layer 15 will compute the "incident" component of the resultant acceleration time history.

Site Specific Response Analysis

Create Input Data for Column No. 2

Option 6: Acceleration Time Histories

The screenshot shows the 'SHAKE2000 - Option 6 Editor: Acceleration' dialog box. It contains the following fields and controls:

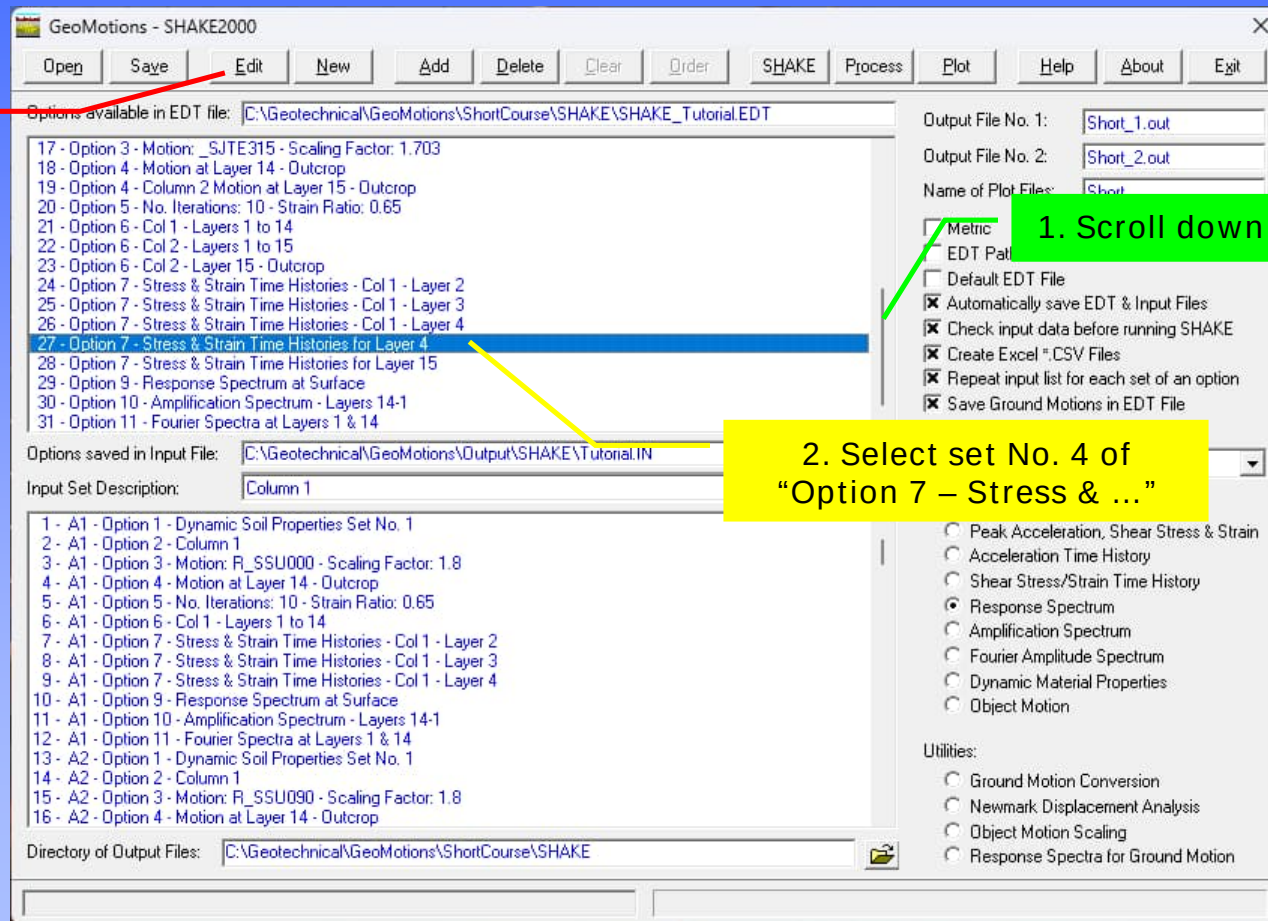
- Repeat** button
- Help** button
- Return** button
- Set No.:** A text box containing the value '3'.
- Acceleration at Top of Sublayers - Set Identification:** A text box containing the value 'Option 6 - Col 2 - Layer 15 - Outcrop'.
- HEA - Option 7** checkbox (unchecked).
- Sublayers for which acceleration time histories are computed:** A row of 15 checkboxes. The first checkbox is checked and contains the value '15'.
- Type of each sublayer: 0 (zero) for outcrop, 1 (one) for within soil profile, or 2 (two) for incident:** A row of 15 checkboxes. The first checkbox is checked and contains the value '0'.
- Output mode for computed accelerations: 0 if only maximum acceleration; or 1 for maximum acceleration and time history:** A row of 15 checkboxes. The first checkbox is checked and contains the value '0'.

Four numbered callouts are present:

1. Enter "Option 6 – Col 2 – Layer 15 – Outcrop" (points to the Set Identification text box)
2. Enter "15" (points to the first checkbox in the Sublayers row)
3. Enter "0" (points to the first checkbox in the Type of each sublayer row)
4. Click on "Return" (points to the Return button)

Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 7: Shear Strain & Shear Stress

SHAKE2000 - Option 7 Editor: Shear Strain and/or Stress Time History

1. Enter "Option 7 - Stress & Strain Time Histories - Col 2 - Layer 4"

2. Enter "Stress - Col 2 - Layer 4"

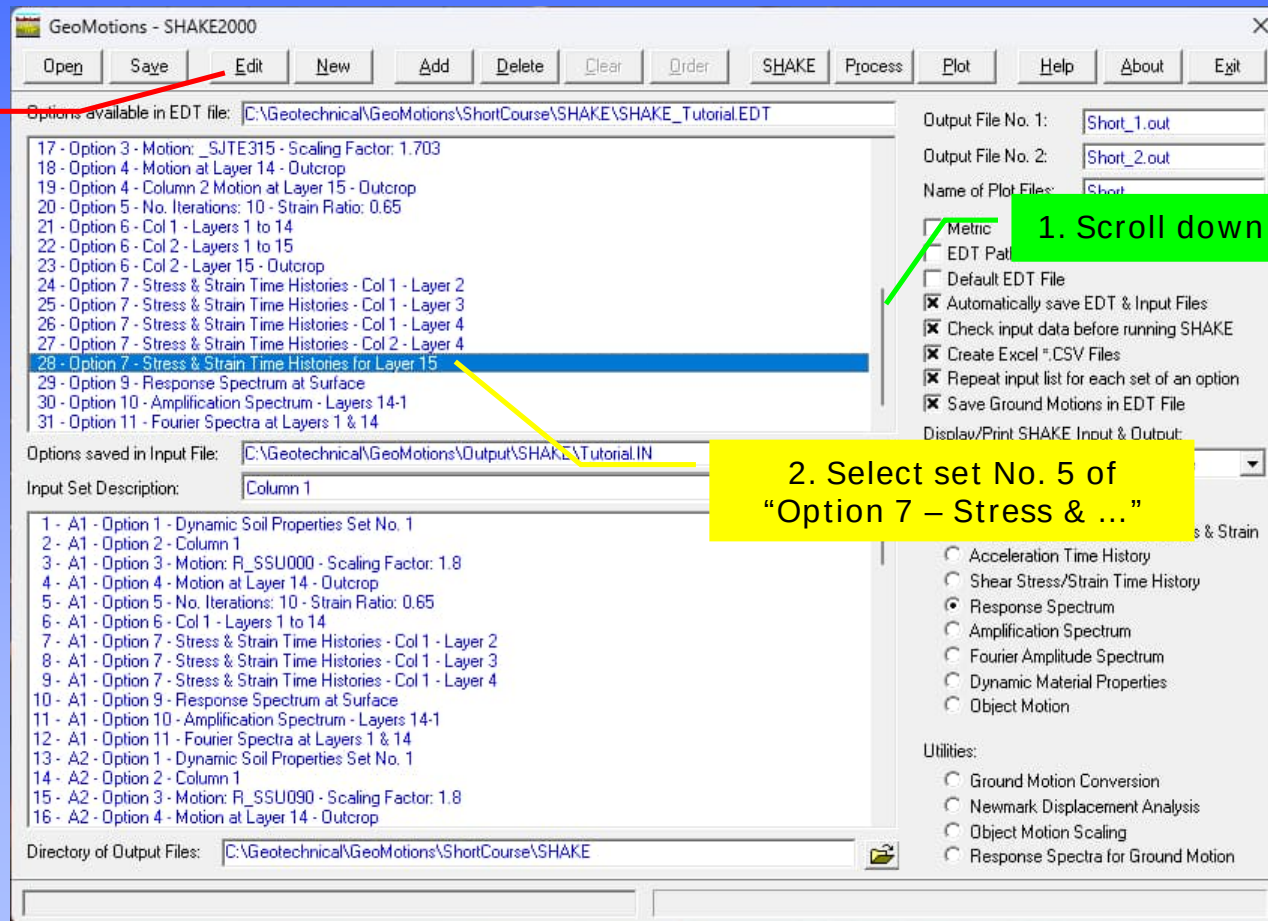
3. Enter "Strain - Col 2 - Layer 4"

4. Click "Return"

Set No.:	Shear Strain or Stress	Sublayer No.:	Stress/Strain:	Save History:	No. Values:	Identification:
4	Option 7 - Stress & Strain Time Histories - Col 2 - Layer 4	4	1	1	2048	Stress - Col 2 - Layer 4
4		4	0	1	2048	Strain - Col 2 - Layer 4

Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 7: Shear Strain & Shear Stress

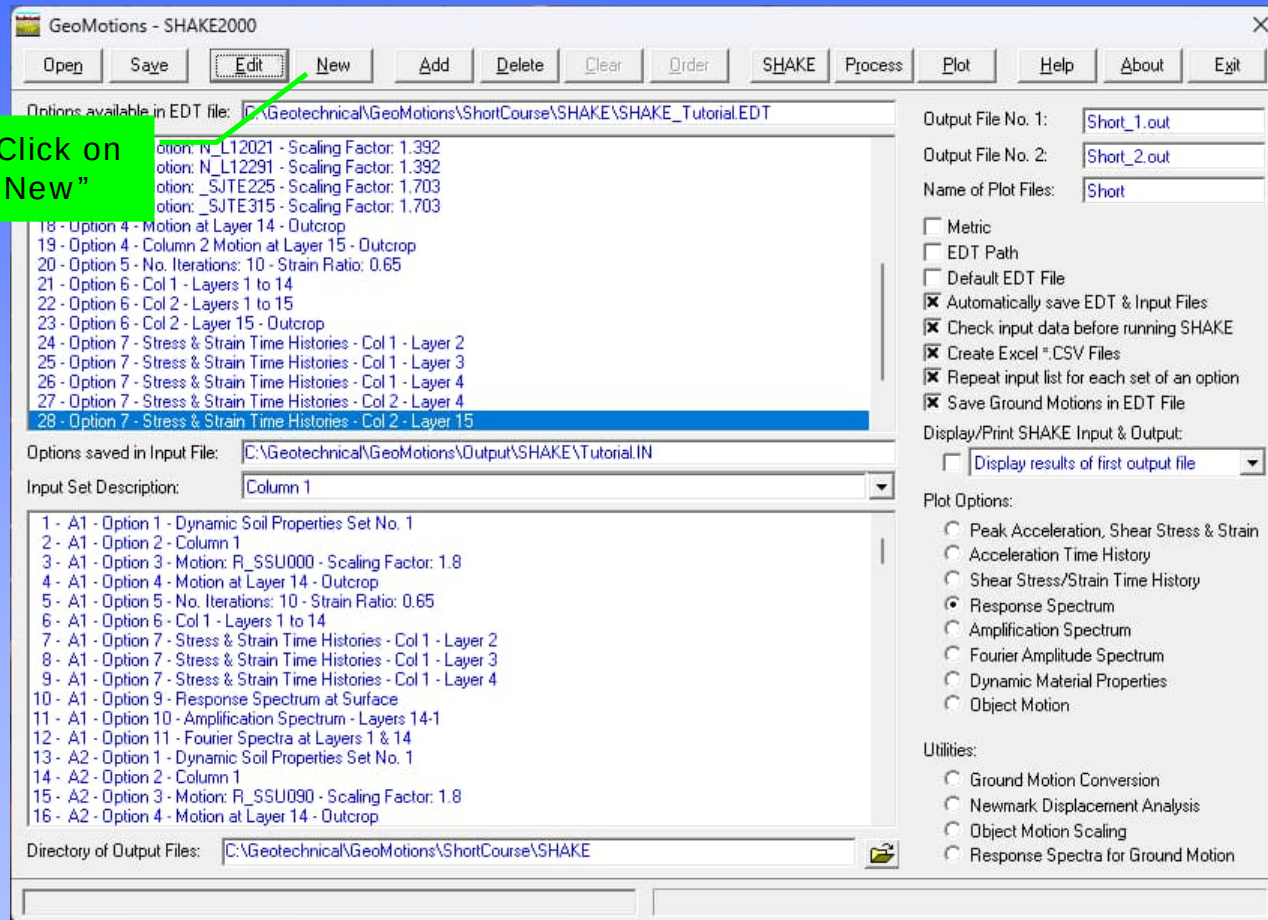
The screenshot shows the 'SHAKE2000 - Option 7 Editor' dialog box. It contains the following fields and instructions:

- 1. Enter "Option 7 – Stress & Strain Time Histories – Col 2 – Layer 15"**: Points to the 'Set Identification' field.
- 2. Enter "Stress - Col 2 – Layer 15"**: Points to the 'Stress/Strain' field for Sublayer 15.
- 3. Enter "Strain – Col 2 – Layer 15"**: Points to the 'Identification' field for Sublayer 15.
- 4. Click "Return"**: Points to the 'Return' button.

Set No.:	Shear Strain or Stress History - Set Identification:				
5	Option 7 - Stress & Strain Time Histories - Col 2 - Layer 15				
Sublayer No.:	Stress/Strain:	Save History:	No. Values:	Identification:	
15	1	1	2048	Stress - Col 2 - Layer 15	
15	0	1	2048	Strain - Col 2 - Layer 15	

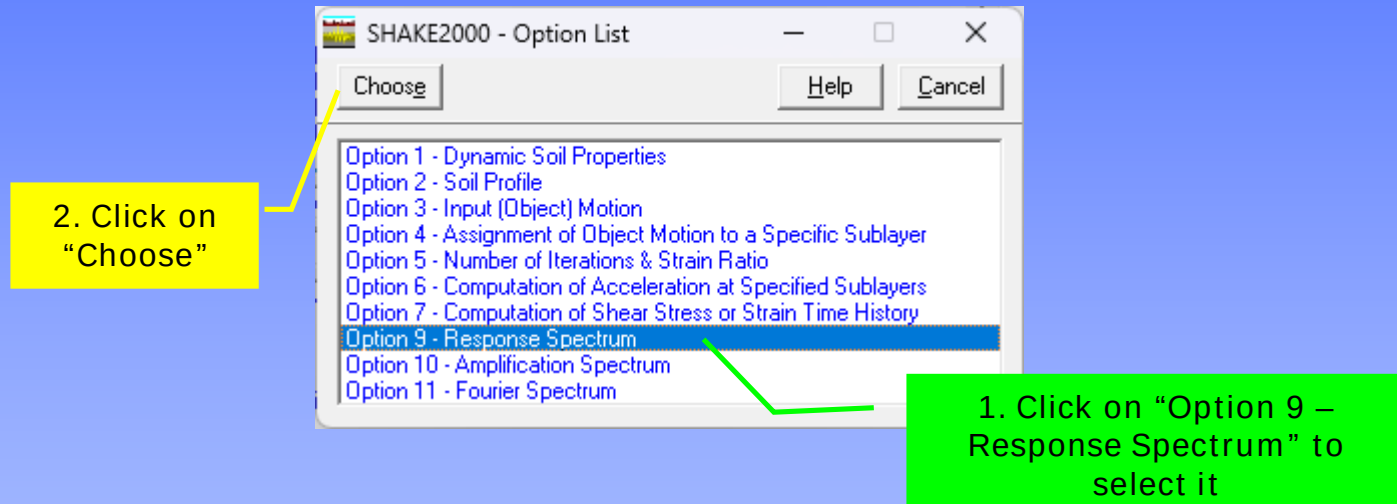
Site Specific Response Analysis

Create Input Data for Column No. 2



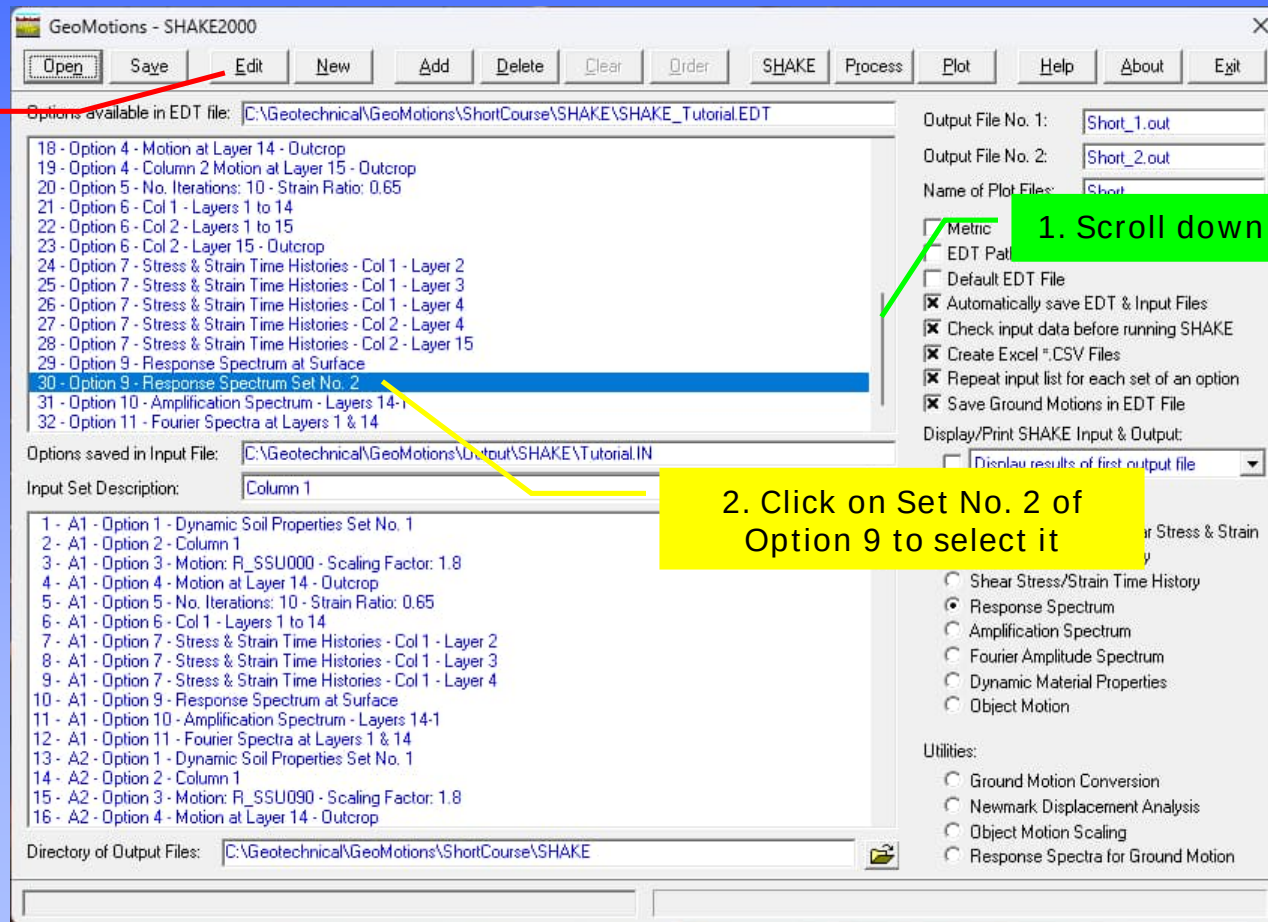
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No 2

Option 9: Response Spectrum

SHAKE2000 - Option 9 Editor: Response Spectrum

Help Return

Set No.: 2 Response Spectrum - Set Identification: Option 9 - Response Spectrum - Col 2 - Layer 15 - Input Outcrop

Sublayer No.: 15 Outcrop/Within: 0

No. Damping: 3 Null Gravity: 32.2

Damping Ratios (in decimal): .05 .1 .2

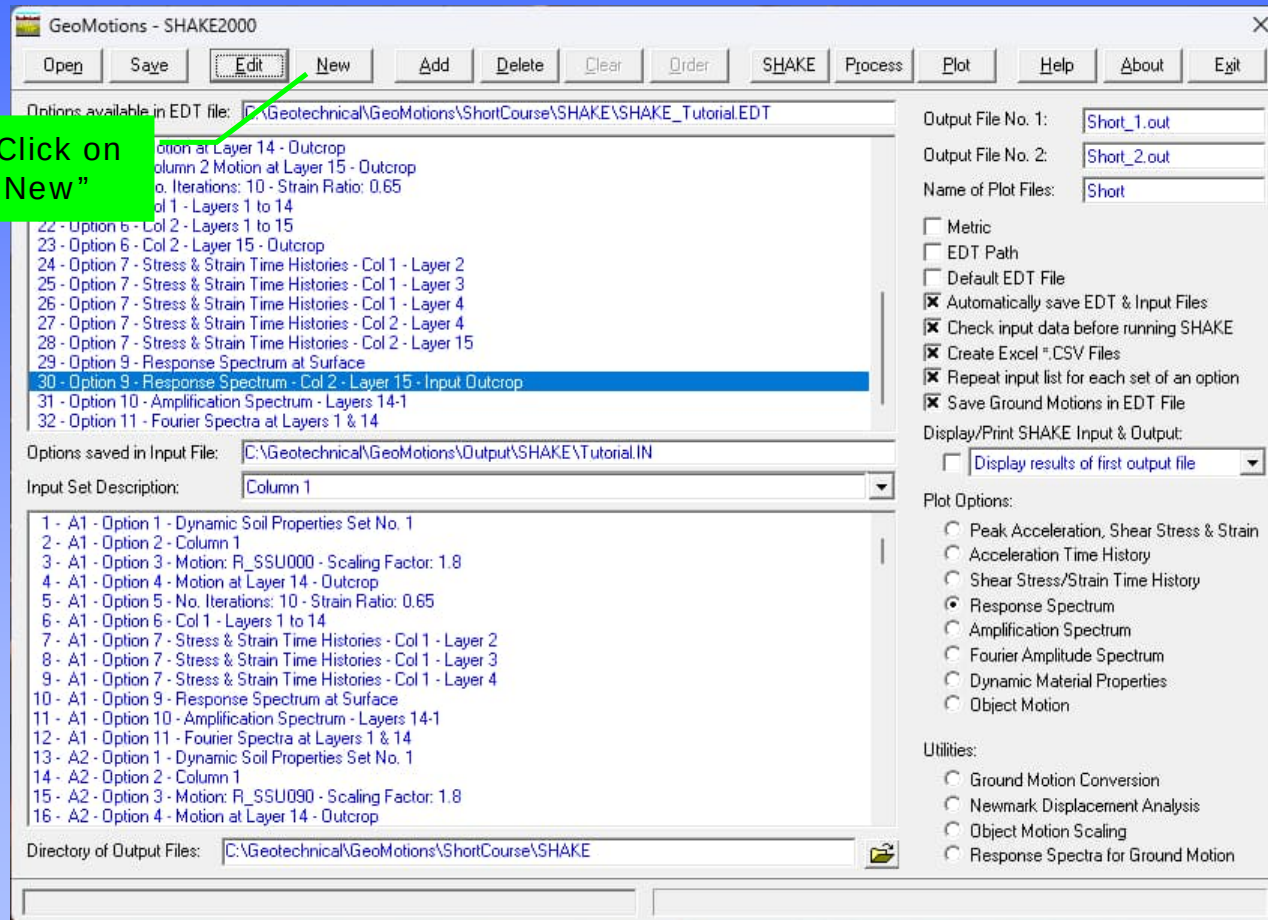
2. Enter
"15"

1. Enter "Option 9 – Response Spectrum
– Col 2 – Layer 15 – Input Outcrop"

3. Click on
"Return"

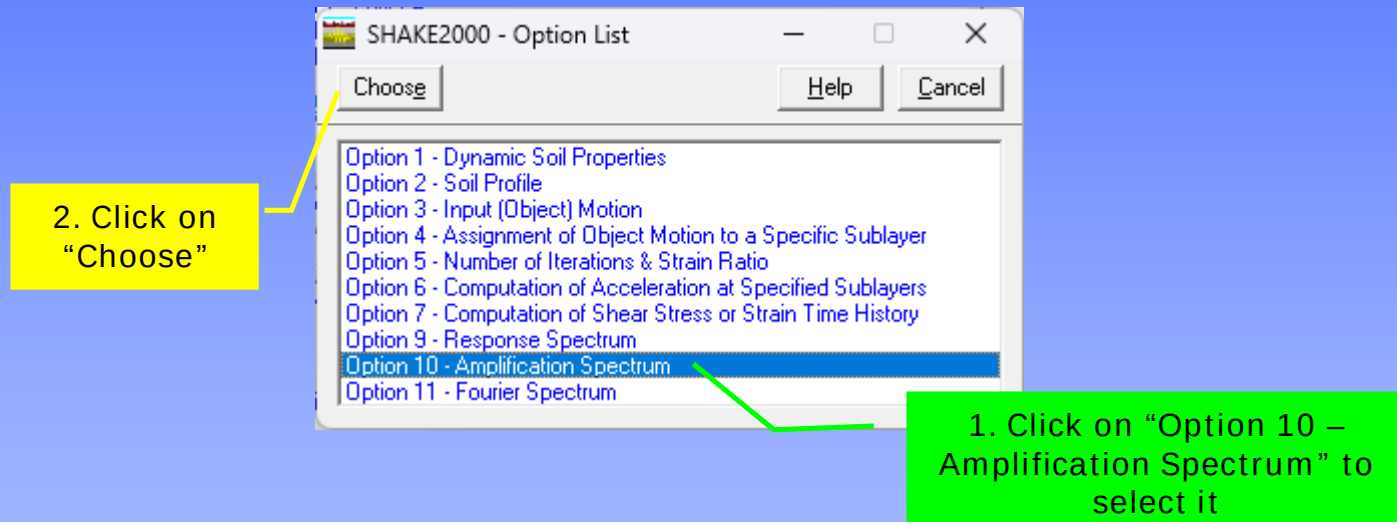
Site Specific Response Analysis

Create Input Data for Column No. 2



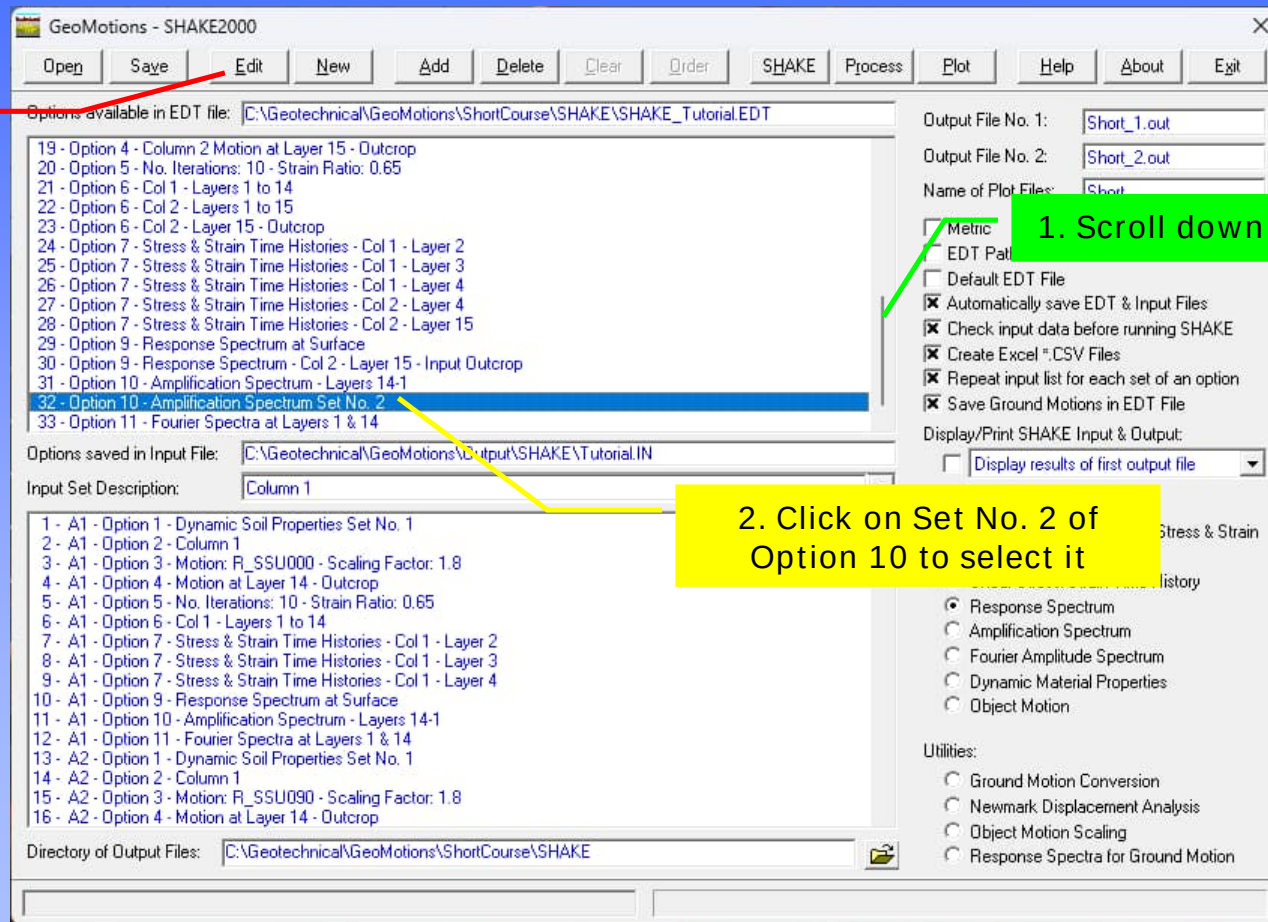
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 10: Amplification Spectrum

1. Enter "Option 10 – Amplification Spectrum – Col 2 – Layers 15-1"

4. Click on "Return"

SHAKE2000 - Option 10 Editor: Amplification Spectrum

Set No.: 2 Amplification Spectrum - Set Identification: Option 10 - Amplification Spectrum - Col 2 - Layers 15-1

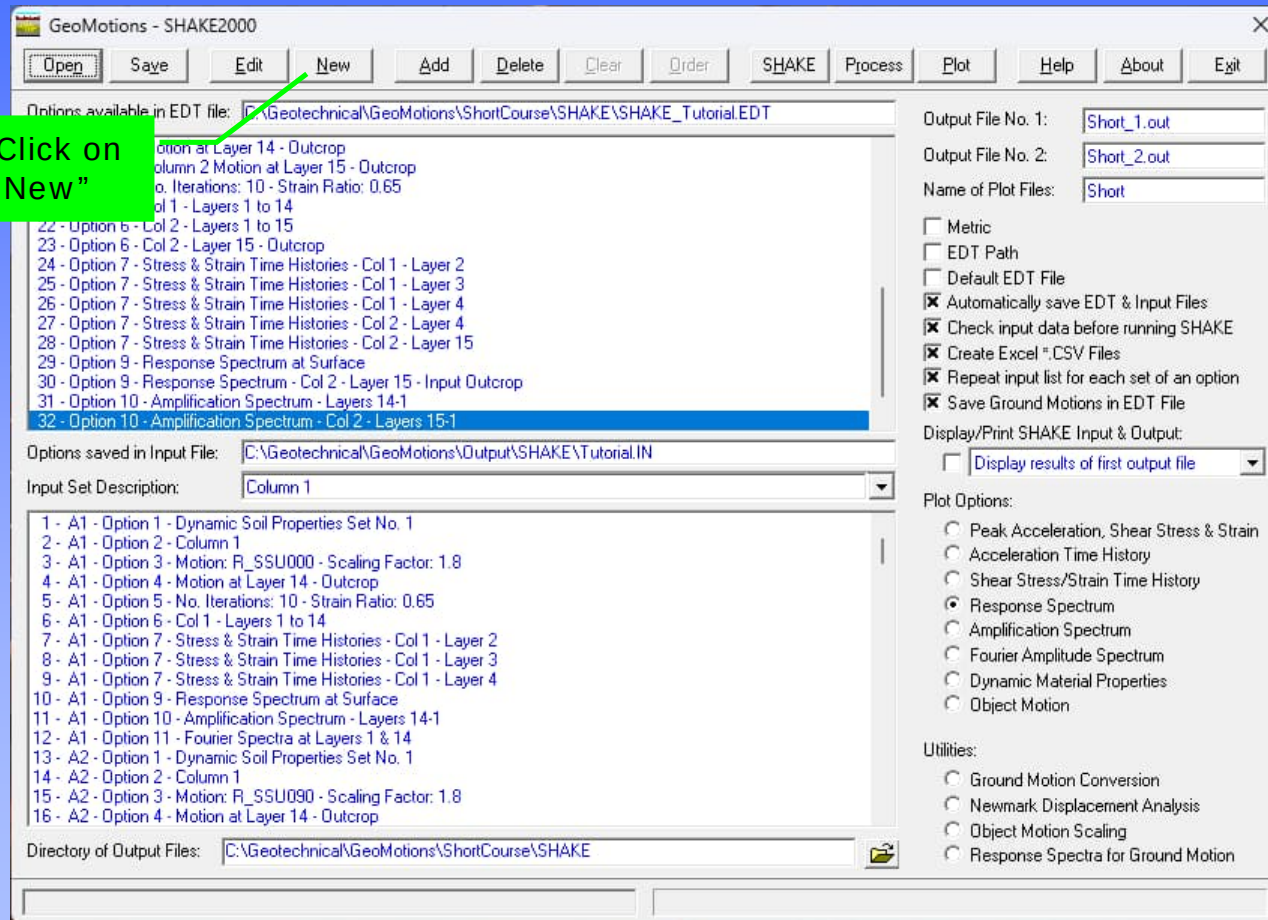
First Layer: 15 Outcrop Within: 1 Second Layer: 1 Outcrop Within: 0 Frequency Step: .125 Amplification Spectrum Identification: Amplification Col 2 Layers 15-1

2. Enter "15"
in First Layer

3. Enter
"Amplification Col
2 Layers 15-1"

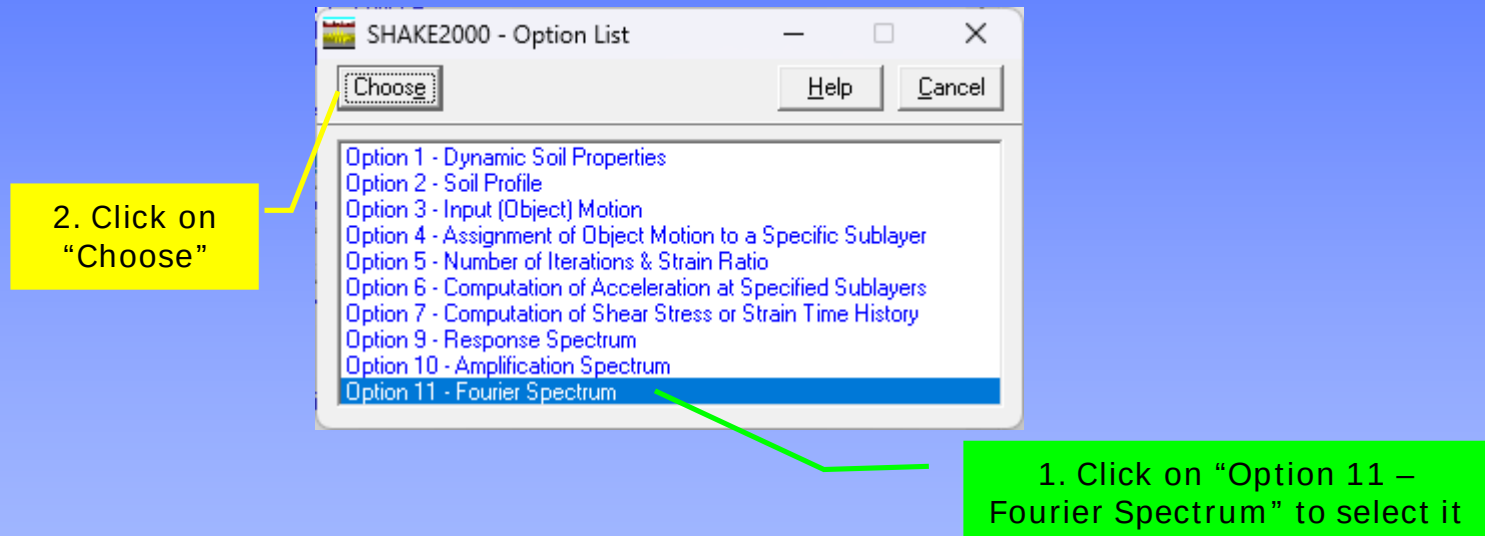
Site Specific Response Analysis

Create Input Data for Column No. 2



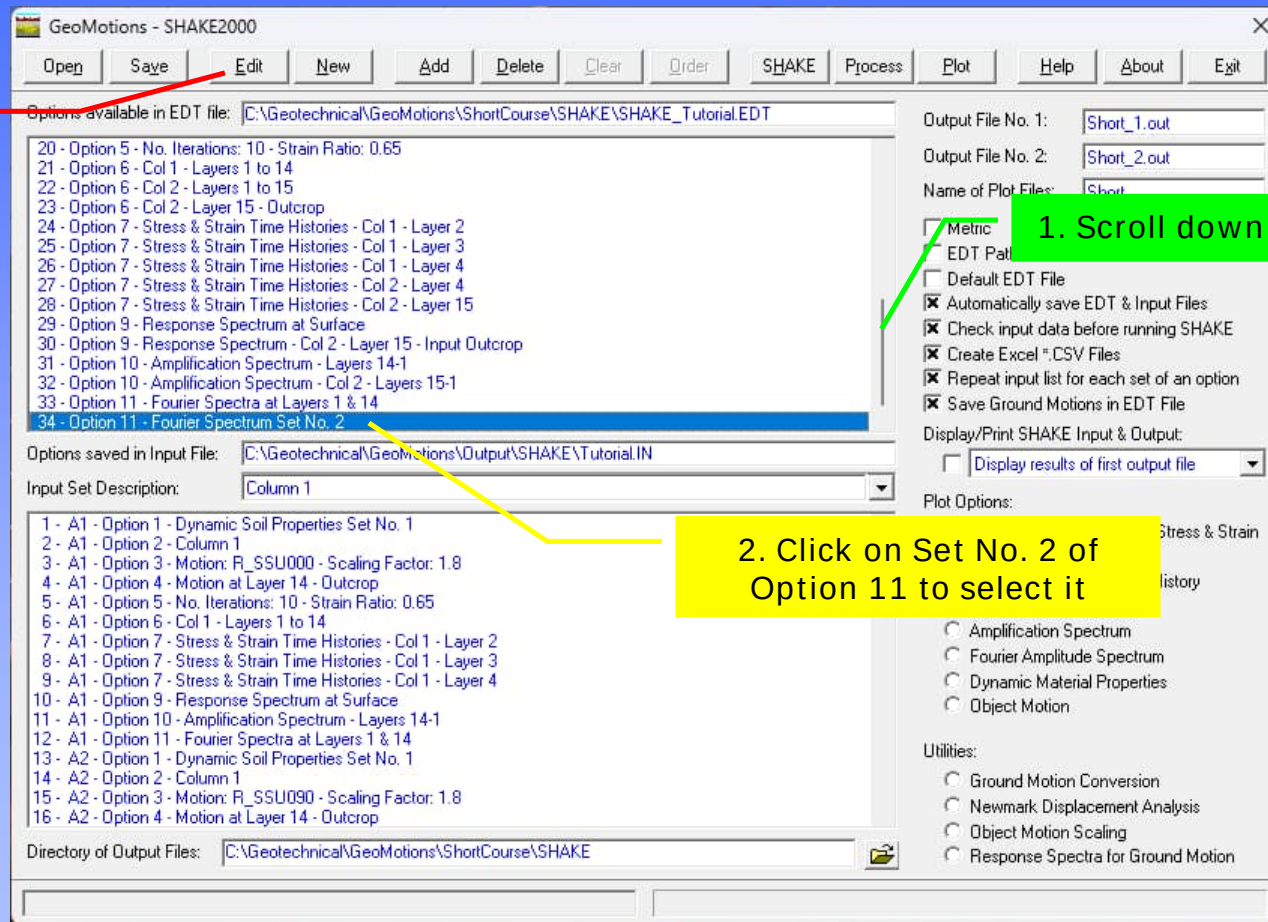
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

Option 11: Fourier Spectrum

1. Enter "Option 11 – Fourier Spectra at Layers 1 & 15 – Col 2"

3. Click on "Return"

SHAKE2000 - Option 11 Editor: Fourier Spectrum

Help Return

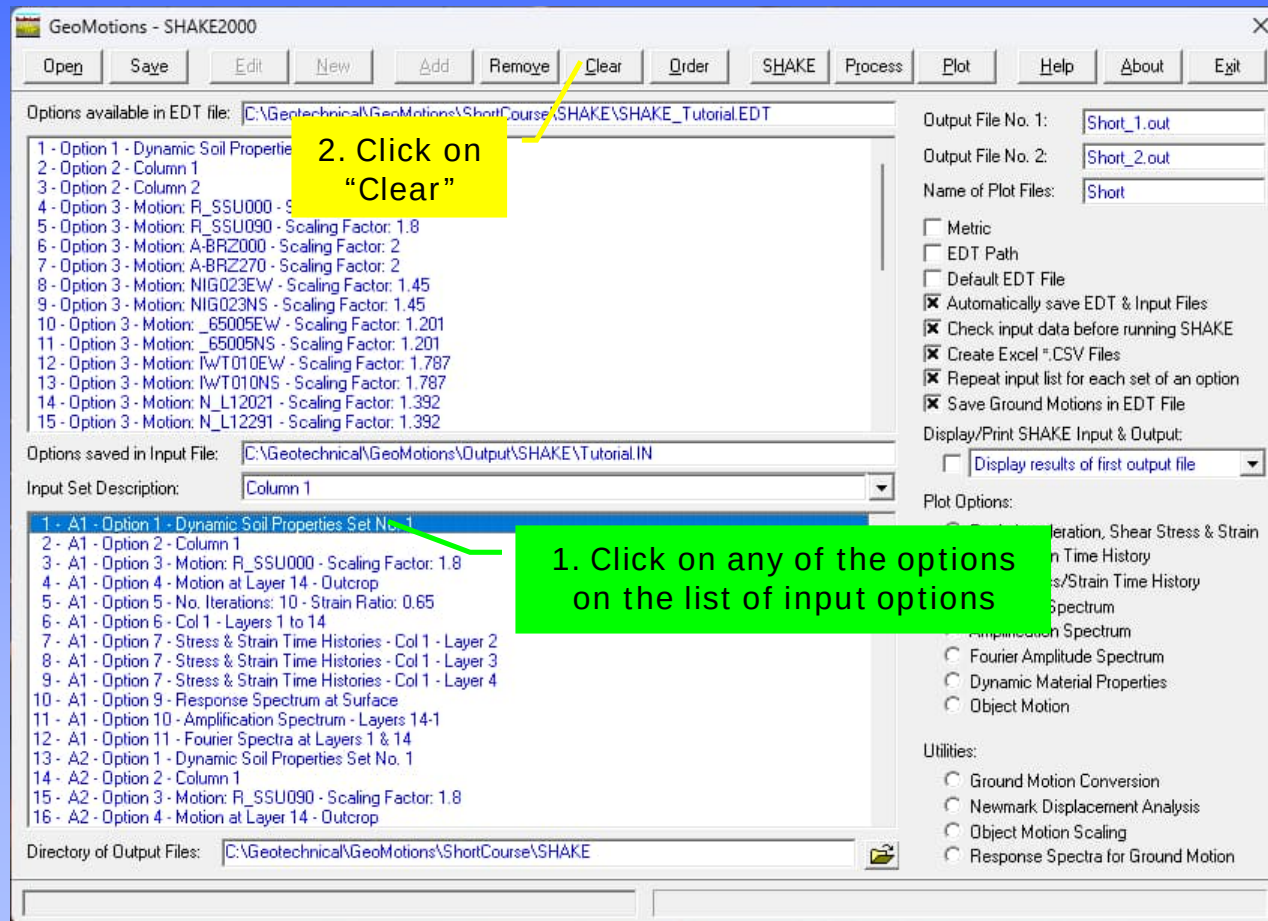
Set No.: 2 Fourier Spectrum - Set Identification: Option 11 - Fourier Spectra at Layers 1 & 15 - Col 2

Sublayer Number:	Outcrop Within	Save to File:	No. Times to Smooth:	No. Values to Save:
1	0	2	3	2048
15	1	2	3	2048

2. Enter "15" in second cell of Sublayer Number

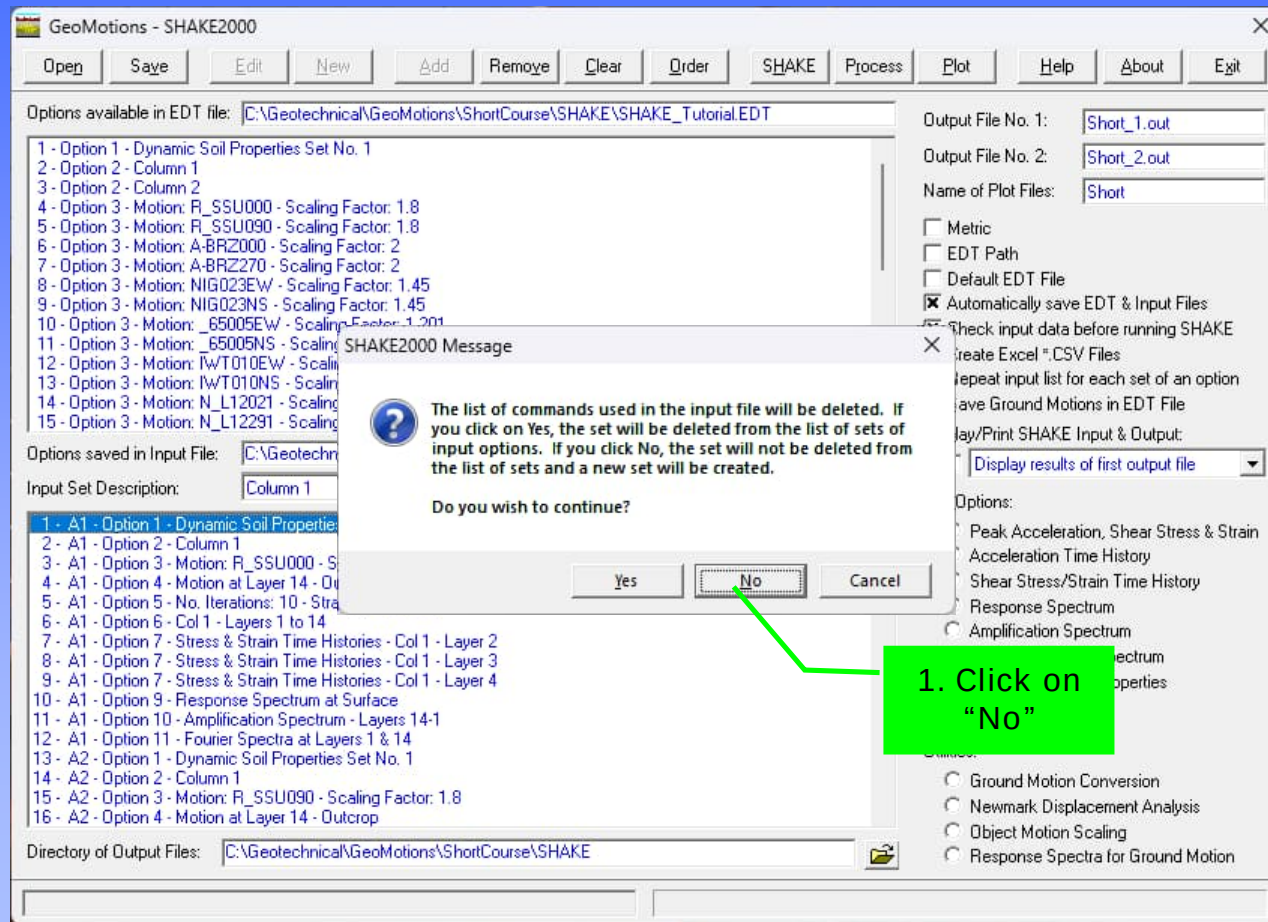
Site Specific Response Analysis

Create List of Input Options for Column 2



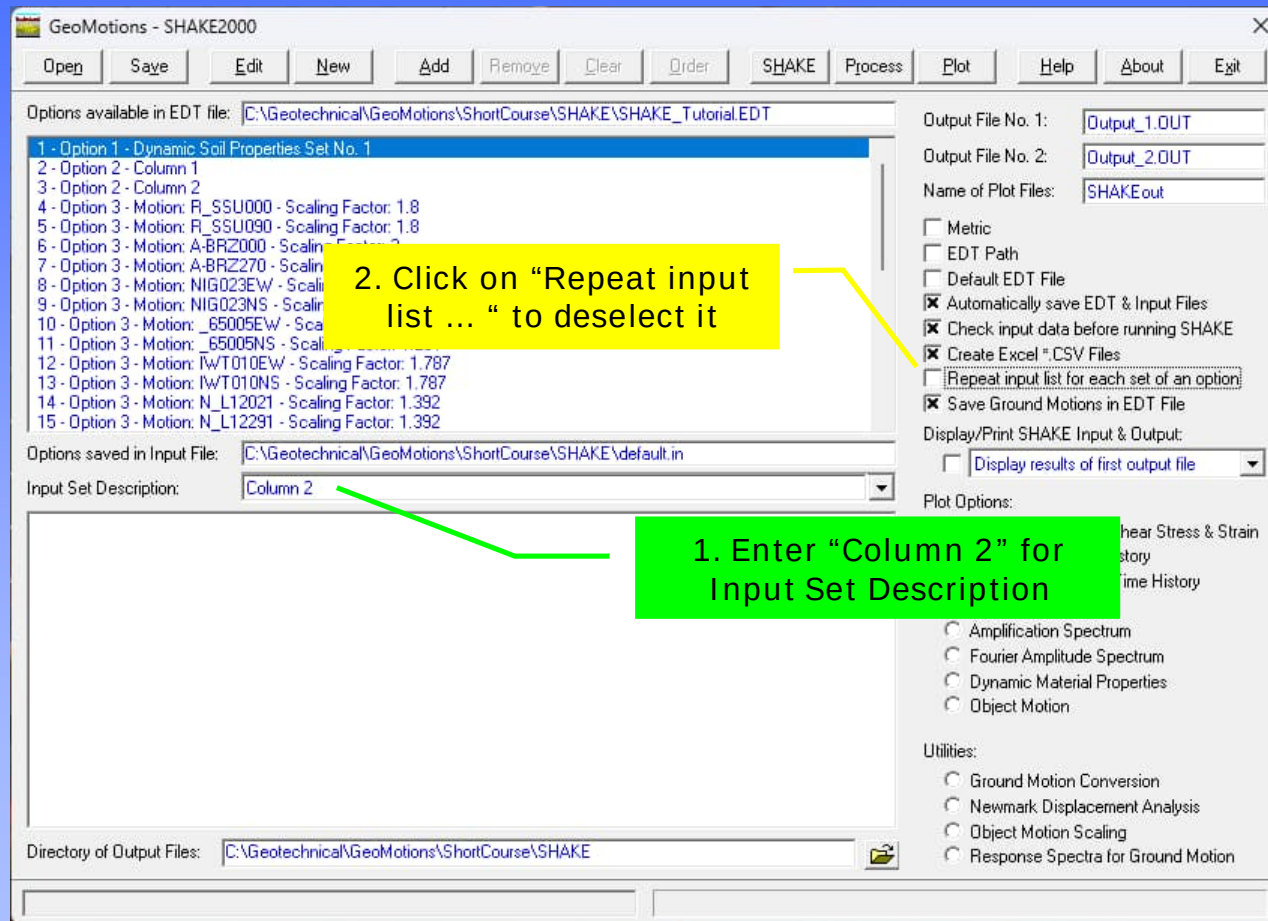
Site Specific Response Analysis

Create List of Input Options for Column 2



Site Specific Response Analysis

Create List of Input Options For Column No. 2



Site Specific Response Analysis

List of Input Options for Analyses of Column No. 2

Add the following options to input file list:

Option	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
3	Option 2 – Column 2
4	Option 3 – Motion: R_SSU000 – Scaling Factor: 1.8
19	Option 4 – Column 2 Motion at Layer 15 - Outcrop
20	Option 5 – No. of Iterations: 10 – Strain Ratio: 0.65
22	Option 6 – Col 2 – Layers 1 to 15
23	Option 6 – Col 2 – Layer 15 - Outcrop
27	Option 7 – Stress & Strain Time Histories – Col 2 – Layer 4
29	Option 9 – Response Spectrum at Surface
30	Option 9 – Response Spectrum – Col 2 – Layer 15 – Input Outcrop
32	Option 10 – Amplification Spectrum – Col 2 - Layers 15-1
34	Option 11 – Fourier Spectra at Layers 1 & 15 – Col 2

Site Specific Response Analysis

Create List of Input Options for Column No. 2

The screenshot shows the GeoMotions - SHAKE2000 software window. The title bar reads "GeoMotions - SHAKE2000". The menu bar includes "Open", "Save", "Edit", "New", "Add", "Delete", "Clear", "Order", "SHAKE", "Process", "Plot", "Help", "About", and "Exit".

Options available in EDT file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SHAKE_Tutorial.EDT

- 20 - Option 5 - No. Iterations: 10 - Strain Ratio: 0.65
- 21 - Option 6 - Col 1 - Layers 1 to 14
- 22 - Option 6 - Col 2 - Layers 1 to 15
- 23 - Option 6 - Col 2 - Layer 15 - Outcrop
- 24 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 2
- 25 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 3
- 26 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 4
- 27 - Option 7 - Stress & Strain Time Histories - Col 2 - Layer 4
- 28 - Option 7 - Stress & Strain Time Histories - Col 2 - Layer 15
- 29 - Option 9 - Response Spectrum at Surface
- 30 - Option 9 - Response Spectrum - Col 2 - Layer 15 - Input Outcrop
- 31 - Option 10 - Amplification Spectrum - Layers 14-1
- 32 - Option 10 - Amplification Spectrum - Col 2 - Layers 15-1
- 33 - Option 11 - Fourier Spectra at Layers 1 & 14
- 34 - Option 11 - Fourier Spectra at Layers 1 & 15 - Col 2**

Options saved in Input File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\default.in

Input Set Description: Column 2

- 1 - A1 - Option 1 - Dynamic Soil Properties Set No. 1
- 2 - A1 - Option 2 - Column 2
- 3 - A1 - Option 3 - Motion: R_SSU000 - Scaling Factor: 1.8
- 4 - A1 - Option 4 - Column 2 Motion at Layer 15 - Outcrop
- 5 - A1 - Option 5 - No. Iterations: 10 - Strain Ratio: 0.65
- 6 - A1 - Option 6 - Col 2 - Layers 1 to 15
- 7 - A1 - Option 6 - Col 2 - Layer 15 - Outcrop
- 8 - A1 - Option 7 - Stress & Strain Time Histories - Col 2 - Layer 4
- 9 - A1 - Option 9 - Response Spectrum at Surface
- 10 - A1 - Option 9 - Response Spectrum - Col 2 - Layer 15 - Input Outcrop
- 11 - A1 - Option 10 - Amplification Spectrum - Col 2 - Layers 15-1
- 12 - A1 - Option 11 - Fourier Spectra at Layers 1 & 15 - Col 2

Directory of Output Files: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE

Output File No. 1: Output_1.OUT

Output File No. 2: Output_2.OUT

Name of Plot Files: SHAKEout

☐ Metric

☐ EDT Path

☐ Default EDT File

☒ Automatically save EDT & Input Files

☒ Check input data before running SHAKE

☒ Create Excel *.CSV Files

☐ Repeat input list for each set of an option

☒ Save Ground Motions in EDT File

Display/Print SHAKE Input & Output:

☐ Display results of first output file

Plot Options:

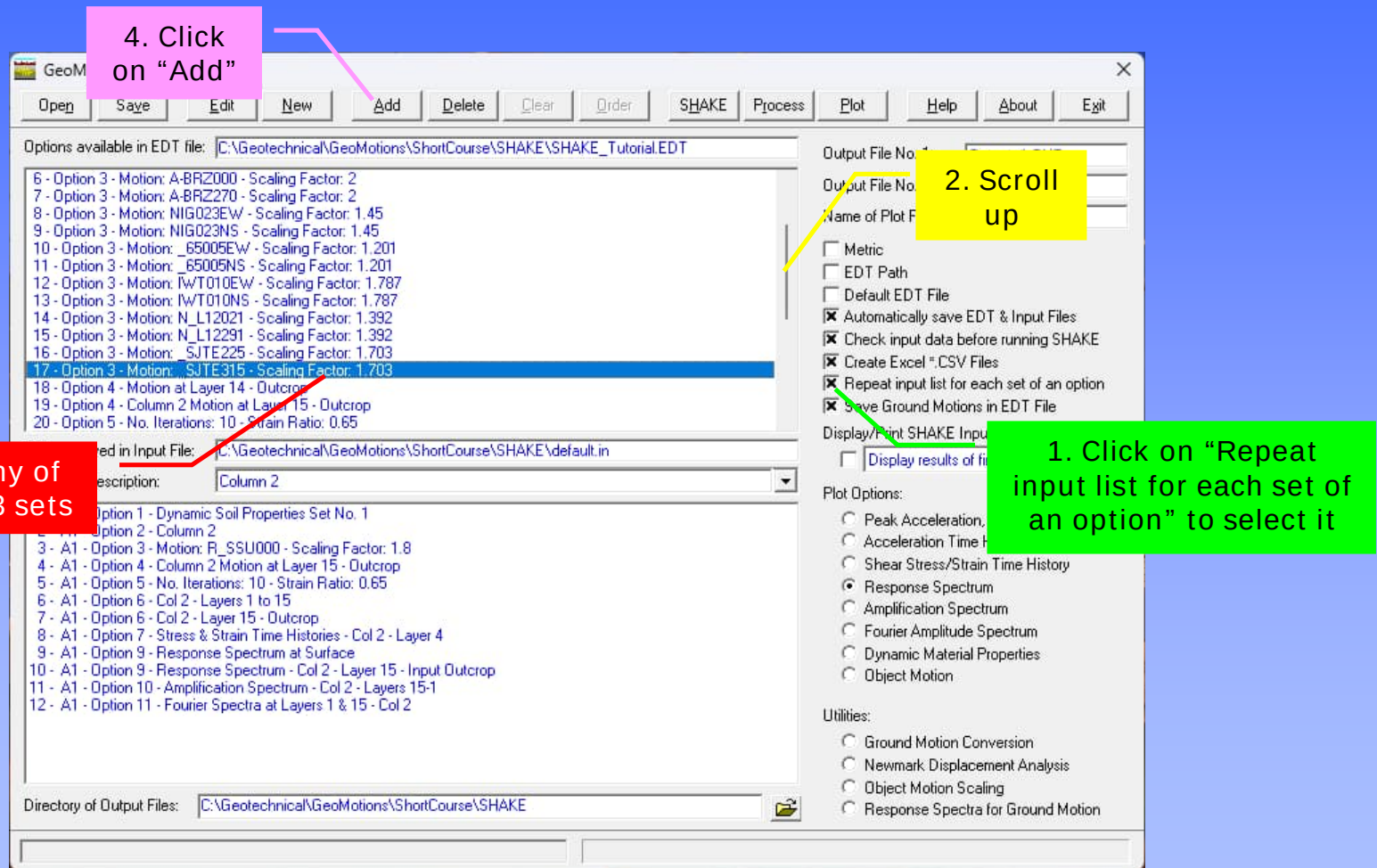
- ☐ Peak Acceleration, Shear Stress & Strain
- ☐ Acceleration Time History
- ☐ Shear Stress/Strain Time History
- ☒ Response Spectrum
- ☐ Amplification Spectrum
- ☐ Fourier Amplitude Spectrum
- ☐ Dynamic Material Properties
- ☐ Object Motion

Utilities:

- ☐ Ground Motion Conversion
- ☐ Newmark Displacement Analysis
- ☐ Object Motion Scaling
- ☐ Response Spectra for Ground Motion

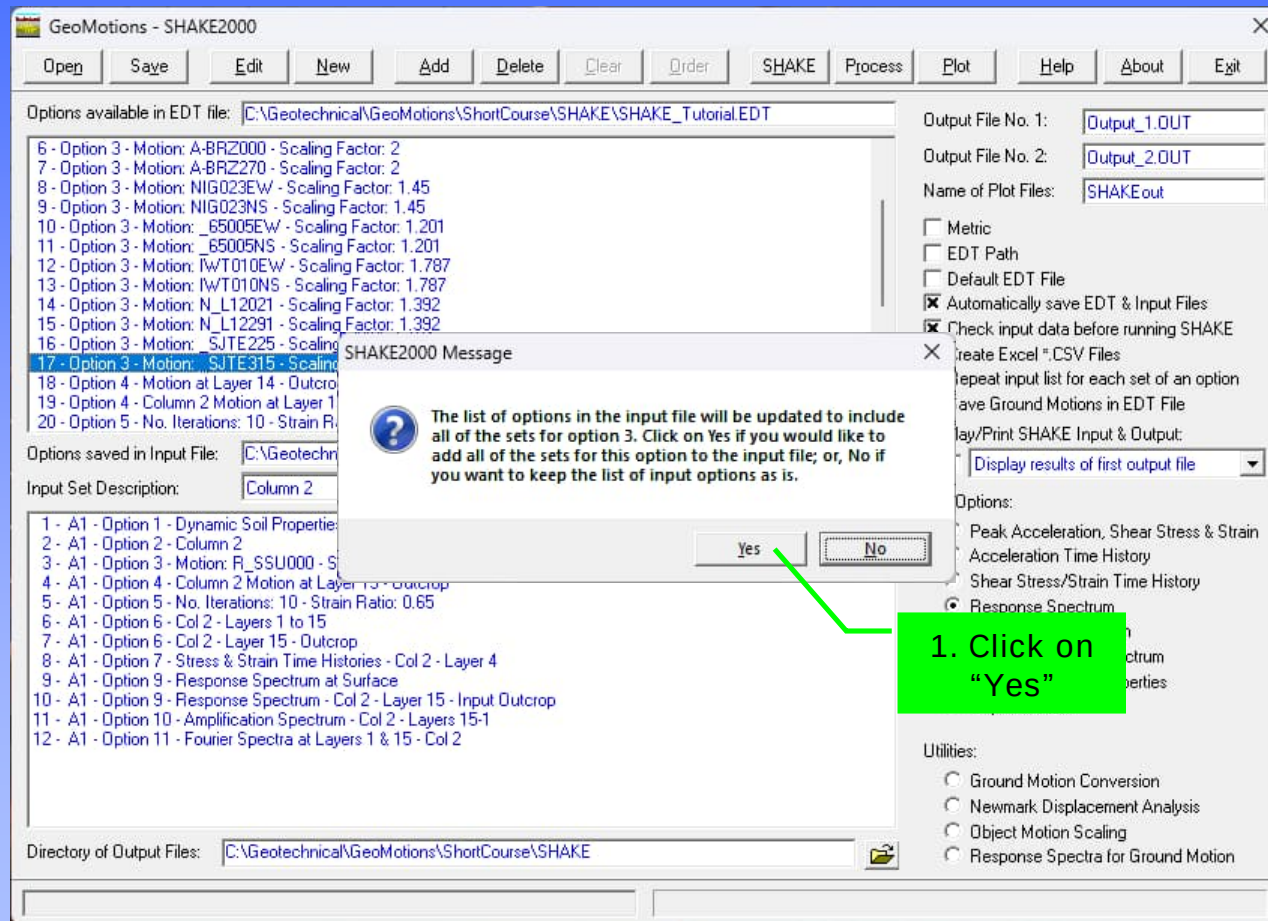
Site Specific Response Analysis

Define Input Options for Multiple Analyses



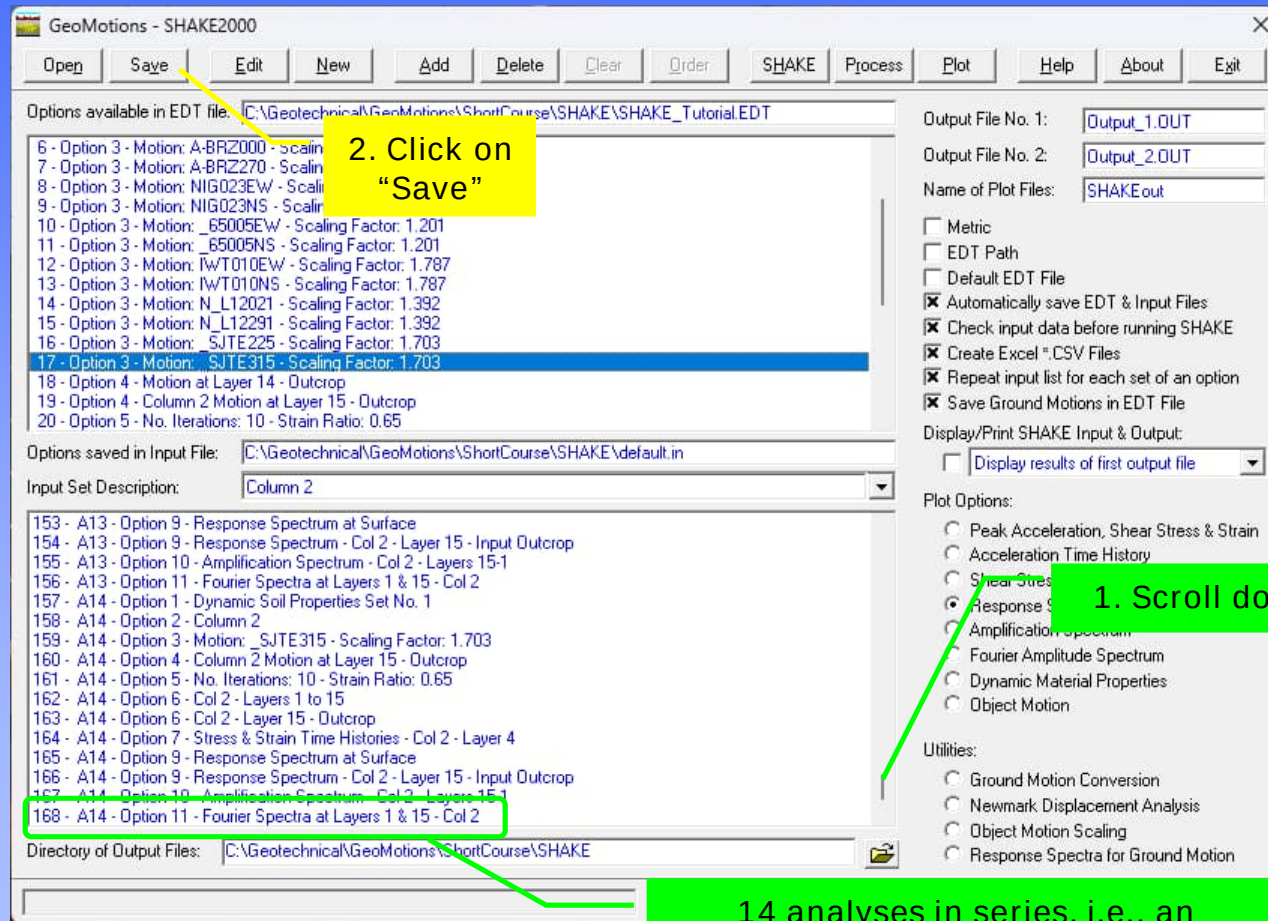
Site Specific Response Analysis

Define Input Options for Multiple Analyses



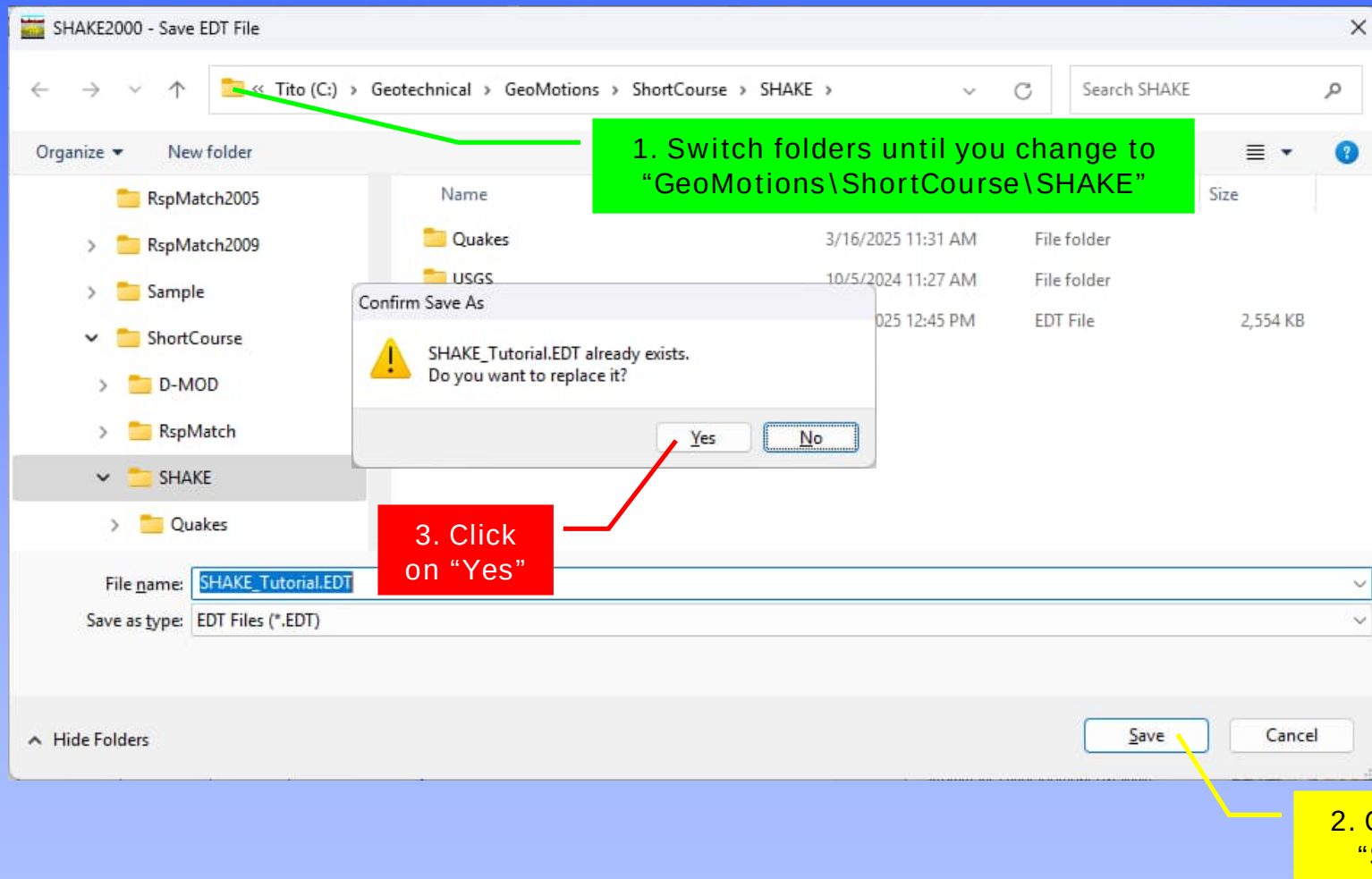
Site Specific Response Analysis

Save SHAKE EDT & Input Files



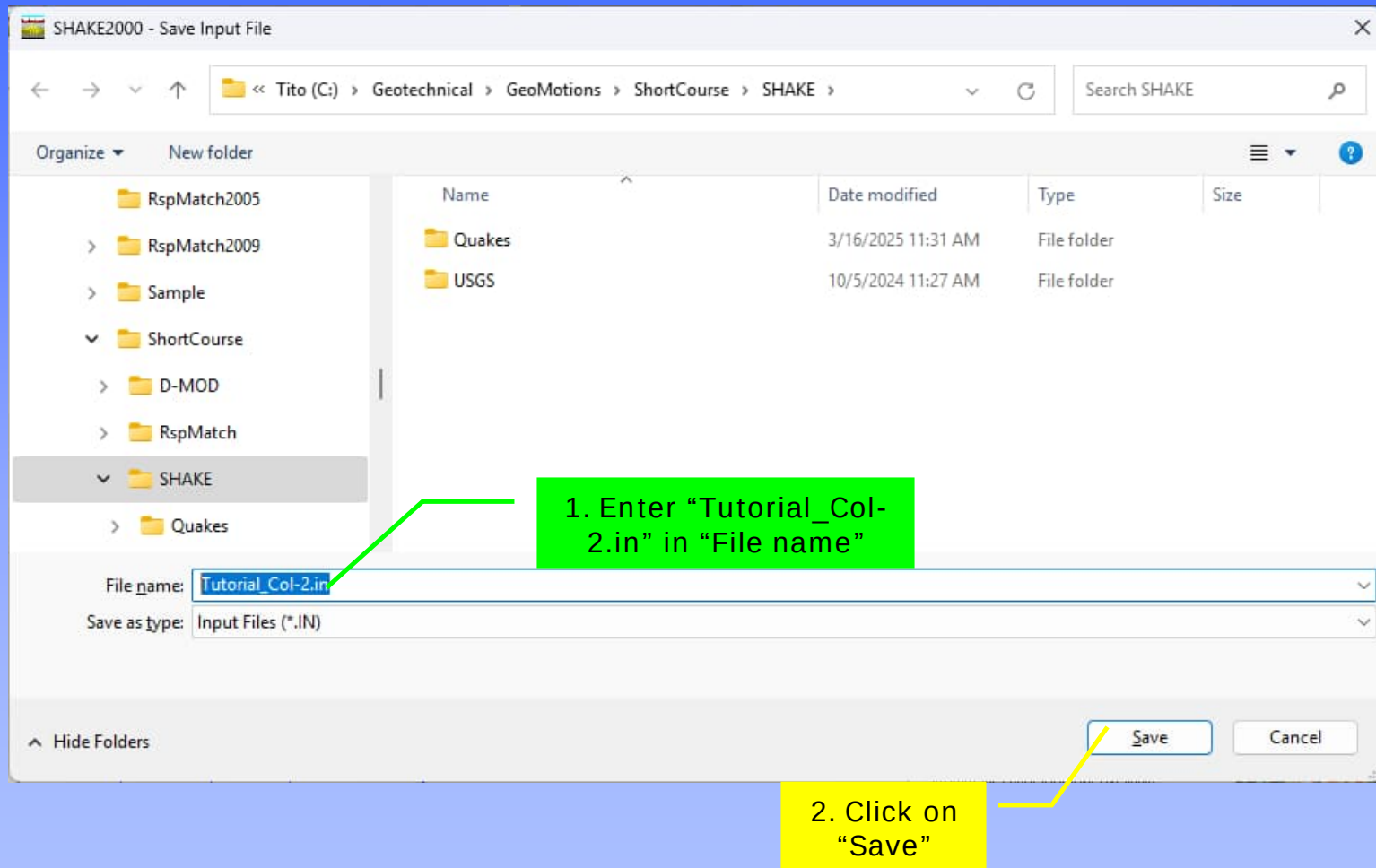
Site Specific Response Analysis

Create EDT & Input Files



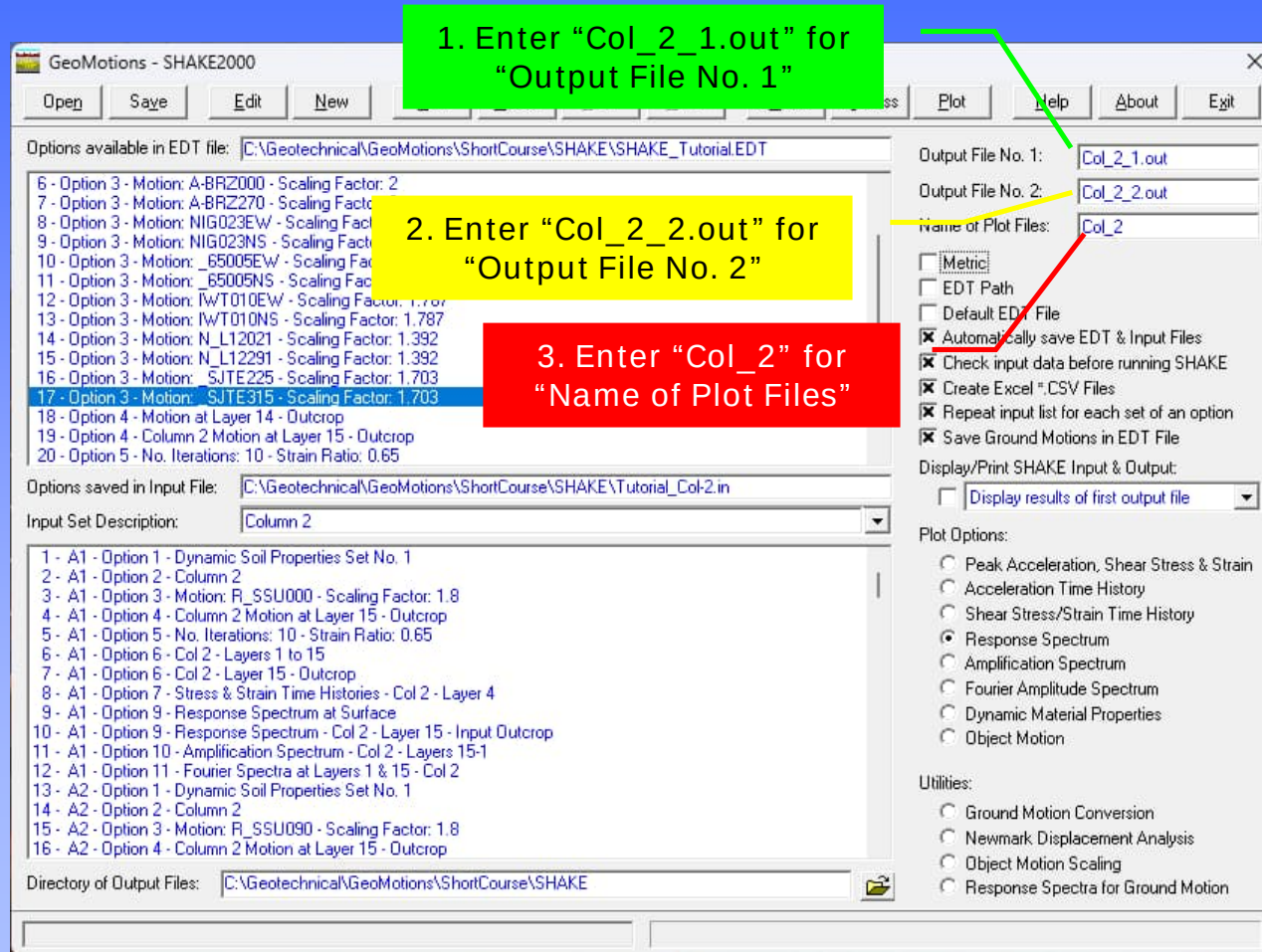
Site Specific Response Analysis

Create EDT & Input Files



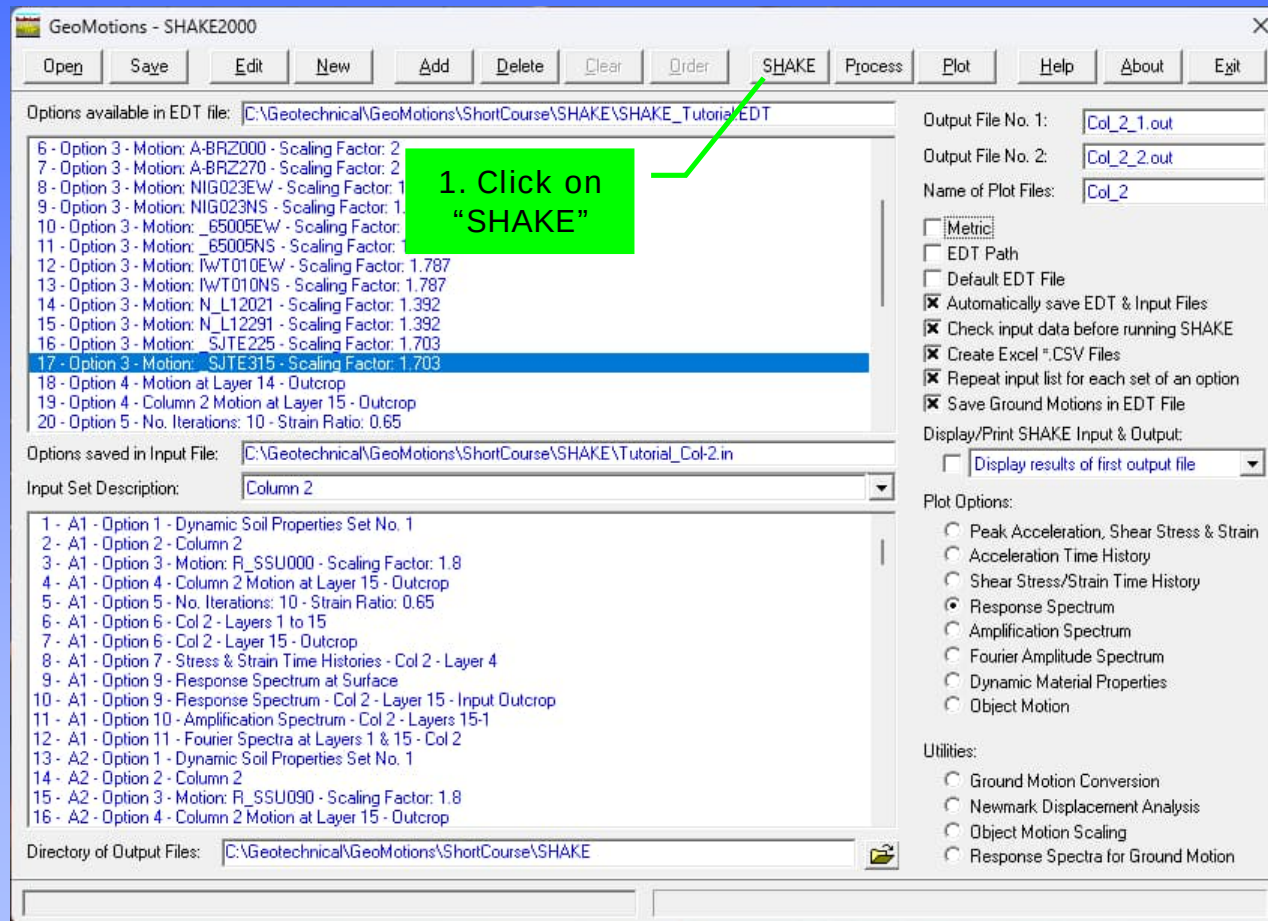
Site Specific Response Analysis

Name Working Files for Column No. 2 2



Site Specific Response Analysis

Run Analyses for Column 2



Site Specific Response Analysis

Run Analyses for Column 2

```
Select C:\Geotechnical\GeoMotions\SHAKE.EXE

*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970   *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified*
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   sponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE  8/01/2022 *
*   RUN TIME 17:32 *
* ----- *

NAME OF INPUT FILE =
  C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2.in

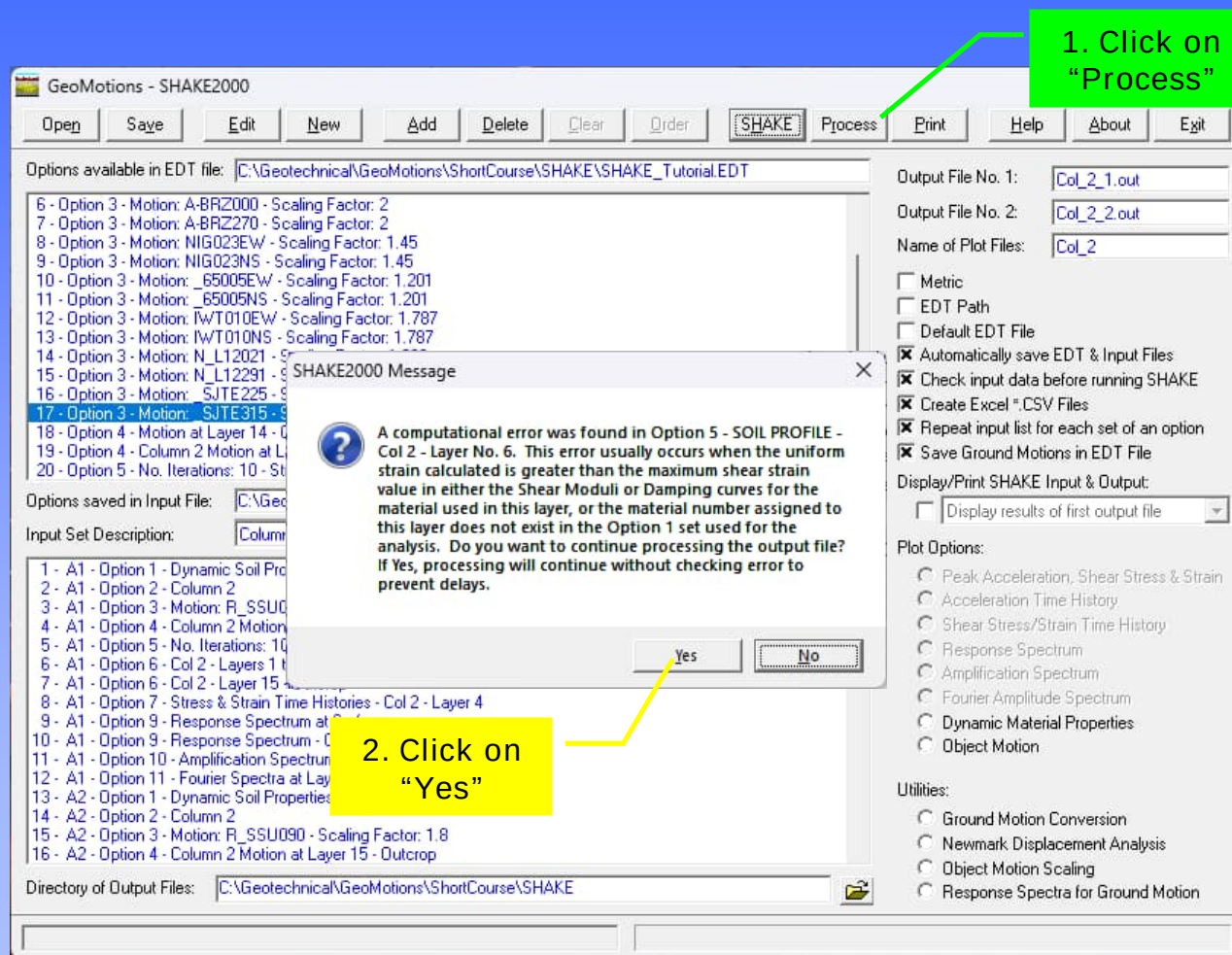
NAME OF OUTPUT FILE #1 (input, peak values, etc)=
  C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2_1.out

NAME OF OUTPUT FILE #2 (layer acc. time histories)=
  C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2_2.out

OPTION NO.    1  IS STARTED.
OPTION NO.    1  HAS BEEN CONCLUDED.
```

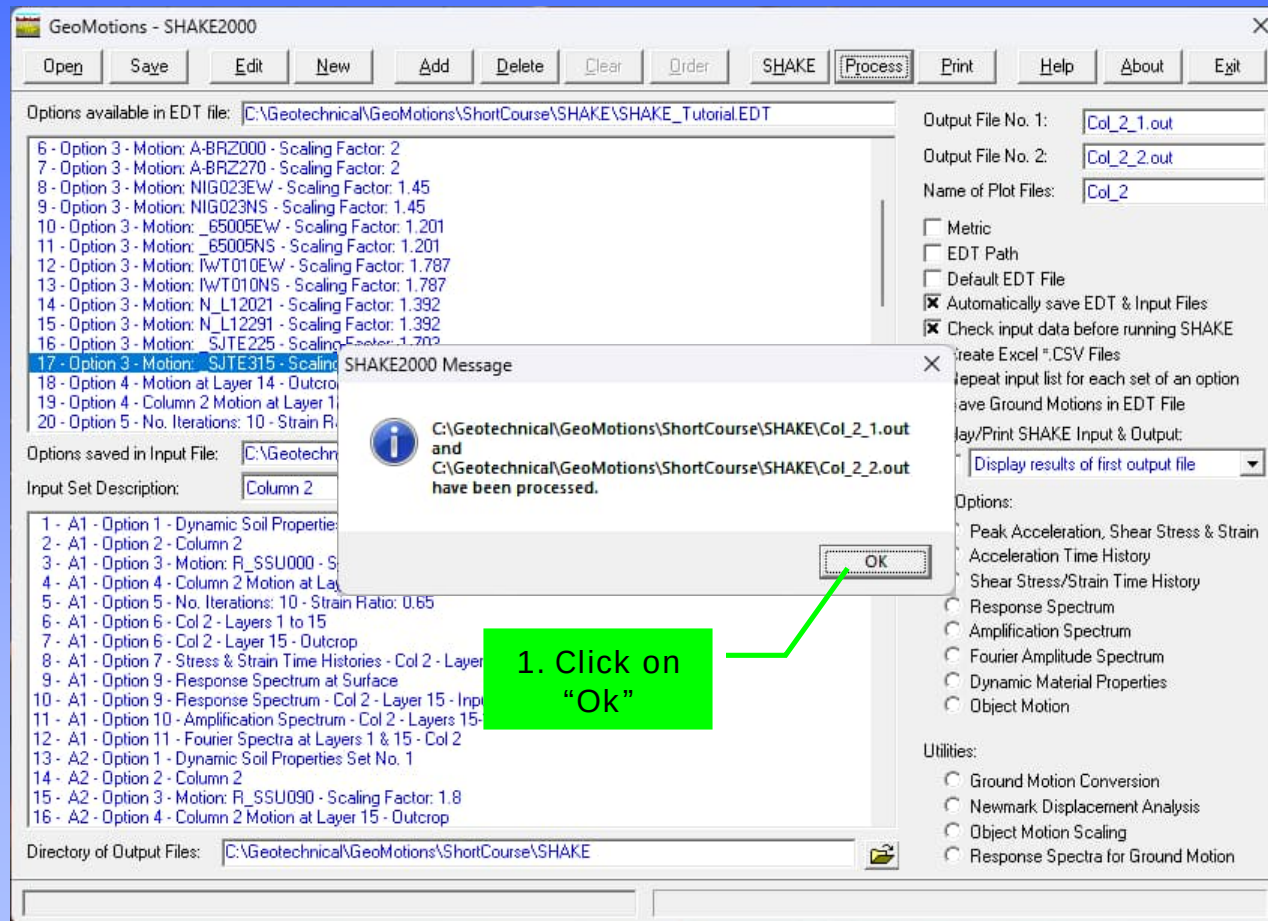

Site Specific Response Analysis

Run Analyses for Column 2



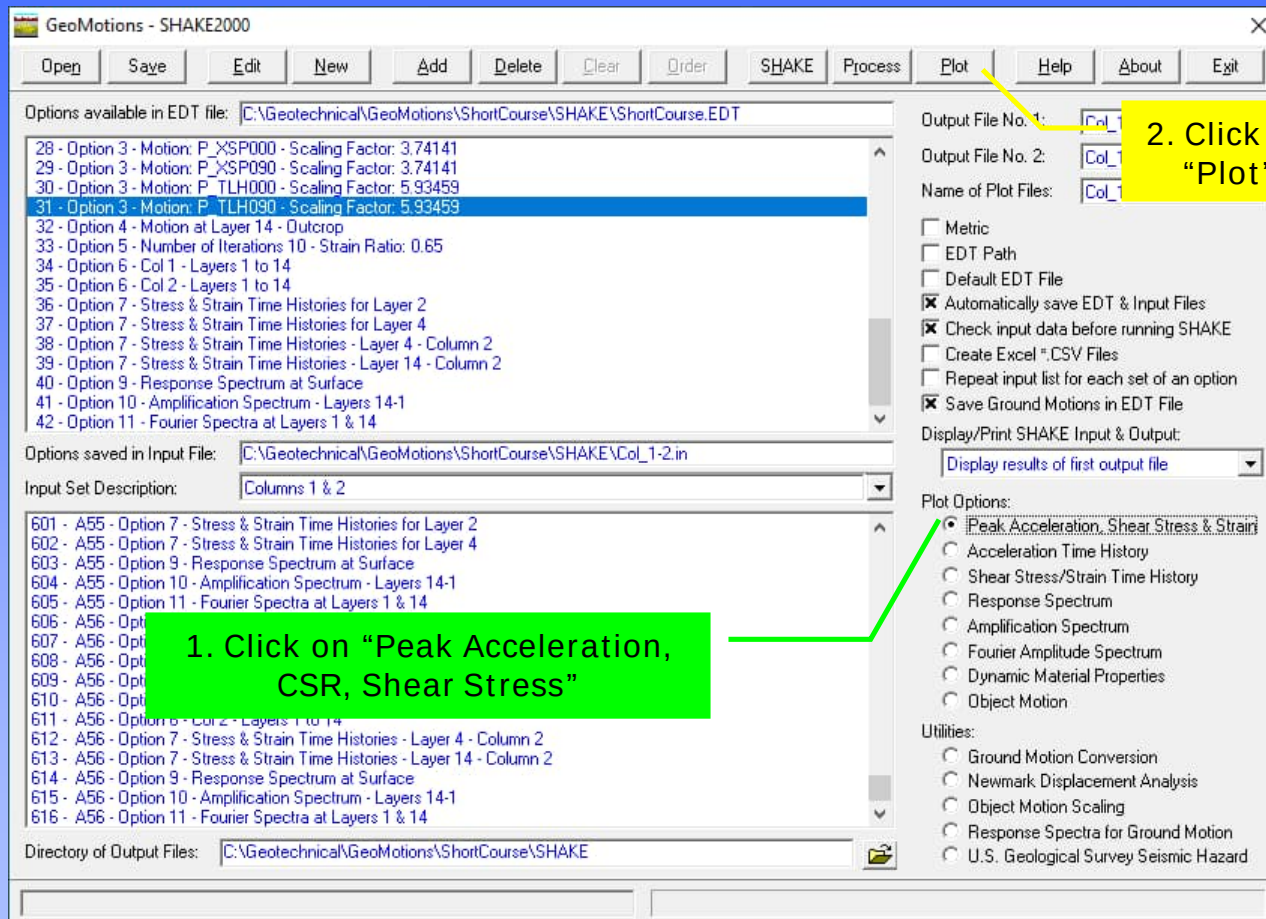
Site Specific Response Analysis

Run Analyses for Column 2

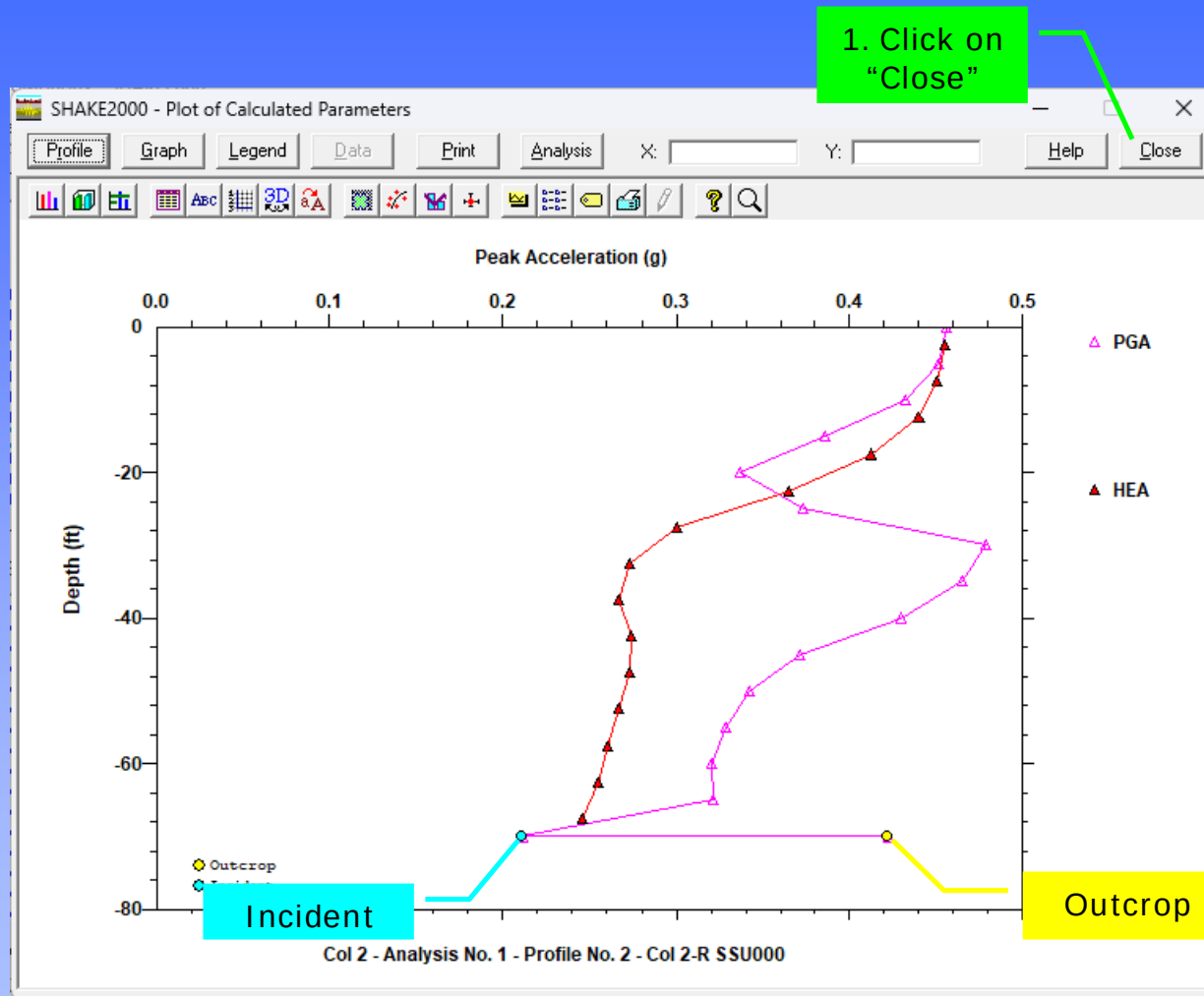


Site Specific Response Analysis

Plot Results

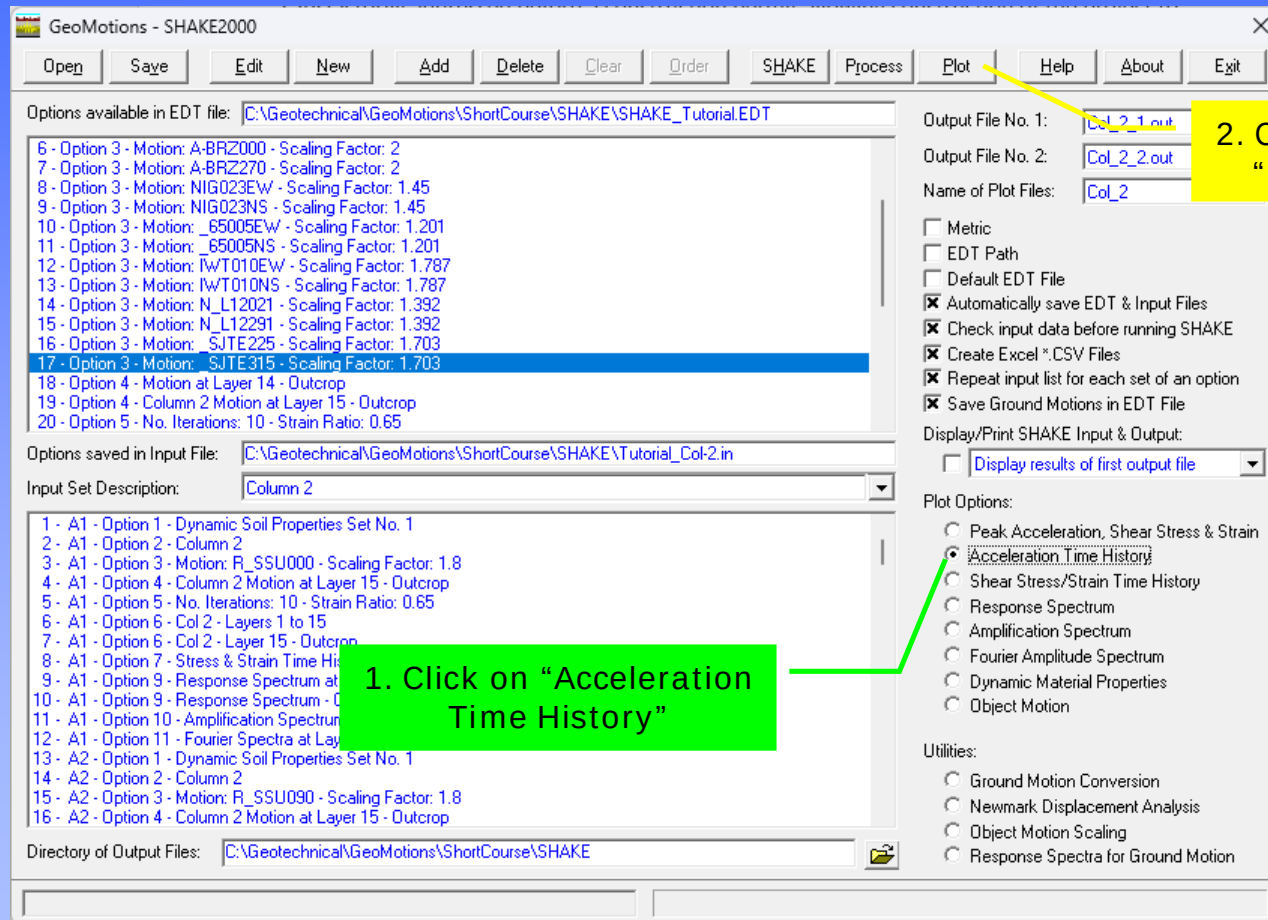


Site Specific Response Analysis Plot Results



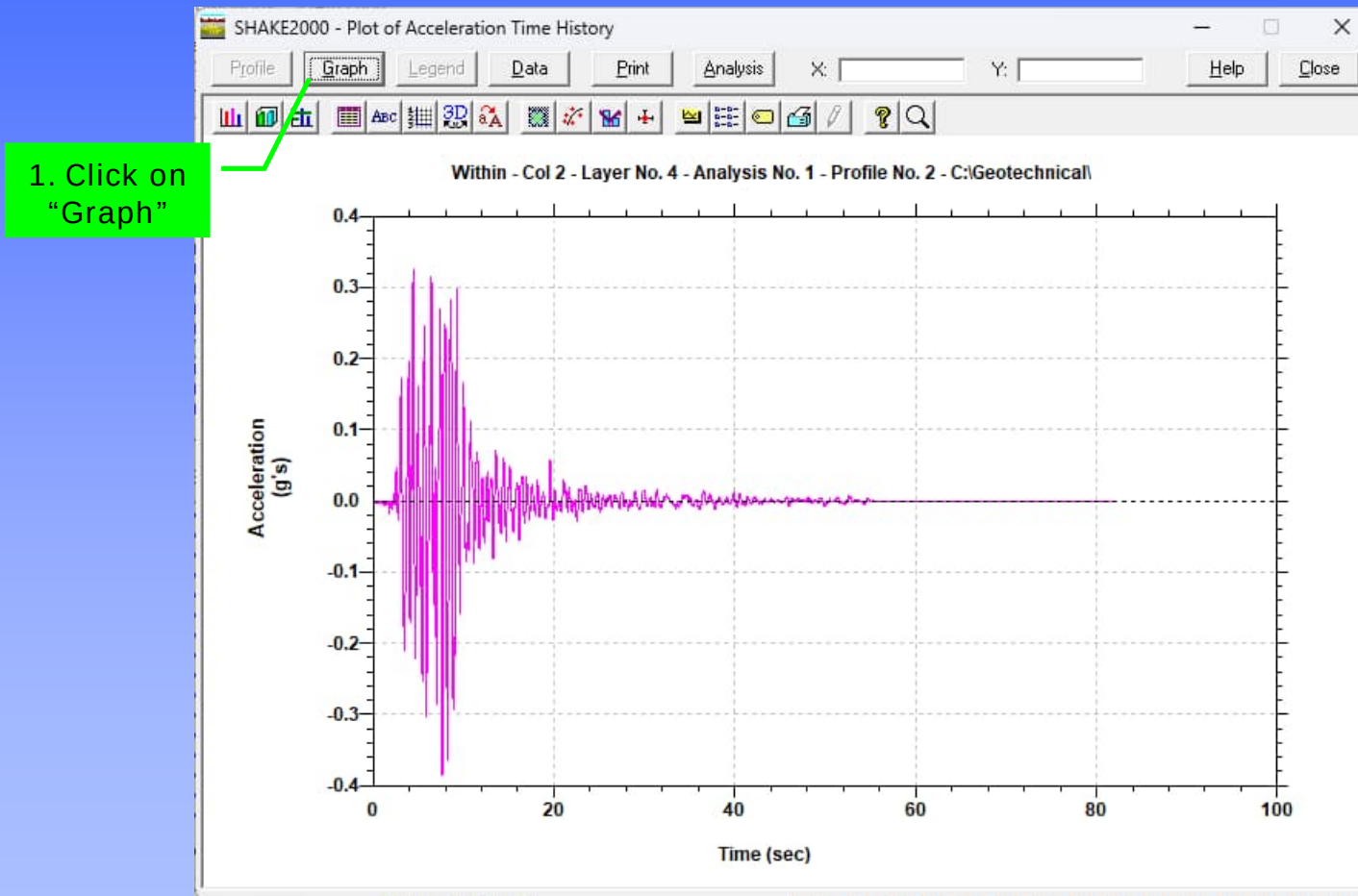
Site Specific Response Analysis

Plot Results

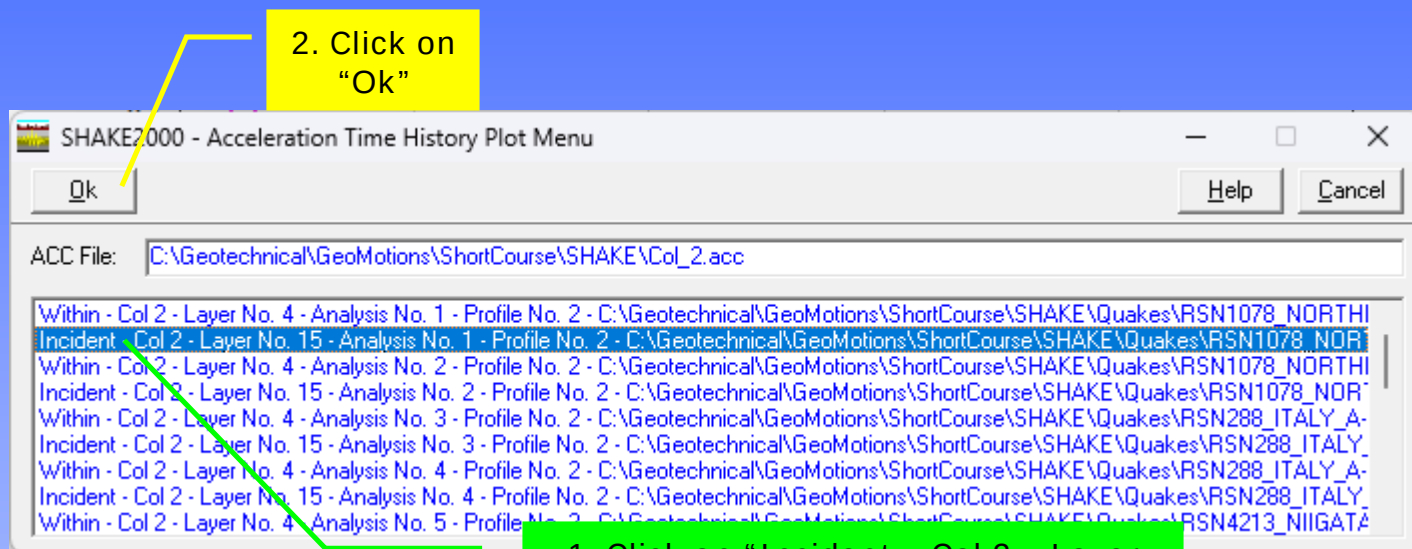


Site Specific Response Analysis

Plot Results

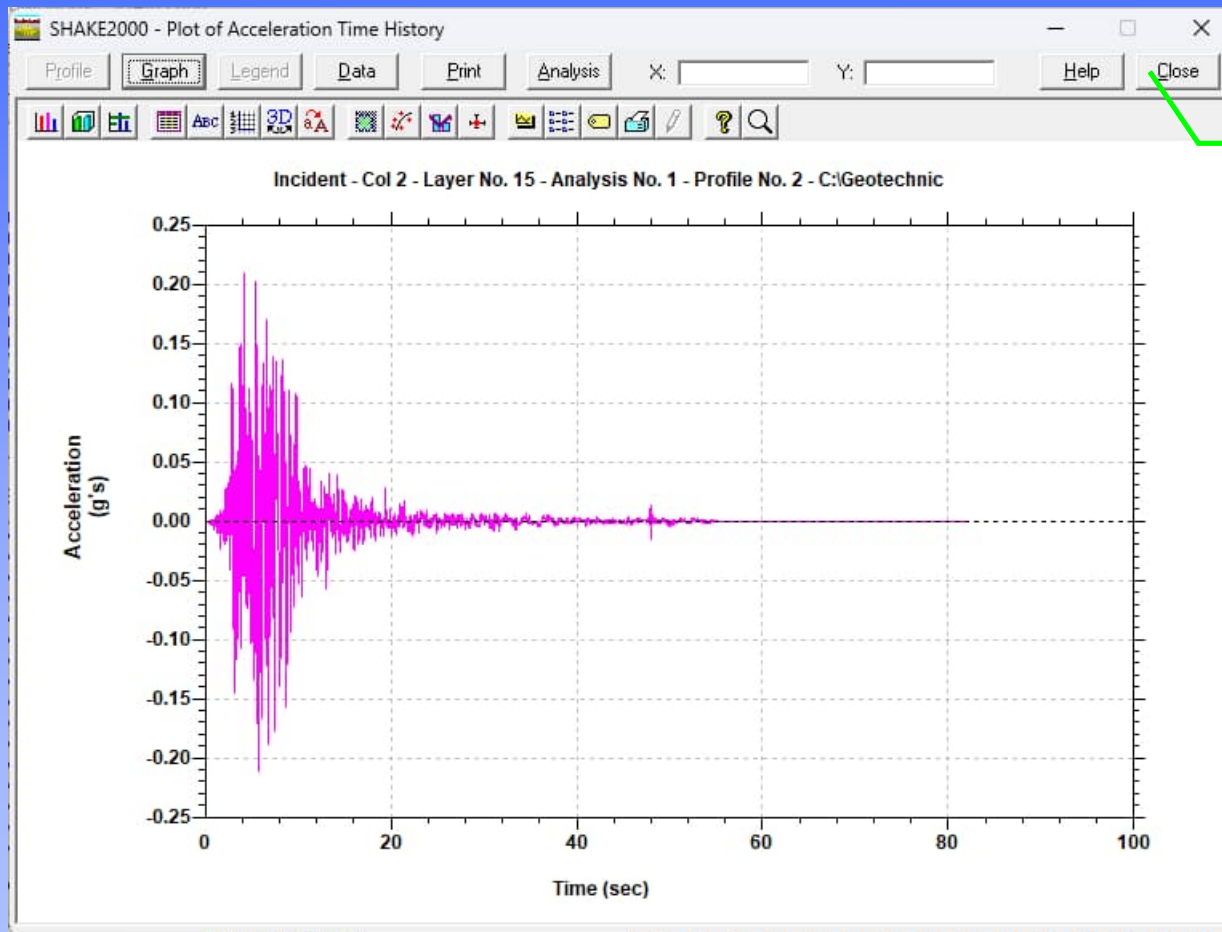


Site Specific Response Analysis Plot Results



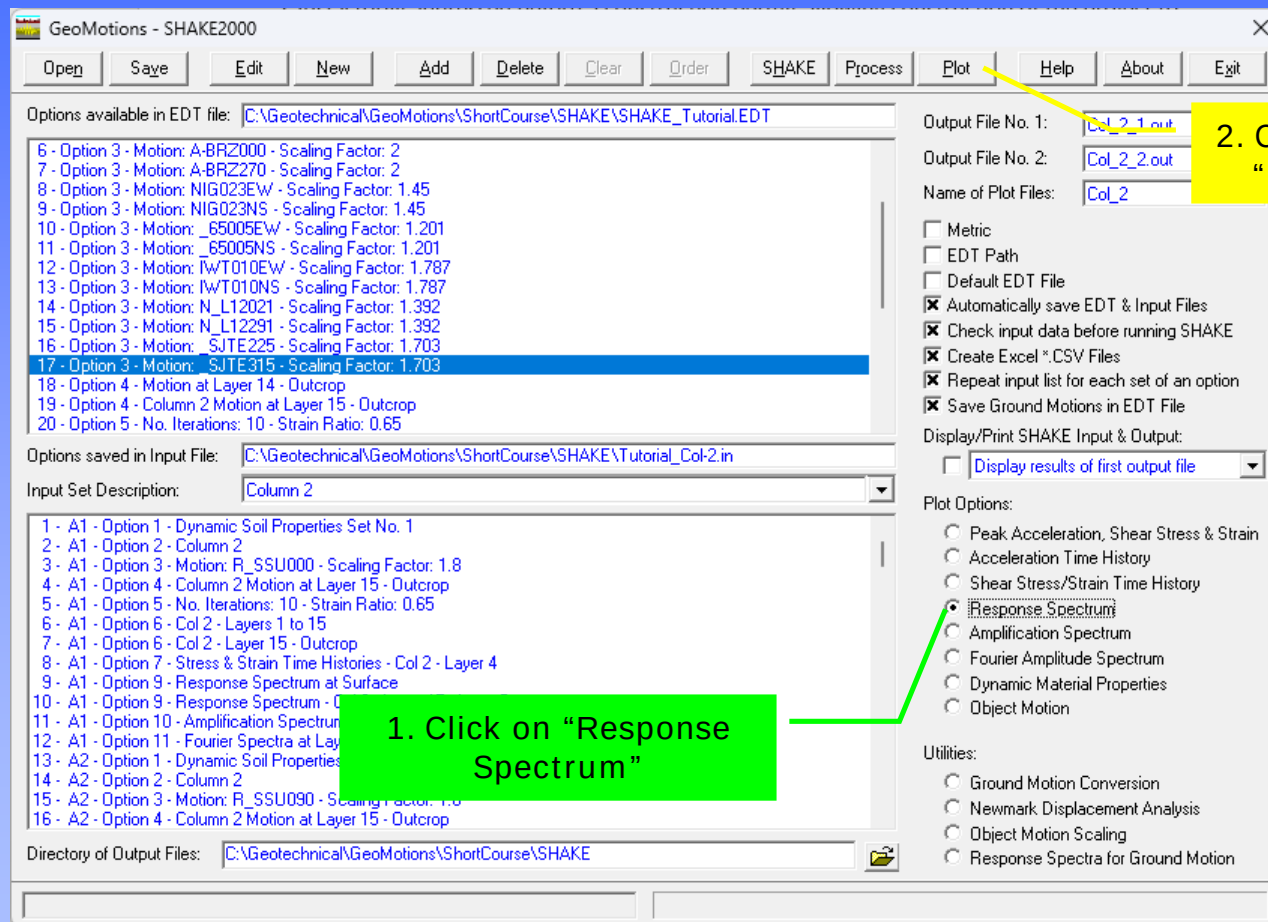
1. Click on "Incident – Col 2 – Layer
No. 15 – Analysis No. 1" to select it

Site Specific Response Analysis Plot Results



Site Specific Response Analysis

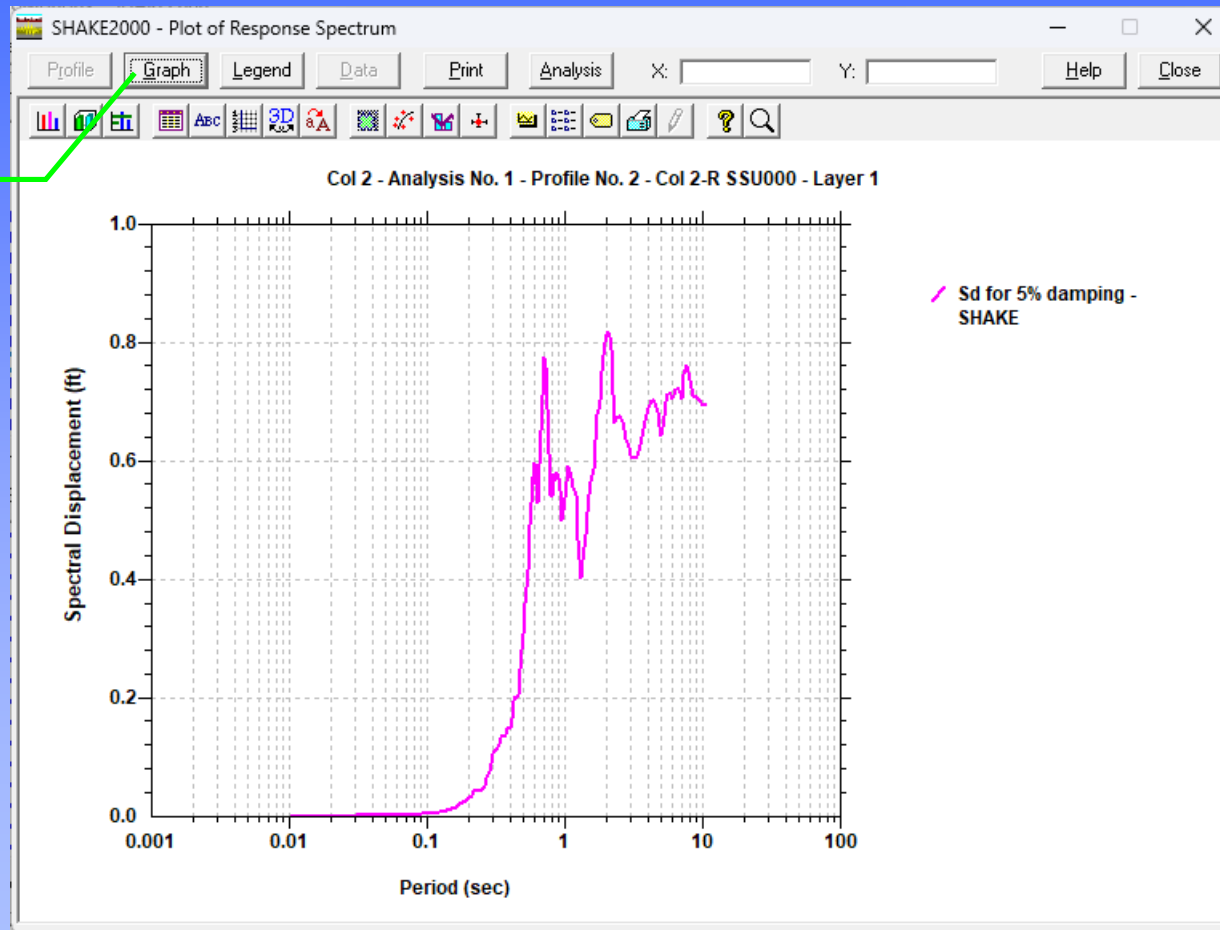
Plot Results



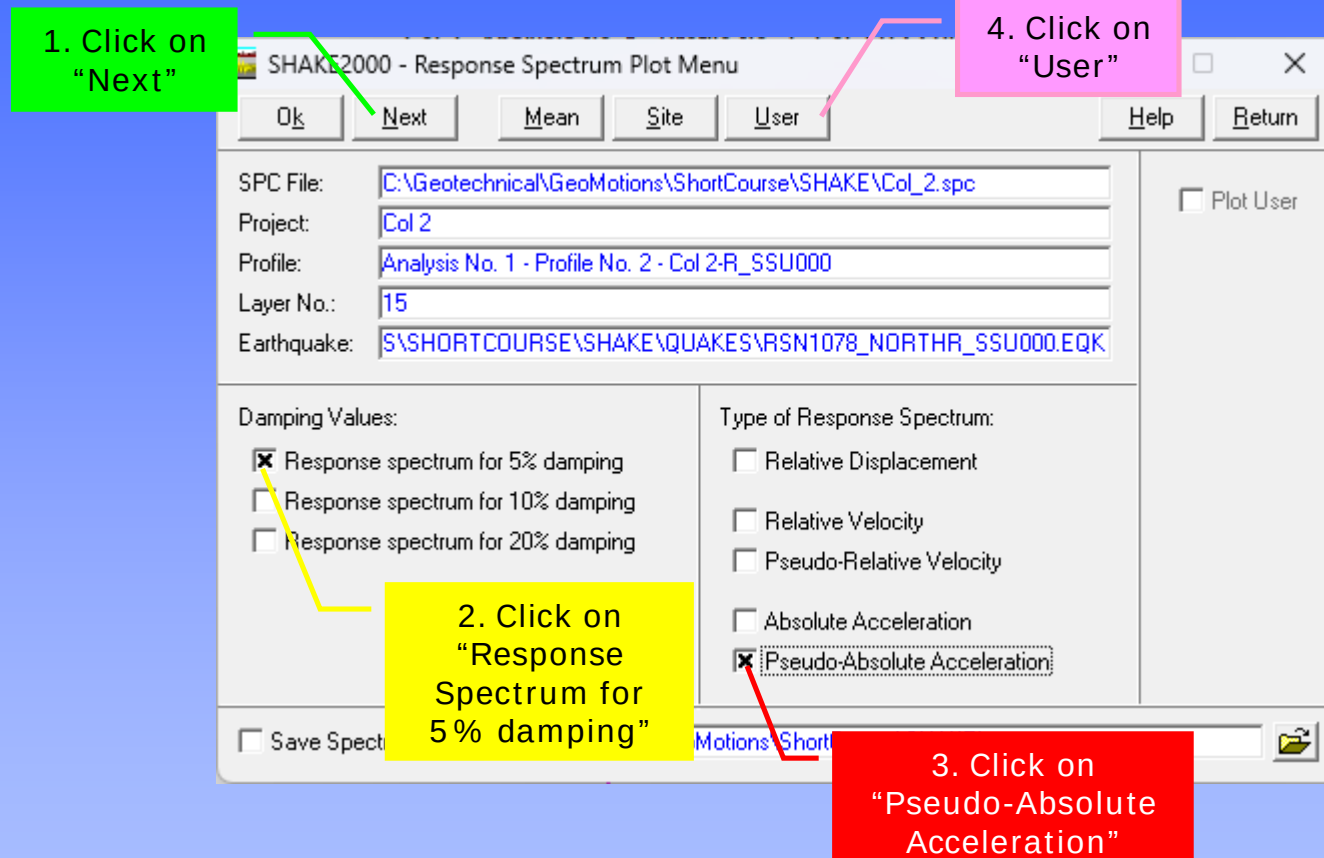
Site Specific Response Analysis

Plot Results

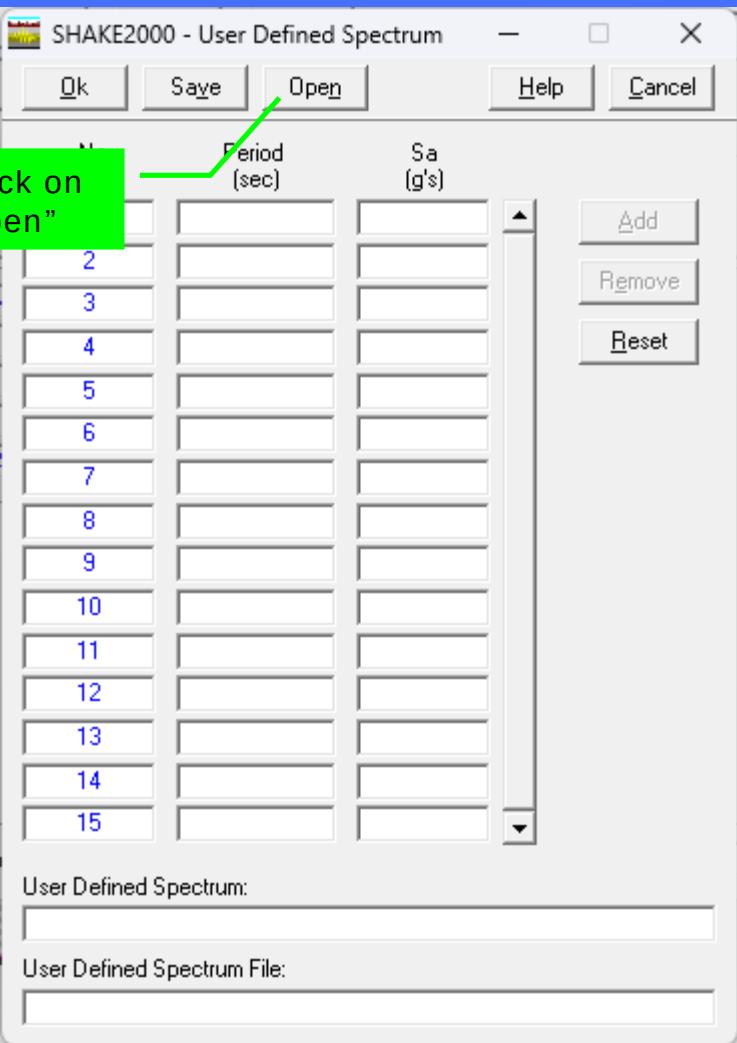
1. Click on
"Graph"



Site Specific Response Analysis Plot Results



Enter Target Response Spectrum Values

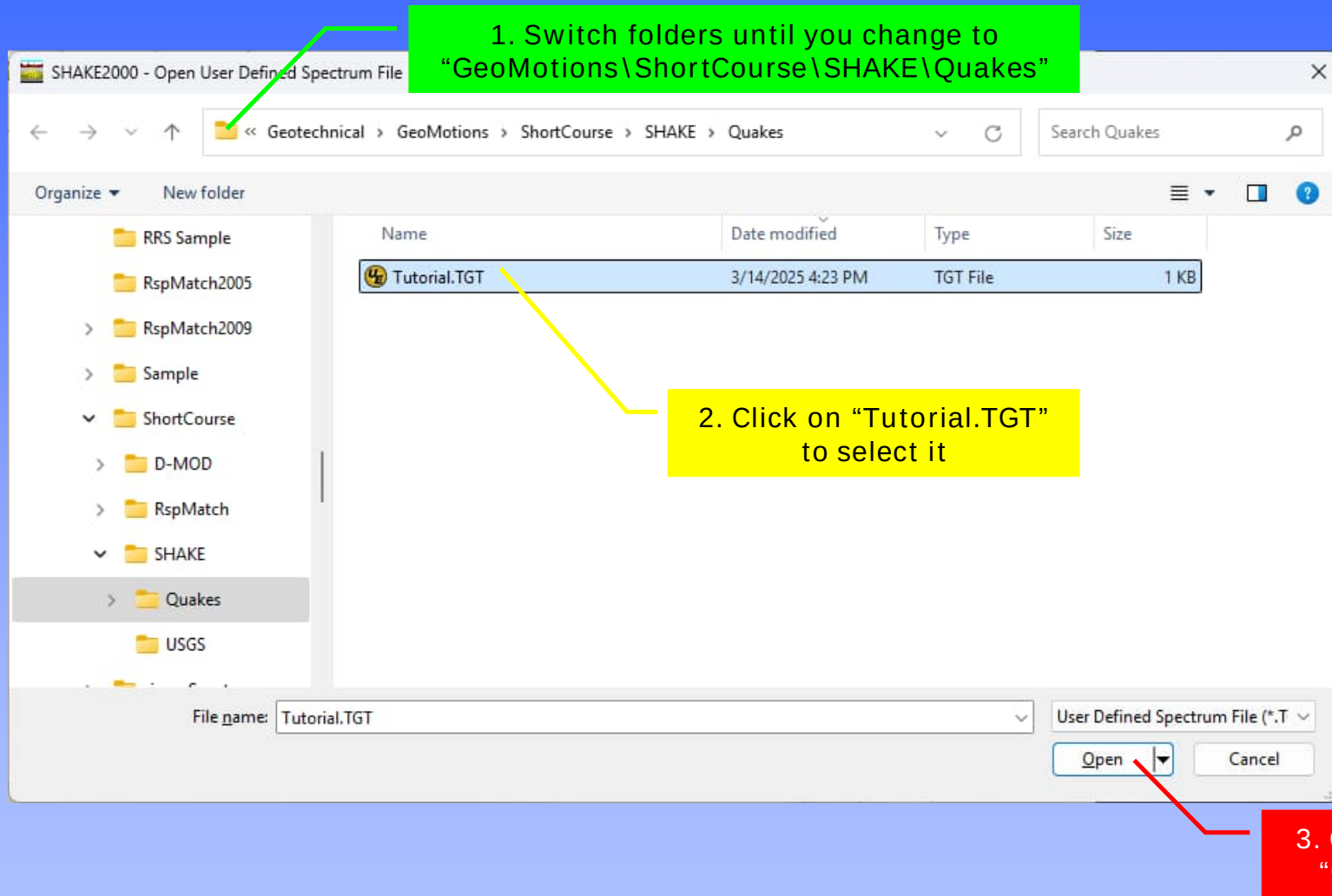


The image shows a screenshot of the "SHAKE2000 - User Defined Spectrum" dialog box. A green callout box with the text "1. Click on 'Open'" has an arrow pointing to the "Open" button in the top toolbar. The dialog box contains a table with three columns: "No.", "Period (sec)", and "Sa (g's)". The "No." column is numbered 2 through 15. To the right of the table are three buttons: "Add", "Remove", and "Reset". At the bottom of the dialog box, there are two text input fields labeled "User Defined Spectrum:" and "User Defined Spectrum File:".

No.	Period (sec)	Sa (g's)
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

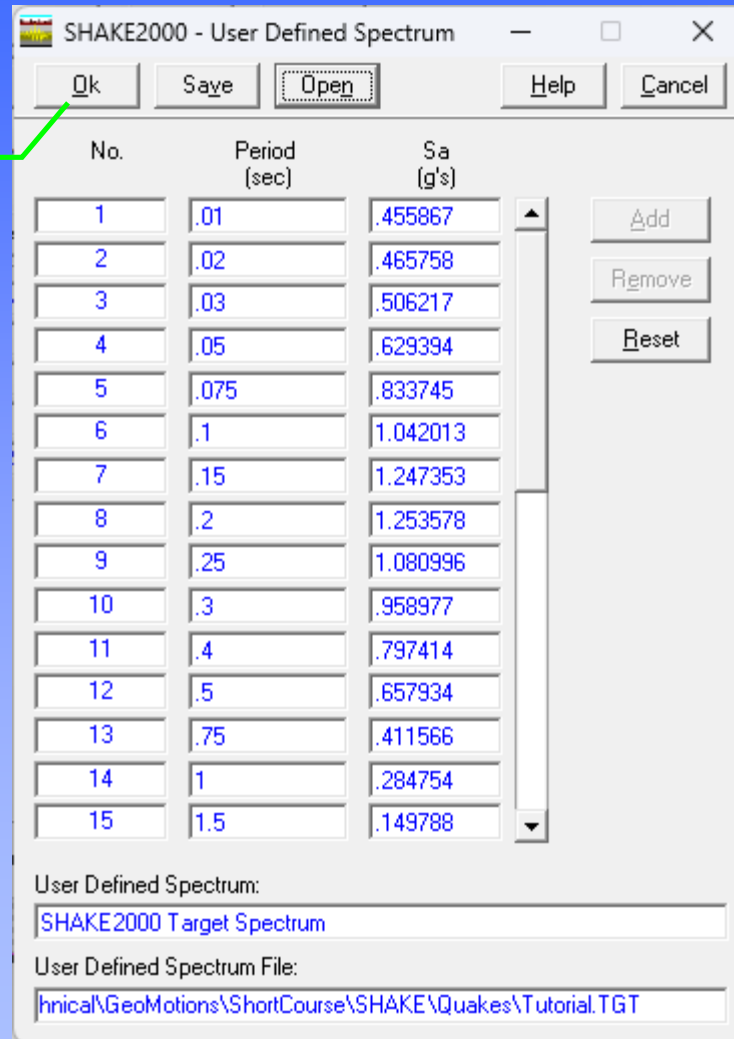
User Defined Spectrum:
User Defined Spectrum File:

Save Target Response Spectrum File



Select Target Response Spectrum

1. Click on
"Ok"



The dialog box titled "SHAKE2000 - User Defined Spectrum" contains a table of 15 rows with columns for No., Period (sec), and Sa (g's). The "Ok" button is highlighted with a green box and an arrow pointing to it from the instruction "1. Click on 'Ok'". The "Open" button is also highlighted with a dashed border. The "User Defined Spectrum" field contains "SHAKE2000 Target Spectrum" and the "User Defined Spectrum File" field contains "hnicl\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.TGT".

No.	Period (sec)	Sa (g's)
1	.01	.455867
2	.02	.465758
3	.03	.506217
4	.05	.629394
5	.075	.833745
6	.1	1.042013
7	.15	1.247353
8	.2	1.253578
9	.25	1.080996
10	.3	.958977
11	.4	.797414
12	.5	.657934
13	.75	.411566
14	1	.284754
15	1.5	.149788

User Defined Spectrum:
SHAKE2000 Target Spectrum

User Defined Spectrum File:
hnicl\GeoMotions\ShortCourse\SHAKE\Quakes\Tutorial.TGT

Site Specific Response Analysis Plot Results

1. Click on
"Mean"

0 - Response Spectrum Plot Menu

Buttons: **OK** **Next** **Mean** **Site** **User** **Help** **Return**

SPC File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2.spc

Project: Col 2

Profile: Analysis No. 1 - Profile No. 2 - Col 2-R_SSU000

Layer No.: 15

Earthquake: S\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTH_R_SSU000.EQK

☒ Plot User

Damping Values:

- ☒ Response spectrum for 5% damping
- ☐ Response spectrum for 10% damping
- ☐ Response spectrum for 20% damping

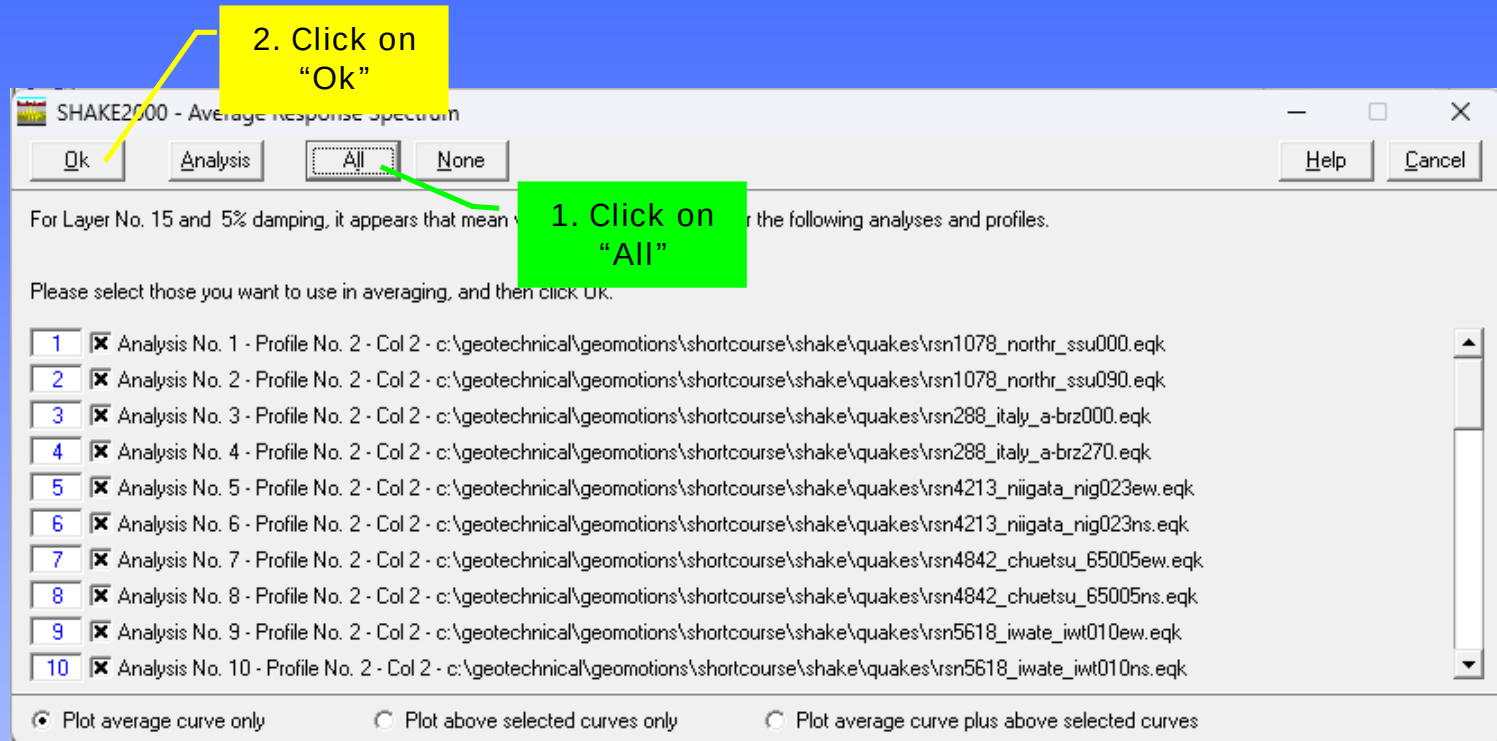
Type of Response Spectrum:

- ☐ Relative Displacement
- ☐ Relative Velocity
- ☐ Pseudo-Relative Velocity
- ☐ Absolute Acceleration
- ☒ Pseudo-Absolute Acceleration

☐ Save Spectrum Data: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\spectra.txt

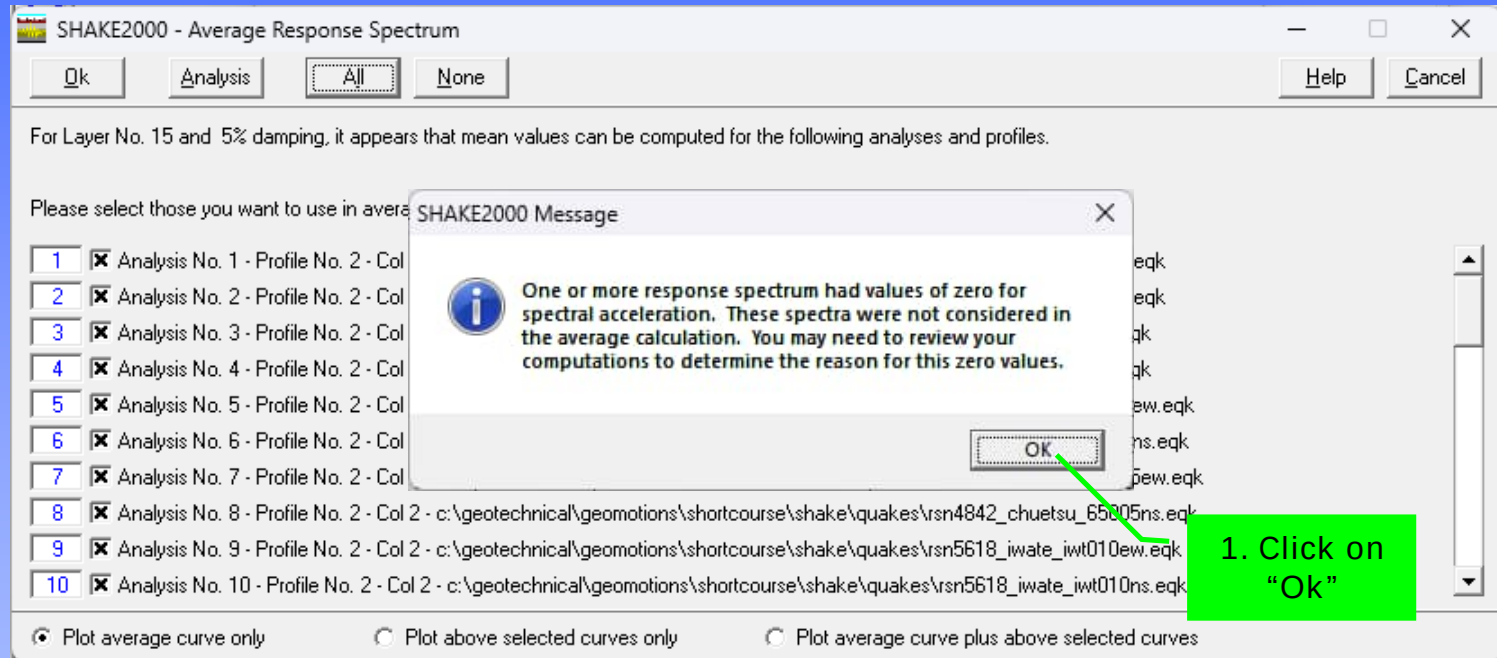
Site Specific Response Analysis

Plot Results



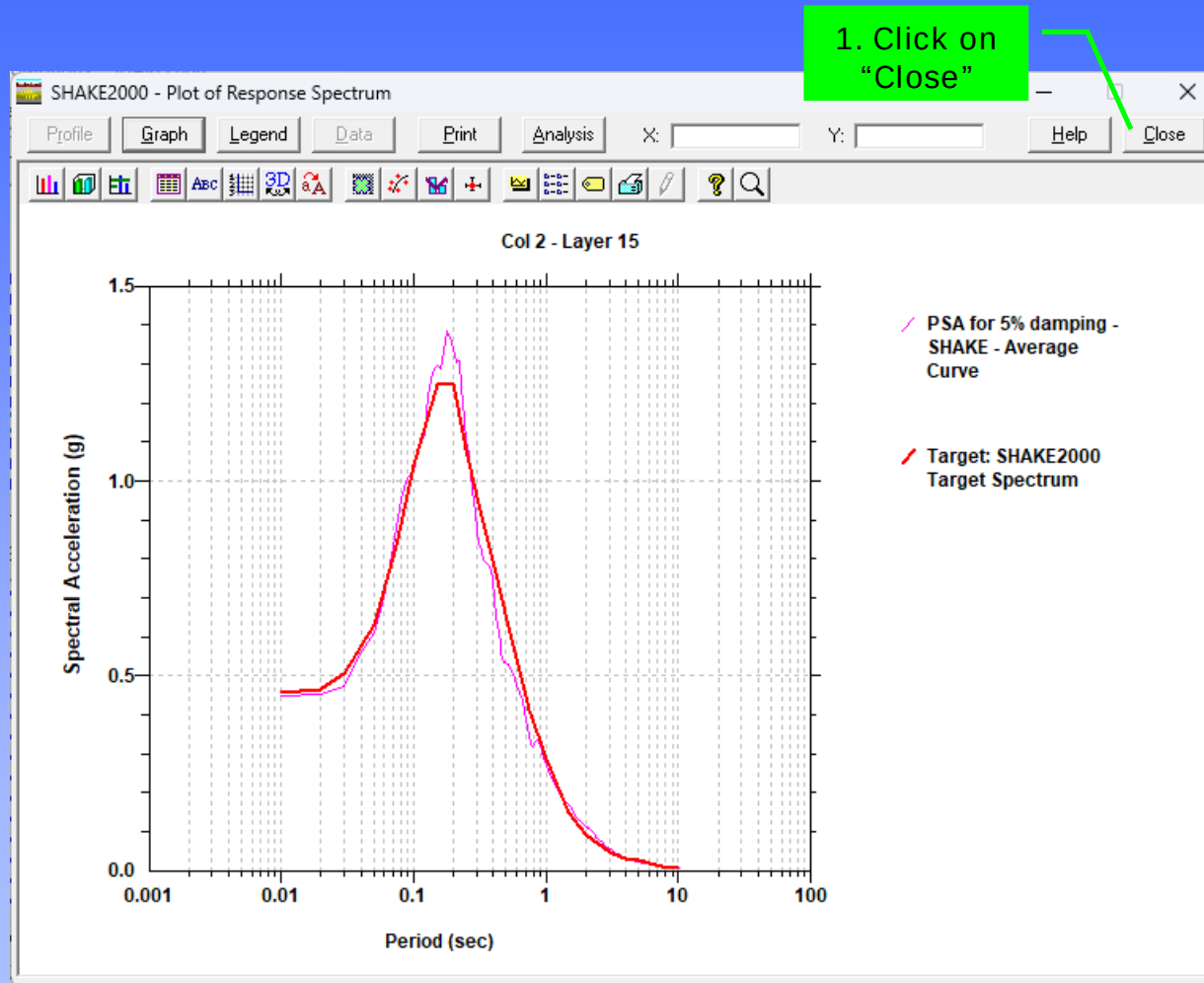
Site Specific Response Analysis

Plot Results



Site Specific Response Analysis

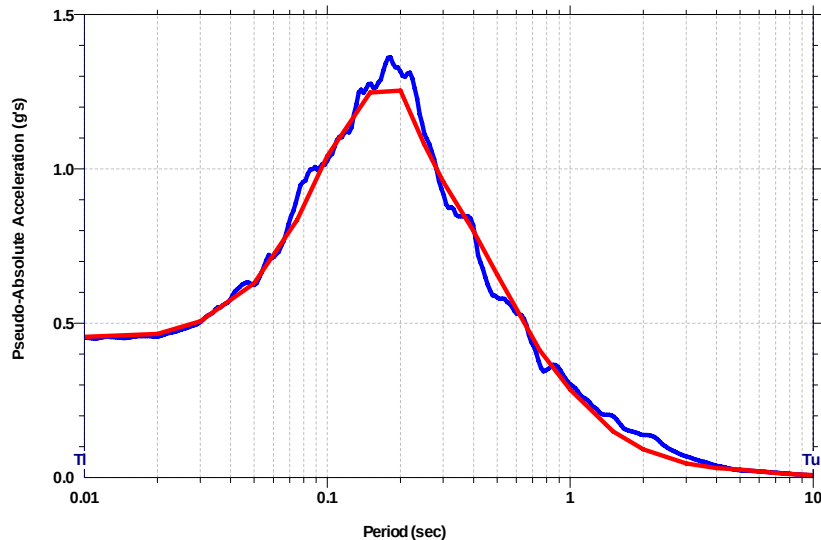
Plot Results



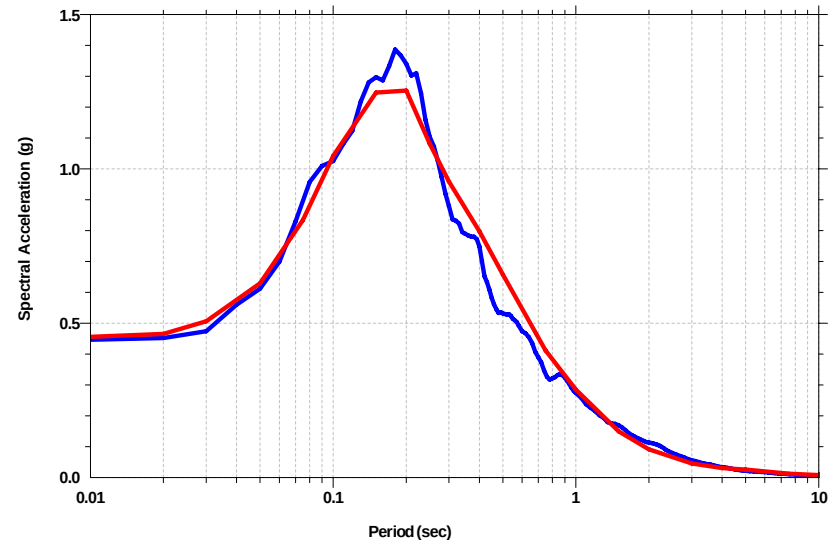
Selection of Acceleration Time Histories

Compare Layer 15 Input-Outcrop average spectrum to Ground Motion Selection average spectrum to check input motions are correctly applied

Ground Motion Selection

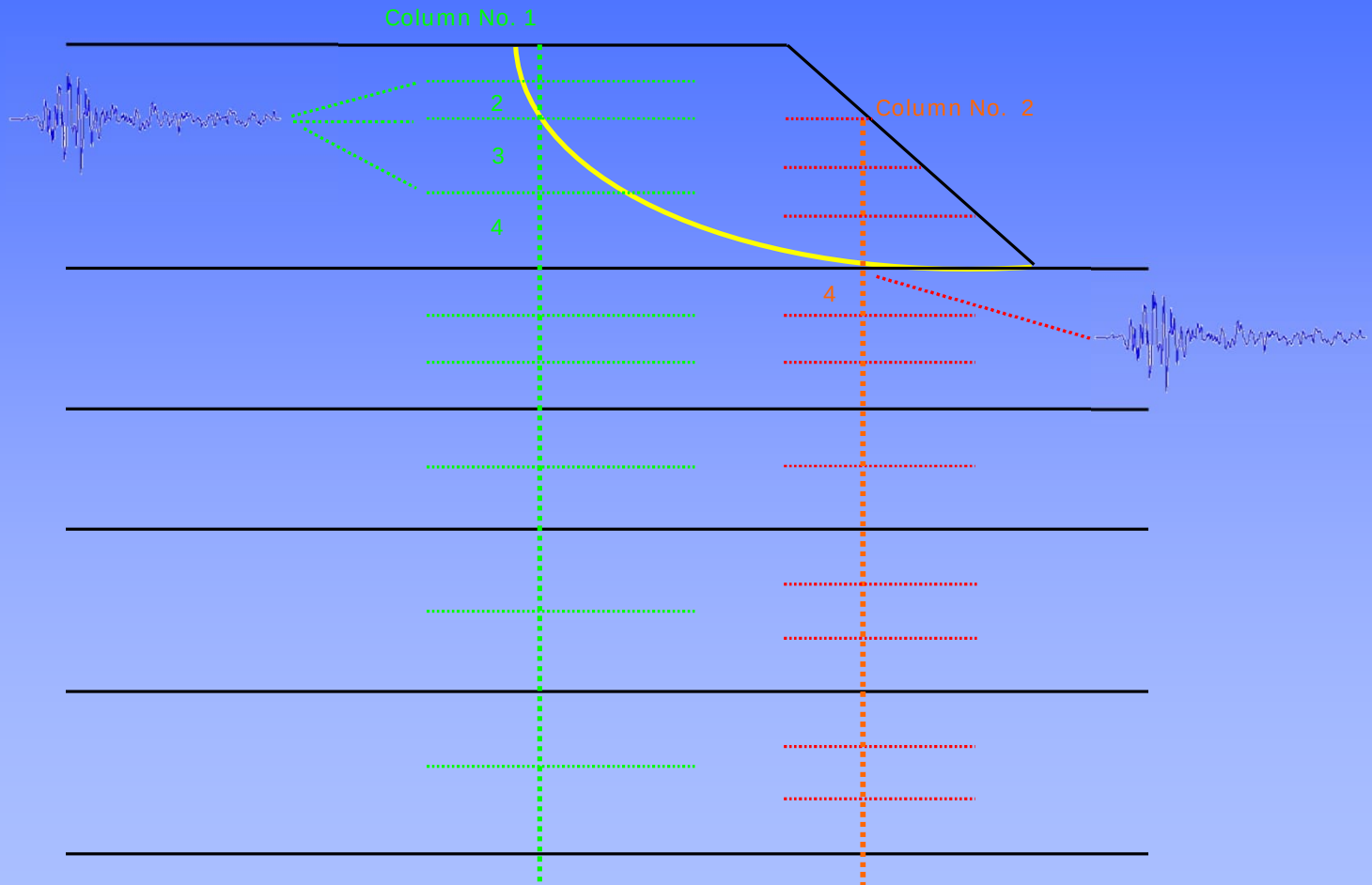


SHAKE Outcrop Layer 15



Sample Problem

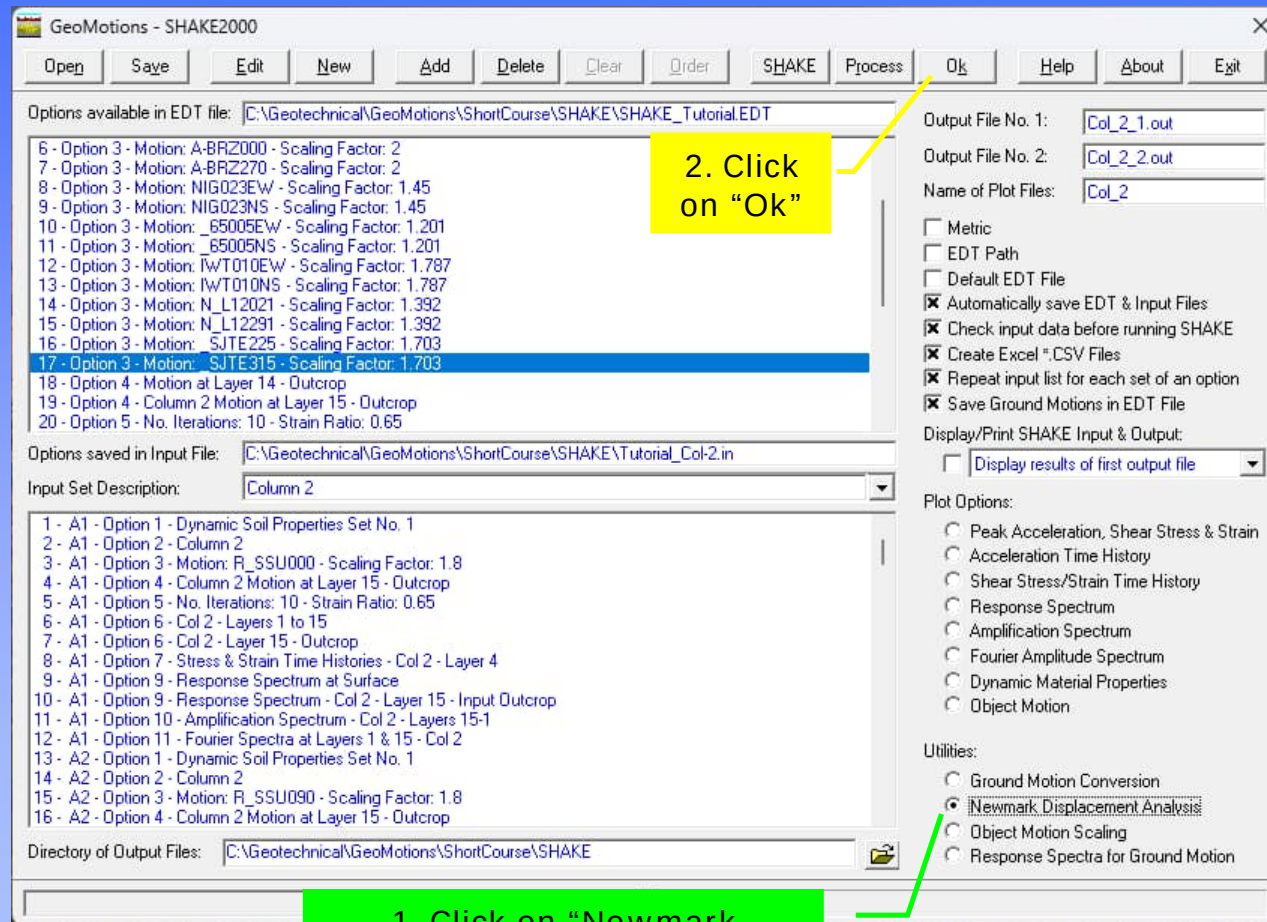
Newmark Displacement Analysis



Acceleration time histories at the top of layers 2, 3, and 4 for Column 1, and at the top of layer 4 for Column 2 will be used in the Newmark Displacement Analysis.

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Yield Acceleration (in g's):

☒ Displacement vs Ky Start: 0.05 End: 0.3 Step: 0.01 Ky

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

Acceleration Time History (g's): File

☐ Starting Time 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

Maximum: Average: Minimum:

Displacement File:

1. Click on
"Displacement vs Ky"

2. Click on
"File"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:  

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File:  For layers to 

☐ Other Acceleration Time History:

☐ Free Format

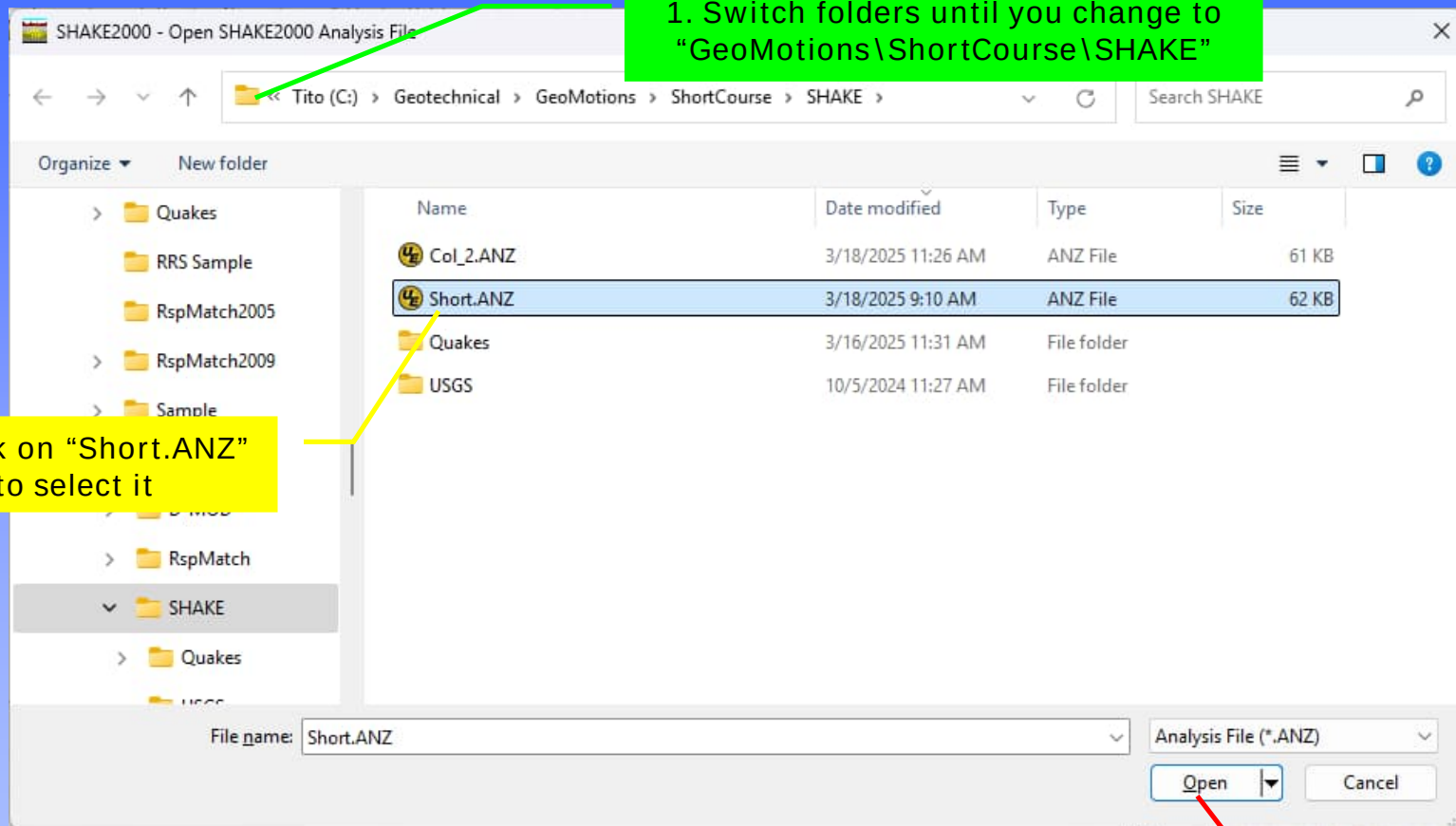
No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

2. Click on open folder icon

1. Enter "4"

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ se\shake\short-l2a1d1-5-col 1-r_ssu000.he	1	1	12592	.005	3	8	15	1
☒ se\shake\short-l3a1d1-7-col 1-r_ssu000.he	2	1	12592	.005	3	8	15	1
☒ se\shake\short-l4a1d1-9-col 1-r_ssu000.he	3	1	12592	.005	3	8	15	1
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File: 

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File: 

☐ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

2. Click on "Ok"

1. Click on EQ icon

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Input Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky File

Acceleration Time History (g's):

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

Maximum: Average: Minimum:

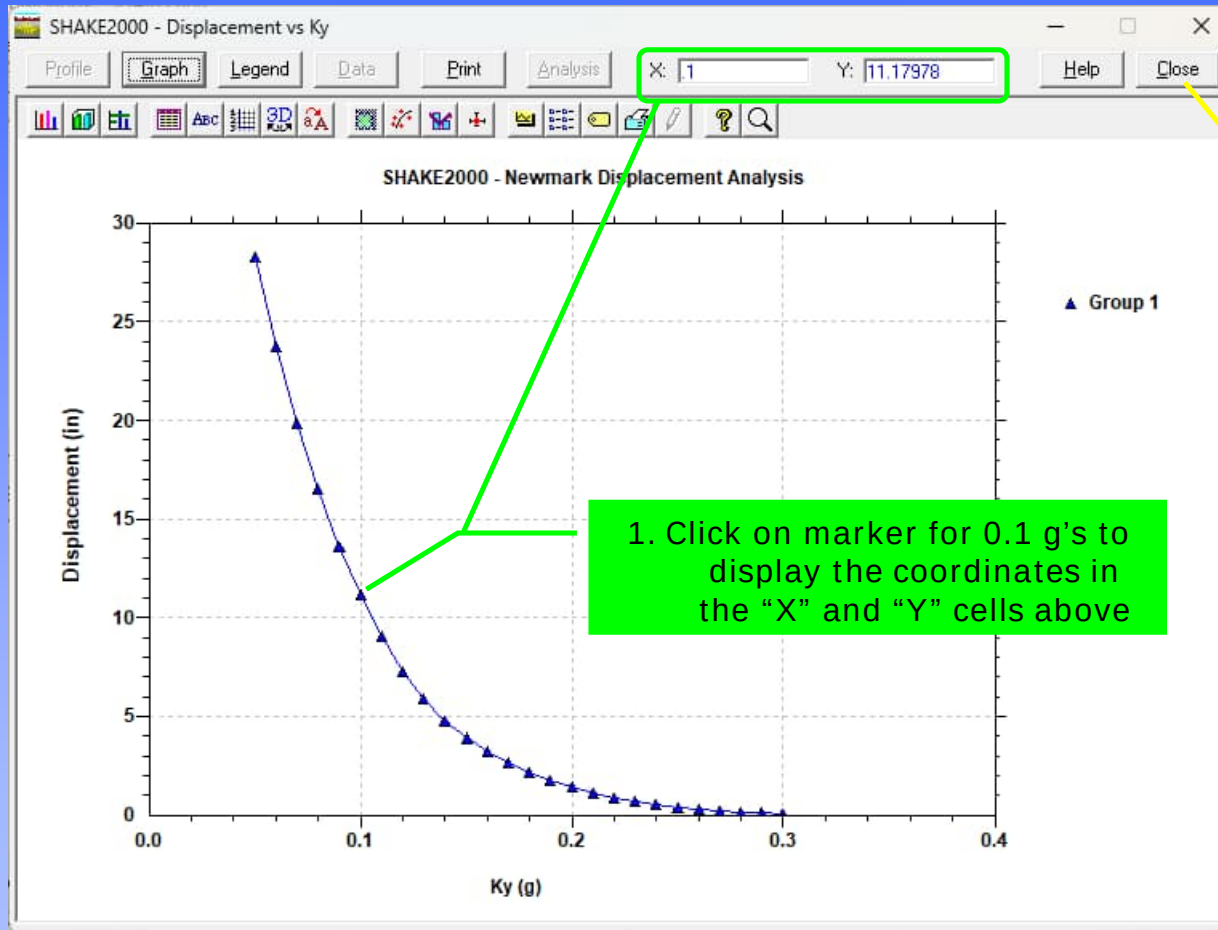
Displacement File: C:\Geotechnical\GeoMotions\output.csv

2. Click
on "Plot"

1. Click
on "Ky"

Site Specific Response Analysis

Newmark Displacement Analysis



Displacement computed based on average of acceleration time histories for motion SSU000 for layers 2, 3, and 4 of Column No. 1

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Yield Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

Maximum: Average: Minimum:

Displacement File:

1. Click on
"File"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ se\shake\short-l2a1d1-5-col 1-r_ssu000.he	1	1	12592	.005	3	8	15	1
☒ se\shake\short-l3a1d1-7-col 1-r_ssu000.he	2	1	12592	.005	3	8	15	1
☒ se\shake\short-l4a1d1-9-col 1-r_ssu000.he	3	1	12592	.005	3	8	15	1
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:  

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File:  For layers to 

☐ Other Acceleration Time History:

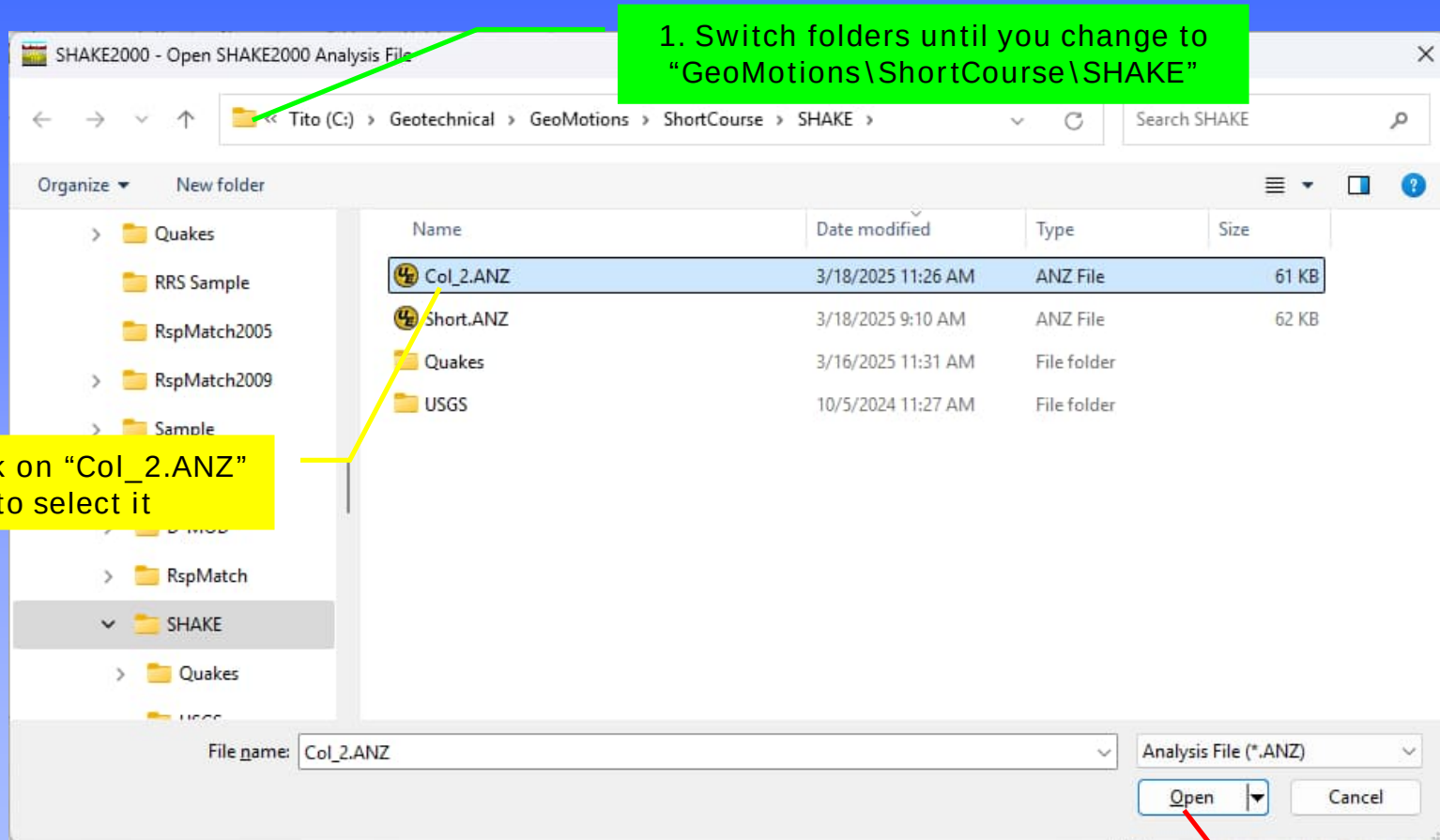
☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

1. Click on open folder icon

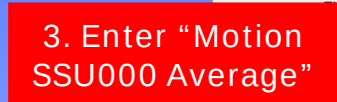
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis



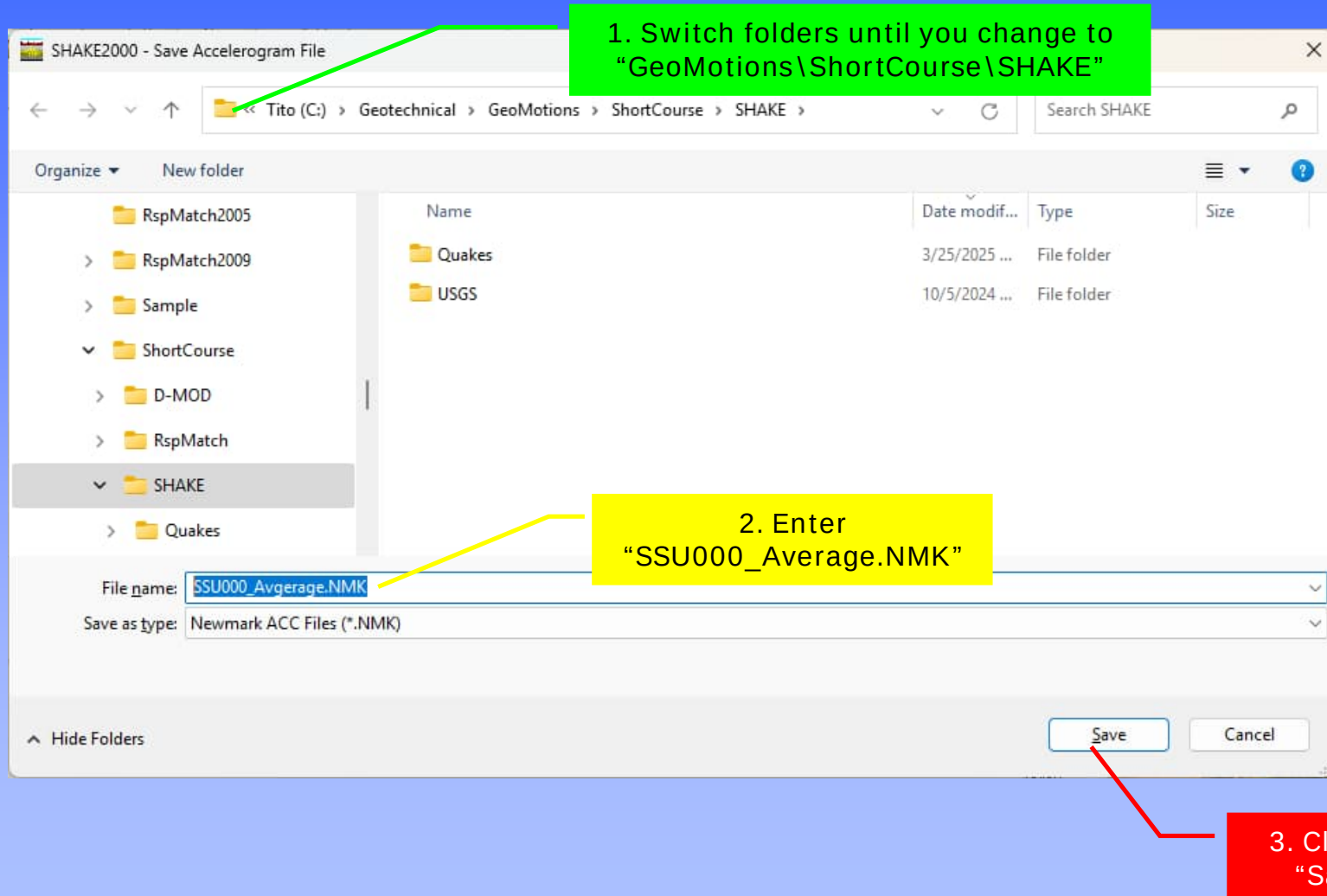
4. Click on
"Save"

2. Enter
"1" **

1. Click on EQ icon

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save **Motion** View Help Close

Weighted motion description: Motion SSU000 Average

Weighted average accelerogram file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU000

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ se\shake\short-l2a1d1-5-col 1-r_ssu000.he	1	1	12592	.005	3	8	15	1
☒ se\shake\short-l3a1d1-7-col 1-r_ssu000.he	2	1	12592	.005	3	8	15	1
☒ se\shake\short-l4a1d1-9-col 1-r_ssu000.he	3	1	12592	.005	3	8	15	1
☒ se\shake\col_2-l4a1d2-4-col 2-r_ssu000.he	4	1	12592	.005	3	8	15	1
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2.ANZ

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 2 and motion R_SSU000

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

1. Click on
"Motion"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description: Motion SSU000 Average

Weighted average accelerogram file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU000_Average.NMK

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ se\shake\short-l2a1d1-5-col 1-r_ssu000.he	1	1	12592	.005	3	8	15	1
☒ se\shake\short-l3a1d1-7-col 1-r_ssu000.he	2	1	12592	.005	3	8	15	1
☒ se\shake\short-l4a1d1-9-col 1-r_ssu000.he	3	1	12592	.005	3	8	15	1
☒ se\shake\col_2-l4a1d2-4-col 2-r_ssu000.he	4	1	12592	.005	3	8	15	1
☒ se\shake\col_2-l4a2d2-9-col 2-r_ssu090.he	5	1	12592	.005	3	8	15	2
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2.ANZ

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 2 and motion R_SSU090

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History: No. Values Units

☐ Free Format

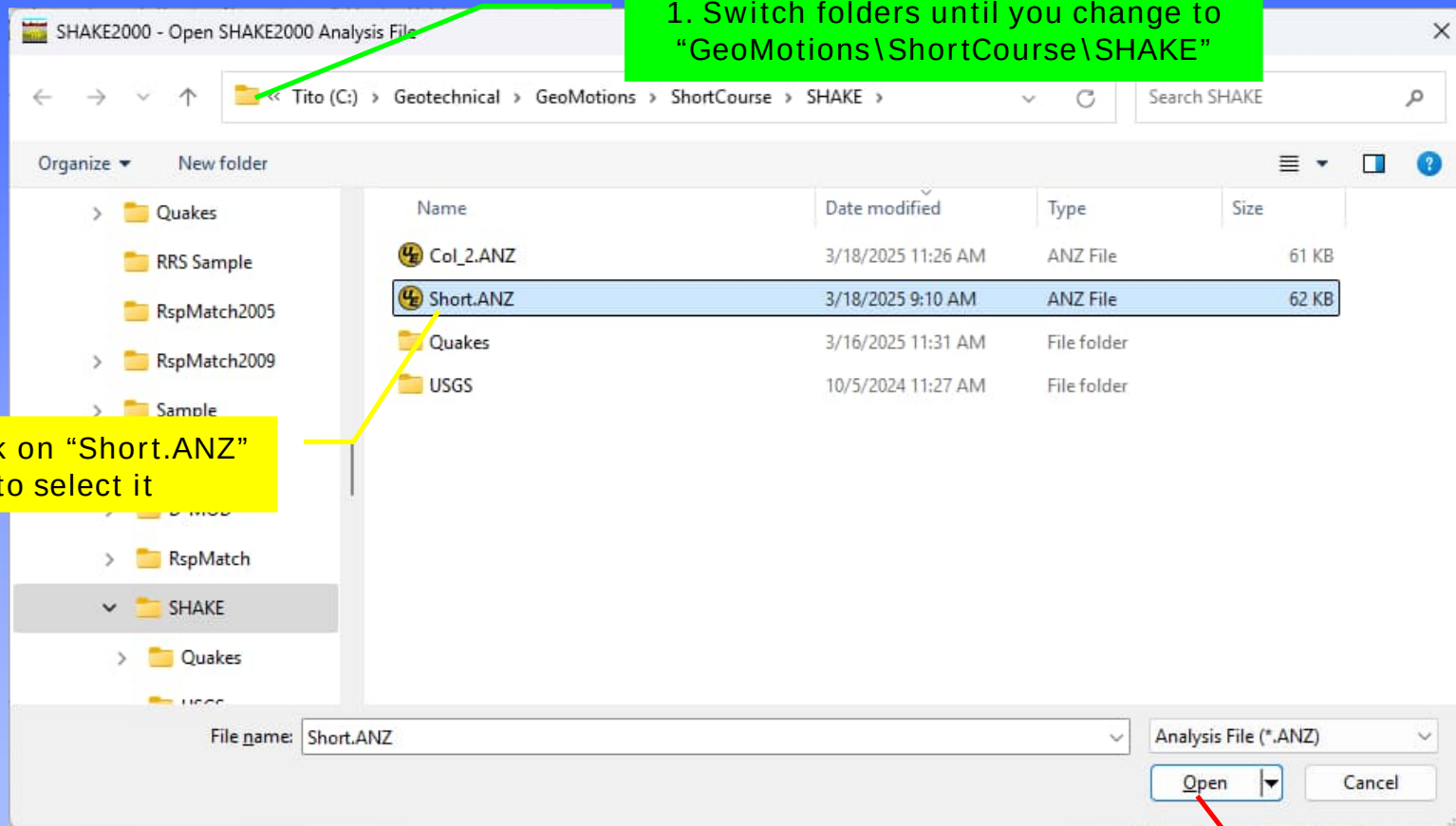
1. Click on down arrow
and select "R_SSU090"

3. Click on
open folder
icon

2. Click on
EQ icon

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

4. Click on "Ok"

3. Change to "2"

2. Click on EQ icon

1. Click on down arrow and select "R_SSU090"

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ se\shake\short-l2a1d1-5-col 1-r_ssu000.he	1	1	12592	.005	3	8	15	1
☒ se\shake\short-l3a1d1-7-col 1-r_ssu000.he	2	1	12592	.005	3	8	15	1
☒ se\shake\short-l4a1d1-9-col 1-r_ssu000.he	3	1	12592	.005	3	8	15	1
☒ se\shake\col_2-l4a1d2-4-col 2-r_ssu000.he	4	1	12592	.005	3	8	15	1
☒ se\shake\col_2-l4a2d2-9-col 2-r_ssu090.he	5	1	12592	.005	3	8	15	2
☒ e\shake\short-l2a2d1-15-col 1-r_ssu090.he	6	1	12592	.005	3	8	15	2
☒ e\shake\short-l3a2d1-17-col 1-r_ssu090.he	7	1	12592	.005	3	8	15	2
☒ e\shake\short-l4a2d1-19-col 1-r_ssu090.he	8	1	12592	.005	3	8	15	2
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short.ANZ

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 1 and motion R_SSU090

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History: No. Values Units

☐ Free Format: g's

Site Specific Response Analysis

Newmark Displacement Analysis

2. Click
on "Save"

E2000 - Newmark Displacement Analysis

Print Plot **Save** Help Close

Project: Motion SSU

Yield Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

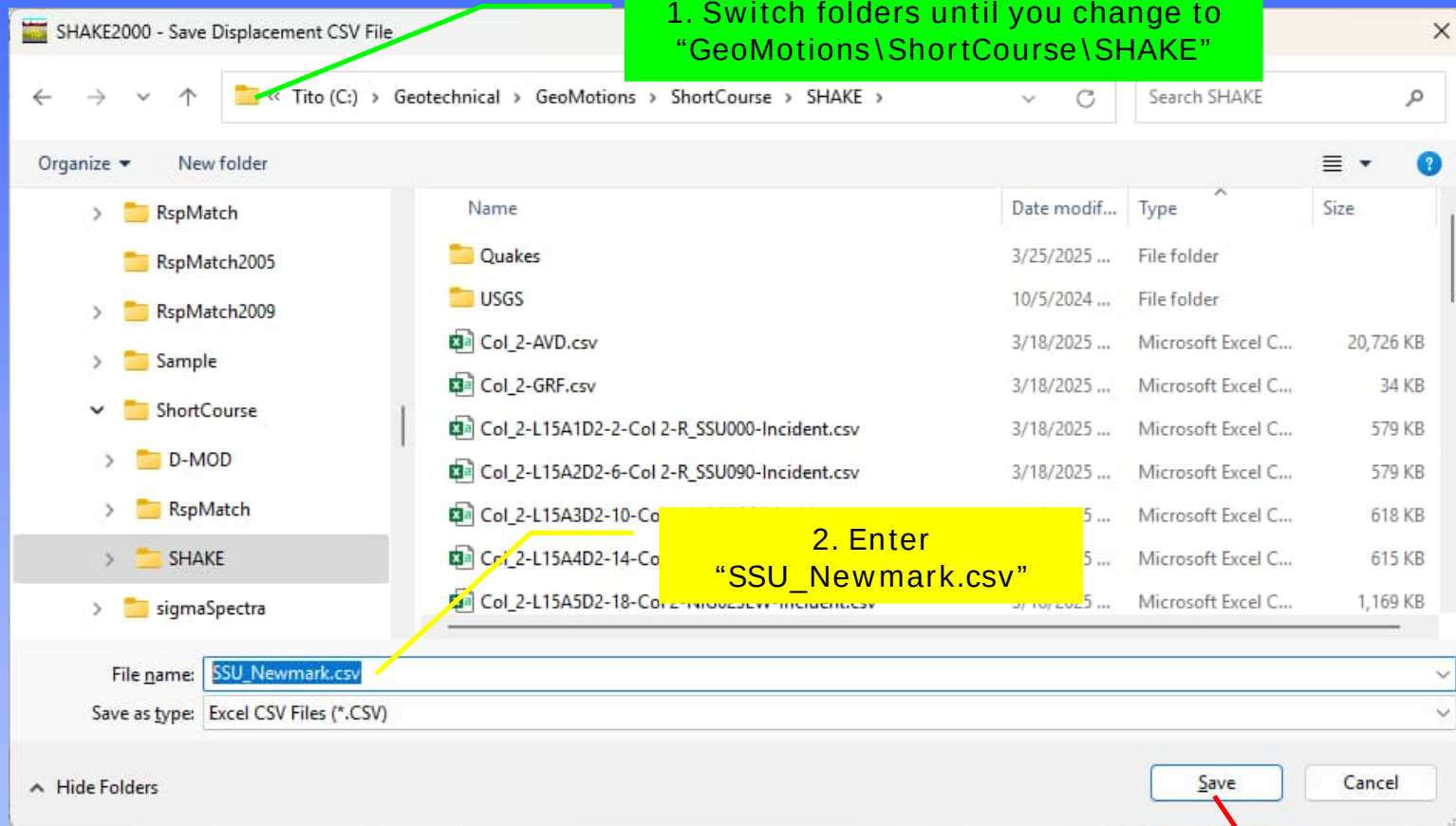
Maximum: Average: Minimum:

Displacement File: C:\Geotechnical\GeoMotions\output.csv

1. Enter "Motion SSU"

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: Motion SSU

Field Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky File

Acceleration Time History (g's):

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

Maximum: Average: Minimum:

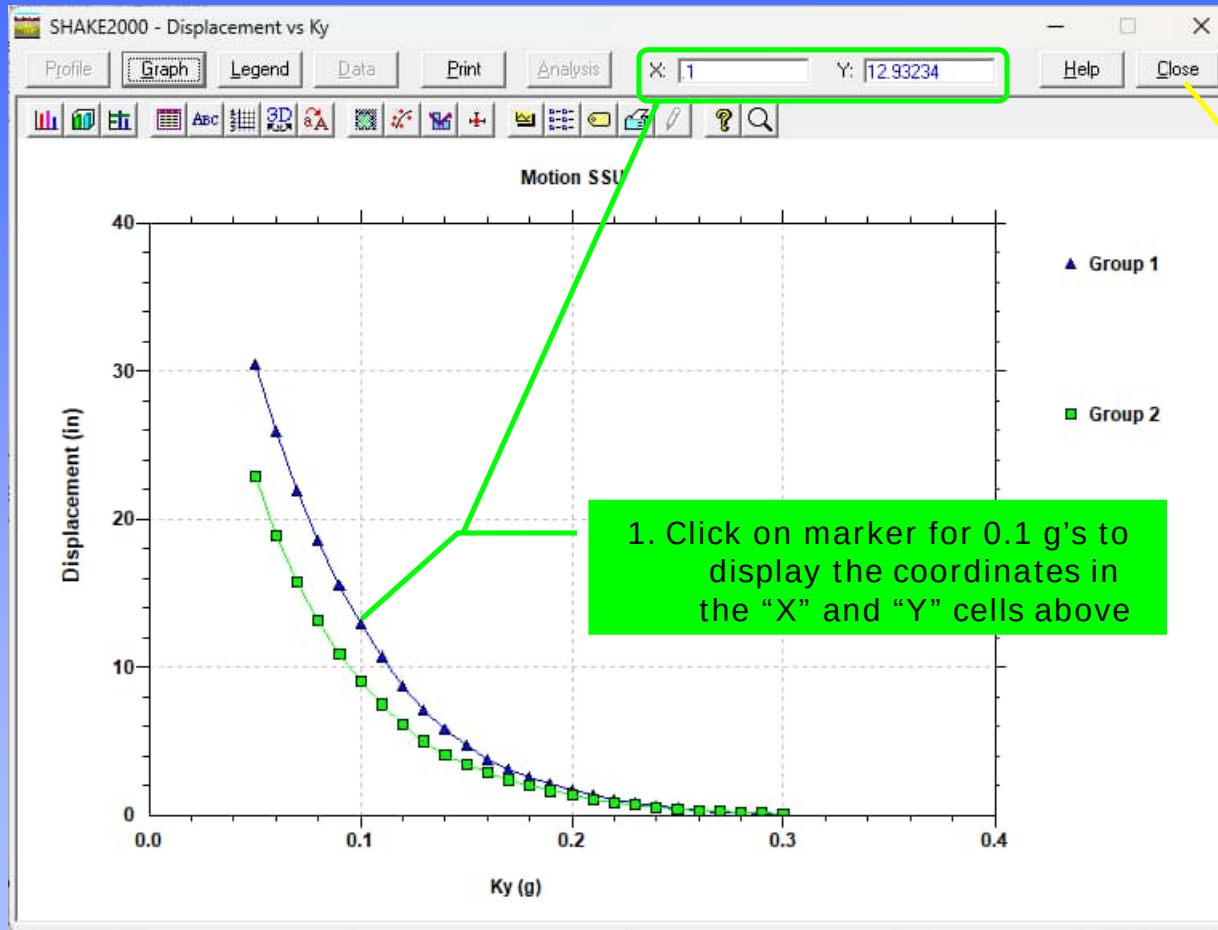
Displacement File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU_Newmark.csv

2. Click
on "Plot"

1. Click
on "Ky"

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis – Excel CSV File

AutoSave Off SSU_Newmark.csv • Saved to this PC

File Home Insert Page Layout Formulas Data Review View Help Acrobat PDF-XChange

Clipboard Font Alignment Number Styles Add-ins Analyze Data Copilot Create a PDF

A48

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	SHAKE2000 - Newmark Displacement Analysis															
2	Project: Motion SSU															
3																
4	Acceleration Time Histories:															
5	Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A1D1-5-Col 1-R_SSU000.he															
6	Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A1D1-7-Col 1-R_SSU000.he															
7	Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A1D1-9-Col 1-R_SSU000.he															
8	Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A1D2-4-Col 2-R_SSU000.he															
9	Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A2D2-9-Col 2-R_SSU090.he															
10	Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A2D1-15-Col 1-R_SSU090.he															
11	Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A2D1-17-Col 1-R_SSU090.he															
12	Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A2D1-19-Col 1-R_SSU090.he															
13																
14	Ky	Group 1	Group 2													
15	(g)	(in)	(in)													
16	0.05	30.45882	22.87733													
17	0.06	25.90473	18.83718													
18	0.07	21.93761	15.71688													
19	0.08	18.52352	13.09887													
20	0.09	15.53254	10.89783													
21	0.1	12.93234	9.019188													
22	0.11	10.71242	7.465989													
23	0.12	8.749531	6.137774													
24	0.13	7.13644	4.985835													
25	0.14	5.779875	4.036942													
26	0.15	4.704566	3.386845													
27	0.16	3.782002	2.851546													
28	0.17	3.120871	2.391517													
29	0.18	2.564147	1.989795													
30	0.19	2.090122	1.640276													
31	0.2	1.686393	1.337904													

SSU_Newmark

Ready Accessibility: Unavailable 100%

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: Motion SSU

Yield Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

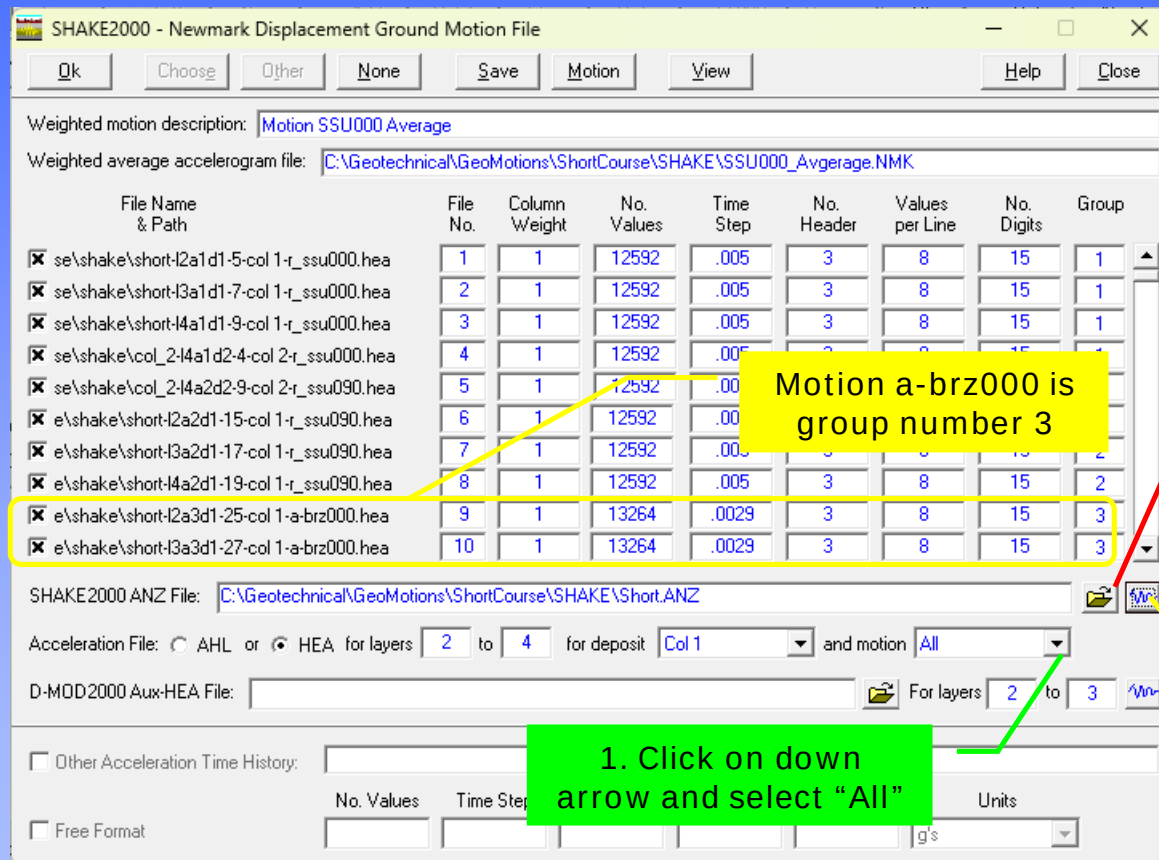
Maximum: Average: Minimum:

Displacement File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU_Newmark.csv

1. Click on
"File"

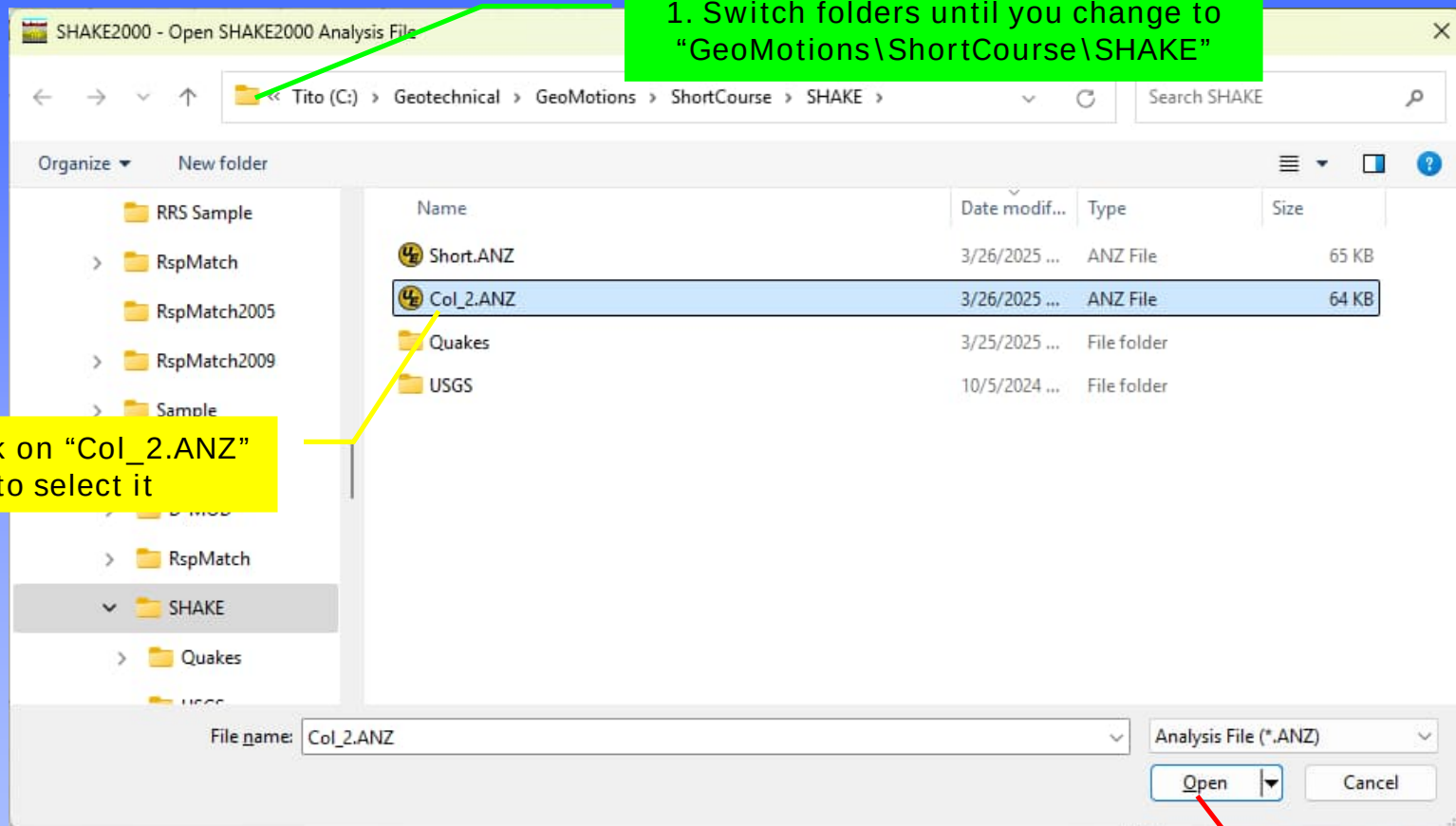
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description: Motion SSU000 Average

Weighted average accelerogram file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU000_Avgerage.NMK

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ e:\shake\short-l4a3d1-29-col 1-a-brz000.he	11	1	13264	.0029	3	8	15	3
☒ e:\shake\short-l2a4d1-35-col 1-a-brz270.he	12	1	13264	.0029	3	8	15	4
☒ e:\shake\short-l3a4d1-37-col 1-a-brz270.he	13	1	13264	.0029	3	8	15	4
☒ e:\shake\short-l4a4d1-39-col 1-a-brz270.he	14	1	13264	.0029	3	8	15	4
☒ e:\shake\short-l2a5d1-45-col 1-nig023ew.he	15	1	18240	.01	3	8	15	5
☒ e:\shake\short-l3a5d1-47-col 1-nig023ew.he	16	1	18240	.01	3	8	15	5
☒ e:\shake\short-l4a5d1-49-col 1-nig023ew.he	17	1	18240	.01	3	8	15	5
☐ e:\shake\short-l2a6d1-55-col 1-nig023ns.he	18	1	18240	.01	3	8	15	6
☐ e:\shake\short-l3a6d1-57-col 1-nig023ns.he	19	1	18240	.01	3	8	15	6
☐ e:\shake\short-l4a6d1-59-col 1-nig023ns.he	20	1	18240	.01	3	8	15	6

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2.ANZ

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 2 and motion All

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History: No. Values Time Step Units

☐ Free Format

3. Scroll down

2. Click on EQ icon

3. Deselect the "nig023ns" motion**

1. Click on down arrow and select "All"

** This motion caused the "Option 5" error when processing the SHAKE output files. Thus, acceleration time histories were not created. Leaving this motion checked would cause an error on the Newmark Displacement calculation.

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description: Motion SSU000 Average

Weighted average accelerogram file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU000_Avgerage.NMK

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ shake\short-14a13d1-129-col 1-_site225.he	41	1	10992	.005	3	8	15	13
☒ shake\short-14a14d1-135-col 1-_site315.he	42	1	10992	.005	3	8	15	14
☒ shake\short-14a14d1-137-col 1-_site315.he	43	1	10992	.005	3	8	15	14
☒ shake\short-14a14d1-139-col 1-_site315.he	44	1	10992	.005	3	8	15	14
☒ e\shake\col_2-14a3d2-14-col 2-a-brz000.he	45	1	13264	.0029	3	8	15	3
☒ e\shake\col_2-14a4d2-19-col 2-a-brz270.he	46	1	13264	.0029	3	8	15	4
☒ e\shake\col_2-14a5d2-24-col 2-nig023ew.he	47	1	18240	.01	3	8	15	5
☐ e\shake\col_2-14a6d2-29-col 2-nig023ns.he	48	1	18240	.01	3	8	15	6
☒ e\shake\col_2-14a7d2-34-col 2-_65005ew.he	49	1	18240	.01	3	8	15	7
☒ e\shake\col_2-14a8d2-39-col 2-_65005ns.he	50	1	18240	.01	3	8	15	8

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\Sho

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 2 and motion All

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History:

☐ Free Format

No. Values Time Step No. Header Values/Line No. Digits Units

g's

1. Scroll down

2. Change group number to correspond to groups for column 1

3. Deselect the "nig023ns" motion**

** This motion caused the "Option 5" error when processing the SHAKE output files. Thus, acceleration time histories were not created. Leaving this motion checked would cause an error on the Newmark Displacement calculation.

Site Specific Response Analysis

Newmark Displacement Analysis

3. Click on "Ok"

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description: Motion SSU000 Average

Weighted average accelerogram file: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SSU000_Average.NMK

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☒ e:\shake\col_2-14a9d2-44-col 2-iwt010ew.he	51	1	26176	.01	3	8	15	9
☒ \shake\col_2-14a10d2-49-col 2-iwt010ns.he	52	1	26176	.01	3	8	15	10
☒ \shake\col_2-14a11d2-54-col 2-n_l12021.he	53	1	4032	.01	3	8	15	11
☒ \shake\col_2-14a12d2-59-col 2-n_l12291.he	54	1	4032	.01	3	8	15	12
☒ \shake\col_2-14a13d2-64-col 2-_site225.he	55					8	15	13
☒ \shake\col_2-14a14d2-69-col 2-_site315.he	56					8	15	14
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2.ANZ

Acceleration File: ☐ AHL or ☒ HEA for layers 2 to 4 for deposit Col 2 and motion All

D-MOD2000 Aux-HEA File: For layers 2 to 3

☐ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

1. Scroll down

2. Change group number to correspond to groups for column 1

Site Specific Response Analysis

Newmark Displacement Analysis

2. Click
on "Save"

SHAKE2000 - Newmark Displacement Analysis

Print Plot **Save** Help Close

Project: SHAKE2000 Tutorial

Yield Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec^2

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All Reversal

Displacement Results:

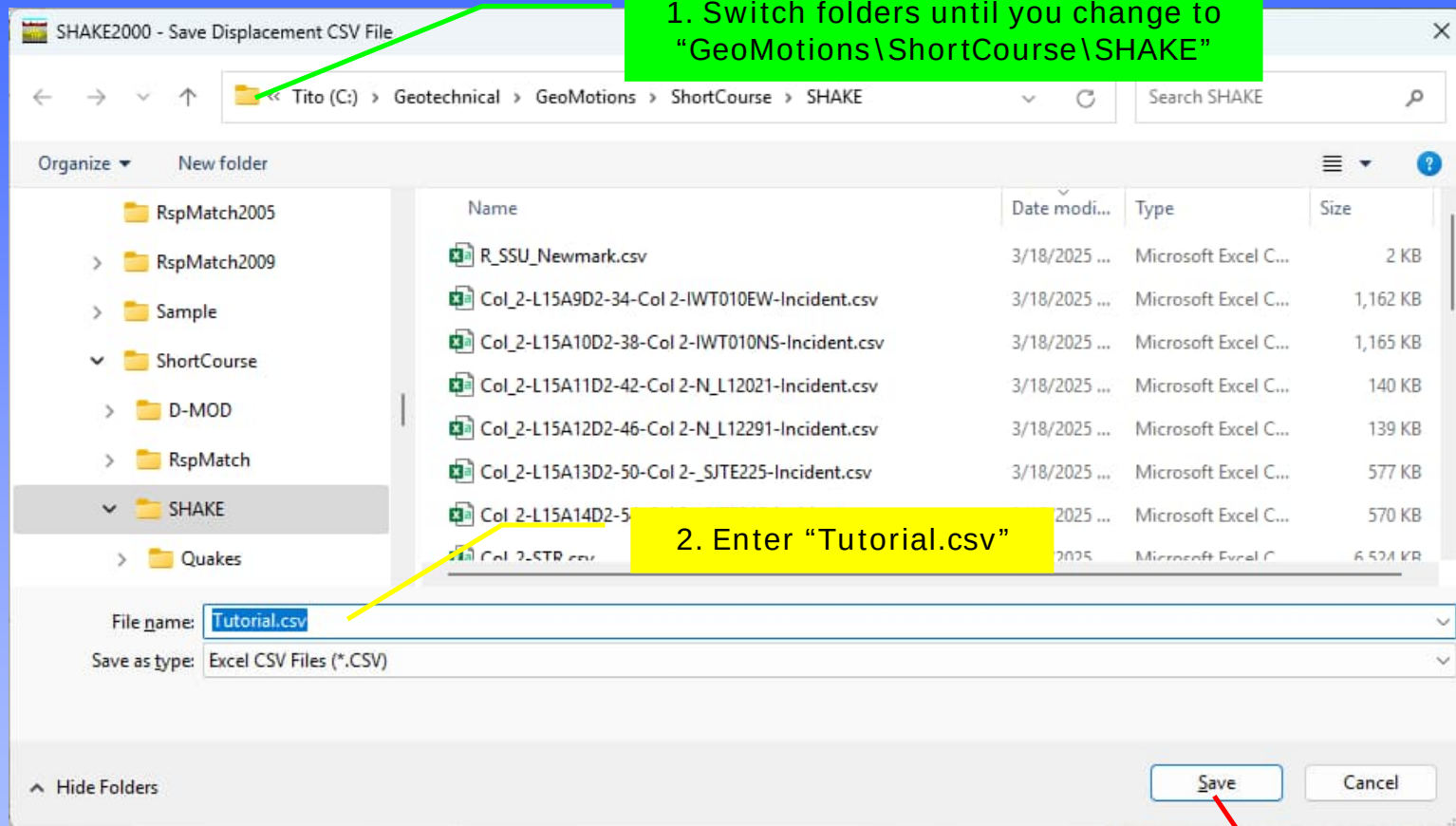
Maximum: Average: Minimum:

Displacement File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\VR_SSU_Newmark.csv

1. Enter "SHAKE2000
Tutorial"

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 Tutorial

Field Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All ☐ Reversal

Displacement Results:

Maximum: Average: Minimum:

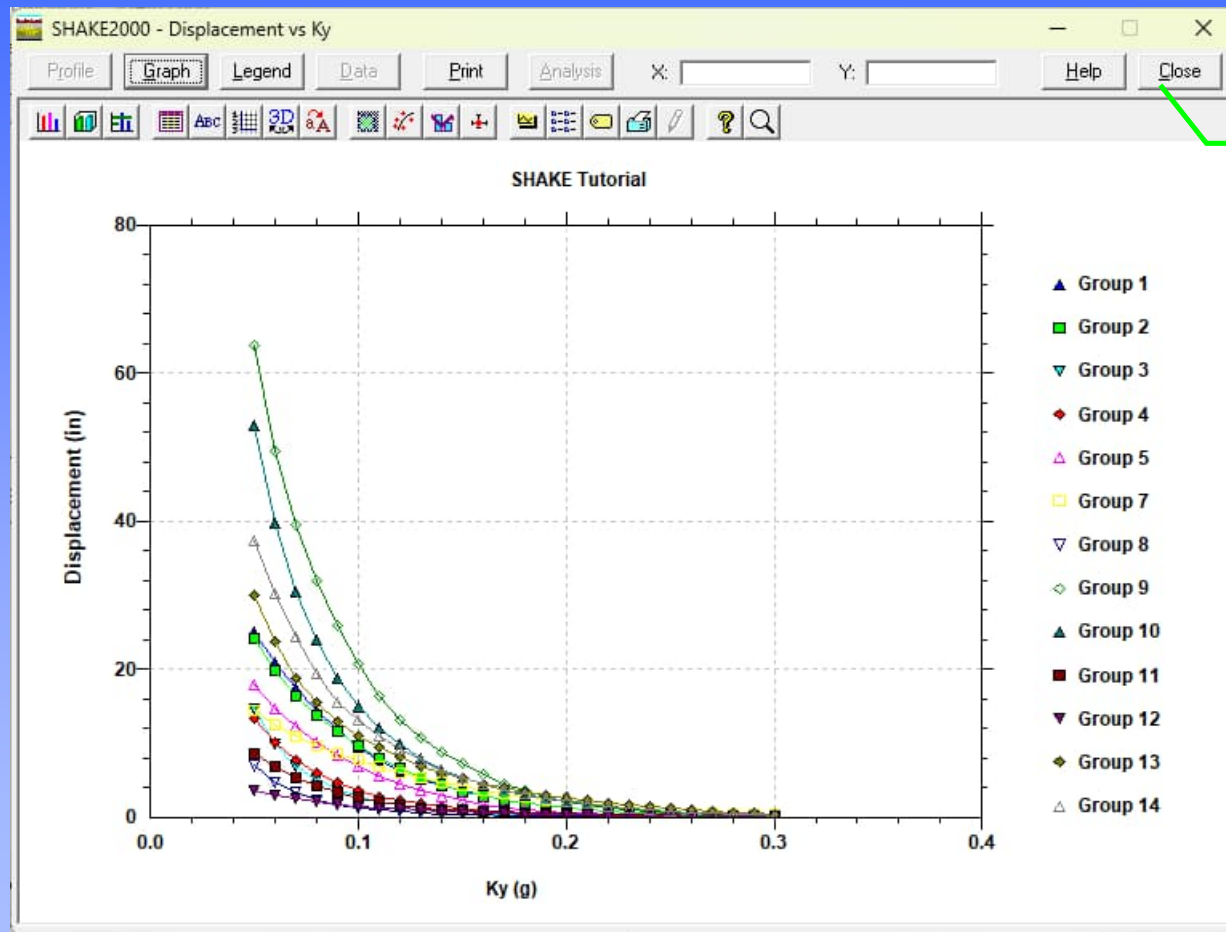
Displacement File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Tutorial.csv

2. Click
on "Plot"

1. Click
on "Ky"

Site Specific Response Analysis

Newmark Displacement Analysis



1. Click on
"Close"

Site Specific Response Analysis

Newmark Displacement Analysis – Excel CSV File

SHAKE2000 - Newmark Displacement Analysis

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
46	Group: 12 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A12D1-117-Col 1-N_L12291.he															
47	Group: 12 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A12D1-119-Col 1-N_L12291.he															
48	Group: 12 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A12D2-59-Col 2-N_L12291.he															
49	Group: 13 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A13D1-125-Col 1-_SJTE225.he															
50	Group: 13 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A13D1-127-Col 1-_SJTE225.he															
51	Group: 13 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A13D1-129-Col 1-_SJTE225.he															
52	Group: 13 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A13D2-64-Col 2-_SJTE225.he															
53	Group: 14 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A14D1-135-Col 1-_SJTE315.he															
54	Group: 14 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A14D1-137-Col 1-_SJTE315.he															
55	Group: 14 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A14D1-139-Col 1-_SJTE315.he															
56	Group: 14 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A14D2-69-Col 2-_SJTE315.he															
57																
58	Ky	Group 1	Group 2	Group 3	Group 4	Group 5	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14		
59	(g)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)		
60	0.05	30.45882	22.87733	14.55107	13.29319	17.92303	14.4529	6.952971	63.69151	52.92528	8.568479	3.65521	29.93416	37.40891		
61	0.06	25.90473	18.83718	9.859968	10.12807	14.70112	12.38944	4.722801	49.44891	39.65154	6.83421	2.953939	23.77464	30.19072		
62	0.07	21.93761	15.71688	6.866948	7.727563	12.17515	10.91064	3.308874	39.57277	30.45419	5.393635	2.452878	18.74866	24.31876		
63	0.08	18.52352	13.09887	5.031834	5.915702	10.03943	9.665499	2.35988	31.91674	23.91646	4.194938	2.070585	15.39171	19.37795		
64	0.09	15.53254	10.89783	3.759575	4.568896	8.263735	8.579967	1.688351	25.91901	18.7367	3.31321	1.767384	12.91799	15.57617		
65	0.1	12.93234	9.019188	2.787371	3.557632	6.81756	7.62458	1.226661	20.77512	14.93887	2.627012	1.524684	11.02644	13.12115		
66	0.11	10.71242	7.465989	2.111547	2.806408	5.589689	6.776248	0.961003	16.33089	12.05516	2.079044	1.315196	9.426832	11.01948		
67	0.12	8.749531	6.137774	1.598787	2.239103	4.533528	6.020028	0.74828	13.04877	9.808528	1.650646	1.133812	8.056023	9.212018		
68	0.13	7.13644	4.985835	1.19727	1.79182	3.626793	5.342637	0.578438	10.7498	7.941513	1.311303	0.976529	6.924395	7.648273		
69	0.14	5.779875	4.036942	0.898255	1.423309	2.849792	4.730958	0.442993	8.826369	6.449728	1.072359	0.840919	6.011092	6.310594		
70	0.15	4.704566	3.386845	0.684451	1.118333	2.247582	4.177182	0.335451	7.183256	5.254313	0.942991	0.721722	5.22544	5.26822		
71	0.16	3.782002	2.851546	0.530593	0.86618	1.726365	3.67597	0.251965	5.768493	4.353153	0.830942	0.616821	4.544444	4.39342		
72	0.17	3.120871	2.391517	0.404427	0.652164	1.29076	3.220796	0.187499	4.5629	3.608098	0.734458	0.523085	3.954571	3.676627		
73	0.18	2.564147	1.989795	0.300287	0.470918	0.999476	2.805781	0.136728	3.564687	3.006311	0.651675	0.439575	3.444412	3.102715		
74	0.19	2.090122	1.640276	0.21469	0.319074	0.773552	2.428258	0.094538	2.7572	2.527571	0.577576	0.364601	3.001132	2.618483		
75	0.2	1.686393	1.337904	0.145994	0.199072	0.602255	2.08436	6.04E-02	2.095374	2.123767	0.510504	0.298081	2.608244	2.207477		
76	0.21	1.349877	1.076915	0.103542	0.139936	0.463805	1.771752	3.37E-02	1.586086	1.771941	0.450206	0.239648	2.25612	1.849292		

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 Tutorial

Yield Acceleration (in g's):

☐ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☒ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All Reversal

Displacement Results:

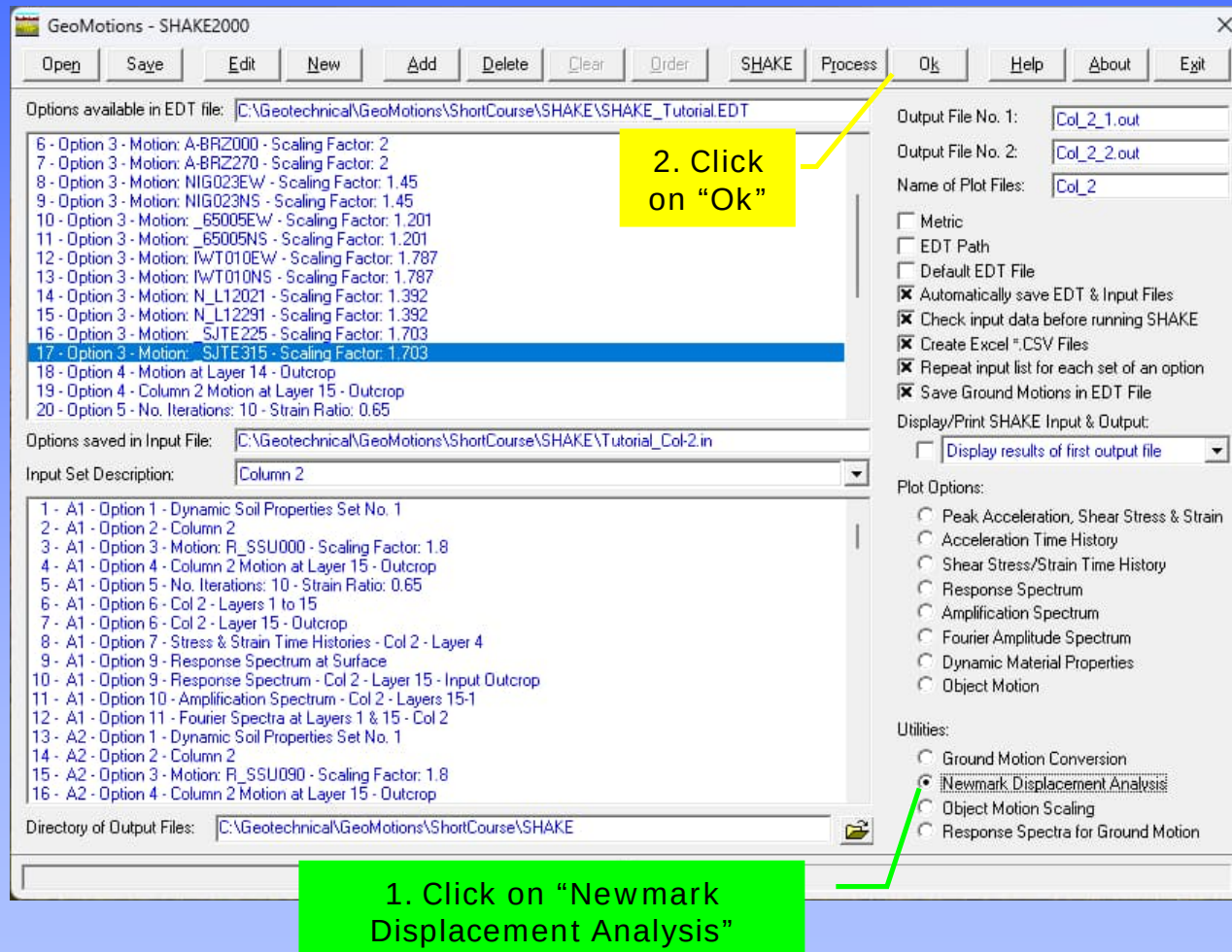
Maximum: Average: Minimum:

Displacement File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Tutorial.csv

1. Click on
"Close"

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Yield Acceleration (in g's):

☒ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☐ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): File

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All Reversal

Displacement Results:

Maximum: Average: Minimum:

Displacement File:

1. Click on
"File"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

1. Click on "Other"

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:  

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File:  For layers to 

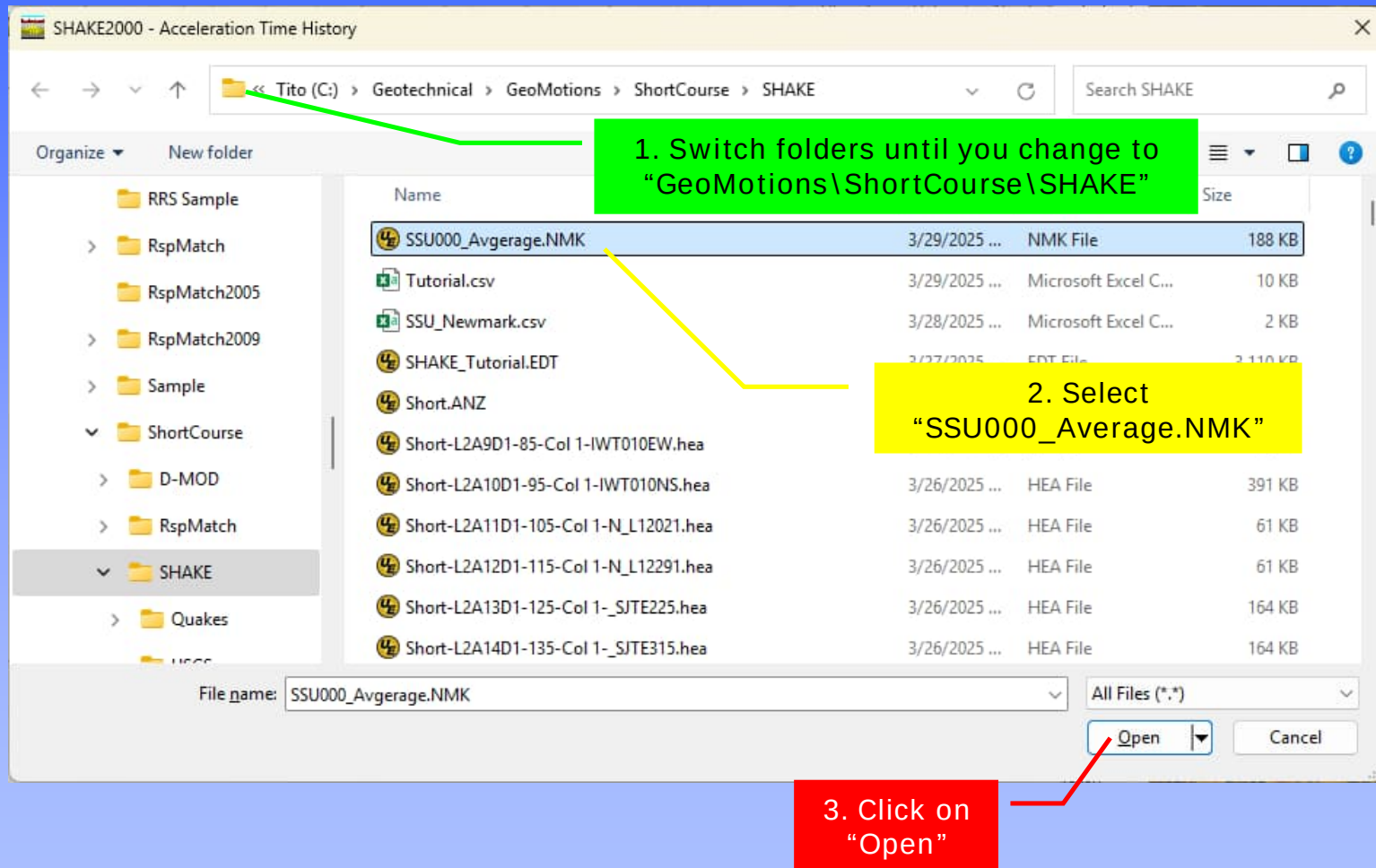
☐ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File: For layers to

☐ Other Acceleration Time History:

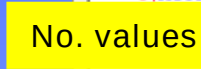
☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
					g's

1. Click on
"View"

Site Specific Response Analysis

Newmark Displacement Analysis – Format Information



Time step

No. header lines

No. columns

No. digits

1. Click on "Close"

Site Specific Response Analysis

Newmark Displacement Analysis – Format Information

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:

Acceleration File: to for deposit and motion

D-MOD2000 Aux-HEA File: For layers to

☒ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
12592	0.005				g's

1. Select check box

2. Enter "12592"

Enter "0.005"

Site Specific Response Analysis

Newmark Displacement Analysis – Format Information

SHAKE2000 - Newmark Displacement Ground Motion File

Ok Choose Other None Save Motion View Help Close

Weighted motion description:

Weighted average accelerogram file:

File Name & Path	File No.	Column Weight	No. Values	Time Step	No. Header	Values per Line	No. Digits	Group
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								
☐ (Click Choose to select a file)								

SHAKE2000 ANZ File:

Acceleration File: ☐ AHL or ☒ HEA for layers to for deposit and motion

D-MOD2000 Aux-HEA File:

☒ Other Acceleration Time History:

☐ Free Format

No. Values	Time Step	No. Header	Values/Line	No. Digits	Units
12592	0.005	3	8	15	g's

4. Click on
"Ok"

1. Enter "3"

2. Enter "8"

Enter "15"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Yield Acceleration (in g/s):

- ☒ Constant acceleration: 0.10
- ☐ Changes with time: [] Edit
- ☐ Changes with displacement: [] Edit
- ☐ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g/s): [h:\hcnal\GeoMotions\ShortCourse\SHAKE\SSU000_Average.NMK] File

[] Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): .3415114 Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

- ☒ Matasovic et al.
- ☐ Franklin & Chang

Plot: All [] Reversal

Displacement Results:

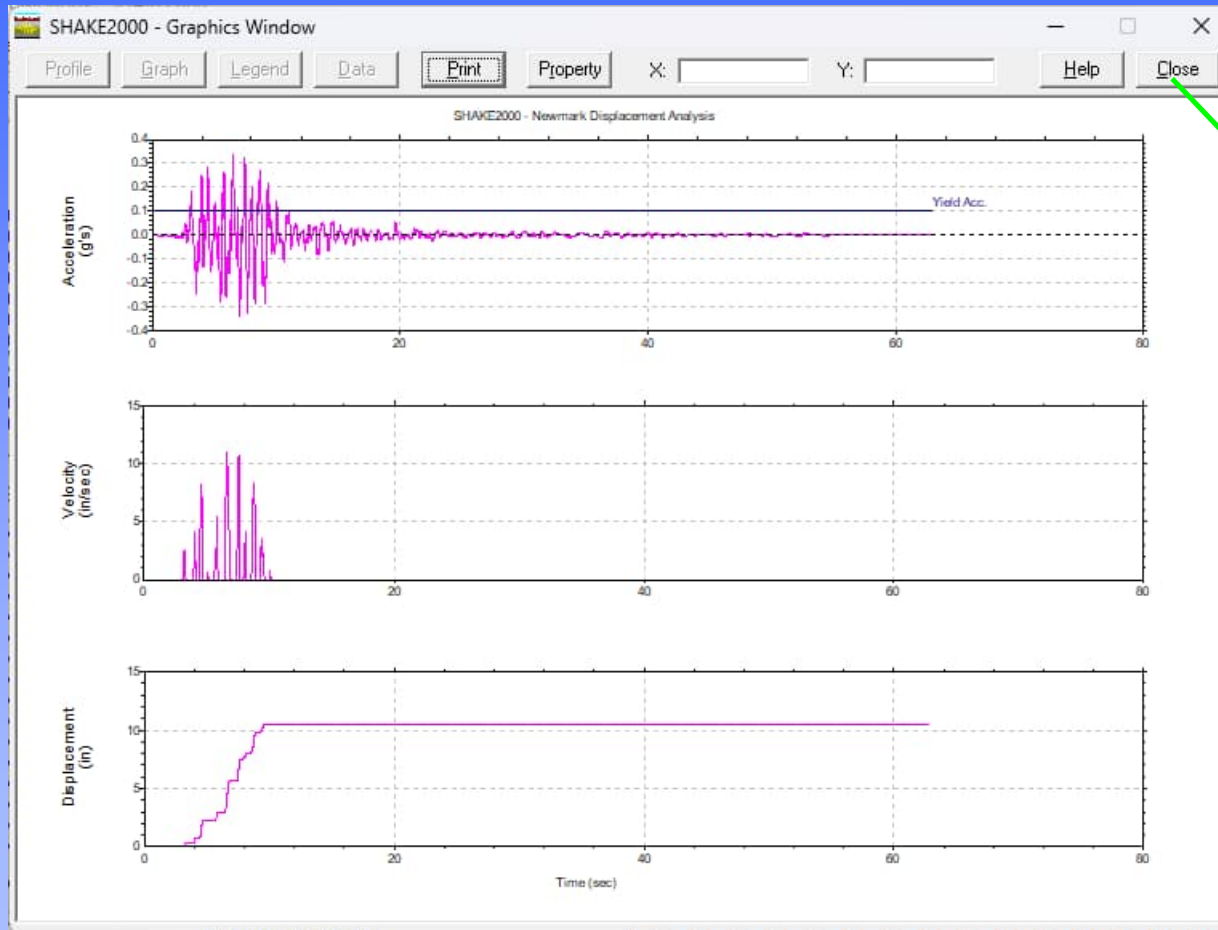
Maximum: 12.93234 in Average: 11.74958 in Minimum: 10.56681 in

Displacement File: []

** The results are computed for the computed motion and the "reversed" motion. Maximum of 12.93234 inches is the same as computed before.

Site Specific Response Analysis

Newmark Displacement Analysis



1. Click on
"Close"

Site Specific Response Analysis

Newmark Displacement Analysis

SHAKE2000 - Newmark Displacement Analysis

Print Plot Save Help Close

Project: SHAKE2000 - Newmark Displacement Analysis

Yield Acceleration (in g's):

☒ Constant acceleration: 0.10

☐ Changes with time: Edit

☐ Changes with displacement: Edit

☐ Displacement vs Ky: Start: 0.05 End: 0.3 Step: 0.01 Ky

Acceleration Time History (g's): technical\GeoMotions\ShortCourse\SHAKE\R_SSU000_Avg.NMK File

0.0 12592 .005 3 8 15

☐ Starting Time (sec): 0 Ending Time (sec): 300

Maximum Acceleration Value (g): .3415114 Acceleration due to Gravity: 386.4 in/sec²

Newmark Method by:

☒ Matasovic et al. ☐ Franklin & Chang Plot: All Reversal

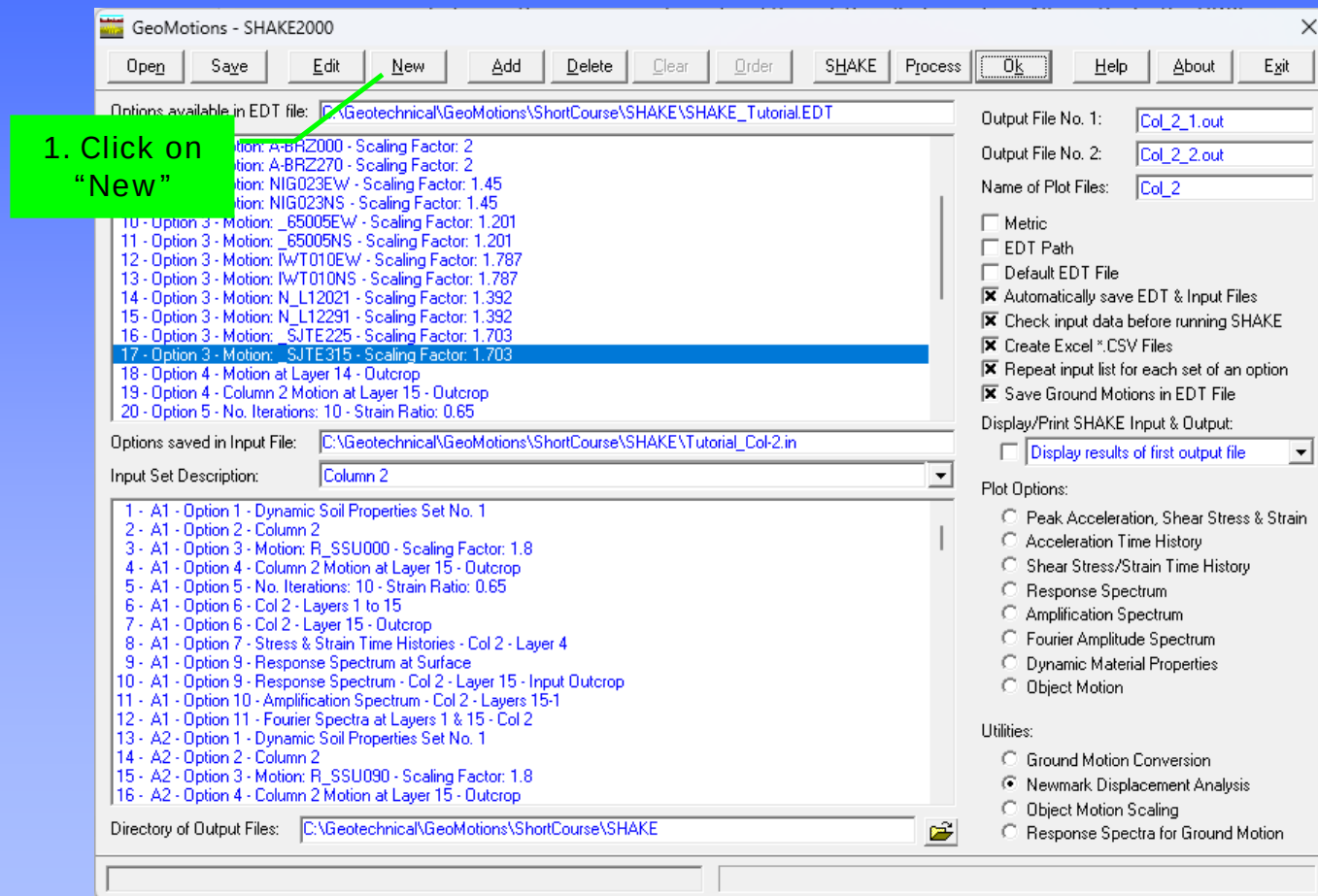
Displacement Results:

Maximum: 12.93234 in Average: 11.74958 in Minimum: 10.56681 in

Displacement File:

1. Click on
"Close"

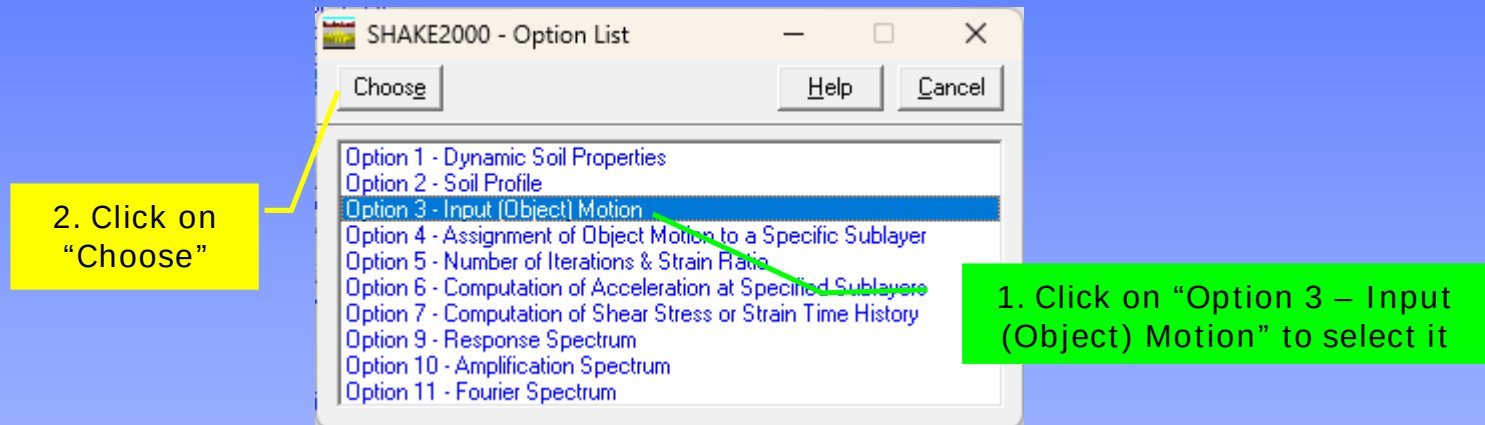
Compare Results from Linearly Scaled Motions with Results from Spectrally Matched Motions



Refer to RspMatchEDT Tutorial for Development of Spectrally Matched Motions Used for this Tutorial

Site Specific Response Analysis

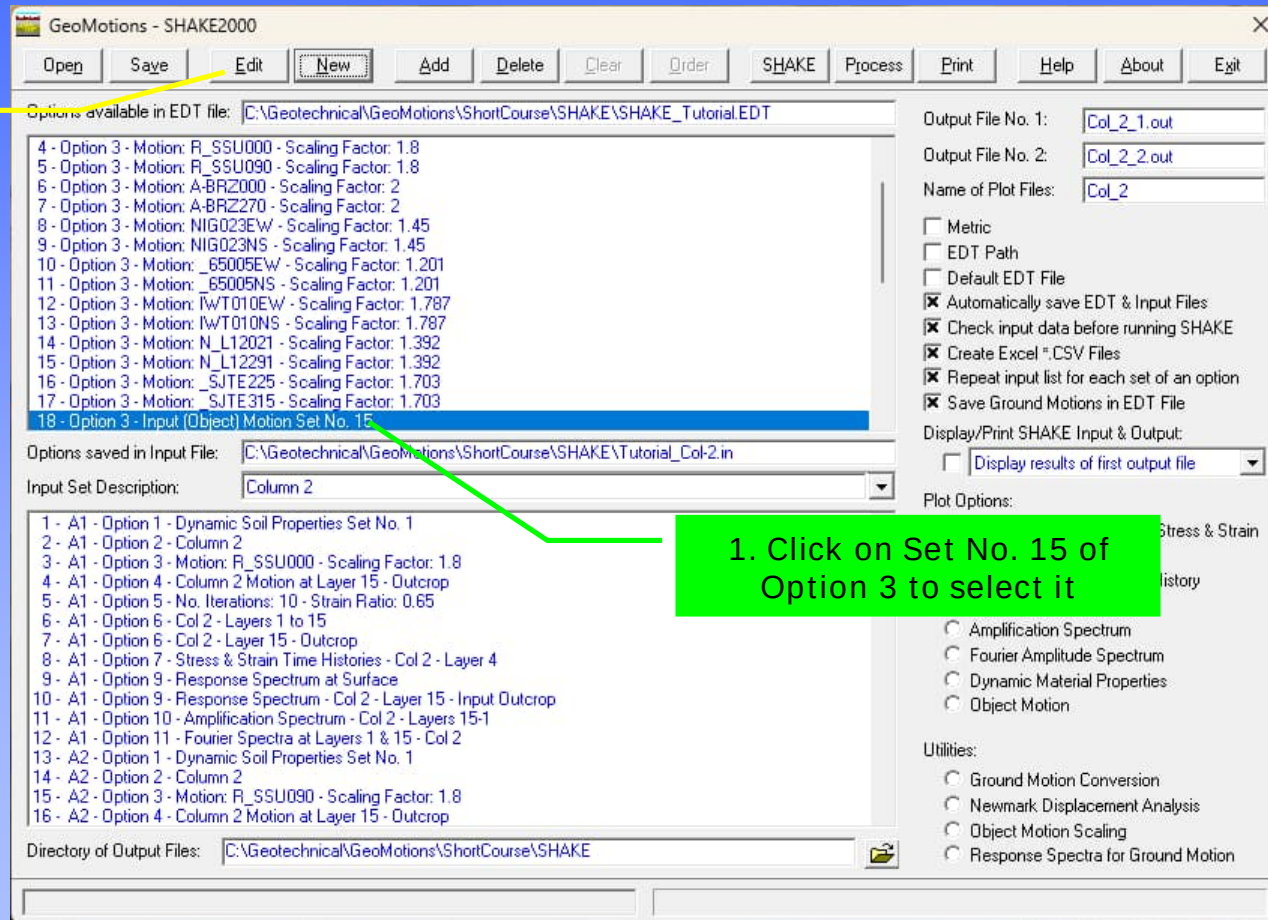
Create Motion Set



Site Specific Response Analysis

Create Option 3 for Spectrally Matched Motion

2. Click on "Edit"



1. Click on Set No. 15 of Option 3 to select it

Site Specific Response Analysis

Create Input Data – Option 3: Input Motion

1. Click on "Convert"

SHAKE2000 - Option 3 Editor: Input (O)

Buttons: Quakes, Other, Convert, Restore, View, Plot, Help, Return

Set No.: 15

Input (Object) Motion - Set Identification: Option 3 - Input (Object) Motion Set No. 15

Acceleration Values:	No. Fourier Values:	Time Interval	Format of Object Motion File	Earthquake Identification
2992	4096	.01	(8f9.6)	TUJ352

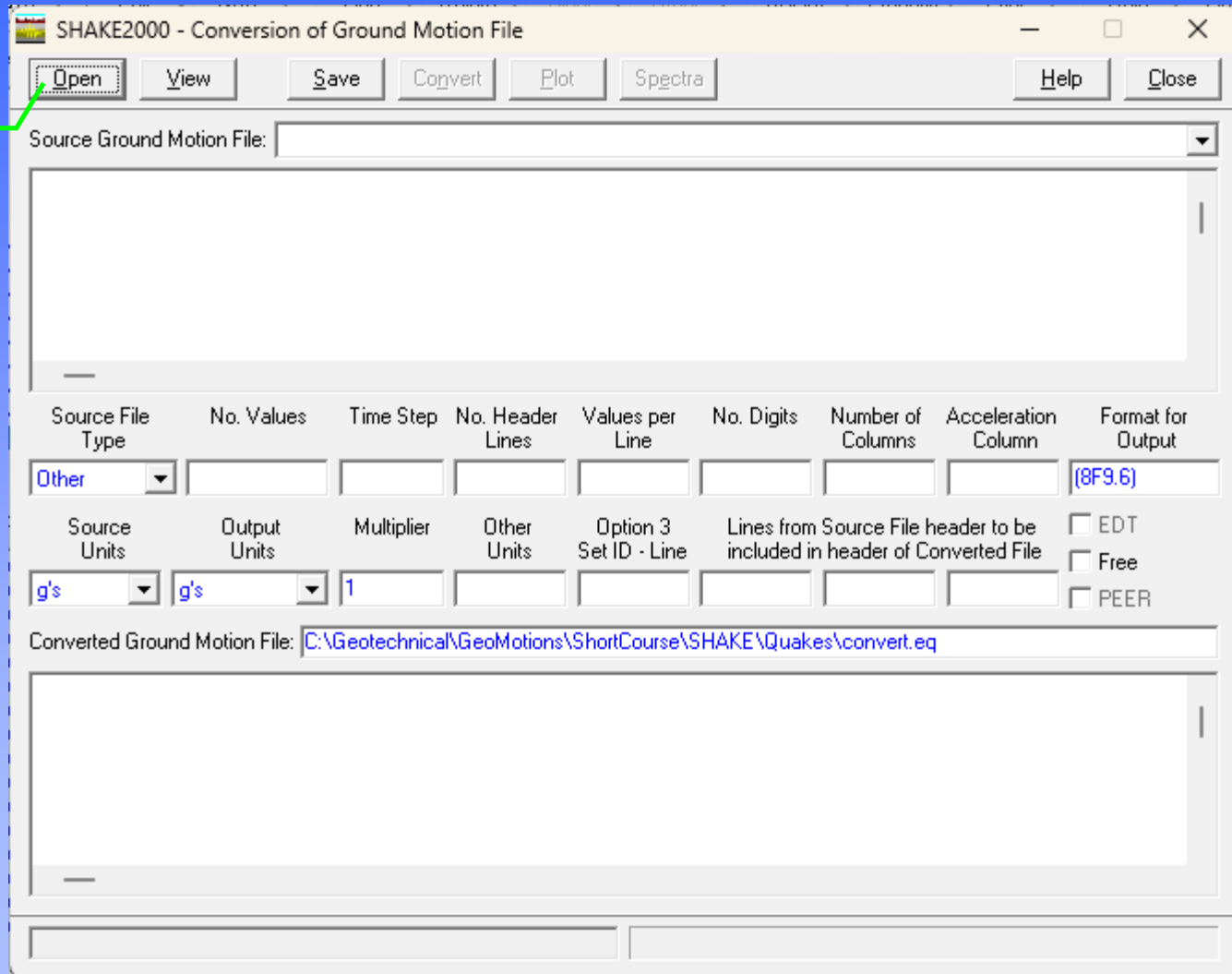
Name and Path of Source Object Motion File:

C:\Geotechnical\GeoMotions\Quakes\SHAKE\Crustal\TUJ352_AT2.eq

Multiplication Factor	Maximum Acceleration	Maximum Frequency	No. Header Lines	Acceleration Values/Line
1		25	8	8

Convert Spectrally Matched Motion File

1. Click on
"Open"



SHAKE2000 - Conversion of Ground Motion File

Open View Save Convert Plot Spectra Help Close

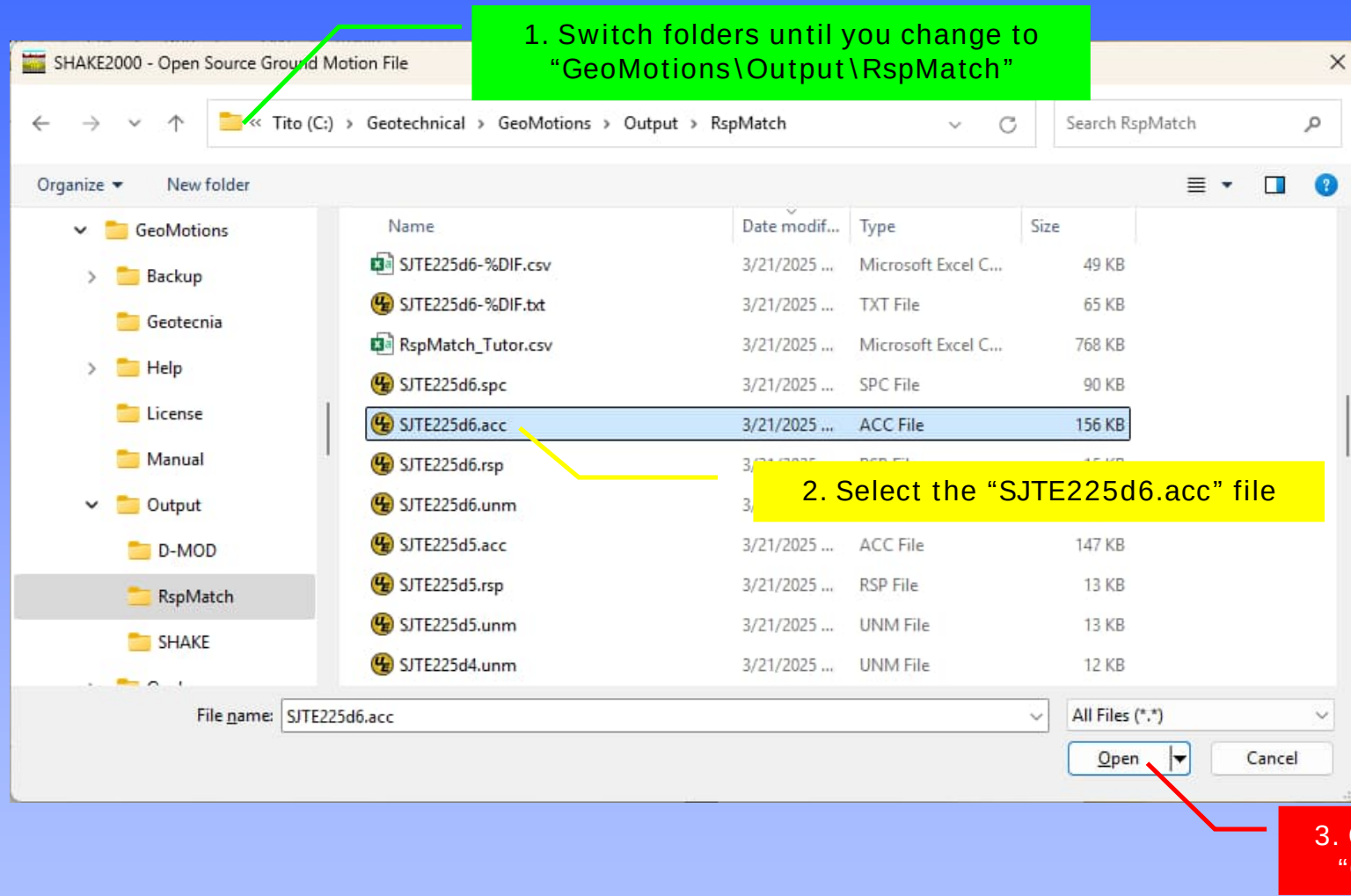
Source Ground Motion File:

Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
Other								(8F9.6)

Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File	☐ EDT	☐ Free	☐ PEER
g's	g's	1						

Converted Ground Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\convert.eq

Open Spectrally Matched Acceleration File



Choose path and name of converted file

SHAKE2000 - Conversion of Ground Motion File

Open View **Save** Convert Plot Spectra Help Close

1. Click on "Save"

File: C:\Geotechnical\GeoMotions\Output\RspMatch\SJTE225d6.acc

story matched to spectrum: C:\Geotechnical\GeoMotions\Output\RspMatch\RspT

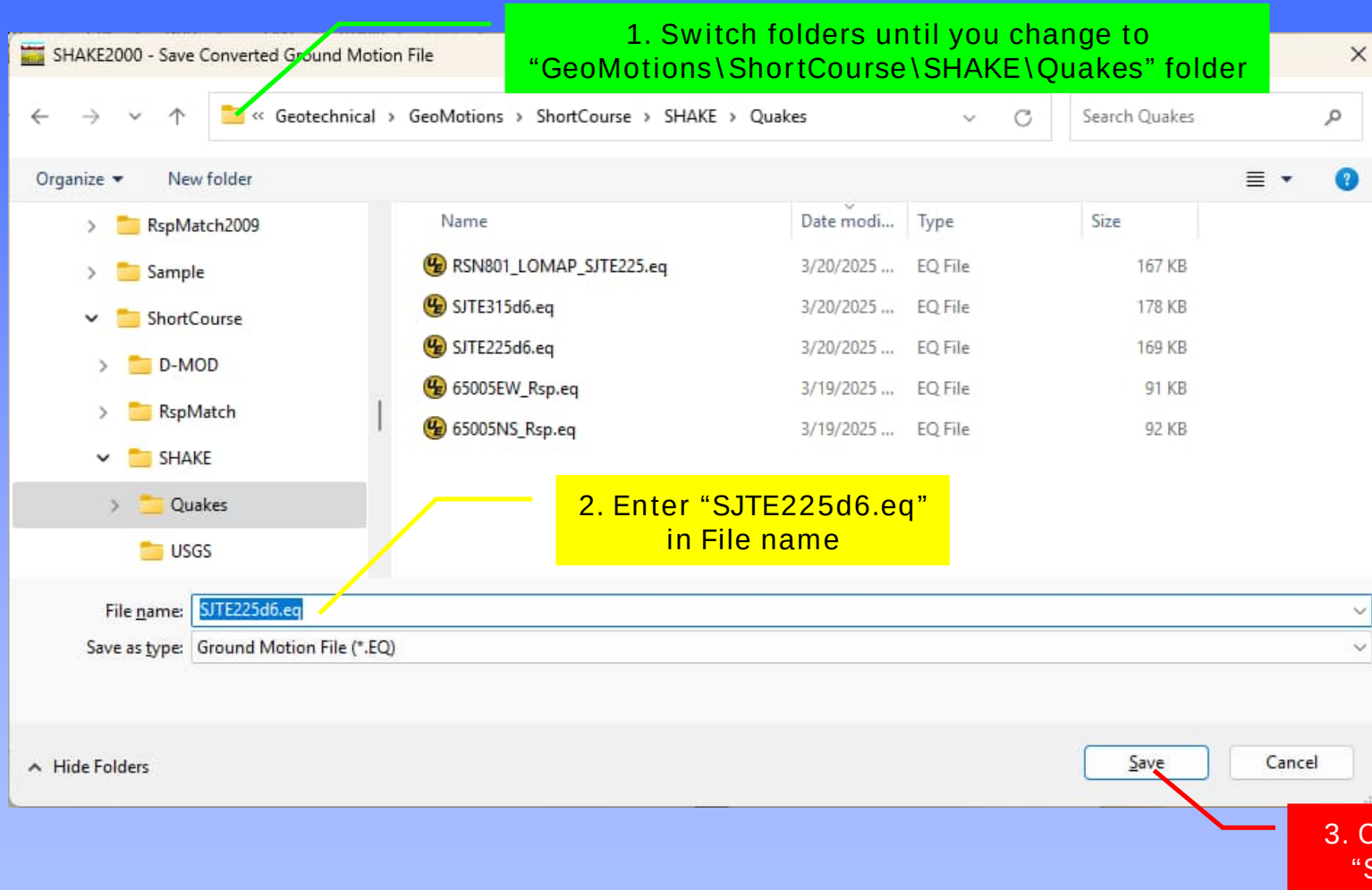
2	11051	0.0050	1055						
3	0.40786E-07	0.45746E-07	0.50728E-07	0.55730E-07	0.60755E-07				
4	0.65798E-07	0.70864E-07	0.75950E-07	0.81056E-07	0.86181E-07				
5	0.91328E-07	0.96492E-07	0.10168E-06	0.10688E-06	0.11210E-06				
6	0.11734E-06	0.12260E-06	0.12788E-06	0.13317E-06	0.13849E-06				
7	0.14382E-06	0.14916E-06	0.15453E-06	0.15991E-06	0.16530E-06				
8	0.17071E-06	0.17614E-06	0.18159E-06	0.18705E-06	0.19252E-06				

Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
RspMatch			2					(6F15.8)

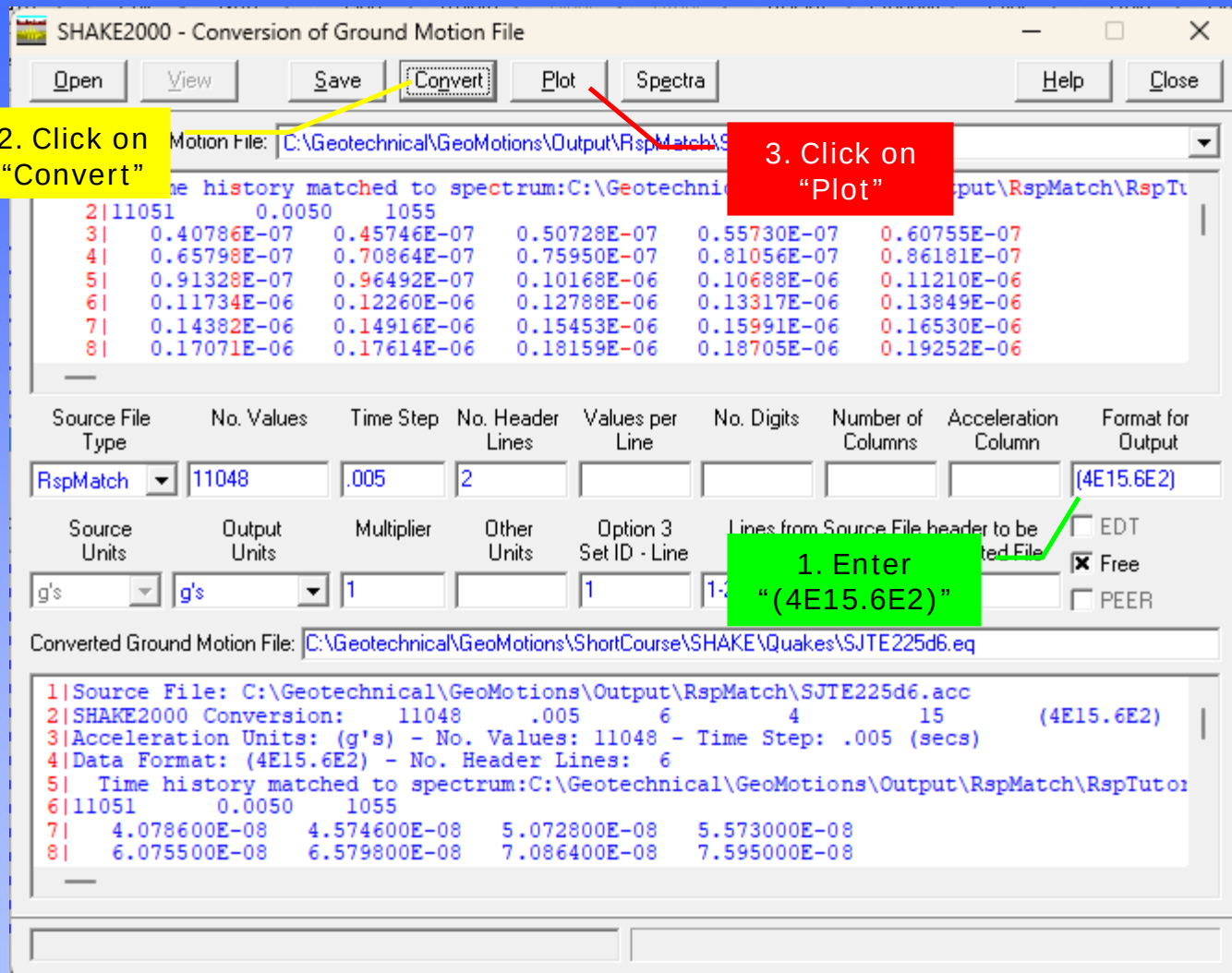
Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File	☐ EDT	☒ Free	☐ PEER
g's	g's	1		1	1-2			

Converted Ground Motion File: C:\Geotechnical\GeoMotions\Output\RspMatch\SJTE225d6.eq

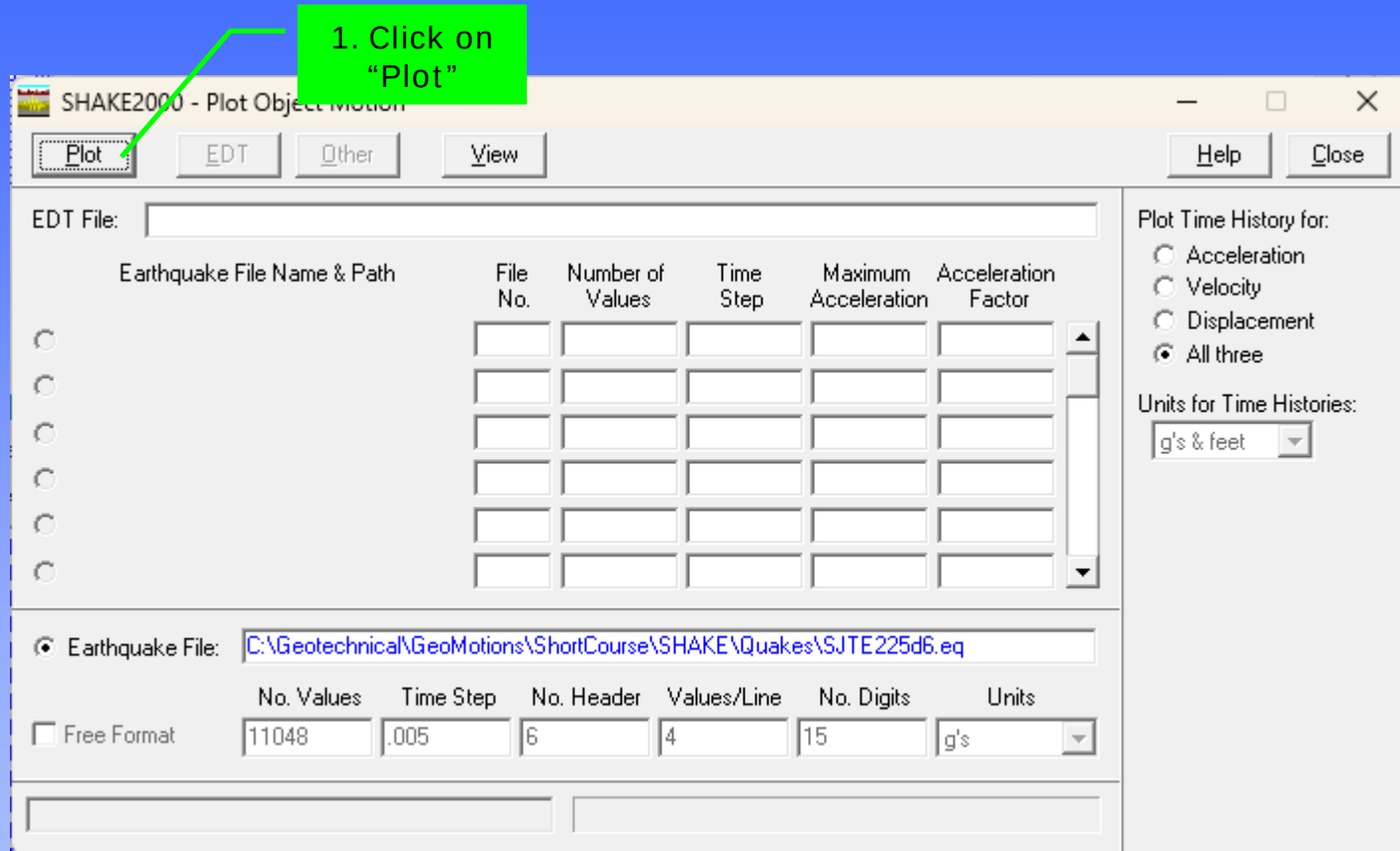
Choose path and name of converted file



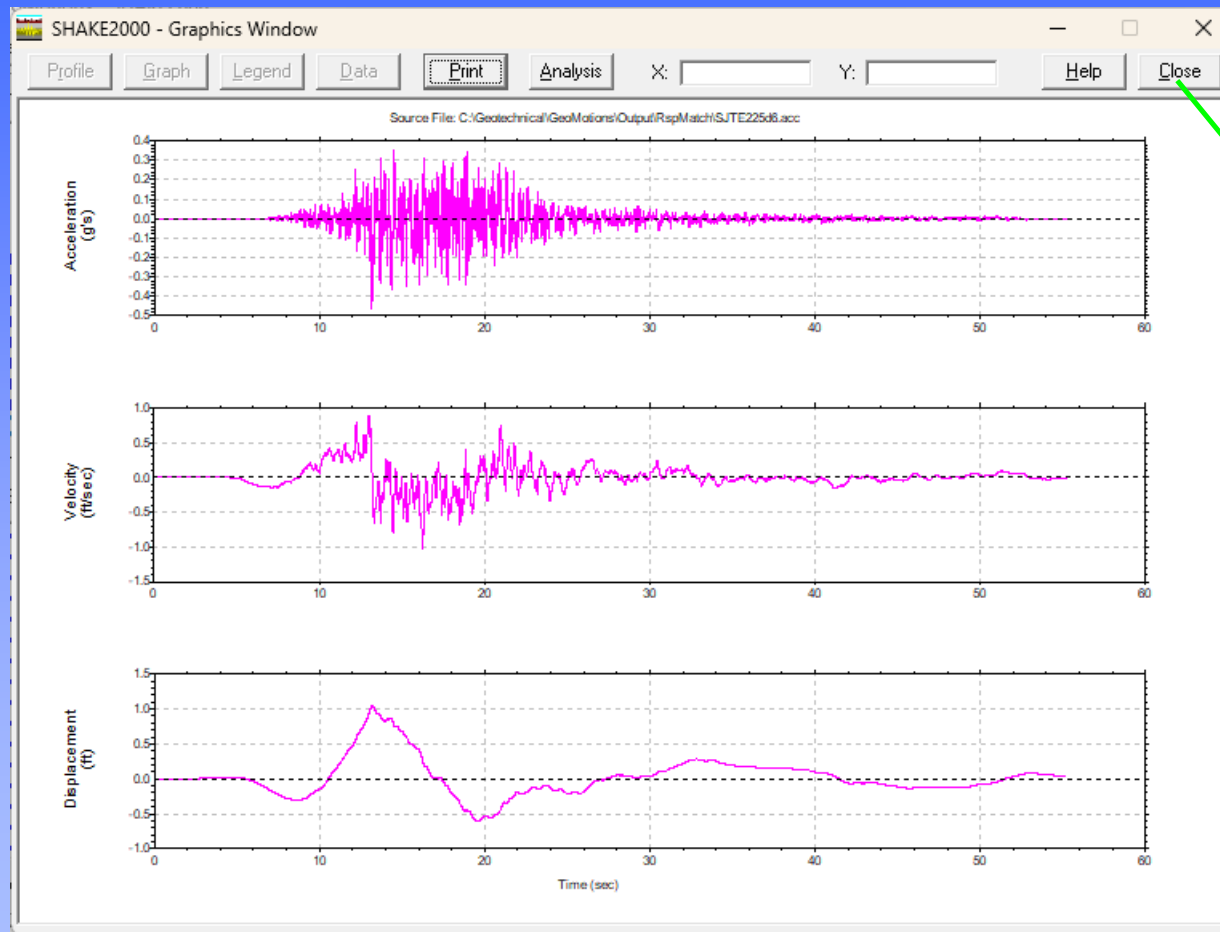
Convert Spectrally Matched Motion



Plot Converted File to Check Conversion

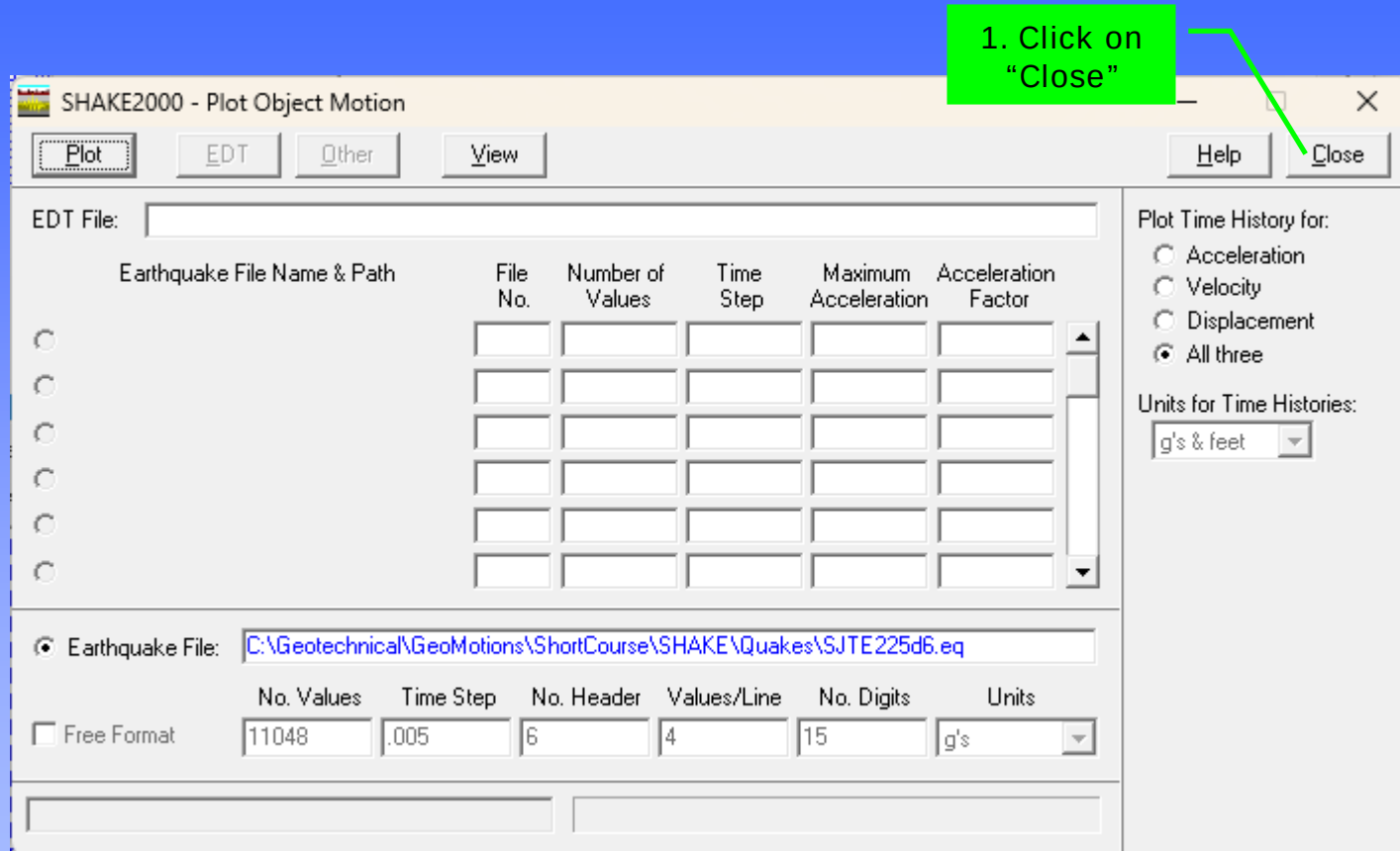


Acceleration, Velocity, and Displacement Time Histories for Converted Input Ground Motion File



1. Click on
"Close"

Plot Converted File to Check Conversion



Create Spectrally Matched Option 3 File

SHAKE2000 - Conversion of Ground Motion File

Open View Save Convert Plot Spectra Help Close

Source Ground Motion File: C:\Geotechnical\GeoMotions\Output\RspMatch\SJTE225d6.acc

1. Click on "Close"

```

1| Time history matched to spectrum:C:\Geotechnical\GeoMotions\Output\RspMatch\RspTuto
2| 11051      0.0050      1055
3| 0.40786E-07 0.45746E-07 0.50728E-07 0.55730E-07 0.60755E-07
4| 0.65798E-07 0.70864E-07 0.75950E-07 0.81056E-07 0.86181E-07
5| 0.91328E-07 0.96492E-07 0.10168E-06 0.10688E-06 0.11210E-06
6| 0.11734E-06 0.12260E-06 0.12788E-06 0.13317E-06 0.13849E-06
7| 0.14382E-06 0.14916E-06 0.15453E-06 0.15991E-06 0.16530E-06
8| 0.17071E-06 0.17614E-06 0.18159E-06 0.18705E-06 0.19252E-06
    
```

Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
RspMatch	11048	.005	2					(4E15.6E2)

Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File	EDT	Free	PEER
g's	g's	1		1	1-2	☐	☒	☐

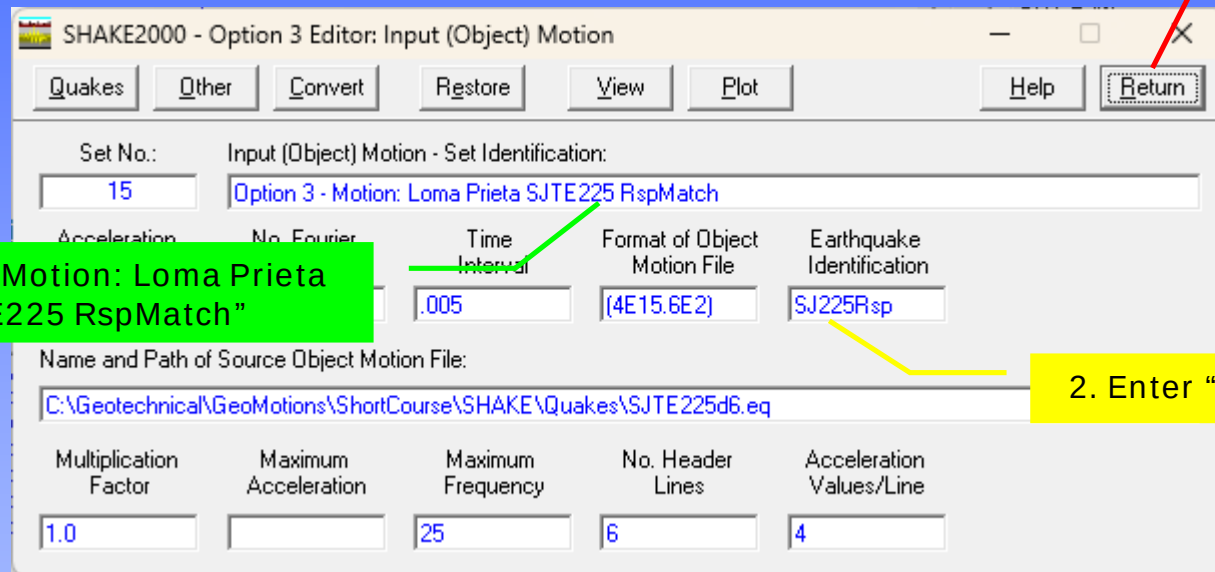
Converted Ground Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\SJTE225d6.eq

```

1| Source File: C:\Geotechnical\GeoMotions\Output\RspMatch\SJTE225d6.acc
2| SHAKE2000 Conversion: 11048 .005 6 4 15 (4E15.6E2)
3| Acceleration Units: (g's) - No. Values: 11048 - Time Step: .005 (secs)
4| Data Format: (4E15.6E2) - No. Header Lines: 6
5| Time history matched to spectrum:C:\Geotechnical\GeoMotions\Output\RspMatch\RspTuto
6| 11051      0.0050      1055
7| 4.078600E-08 4.574600E-08 5.072800E-08 5.573000E-08
8| 6.075500E-08 6.579800E-08 7.086400E-08 7.595000E-08
    
```


Site Specific Response Analysis

Create Input Data – Option 3: Input Motion



SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 15 Input (Object) Motion - Set Identification: Option 3 - Motion: Loma Prieta SJTE225 RspMatch

Acceleration No. Fourier Time Interval .005 Format of Object Motion File ((4E15.6E2)) Earthquake Identification SJ225Rsp

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\SJTE225d6.eq

Multiplication Factor	Maximum Acceleration	Maximum Frequency	No. Header Lines	Acceleration Values/Line
1.0		25	6	4

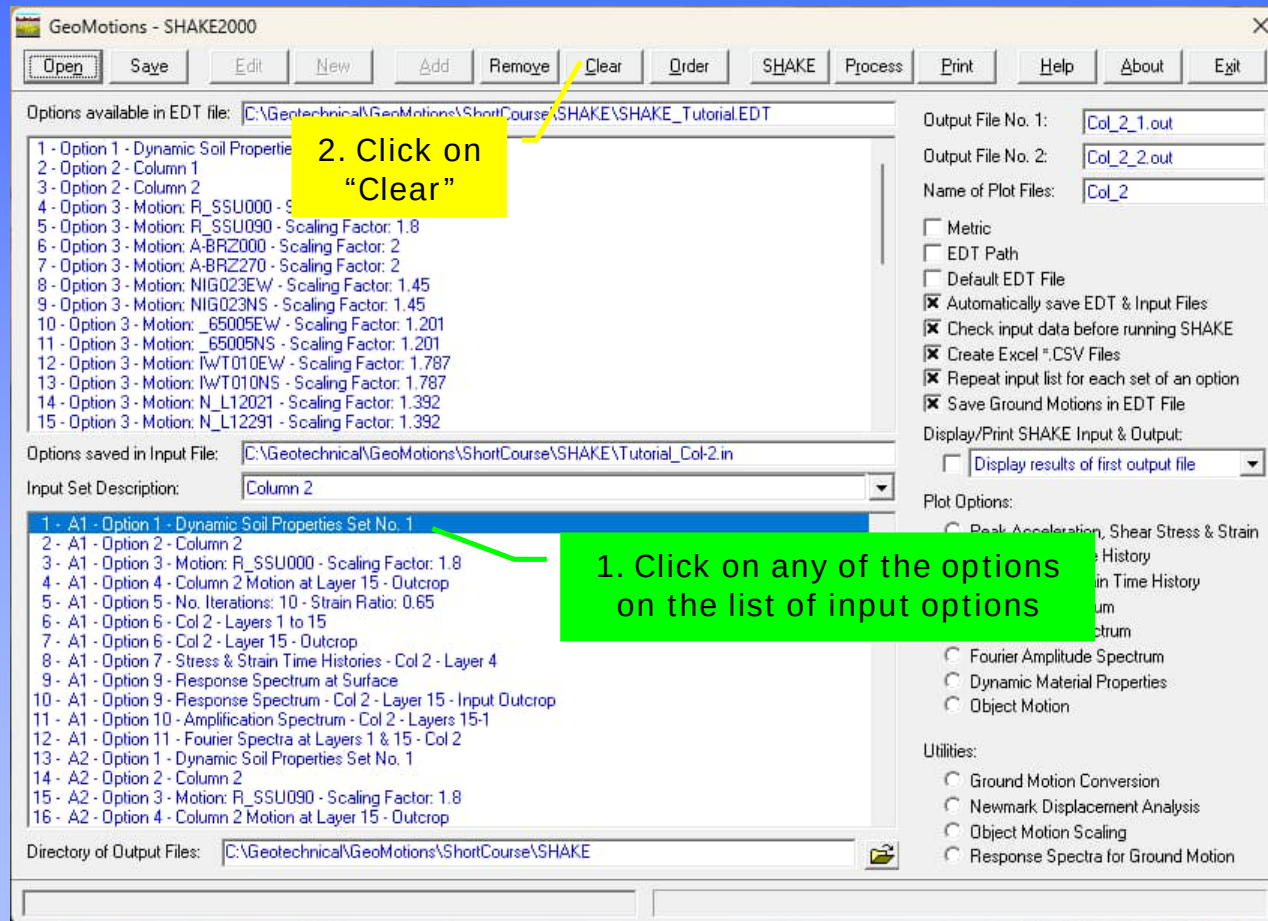
1. Enter "Motion: Loma Prieta SJTE225 RspMatch"

2. Enter "SJ225Rsp"

3. Click on "Return"

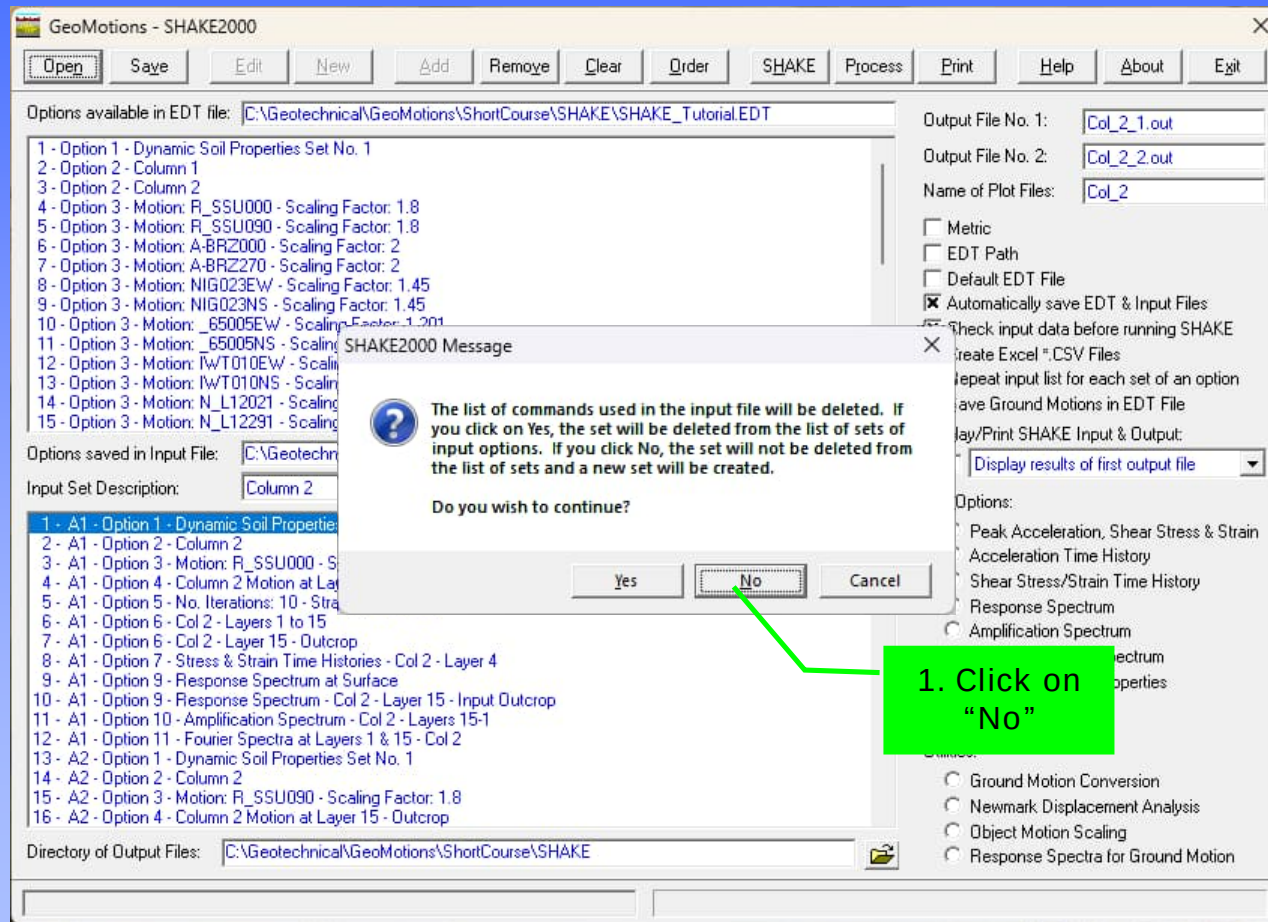
Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



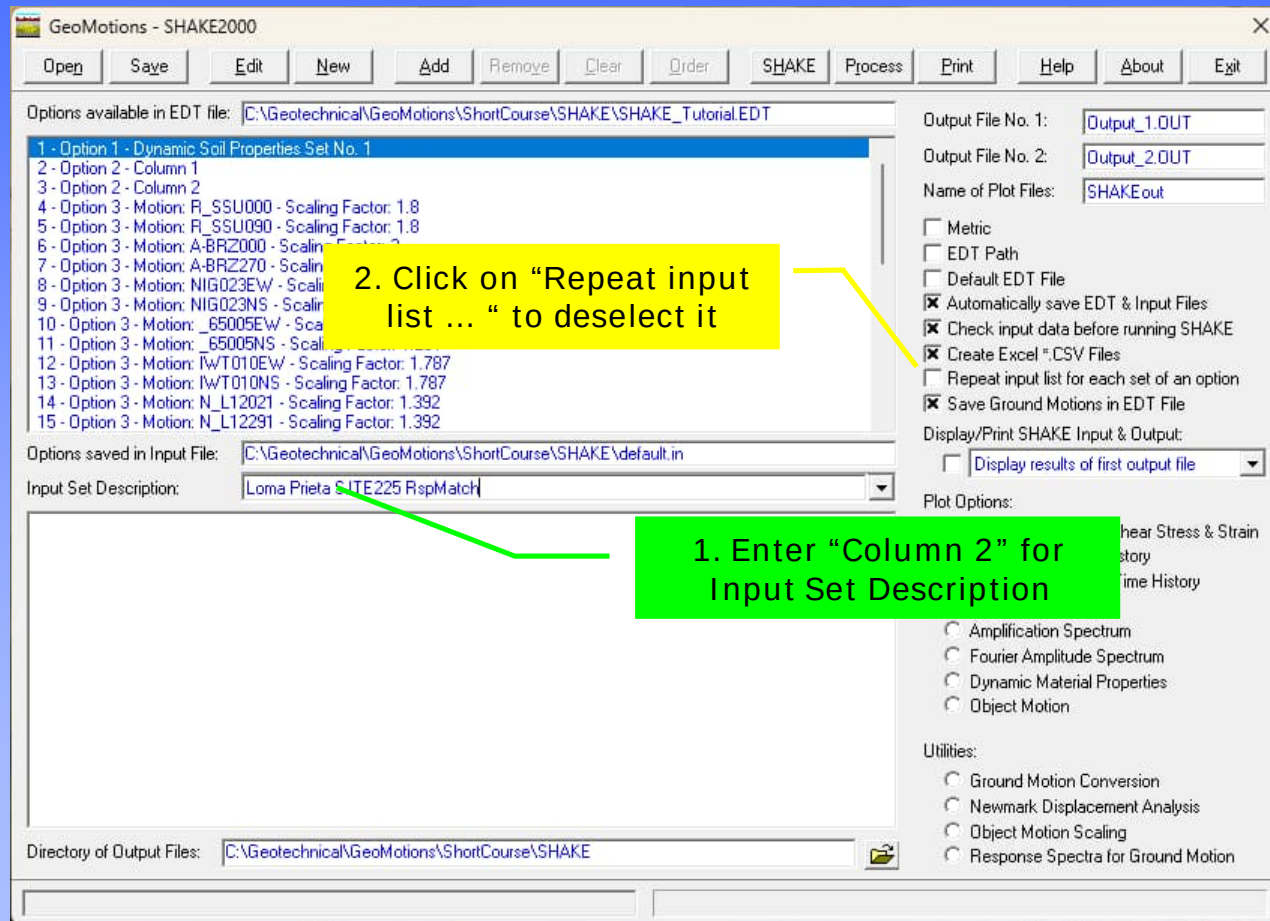
Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

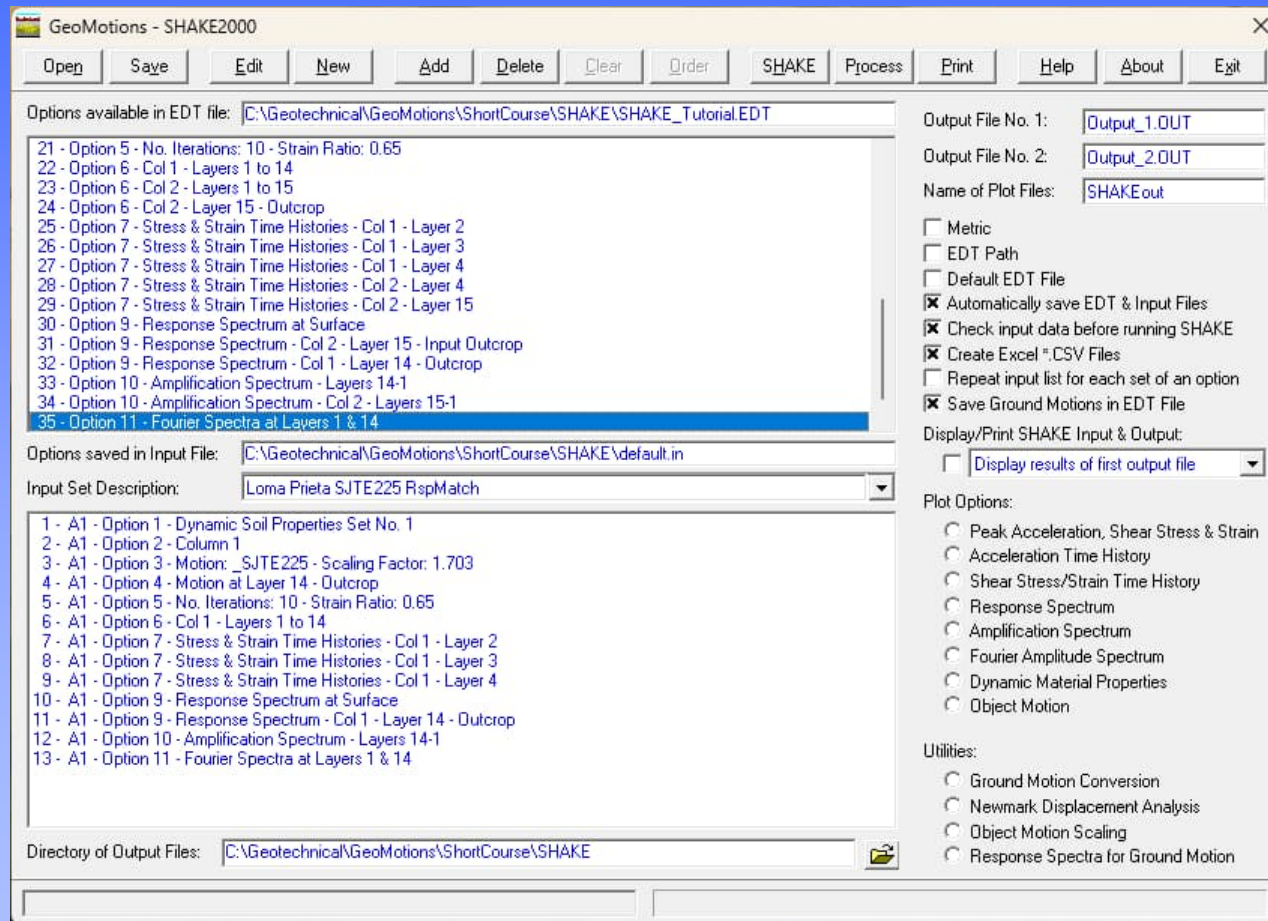
Create List of Input Options for Spectrally Match Comparison

Add the following options to input file list:

Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
2	Option 2 – Column 1
16	Option 3 – Motion: _SJTE225 – Scaling Factor 1.703
19	Option 4 – Motion at Layer 14 Outcrop
21	Option 5 – No. of Iterations: 10 – Strain Ratio: 0.65
22	Option 6 – Col 1 – Layers 1 to 14
25	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
26	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
27	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
30	Option 9 – Response Spectrum at Surface
32	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
33	Option 10 – Amplification Spectrum – Layers 14-1
35	Option 11 – Fourier Spectra at Layers 1 & 14

Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison

Add options to create analyses for :

SHAKE Column

Col 1

Col 2

Col 2

Ground Motion

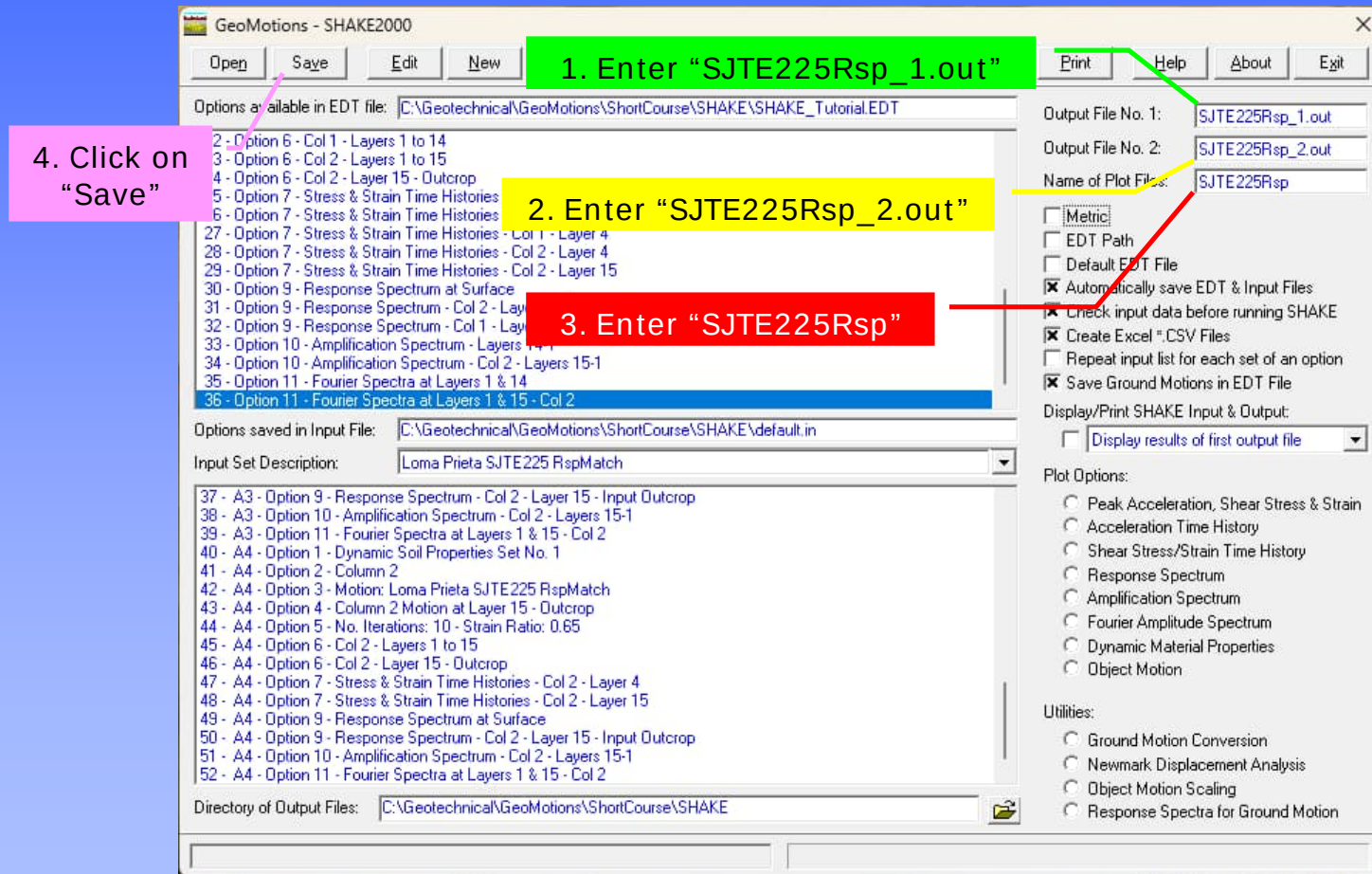
SJTE225 RspMatch

_SJTE225 Saling Factor: 1.703

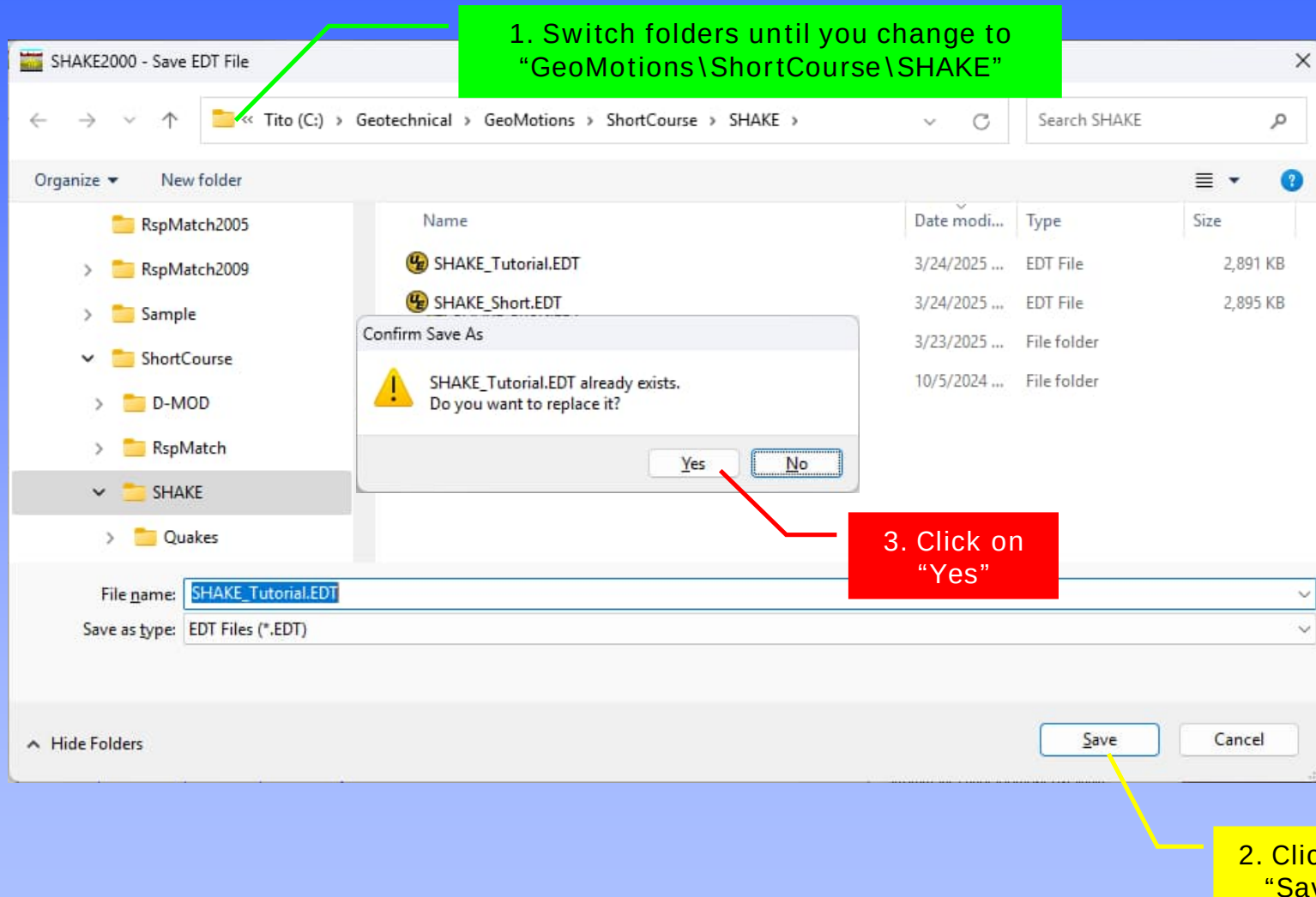
SJTE225 RspMatch

Site Specific Response Analysis

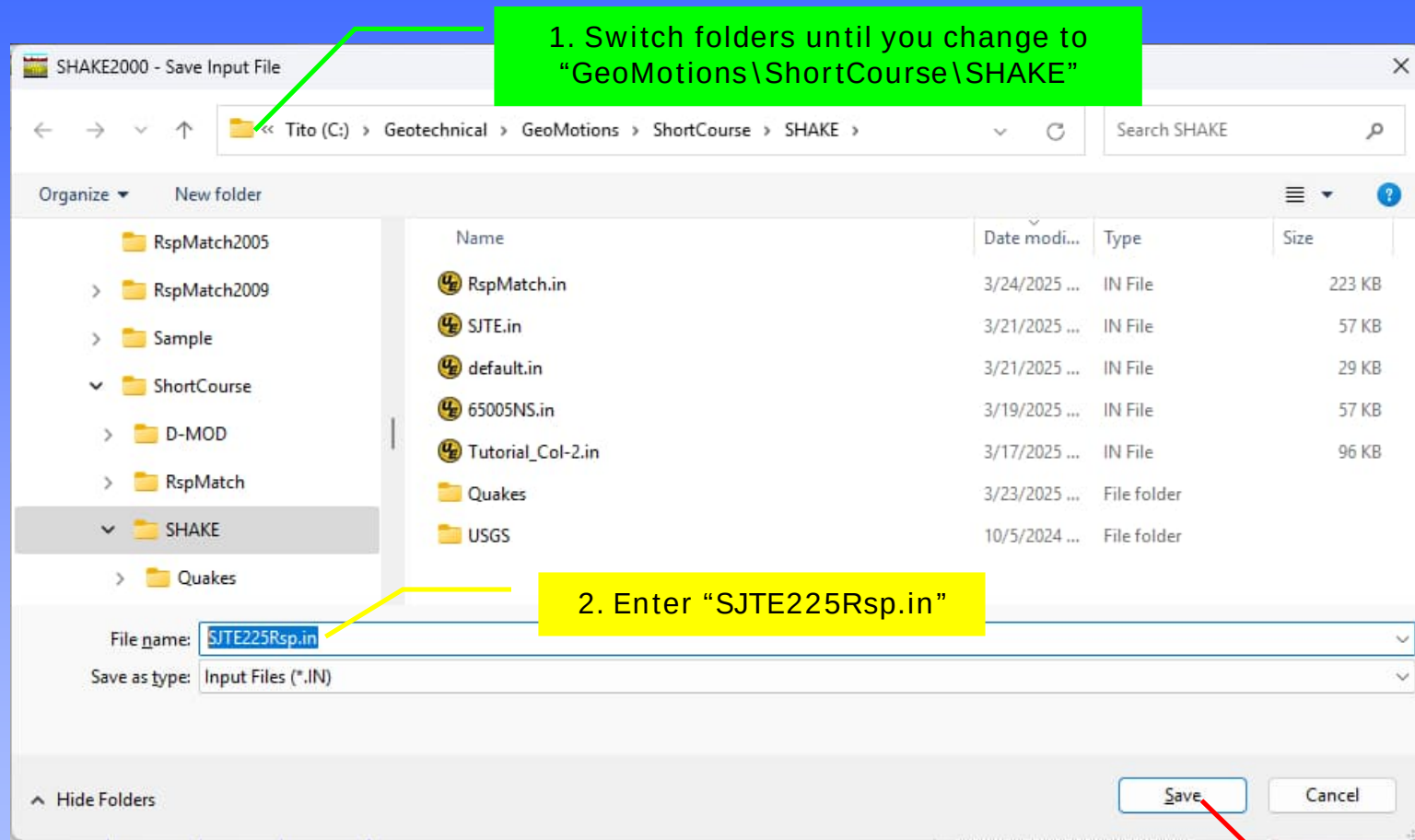
Rename SHAKE's Output Files and Plot Files



Save EDT File

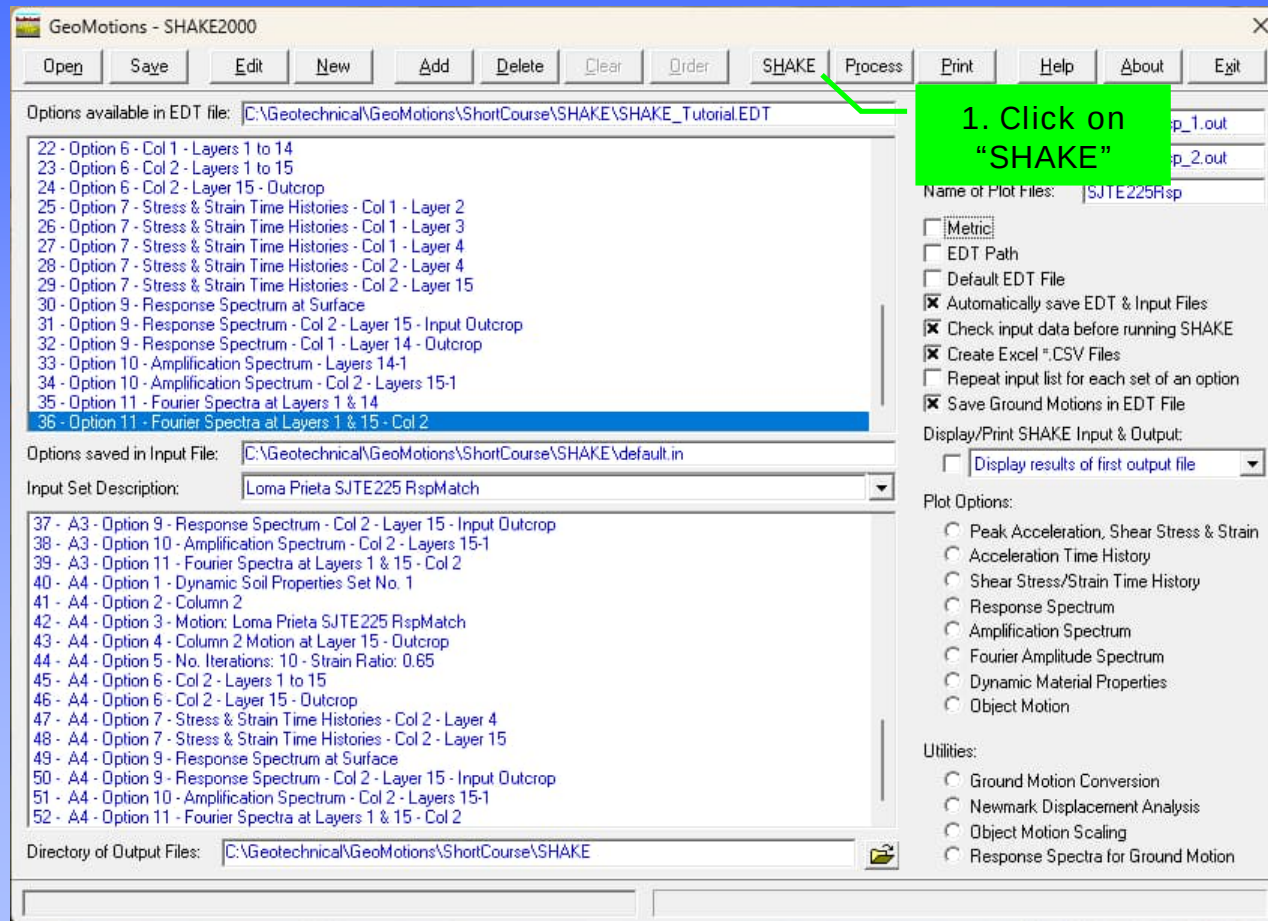


Save Input File



Site Specific Response Analysis

Execute SHAKE



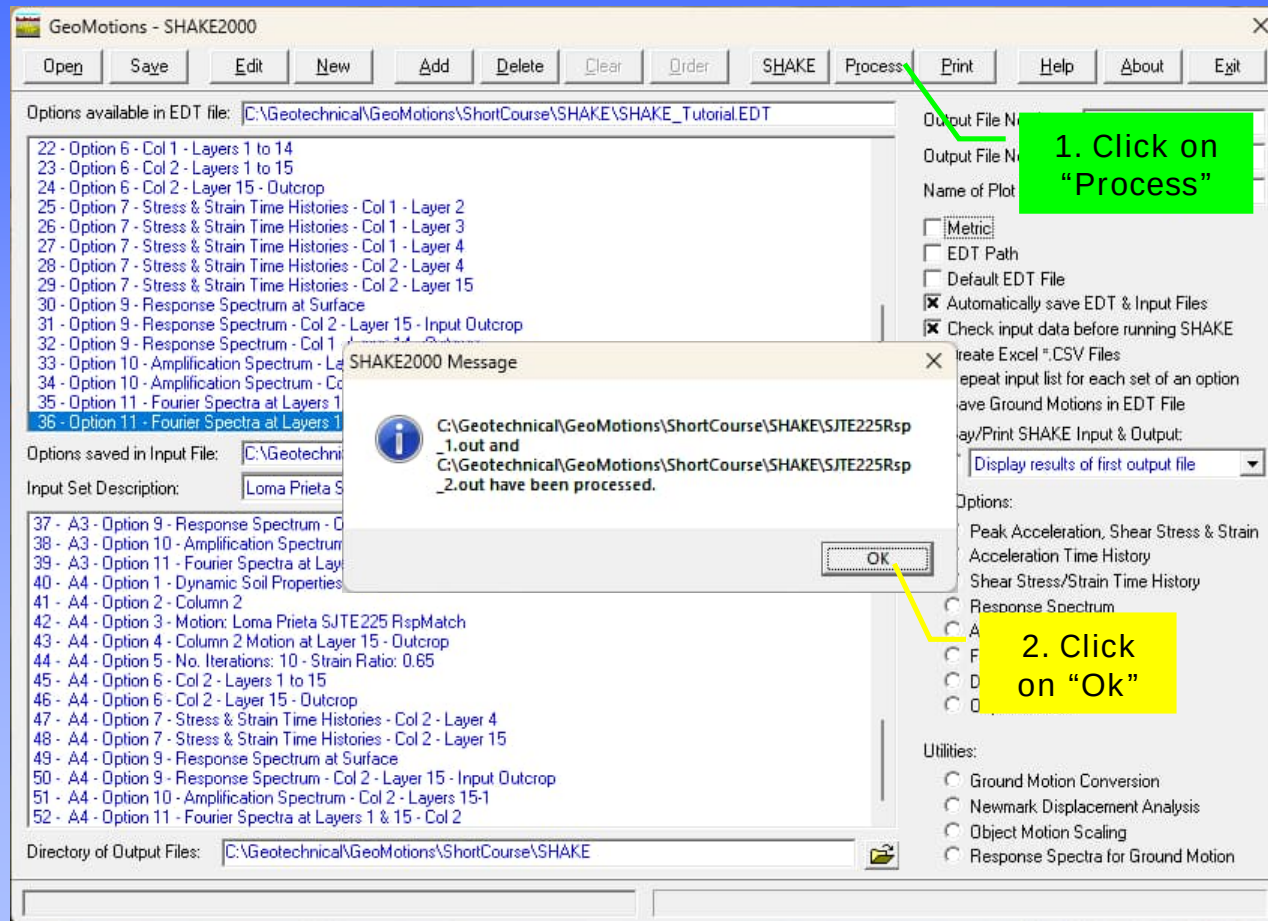
Site Specific Response Analysis

Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v
*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified*
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   ponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE 3/15/2025 *
*   RUN TIME 16:40 *
*****
```

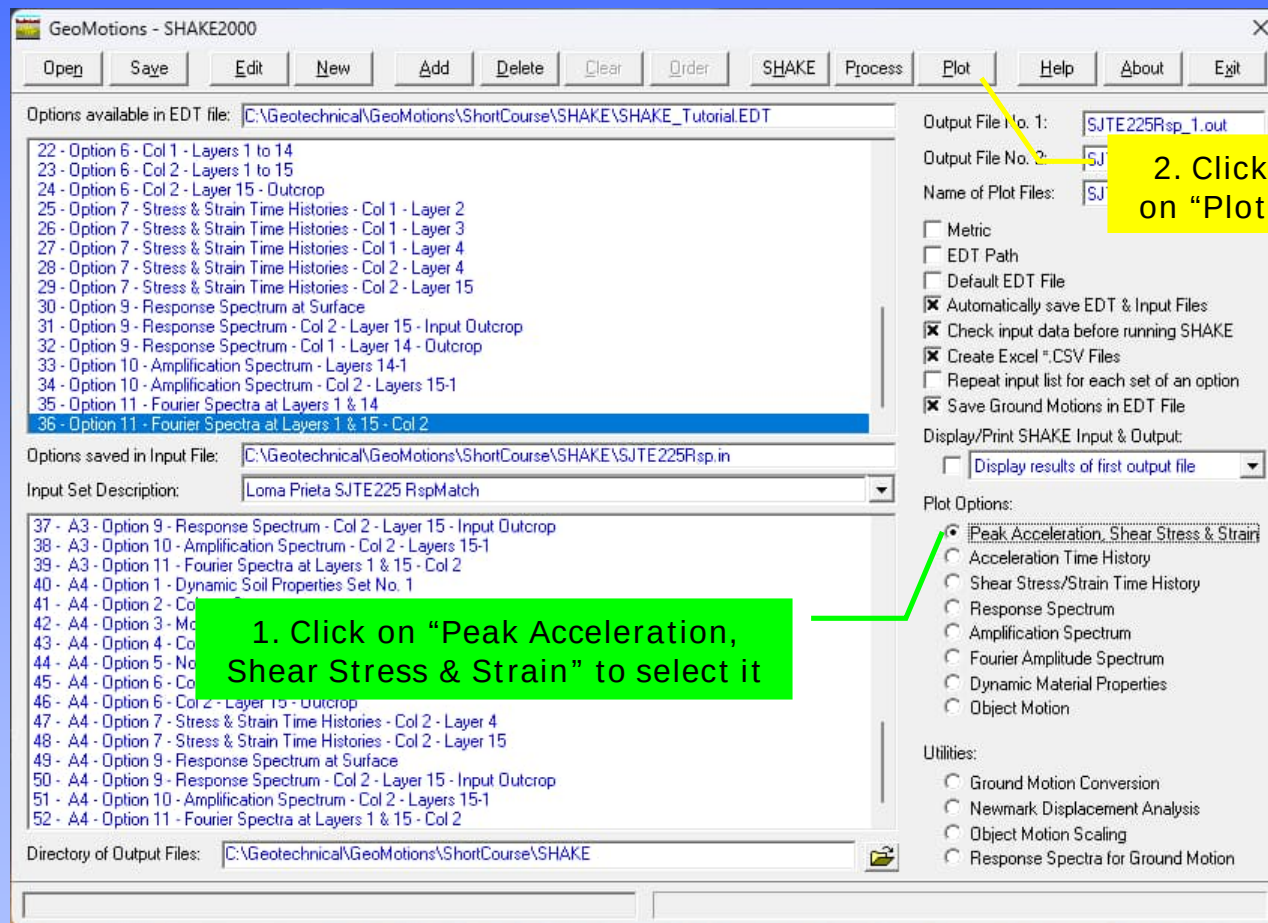
Site Specific Response Analysis

Process SHAKE's Output Files



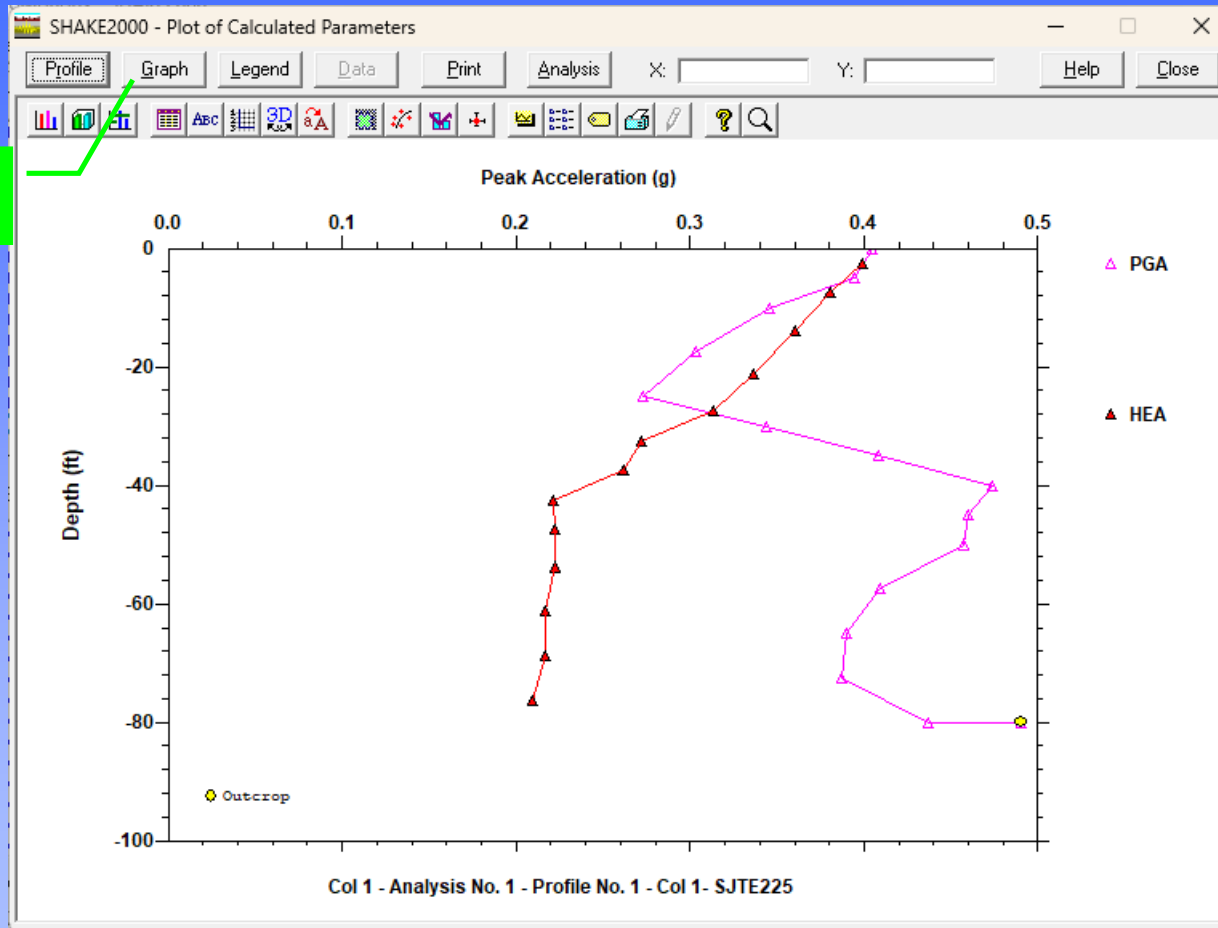
Site Specific Response Analysis

Plot Results



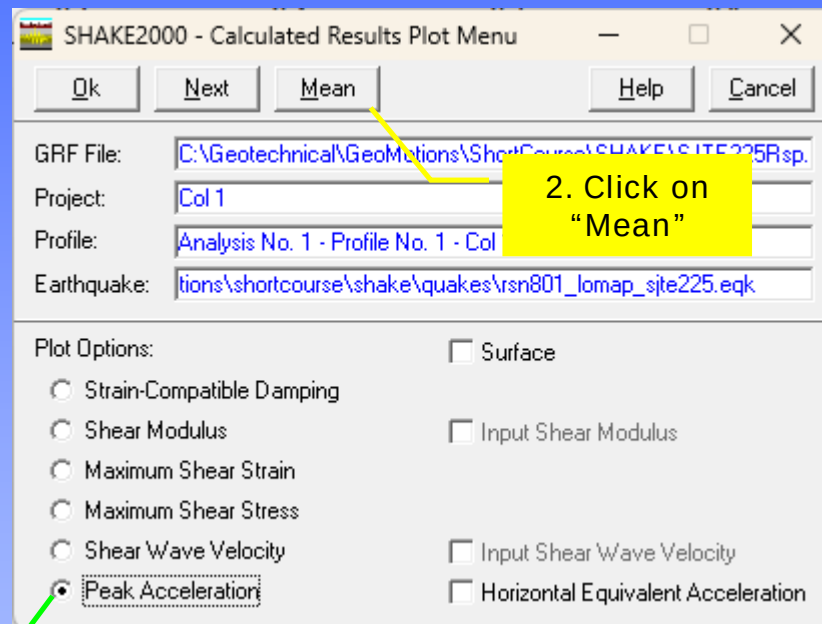
Site Specific Response Analysis Plot Results

1. Click on
“Graph”



** The “Outcrop” symbol (i.e., a yellow circle) is not shown for the surface values, only for those layers denoted as outcrop in Option 6, other than layer number 1.

Site Specific Response Analysis Plot Results

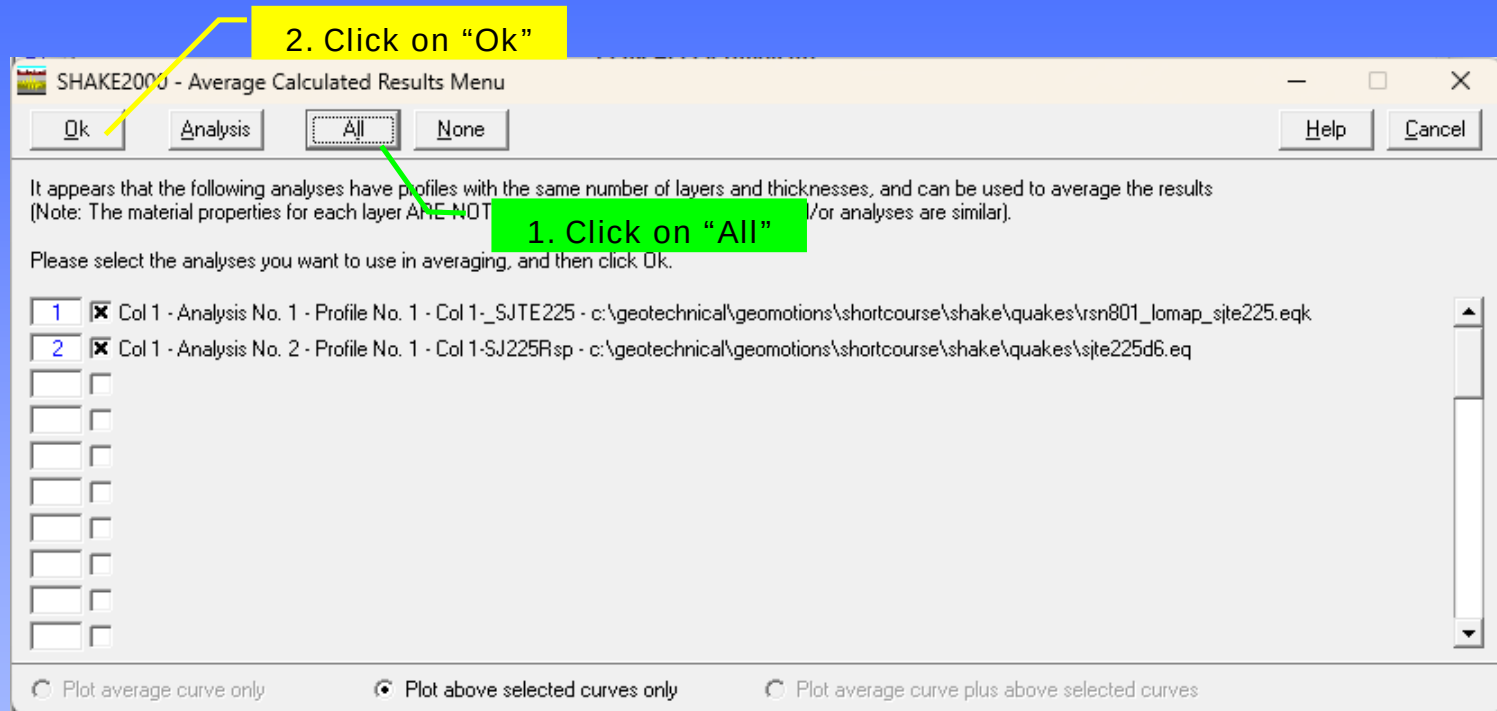


1. Click on "Peak Acceleration" to select it

2. Click on "Mean"

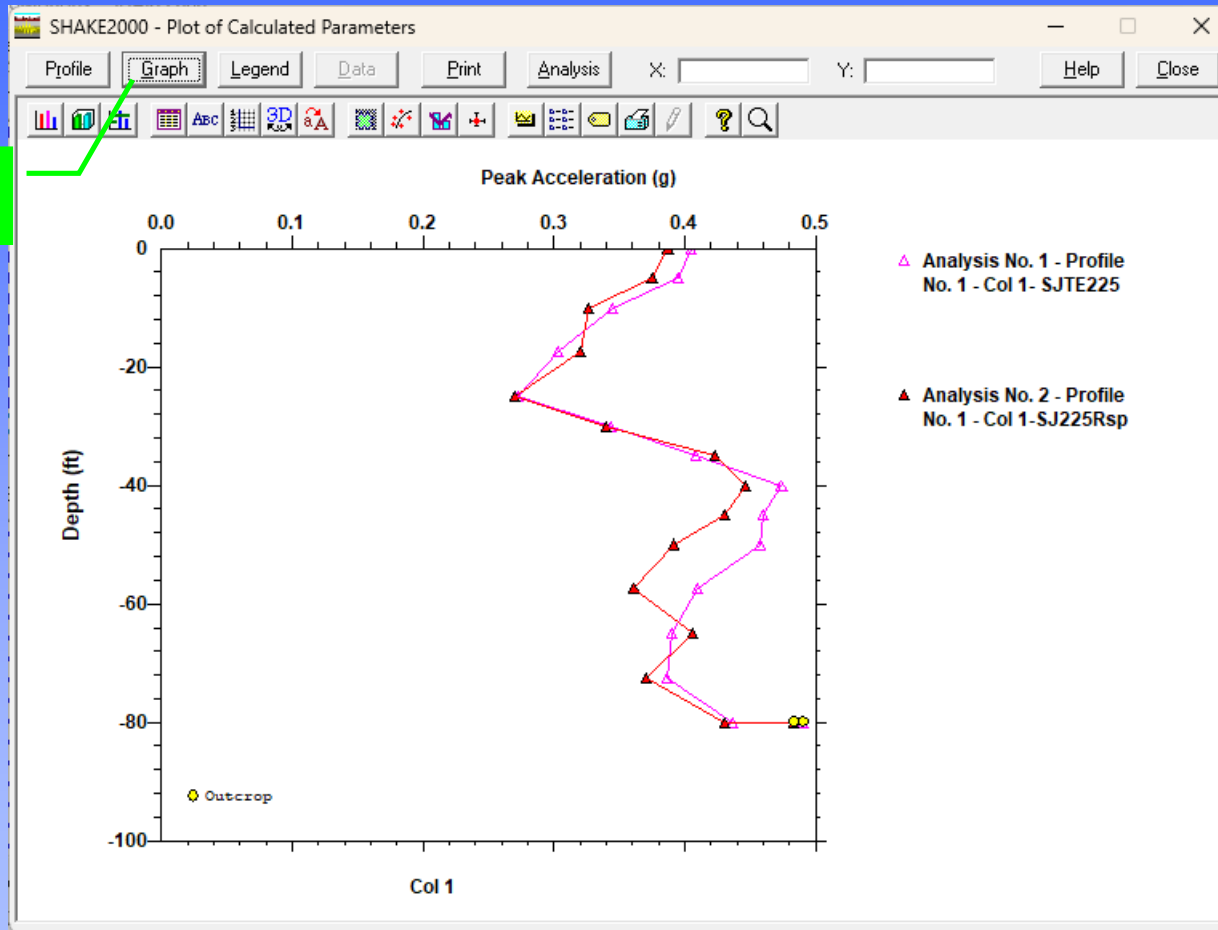
Site Specific Response Analysis

Plot Results



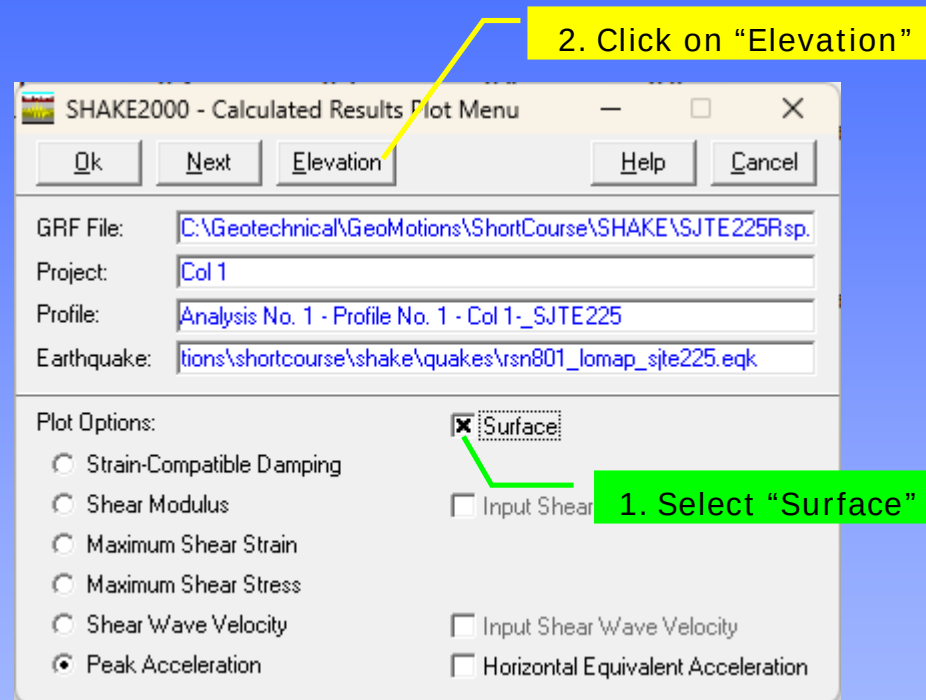
Site Specific Response Analysis Plot Results

1. Click on
"Graph"

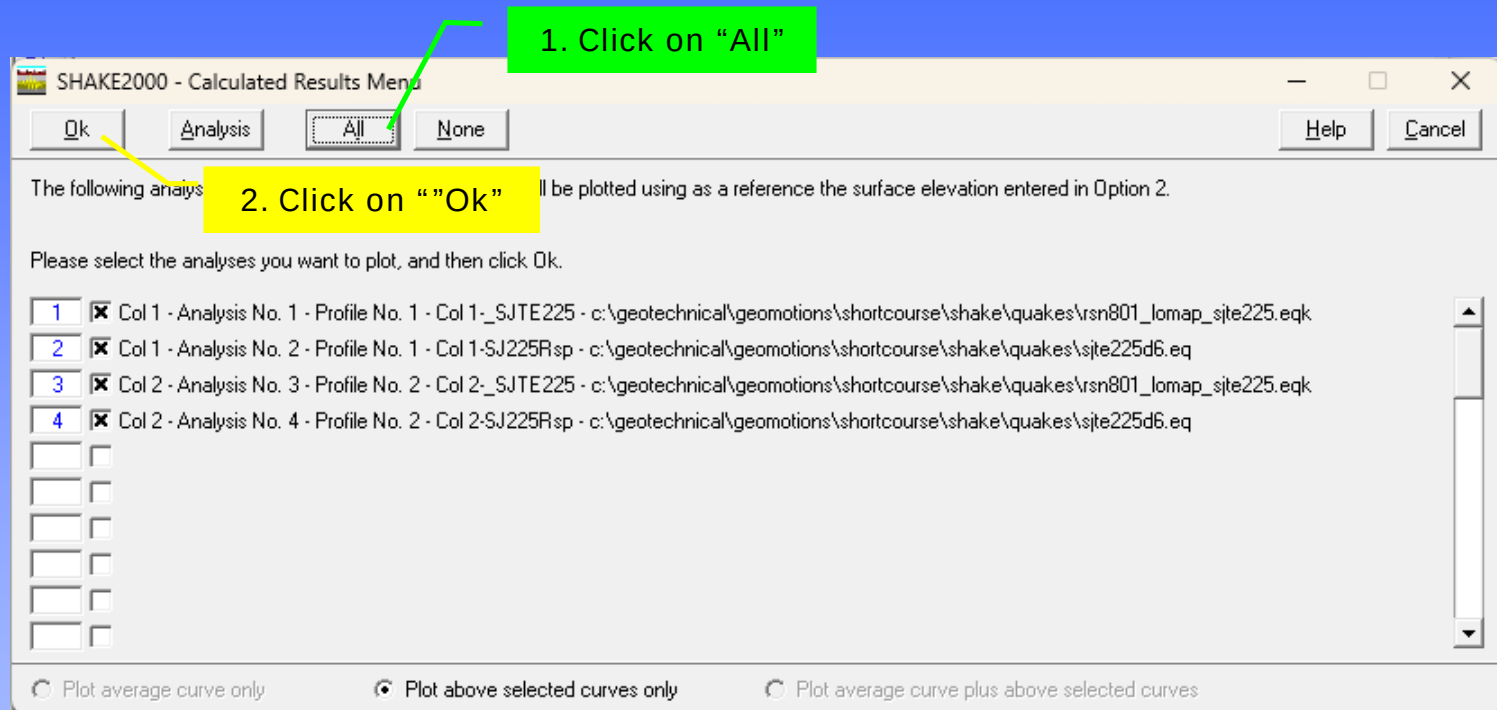


Site Specific Response Analysis

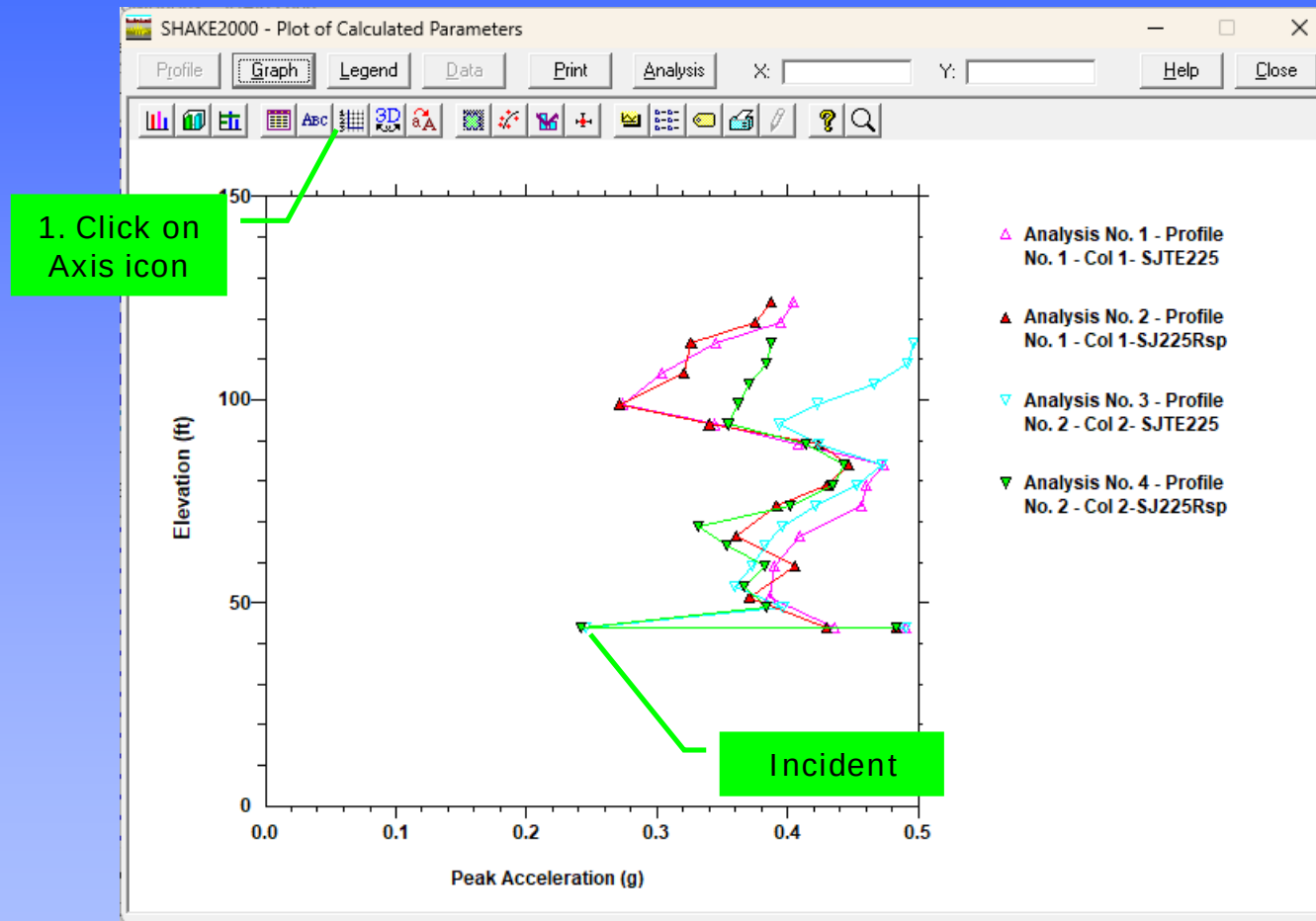
Plot Results



Site Specific Response Analysis Plot Results



Site Specific Response Analysis Plot Results



Change Graph Properties

The screenshot shows the 'Graph Control' dialog box with the following settings and callouts:

- 1. Select "X"**: A green box highlights the 'X' radio button under the 'Apply to Axis' section.
- 2. Select "User Defined"**: A yellow box highlights the 'User-Defined' radio button under the 'Scale' section.
- 3. Enter "0.5" in Max**: A red box highlights the 'Max' input field in the 'Range' section, which contains the value 0.5.
- 4. Enter "0.2" in Min**: A pink box highlights the 'Min' input field in the 'Range' section, which contains the value 0.2.
- 5. Enter "6" in Ticks**: A blue box highlights the 'Ticks' input field in the 'Range' section, which contains the value 6.

Other visible settings include: 'Position' set to 'Variable', 'Grids' set to 'Show', and 'Style' set to 'Line'.

Change Graph Properties

The screenshot shows the 'Graph Control' dialog box with the 'Axis' tab selected. The 'Apply to Axis' section has radio buttons for X, Y Primary (selected), Y Overlay, and Z. The 'Position' section has radio buttons for Variable (selected), Left, and Right. The 'Scale' section has radio buttons for Zero Origin, Variable Origin, and User-Defined (selected). The 'Range' section has input fields for Max (130), Min (40), and Ticks (9). The 'Grids' section has a 'Show' checkbox, a 'Style' dropdown, and a 'Color' dropdown. The 'OK' button is at the bottom left.

1. Select "Y"

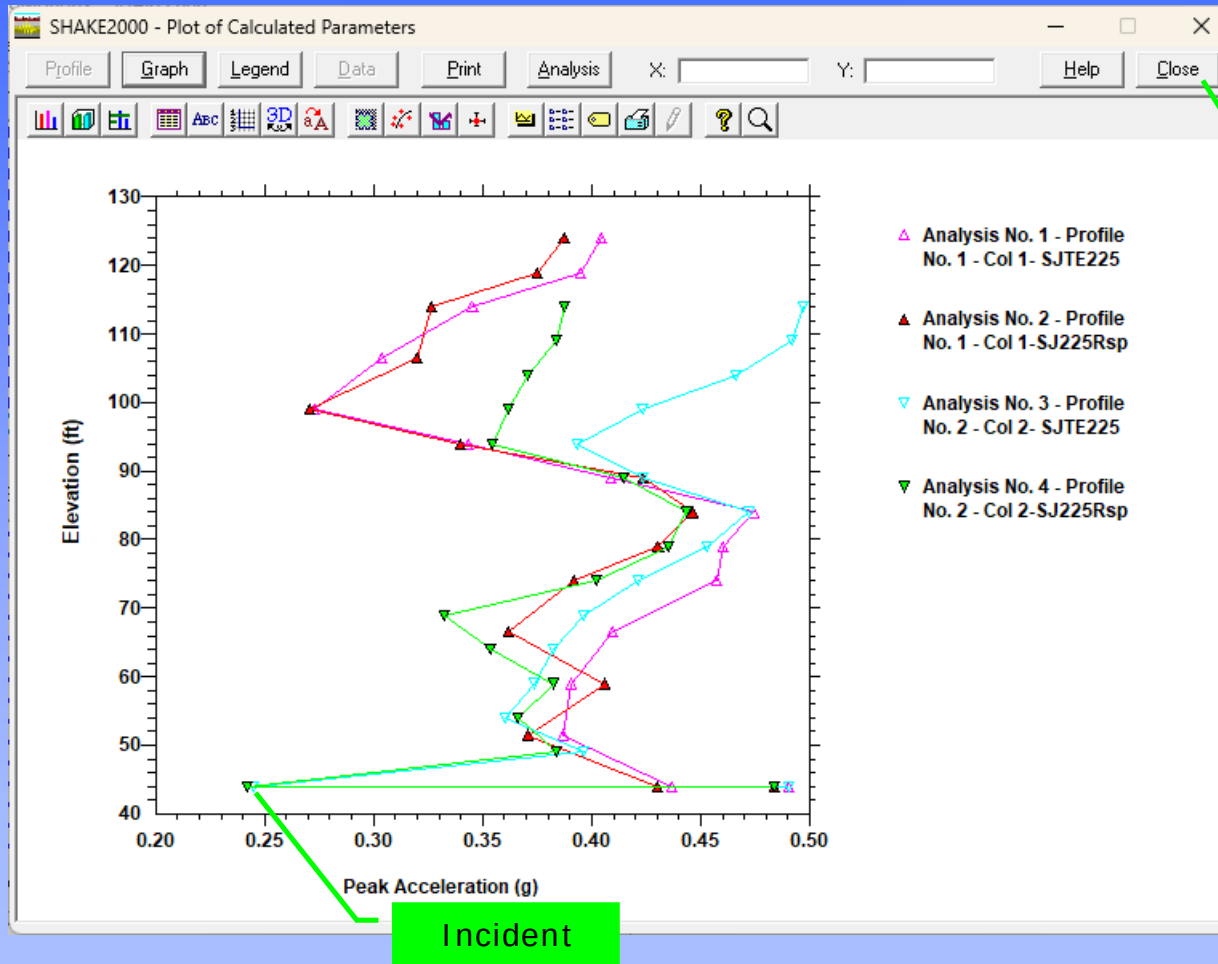
2. Select "User-Defined"

3. Enter "130" in Max

4. Enter "9" in Ticks

5. Click on "Ok"

Site Specific Response Analysis Plot Results



SHAKE Analysis to Calibrate a D-MOD Analysis

The first step in a nonlinear analysis using D-MOD2000 is to estimate viscous damping by calibrating the D-MOD analysis against results from an equivalent-linear SHAKE analysis that has a constant value of viscous damping at all frequencies. There are two approaches that can be used to evaluate the Rayleigh Damping coefficients, n and ξ , using an iterative procedure based on comparing how well the SHAKE and D-MOD surface response spectra and peak acceleration & shear strain vs. depth compared to each other:

1. Develop a SHAKE column and perform an equivalent-linear SHAKE analysis to obtain the acceleration time history at the surface level. Limit PGA to ≤ 0.4 g and Shear Strain to $< 0.5\%$.
2. Develop a SHAKE column and perform a small strain, linear SHAKE analysis to obtain the acceleration time history at the surface level. Use G_{max} and 5% damping for all layers (i.e., use “zero” type soils in Option 2). More detailed information about this approach is provided by Stewart et al. (2008).

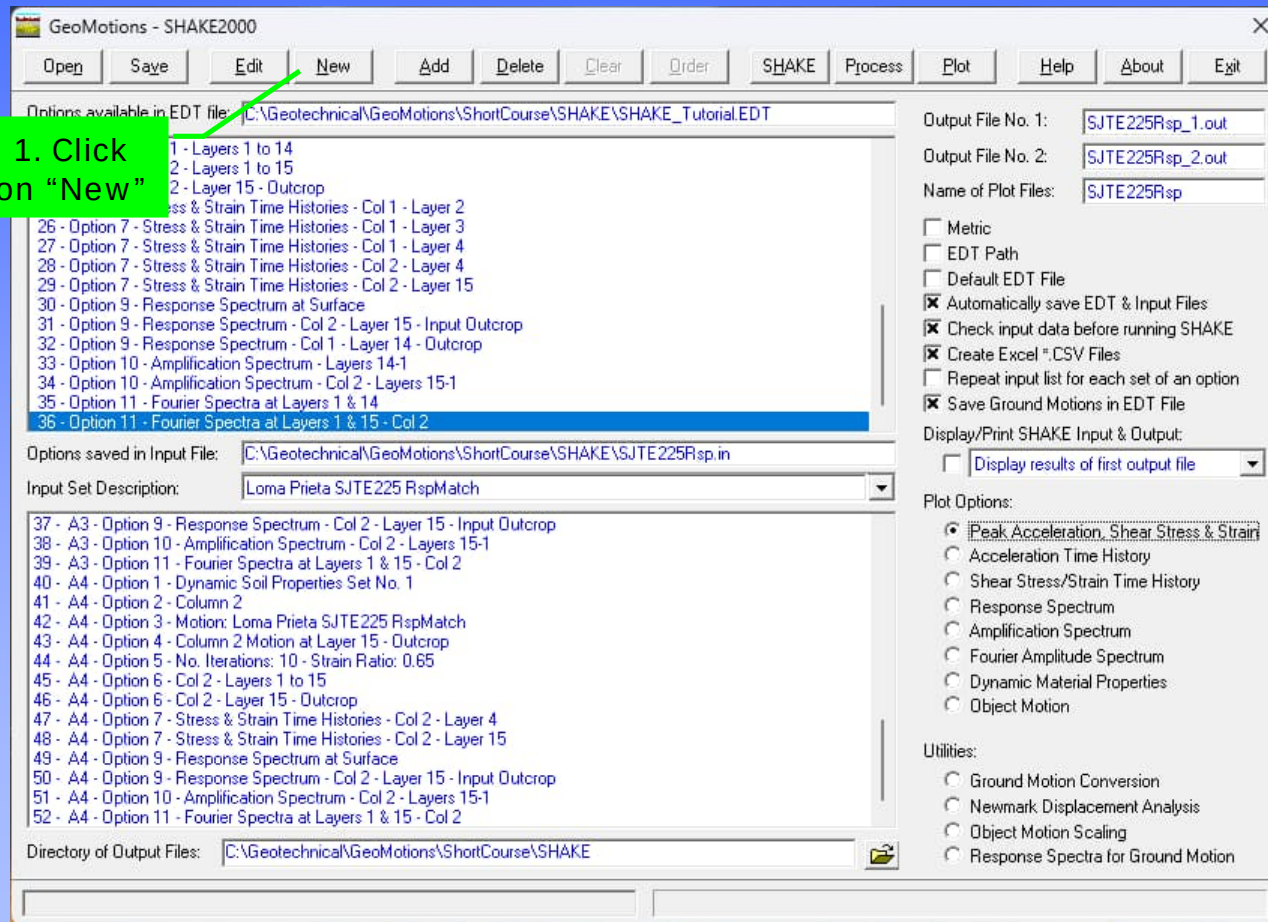
Use First Approach to Calibrate a D-MOD Analysis

The first approach involves evaluation of the Rayleigh Damping coefficients, n and ξ , using an iterative procedure as follows:

1. Develop a SHAKE column and perform the SHAKE analysis to obtain the response spectrum at the surface level. Limit PGA to ≤ 0.4 g and Shear Strain to $< 0.5\%$ (this tutorial).
2. Develop the D-MOD column to match the SHAKE column as close as possible and use $n = 0$ and $\xi = 0.5$ for first iteration.
3. Perform a total-stress nonlinear analysis with D-MOD.
4. Compare the surface response spectrum from SHAKE to the response spectrum from D-MOD.
5. Adjust n and ξ and repeat from step 3 until a “satisfactory” match between the SHAKE and D-MOD spectra is obtained. Also, compare the shear strain vs. depth plot from both SHAKE and D-MOD.

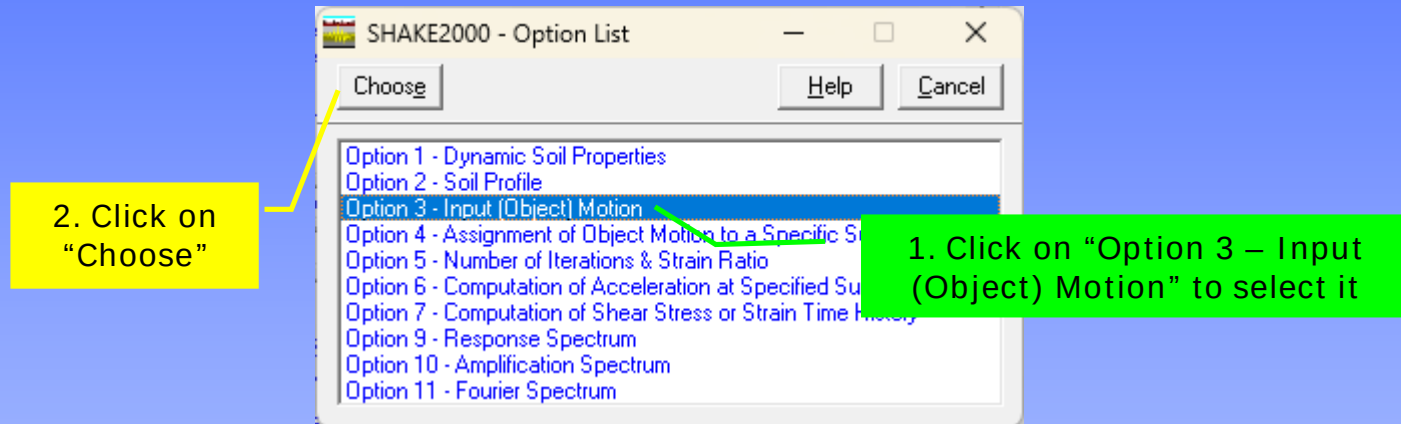
SHAKE2000

D-MOD Calibration



Site Specific Response Analysis

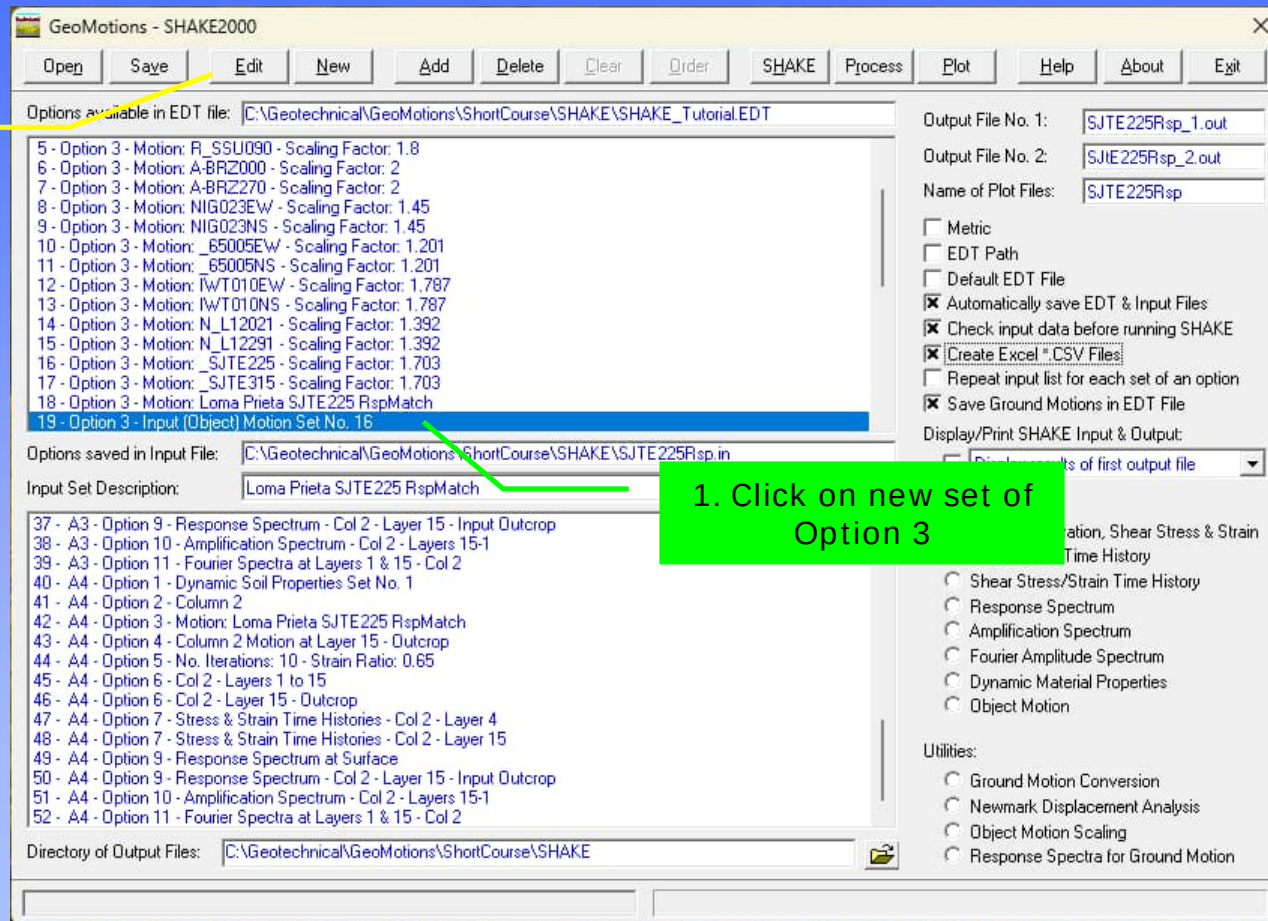
Create Object Motion for D-MOD Calibration



Site Specific Response Analysis

Create Object Motion for D-MOD Calibration

2. Click
on "Edit"



Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration

1. Click on "Convert"

SHAKE2000 - Option 3 Editor: Input (O)

Quakes Other **Convert** Restore View Plot Help Return

Set No.: 16 Input (Object) Motion - Set Identification: Option 3 - Input (Object) Motion Set No. 16

Acceleration Values:	No. Fourier Values:	Time Interval	Format of Object Motion File	Earthquake Identification
2992	4096	.01	(8f9.6)	TUJ352

Name and Path of Source Object Motion File:

C:\Geotechnical\GeoMotions\Quakes\SHAKE\Crustal\TUJ352_AT2.eq

Multiplication Factor	Maximum Acceleration	Maximum Frequency	No. Header Lines	Acceleration Values/Line
1		25	8	8

Convert At2 Motion to D-MOD Format

RSN801_LOMAP_SJTE225.AT2

1. Click on
"Open"

SHAKE2000 - Conversion of Ground Motion File

Open View Save Convert Plot Spectra Help Close

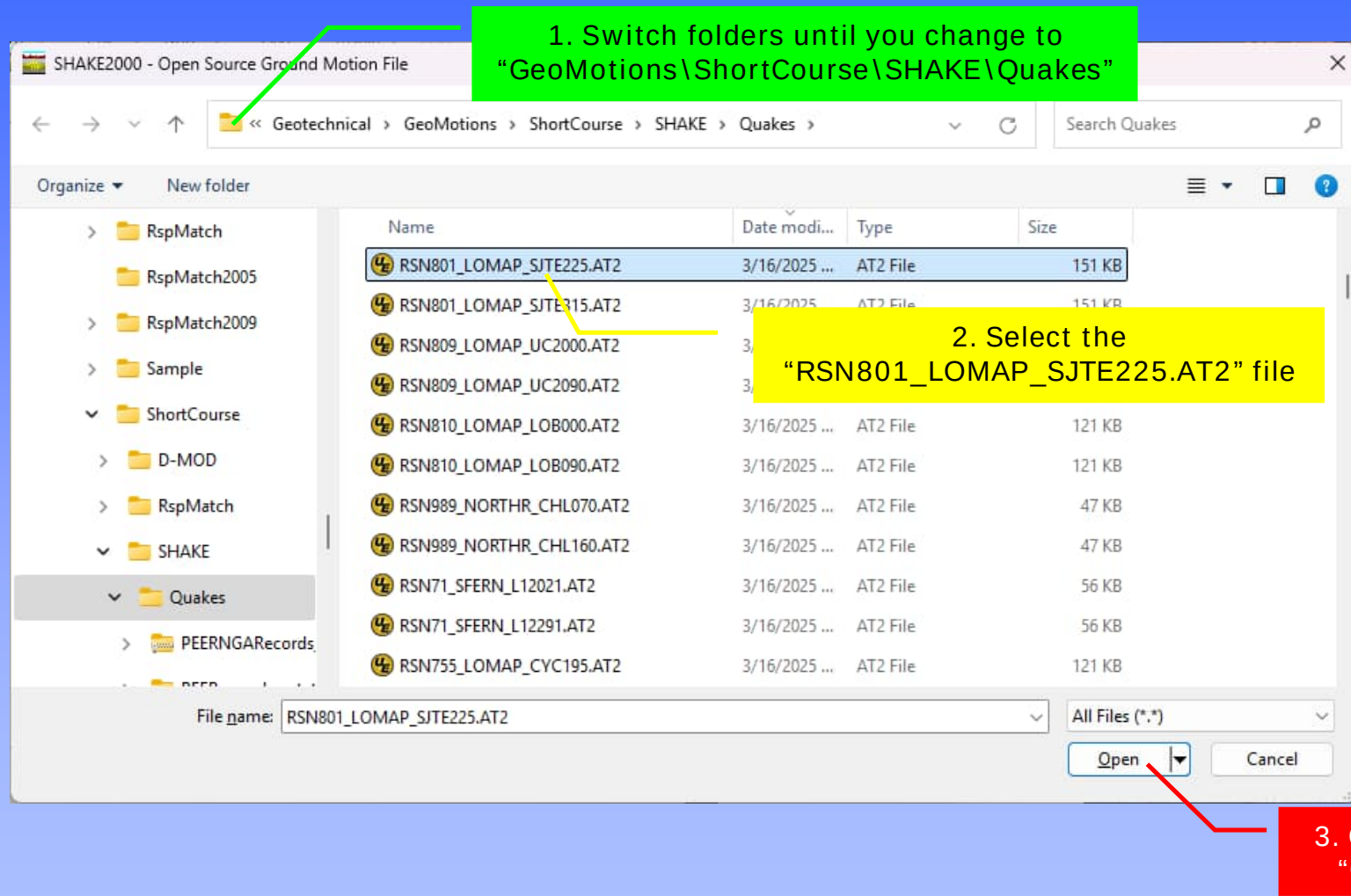
Source Ground Motion File:

Source File Type: Other No. Values: Time Step: No. Header Lines: Values per Line: No. Digits: Number of Columns: Acceleration Column: Format for Output: (8F9.6)

Source Units: g's Output Units: g's Multiplier: 1 Other Units: Option 3 Set ID - Line: Lines from Source File header to be included in header of Converted File: ☐ EDT ☐ Free ☐ PEER

Converted Ground Motion File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\convert.eq

Open PEER Acceleration File



Choose path and name of converted file

SHAKE2000 - Conversion of Ground Motion File

Open View **Save** Convert Plot Spectra Help Close

1. Click on "Save"

File: technical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_LOMAP_SJTE225.AT2

STRONG MOTION DATABASE RECORD

2| Loma Prieta, 10/18/1989, San Jose - Santa Teresa Hills, 225

3| ACCELERATION TIME SERIES IN UNITS OF G

4| NPTS= 9999, DT= .0050 SEC,

5| -.1712802E-02 -.1710297E-02 -.1707754E-02 -.1705192E-02 -.1702631E-02

6| -.1700070E-02 -.1697514E-02 -.1694953E-02 -.1692397E-02 -.1689828E-02

7| -.1687259E-02 -.1684693E-02 -.1682117E-02 -.1679546E-02 -.1676969E-02

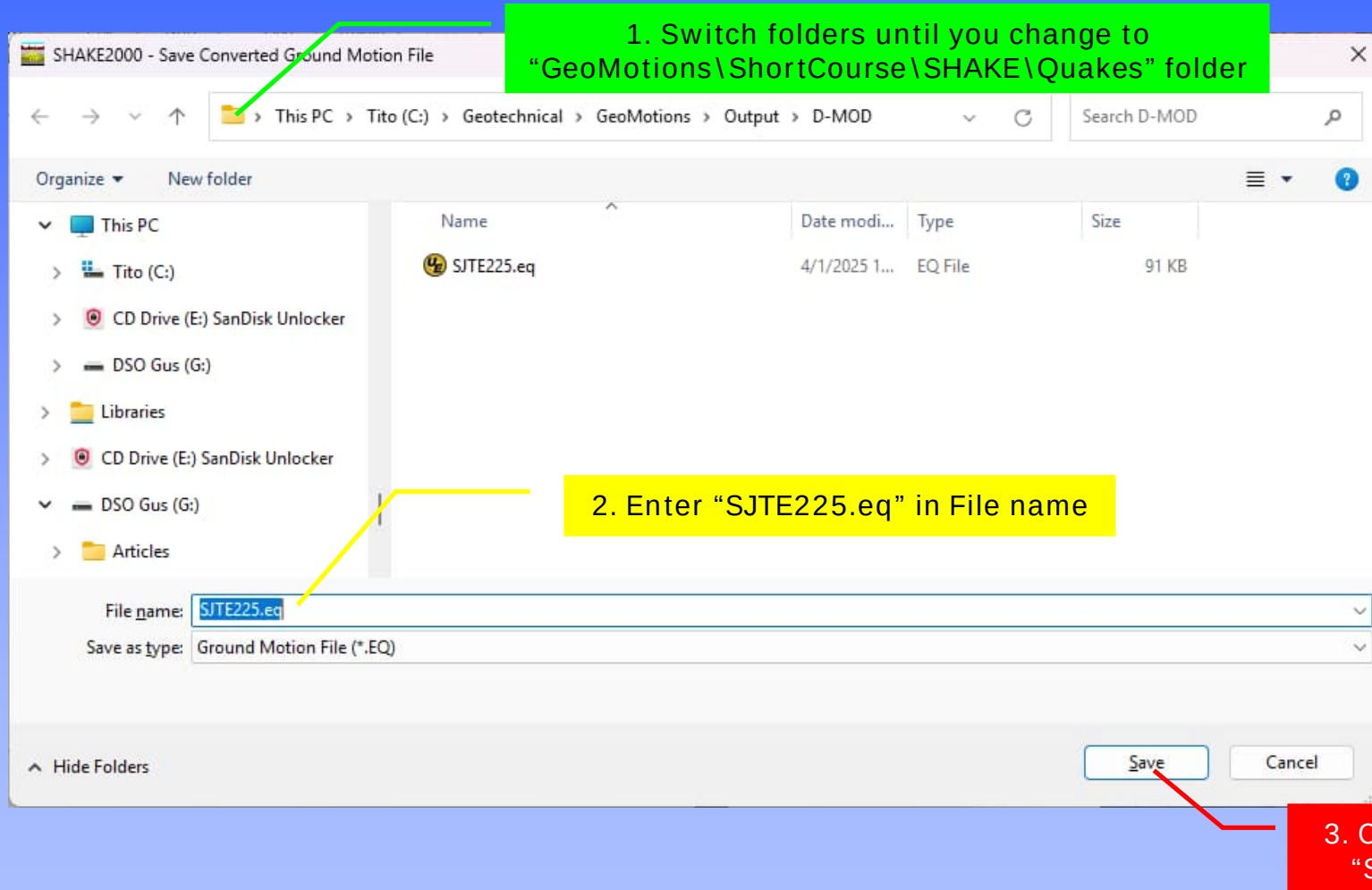
8| -.1674395E-02 -.1671811E-02 -.1669234E-02 -.1666649E-02 -.1664063E-02

Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
PEER NGA			4					(4E15.6E2)

Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File	
g's	g's	1		2	1-4	☐ EDT ☒ Free ☐ PEER

Converted Ground Motion File: technical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_LOMAP_SJTE225.eq

Choose path and name of converted file



SHAKE2000 - Conversion of Ground Motion File

Open View Save Convert Plot Spectra Help Close

Motion File: technical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_LOMAP_SJTE225.E225.AT2

NGA STRONG MOTION DATABASE RECORD
 2| Loma Prieta, 10/18/1989, San Jose - Santa Teresa Hills, 225
 3| ACCELERATION TIME SERIES IN UNITS OF G
 4| NPTS= 9999, DT= .0050 SEC,
 5| -.1712802E-02 -.1710297E-02 -.1707754E-02 -.1705192E-02 -.1702631E-02
 6| -.1700070E-02 -.1697514E-02 -.1694953E-02 -.1692397E-02 -.1689828E-02
 7| -.1687259E-02 -.1684693E-02 -.1682117E-02 -.1679546E-02 -.1676969E-02
 8| -.1674395E-02 -.1671811E-02 -.1669234E-02 -.1666649E-02 -.1664063E-02

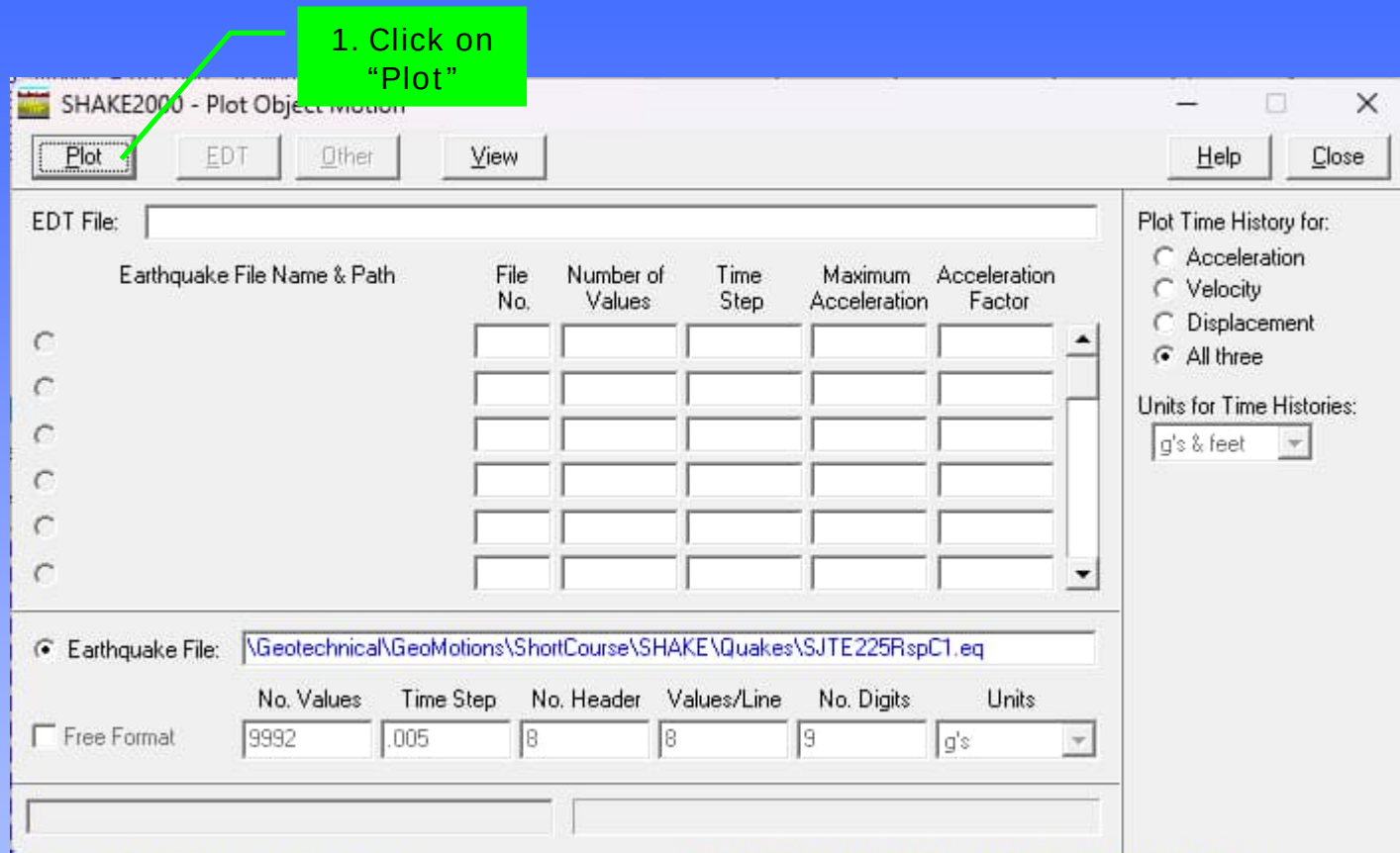
Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
PEER NGA	9992	.005	4					(8F9.6)

Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File	EDI	Free	PEER
g's	D-MOD2000	1		2	1-4	☐	☒	☐

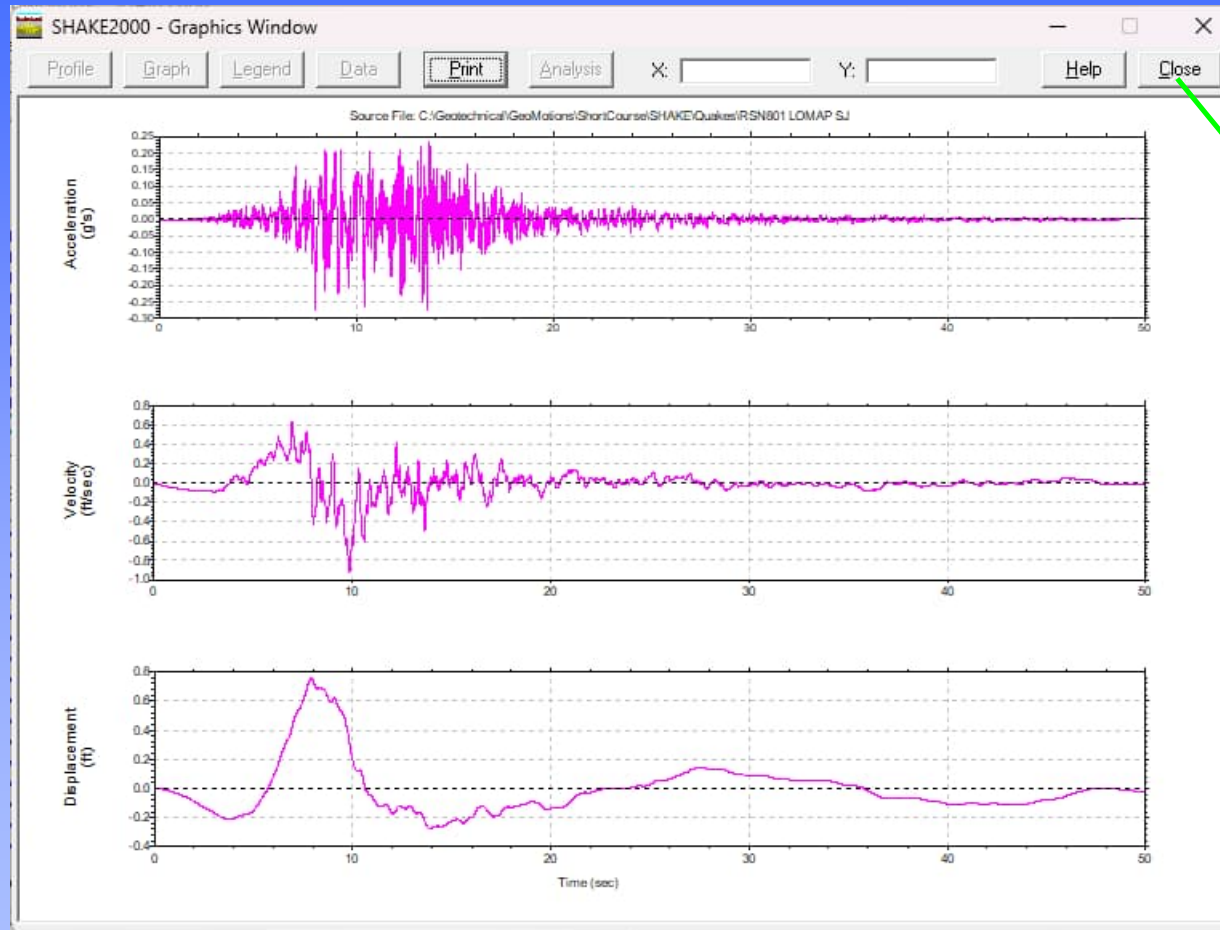
Converted Ground Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

Source File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_LOMAP_SJTE225.
 SHAKE2000 Conversion: 9992 .005 8 8 9 (8F9.6)
 Acceleration Units: (g's) - No. Values: 9992 - Time Step: .005 (secs)
 4| Data Format: (8F9.6) - No. Header Lines: 8
 5| PEER NGA STRONG MOTION DATABASE RECORD
 6| Loma Prieta, 10/18/1989, San Jose - Santa Teresa Hills, 225
 7| ACCELERATION TIME SERIES IN UNITS OF G
 8| NPTS= 9999, DT= .0050 SEC,

Plot Converted File to Check Conversion

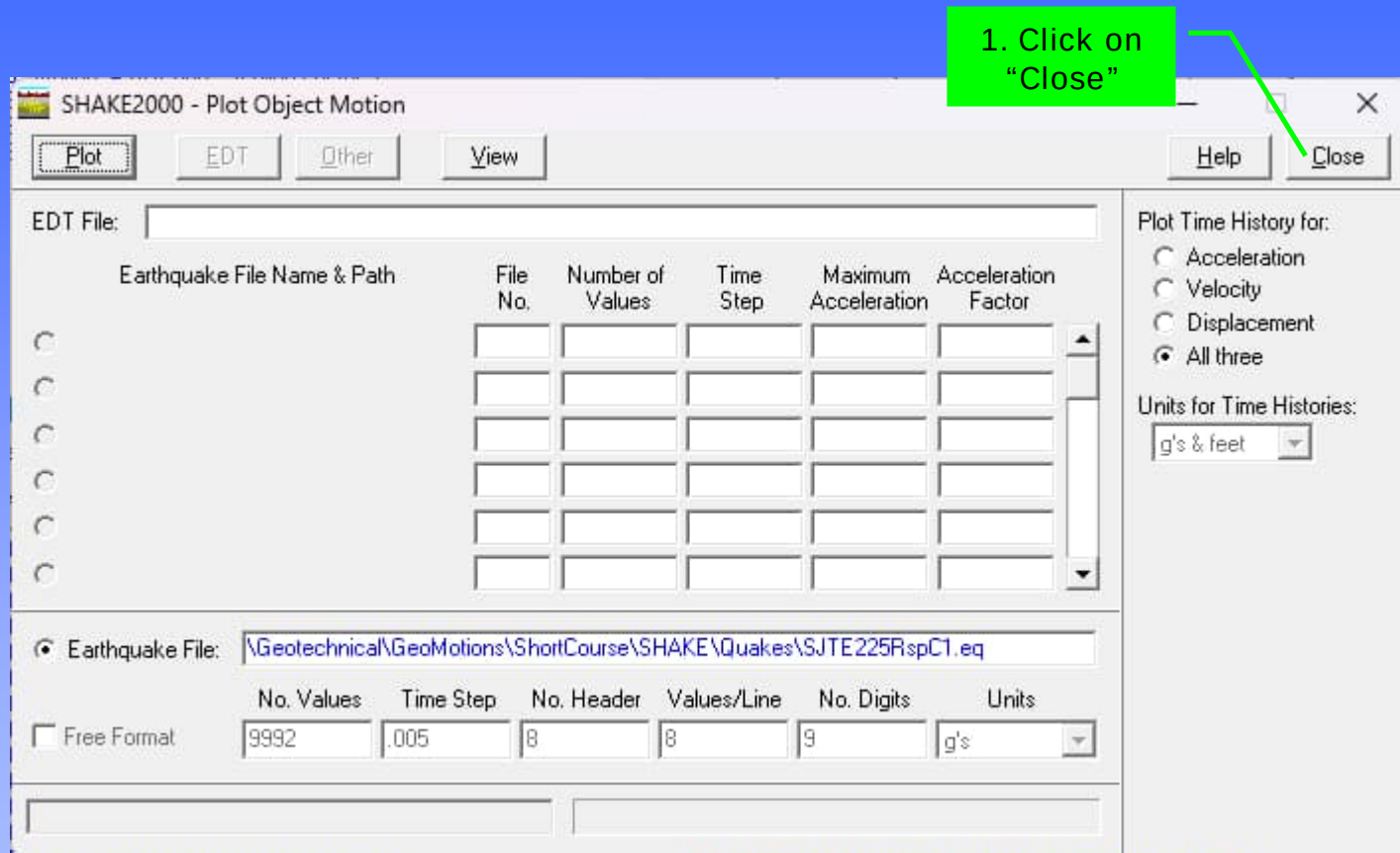


Acceleration, Velocity, and Displacement Time Histories for Converted Input Ground Motion File



1. Click on
"Close"

Plot Converted File to Check Conversion



Create Spectrally Matched Option 3 File

SHAKE2000 - Conversion of Ground Motion File

Open View Save Convert Plot Spectra Help Close

Source Ground Motion File: technical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_L

1. Click on "Close"

```
1|PEER NGA STRONG MOTION DATABASE RECORD
2|Loma Prieta, 10/18/1989, San Jose - Santa Teresa Hills, 225
3|ACCELERATION TIME SERIES IN UNITS OF G
4|NPTS= 9999, DT= .0050 SEC,
5| -.1712802E-02 -.1710297E-02 -.1707754E-02 -.1705192E-02 -.1702631E-02
6| -.1700070E-02 -.1697514E-02 -.1694953E-02 -.1692397E-02 -.1689828E-02
7| -.1687259E-02 -.1684693E-02 -.1682117E-02 -.1679546E-02 -.1676969E-02
8| -.1674395E-02 -.1671811E-02 -.1669234E-02 -.1666649E-02 -.1664063E-02
```

Source File Type	No. Values	Time Step	No. Header Lines	Values per Line	No. Digits	Number of Columns	Acceleration Column	Format for Output
PEER NGA	9992	.005	4					(8F9.6)

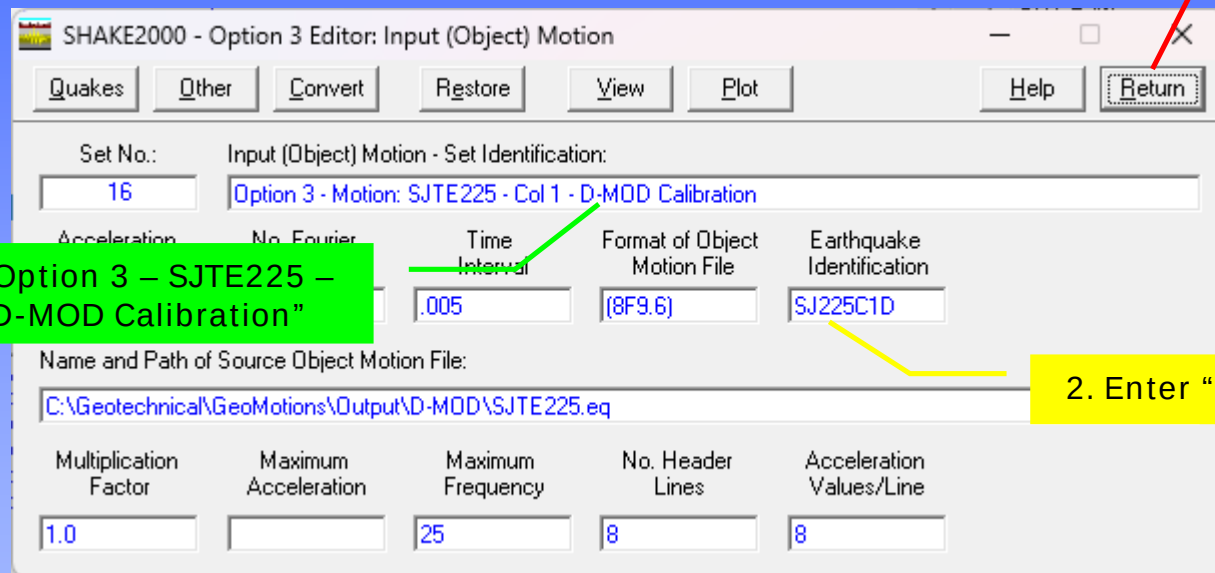
Source Units	Output Units	Multiplier	Other Units	Option 3 Set ID - Line	Lines from Source File header to be included in header of Converted File		
g's	D-MOD2000	1		2	1-4	☐ EDT	☒ Free
						☐ PEER	

Converted Ground Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

```
1|Source File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN801_LOMAP_SJTE225.
2|SHAKE2000 Conversion: 9992 .005 8 8 9 (8F9.6)
3|Acceleration Units: (g's) - No. Values: 9992 - Time Step: .005 (secs)
4|Data Format: (8F9.6) - No. Header Lines: 8
5|PEER NGA STRONG MOTION DATABASE RECORD
6|Loma Prieta, 10/18/1989, San Jose - Santa Teresa Hills, 225
7|ACCELERATION TIME SERIES IN UNITS OF G
8|NPTS= 9999, DT= .0050 SEC,
```

Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration



SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 16 Input (Object) Motion - Set Identification: Option 3 - Motion: SJTE225 - Col 1 - D-MOD Calibration

Acceleration No. Fourier Time Interval .005 Format of Object Motion File ((8F9.6)) Earthquake Identification SJ225C1D

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

Multiplication Factor 1.0 Maximum Acceleration Maximum Frequency 25 No. Header Lines 8 Acceleration Values/Line 8

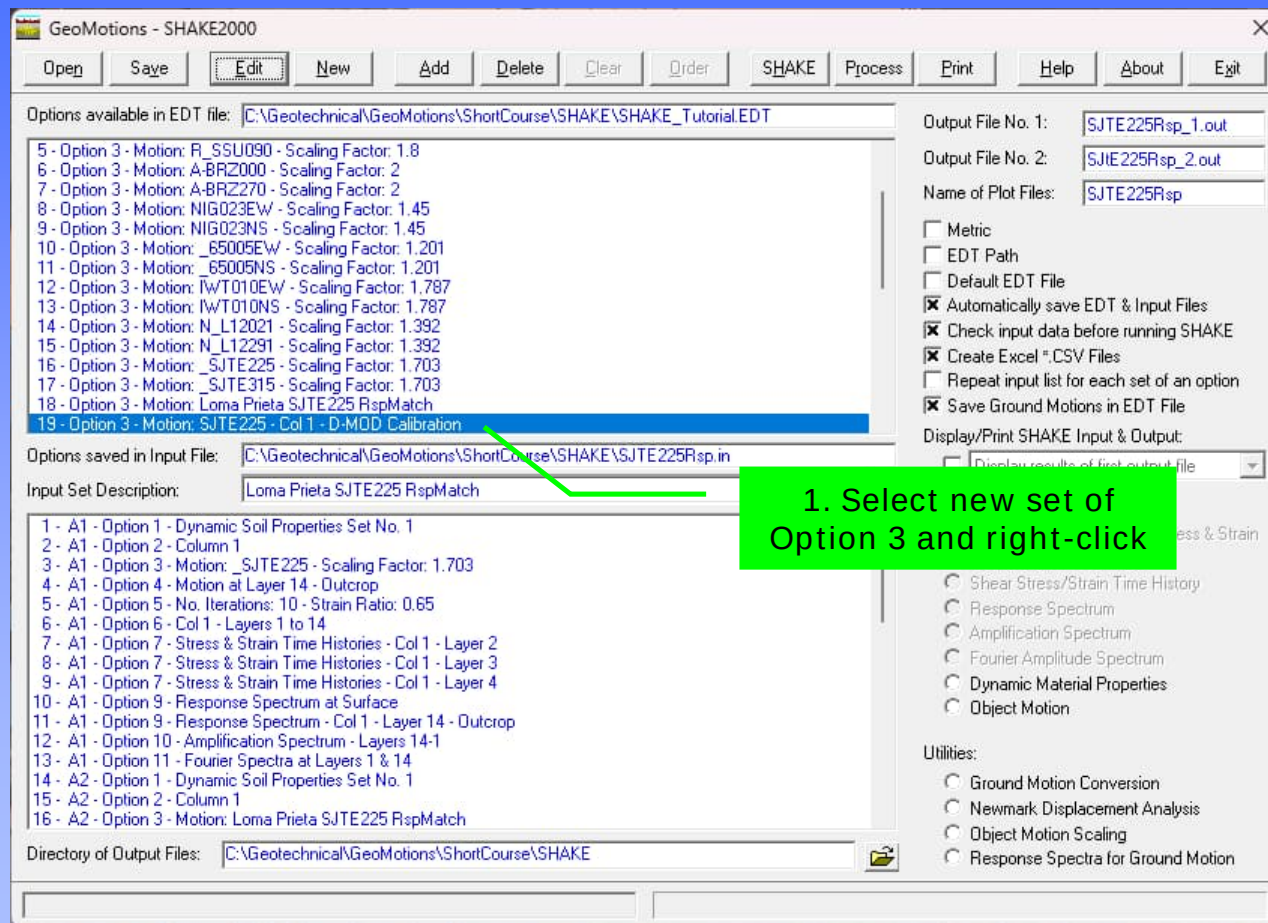
3. Click on
"Return"

1. Enter "Option 3 – SJTE225 –
Col 1 – D-MOD Calibration"

2. Enter "SJ225C1D"

Site Specific Response Analysis

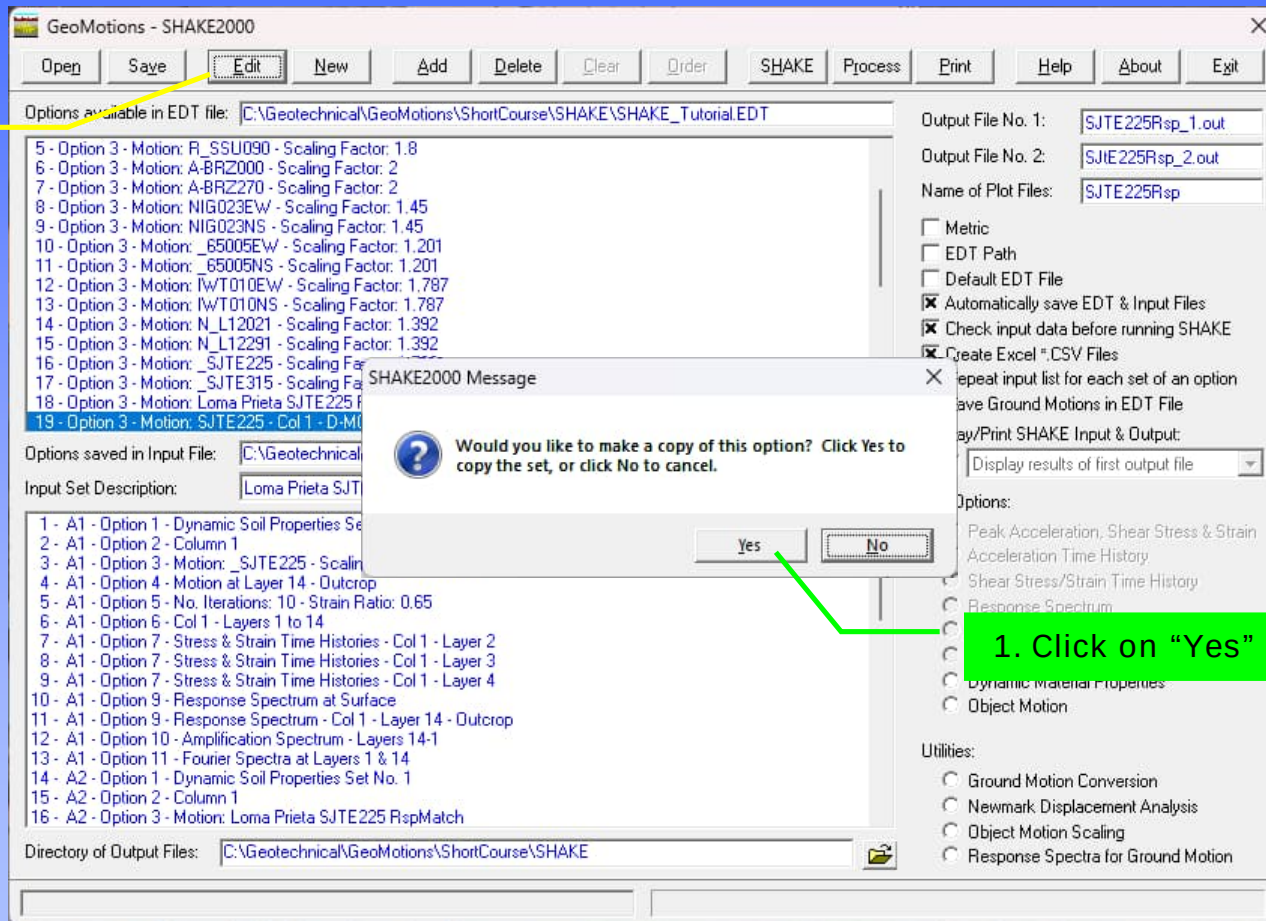
Create Motion for D-MOD Calibration of Column No. 2



Site Specific Response Analysis

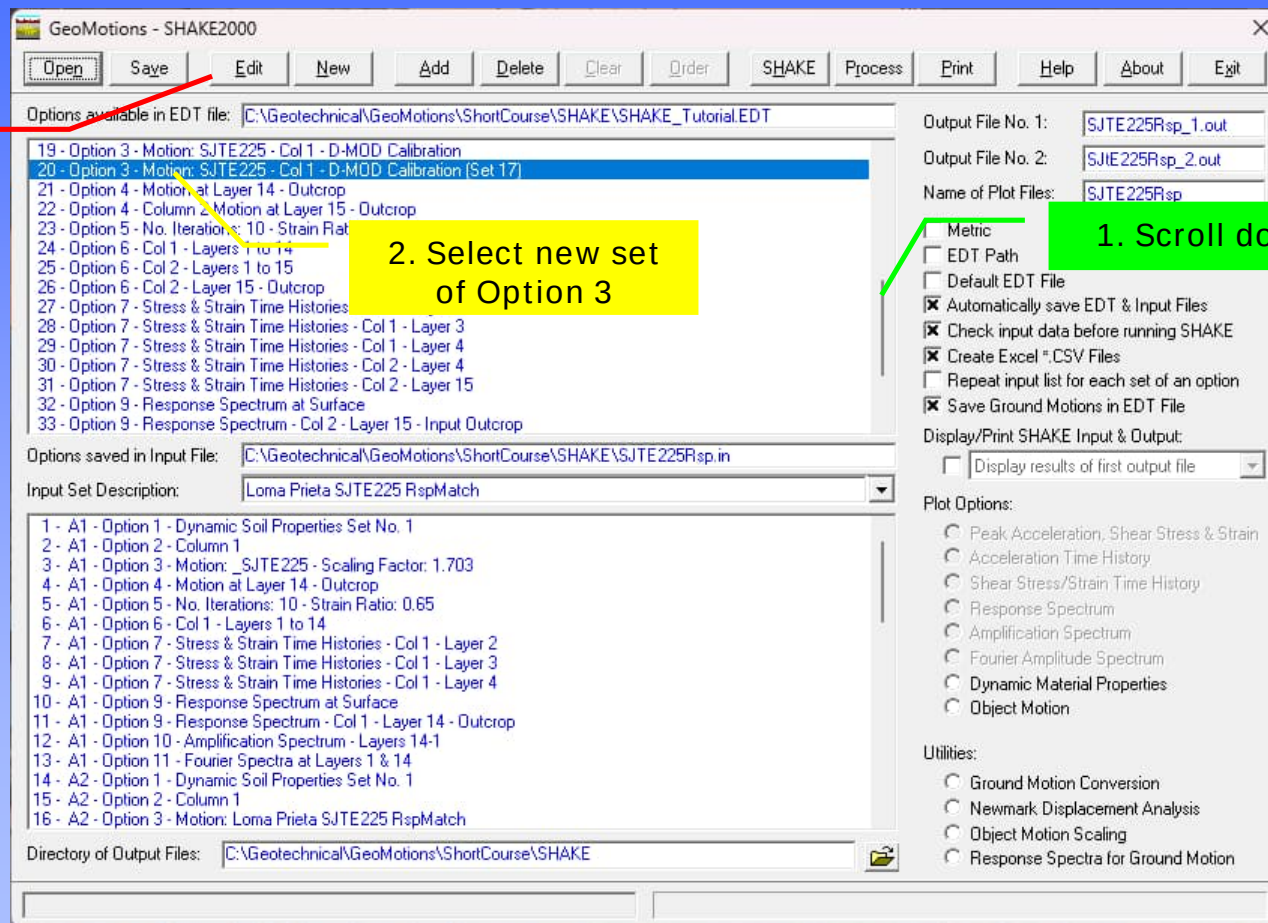
Create Motion for D-MOD Calibration of Column No. 2

2. Click on "Edit"



Site Specific Response Analysis

Create Motion for D-MOD Calibration of Column No. 2



Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 2

SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 17 Input (Object) Motion - Set Identification: Option 3 - Motion: SJTE225 - Col 2 - D-MOD Calibration

Acceleration: 1.0 No. Fourier: 8 Time Interval: .005 Format of Object Motion File: (8F9.6) Earthquake Identification: SJ225C2D

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

Multiplication Factor: 1.0 Maximum Acceleration: Maximum Frequency: 25 No. Header Lines: 8 Acceleration Values/Line: 8

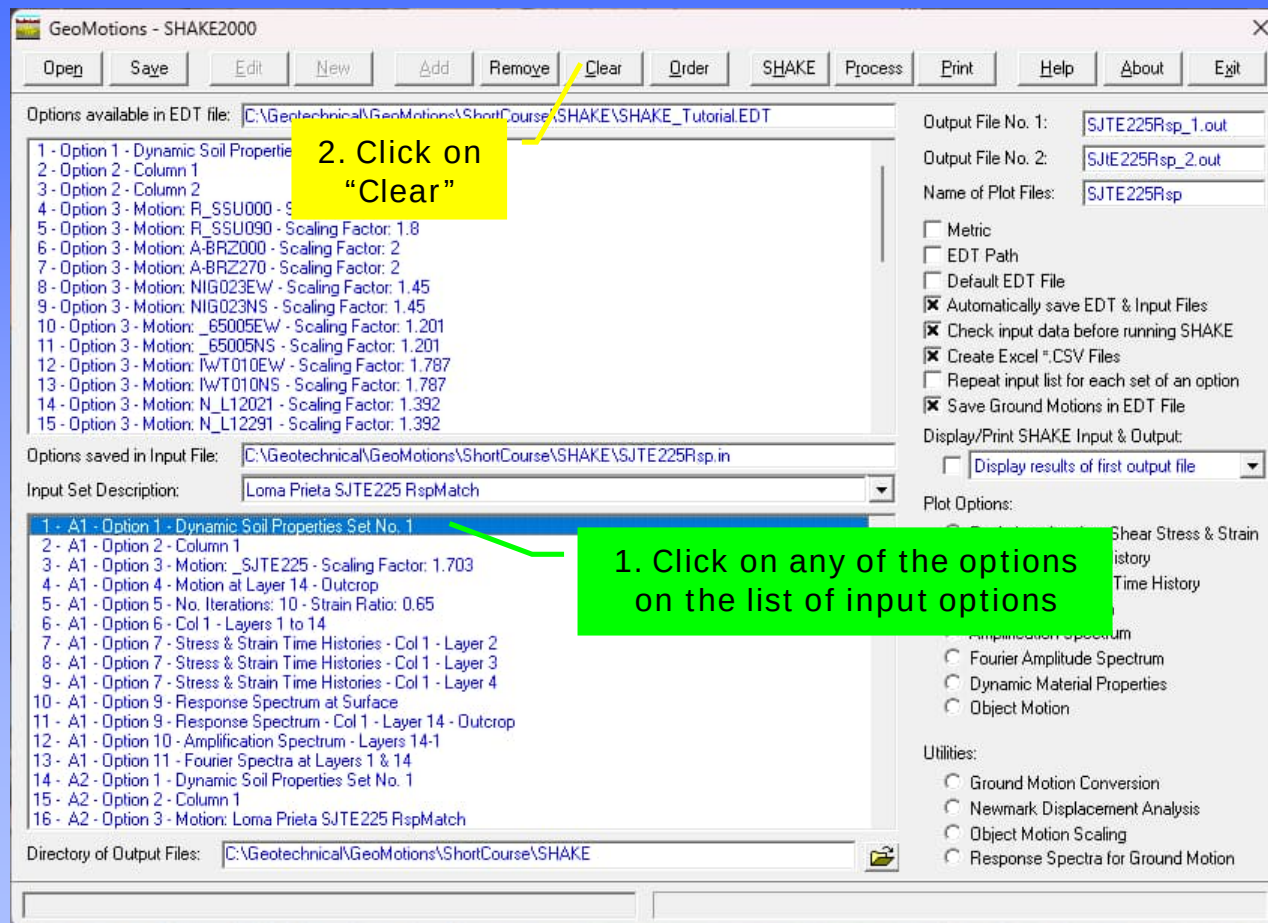
3. Click on
"Return"

1. Enter "Option 3 – SJTE225 –
Col 2 – D-MOD Calibration"

2. Enter "SJ225C2D"

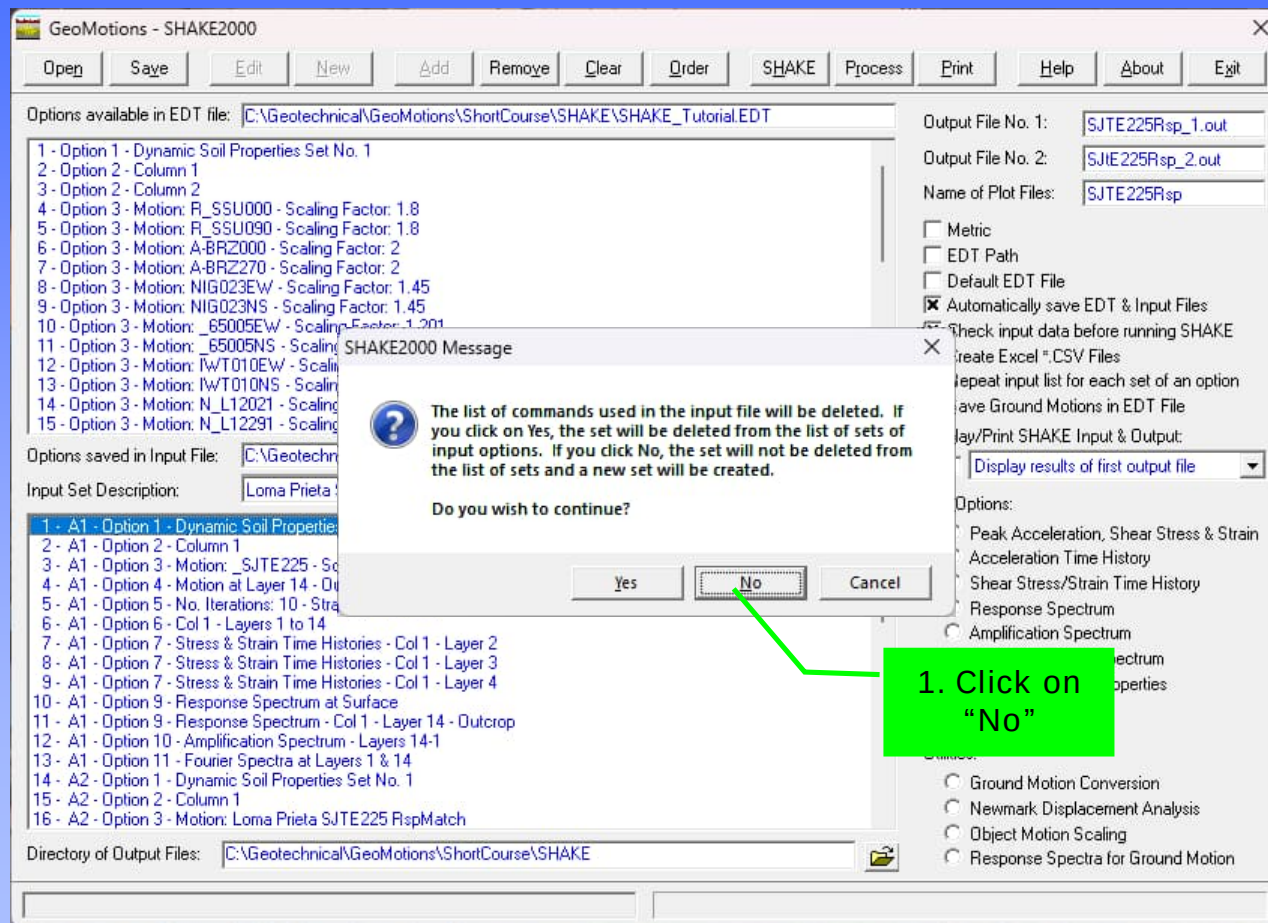
Site Specific Response Analysis

Create List of Input Options for D-MOD Calibration



Site Specific Response Analysis

Create List of Input Options for Column 2



Site Specific Response Analysis

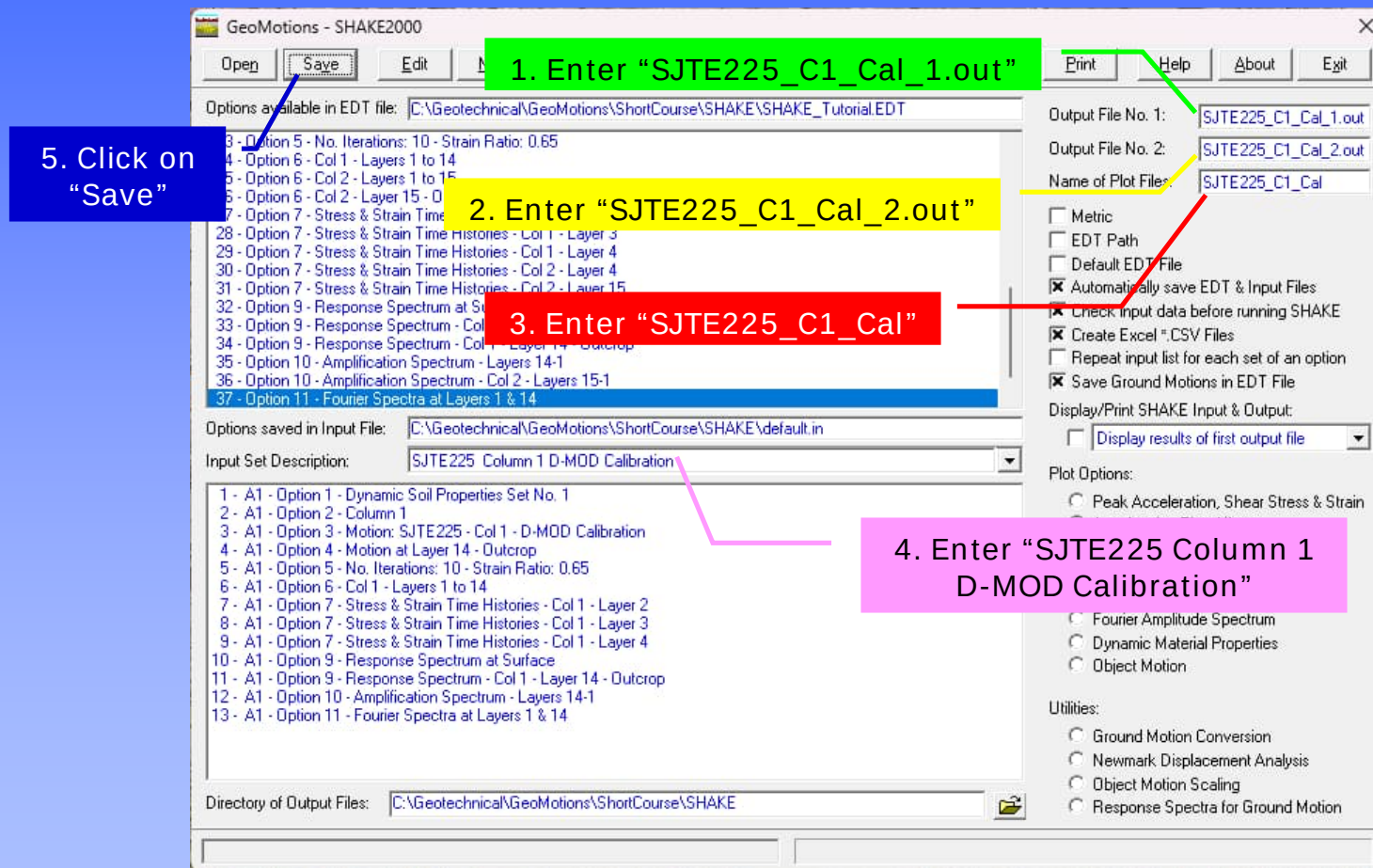
List of Input Options for D-MOD Calibration

Add the following options to input file list:

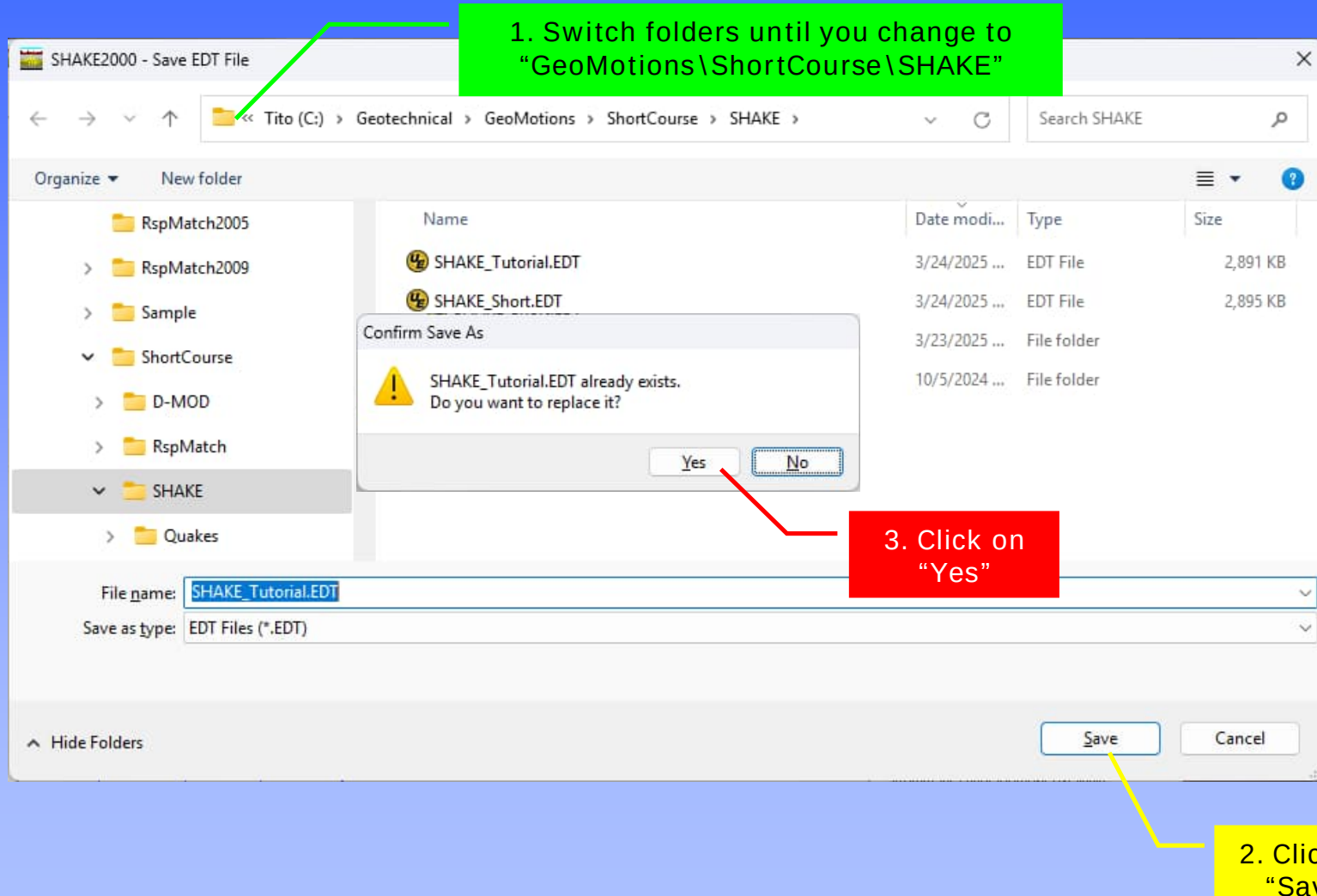
Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
2	Option 2 – Column 1
19	Option 3 – Motion: SJTE225 – Col 1 – D-MOD Calibration
21	Option 4 – Motion at Layer 14 - Outcrop
23	Option 5 – No. of Iterations: 10 – Strain Ratio: 0.65
24	Option 6 – Col 1 – Layers 1 to 14
27	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
28	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
29	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
32	Option 9 – Response Spectrum at Surface
34	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
35	Option 10 – Amplification Spectrum – Layers 14-1
37	Option 11 – Fourier Spectra at Layers 1 & 14

Site Specific Response Analysis

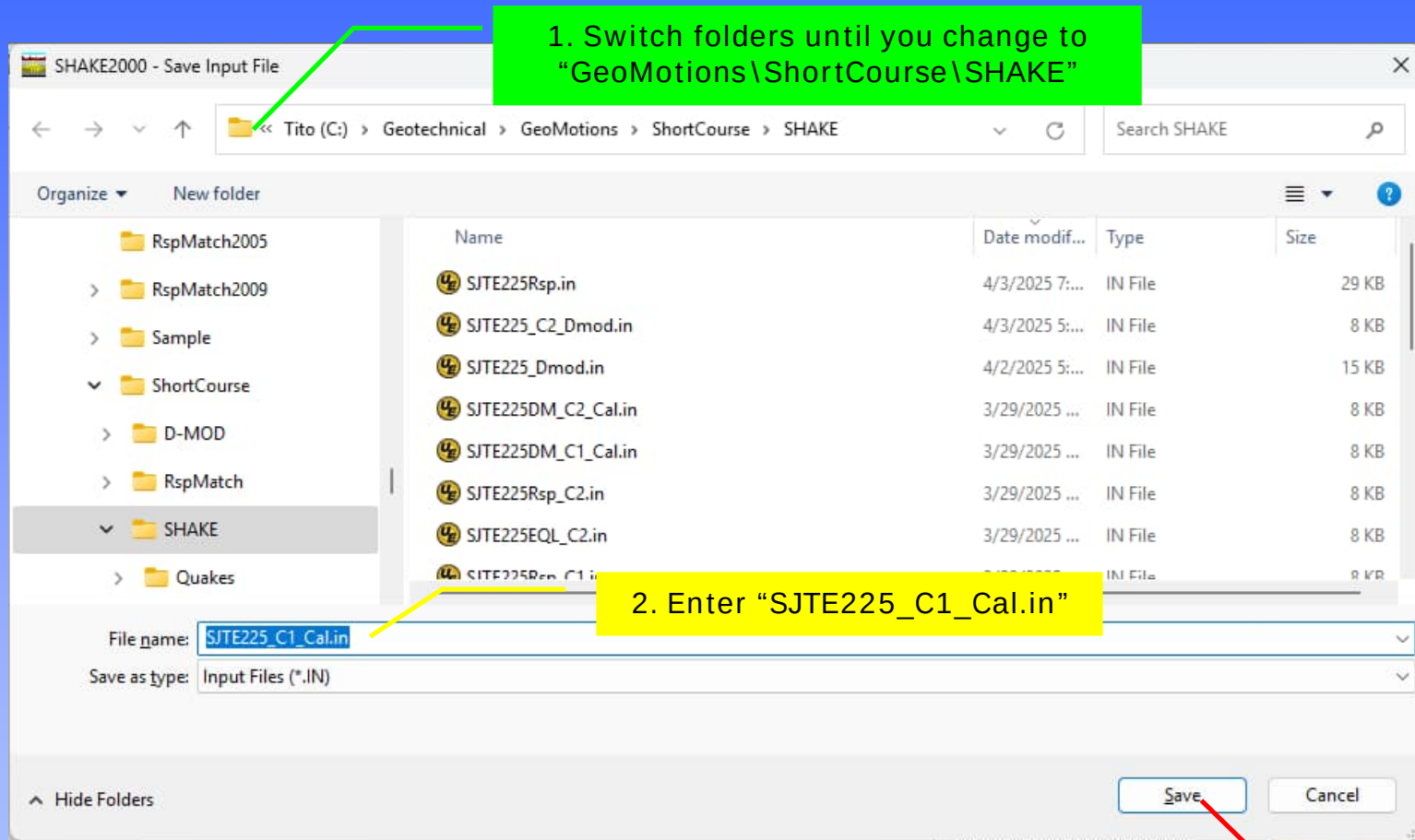
Rename SHAKE's Output and Plot Files



Save EDT File

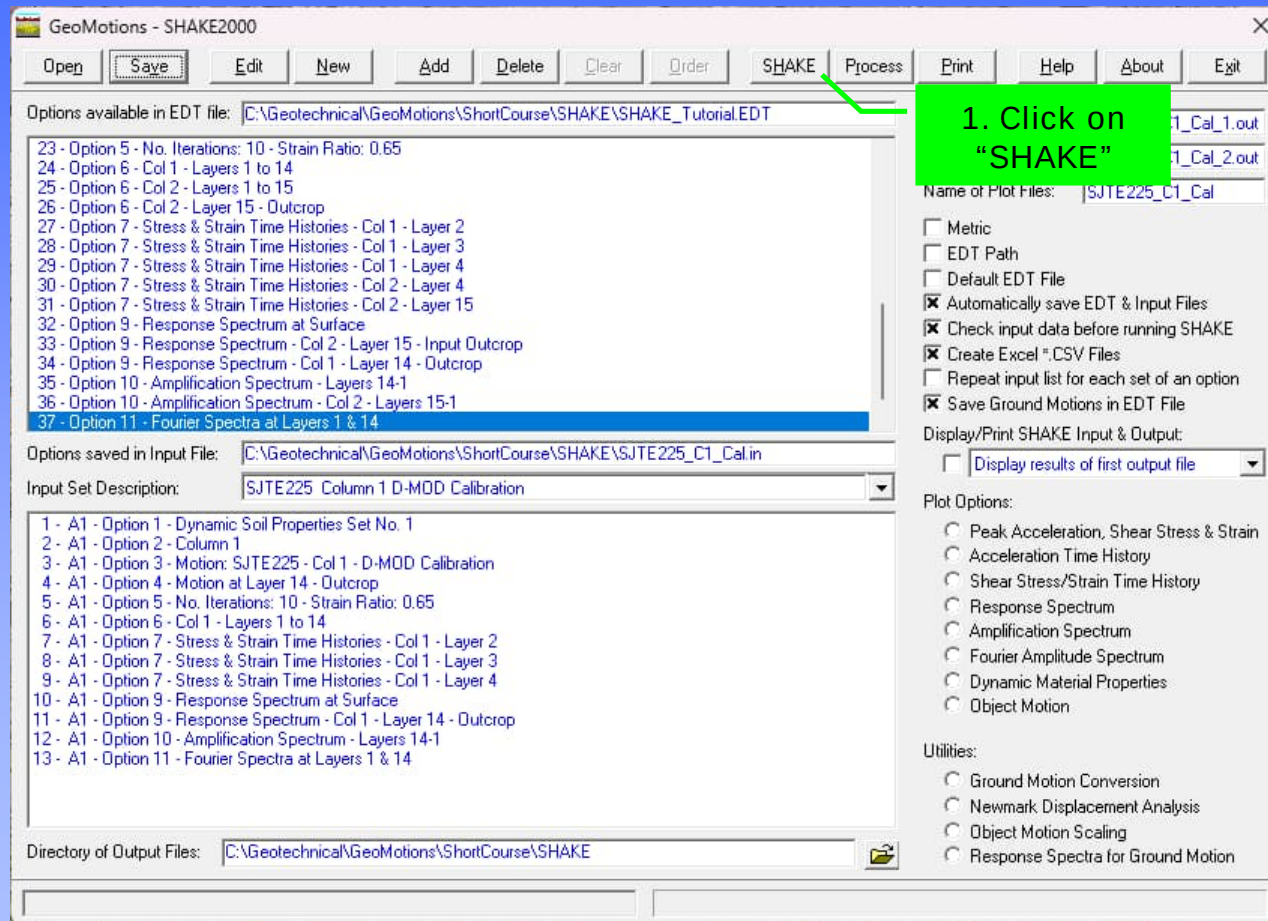


Save Input File



Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

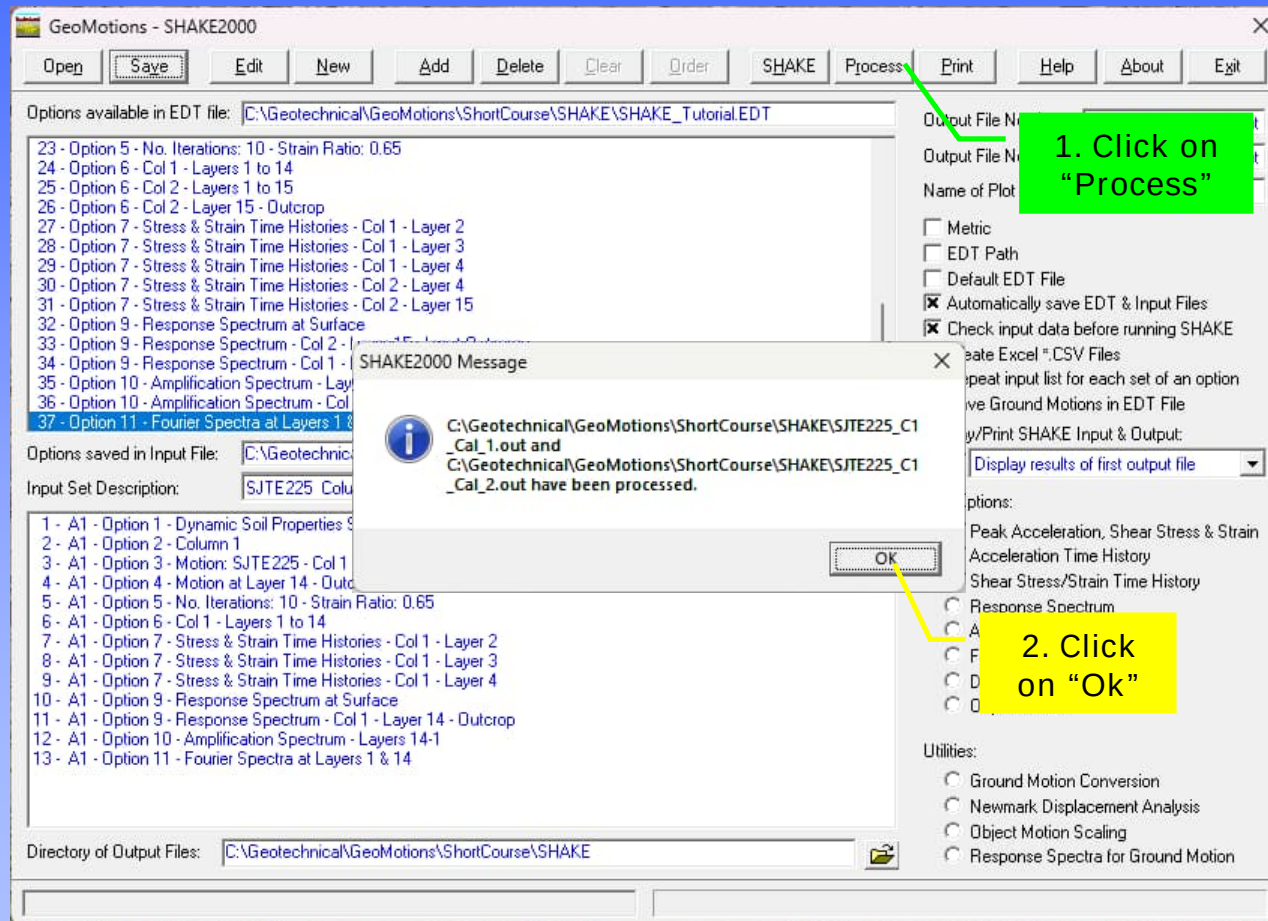
Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v

*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified *
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   ponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE 3/15/2025 *
*   RUN TIME 16:40 *
*****
```

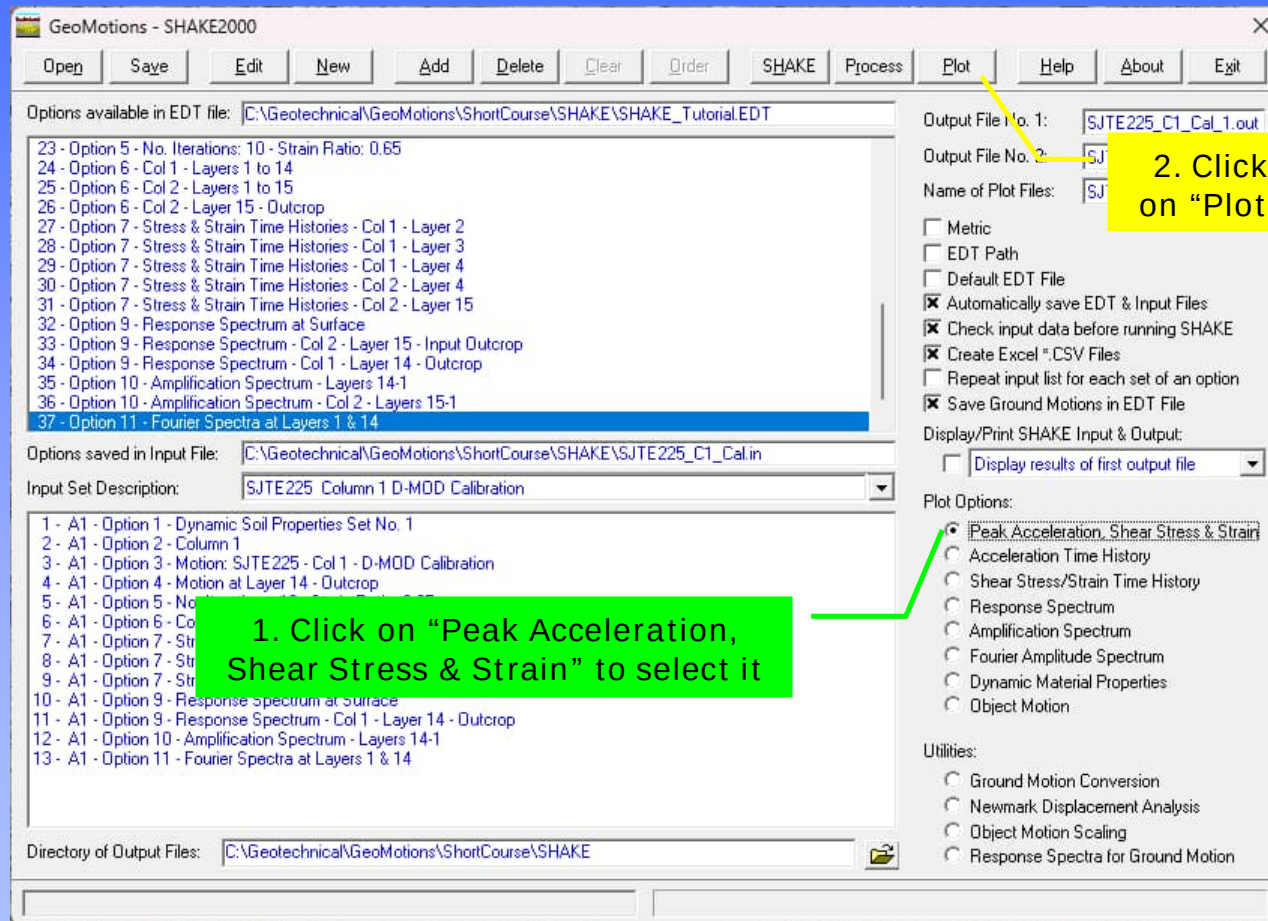
Site Specific Response Analysis

Process SHAKE's Output Files

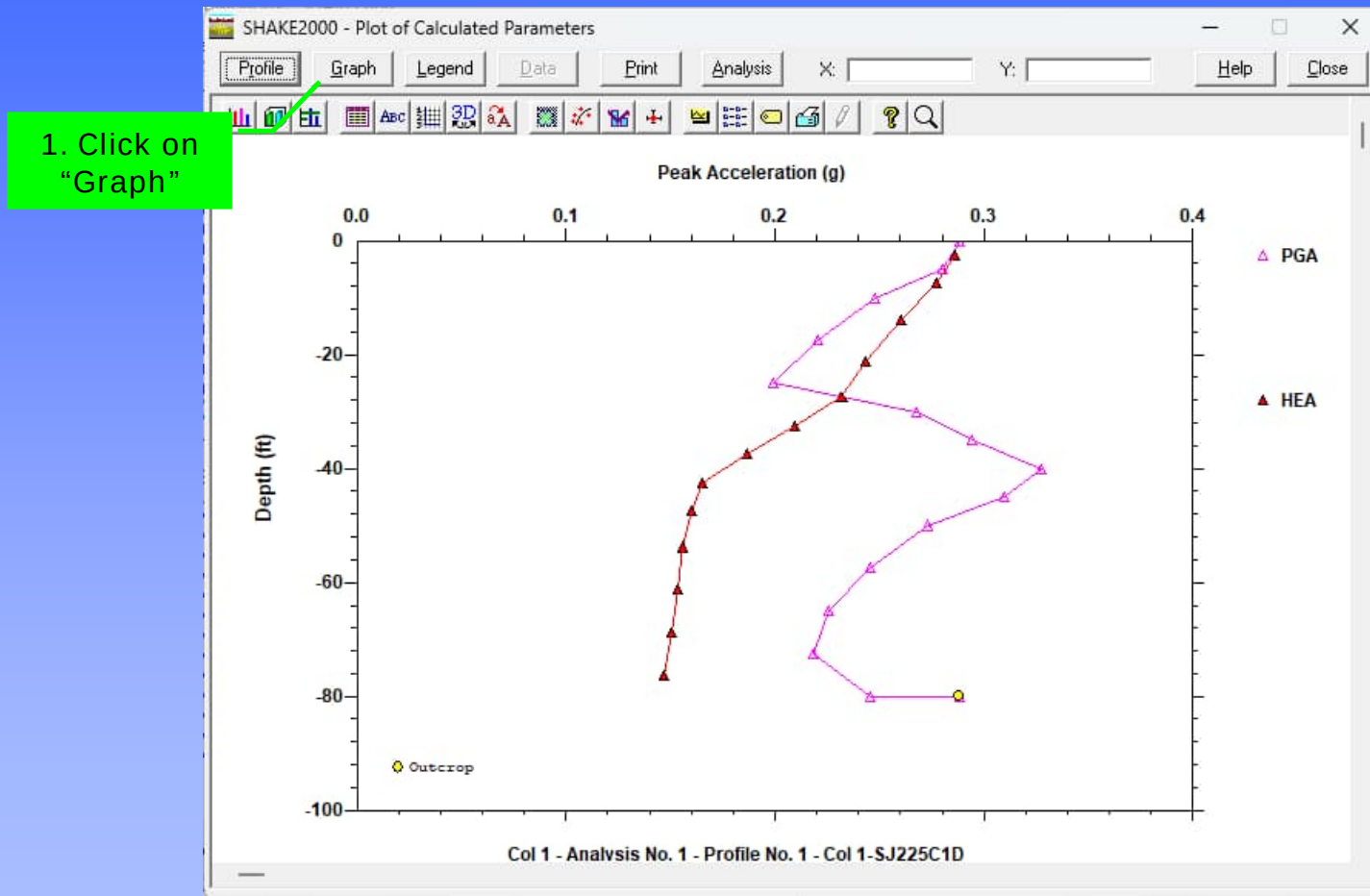


Site Specific Response Analysis

Plot Results



Plot Acceleration and Strain for Column No. 1

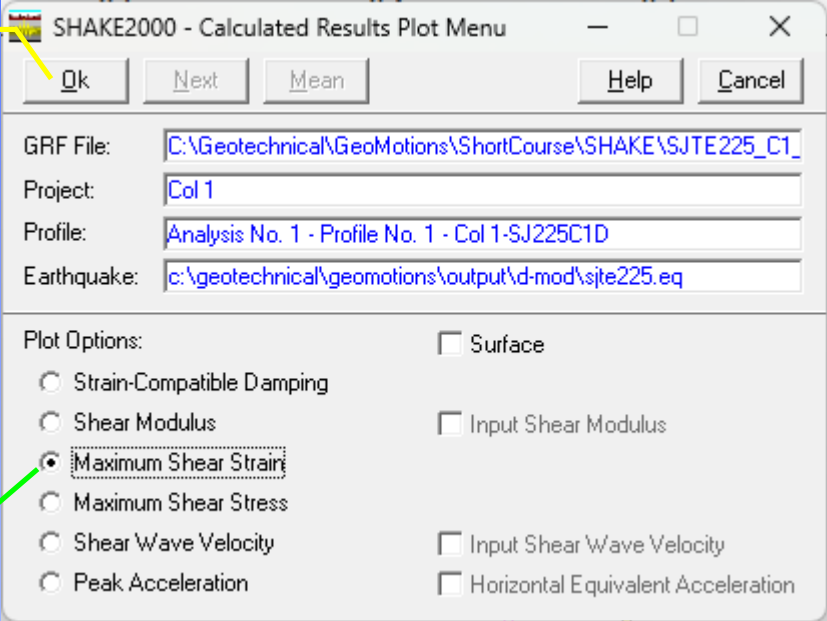


If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Plot Acceleration and Strain for Column No. 1

2. Click on "Ok"

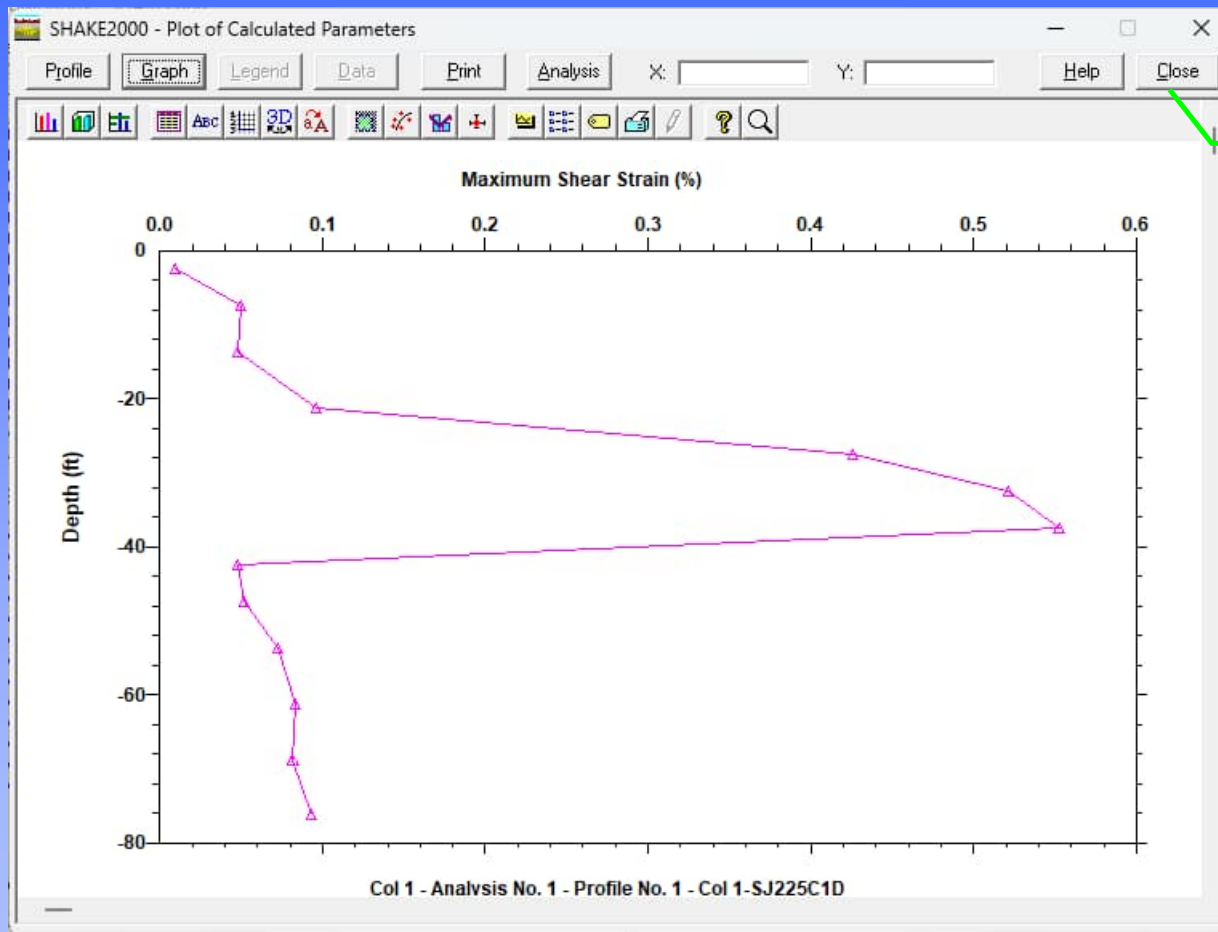
1. Select
"Maximum ..."



The image shows the 'SHAKE2000 - Calculated Results Plot Menu' dialog box. It has a title bar with a minus, maximize, and close button. Below the title bar are buttons for 'Ok', 'Next', 'Mean', 'Help', and 'Cancel'. The dialog contains several input fields: 'GRF File:' with the path 'C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1_', 'Project:' with 'Col 1', 'Profile:' with 'Analysis No. 1 - Profile No. 1 - Col 1-SJ225C1D', and 'Earthquake:' with 'c:\geotechnical\geomotions\output\d-mod\sje225.eq'. Below these is a 'Plot Options:' section with two columns of radio buttons and checkboxes. The first column has radio buttons for 'Strain-Compatible Damping', 'Shear Modulus', 'Maximum Shear Strain' (which is selected), 'Maximum Shear Stress', 'Shear Wave Velocity', and 'Peak Acceleration'. The second column has checkboxes for 'Surface', 'Input Shear Modulus', 'Input Shear Wave Velocity', and 'Horizontal Equivalent Acceleration'.

Plot Options:	
☐ Strain-Compatible Damping	☐ Surface
☐ Shear Modulus	☐ Input Shear Modulus
☒ Maximum Shear Strain	
☐ Maximum Shear Stress	
☐ Shear Wave Velocity	☐ Input Shear Wave Velocity
☐ Peak Acceleration	☐ Horizontal Equivalent Acceleration

Plot Acceleration and Strain for Column No. 1



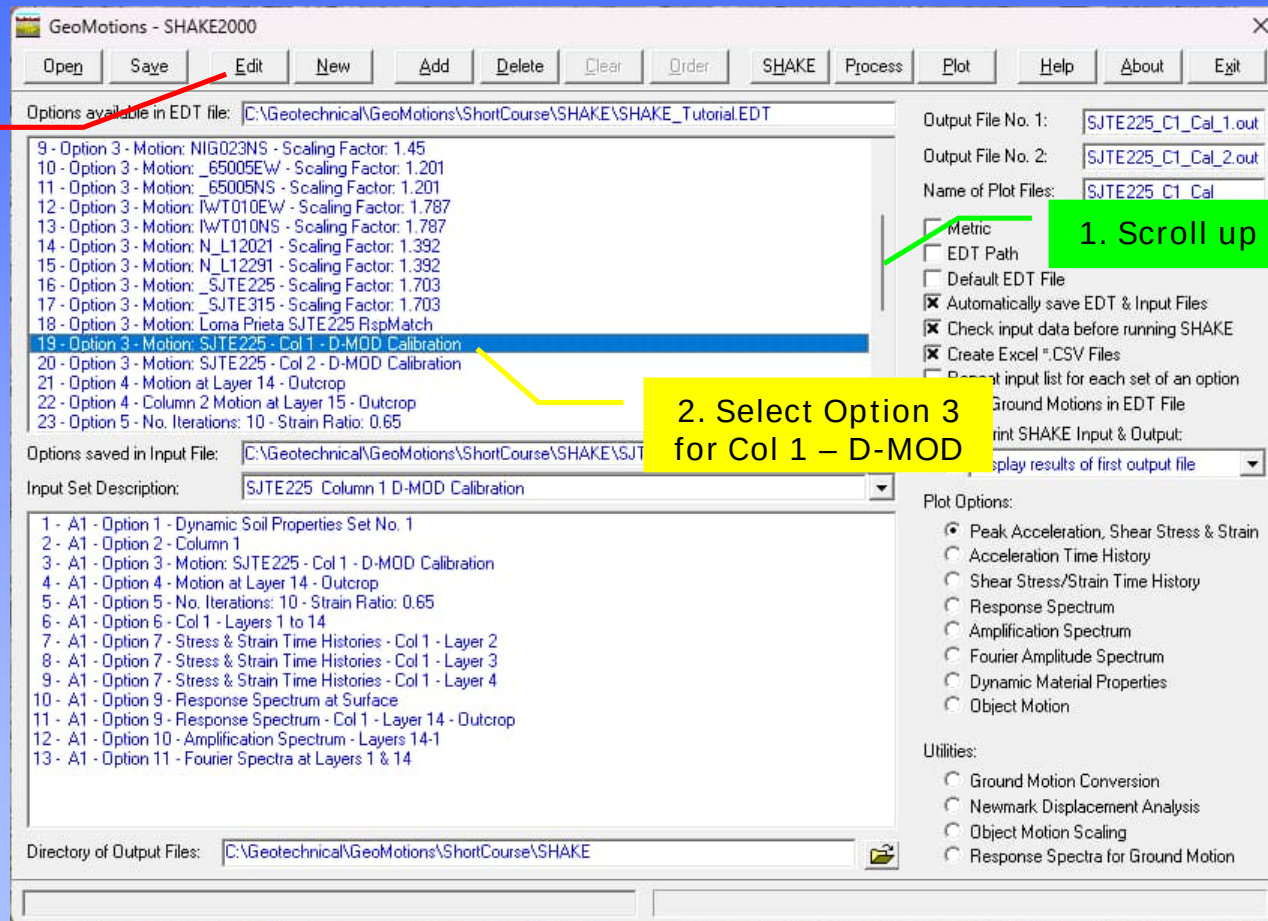
1. Click on
"Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Site Specific Response Analysis

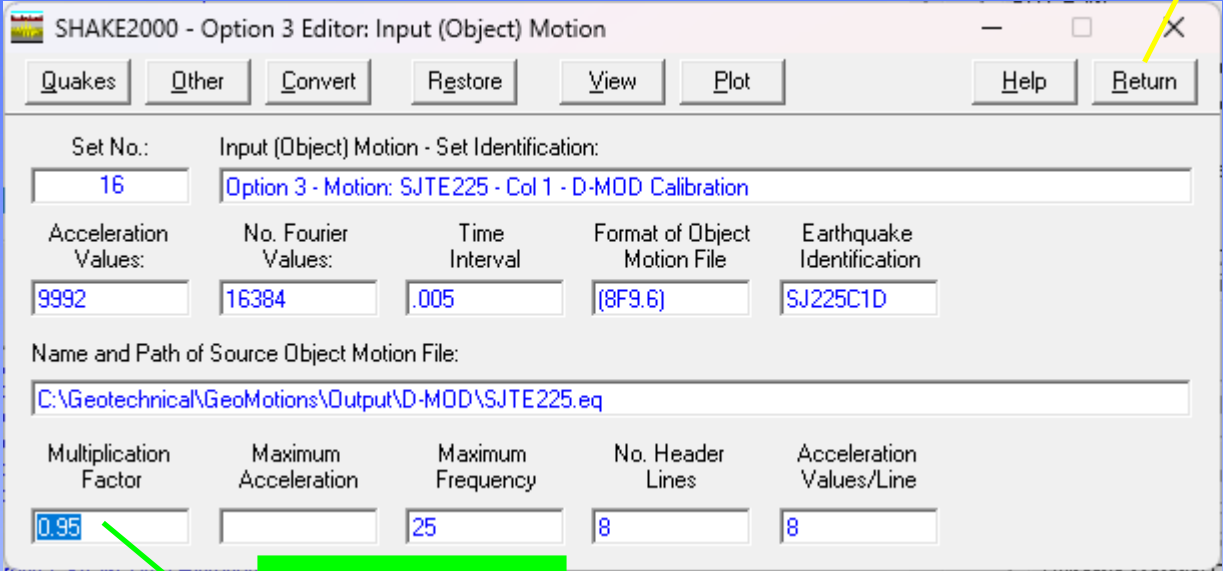
Modify Scaling Factor

3. Click
on "Edit"



Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 1 Modify Scaling Factor



SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 16 Input (Object) Motion - Set Identification: Option 3 - Motion: SJTE225 - Col 1 - D-MOD Calibration

Acceleration Values: 9992 No. Fourier Values: 16384 Time Interval: .005 Format of Object Motion File: (8F9.6) Earthquake Identification: SJ225C1D

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

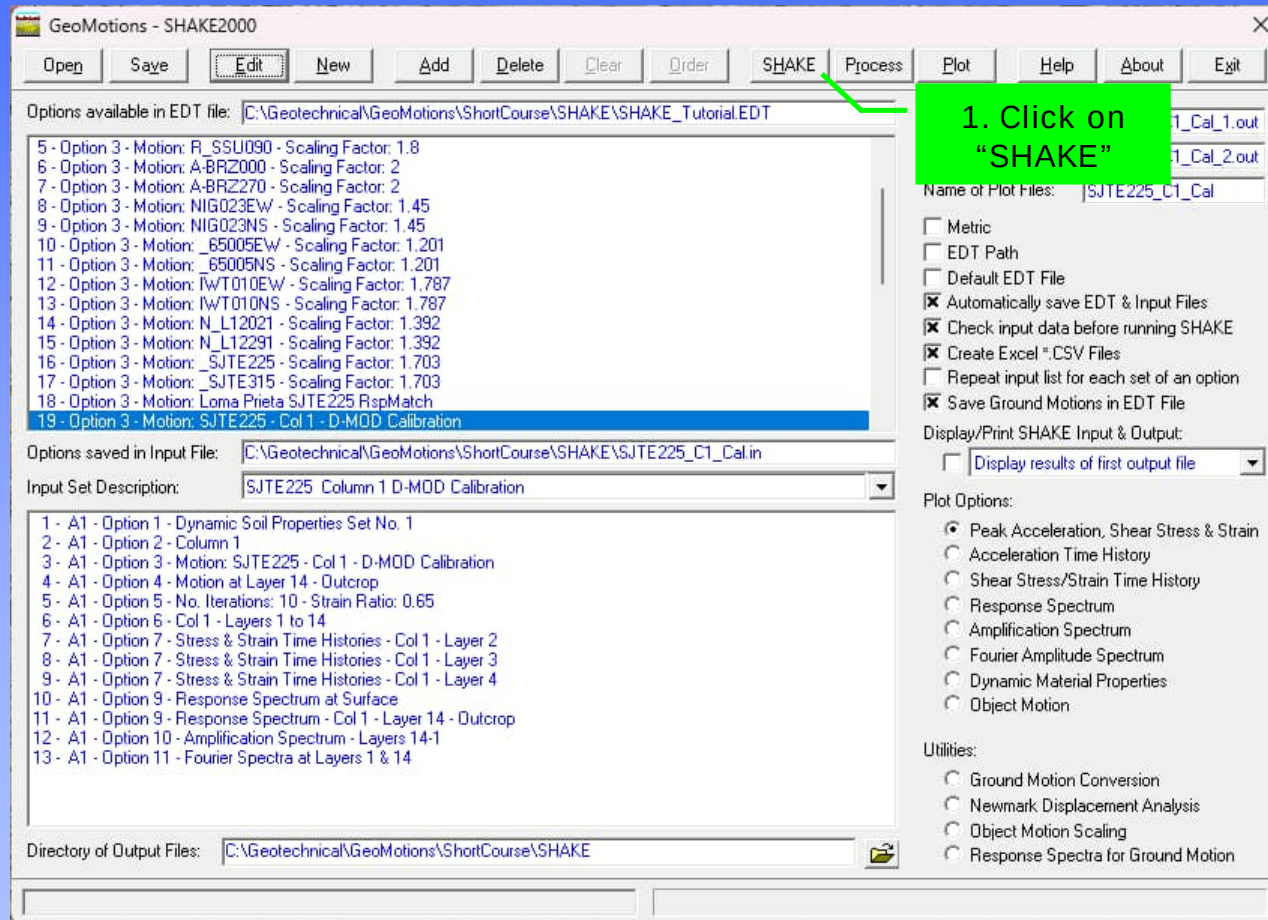
Multiplication Factor: 0.95 Maximum Acceleration: Maximum Frequency: 25 No. Header Lines: 8 Acceleration Values/Line: 8

2. Click on "Return"

1. Enter "0.95"

Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

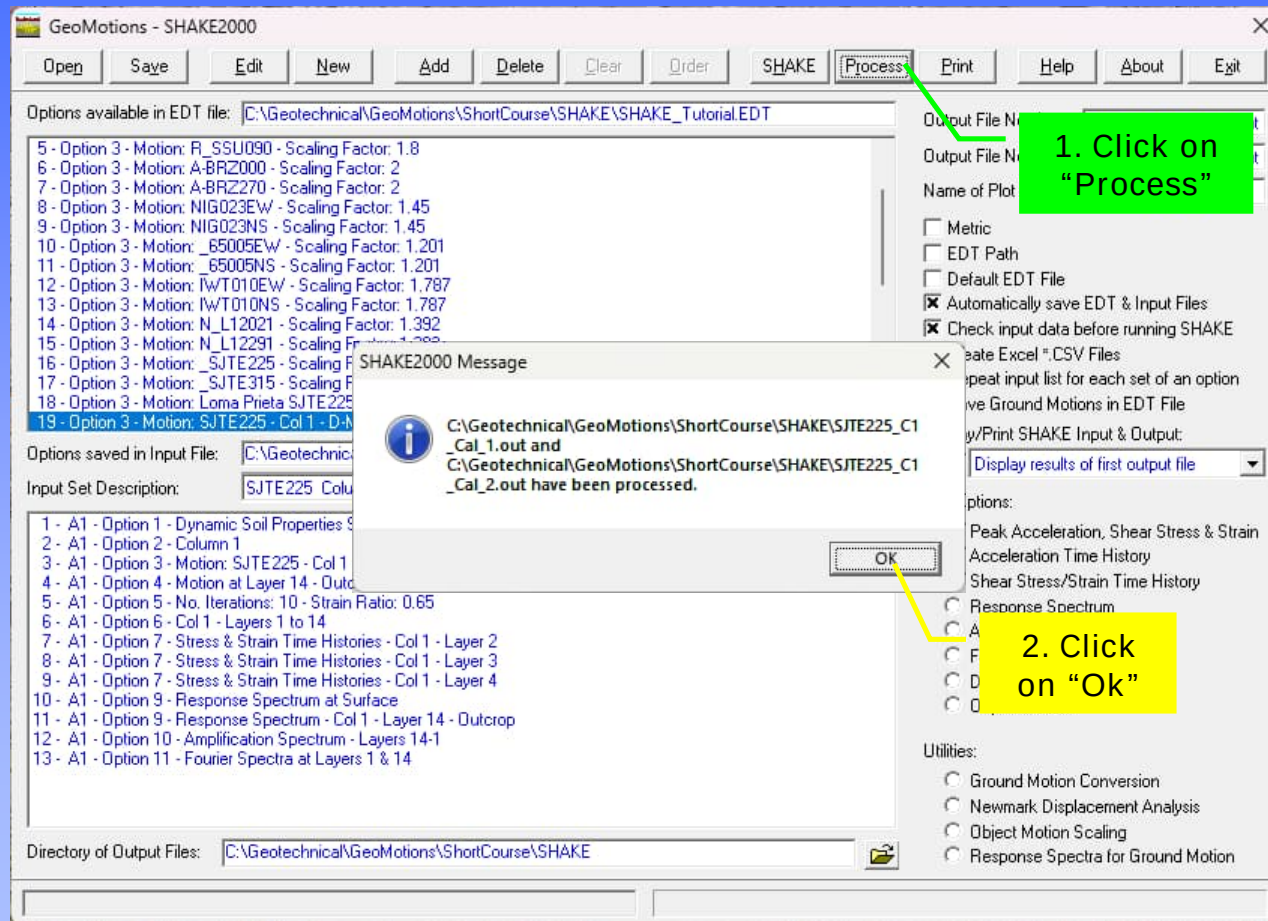
Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v

*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified*
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   ponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE 3/15/2025 *
*   RUN TIME 16:40 *
*****
```

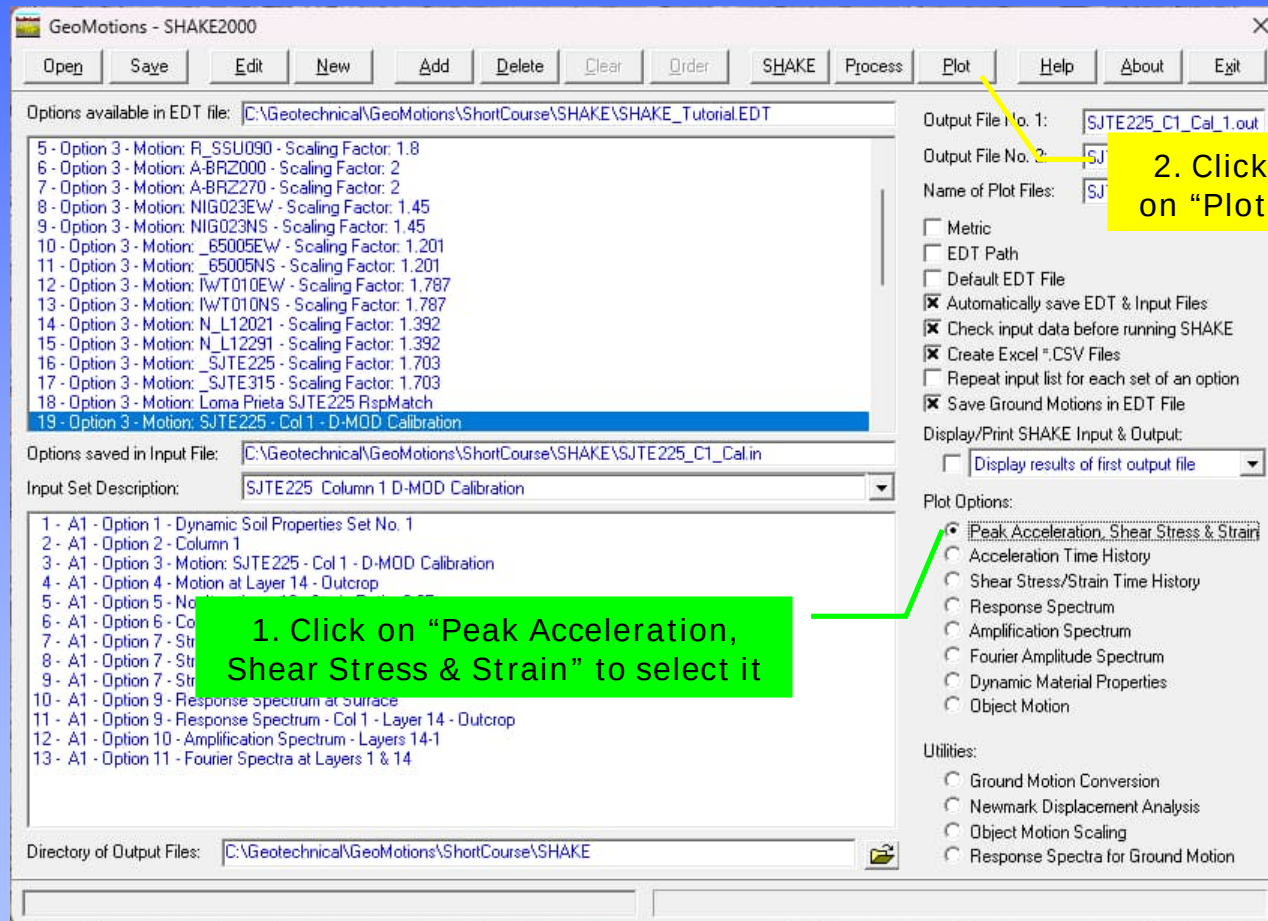

Site Specific Response Analysis

Process SHAKE's Output Files

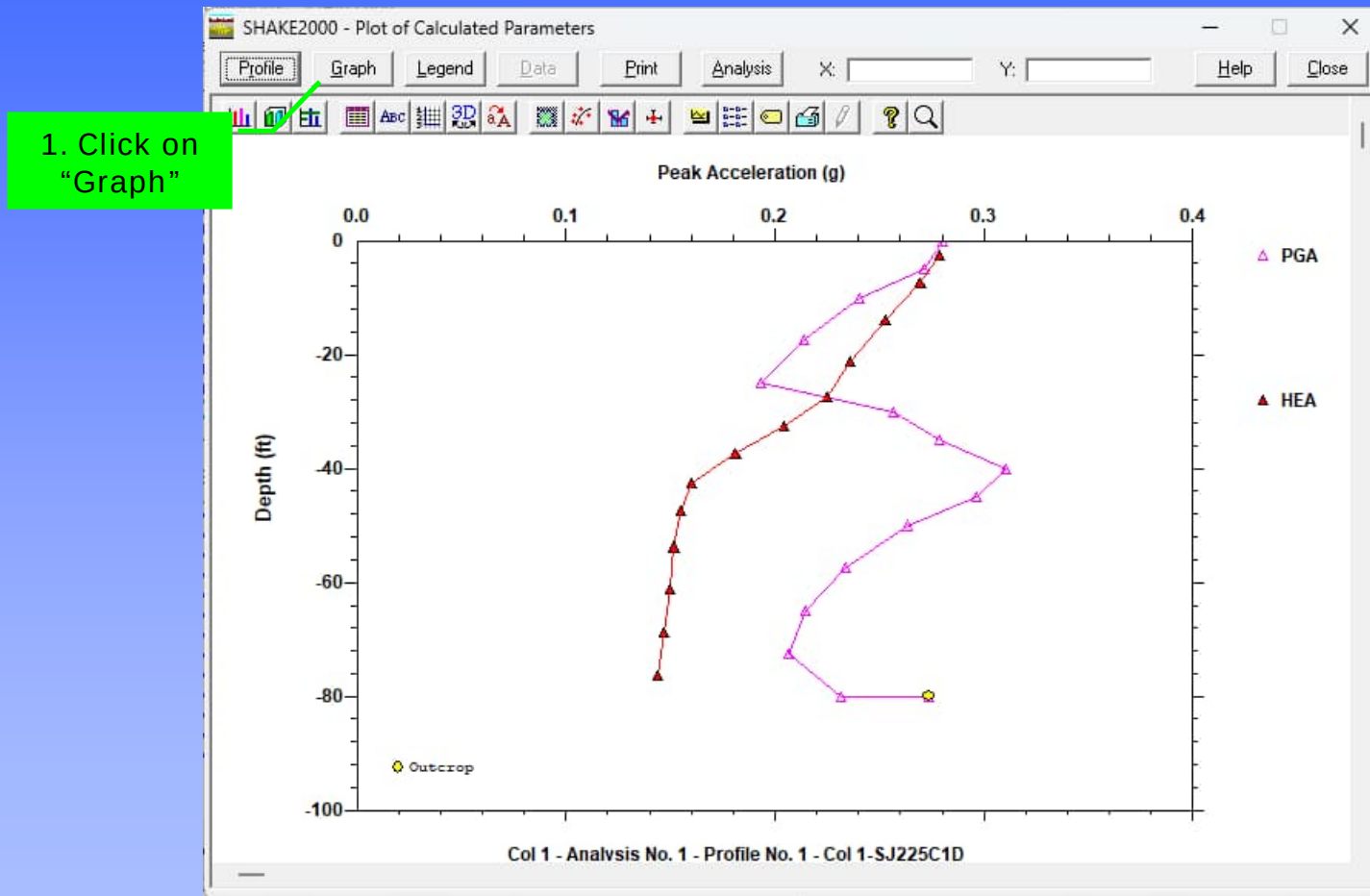


Site Specific Response Analysis

Plot Results



Plot Acceleration and Strain for Column No. 1

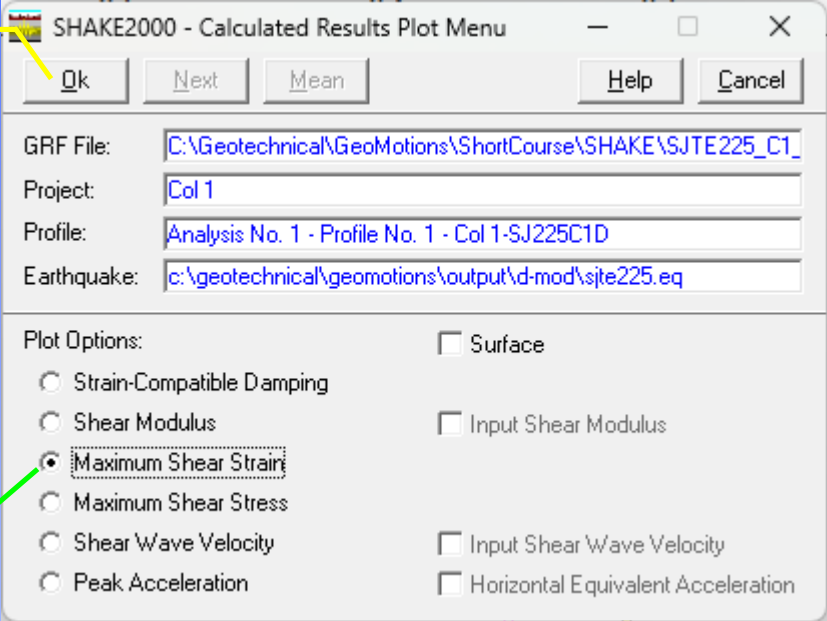


If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Plot Acceleration and Strain for Column No. 1

2. Click on "Ok"

1. Select
"Maximum ..."



The image shows the 'SHAKE2000 - Calculated Results Plot Menu' dialog box. It has a title bar with a minus, maximize, and close button. Below the title bar are five buttons: 'Ok', 'Next', 'Mean', 'Help', and 'Cancel'. The 'Ok' button is highlighted with a yellow arrow pointing from the text '2. Click on "Ok"'. The dialog contains several input fields: 'GRF File:' with the path 'C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1_', 'Project:' with 'Col 1', 'Profile:' with 'Analysis No. 1 - Profile No. 1 - Col 1-SJ225C1D', and 'Earthquake:' with 'c:\geotechnical\geomotions\output\d-mod\sje225.eq'. Below these fields is a section titled 'Plot Options:' containing two columns of radio buttons and checkboxes. The first column has radio buttons for 'Strain-Compatible Damping', 'Shear Modulus', 'Maximum Shear Strain' (which is selected and highlighted with a green arrow from the text '1. Select "Maximum ..."'), 'Maximum Shear Stress', 'Shear Wave Velocity', and 'Peak Acceleration'. The second column has checkboxes for 'Surface', 'Input Shear Modulus', 'Input Shear Wave Velocity', and 'Horizontal Equivalent Acceleration'.

SHAKE2000 - Calculated Results Plot Menu

Ok Next Mean Help Cancel

GRF File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1_

Project: Col 1

Profile: Analysis No. 1 - Profile No. 1 - Col 1-SJ225C1D

Earthquake: c:\geotechnical\geomotions\output\d-mod\sje225.eq

Plot Options:

☐ Strain-Compatible Damping ☐ Surface

☐ Shear Modulus ☐ Input Shear Modulus

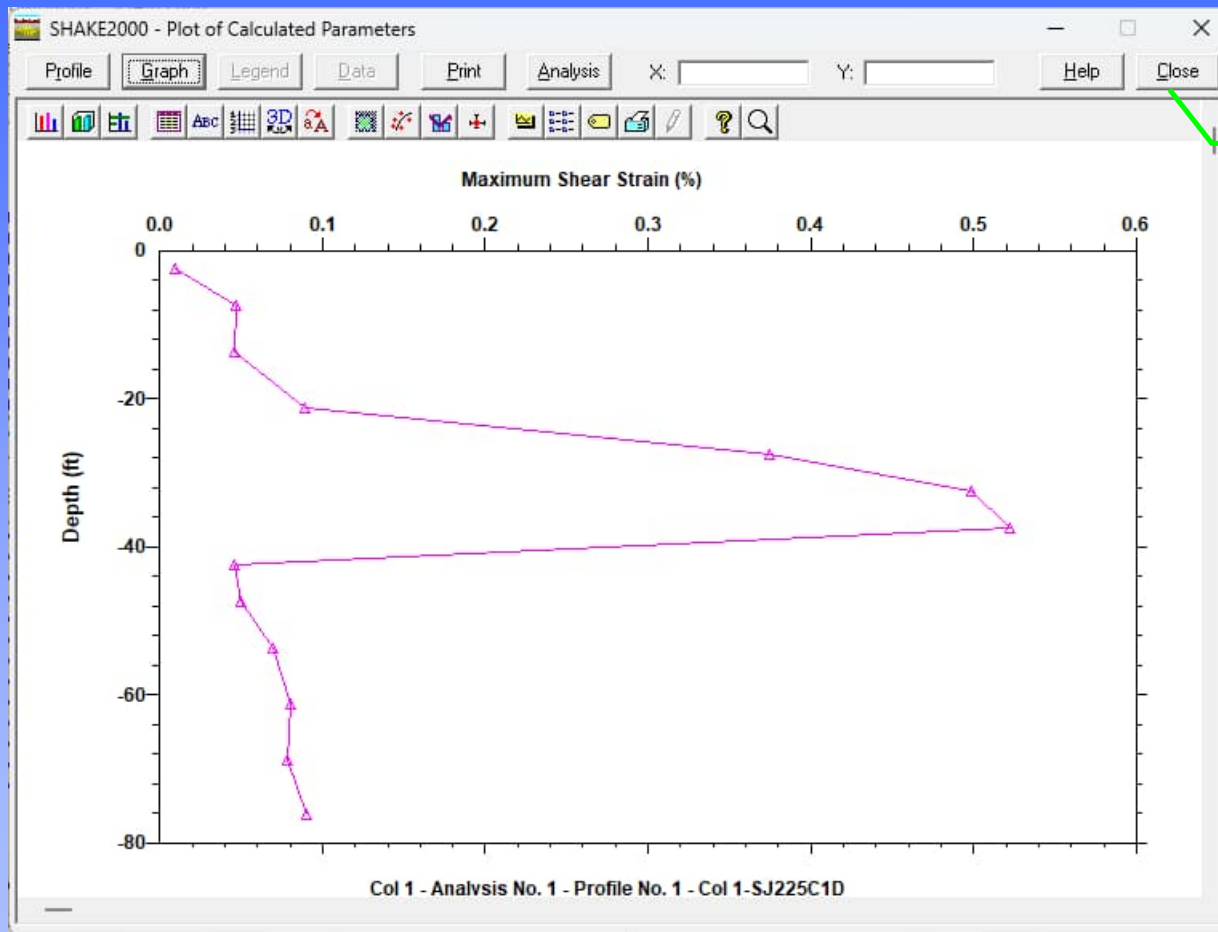
☒ Maximum Shear Strain

☐ Maximum Shear Stress

☐ Shear Wave Velocity ☐ Input Shear Wave Velocity

☐ Peak Acceleration ☐ Horizontal Equivalent Acceleration

Plot Acceleration and Strain for Column No. 1



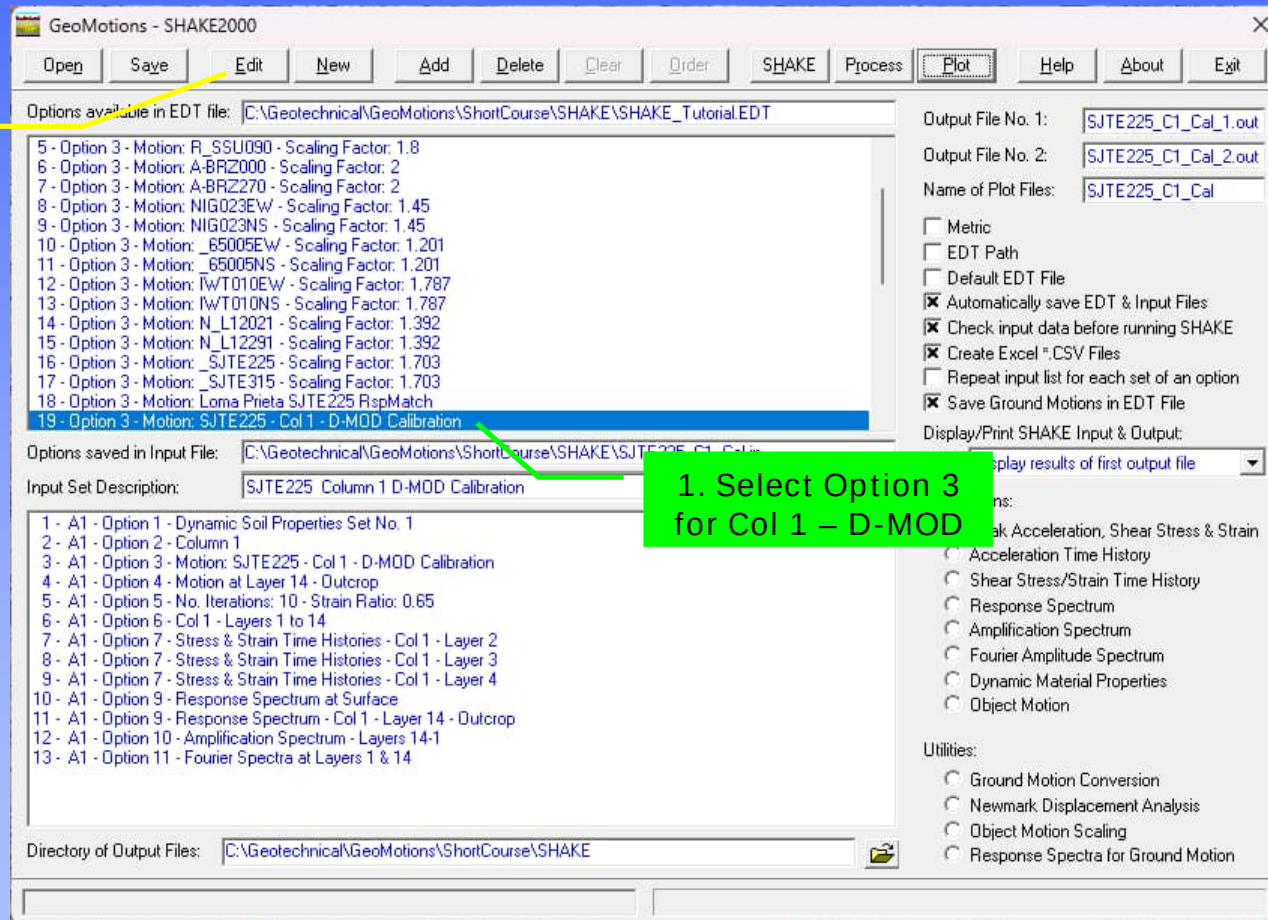
1. Click on
"Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Site Specific Response Analysis

Modify Scaling Factor

2. Click
on "Edit"



Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 1 Modify Scaling Factor

SHAKE2000 - Option 3 Editor: Input (Object) Motion

Quakes Other Convert Restore View Plot Help Return

Set No.: 16 Input (Object) Motion - Set Identification: Option 3 - Motion: SJTE225 - Col 1 - D-MOD Calibration

Acceleration Values: 9992 No. Fourier Values: 16384 Time Interval: .005 Format of Object Motion File: (8F9.6) Earthquake Identification: SJ225C1D

Name and Path of Source Object Motion File: C:\Geotechnical\GeoMotions\Output\D-MOD\SJTE225.eq

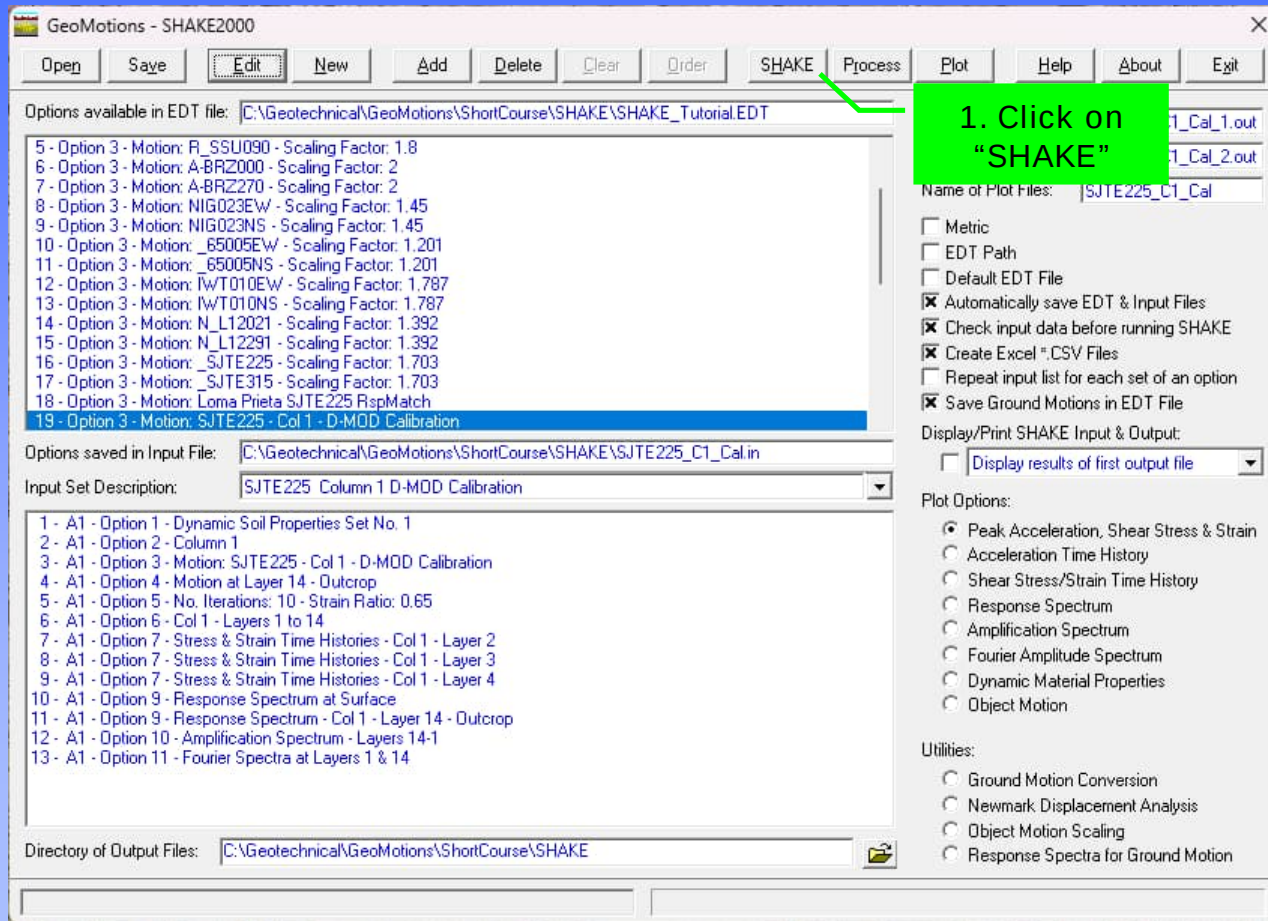
Multiplication Factor: 0.91 Maximum Acceleration: Maximum Frequency: 25 No. Header Lines: 8 Acceleration Values/Line: 8

1. Enter "0.91"

2. Click on "Return"

Site Specific Response Analysis

Execute SHAKE



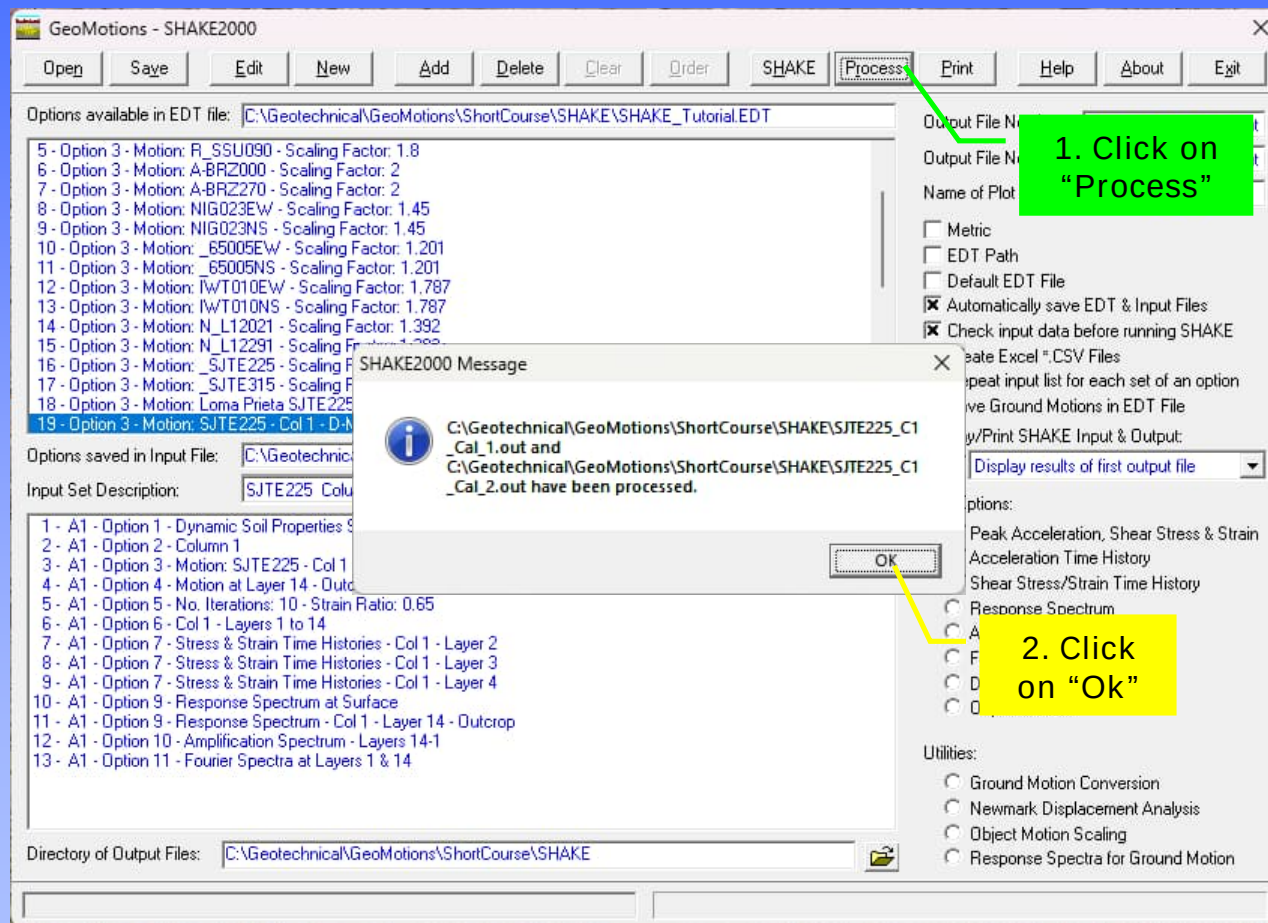
Site Specific Response Analysis

Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v
*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*   LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
*   using results from Sun et al (1988) by J. I. Sun *
*   & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
*   Gmax or max Vs; up to 13 materials can be specified *
*   by user; up to 50 Layers can be specified; object *
*   motion can be read in from a separate file and can *
*   user specified format; Different periods for res- *
*   ponse spectral calculations; options are renumbered; *
*   and general cleanup by: J. I. Sun, I. M. Idriss & *
*   P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
*   put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
*   option 2, changed path to ground motion file in *
*   SHAKE91, input file, increased motion to 30,000 values *
*   Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
*   RUN DATE 3/15/2025 *
*   RUN TIME 16:40 *
*****
```

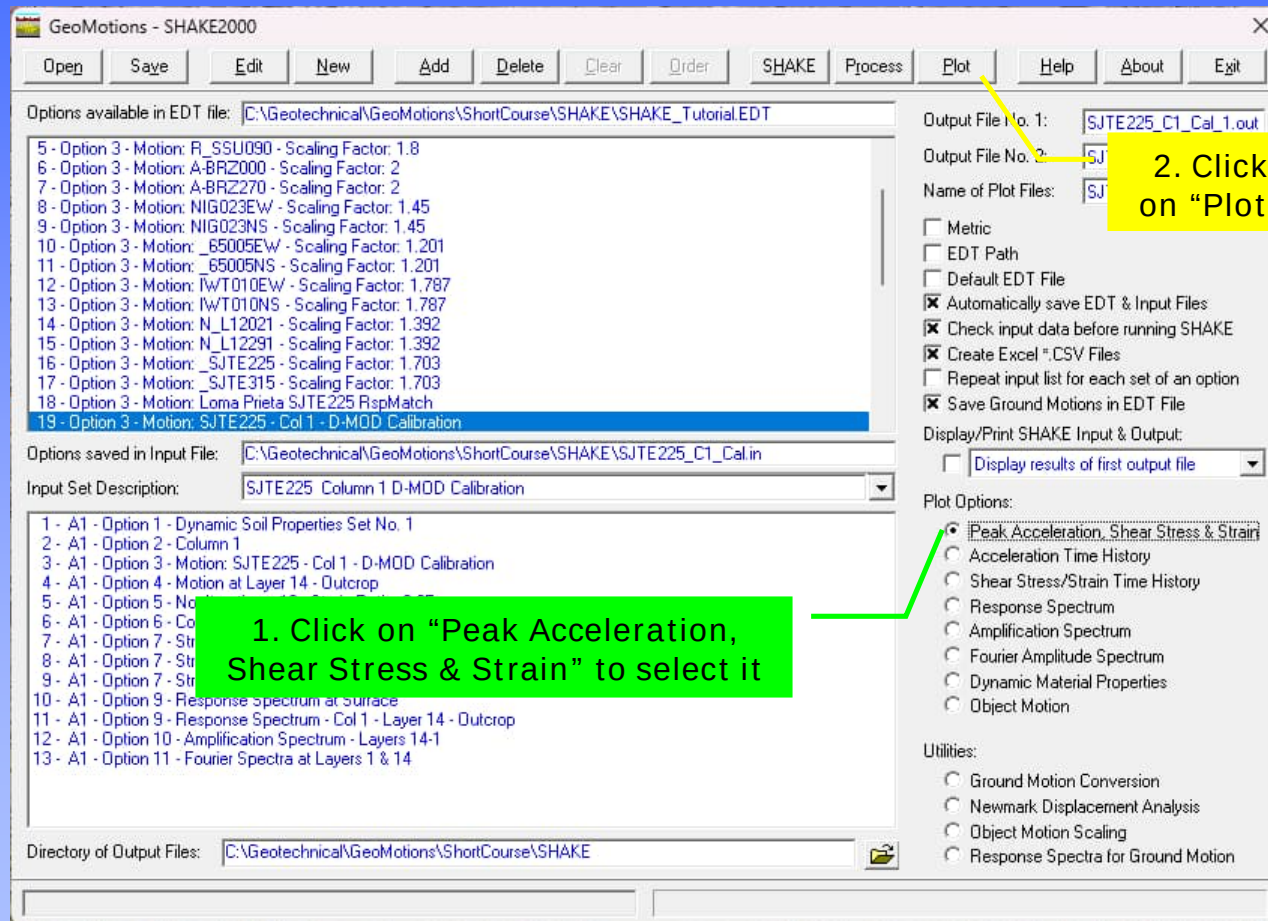
Site Specific Response Analysis

Process SHAKE's Output Files



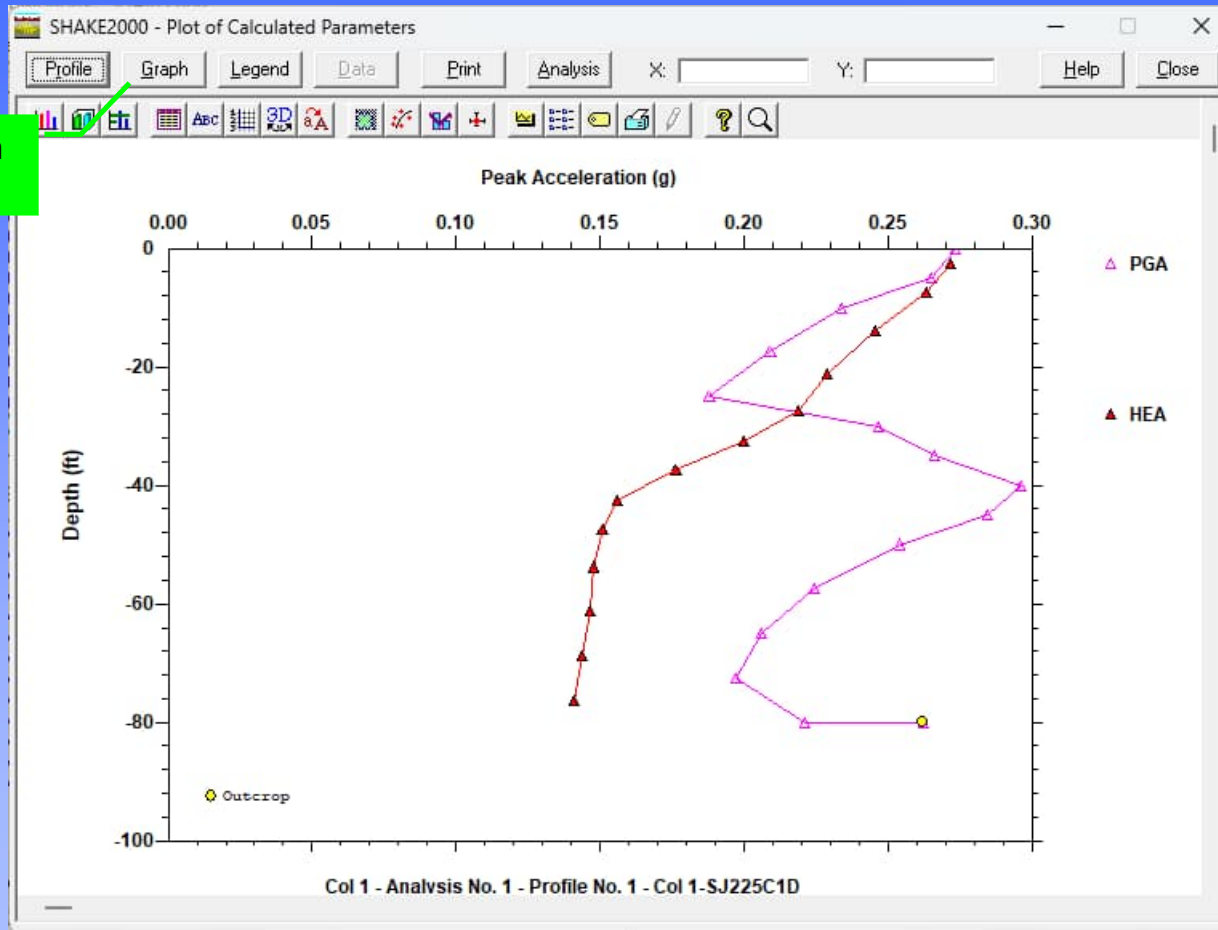
Site Specific Response Analysis

Plot Results



Plot Acceleration and Strain for Column No. 1

1. Click on
"Graph"

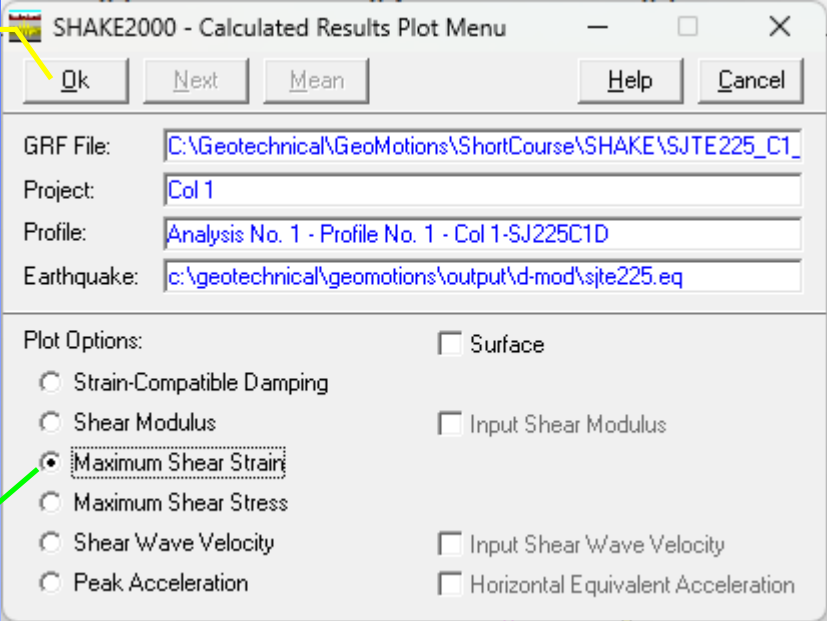


If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Plot Acceleration and Strain for Column No. 1

2. Click on "Ok"

1. Select
"Maximum ..."



The image shows a screenshot of the 'SHAKE2000 - Calculated Results Plot Menu' dialog box. The dialog has a title bar with a minus, maximize, and close button. Below the title bar are five buttons: 'Ok', 'Next', 'Mean', 'Help', and 'Cancel'. The 'Ok' button is highlighted with a yellow arrow pointing from the text '2. Click on "Ok"'. The dialog contains several input fields: 'GRF File:' with the path 'C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1_', 'Project:' with 'Col 1', 'Profile:' with 'Analysis No. 1 - Profile No. 1 - Col 1-SJ225C1D', and 'Earthquake:' with 'c:\geotechnical\geomotions\output\d-mod\sje225.eq'. Below these fields is a section titled 'Plot Options:' which contains two columns of radio buttons and checkboxes. The first column has radio buttons for 'Strain-Compatible Damping', 'Shear Modulus', 'Maximum Shear Strain' (which is selected and highlighted with a green arrow from the text '1. Select "Maximum ..."'), 'Maximum Shear Stress', 'Shear Wave Velocity', and 'Peak Acceleration'. The second column has checkboxes for 'Surface', 'Input Shear Modulus', 'Input Shear Wave Velocity', and 'Horizontal Equivalent Acceleration'.

SHAKE2000 - Calculated Results Plot Menu

Ok Next Mean Help Cancel

GRF File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1_

Project: Col 1

Profile: Analysis No. 1 - Profile No. 1 - Col 1-SJ225C1D

Earthquake: c:\geotechnical\geomotions\output\d-mod\sje225.eq

Plot Options:

☐ Surface

☐ Strain-Compatible Damping

☐ Shear Modulus

☒ Maximum Shear Strain

☐ Maximum Shear Stress

☐ Shear Wave Velocity

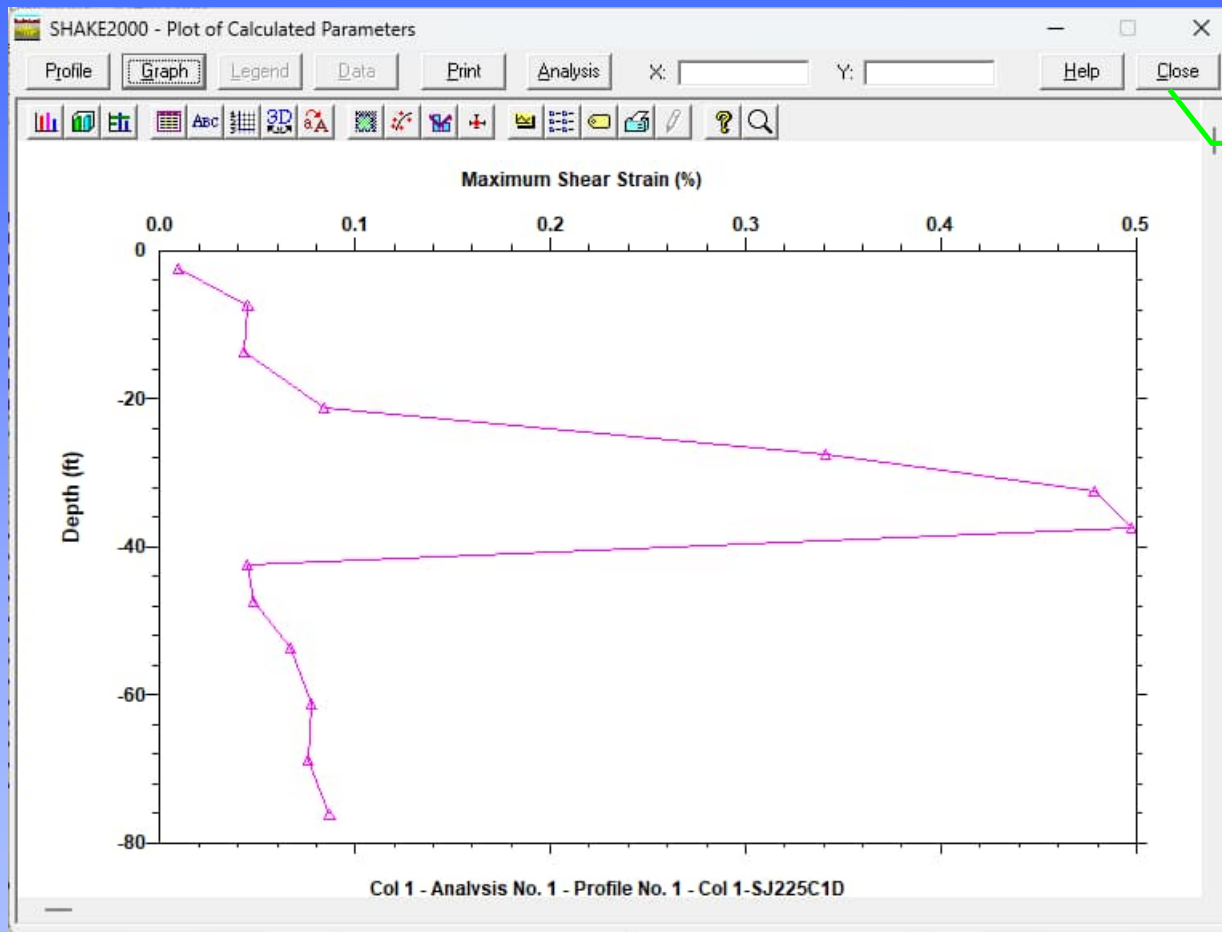
☐ Peak Acceleration

☐ Input Shear Modulus

☐ Input Shear Wave Velocity

☐ Horizontal Equivalent Acceleration

Plot Acceleration and Strain for Column No. 1



1. Click on
"Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

SHAKE Calibration for D-MOD Analysis

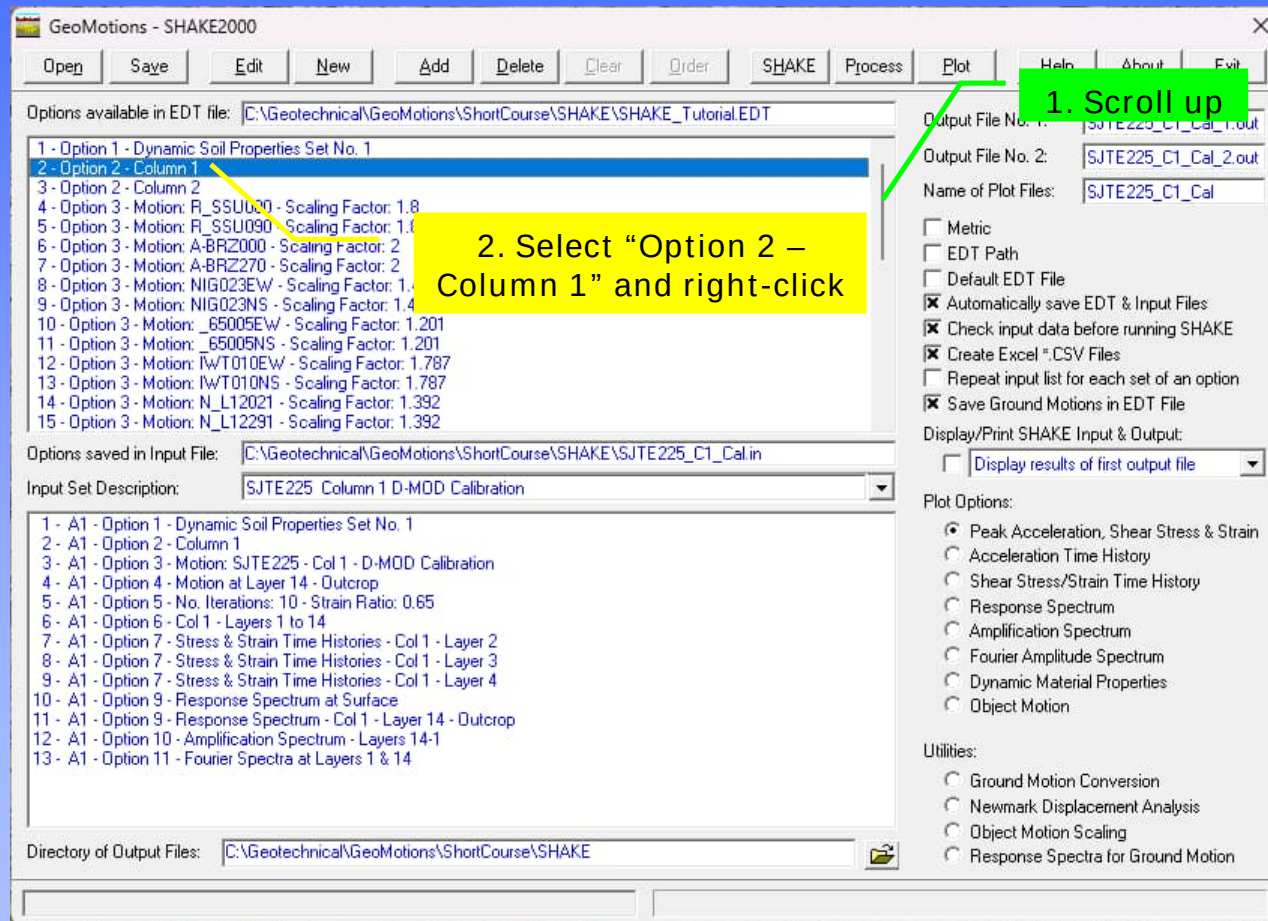
A second approach to estimate viscous damping parameters is by calibrating the D-MOD analysis against a linear SHAKE, analysis for small strain conditions (i.e., use $G_{\max}$ and a constant value of 5% damping for all soil layers). More detailed information on this procedure is presented by Stewart et al (2008).

1. Develop a SHAKE column and perform a small strain linear SHAKE analysis to obtain the acceleration time history at the surface level. Use $G_{\max}$ and 5% damping for all soil layers (i.e., use “zero” type soils in Option 2). (This tutorial).
2. Develop the D-MOD column to match the SHAKE column as close as possible; use $n = 0$ and $\xi = 5$ for first iteration.
3. Perform a Total-Stress\Linear-Elastic analysis with D-MOD.
4. Compare the surface response spectrum from SHAKE to the response spectrum from D-MOD.
5. Adjust n and ξ and repeat from step 3 until a match between the SHAKE and D-MOD spectra is obtained within a reasonable degree of tolerance. Also, compare peak acceleration & Shear Strain vs. depth obtained from SHAKE and D-MOD.

Stewart, Jonathan P., Annie On-Lei Kwok, Youssef M.A. Hashash, Neven Matasovic, Robert Pyke, Zhiliang Wang, Zhaohui Yang (2008). *Benchmarking of Nonlinear Geotechnical Ground Response Analysis Procedures*. PEER Report 2008/04, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, Berkeley. August 2008.

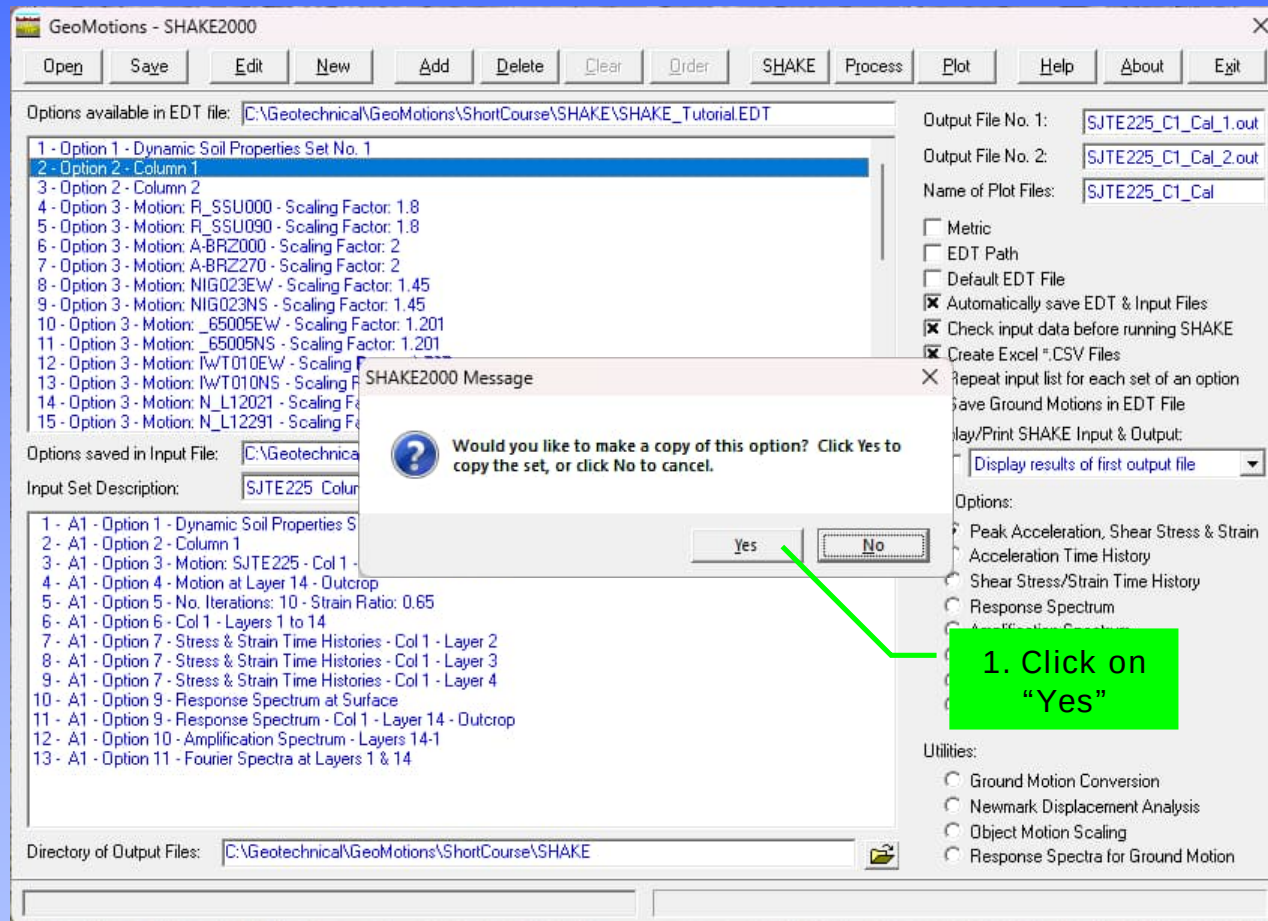
D-MOD Calibration

Small Strain Linear Analysis



D-MOD Calibration

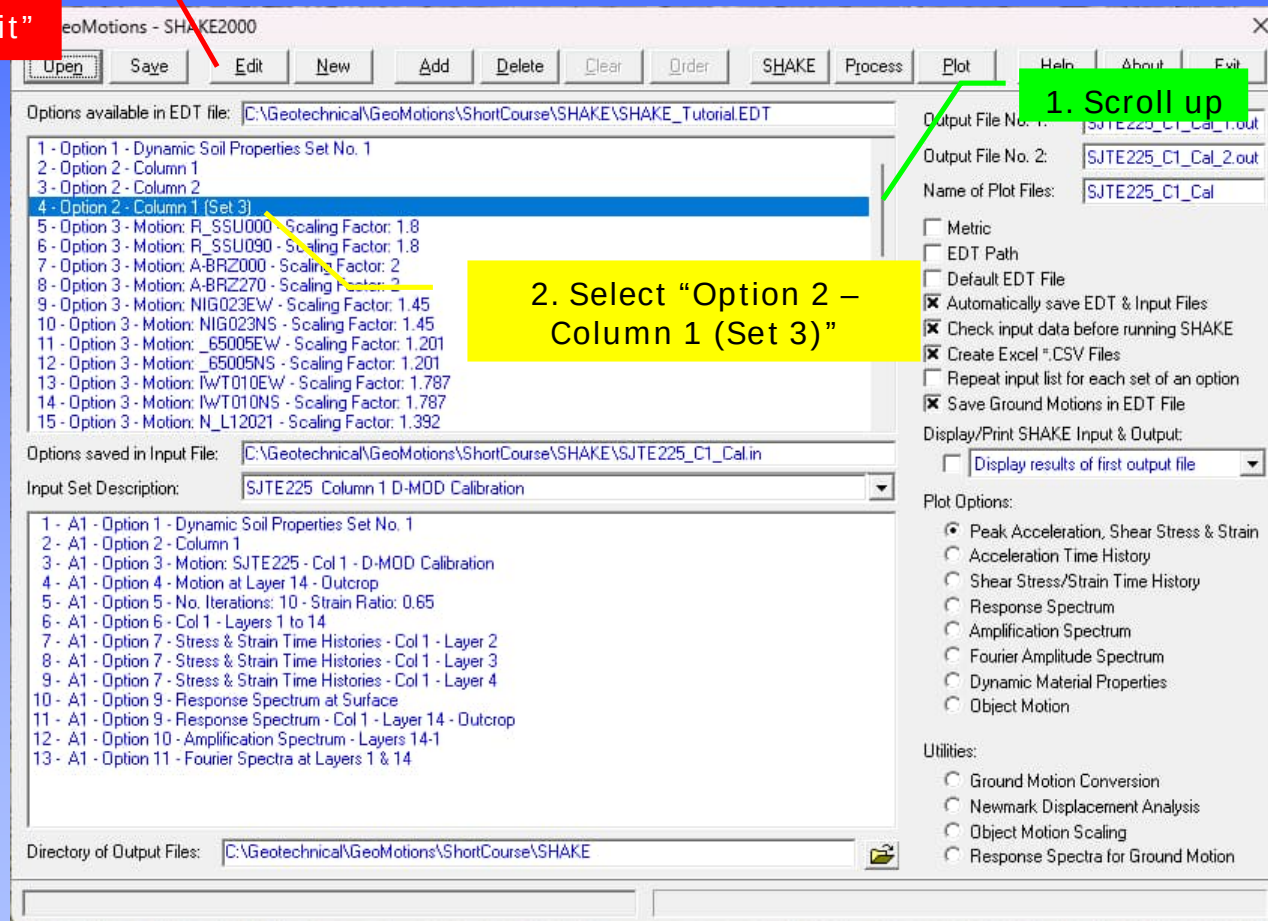
Small Strain Linear Analysis



D-MOD Calibration

Small Strain Linear Analysis

3. Click
on "Edit"



Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile

1. Enter "Option 2 – Column 1 – Small Strain"

2. Enter "Col 1 - SM"

3. Enter "0" in Soil Type

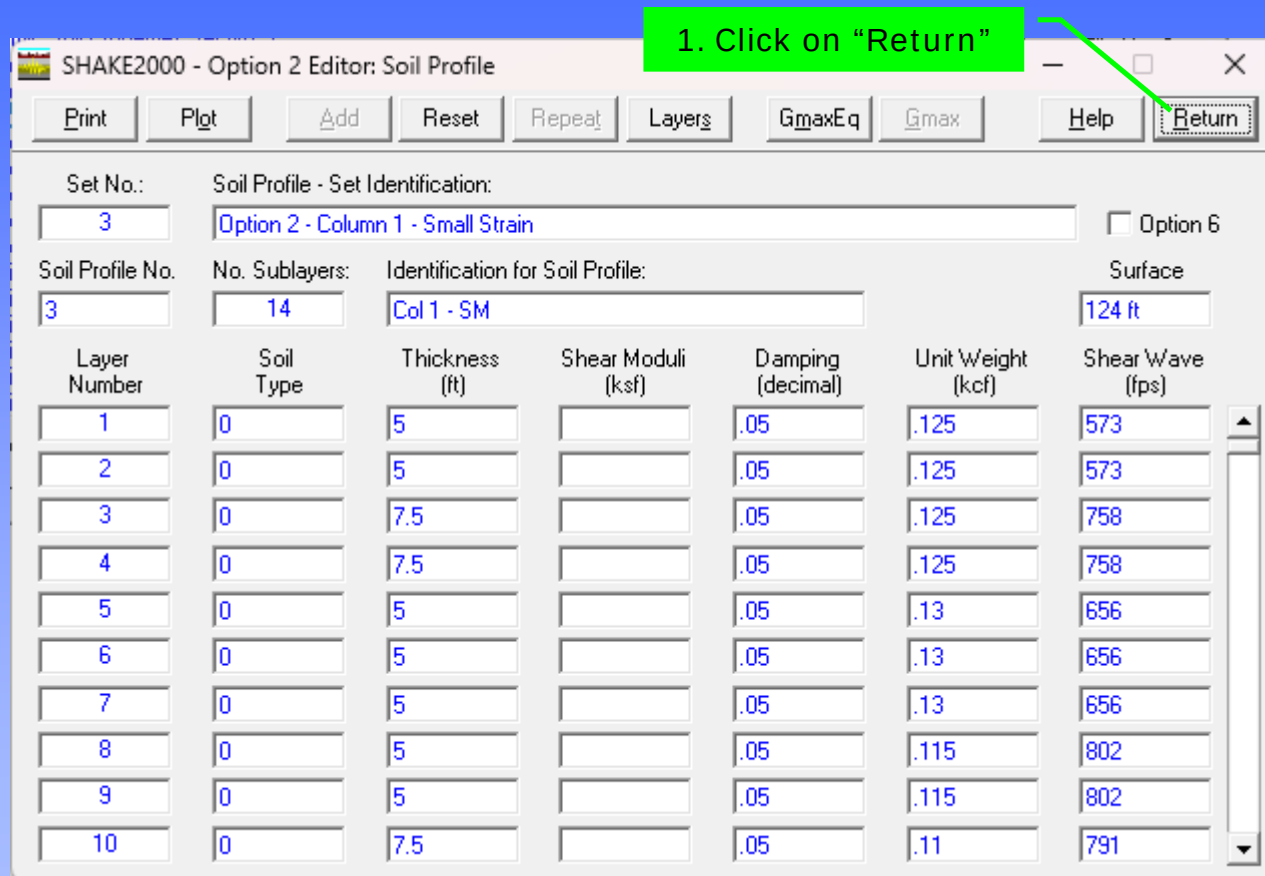
4. Click on "Yes"

Layer Number	Soil Type	Thickness	Shear Modulus	Damping	Unit Weight	Shear Wave Velocity (fps)
1	1					
2	1					
3	1					
4	1					
5	2					
6	2					
7	2					
8	3	5		.05	.115	
9	3	5		.05	.115	802
10	4	7.5		.05	.11	791

Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile

1. Click on "Return"



SHAKE2000 - Option 2 Editor: Soil Profile

Print Plot Add Reset Repeat Layers GmaxEq Gmax Help Return

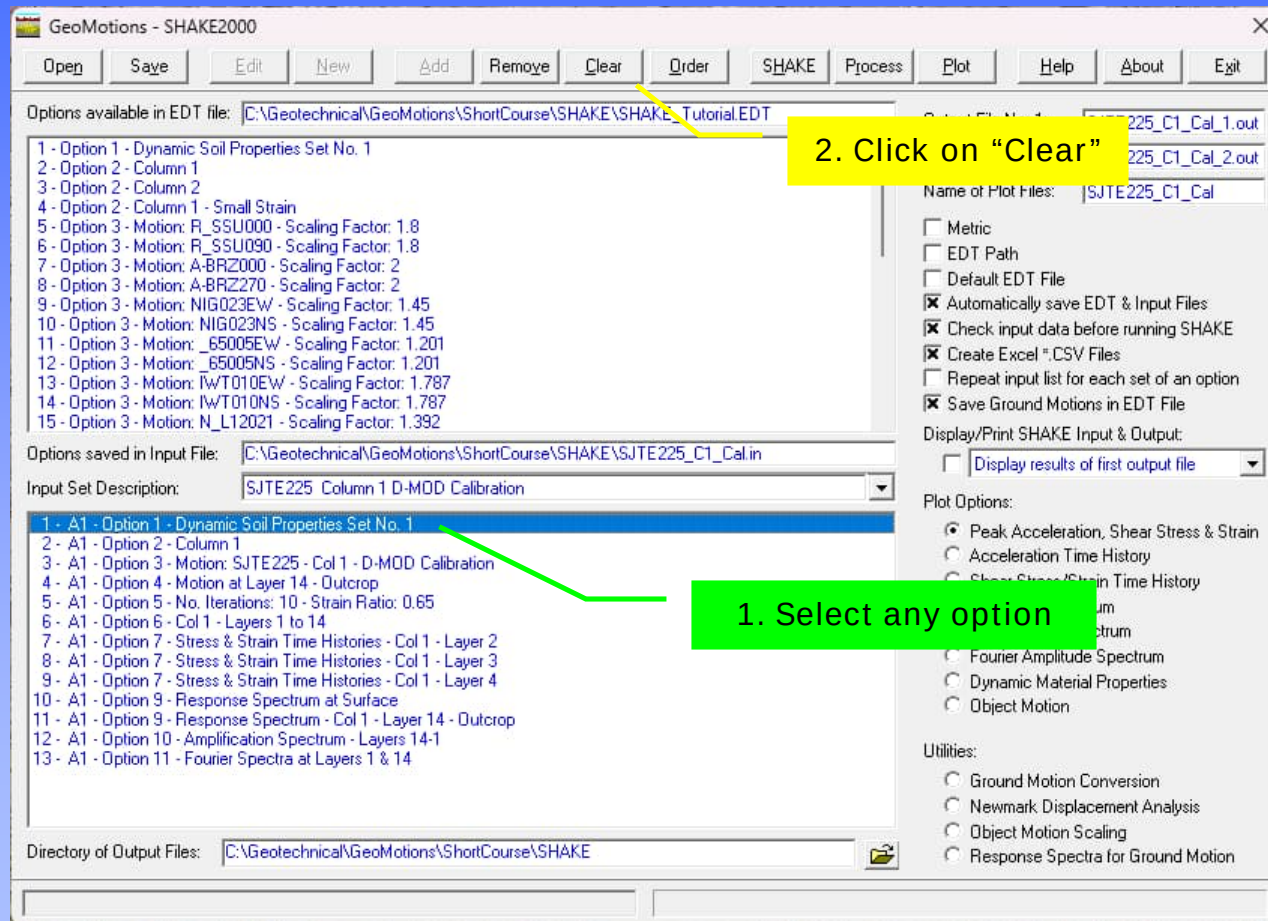
Set No.: 3 Soil Profile - Set Identification: Option 2 - Column 1 - Small Strain ☐ Option 6

Soil Profile No. 3 No. Sublayers: 14 Identification for Soil Profile: Col 1 - SM Surface 124 ft

Layer Number	Soil Type	Thickness (ft)	Shear Moduli (ksf)	Damping (decimal)	Unit Weight (kcf)	Shear Wave (fps)
1	0	5		.05	.125	573
2	0	5		.05	.125	573
3	0	7.5		.05	.125	758
4	0	7.5		.05	.125	758
5	0	5		.05	.13	656
6	0	5		.05	.13	656
7	0	5		.05	.13	656
8	0	5		.05	.115	802
9	0	5		.05	.115	802
10	0	7.5		.05	.11	791

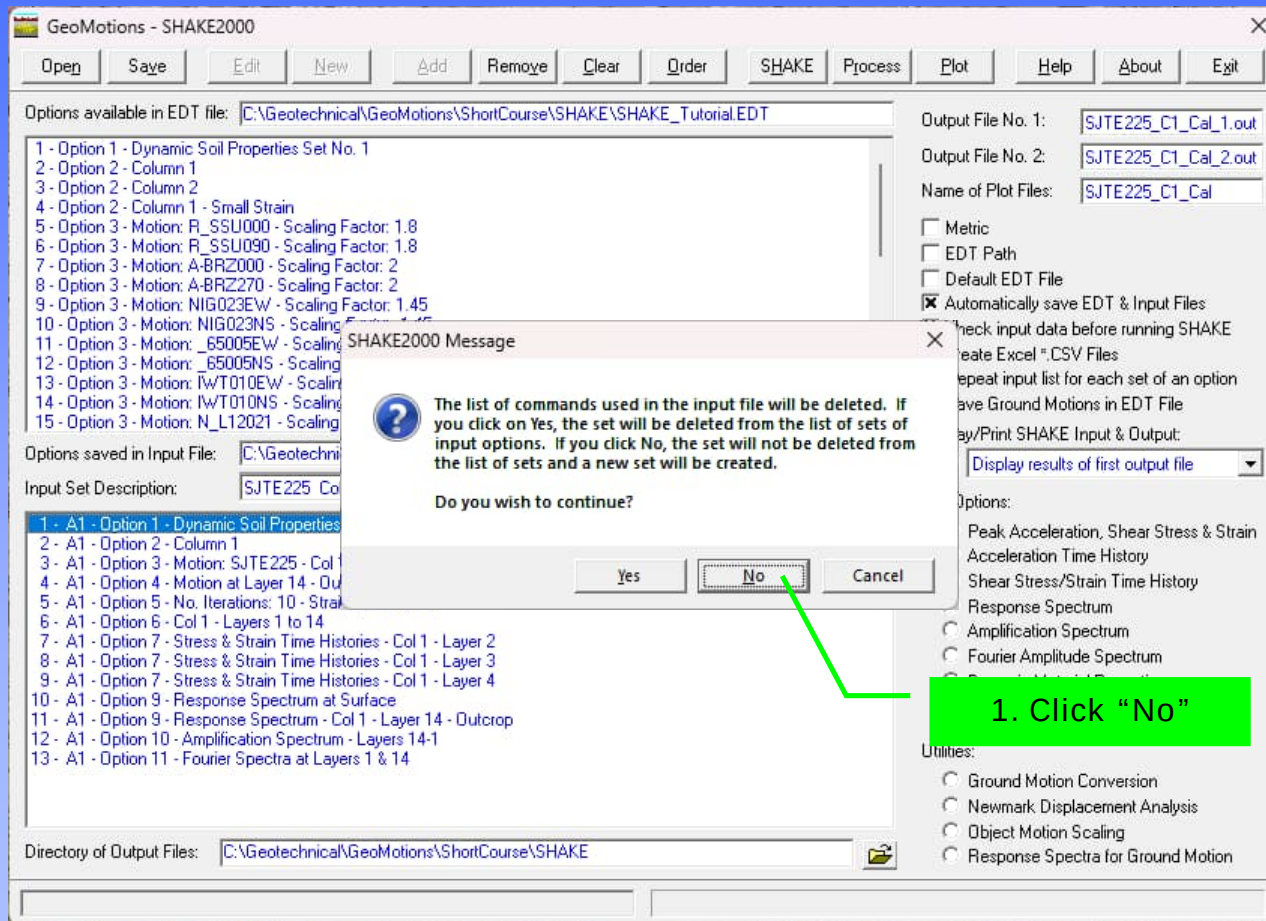
D-MOD Calibration

Small Strain Linear Analysis



D-MOD Calibration

Small Strain Linear Analysis



Site Specific Response Analysis

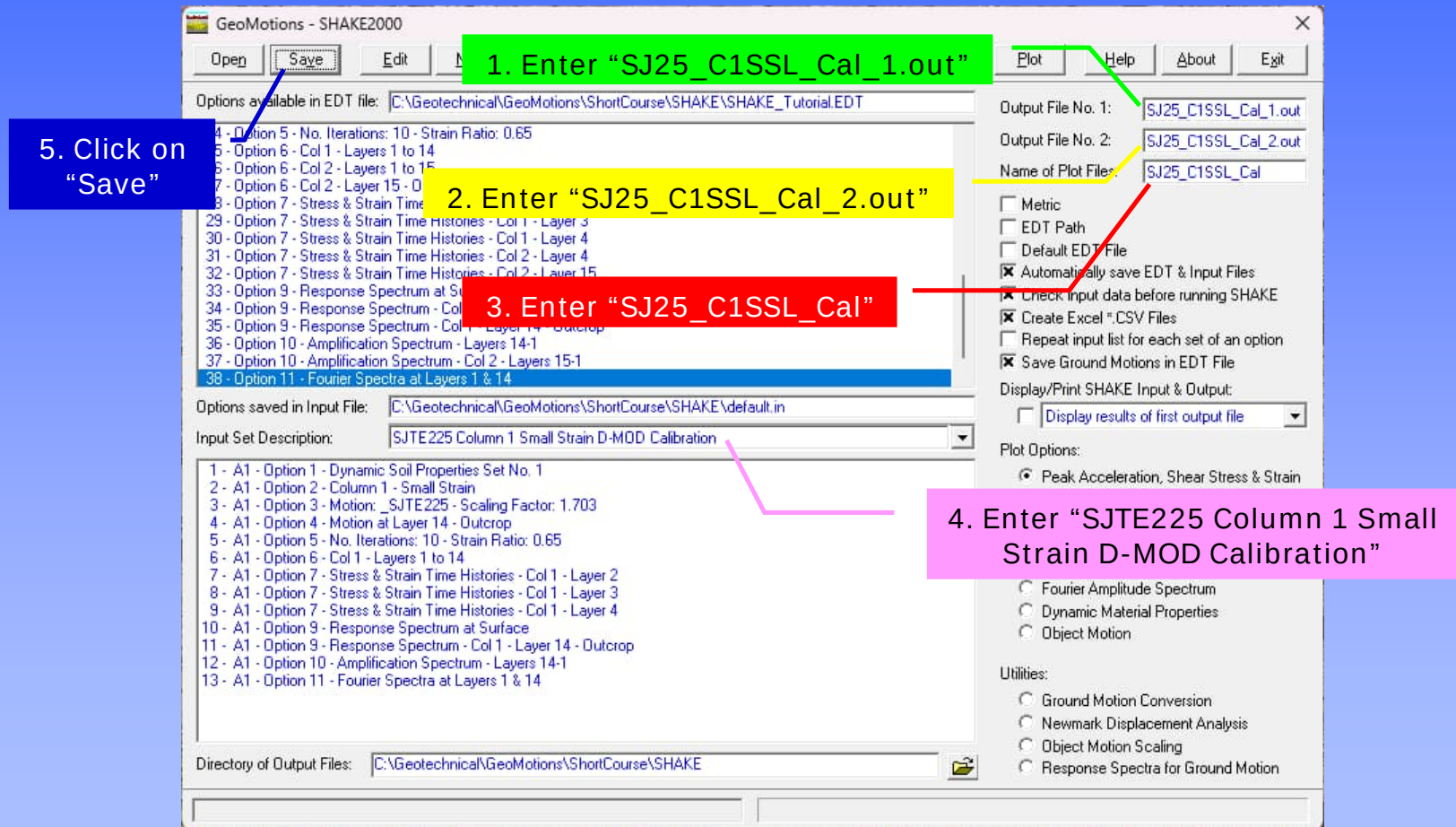
List of Input Options for D-MOD Calibration

Add the following options to input file list:

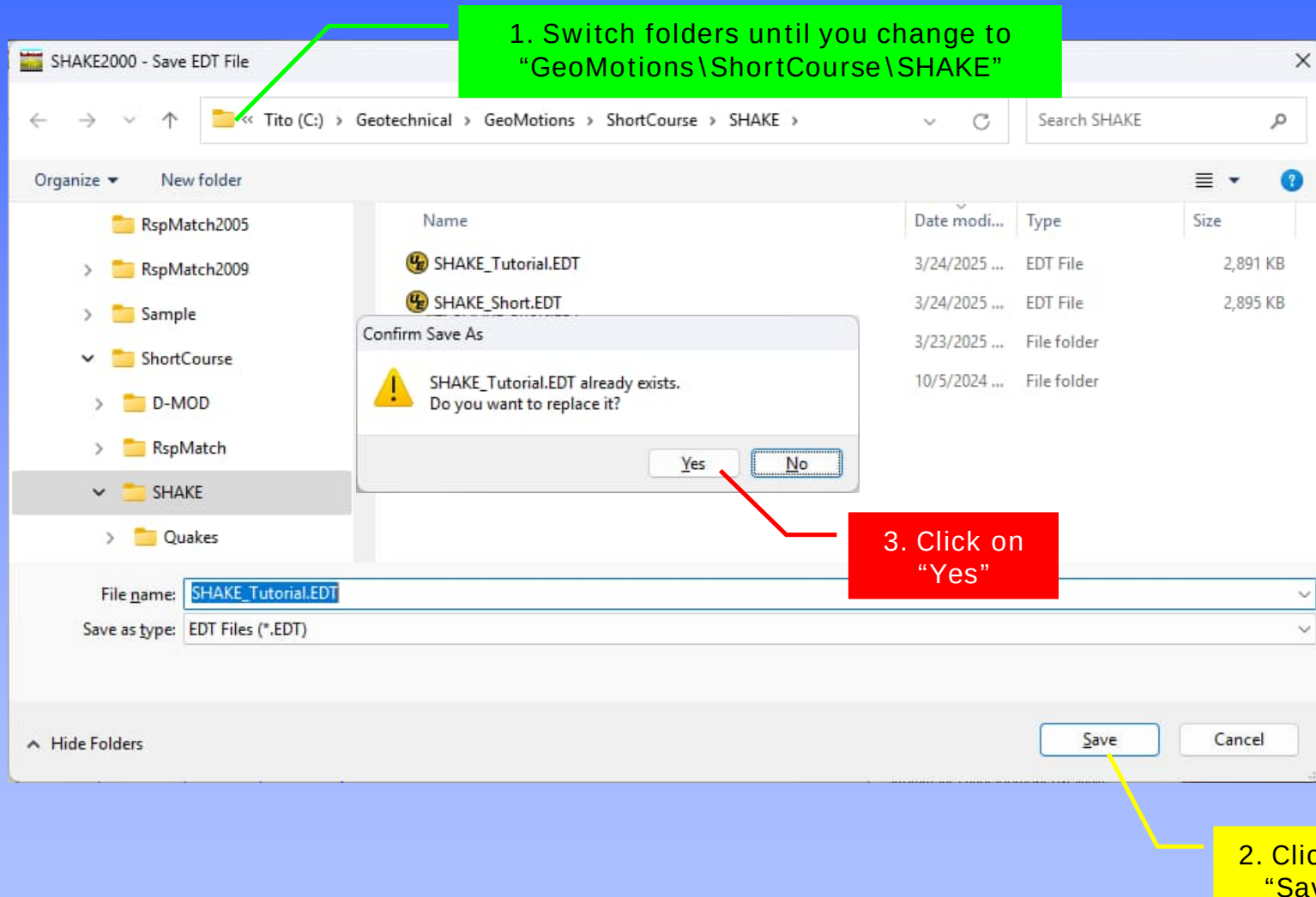
Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
3	Option 2 – Column 1 – Small Strain
17	Option 3 – Motion: _SJTE225 – Scaling Factor: 1.703
22	Option 4 – Motion at Layer 14 - Outcrop
24	Option 5 – No. of Iterations: 10 – Strain Ratio: 0.65
25	Option 6 – Col 1 – Layers 1 to 14
28	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
29	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
30	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
33	Option 9 – Response Spectrum at Surface
35	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
36	Option 10 – Amplification Spectrum – Layers 14-1
38	Option 11 – Fourier Spectra at Layers 1 & 14

D-MOD Calibration

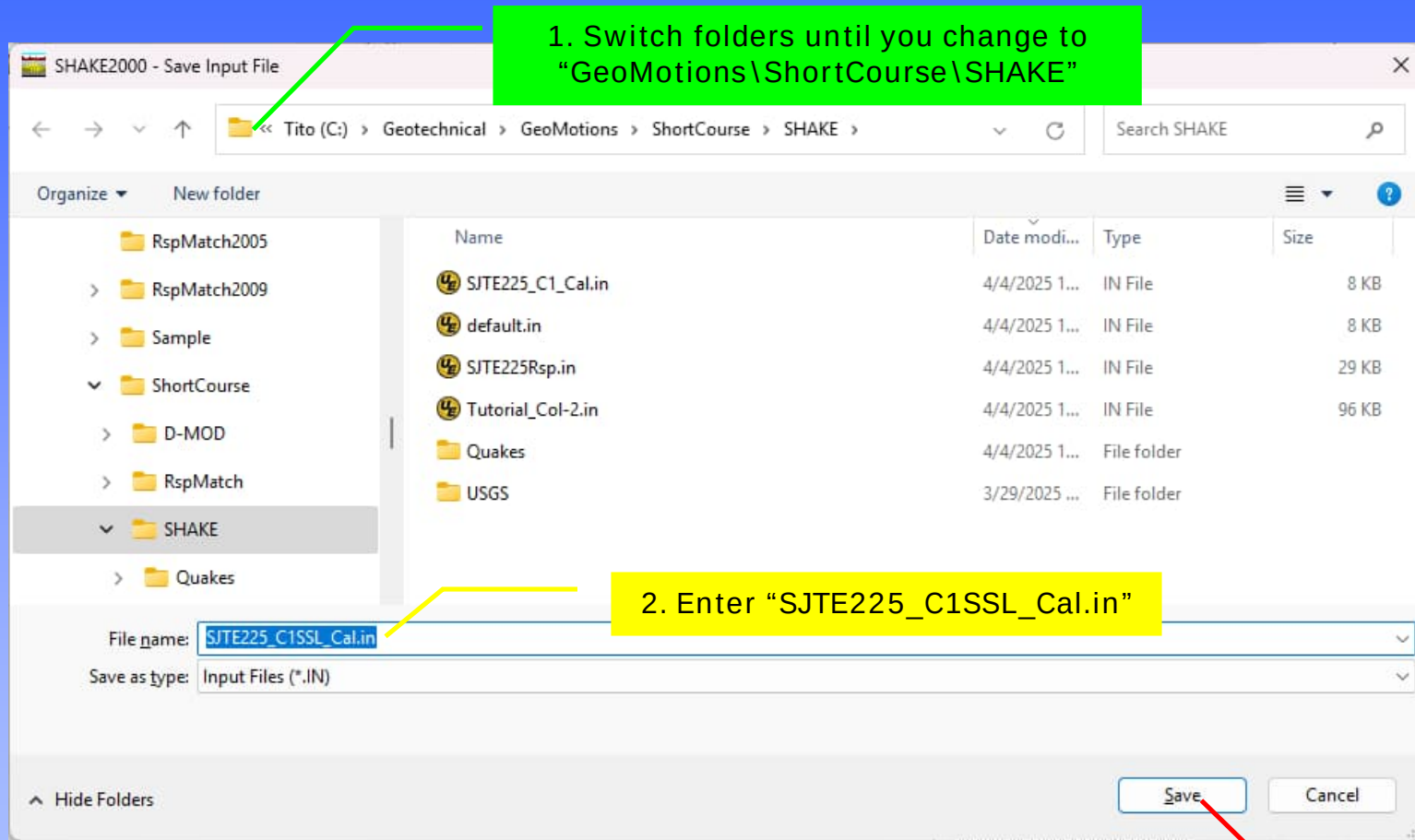
Rename SHAKE's Output and Plot Files



Save EDT File

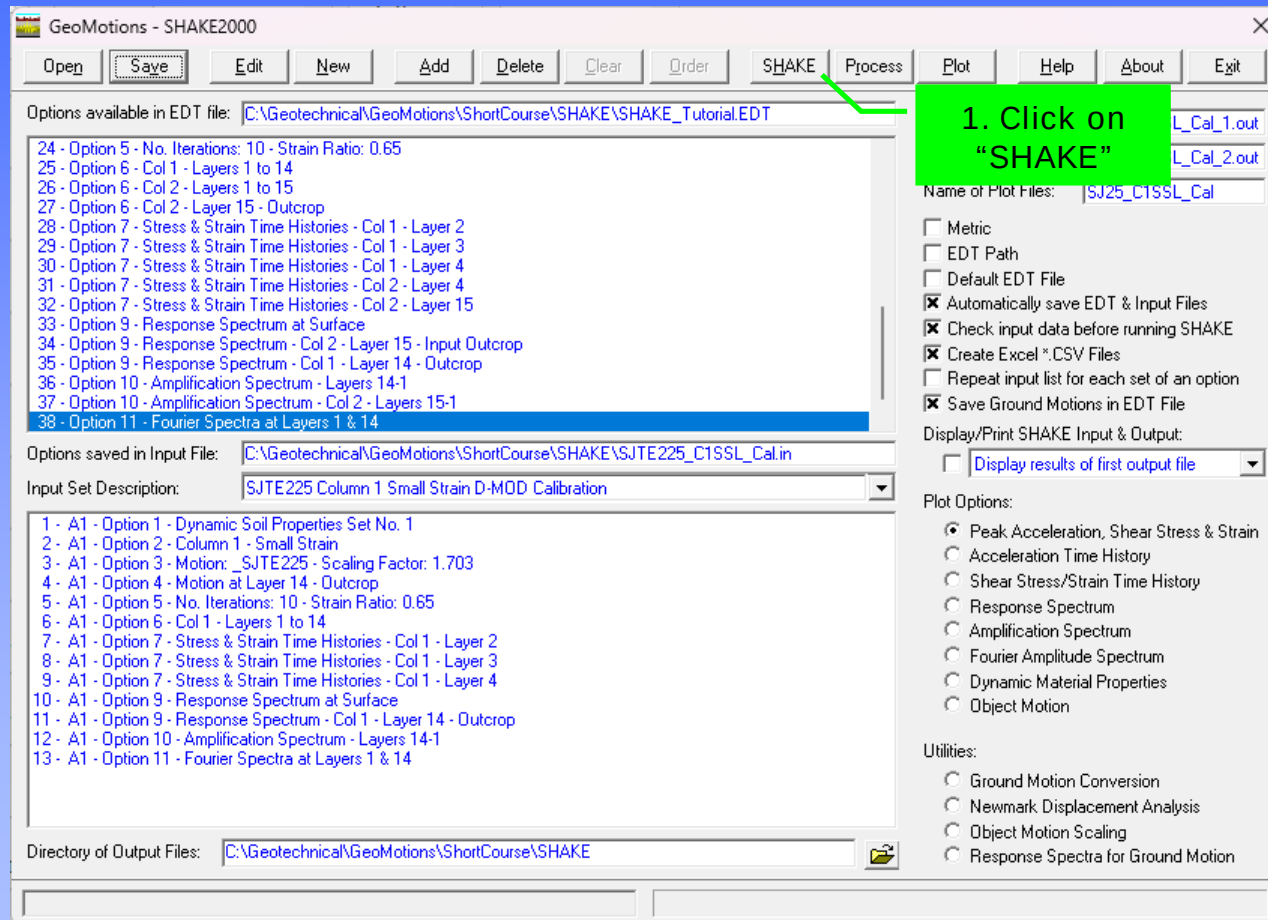


Save Input File



D-MOD Calibration

Execute SHAKE



D-MOD Calibration

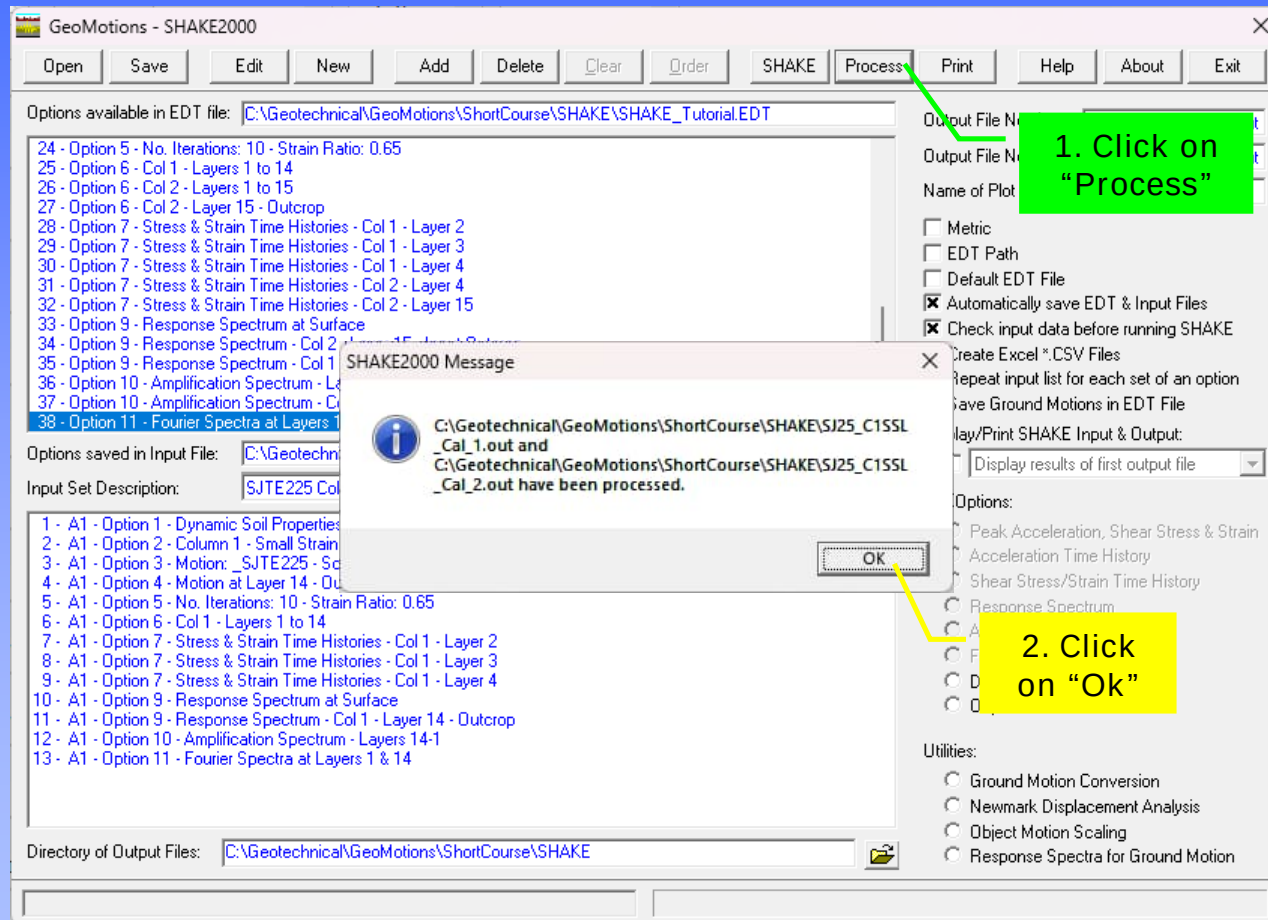
Execute SHAKE

```
C:\Geotechnical\GeoMotions\ x + v

*****
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
* LAYERED SITES by Per Schnable & John Lysmer - 1970 *
* ----- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai, Jan 1985 *
* ----- *
* SHAKE88 :New modulus reduction curves for clays added *
* using results from Sun et al (1988) by J. I. Sun *
* & Ramin Golesorkhi February 26, 1988 *
* ----- *
* SHAKE90/91: Adjust last iteration; Input now is either *
* Gmax or max Vs; up to 13 materials can be specified*
* by user; up to 50 Layers can be specified; object *
* motion can be read in from a separate file and can *
* user specified format; Different periods for res- *
* ponse spectral calculations; options are renumbered; *
* and general cleanup by: J. I. Sun, I. M. Idriss & *
* P. Dirrim June 1990 - February 1991 *
* ----- *
* SHAKE91: General cleanup and finalization of input out- *
* put format, etc. by: I. M. Idriss December 1991 *
* ----- *
* SHAKE2000: Fix incorrect output of total stress in *
* option 2, changed path to ground motion file in *
* SHAKE91, input file, increased motion to 30,000 values *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020 *
* RUN DATE 3/15/2025 *
* RUN TIME 16:40 *
*****
```

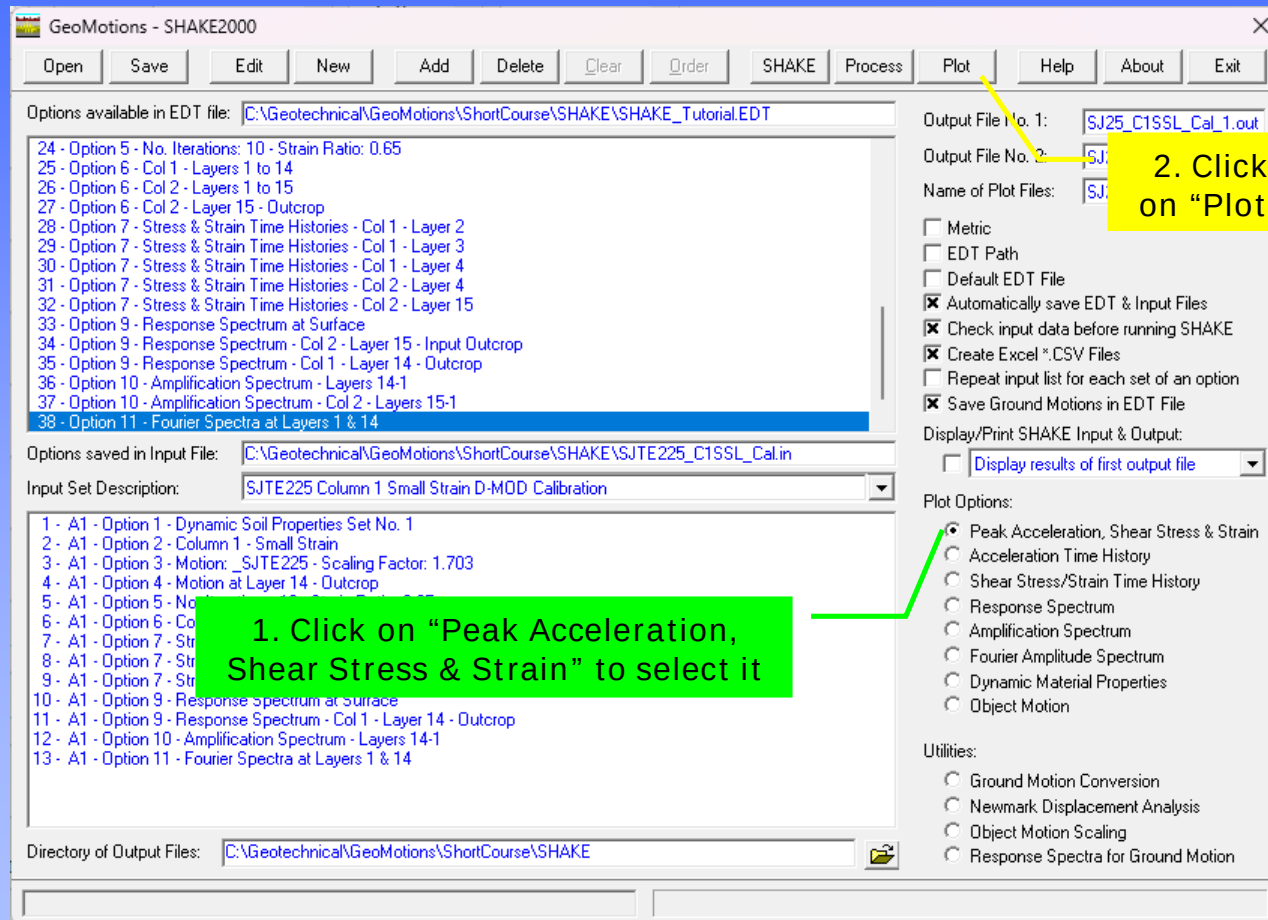
D-MOD Calibration

Process SHAKE's Output Files



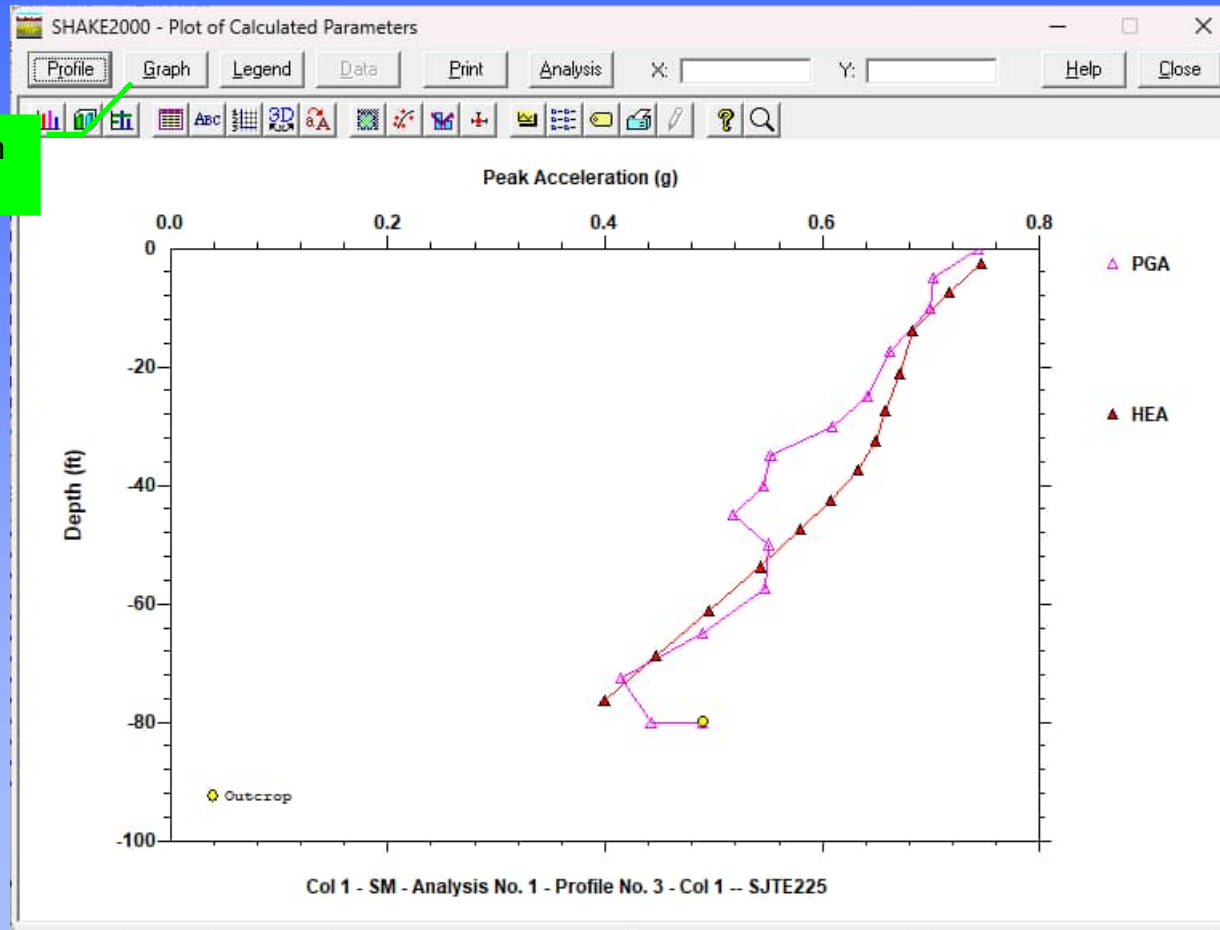
D-MOD Calibration

Plot Results



Plot Acceleration and Strain for Column No. 1

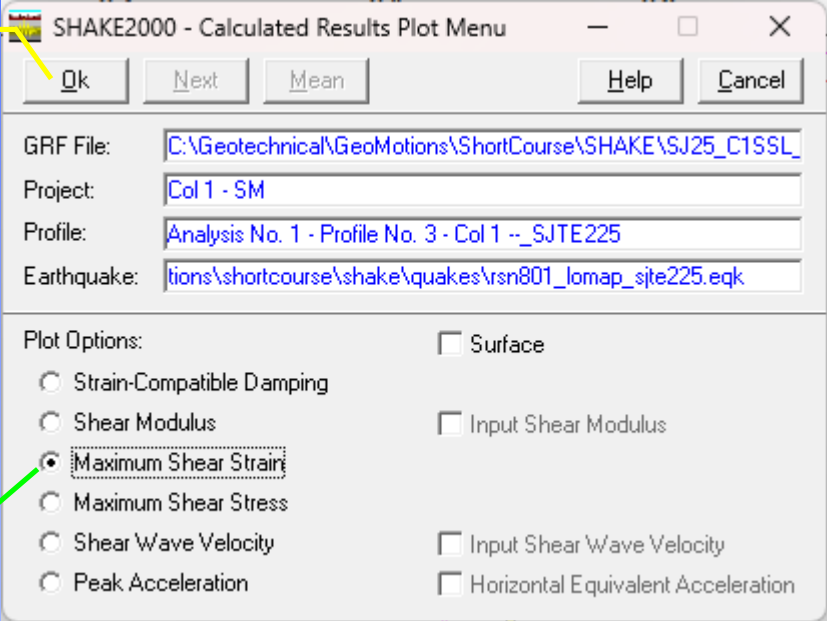
1. Click on
"Graph"



Plot Acceleration and Strain for Column No. 1

2. Click on "Ok"

1. Select
"Maximum ..."



The image shows the 'SHAKE2000 - Calculated Results Plot Menu' dialog box. It has a title bar with a minus, maximize, and close button. Below the title bar are five buttons: 'Ok', 'Next', 'Mean', 'Help', and 'Cancel'. The 'Ok' button is highlighted with a yellow arrow from the text '2. Click on "Ok"'. The dialog contains four text input fields: 'GRF File:' with the path 'C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJ25_C1SSL_', 'Project:' with 'Col 1 - SM', 'Profile:' with 'Analysis No. 1 - Profile No. 3 - Col 1 --_SJTE225', and 'Earthquake:' with 'tions\shortcourse\shake\quakes\rsn801_lomap_site225.eqk'. Below these fields is a section titled 'Plot Options:' containing two columns of radio buttons and checkboxes. The first column has radio buttons for 'Strain-Compatible Damping', 'Shear Modulus', 'Maximum Shear Strain' (which is selected with a green arrow from the text '1. Select "Maximum ..."'), 'Maximum Shear Stress', 'Shear Wave Velocity', and 'Peak Acceleration'. The second column has checkboxes for 'Surface', 'Input Shear Modulus', 'Input Shear Wave Velocity', and 'Horizontal Equivalent Acceleration'.

SHAKE2000 - Calculated Results Plot Menu

Ok Next Mean Help Cancel

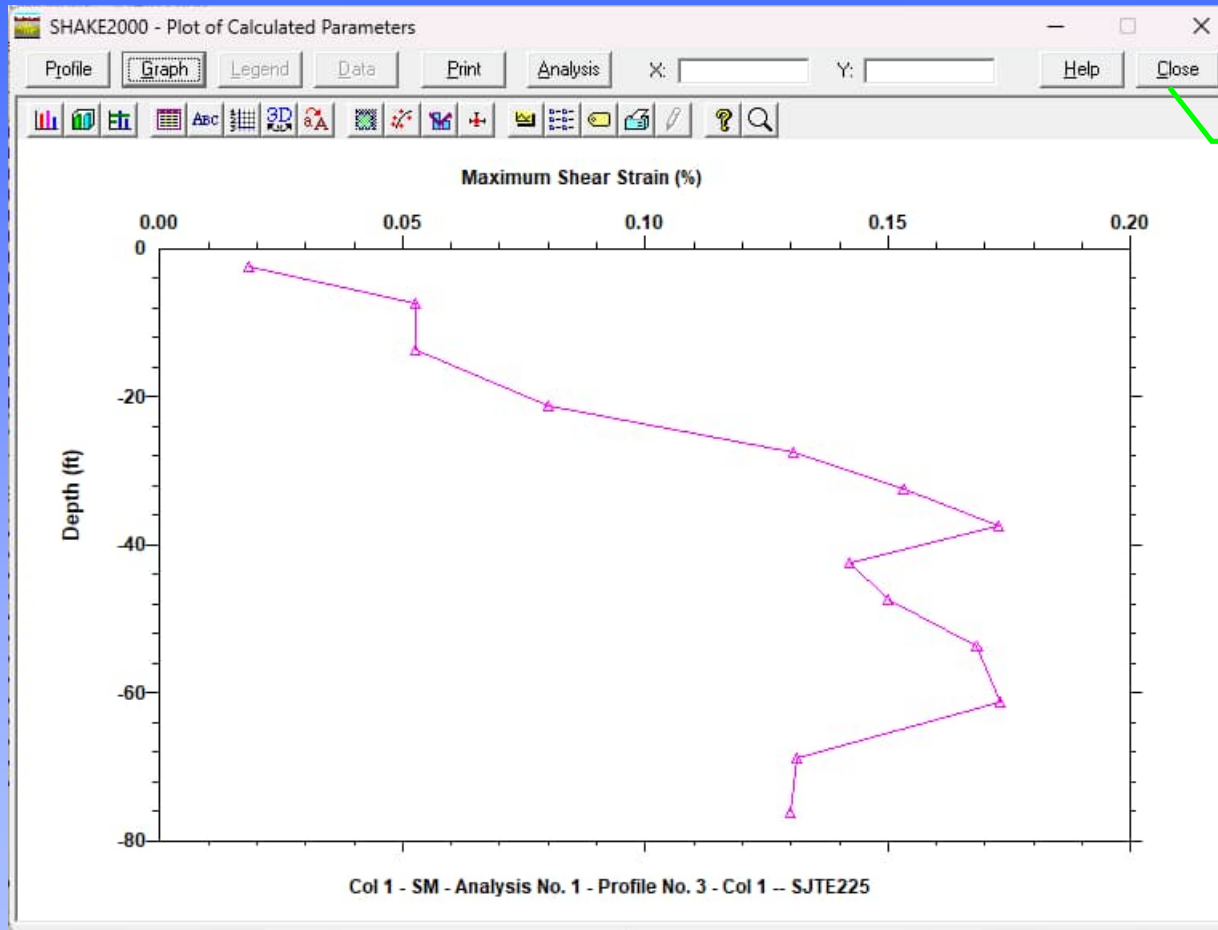
GRF File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJ25_C1SSL_
Project: Col 1 - SM
Profile: Analysis No. 1 - Profile No. 3 - Col 1 --_SJTE225
Earthquake: tions\shortcourse\shake\quakes\rsn801_lomap_site225.eqk

Plot Options:

☐ Strain-Compatible Damping
☐ Shear Modulus
☒ Maximum Shear Strain
☐ Maximum Shear Stress
☐ Shear Wave Velocity
☐ Peak Acceleration

☐ Surface
☐ Input Shear Modulus
☐ Input Shear Wave Velocity
☐ Horizontal Equivalent Acceleration

Plot Acceleration and Strain for Column No. 1



1. Click on
"Close"

SHAKE2000

1. Click on "Exit"

