USING

GEOSYSTEM®

SHEAR TEST SOFTWARE

WITH

DATA ACQUISITION EQUIPMENT

September 26, 2007

USING THE GEOSYSTEM
SHEAR TEST PROGRAM
WITH DATA ACQUISITION EQUIPMENT

Introduction

The GEOSYSTEM for Windows Shear Test Module (*Shear*) can import the data logged by Data Acquisition (D/A) systems from several manufacturers. The GEOSYSTEM *DA4Shear* program is a plug-in used to perform the import. This manual describes the use of *DA4Shear* in the import process and how to filter the readings and test cycles. Refer to your test equipment manuals for information on how to run tests, log data and download it.

Users who are unfamiliar with the GEOSYSTEM for Windows Shear Test Module should familiarize themselves with it before using the data import capability. After becoming familiar with manual data entry procedures, the process of importing test data, explained in this manual, will be easier to understand.

Software Installation

Installation of the *DA4Shear* software occurs along with the installation of *Shear*, if they are licensed at the same time. In cases where *DA4Shear* is licensed separate from *Shear* it is supplied on a floppy disc or a CD. Look for a program named SETUP on the *DA4Shear* floppy or CD and run it. One way to do this is to start at your Windows desktop and select **Start, Run,** then enter **A:SETUP**. (for a CD master disc enter the drive letter of the CD instead of "A"). Install the program in your GEOSYSTEM for Windows folder, in most cases the installer will suggest the correct location. Since *DA4Shear* is integrated into *Shear*, you do not need a shortcut to it - it is started automatically when it is needed.

What DA4Shear Does

The GEOSYSTEM *DA4Shear* program is used to convert the D/A file format to the standard format used by *Shear.* In the process it also allows you to reduce the number of readings taken, called filtering. It also allows you to reduce the number of cycles of repeated shearing in a repeated residual direct shear test.
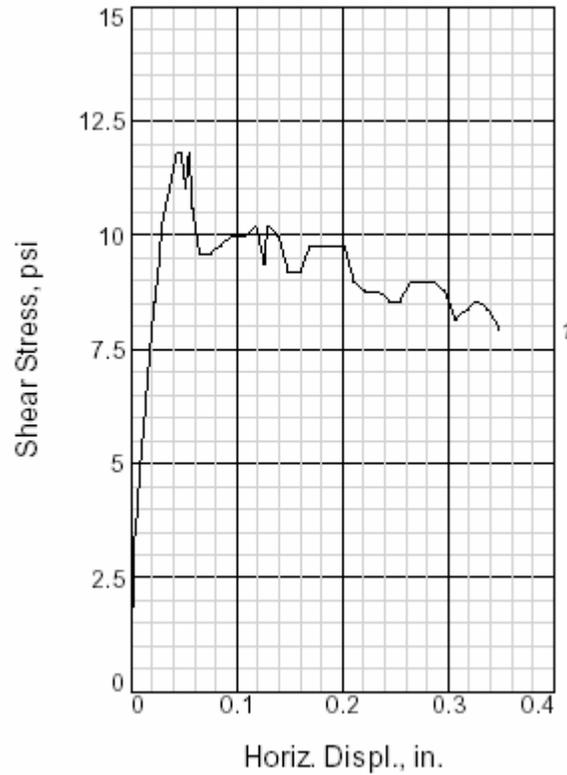
Filtering

Since Data Acquisition (D/A) systems may log thousands of readings it is usually helpful to filter out some of the readings. *DA4Shear* has settings to allow filtering based on strain or load.
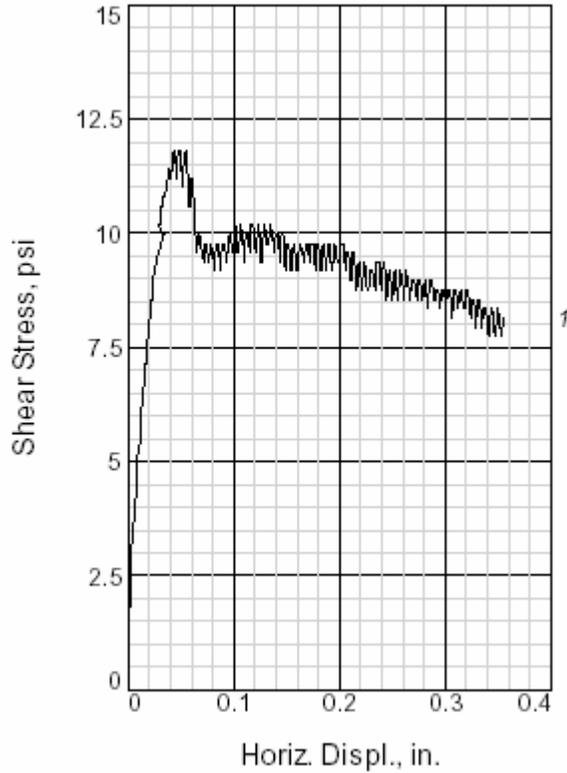
Figure 1
Result of not filtering a 212 reading
Direct Shear Test D/A file

Figure 2
Result of filtering a 212 reading Direct
Shear Test D/A file down to 47 readings

In the example above, the filtering process leaves representative readings, as shown in Figure 2. The same D/A file without filtering is shown in Figure 1. The filter criteria chosen in this example was 0.01 inch max. without a point and 3% of max. load without a point. When filtering, the peak load is always kept.

Increasing either the displacement filter or the load filter will reduce the number of readings. Whether you filter more readings using the displacement or load criterion depends on which criteria is currently passing more readings. In the example below, the majority of readings are passing the displacement criterion. so it would be most appropriate to increase the value for the displacement filter.

~~Skip load repeats:~~	
Readings meeting disp. criterion:	135
Readings meeting load criterion:	40
Readings to be written:	175
~~Vertical Pressure:~~	~~n/a~~

Figure 3 - Choosing Which Criterion to Change

The displacement and load filter criteria are changed by entering a new filter value and clicking on the Apply Change button. The filter criteria section of the DA4Shear screen is shown in the figure below:

FILTER CRITERIA	
Maximum displacement without a point:	0.01
Load change without a point as % of maximum:	3

RESULTS OF FILTERING READINGS

Figure 4 - Changing Filter Criteria

In the illustration the displacement filter is set to 0.01. During import each reading in the import file will be compared to the most recent reading passing either the displacement or the load filter. If the displacement has increased more than the maximum displacement specified, the reading will be added to the file for *Shear*. Likewise, if the load has increased more than the specified percent of the maximum load, the reading will be added to the file for *Shear*. If, say, the peak load reading in the D/A file is 100 lbs, and the filter is set to 3%, like in the example above, the filter becomes 3 lbs. Readings with loads differing by more than 3 lbs. from the last accepted reading get added to the file for *Shear*. The peak load and the second peak load reading always get added.

The displacement criterion tends to filter out the readings taken later in a test, as the test approaches and passes failure. The load criterion has more effect filtering readings early in the test, when the stresses are building up rapidly. A good starting value is 0.01 inches. Loads increase rapidly at the beginning of a test, so the load criterion has more effect on those readings. A good starting value is 1%, with adjustments in 1% increments.

Cycle reduction for Direct Shear Tests

Since direct shear tests can reverse direction, multiple cycles of shear on the same specimen may be logged. Each direction change is called a cycle, and *DA4Shear* was designed to handle up to 10 cycles per specimen. Tests with more than 10 cycles run on a specimen cannot be analyzed using *DA4Shear*. Start the cycle selection process by clicking the specimen number for the specimen to be worked on, the specimen number will turn black indicating it is selected. Then click on the menu option "Cycle Selection". A panel listing the cycles in the Data Acquisition (D/A) import file (up to 10) is displayed (see example in Fig. 3)
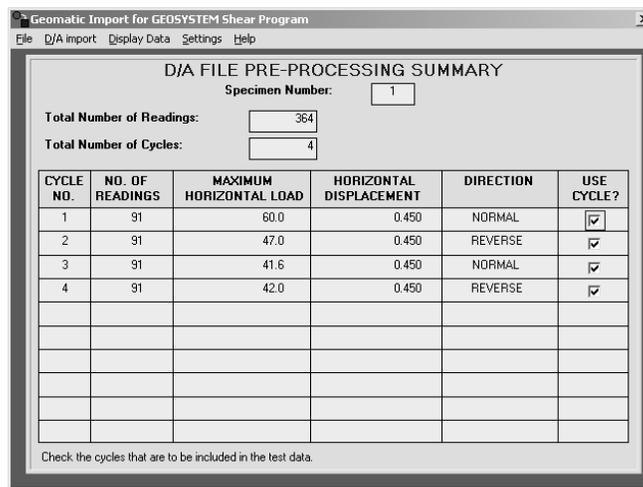

Figure 5 - Cycle Selection

Select the cycles to be included by checking them in the "Use Cycle" column. The resulting test with all cycles included would look something like the example in Fig. 4.
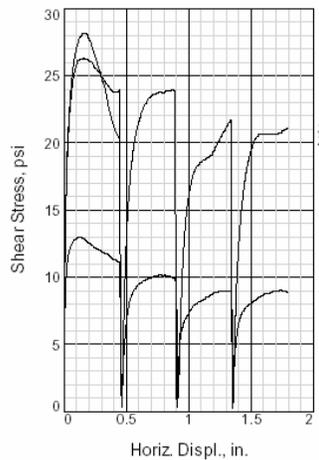

Figure 6 - Multi Cycle results

Importing One Specimen at a Time

It is not necessary to complete testing of all specimens before importing the data into the *Shear* program. You may import data for one specimen at a time, or wait until the test is complete and import all specimens at once. If importing one specimen at a time follow these steps:

First specimen:

1. Download the Data Acquisition (D/A) data for the first specimen.

2. Open a new shear test for your project.

3. Select the import D/A file option.

4. *DA4Shear* will start, select the test type then select the D/A file.

5. Adjust import parameters for a satisfactory import.

6. Save and exit

7. Complete the specimen in *Shear*

See general import Instructions for more details.

Subsequent specimens:

1. Open the shear test that is ready for a second specimen.

2. Select the import D/A file option, *Shear* will alert you to the fact that there is already one (or more) specimens entered and offer the choice of overwriting or appending. Select the option to append.

3. *DA4Shear* will start, select the test type, then select the D/A file *for the 1st specimen*. It will be ignored by *Shear* because you chose to append not overwrite.

4. After it is read, select the D/A file for the 2nd specimen, and 3rd if ready for it, and 4th if ready for it.

5. Save and exit, and the new specimen's data will be appended.

6. Repeat for all subsequent specimens.

See general import Instructions for more details.

Display Data Menu Option

The "Display Data" menu option provides a way to view and print the D/A file. It also includes some of the calculated results. An example of this is shown in Figure 7.
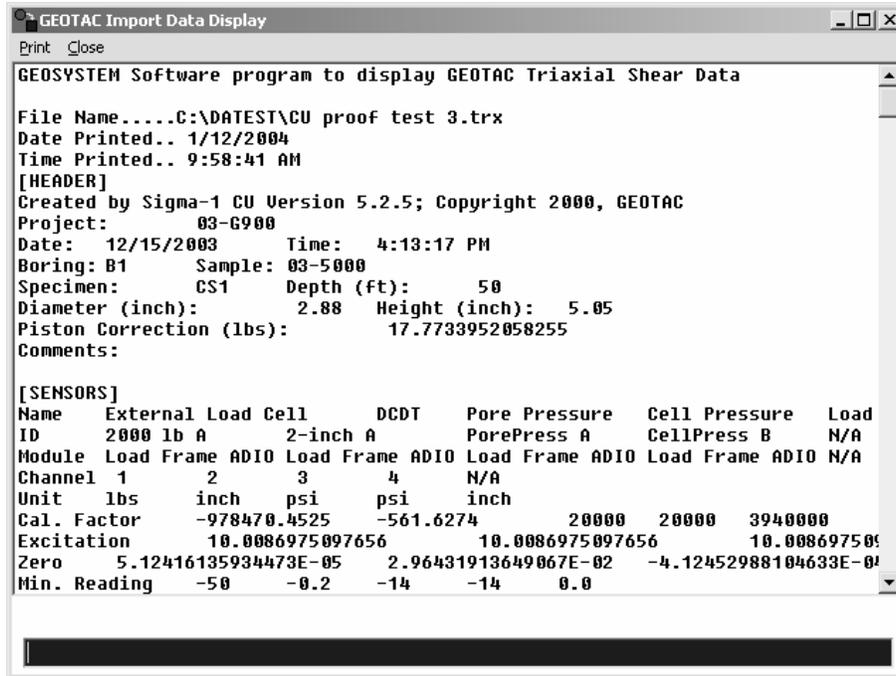

Fig. 7 Data Display Screen

The data shown includes both raw D/A file data and some calculated data. To view a line which is too long for the screen, highlight it, and it will be displayed in a text box at the bottom of the screen. There you can use the left and right arrow keys to view the entire line.

General Import Instructions

Here are general instructions for importing *Shear* Data Acquisition (D/A) data.

1. Before importing: Use the software that came with your D/A equipment to transfer the data to your computer. Make a note of where the data files are saved, you will need to be able to find them when importing the data.

2. With your GEOSYSTEM Software, open the project and sample for the shear test. Select the import D/A file option.

3. FIRST TIME ONLY:

Select the menu option settings, then select the type of data acquisition system you are using. See the illustration below

Source of data acquisition files:	Geomatic ▾

The supported systems are currently:

       Geomatic for Direct Shear, Cyclical Direct Shear

       Durham Geo for Triaxial Shear, Direct Shear, and Unconfined Compression

       GEOTAC for Triaxial Shear, Direct Shear, and Unconfined Compression

       Humboldt WinHost for Triaxial Shear, Direct Shear, and Unconfined Compression

       Humboldt Mini Scanner for Triaxial Shear and Unconfined Compression

       Geotest - Triaxial Shear, Direct Shear, and Unconfined Compression

       ELE/Soiltest - support coming soon

       Proprietary client for Triaxial shear (special system one customer has)

When this one-time selection has been made, check other settings for that type of D/A system (See the section titled "D/A System Specific Settings). Then click Close.

4. Before importing, select the test type (see example below). Only test types supported by your D/A system will be available to choose.

Type of test:	Unconfined Compression ▾
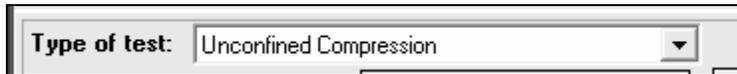
5. Then select the D/A file for the 1st specimen. Do this by clicking on the Select D/A File button, as shown below:

ngs meeting load criteria:			
ngs to be written:			
essure:			
um load:			
o Failure:			
	Select D/A File		

A standard Windows file selection dialog will appear. Navigate to and select the D/A file for the first specimen of the test.

6. After a file has been read, *DA4Shear* displays the results of the D/A file import process. The appearance of the screen is shown below:
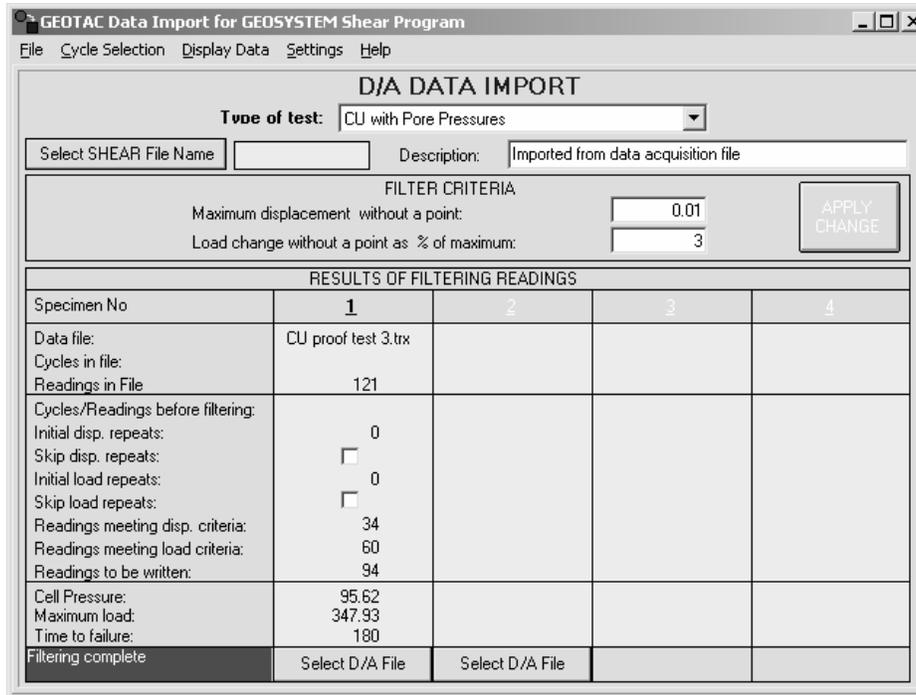
7. The table on the screen contains information about what was found in each of the D/A data files. Briefly the significance of these values is as follows:

No. of cycles in file:	A cycle is a set of shear readings taken before a direction reversal
No. of readings in file:	The total number of readings in all cycles
Cycles/Readings before filtering:	In the case of cyclical tests, some cycles may have been excluded by the user. This is the number of cycles being used and the number of readings in these cycles
Initial disp. repeats:	The number of duplicate displacements at the start of a set of readings
Skip disp. repeats:	Checkbox indicates whether or not to skip those repeats
Initial load repeats:	The number of duplicate loads at the start of a set of readings
Skip load repeats:	Checkbox indicates whether or not to skip those repeats
Readings meeting disp. Criteria:	The number of readings selected because of the displacement tolerance filter criteria
Readings meeting load criteria:	The number of readings selected because of the load tolerance filter criteria
Readings to be written:	The number of readings to be written to the SHEAR data file
Vertical pressure or Cell pressure:	The vertical pressure or cell pressure
Maximum load:	The largest load recorded
Time to failure	Difference in minutes between the first and last readings

8. Now you are ready to do filtering

9. If it is a repeated direct shear test, you can de-select some of the cycles. Refer to the earlier section cycle selection for details about this.

10. To filter readings so that there aren't as many in the *Shear* data file you can apply displacement or load filters. The first filter option is the *maximum displacement without a point*. The program will skip readings which are closer than the incremental displacement specified here. More information can be found in the earlier section on filtering.

11. The second filter option is *maximum load change without a point*, expressed as a percentage of the maximum load. This criterion works the same as the displacement criterion discussed above. *DA4Shear* will skip readings with changes in loads smaller than the increment specified here. More information can be found in the earlier section on filtering.

12. During filtering, the program also checks for the following:

    1. Are there duplicate displacement readings at the start of the file? This would indicate that readings were being taken before shearing began.
    2. Are there duplicate load readings at the start of the file? This would indicate equipment or sample seating occurred after the shearing displacement started.

    If either case is true, the program will display the number of such duplicates. In most cases they should be ignored, done by checking the checkbox below either item. See the example below:

13. Once the number of filtered readings for a specimen is at the point desired, the next data file can be imported. To do so click on the button labeled Select D/A file for the next specimen. Repeat the previous steps, where applicable, for all the D/A data files.

14. After all of the specimens have been filtered, select File>Save and Exit.

15. *DA4Shear* will close and the data will be returned to *Shear*. This completes the import of the D/A data into *Shear*.

Project and Specimen Data Entry in *Shear*

After importing specimens into *Shear*, the specimen dimensions and other test information, such as back pressure or normal load can be entered. Some of this data may automatically be transferred from the D/A file, depending on the type of D/A system. Here is a basic list of what to do after importing:

1. If it has not yet been done, the Project Data should be entered, as documented in the SHEAR reference manual. Be sure that the Strain Dial Constant is 1.

2. Enter the Specimen Data for each specimen.

3. Check that the units *Shear* is using for displacement, load, and stress match those of the imported data.

4. Check the Readings Data for each specimen. Check the normal stress/confining stress and rate of strain/time to failure and adjust as needed. Check the initial (zero) reading and the rest of the readings. If any changes are needed, follow normal SHEAR procedures to add/delete/revise any of the readings.

5. Display the stress strain curve for each of the specimens, and look at the chart preview. Based on its appearance you may wish to re-import the readings using different filtering criteria, or simply delete some of the readings.

6. Finally, review the failure envelopes and select cases to be reported (total/effective, peak/residual).

DA4Shear Settings

The menu option Settings displays a form for selecting the type of D/A file being imported and any options that are associated with them. There are also a few settings for using DA4Shear with the DOS version of the GEOSYSTEM Shear Test program. The DOS options are not of any importance to DA4Shear users who have the GEOSYSTEM for Windows Shear program. Select the type of D/A system from the dropdown list:
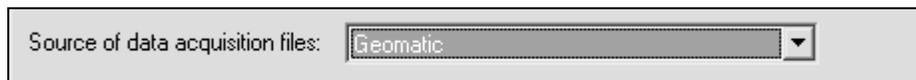
The type of D/A system only needs to be set once, unless you are using more than one type of D/A system, or change the type of D/A system. Some notes about each of the D/A systems supported follows:

D/A System	Test Types	Units	Test Rate	Other Information Imported	
Geomatic	Direct shear Cyclical (repeated) direct shear	Force: lbs Stress: psf Length: inches	Inches/min	Client Project Sample Number Technician Diameter & Area	Job Number Boring Depth Soil Type Normal stress
Geotest	Triaxial Direct Shear and Unconfined compression	Force: lbs Stress: ksf Length: inches	n/a	Client Job Number Boring No. Depth Tested by Type of specimen Specimen preparation Height Normal stress	Project Location Sample No. Description Diameter Time to failure
Proprietary Client (126)	Triaxial	Force: kN or lbs Stress: ksi, psf, ksf, tsf, kPa, mPa, ksc, or psi Length: in, cm or mm	Minutes	Project Sample Number Diameter & Area Sample Height Confining stress	Boring Depth
Durham Geo	Triaxial Direct Shear and Unconfined compression	Force: kN or lbs Stress: ksi, psf, ksf, tsf, kPa, mPa, ksc, or psi Length: in, cm or mm	Minutes	none	
GEOTAC	Triaxial Direct Shear and Unconfined compression	Force: kN or lbs Stress: ksi, psf, ksf, tsf, kPa, mPa, ksc, or psi Length: in, cm or mm	Minutes	Project Boring Depth Sample Height Type of Triax (CU, UU) Confining Stress	Date Sample Number Diameter & Area
Humboldt WinHost	Triaxial Direct Shear and Unconfined compression	Force: kN or lbs Length: in, cm or mm	Minutes	none	
Humboldt "Mini-Scanner"	Triaxial and Unconfined compression	Force: lbs Length: in	Minutes	none	

DA System Specific Settings

D/A System	Setup Screen Settings
Geomatic	None
Geotest	None
Proprietary Client	None
Durham-Geo	None
Geotac	• Insert zero reading if D/A file starts with a non-zero displacement reading: If you wish to insert a row with values = 0 as zero readings check this box. Since the GEOSYSTEM Shear Test Module interprets the first row of readings as "zero" readings and subtracts them from all subsequent readings, check this to preserve the first row of GEOTAC readings in the D/A file as true shearing readings, not the start of test steady state readings. • Always use DCDT for displacement (even when platen data is available): GEOTAC displacements can come from either the platen movement readings or the DCDT readings. If DCDT data is unavailable, the platen will always be used. If DCDT data is available, some users still prefer calculating displacement using the platen, and the program will use it by default. If you prefer to use DCDT (more accurate) when it is available, check this box. • Change the sign on displacements calculated using DCDT: For some unknown reason, the DCDT displacement readings sometimes have a positive sign, sometimes have a negative sign. If the displacements are importing into the Shear Test Module as negative, check or uncheck this box as needed. • Use first displacement as zero instead of Zero value from the D/A file: GEOTAC D/A files contain a "Zero" reading for the displacement calculation which is similar to the first DCDT reading. In some cases the true steady state reading of displacement at the start of test is the first reading, rather the "Zero" reading supplied in the D/A file. The user should check this box if the displacement calculation based on DCDT readings should use the first DCDT reading instead of the "Zero" reading. • For direct shear vertical displacement, use first displacement as zero instead of Zero value from the D/A file: GEOTAC D/A files contain a "Zero" reading for the vertical displacement calculation which is similar to the first DCDT vertical reading. In some cases the true steady state reading of vertical displacement at the start of test is the first reading, rather the "Zero" reading supplied in the D/A file. The user should check this box if the vertical displacement calculation based on DCDT readings should use the first DCDT vertical reading instead of the "Zero" reading.

12

Humboldt Winhost	• Time to failure or Rate of strain: Time to failure or Rate of strain can be reported on the final GEOSYSTEM Shear Test Module report. Select the option desired. • Use Excel exported data acquisition files: This should be blank for Winhost equipped systems. • Deformation reading divisor: This is not used with Winhost systems.
Humboldt Mini-Scanner	• Time to failure or Rate of strain: Time to failure or Rate of strain can be reported on the final GEOSYSTEM Shear Test Module report. Select the option desired. • Use Excel exported data acquisition files: This should be checked for Humboldt systems equipped with their Mini Scanner. That system uses Microsoft Excel to download the test data. To use that data with the GEOSYSTEM Shear Test module it must be exported from Excel. To do so, after downloading to an Excel file, use the Excel "Save As" function to save as a *Tab Delimited Text File*. • Deformation reading divisor: If the deformation readings are taken in any units other than inches, enter a divisor in this space which will convert the units to inches.

Notes:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____