28 GDS Helpsheet

World Leaders in Computer Controlled Testing Systems for Geotechnical Engineers and Geologists

Software

GDSTTS

Calculations Relating to the Triaxial Cell

1. Introduction

All of the values of parameters relating to the triaxial cell are calculated from the raw data gathered from the controllers and DPI. Each controller reports on its pressure and volume change, the DPI reports only on its pressure. If you look at a controller you will see that the sign of volume change is in relation to the controller such that to cause an increase in pressure the sign of the volume change is negative, i.e. the controller is trying to expel water from the cylinder when it is trying to increase the pressure. The GDSTTS software reverses the sign of volume changes when it takes readings from controllers so that the volume changes recorded by the software are with respect to the test specimen, i.e. an increase of volume of the test specimen has a positive sign.

The data saved by GDSTTS consists of sets of the raw data from the controllers and DPI plus time , these are:-

T	The current time
P6	The pressure read from the DPI (the pore pressure)
P7	The pressure read from the radial controller (the cell pressure)
V7	The volume change read from the radial controller
P8	The pressure read from the back pressure controller (the back pressure)
V8	The volume change read from the back pressure controller (the specimen volume change)
P9	The pressure read from the lower chamber controller
V9	The volume change read from the lower chamber controller

Each set of data is gathered at the same point in time. All of the other parameters related to the triaxial cell and the test specimen can be calculated from these basic values

2. Calculations

The calculations of the various parameters uses the following formulae:-

Variable Name & Description		**Calculation & Comments**
T0	Test start time	
D0	Initial diameter of test specimen	
A0	Initial Area of test Specimen	
L0	Initial height of test specimen	
V4	CONSTANT	V4=A1*L0
E1	Axial Strain	V9/V4 , +ve strain is compression
A	The current area of the test specimen	A=A0*((1+V8/V0)/(1-E1), average right

		cylinder calculation
E2	The average radial strain	E2=1-SQR(A/A0), function SQR() means square root
S1	Total axial stress	S1=(P9-P7)*A1/A +P7, a modified form of the Bishop & Wesley equation.
S2	Effective axial stress	S2=S1-P8
S3	Effective radial stress	S3=P7-P8
D1	Deviator stress (invariant)	D1=S1-P7, "Cambridge" q and q'
R6	Stress ratio (effective stresses)	R6=S2/S3
E4	Axial % strain	E4=E1*100
D2	Average diameter change	D2=E2*D0*1000, micrometres
Q0	Maximum shear stress	0.5*D1, "MIT" q and q'
Q2	Mean stress	0.5*(S1+P7), "MIT" p
Q1	Mean effective stress	0.5*(S2+S3), "MIT" p'
L1	Axial deformation	E1*L0, in mm
D3	Average diameter change in mm	E2*D0
T'	Time since start of test	T'=T-T0
T5	Square root of time	T5=SQR(T'), square root of time since test start
T6	Log of time	T6=LGT(T'), log base ten of time since test start
L2	Log of effective axial stress	L2=LGT(MAX(0.1,S2)), log base ten of max of 0.1 or S2
E5	Maximum shear strain %	E5=(E4-E2*100)*0.5
P5	Mean stress invariant	P5=(S1+P7+P7)/3, "Cambridge" p
P4	Effective mean stress invariant	P4=P5-P8, "Cambridge" p'

Where dimensions are not indicated they are in units of kPa or mm or the variable is dimensionless.

If your system is not fully configured the software substitutes values for those that would have been read from the missing device. For example if you do not have a DPI the software sets the value of pore pressure equal to the value read from the back pressure controller. As another example if you do not have a cell pressure controller configured the software assumes that you have a laboratory source of cell pressure and accepts the value of cell pressure that you entered during the program initialisation sequence. If you are not sure what substitution the software has made it is a simple matter to tabulate or plot the basic parameters of time, pore pressure, cell pressure, back pressure, specimen volume change, lower chamber pressure and lower chamber volume change. From this information you can see quickly which values the system is basing its calculations on.