



August 2008 Newsletter – 1st ISSMGE International Conference on Transportation Geotechnics  
25-27 August 2008

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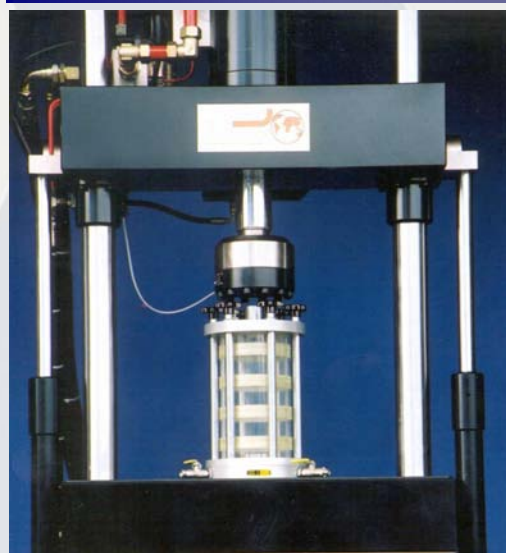


## Transportation Geotechnics in the Laboratory

Transportation Geotechnics poses a series of challenges in the laboratory compared to traditional soil mechanics. Chiefly amongst these is the grain size of the materials under test.

New European standards such as the EN13286-7 call for tests to be carried out on specimen where the diameter is 5 times the diameter of the largest constituent particle this can lead to 200-300mm sample diameters. Large sample diameters lead to laboratories requiring specialised equipment to test these samples. Dynamic systems are usually required to carry out resilient Modulus tests followed by shearing of the samples. While the vast majority of the dynamic tests require loads of less than 20kN the static shearing of the sample can require loads of up to 100kN. This can lead to a conflict within the equipment specification. Two distinct loading systems could be provided, one dynamic and one static, however, this approach can lead to either sample disturbance during the cell transfer from one loading system to the other or if they are integrated into one machine each loading system must be capable of being locked to provide a stable testing platform while the other loading system is in action. Alternatively, a single loading system can be specified which is capable of providing axial loads up to 100kN either statically or dynamically.

### 100kN / 10Hz Dynamic Triaxial



This solution is the most effective for high quality testing but does carry a slightly higher overhead in terms of initial setup cost.

Aside from the size of the sample the large particle sizes can cause further concerns. For example, the material used as a membrane must be more puncture resistant than traditional triaxial membranes due to the hard and sometimes sharp particle edges. Attention must also be paid to the measurement of sample volume changes (please see over leaf).

### 300mm Triaxial Specimen



High numbers of cycles during resilient modulus testing generally means that the choice of actuation methods selected for axial loading are restricted to either pneumatic or hydraulic. While pneumatic loading systems are cost effective to buy they have control and capacity issues when compared to hydraulic or electro-mechanical systems. Where dynamic cell pressures are required, such as that specified for *Method A* in EN13286-7, pneumatic systems are generally incapable of moving sufficient air in and out of the cell to give the required amplitude so again where dynamic cell pressures are required hydraulic systems should generally be specified. For further information on actuator types please contact GDS for our white paper.

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GDS Instruments has developed a wide range of equipment for static and dynamic testing of large samples including environmental control systems; please visit our website for further information.



### Volume change measurement of large triaxial samples

Standard methods of volume change measurement using back pressure volume change or local measurement may not be applicable for some samples due to the dry or semi-saturated nature of some triaxial testing associated with transportation Geotechnics. Local strain measurement techniques tend to measure the grain movements rather than the overall dimension change of the sample for samples with very large grain sizes. This has led to a new application of the HKUST total volume change measurement system being implemented for large samples.

300mm Triaxial Cell with HKUST at Nottingham University - NCG



### Rail track deformations and stress rotation

During research carried out at Southampton University it was identified that PSR, or Principal Stress Rotation, has a significant impact on the development of permanent strains in the track substructure (*Permanent Deformation of Railway Foundations under Heavy Axle Loading*, Gräbe and Clayton, IHHA Dallas 2003).

PSR had been studied in track foundations by use of a combination of the Hollow Cylinder Apparatus and, shown below left and dynamic finite element analysis. Similar versions of the Hollow Cylinder Apparatus have since been developed to test samples with diameters of up to 200mm, *below right*.

Hollow Cylinder Apparatus - Standard and Large Diameter



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### A short course in geology for civil engineers.

GDS Founder and Chairman, Dr Bruce Menzies, has had his new book, "A short course in geology for civil engineers", published by Thomas Telford.

The book was written with first author Dr Marcus Matthews of the University of Surrey. Marcus and Bruce have co-authored two other books in the five book series, on soil and rock slope engineering, and on geotechnical site investigation.

"A short course in geology for civil engineers" may be purchased directly from the publishers at the link below [http://www.thomastelford.com/books/Ground\\_Engineering.asp](http://www.thomastelford.com/books/Ground_Engineering.asp)

GDS Sudoku Boredom Buster (for the train home). Submit the numbers from the highlighted cells to [enews@gdsinstruments.com](mailto:enews@gdsinstruments.com).

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