Managing Asphalt Fracture Test Data

O. Portillo, G. Johnson, W. Lam, D. Cebon, Cambridge University Engineering Department

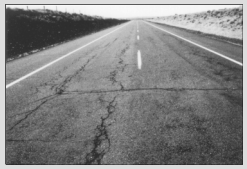
University of Cambridge

Introduction

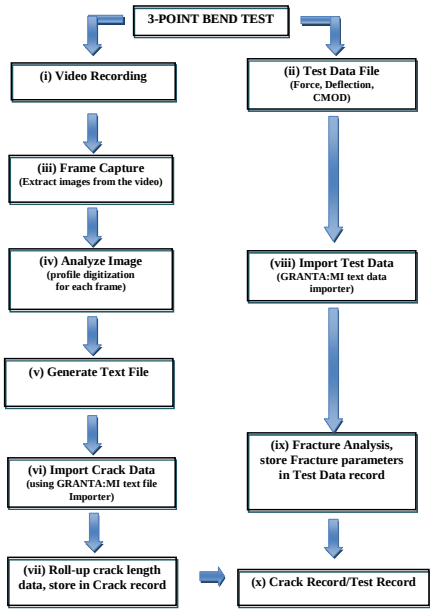
Materials research groups often have several researchers, working over many years, on the same or similar projects – investigating various material combinations under many different test conditions. There is a strong need for such groups to organize and preserve the data that they collect, so that each project can build from the experience and data generated by previous projects. If this approach is to be effective, it is essential that the background 'pedigree' of all test data can be traced. For example, it is necessary to know the test conditions used for each data record, details of the testing procedure, the specimen geometry, material composition, specimen manufacturing details, information about the testing machine, the instrumentation (e.g., load cell capacity, when it was last calibrated…), who performed the test and when, what data reduction was performed, etc. Without this full package of information, individual test records often can't be understood and therefore can't be re-used in subsequent projects.

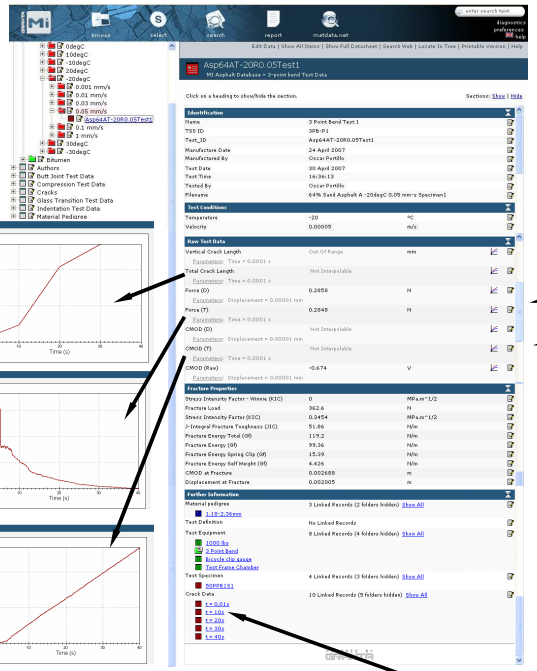
A good approach to managing materials research information is to use a special purpose materials data management system. This poster describes the use of the GRANTA:MI software system to manage materials test data generated in a programme of research into the permanent deformation and fracture performance of bituminous materials (asphalts), used for road construction.

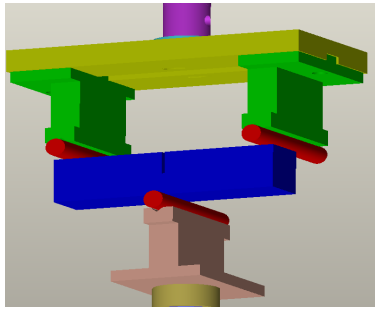
The motivation for this research



Data processing methodology

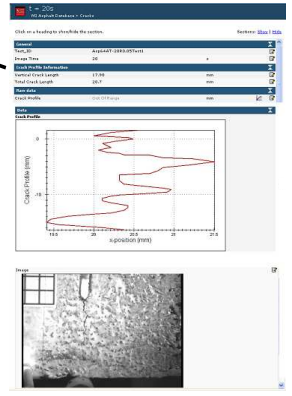






3-point bend tests on asphalt beams

Optical crack measurement



All test pedigree information automatically captured and stored

Conclusions

A materials data management system has been implemented to collect, organize and analyze an extensive set of experimental data on bituminous materials. It covers a wide range of test types, including tension, compression, triaxial tests, adhesive joint fracture, and three-point bend tests. It also captures all necessary pedigree information about the material, specimen, test standards and equipment and testing conditions.

The structure of the database enables full traceability of all aspects of the data. This ensures that the data can be re-analyzed and re-used in future with confidence.

An automated process has been developed to manage two separate data streams generated by three-point bend tests. Video images of the test are used to compute crack profiles and crack length statistics and this information is synchronised in time with force, deflection and crack mouth opening displacement data collected by the testing machine. All of this data is stored together in a test data record, from which it can be extracted in order to compute fracture parameters such as fracture toughness, J-integral and C*-integral.

The GRANTA MI material data management system was found to provide all of the necessary data types and data structures needed for managing the test data. Its automated input and output facilities enabled the data importing and analysis tasks to be made fast, reliable and consistent, ensuring efficient generation of high-quality research data. Its flexible reporting tools enable rapid retrieval of information for inspection and further analysis by external software systems.

Reference: O. Portillo, G. Johnson, W. Lam, D. Cebon, 'Automated analysis and data handling for asphalt fracture experiments', Cambridge University Engineering Department CUED/C-MATS/TR.262, Oct 2007