



## **EFFFC-DFI SUPPORT FLUID GUIDE FIELD RESEARCH STUDY 24<sup>TH</sup> JANUARY 2019**

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### **1.0 INTRODUCTION**

The European Federation of Foundation Contractors (EFFFC) and The Deep Foundations Institute (DFI) have set up a Task Group to compile the EFFFC/DFI Support Fluid Guide for Deep Foundations. The First Edition of this Guide has been drafted and is due for publication in early 2019. The aim of the Guide is to improve existing support fluid design, testing and practices for deep foundation elements – bored piles (drilled shafts), barrettes (LBE's) and diaphragm wall panels. This Guide has identified areas of support fluid performance where knowledge is limited. Before the second edition of the Guide can be published it is proposed to carry out a series of field research studies. This Note sets out the planned scope of these studies which are going to be funded by EFFFC, DFI, contractors, consultants and suppliers. This research is also linked to university research work in USA and Europe.

The research is in three parts: -

- 1) obtain contractor's standard test data sets from about 40 sites.
- 2) develop non-standard test methods and obtain data sets from about 20 sites by independent specialist visits.
- 3) working with academic partners carrying out related studies

It is anticipated that standard data sets will be compiled by the contractors from sites in North America and Europe, including all types of support fluid currently used in practice (bentonite, polymer, and blended fluids). This information will be interpreted by the Support Fluid Task Group to develop a better understanding of the current status of testing on site and the range of compliance values being used on sites.

The non-standard information will be obtained by independent Specialists appointed by the Support Fluid Task Group. The Specialists will work with the Contractor to review the Contractor's standard test data sets and also carry out additional non-standard tests and sampling. This non-standard testing will be linked to university research work. It is anticipated that the university researchers will accompany the specialists on some of their site visits and help perform the additional testing.

It is planned that all testing should be completed by early 2021.

The data from the Contractors will be treated in strictest confidence. Sites will not be referred to by name, merely a number.

### **2.0 CONTRACTOR'S STANDARD TEST DATA SETS**

The field research will include compiling contractor's standard data sheets on support fluids. The participating Contractors will be asked to provide details of the site ground conditions, structural detailing including element geometry and typical reinforcement details, specifications, concrete

mix and results, excavation methods and support fluid details. A summary sheet for this information is given in Appendix A. Contractors will be asked to provide details of the support fluid test methods and results, together with their own construction records and test results sheets. The contractor shall provide copies of their completed record sheets.

Contractors are tasked to only use support fluids which they consider well suited for use in the deep foundation elements, preferably using fluids which they have successfully used before (overall using their standard procedures). All performed tests shall (where possible) be documented by video.

All collected data will initially be reviewed by the Specialist followed by the Support Fluid Task Group to assess whether existing specified performance criteria are set at the appropriate values.

### **3.0 NON-STANDARD DATA SETS / SITE VISITS BY THE SPECIALISTS**

During the development of the EFFC/DFI Tremie Concrete Guide a series of non-standard concrete tests were trialed in the laboratory and on site. This helped to understand the importance of specifying concrete workability requirements as well as stability.

In the same way this Field Research Study will investigate a series of non-standard tests to supplement the existing relevant standard tests and study specific issues. An initial three-month development period is required to organize equipment and finalise method statements, and this is scheduled to commence in early 2019. The non-standard tests would then be used by the EFFC/ DFI Specialists during their site visits. Whilst on site, the Specialists will also carry out concrete tests, the results of which will be fed back to the Tremie Concrete Task Group.

Appendix B covers the background information about the site and the deep foundation construction work which should be completed before the Specialist's visit. The information will be treated as Strictly Confidential by the Specialists and will not be disclosed to third parties without the express approval, in advance, of the Contractor: -

- brief project summary (size & depth of elements, excavation technique, soil conditions).
- full details of fluid type including preparation, refreshing and disposal.
- concrete mix design with all aggregate and additive specification sheets and all field testing performed.
- any available integrity test results (Koden, Sonic-Caliper, CSL, GGL, TIP, core logs etc)
- video documentation of all field and site laboratory tests.
- base cleaning procedure and results (video the airlift/pump outlet or bucket sediment).

The EFFC/DFI funds will be used to support the Specialist and may also be used to cover travel costs for some academic site visits. In addition, some funds may be used by academics for certain laboratory tests to be defined by the Task Group.

Non-standard equipment being developed includes: -

- samplers for support fluids
- interface layer samplers
- in-situ pressure sensors
- Mullins meter - to profile viscosity, density and sand content

Standard and non-standard laboratory test procedures include: -

- density
- sand content
- silt/clay content
- viscosity
- pH
- gel strength and shear strength
- filtration and filter cake development (thickness)
- determination of active polymer concentration - self-syphoning and other tests
- assessment of polymer flocculating/cleaning agents

The issues being investigated include: -

- fluid properties distribution along element depth during excavation and concreting.
- impact of clay and silt suspension on the support fluid properties.
- filter cake development and its effect on cover zone reduction, shaft friction reduction as well as panel stability.
- flocculation and sedimentation processes in support fluids during excavation.
- interface layer development during concreting and its possible effect on the deep foundation element quality.

Full details of proposed test procedures, test equipment and issues for investigation are given in Appendix C.

## References

EFFC / DFI 2018	Tremie Concrete Guide - 2 <sup>nd</sup> Edition
EFFC / DFI 2019	Support Fluid Guide - 1 <sup>st</sup> Edition
ICE SPERWALL 2017	Specification for Piles and Embedded Retaining Walls
Lam C and Jefferis S (2018) Publishing)	Polymer Support Fluids in Civil Engineering (ICE