ABSTRACT

The assessment of a Project’s soil conditions is the most important factor to determine dredgeability, the choice of suitable equipment, production rates and ultimately the associated costs for the dredging works. The basic principle of “adverse physical conditions” is whether or not they are foreseeable and whether or not there is a contract clause that will give the contractor the right to claim for additional time and money in case unforeseeable physical conditions occur, which were not reasonably foreseeable by “an experienced contractor,” the term commonly used by FIDIC.

A prudent tenderer when analysing the site data needs to be assured that the data has been collected and prepared by a competent soil investigation company in accordance with relevant international standards such as British Standards (BS) and American Society for Testing and Materials (ASTM) or others. Three examples are described to illustrate the direct relationship between dredging costs and actual soil or rock conditions encountered with examples of the relationship between soil and rock conditions on production and costs. Variations in soil or rock conditions contribute the greatest cost uncertainty involved in dredging projects.

Rather than rely on a standard adverse physical conditions clause in the case of significant capital works involving excavation of varying subsoil, weathered or solid rock, the suggestion is made that contracting parties should preferably establish limiting reference conditions in the Contract beyond which the Contractor is entitled to claim for additional compensation.

Of the contracts available for use on dredging contracts only the FIDIC 1999 Red Book and the United Kingdom’s NEC 3 Engineering and Construction Contract deal with the broad concept of reference conditions.

Some suggestions and recommendations are outlined therein for both Employers and Contractors. The authors wish to thank Jim Anderson and Bart Graswinckel for their peer review of the article.

INTRODUCTION

The concept of how adverse physical conditions are dealt with verges on the holy grail of marine infrastructure projects. On the one side they are part of a Marine Contractors “must have” clauses whilst Clients often view it as the equivalent of a “get out of jail free” card. The balance of risk has been hotly debated and fought over the years with the results little published or revealed due to disputes being resolved in arbitration or adjudication.

Added to this mix is the notion of “unforeseeability” and what “an experienced contractor,” the term used by FIDIC, can expect. It is no wonder that the vast majority of marine infrastructure claims revolve around the issue of sub-surface conditions.

The assessment of a Project’s soil conditions is the most important factor determining dredgeability, the choice of suitable equipment, production rates and ultimately the associated costs for the dredging works. Even a full-scale and technically perfect soil investigation will only test a fraction of the volume of material that is to be dredged by the Contractor. Combined with the fact that natural conditions like rock strength,
grain size, permeability, plasticity, presence of rock outcrops or boulders (to name a few) vary enormously, it is no surprise that disputes on dredging contracts often focus on conditions that are claimed to be different from what an experienced contractor could reasonably have foreseen.

This article examines the relationship between site inspection, unforeseeability and adverse physical conditions and their incorporation in contracts ranging from the UK’s ICE/ECC Contracts to their use in international construction contracts such as FIDIC, and their evolution over the years to the present day. Although the article focuses on sub-surface conditions, it should be realised that a broader spectrum of conditions such as wind, wave, current and human-made obstructions can also fall under the concept of “adverse physical conditions”. The article is dedicated to the memory of Frank Kinlan and the crews of the CSD Port Sunlight and TSHD Gouda who battled to dredge caprock in Manama Harbour, Bahrain in 1975 (Figure 1).

BASIC PRINCIPLES
The basic principle of foreseeability of adverse physical conditions is whether or not there is a contract clause that will give the Contractor the right to claim for additional time and money in case unforeseeable physical conditions – conditions not reasonably foreseeable by an experienced contractor – are encountered.

This simple principle is present in one way or the other in virtually every dredging contract. A dual purpose lies hidden behind this contract principle, namely to:

– Compensate the Contractor for encountering conditions more severe than could be derived from investigations available at the time of preparing the offer. Employers must not and should not expect the Contractor to gamble: Taking a risk provision to cover every imaginable situation would make an offer non-competitive, whereas the absence of a risk provision is a denial of the fact that dredging by its very nature has significant uncertainties. Employers tend to be overly

CASE STUDY: REFERENCE CONDITIONS AT ØRESUND CONTRACT NO 2.

At this project involving dredging of a trench in very weak to very strong rock, the soil investigation of the Employer was the basis of the BoQ (Bill of Quantities, with respect to quantities in the different rock qualities). Tenderer had to price these as part of his offer, resulting in a wide range of unit rates for the various grades of limestone as specified in the Contract.

Furthermore, a system of Reference Conditions was applied. The Contractor executed an additional soil investigation programme after award but before commencement of the works. The investigation was executed in accordance with an approved quality proposal with respect to geotechnical methodology, sampling and laboratory work. This investigation would reveal if rock indurations of the different rock grades were within their specific Reference Frames.

This acknowledged the fact that during dredging different soil properties cannot be determined with accuracy nor reliability. The basic idea of the Reference Conditions system was that if the Contractor could prove (according to the results of his investigation) the quantities of the various bill items were no longer correct and that the quantities of the stronger rock grades were underestimated, the Contractor would be entitled to additional compensation. Following the preparations this compensation could simply be determined by renewed application of agreed unit rates.

This is a good example of a predefined system that can be used to make the uncertainty involved in “unforeseeable” physical conditions manageable for both the Employer and the Contractor embarking into a Contract.
biased towards achieving the lowest contract price for their work by passing all conceivable risk to the Contractor whether or not the Contractor is in a position to deal with such risk.

- Protect the Employer from Contractors who may try to claim additional compensation for interpretation or calculation errors made by the Contractor which result in a loss on the project. A loss in itself is no justification for additional compensation; furthermore an Employer has very limited possibilities to assess the factual cause of the loss.

In between the relative simplicity of these two extremes lies a gray area, and it is here that disputes are generally fought out. The authors support the view that a sufficiently high threshold for additional compensation should be present, balancing the interests of the Employers (by not having to battle over every minor issue) and of the Contractors (by having capped their risk and providing for additional compensation above a given threshold).

A further suggestion is that a risk matrix framework be established to assess the magnitude of the additional compensation before award of the contract.

**INSPECTION OF THE SITE**

Before tender submission, the Contractor is generally under an obligation to inspect the Site to evaluate the influence which the local conditions will have on the work to be carried out. But how is this inspection conducted when the Site consists of an expanse of water and a sub-surface many metres below it?

In general, the only chance tenderers have to do their own inspection will be on the site visit when they can do a visual inspection of the surrounding geology and geo-morphological aspects surrounding the Site (Figure 2). Land-based sources such as rock faces, road cuttings or nearby quarries can provide a useful guide, but nothing beats soil or rock samples taken from the Site itself and/or the location and immediate vicinity where the dredging is to be undertaken (Figures 3 and 4).
Tenderers to weigh the information provided to them when making their own assessment. This principle was embraced and carried forward into the 3rd and 4th Editions of the FIDIC Red Books where Contractors were deemed to have based their Tenders on the data made available by the Employer, together with their own inspections and examinations. However what constituted the Contractor's inspection and examination and whether this meant that the Contractor was obliged to source information about the Site and its environment remained unclear.

The IADC in its 1990 FIDIC User Guide publication attempted to remove any doubt as to inspection and examination with the suggestion to amend the standard FIDIC wording such that the tender was based solely on the Employer supplied data. This precept was largely resisted by Employers and Consultants tasked with drafting the terms and conditions of contract. As a balance and to avoid a Contractor "ambush" and claims of misrepresentation of information, Employers felt that Contractors should not entirely rely on the information provided by the Employer when there were circumstances when they had their own possibly conflicting information.

The more recent FIDIC Red Book 1999 includes in clause 4.10 [Site Data] that the Employer shall have made available all relevant data in the Employer's possession both before and after the Base Date in the Contract. This is balanced by the provision in the same clause that the Contractor shall be deemed to have obtained all necessary information as to the risks, contingencies and other circumstances "to the extent which was

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provides that the Contractor shall have “Inspected and examined the site, its surroundings and available information, and, shall have satisfied himself before submitting his tender as to the nature of the ground and subsoil”.

The clause did not oblige the Employer to provide any information in its possession and in the past Employers were reluctant to provide such information to tenderers for fear of how this might negatively affect bid prices. Not surprisingly claims were the result. Fortunately this “no site information” loophole was closed with the publication of the FIDIC 2nd Edition 1969 which stated that the Tender shall be deemed to have been based on such data regarding physical conditions as shall have been supplied by the Employer in the documents furnished to the Contractor by the Employer for the purpose of tendering. It would then be up to the tenderers to weigh the information provided to them when making their own assessment.

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practicable (taking account of cost and time)". The consensus is that in the limited time made available to tenderers, they cannot be expected to do the same degree of discovery of site investigation information as the Employer.

The onus is thus placed on the Contractors to review their own soil databases to confirm whether they may have any supplemental information on the site and its immediate environment on file. The large international dredging contractors have considerable geotechnical databases of information gleaned from past tenders going back many decades and may have information which the Employers and their consultants do not have. Whilst tenderers are under no obligation to mention this in their offers, if the information conflicts with that supplied by the Employer then it would be advisable to inform an Employer that they are relying on other information, especially as their data may have a significant negative price impact compared to other tenderers.

The ICE Conditions of Contract 7th Edition has a clear provision (Clause 11(3)) stipulating that Contractors have based their tenders on information, whether obtainable by them or made available by the Employer, with the proviso that information obtained by the Employer shall only be taken into account to the extent it was made available to the Contractor.

One of the most contentious aspects of site inspection is to what extent tenderers should be obliged to do their own investigations and research from archives, libraries and local sources when evaluating the site information made available by the Employer.

Clearly tenderer’s time is limited and the tenderer does not have the time or resources to do detailed research in the same manner as the Employer and Engineer who have had many months, and in some cases years, to collate information. Often when disputes go to arbitration the Contractor and the Employer spend a great deal of time and sums of money employing geotechnical experts to support their cases. These experts may have a more academic approach to the evaluation of available data than the Contractor’s production estimator, who just focuses on the information at hand - which is primarily the site information supplied by the Employer with some supplementary information from past works and a site visit.

**DATA PROVIDED BY EMPLOYER**

In FIDIC Red Book 1999 maintains a continuing obligation for Employers to supply all data which comes into their possession both before and after the Base Date, a date 28 days prior to the Contractors submitting their tenders. Contractually the Employer is obliged to be transparent when gaining information which will adversely affect the Contractors’ operations and the basis of their pricing of the Works.

Not supplying such information if it comes available to the Employer could possibly lead to a Contractor claiming fraudulent misrepresentation by the Employer in that it knowingly withheld information from the Contractor in order to avoid the negative cost consequences. Certain case law in England, Australia and the USA address the duty of the Employer to supply full information. This case law is by no means conclusive about the duty of disclosure, however, in *Brown & Hudson v York* (1985) an Employer was held liable for the Engineer’s negligence in omitting water levels from the soils information given to tenderers.

Generally the sub-surface site information which is supplied to tenderers in the tender documents will consist of the following:

a) geophysical data;
b) borelogs or vibrocores; and
c) laboratory test results

Readers will be familiar with the various forms of geotechnical and site information (e.g., M.J. Stone, *Terra et Aqua* No. 48, 1992 as well as *Site Investigation Requirements for Dredging Works*, PIANC, 2000). Being aware of various site investigation techniques (Figure 5) and their advantages and disadvantages and the influence that can bear on the interpretation of the data is important (see Table I).

Tenderers are regularly confronted with problems arising from the quality of the investigations performed or the reporting of the results which is sub-standard. This greatly undermines the proper intention of making available sound geotechnical information to tenderers. Using an independent geotechnical engineer experienced in dredging to supervise the work of the company running the site investigation is highly recommended as a way to check on the quality of work and the subsequent reporting of the in-situ conditions and laboratory results.
Witnessing site investigations to ensure competency

A prudent tenderer when analysing site data needs to be assured that the data has been collected and prepared by a competent soil investigation company in accordance with relevant international standards such as British Standards (BS), American Society for Testing and Materials (ASTM) or others. Employers should seriously consider inviting potential tenderers to witness the soil investigation campaign because it can provide them valuable insights into what information the tenderers will focus upon. All potential tenderers should accept this invitation to witness the site investigation to ensure an equal chance of evaluating the site investigation techniques and results.

Employers not used to offshore work can sometimes be taken aback by the high cost of offshore site investigation. They may try to limit their budget for this and then pass the risk of the soil conditions onto the Contractor. This risk receiving qualified offers from the potential tenderers. It may also mean that the short-listed Contractors require their own supplementary site investigation, or that the winning tenderer will need to do further investigation post-contract and prior to commencement of dredging to verify the Employer’s own site investigation results. All of this brings extra costs.

Consequently, a client should not scrimp on the costs of the site investigation, otherwise the old adage “penny-wise, pound foolish” would be particularly apt. Any apparent savings at this stage increase the risk of significant delays and claims for differing conditions when the project is underway.

Status of information vs. interpretation

Modern Contract Conditions oblige Employers to provide all information that is known to them during the tender process. A distinct difference should be made between “factual information” and “interpretations”. The correctness of the former will remain the responsibility of the Employer, being part of the data supplied as a basis for the Contract. However, for the interpretations it is recommended that the Employer clearly state that “any interpretation is for information only and is no part of the data supplied nor a basis for the Contract”.

Whatever the value of geophysical surveys, their interpretative nature will always make it recommendable to label it as “for information only” as opposed to any result from geotechnical investigation or laboratory analysis. FIDIC enshrined

Figure 6. Comparison of results of common head loss prediction formulas.
the principle between factual information and interpretation in FIDIC 4th Edition by stating that “the Contractor shall be responsible for his own interpretation” of any such data made available to the Contractor by the Employer.

DEFINING DREDGEABILITY
Three examples are described below to illustrate the direct relationship between actual soil or rock conditions and production and dredging costs. In practice, when disputes arise the comparison can be significantly more complex and a number of significant other factors may have to be taken into account. In summary, variations in soil or rock conditions contribute the greatest cost uncertainty involved in dredging projects.

Example 1: Grain size defines pumping production
Pumping soil-water mixtures through (long) pipelines requires energy to prevent the settling of the particles in the pipeline (head loss). Installed pump power is a limiting factor for any given dredger, hence the maximum pumping productivity that can be achieved is determined to a large extent by the actual head loss of the mixture.

When calculating head losses a broad range of empirical formulas exist. Van der Schrieck (2009) describes a few commonly used one-dimensional calculation procedures for heterogeneous mixtures (e.g., Durand-Gibert, Jufin-Lopatin, and Führböter) and shows the wide scatter present in the original test results. These (and other) calculation procedures indicate a very significant effect of grain size (usually dmf) on head loss and ultimately on pumping production. However, the results are quite different regarding the relative importance of grain size and mixture density on the head loss (see Figure 6 for comparative results).

To name a few complications associated with calculations of head loss:
– The formula of Jufin-Lopatin shows a head loss equal to the square root of the transport concentration, contrary to Durand-Gibert and Führböter in which the transport concentration has a power of one.
– Kazansky (1978) indicates that low, medium or high concentration values in fact require different prediction formulas, which is not commonly applied.

– Very high pumping concentration, feasible while emptying large trailing suction hopper dredgers, result in head losses significantly lower than predicted by classic empirical formulas. This is caused by hindered settlement: Due to the very high concentration the particles are preventing each other from settling, thus reducing the additional energy needed to keep them in suspension.
– The effect of fines (particles smaller than 63 micron) on the head loss is relatively unknown. The fines cause a decrease of the fall velocity of grains, effectively reducing the overall head loss. Van der Schrieck (2009) describes the straightforward calculation procedure by Bruhl.

When evaluating a dispute involving pumping productions that have been influenced by soil characteristics differentiating what is reasonable from unreasonable is not an easy task. An added complication is that most Contractors will have developed their own head-loss calculation procedure, based on but distinctly different from the above-mentioned criteria.

Granted that it is impossible to cover every single adverse condition in a contract beforehand, the chances of a settlement would be greatly improved by adding an appendix to the contract either specifying the outline of the calculation procedure in case of varying conditions or agreeing on unit rates for specific varying conditions. At least the discussion would then be narrowed considerably to a few elements.

Example 2: Rock strength and structure define cutting production
The two main geotechnical parameters which define the energy to excavate rock material are strength and structure. When evaluating these parameters a variety of tests, which describe parameter values, are available. From these the often-used measure of “specific energy” can be derived.

Specific Energy is defined as the amount of energy needed to excavate a volume of rock (in formula: \( \text{Espec} \ [\text{MPa}] = \text{cutting power} \ [\text{kW}] / \text{cutting production} \ [\text{m}^3/\text{s}] \)). The physics of the process is very complex and is still only partially understood and information is not widely published because of the desire to protect innovative knowledge.

All dredging contractors use their own production calculation models, based on a combination of theoretical basics and practical experience with their equipment in a variety of rock conditions. In this respect technological developments are a significant factor which should not to be underestimated (see Wijma 2009).
To illustrate the importance of properly establishing the geotechnical conditions on a project, results from a simplified and indicative model are shown here (Figure 7), with Specific Energy being based on Unconfined Compressive Strength and Rock Quality Designation.

Assume the actual UCS-value (case B) is 15% more than the estimated value based on rock data (case A), and RQD value is 80% instead of 60%. This model indicates a reduction of the production rate per operational hour of 50%(!). In addition to this, the wear rate of all dredge parts will increase significantly, adding to the weekly costs. The idle time for repair of worn parts like cutters and pickpoints will increase significantly as well, reducing efficiency hence weekly production even further (Figure 8). In this example, the actual total costs (case B) could well be twice the estimated value (case A). Project duration will also increase significantly.

Poorly carried out site investigation programmes, along with associated lab tests on the rock samples, can easily result in a failure to predict the conditions correctly. The choice of drill locations, sample selection, budget constraints on the number of test locations, compromising quality during execution of investigation, post-investigation layout shifts, are a few likely causes for test results not being representative for the actual situation encountered during execution of the dredging works. The example above gives an indication of the possible consequences from actual conditions being adverse from anticipated ones.

**Example 3: CSD dredging sandy material**

Dredging sandy material with a CSD (Figure 9) and depositing it at a relatively short distance is limited, mainly by the excavation production (until the suction limit of the first dredge pump is reached, indicated by the dashed line in Figure 10). Figure 10 indicates the importance of soil characteristics.

A soil investigation that is not executed properly, for instance, failing to report any slight cementation or small layers of cohesive material, will under-report the actual geotechnical parameters for Contractors to base their production assessment correctly.

**ADVERSE PHYSICAL CONDITIONS**

The FIDIC 1st Edition 1956 included “Clause 12” to deal with Adverse Physical Conditions and Artificial Obstructions. The clause stated that if during the execution of the Works unfavorable physical conditions (other than weather conditions) were encountered, which could not in the opinion of the Engineer have been reasonably foreseen by an experienced contractor, then the Engineer should certify and the Employer should pay the additional expense by reason of such conditions.

The basic principle contained in Clause 12 has remained in the ICE and FIDIC suite of contracts (other than the FIDIC Silver Book) for more than 40 years with only very minor modifications. The Australian Standard suite of contracts also has a Clause 12 dealing with “latent conditions” which, although worded differently, contains the core provisions of the ICE/FIDIC Clause 12.

The courts have only very rarely dealt with Clause 12 as written in *Ceredigion CC v Thyseen Construction Ltd* (1999): “Those who drafted clause 12 and those parties who chose to include it in their contracts conferred on an engineering arbitrator a very wide discretion with which the Court had in general no wish to interfere”.

A radical overhaul occurred with the issue of the Rainbow suite of FIDIC Contracts in 1999. The FIDIC Contracts Committee perhaps sensed the need to guide arbitrators as to some of the meanings in Clause 12 and sought to give definitions. New to the clause was the definition of “physical conditions”
and “unforeseeable”. The former had a wide definition to include natural physical conditions, physical obstructions, man-made obstructions as well as pollutants and hydrological conditions, whilst excluding climatic conditions. The definition of “unforeseeable” in the new FIDIC 1999 is “not reasonably foreseeable by an experienced contractor by the date for submission of the tender”.

In the UK the widely used NEC3 has as a Compensation Event in Clause 60.1 (12) which states that if the Contractor encounters physical conditions, which an experienced contractor would have judged at the Contract Date to have such a small chance of occurring, then it would be unreasonable to consider that the Contractor should have allowed for such in his pricing. It further states that only the difference between the physical conditions encountered and those which it would have been reasonable to have expected should be taken into account.

There is little published material to guide Employers and Contractors in the operation of physical conditions and unforeseeability and what constitutes an “experienced contractor,” and the relevant case law is sporadic.

Case study UK
The first significant case which dealt with what constitutes a physical condition was the Humber Oil Trustees Ltd v. Harbour & General Works (Stevin) Ltd (1991) which concerned the collapse of a jack-up barge resulting from encountering an unforeseeable condition in the soil under one of the legs. The soil had a liability to shear at a much lower loading than had been withstood up to the date of the accident. The Employer argued that physical condition referred to a material thing such as rock or running sand not intransient conditions such as applied stress. The arbitrator in his decision found that an experienced contractor could not have reasonably foreseen this condition.

The judges in the Court of Appeal agreed with him stating that the soil behaved in an unforeseeable manner and that was a physical condition within Clause 12.

This decision offered some guidance to arbitrators when determining Clause 12 claims in not being too restrictive when assessing what constitutes a “physical condition”. The FIDIC 1999 Red Book has gone some ways to defining physical condition as meaning natural physical conditions and man-made and other physical obstructions and pollutants including sub-surface and hydrological conditions, but excluding climatic conditions.

With respect to what is unforeseeable with the definition as given, the Contractor in his notice must merely establish that based on the information available at time of tender, a reasonable thorough investigation would not have brought to light the particular adverse physical condition which is causing the delay. This is based on the principle that the Contractor has a limited ability to inspect and examine all possible data. The FIDIC Contracts in both the 4th Edition and 1st Edition 1999 maintained the principle that the Contractor was limited “to the extent which was practicable taking account of cost and time”, it being important that both Employers and arbitrators are aware of the extent of a Contractor’s own investigation.

Case study Australia
A more recent case in Australia sheds some interesting light on the aspect of disclaimers, notices and the examination of information supplied by the Employer. The case is BMD Major Projects Pty Ltd v Victorian Urban Development Authority [2007] VSC 409.

It was a latent (physical) condition claim under the Australian Standard AS 2124 contract. So-called “disclaimers” were stated to be for the benefit of the Contractor and not for the Employer to avoid liability for the information given. Concerning the requirement to examine all data made available by the Employer, the Judge found that this was an objective test (i.e. related to facts and not subjective, that is based on opinion or interpretation) and that it was unreasonable to expect the Contractor to undertake or seek expert advice or analysis to look for inaccuracies in the information supplied. It was found that a reasonably competent contractor could not have been expected to investigate the information to the extent claimed by the Employer.

ESTABLISHING ADDITIONAL COSTS FOR UNFORESEEN PHYSICAL CONDITIONS
The dredging process itself remains a mystery for a large number of Employers, and the mystery is even more profound as to how costs for dredging projects are comprised. In a dispute situation, with a level of mutual trust being generally low, the situation gets worse and the Employer does not believe any of the figures of the Contractor are true (irrespective of the factual truth). It is then left to the dispute resolution process to determine compensation based on expert opinion and the balance of probabilities with the adjudicator or...
arbitrator believing one party or the other (Figure 11).

Contractors often have to put in considerable effort to back up a claim, not just with site records but also with reference to theoretical publications in order to prove their point. This is not an easy task, since often knowledge of the dredging process is not openly published. No solution for this inherent inequality of knowledge is in sight.

For the contracting parties two options remain:
– Accept the unpleasant consequences of disputes and deal with them if and when they occur, or
– Deal with the possibility of unforeseen conditions, and their consequences in terms of additional compensation before award of the Contract.

The second option has its limitations, but often in the pre-award stage an agreement describing the consequences of an unfavorable variation of a number of key characteristic engineering parameters of the soils or rocks to be dredged can be reached. Combined with a threshold value that effectively acts as an upper value for the Contractor (capping the Contactor’s risk) and a lower value for the Employer (budget consequences only above this value), both Parties agree on the basics for solving a dispute of unforeseen physical conditions. This conceivably will greatly improve the chances of a smooth settlement.

General recommendations on the threshold value to be chosen are not appropriate: During every contract that is drafted one should carefully evaluate the options and the preferences of the Employer. Generally, the range between the upper limit of the conditions encountered during the geotechnical investigations and the chosen threshold value determines the level of risk the Contractor has to absorb.

This is to be reflected in the base rate (being valid for all conditions below the threshold value). In case the threshold value is close to the technical limitations of the dredging equipment planned for the project, the Contractor’s risk increases even further.

Of the contracts available for use on dredging projects only the FIDIC 1999 Red Book and the UK’s NEC 3 Engineering and Construction Contract deal with the broad concept of reference conditions.

In the FIDIC 1st Edition 1999 in both the “Red” and “Yellow” Books, when evaluating a claim the Engineer may also review whether other physical conditions in similar parts of the Works were more favourable than reasonably could have been foreseen to counterbalance the Contractor’s claim, providing any adjustment is not lower than the original Contract Price.

The NEC 3 EEC Contract takes this a stage further. In the Guidance Notes it states that all that is necessary to substantiate a claim is a clear definition of the reference conditions, with conditions outside the reference condition boundaries constituting a compensation event. It is thus sensible to define criteria recognising that conditions in the new investigation are outside the reference boundary conditions. This can be detailed by using Option Z in the contract to describe the boundary conditions in the form of soil characteristics, level of rock, and so on.

It should be noted that the FIDIC “Blue Book” Form of Contract for Dredging and Reclamation Works just relies on site data the Employer has made available at time of tendering, together with the basic principle of what is reasonably foreseeable by an experienced Contractor.

Users should not rely on the statement in the Notes for Guidance that the contract is intended to be suitable for all types of dredging and reclamation work as there is no allowance for the application of reference conditions.
CONCLUSIONS

Employers should ensure that an extensive and sound geotechnical investigation is executed before or during the tender process for a dredging project. An independent geotechnical engineer experienced in dredging should supervise the work of the company running the investigation, to check on the quality of work and the subsequent reporting of the in-situ conditions and laboratory results. Employers should seriously evaluate the option of inviting all Tenderers to witness the investigations in cases where varying subsoil conditions are expected.

Professional Employers and Contractors should be transparent concerning their assessment of the available site investigation data whilst negotiating and entering into a contract. Potential geotechnical related risks should be openly discussed before the award of the contract. This may increase the possibility that additional payments have to be made upfront; however, these payments will be significantly less and the effort involved can be considerably reduced by avoiding the need to resort to dispute resolution to resolve any disagreements.

Rather than rely on the basic adverse physical conditions clause in the case of significant capital works involving excavation of varying subsoil, weathered or solid rock, it is suggested to apply reference conditions in the Contract based on the actual information which can easily be measured and reviewed from the soil survey, outside of which the Contractor is entitled to claim additional compensation.

Employers should not rely on blanket disclaimer provisions in respect of the accuracy of all data supplied to tenderers as they are proven to be ineffective. In case it is not reasonably possible for Employers to eliminate specific issues on accuracy, completeness or ambiguity of the information before asking for tenders, a qualification can be added that the data are “for guidance only”, alerting tenderers to take particular care if they intend to use this information.

Where tenderers are concerned as to the accuracy, completeness or ambiguity of information supplied by the Employer they should not remain silent and should raise their concerns prior to tender submission.

If the Contractor has concerns as to the information given and considers that supplementary site investigation should be undertaken prior to commencing with the Works, then both parties should consider the option to agree on unit rate variations relative to characteristic soil parameters beforehand.

Each dredging project is unique in its scope, conditions and the potential for adverse conditions. Although much can and should be learned from former experiences, preparing a Contract should involve more than briefly re-visiting and revising a previously used contract. Careful analysis of the project characteristics and choosing the required contractual balance will eventually save time and money, and probably lengthy disputes as well.

REFERENCES


de Kok, Maurice, Dirks, Wouter and Hessels, Rienk (March 1997). “The Øresund Fixed Link: Dredging Reclamation”. Terra et Aqua Nr. 66.


Wijma, K. (2009). Wear resistant dredge cutter teeth - a look at the development of the tooth and its impact on the economical and environmental aspects of dredger logistics and foundry. CEDA Dredging Days Proceedings, Rotterdam, the Netherlands.