

MASTERING THE INTERFACES—CONSTRUCTION CONTRACTS DRAFTING FOR DISPUTE AVOIDANCE*

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1. INTRODUCTION: SOURCES OF CONSTRUCTION DISPUTES

Construction contracts are notorious for giving rise to disputes. In these contracts disputes are probably more frequent and more complex than in many other types of contracts. Often they require many different claims to be considered and involve vast numbers of documents and other evidence.¹ Much time and money is spent on resolving them.

This situation in recent years has prompted a wave of proposals and institution for alternative methods of dispute resolution (ADR) which seem to have varying degrees of success. Important as it is to increase efficiency of the dispute resolution process it is, of course, preferable to prevent disputes from arising. But dispute avoidance has not been quite as prominent in the discussion on construction contracts as ADR, partly perhaps because the subject is less easily institutionalised.

An important part of dispute avoidance concerns contract management and depends on the competence of those involved in the work and their ability to manage the conflict situations arising every day on a construction project. But the seeds of disputes are laid in the contract itself.

Dispute avoidance, therefore, must start with contract drafting. This is not merely a matter of choosing the right words to which the lawyer's function is sometimes believed to be limited. Of critical importance is the structuring of the contract, the right combination of concepts and mechanisms and their clear expression.

Many proposals have been made for formulas and mechanisms to avoid disputes. But the effectiveness of such proposals is difficult to judge: if disputes do not arise, it would require both detailed analysis of individual contracts and statistical information² to know why they did not arise and whether, in the absence of a particular dispute avoidance mechanism, they would have arisen. But something might be learned from past experience.

In preparing this article I have, therefore, started by looking at some of the

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construction disputes with which I had to deal in my practice as counsel or arbitrator. I asked myself why these disputes arose and what could have been done to avoid them during the course of contract performance and, especially, when drafting the contract.

There is, of course, no answer which applies to all cases. But it appears to me that there are a number of typical situations in which disputes arise most frequently. Some of these situations relate to difficulties internal to one or the other party; others relate to events outside the contractual relationship and which neither side controls. However, the most frequent sources for disputes are what I suggest to call the "interface situations", i.e., those situations in which the contractor's and the employer's (in American English, the owner's) responsibilities and activities meet.

There are many interface situations in construction contracts: they relate to such matters as the employer's contributions in terms of materials, feedstock, utilities, etc.; the payment mechanisms; the contractor's access to the site and his relation with other contractors working there. Perhaps the most important of these interfaces is that between design and construction. I shall deal with it first.

When drafting international construction contracts, it is always helpful to turn to some of the standard forms prepared by various specialised bodies. Some of the better ones, after careful scrutiny of their suitability for the contract at hand, sometimes may be used as they are proposed. All of them can provide useful guidance when seeking solutions to the problem areas identified below. In preparing this article, I have made frequent reference to a number of them. These standard conditions are listed at the end of this article.

2. THE DESIGN/CONSTRUCTION INTERFACE

The subject of a construction contract is something that does not exist—not yet. It remains to be constructed. The parties must agree on what it will look like once it has been built. They have to agree on its design. This raises the question as to how the design is prepared and by whom.

2.1 Traditional separation of design and construction

Traditionally, the employer retained a design professional, an architect or an engineer (I shall refer to him or her as the engineer). The engineer prepared the design. The contractor quoted his price on the basis of this design and constructed the work according to it.

A difficulty which arises from the separation of design and construction relates to the interpretation of the design in case of doubt. This difficulty is avoided to a large extent if the engineer who made the design also supervises the construction; in case of ambiguities or doubts, he is the first interpreter of his design. This contracting approach which gives a critical role to the engineer is

particularly developed in British and American building and civil engineering contracts mainly through the FIDIC Civil Engineering Conditions.³

Apart from doubts about the correct interpretation of the original design, difficulties may also arise from incomplete design. No matter how detailed the original design is, it is never complete in the sense of defining every minute aspect of the final works. Some aspects normally are and indeed should be left to the choice of the contractor; this applies with respect to sources of construction materials, subcontractors and suppliers of manufactured equipment (except in cases of nomination) and certain construction methods—all of which may influence an aspect of the final works.

Where the contractor has to make design decisions, the employer normally protects himself by reserving his approval. This reservation, in particular, gives rise to disputes when the approval is delayed or unreasonably withheld. To some extent, the disputes can be avoided by stipulating the grounds on which the employer may refuse approval and the period within which the decision on the requested approval must be given, failing which the approval is deemed to have occurred.⁴ In case of abusive refusal of approval, it may be helpful to allow immediate review, for instance, by a dispute review board, by an expert, a pre-arbitral referee or in similar proceedings.⁵ However, the review should concern only the financial consequences of the refusal.⁶ The final word on the design itself should rest with the employer; he is the one who will, in the end, use the works and who must be satisfied with the design.⁷ Here again, the role of the engineer, as conceived in the British and American practice, can be beneficial.

In my view, the role of the engineer, as just described, contributes much to the avoidance of disputes—provided it is properly understood and is exercised professionally and impartially.⁸ It does, however, raise a new difficulty in all those situations in which the engineer's design is defective. In such situations, there is a risk that the engineer seeks to "cover" his mistakes—sometimes at the expense of the contractor or the project as a whole. I have seen serious disputes arise under these circumstances.⁹ If one maintains the engineer's role with its useful features, I do not see any possibility of avoiding this type of dispute altogether. However, its damaging consequences can be reduced if immediate review were provided through procedures as just mentioned. In so far as payments to the contractor are concerned, the remedy could also be provided by a review certifier as will be discussed below (section 4).

2.2 Design by the contractor or turn-key

Some of the disputes resulting from the design/construction interface can be avoided if the contractor not only constructs the works but also provides the design. Contracts of this type are described as "design and build" or "turn-key".¹⁰

However, the design/construction interface is not altogether avoided in turn-key contracts. Some elements of design are required so that the contractor knows what he has to provide and the employer what he will or should receive.

A performance specification usually would be sufficient; but often, turn-key contracts provide further details. As the contractor's design progresses, an approval process is applied essentially of the same type as that for the minor design activities by the contractor were the works have been designed by the engineer.

Design-related disputes arise mainly in this approval process. The process can be particularly complex and prone to disputes in cases where some of the design is to be prepared by the subcontractor but has to be approved by the employer.¹¹ Generally, the mechanisms for avoiding disputes in this context follow the model described above. However, since the contractor himself designs the works, the engineer whom the employer may retain, in this type of contract, plays a role different from that described above. Normally he is merely the employer's project manager or supervisor.

It is not uncommon in international practice that contract conditions following the model of the FIDIC Civil Conditions are used for turn-key lump sum contracts. Since this type of conditions is not made for such contracts, difficulties can arise from this misuse. They can be avoided by using different conditions or, at least, by carefully adapting the FIDIC Civil Conditions to the design and build situation.¹²

In this context, the ENAA turn-key conditions provide an interesting solution¹³. When design-related disputes arise, the parties may submit them to an expert. This provides the parties with an immediate reconsideration of the contentious issue by a neutral person and, thus, is likely to avoid in many cases that the difference turns into a major dispute. It is important to note that, under the ENAA mechanism, the employer has the right to give instructions on how the works should go on while the matter is before the expert. In other words, the expert's decision, in essence, will be limited to findings on (i) the contractor's claim for additional money and time and (ii) relief of his responsibility as a result of the employer's design requirement. Thus, the expert in the ENAA contract does not take the role of the engineer in the FIDIC type contract; he does not decide the technical aspects of the works. This appears to be a wise approach since, as stated above, the employer should have the last word in the design of the works and, consequently, should bear the effects which changes made by him cause with respect to time, money and responsibility.¹⁴

2.3 Contracting with insufficient design information

Situations arise when the employer wishes to proceed with the project and to engage the contractor under circumstances which do not allow a precise definition of what is required in terms of construction (including the contractor's possible design input). The need to proceed in this manner is felt in particular when new or rapidly-changing technologies are involved or where more time is needed to obtain some of the information necessary for the design; in some cases, the information can best be obtained as the works progress. Examples are work under ground, unfamiliar climatic conditions, works

requiring important research and development or situations where the employer wishes to proceed with design and construction of the project but reserves his options on some parts, for instance in order to benefit from technological developments concerning mechanical and electrical equipment.

In such situations, employers sometimes tend to place on the contractor burdens and risks far beyond those which can be reasonably assessed by the contractor with the available information. Some employers require extensive design work at the tender stage; the process is wasteful and requires from the unsuccessful tenderer services without remuneration.¹⁵ Other employers insist on fixed prices for the works although the requirements for their construction are insufficiently defined. When introducing its New Engineering Contract, the British Institution of Civil Engineers criticised the practice in the following terms: "Ever since mechanisms were introduced into contracts making it possible to invite tenders without making a complete statement of what the contractor was required to do, their misuse has grown".¹⁶ Such contracting practices almost inevitably lead to disputes; some major international projects have suffered from them.

There are, however, contracting methods and procedures which respond to the employer's needs in such situations without provoking disputes through unsuitable risk allocation: the basic principle is to award all work which cannot suitably be priced on a cost reimbursement (or "cost plus") basis. The contracts may be fully at reimbursable costs or may contain fixed price elements (normally lump sum, but unit rates are also possible).

Cost-reimbursement contracts, in some cases, have ended up with final costs far above the budget; occasionally they have given rise to serious disputes. It is submitted that, in most of these cases, the project would not have fared much better had the employers attempted to award the contract at fixed prices under conditions which would not have allowed proper pricing. Many problems with cost-reimbursement contracts, however, arise due to insufficient understanding of the particularities and specific requirements of this type of contract.

When using the cost-reimbursement approach, the employer can start the project and award the contract before the design and specifications are prepared. In so far, he can save time and possibly costs. He must, however, take great care in specifying principles and procedures for establishing allowable costs and for controlling their engagement. The need for careful drafting of costing and cost control provisions in cost-reimbursement contracts is often under-estimated. In my experience, this neglect is one of the principal sources of disputes in this type of contract.¹⁷ It must be given particular attention if disputes are to be avoided.

There can be little doubt that the best mechanism for cost control is a fixed price. Cost-reimbursement contracts, therefore, should remain the exception and should be applied only on those cases where the contractor cannot reasonably be required to quote a fixed price. Where the situation of the project calls for a cost-reimbursement approach but allows the pricing of certain

components, lump sum elements can be included in a cost-reimbursement contract.¹⁸ For these lump sum elements, detailed specifications must be prepared as in any fixed-price contract.

As the work under a cost-reimbursement contract progresses, more and more design elements are completed. It becomes possible to agree fixed prices for them. This can be done by progressively converting the cost-reimbursement contract into a fixed-price contract. A similar result is achieved by awarding fixed-price subcontracts for components of the project as their design advances.¹⁹ In the environment of a cost-reimbursement contract, there is a certain risk that the specification requirements for pricing do not receive sufficient attention. It must be emphasised, therefore, that, in case of such a conversion, the requirements in precision for the specifications are just as great as in any fixed-price contract.

In recent years, the management contract has gained increasing popularity in circumstances of insufficient design as described here. Although not all specialists might agree with me, I view the management contract as a variation of the cost-reimbursement approach. Its main particularity is that the management contractor subcontracts all the construction works while in an ordinary cost-reimbursement contract, the contractor performs much of the work himself. The advantage of the management contract resides in the possibility of an early appointment of the contractor, well before design has advanced to the stage when a realistic cost estimate can be prepared for tendering. Such an early appointment enables the commercial and construction knowledge of the main contractor to be brought to bear on the early design and planning process.²⁰ It does so in terms which avoid some of the potential for disputes arising when the employer requires from a contractor firm commitments, in terms of price and quality, at a time when design has not yet advanced to the stage where this can reasonably be done.

Management contracts and cost-reimbursement contracts of the type described may imply some early design decisions; the very choice of the contractor, due to his qualifications and proprietary rights in the technology for the project, may give a definite design orientation to the project and exclude others. Sometimes, employers try to avoid the resulting limitations of requiring, as mentioned already, extensive design work from tenderers.

However, there are some contracting methods which avoid the inconveniences and difficulties inherent in this approach:

— Among the oldest arrangements of this type is the “framework contract”,²¹ developed in the Netherlands for major and complex works (ports, tidal protection structures, a ship elevator, etc.) and applied also in Belgium: the general terms for the design and construction work are set out in a framework contract with the main contractor, normally a group of specialised contractors. As the design progresses, partial agreements are made with the main contractor or, pursuant to a special competitive price fixing procedure, with some other independent contractors.

— A source of innovative contract arrangements is bodies acting at the forefront of technological development such as those working in outer space, notably the US National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA).²² As a particularly interesting example of the “new legal technologies” developed there, one may mention the competitive design and construction used for instance in ESA’s astrometric satellite Hipparcos. The project, like most others in space development, proceeded in phases; ESA first determined the feasibility of the project and then defined the scientific objectives of the satellite and the requirements for meeting these objectives. This was followed by a two-stage competitive tendering: During the first stage, the tenderers prepared, on a cost-reimbursement basis, proposals outlining the solutions for the design and manufacture of the satellite. From among these tenderers not one, but two contractors were chosen. These two contractors worked in parallel on a fixed-price basis. At the end of this phase, they had prepared the “system design” and the documents necessary for ESA to award to one of them the detailed design and manufacture of the satellite.

— Particularly innovative approaches have been adopted in defence contracts, especially in the United States. Contracts for the development of new airplanes, ships or weapon systems, for complex civil engineering or other projects face the need of combining design and construction in contractual arrangements through which contractors with specialist experience and know-how are associated to the design process while the terms for the construction are defined progressively.

It may not always be possible to apply these contracting method to projects outside the areas for which they have been developed. However, they show the wide range of possible arrangements available for allocating responsibilities at the design/construction interface. From the point of view of dispute avoidance, it is essential that the allocation chosen in a particular contract be in line with the financial terms of the contract.

2.4 Changes in design (variations)

During the course of the performance of the contract, the employer may have reasons to vary the design. Indeed, there are probably few construction projects on which no variations (or “changes” in American English) are made to the design during the construction. In most construction disputes, at least some of the contractor’s claims relate to such variations.

When dealing with variations, it should be remembered that there are basically three approaches to be followed²³:

— One of these approaches is frequently adopted in civil engineering and building contracts: the employer or his engineer are free to order a variation;

the contractor must carry it out (subject to some limitations, in particular if the value of the variation exceeds a certain threshold). He is paid according to rates and prices agreed in the contract.²⁴

— In the opposite approach, the contractor must agree to the variation in the design and to the corresponding modification in the price. This approach is more frequent in contracts for industrial works.

— Many industrial works contracts, however, adopt an intermediate position: the contractor has the right to object on specified grounds to the variation order; if he does not object, the parties seek agreement on the variation and its financial and other consequences; in the absence of an agreement, the employer may nevertheless order the variation. The price for it then is determined according to contract rates or, in their absence, by an expert or some other form of dispute settlement mechanism.²⁵

The type of dispute which is likely to arise, to some extent, depends on the approach chosen in the contract: In all three approaches, there may be disputes concerning the question whether a certain request of the employer or an instruction by the engineer is a variation in the works or merely a clarification.²⁶ The scope for disputes of this nature may be reduced by careful drafting of the contract documents and, in particular, the specifications; but it appears hardly possible to avoid such disputes altogether.

Where the contractor must perform variations instructed by the employer or the engineer, disputes may arise with respect to the applicability of the contractual rates and the extent to which they cover adequately all the effects of the variation.²⁷ In particular, these rates normally do not quantify secondary effects such as delay and disruption caused by an untimely change in the design.²⁸

In order to avoid such disputes, it is highly desirable that the financial and other consequences be settled before the variation is made. In case of major variations, a contractor would be well advised to seek agreement in this respect even if the contract conditions do not require him to do so. It must be recognised, however, that the disruptive effects of a variation cannot always be appreciated adequately in advance. Some subsequent quantification may have to be reserved.

The usefulness of notice and warning procedures also should be underlined. Many contracts provide that the contractor must give notice of claims when the incident arises. The clause on early warning in the New Engineering Contract deserves particular mention.²⁹ In the context of variation orders, it allows the employer to reconsider such an order if the consequences of which the contractor gives warning are out of proportion with the expected advantages of the variation. At that stage, when the variation order is made, it is often still possible to avoid or clearly circumscribe a dispute which, if it arises later, may be bitter and costly.

3. THE INTERFACE WITH THE EMPLOYER'S CONTRIBUTIONS

Apart from payments which shall be dealt with separately, the employer has to make a number of contributions to the works. The scope of these contributions varies from one contract to another. But in all cases the interface between these contributions and the contractor's activities is a major source of potential difficulties and conflict. There are two principal groups of such contributions; one relates to the site and the other to the works and their operation.

3.1 The site

The works are constructed by the contractor on a site which normally is provided by the employer. This interface gives rise to frequent difficulties and is one of the principal sources of construction disputes. The main difficulties concern availability of the site for possession by the contractor and its physical conditions.

Possession of the site must be given by the time and to the extent to which it is required for the works.³⁰ Access may be given at a single date or in successive portions. Unless the dates required for access are stipulated in the contract, it is normally for the contractor to notify the employer of these dates. In most cases this is done by the programme of work.³¹ Difficulties often arise because access dates are not always clearly and completely specified; the notice may be too short for the employer to make the necessary arrangements; or the employer may not have taken the necessary precautions.

The first precaution for avoiding access difficulties, therefore, is careful programming. But the contractor may want to go further and include in his own planning and monitoring activity, to the extent possible, the employer's preparations concerning the site. This may be particularly advisable when the employer is a public body and availability of the site depends on a number of different governmental departments. If the process of preparing access is properly monitored, difficulties and delays may be known in advance, at the time when the programme can be adjusted without much disruption.

In many cases, especially in industrial works contracts, the contractor shares the site with other contractors who are retained by the employer directly or indirectly (through the employer's contractors). The contractors must give reasonable opportunities to such other contractors³² and can expect from them that they do not interfere with his own work. Co-ordination normally is the task of the employer or his engineer. The situation is full of difficulties. Disputes are frequent both between the main contractors and between them and their respective subcontractors.³³ Careful interface programming, of course, is indispensable; but some interferences and resulting disputes are probably unavoidable.

Apart from matters of access and time, co-ordination and interface management with respect to the site is required with respect to dimensions and

other criteria of those parts of the works which are constructed by other contractors.³⁴ This need arises for instance in the interface between the civil engineering contractor and the contractors providing electrical and mechanical equipment who may be retained separately by the employer. Precise indications for the design interface are, of course, required. Some monitoring of the employer's co-ordination, here too, may be useful to prevent conflicts.

The *physical conditions* of the site are a very serious source of potential disputes. They can be considered as part of the outside events or factors, in the sense that they are normally not under the control of one or the other party. Much has been written on the question as to who should bear the risk for these conditions.³⁵ The risk considered here is that of physical conditions³⁶ different from those which had to be assumed from the information available to the contractor at the time of his tender.³⁷ Most of the standard conditions place the risk on the employer.³⁸ In contract practice, however, one finds provisions which give a wide scope to the prior inspection clause. Such a clause makes a presumption to the effect that the contractor is familiar with all physical conditions of the site and has taken account of them in his tender.³⁹

In most cases, disputes about physical conditions of the site concern the question whether, on the basis of the information available to him, the contractor had to account for conditions of a kind such as those actually encountered. Some of the difficulties can be avoided if the contract contains clear indications concerning the information which the contractor had to take into account. A well-balanced provision in this respect is Clause 60.1 of the New Engineering Contract⁴⁰ which, in the consultation version, described one of the Compensation Events as follows:

- "The contractor encounters physical conditions within the Site which, at Acceptance, he could not reasonably have expected to be a significant probability having taken into account
- the Site Information
 - publicly available information referred to in the Site Information
 - information which an experienced contractor could reasonably be expected to have and
 - information obtainable from a visual inspection of the Site."

The Guidance Notes for this contract state the recommended content of the Site Information.⁴¹ In the version now published as the 1st edition of the NEC this clause has been simplified and refers to "physical conditions within the Site, other than weather conditions which, at the Contract Date, an experienced contractor would have judged to have such a small chance of occurring that it would have been unreasonable for him to have allowed for them".

In the United States, the Underground Technology Research Council went one step further in its advice for dispute avoidance. The Technical Committee on Contracting Practices of this council recommends that the employer and his engineer establish the geotechnical baseline for all anticipated conditions.⁴² In its recommendations the committee writes: "Nothing can eliminate the risk of encountering differing site conditions. But the potential for costly disputes and

possible litigation over what constitutes differing conditions is greatly reduced, if not eliminated, with well-defined geotechnical baselines".⁴³

These baselines, in the committee's recommendations, should be contained in what is called the "Geotechnical Design Summary Report (GDSR)". This report "sets forth the designer's anticipated subsurface conditions and their impact on design and construction".⁴⁴

The Council explains that employers throughout the United States have used GDSRs and that reports on their use from employers, engineers and contractors have been "consistently favorable".⁴⁵ Its report concludes by stating that "some have credited the GDSR directly with saving millions of dollars in avoided claims and litigation".⁴⁶

3.2 Contributions to works and their operation

In many contracts, the employer contributes materials for incorporation into the works. Often he also provides water, power, fuel and other commodities which the contractor needs for performing his work. The interfaces with respect to these supplies are a potential source of dispute but normally can be avoided by careful contract drafting.

The contract must be clear about the specifications of these supplies, the qualities and quantities required and the conditions under which they are supplied. The contract should also regulate the requirements of inspection at the time of delivery and liabilities for undetected shortages, defects or defaults.⁴⁷

In industrial works contracts, the contractor delivers a plant which will have to operate with materials or feedstock supplied by the employer. The design of the plant must take account of the specific characteristics of these materials. In turn-key contracts, as explained, the design forms part of the contractor's obligations; on completion the contractor must show that the plant meets the contractual performance criteria with the employer's feedstock.

Normally, turn-key contracts for industrial works contain provisions on the characteristics of the feedstock and on the performance tests. In practice, however, these provisions are often inadequate and many disputes arise in this area. The importance of careful drafting in this respect cannot be overemphasised.

With respect to the specification of the feedstock, particular attention must be paid to those characteristics which are critical for the process or for the specific design adopted by the contractor. It is advisable that the contractor draws the attention of the employer to these critical characteristics.⁴⁸

If the contract specifies the characteristics of the feedstock and the performance tests fail due to defective feedstock, the contractor is not responsible. However, a failed performance test creates much disturbance for the contractor, even if the causes do not fall in his responsibility. In addition, it is often not very easy to determine whether the failure of the performance test is due exclusively to defective feedstock or whether other factors for which the

contractor is responsible also are to blame.⁴⁹ Therefore, the contractor should be seriously concerned by the employer's capacity to supply feedstock of the specified characteristics. If he has doubts, the matter should be raised at the time when the contract is made and the design prepared.

Another aspect of critical importance for dispute avoidance concerns the conditions and circumstances under which the performance tests have to be conducted. It happens that the employer does not provide feedstock, materials, utilities or services for the tests as required in the contract.⁵⁰ If it can be established that such a default of the employer is the only cause of the failure of the performance test, the test may be presumed to have succeeded. But, as just explained, the causes for the failure often are difficult to establish. Complex disputes are the result. Therefore the parties are well advised, when drafting the contract, to pay particular attention to such circumstances and to methods by which the contractor can establish compliance with the contractual performance guarantees despite the employer's default.

4. PAYMENTS

Construction contracts normally provide for partial payments at various stages of the project. Different systems are used to determine time and amount of partial payments.

Some payments, especially those for equipment manufactured off-site, are made according to pre-agreed milestones, such as start of manufacture, certain tests, shipment, etc. The milestones and the amount due must be clearly defined. This is normally the case and, to my knowledge, such payment conditions rarely give rise to serious disputes.

Other payments are made according to the progress of the work measured in regular intervals. Progress can be measured in terms of percentage of the works completed or on the basis of quantities and unit rates.

Progress payments by reference to percentage of completion are normal practice in lump-sum contracts. In order to facilitate the measurement of progress, the works are subdivided into parts or activities. For each of these activities the value relative to the total lump-sum price must then be determined. For payment purposes, progress is measured separately for each activity and the measured progress is applied to the value of the activity. The total value of all activities gives the value of progress at any given time. Monthly payments are then determined by making deduction for earlier payments, retention and a proportion of the advance payment.

The difficulty which arises first when applying this system concerns the definition and value of the activities. The matter can have considerable influence on the contractor's cash flow. Therefore, he has an interest in valuing the early activities as high as possible. The employer has the opposite interest. Disputes on the valuation, therefore, are frequent. Normally, such disputes are resolved on the site and do not reach litigation or arbitration. Nevertheless, it is

advisable for the parties not to wait with establishing the activity breakdown until the time when the first progress payments have to be made; rather, the matter should be addressed before the contract is signed or at the latest in the very early stage of its performance:

The New Engineering Contract goes a step further and suggests that tenderers submit an Activity Schedule with their tenders. This schedule is a list of activities with an amount entered against each and every activity which will become the price for the activity under the contract.⁵¹

When payments are determined by reference to unit rates, it is, of course, important that the bill of quantities is carefully drafted.⁵² In addition, clear provisions on the method of measurement are essential for avoiding disputes in this type of payment arrangements.⁵³

In order to avoid disputes with respect to payments in construction contracts, a particularly ingenious method has been developed in England: the system of certification. From England the system spread throughout the Anglo-American legal systems. It is now widely used in international construction contracts all over the world—but often is not properly understood and is misapplied.

In the certification system, payments which the employer must make under the contract are neither fixed unilaterally by one or the other party nor agreed in advance by both parties; rather they are stipulated in a certificate, issued by the engineer. Basically, the certificate of the engineer has a double function: on the one hand, it constitutes a condition precedent to the contractor's claim for payment; on the other hand, it creates a binding obligation for the employer to pay.⁵⁴

The certificate system, if correctly applied, has the great advantage that the decision about the payment is made by the person who is most familiar with the project and who is considered not to have an interest in the certificate. The engineer is expected "to act impartially, honestly and with professional integrity towards both parties to the contract".⁵⁵

Unfortunately, difficulties arise in the application of the system. It was conceived to be applied by engineers who are independent of the employer and who have a long-standing tradition and established ethos of acting in such an impartial manner. However, even for an independent engineer, it is not easy to act impartially in cases where his own work and possible liability for it is at stake. This impartiality also may come under strain when the engineer is retained by a powerful employer from whom he expects further work. Moreover, the certificate system now is often applied in situations where the role of the certifier is exercised not by an independent engineer but by a member of the employer's staff. In such situations it cannot function properly as originally conceived.

In response to the misuse of the certificate system, it has been suggested to abolish it altogether and to replace the engineer as certifier by a neutral expert.⁵⁶ It is submitted that such a replacement would be neither practical nor desirable. Rather than abolishing it, the system should be strengthened. This

can be done by a "review certifier" as I have suggested some time ago.⁵⁷ A review certifier is an independent expert jointly appointed by the parties who intervenes in case of disagreements over certificates during the course of construction. Upon application by either side, he reviews on short notice the engineer's certification decision. He may correct the amounts certified by the engineer and may issue certificates where the engineer failed to do so.

One might also think of pre-arbitral referee and similar proceedings through which such an immediate and limited review of the engineer's decision can be provided.⁵⁸

5. SOME OTHER SOURCES OF DISPUTES

There are, of course, many other circumstances and events which can give rise to disputes. I can only make short references to those which, in my experience, have appeared as the most risky ones.

5.1 Outside events

Events which are outside the control of either of the parties, normally, are regulated in the contract. If they occur, the parties affected by them are exempted from liability. For instance, a contractor delayed by an event of *force majeure*, may claim an extension of time for completion.

In many construction contract conditions, some such *force majeure* events (included for instance in "special risks" clauses) may entitle the contractor also to additional payments. Provisions to this effect often give rise to disputes, mainly on two grounds: on the one hand, the definition of the event often is not very clear⁵⁹; on the other hand, there may be doubts as to the precise effects of the event on the works and the contractor's costs. War, for example, is an event of *force majeure* and included in the special risks for which, under clause 65 of FIDIC Civil Conditions, the contractor is not liable. The contractor may also claim "any costs of execution of the Works" which are "in any way whatsoever connected with the said special risk".⁶⁰ But disputes arise concerning the link of causation between the event and the costs for which the contractor claims.⁶¹

Questions of this type can only be answered on a case by case basis in the light of the circumstances of each instance. Unless the parties approach the matter constructively and in a co-operative spirit, disputes about them can hardly be avoided.

Weather is an exterior event which is of particular importance in construction contracts. To a certain extent, contractors must allow for inclement weather conditions. Two principal types of disputes arise in this respect. The first concerns the limit beyond which an event of bad weather is no longer an ordinary risk of the contractor and becomes a ground on which the contractor can claim an extension of time and, possibly, additional payments. The second type of dispute concerns mainly periodical weather events, such as

winter or rainy season, which prevent or slow down construction work. The contractor must make allowance for them in his programme; but he may be entitled to a claim if, due to reasons for which the employer is responsible, his programme is changed and he now must work during a more difficult season.

Little can be done to avoid the latter type of dispute, apart from good co-operation in general. With respect to the former, however, some precautions can be taken: the contract may set out in a schedule the weather parameters which the contractor may have to expect, in terms such as rainfall, snow or frost. If he then encounters more adverse conditions, he may be entitled to additional time and money.⁶²

5.2 Events affecting one of the parties only

Either of the parties may be faced with developments which substantially change its position to the project and the contract. In such circumstances, the relationship between the parties may rapidly deteriorate and disputes may arise which often are very difficult to resolve.

The employer, for instance, may suffer financial difficulties; economic, legal or other events may affect the profitability of the project; or, due to a change in the employer's overall policy, the project may have lost its priority. When this occurs in the course of a construction contract, the project will inevitably run into difficulties. If the employer is no longer motivated to support the project, disputes will arise even from minor incidents which otherwise could have been resolved easily.

In such a situation, the employer may rely on the Termination for Convenience Clause which most contracts contain. But, often this is not much comfort for him because he must pay the contractor for the work performed, the costs of winding down the work and, in some contracts, for the loss of profit on the cancelled work. Against these payments he receives an uncompleted project which may be a complete loss for him.

When the employer faces such difficulties, the contractor may take the view that they are not of his concern; he may insist on the terms of the contract and, if they are not honoured, may claim damages. In some cases, this may indeed be the best or the only approach which the contractor can take. But he then must face the difficulties which arise when a project is constructed without the support of the employer. He may have to fight long procedural battles for having his rights and claims recognised. In the end, there may remain no funds of the employer to satisfy these claims. Often the contractor will be better advised if he addresses the problem squarely and seeks with the employer possibilities to adjust the project, scale it down or otherwise assist the employer to face the situation.

The contractor, too, can be faced with developments which seriously affect his position to the project. He may discover a major error in the calculation of his contract price; he may realise that, due to a wrong assessment of the risk which he had accepted under the contract, the performance becomes much

more onerous than calculated; his company may have been reorganised and, as a result, the activity under the contract may have fallen outside the company's priorities.

In such situations, the contractor may not be motivated to allocate to the contract work the resources, the efforts and the dedication which are necessary for completing a complex construction project; or he may concentrate his efforts on recovering some of his losses through claims. In both cases, the project is likely to run into problems.

Legally, the employer would be within his right to disregard the contractor's problems and insist on correct performance of the contract. In many cases, this is probably the most appropriate approach. In other cases, it may, however, be preferable to adapt the contract, rather than continuing it under conditions which one of the parties considers excessively burdensome or uninteresting. The concessions which the employer would have to make in such an adaptation may be less costly than a disrupted contract and many years of litigation.

5.3 Communication between the parties

Construction contracts, more than many others, require good communication between the parties. The discussion of the interface issues has shown this. In contract practice, there are many occasions where communications break down; disputes often are the result.

Good communication is necessary from the very beginning. Indeed, the purpose of the contract is to express the common intentions of the parties. They must have communicated about its contents. In practice, it is surprising to see how many poorly-drafted contracts are concluded. Later, when they have to perform the contract, the parties have to face the many contradictions in the texts they have adopted.

In international contracts where the parties often speak different languages and come from different legal and cultural backgrounds, the potential for misunderstandings is particularly great. Careful drafting of the contract by a person well familiar with the language and the applicable law, therefore, is an essential precaution for avoiding disputes.

Any drafting of a contract clause must be preceded by agreement on its substance. This sounds self evident. In practice, however, many provisions of a contract are taken from other contracts without full understanding of their meaning and of their impact on the contract into which they are imported.

Major causes of confusion and subsequent disputes are shifts in the technical and commercial philosophy of the project or substantial modifications of the transaction during the development of the contract documents. The resulting adaptations of the documents often are incomplete and lead to contradictions. The British Institution of Chemical Engineers, in its Conditions of Contract for Process Plant, gives the following very useful advice: "Where there have been any changes in concept during the negotiations, the Special Conditions and the Specification should be re-written before the Agreement is signed . . ." ⁶³

Communication, obviously, must continue during the performance of the works. It is part of good management which is of paramount importance. In particular, the New Engineering Contract rightly places much emphasis on good contract management and communication, especially through such provisions as those on early warning, organisation of management meetings, procedures and rules for compensation events and, more generally, in its underlying drafting philosophy.

The need for good communication exists not only between the parties. It is just as great within the organisations of the employer, the engineer and the contractor. Within these organisations, information on potentially damaging events often is controlled by those who are responsible for the event and its consequences. As a result, executives of these organisations often see the events on site with the bias of their respective site representatives. It must be expected that, in one or the other instance when their own responsibility is at stake, these representatives present these events in a light in which the mistakes of the other side are better visible than their own.

It is one of the useful functions of early dispute settlement mechanisms (such as the reference to the engineer under Clause 67 of FIDIC Civil, the dispute review board, pre-arbitral referee proceedings and the like) that they draw the attention of senior management to the existence of a problem which deserves attention; through these proceedings senior management is alerted and can be appraised of the formulated view of the other side to the dispute. This communication alone can bring about a reconsideration of the situation and avoid a long-drawn-out dispute.

6. QUANTIFICATION OF CLAIMS AND COST CONTROL IN CASE OF MAJOR DISRUPTIONS

In most construction disputes, the parties disagree not only on the question whether the contractor is entitled in principle to his claim but also on the amount which should be allowed for it. Indeed, many claims (including those where the principle of entitlement is disputed) might not reach the stage of litigation or arbitration if their amount were clear from the outset. Clear rules on quantification of claims, therefore, can contribute much to avoiding disputes.

With respect to variations in the work, the claims normally can be quantified by reference to rates and prices forming part of the contract. But changes may occur to which these rates and prices do not apply; new ones may have to be derived from the agreed rates and prices or the claim may have to be quantified by reference to the contractor's costs. In addition, the rates normally cover only the varied work itself, but not the disruption and delay associated with the variation.

Claims on grounds other than variations in the work possibly may not be quantified by reference to the contract rates and prices. This applies in

particular to all those claims for which the contractor is entitled to compensation in terms of "equitable adjustment" of the contract price provided, for instance, in US Government contracts.

In order to facilitate agreement on the amount of such claims once they have arisen, it is useful to prepare the grounds at the time when the contract is made. The contract may for instance include a schedule of actual costs⁶⁴ and thereby avoid disputes about the types of the costs for which the contractor may claim.

It has also been recommended that the contractor should deposit in escrow his calculations and the information used in preparing his tender. Before their deposit, the Escrow Bid Documents, as they are called in the US, are examined jointly by the employer and the contractor to verify authenticity, completeness and legibility. Thereafter, either party may request consultation of these documents, whenever the settlement of a dispute could be facilitated by knowing about the make-up of the contract prices.⁶⁵

In case of major disruptions, a further difficulty arises and frequently causes disputes: in such cases, the disagreement often relates not only to the amount of the costs incurred by the contractor but also, and often even more so, to the question whether the costs are reasonable and whether they could have been avoided or reduced had the contractor taken a different course of action.

Such situations arise in case of unforeseen site conditions, major untimely variations, *force majeure* events or delay and disruption caused by the employer's failure to meet his obligations. To the extent to which the contractor may claim for his costs arising from such situations, the contract is transformed into a cost-reimbursement contract. The parties rarely appreciate the adaptations to the contract which such a partial transformation requires. Most standard conditions of contract, too, do not address the issue fully.

If the contractor intends to claim for events such as those described, most contracts require him to give notice. This is a useful and necessary requirement, but it is not sufficient. In many cases which have given rise to disputes, the contractor gave notice of the event, took the action he considered appropriate under the circumstances and at the end quantified his claim. Had the employer been consulted about this action, he may have decided a different course, possibly adapting the project or the programme and thus reducing the cost.⁶⁶

If disruptive events occur, the contractor, therefore, is well advised not only to give notice but to consult the employer about the action to be taken. Many construction disputes which end in long and costly arbitration or litigation could have been avoided or limited in scope, had such consultations taken place in time.

Against this background one appreciates the usefulness of contract provisions which require the contractor, on occurrence of certain claims events, not only to give notice to the employer but also to indicate the action required to deal with them and the anticipated delay and additional costs.⁶⁷ It appears desirable that, wherever possible, agreement on additional cost and time be reached at the earliest possible moment, preferably before any action is taken

with respect to the event; some contracts follow this approach with respect to variations.⁶⁸ It could well be adopted in some other situations, too.

However, the events giving rise to the claim often do not allow an early assessment and agreement on their effects in time and money. Procedures for management and cost control should then be followed comparable to those in cost-reimbursement contracts.⁶⁹ Fixed price contracts rarely contain provisions to this effect. A notable exception is the New Engineering Contract with its procedures for early warning and anticipated assessment of Compensation Events.⁷⁰ It may well be expected that the procedures stipulated there, if properly applied, will make a major contribution to avoiding or limiting disputes in this difficult area of construction contracts.

ANNEX

List of contract conditions

In the preparation of this paper, the following standard conditions of contract were consulted. They are listed in the alphabetical order of their abbreviations used in the notes.

- CCAG-Travaux: *Cahier des Clauses Administratives Générales applicables aux Marchés Publics de Travaux*, Conditions for French Government works contracts, issued by Decree 1976 and subsequently amended.
- EDF Works: General Conditions for Works Contracts Financed by the European Development Fund, adopted by the ECC-ACP Council of Ministers 29 March 1990 and entered into force on 1 July 1991.
- ENAA-Contract: Model Form, International Contract for Process Plant Construction (Turn-key Lump Sum Basis), 2nd edition 1992.
- FIDIC Civil: Conditions of Contracts for Works of Civil Engineering Construction, 4th edition 1987, issued by the *Fédération Internationale des Ingénieurs-Conseils* (FIDIC).
- FIDIC E & M: Conditions of Contract for Electrical and Mechanical Works, including erection on site, 3rd edition 1987, issued by the *Fédération Internationale des Ingénieurs-Conseils*.
- IChemE Reimbursable: Model Form of Conditions of Contract for Process Plant, suitable for reimbursable contracts. 2nd edition 1992, issued by the Institution of Chemical Engineers.
- IChemELump-sum: Model Form of Conditions of Contract for Process Plant, suitable for lump-sum contracts in the United Kingdom, 3rd edition in preparation.
- NEC: The New Engineering Contract, published for consultation in 1991 by the Institution of Civil Engineers, London, in the following versions:
 — A: Conventional Contract with Activity Schedule.
 — B: Conventional Contract with Bill of Quantities,
 — C: Target Contract with Activity Schedule,
 — D: Target Contract with Bill of Quantities,
 — E: Cost reimbursable Contract,
 — F: Management Contract,
 together with the New Engineering Sub-Contract and Guidance Notes; the official publication of the First Edition has been published on 30 March 1993, see note 40.
- UNIDO-Contract Fertiliser Plant: Model Form of Turnkey Lump Sum Contract for the Construction of a Fertiliser Plant, published in 1981 by the United Nations Industrial Development Organisation (UNIDO), with Guidelines; model forms have also been published for a "Semi-Turnkey" and a Cost-Reimbursable Contract.
- VOB: *Verdingungsordnung für Bauleistungen*, collective conditions for awarding (Part A) and performing (Part B) construction contracts in Germany, latest edition 1990.

NOTES

1. See the present author's article on Arbitration of Construction Disputes in Böckstiegel (ed.): *Contracts and Dispute Settlement in Civil Engineering and Construction of Plants*, Publication of the German Institute of Arbitration, vol. 4, Cologne 1984, pp. 187-244; for an American experience in this area, see Overton A Currie, "Avoiding, Managing and Winning Construction Disputes" [1991] ICLR 344.
2. Some attempts in this direction have been made with respect to the Geotechnical Design Summary Report; see below section 3.1.
3. First published in 1957; now in their 4th edition; for comment on these conditions, see Nael G Bunni: *The FIDIC Form of Contract*, Oxford 1991; E C Corbett, *FIDIC 4th—A Practical Legal Guide*, London 1991 and many articles in ICLR.
4. In this sense for instance the ENAA-Contract GC 20.3.2 and 20.3.3.
5. See, e.g., Davis, "The ICC Pre-Arbitral Referee Procedure in Context with Technical Expertise, Conciliation and Arbitration" [1992] ICLR 218; Jean-Jacques Arnaldez and Erik Schäfer, "Le Règlement de Référé Pré-Arbitral de la Chambre de Commerce Internationale", [1990] *Revue de l'Arbitrage*, pp. 835-849.
6. The point has been discussed in my proposal for a Review Certifier, see "Arbitration of Construction Disputes" (1984) 1 ICLR 317 at 319; see also the ENAA process below at note 13.
7. The ENAA-Contract, for instance, in GC 20.3.5 allows reference to an expert.
8. The principle is now clearly stated in FIDIC Civil, Clause 2.6.
9. As an example I may mention the case where the engineer had specified the parameters for the asphalt mix and the contractor had to "design" the mix within these parameters, allowing for the particular characteristics of the materials at his disposal. When the asphalt layer failed, the employer argued that the mix was defective, while the contractor argued that the parameters were unsuitable.
10. See the present author's article on "Turnkey Contracts—Concepts, Liabilities, Claims" (1986) 3 ICLR 338.
11. In such cases, the design which the employer has to approve may be composed of elements provided by the main contractor and others made by the subcontractor. As an example, the case of the design for tank foundations may be given where the main contractor designed the tanks and the civil engineering subcontractor the foundations. The subcontractor argued that the foundations which the employer required were more extensive than he had to expect from the contract; he attributed this to the main contractor's unreasonable design choice for the tanks.
12. See, e.g. Bunni, *op. cit.*, p. 67. FIDIC has now formed a Turnkey Contract Task Committee which announced that, by the end of October 1993, draft conditions for this type of contract will be made available for review by outside organisations and specialists, [1993] *Independent Consulting Engineer*, Number 2, p. 8.
13. ENAA GC 20.3.5.
14. Exceptionally, there may be situations where the contractor, for reasons of intellectual property, reputation or similar considerations, may have a justified interest in not being associated with the construction of works to a design which he considers unacceptable.
15. However, in a recent case, the Swiss Supreme Court awarded compensation to a tenderer who had performed extensive work for a proposal which then was taken by the employer and used for negotiating a contract with another firm: decision of 3 February 1993 in *Semaine Judiciaire* 1993 No. 22, pp. 341-347.
16. *The Need for and Features of the NEC*, The Institution of Civil Engineers, London, 1991, p. 8.
17. For guidance in this respect see IChemE Reimbursable, Guide Notes in particular Q, Z, CC, DD, EE; Schedule of cost components in NEC cost reimbursable and Guidance Notes, pp. 79-85; UNIDO-Contract, Cost Reimbursable version, Annexure XXVII.
18. See IChemE Reimbursable, Guide Note CC.
19. See in particular J J Goutsmit, "Frame Contracts and the Closing of the Eastern Scheldt" (1986) 3 ICLR 117 and Michael Leroy, "Le Contract-cadre", in *L'Entreprise et le Droit*, 1978, pp. 253-267.
20. *The Need, op. cit.* (above, note 16), p. 13.
21. See above, note 19.
22. See for instance the DOD/NASA *Incentive Contracting Guide*, 1969, the Armed Services Pricing Manual, various sections of the Federal Acquisition Regulations (FAR), and the ESA *Contracts Handbook*. The competitive design approach described in the following example from ESA's practice seems to be used also in the contracts which the British Government has just awarded to two rival groups for the development of a new battlefield radio system; see *Financial Times*, 20 August 1993.
23. See UNCITRAL: *Legal Guide on Drawing up International Contracts for the Construction of Industrial Works*, United Nations, 1988, Chapter XXVIII.
24. See, e.g., FIDIC Civil, Clauses 51 and 52.
25. FIDIC E & M, Clause 31; ENAA GC 39.

26. For example, the employer or the main contractor may specify the manufacturer, country of origin or dimensions, capacities and other characteristics of certain equipment and the contractor or the subcontractor, having to supply the equipment, may argue that the restrictions thus imposed on his choice increase his costs and that he should be compensated for the increase. In one case, the contract had specified three acceptable gradings of material for the sub-base of a road. The engineer issued an amended design, requiring that only grade A be used. This requirement restricted the choice of the contractor and was found to be a variation.

27. In the previously-mentioned example concerning the sub-base gradings, the quarry identified by the contractor had not sufficient material for grade A as required by the engineer. The contractor had to win this material from another quarry which was further away from the site. In this other quarry, he had to treat a much greater quantity of raw material to win grade A than would have been necessary for grade C material. He argued that the rate for sub-base material in the bill of quantities had to be adjusted to allow for the additional manpower and equipment required and for the additional transport costs.

28. In one case, for instance, the contractor was compensated for each variation by payment for the manpower and equipment used to carry out the variation. He claimed that the great number of variations ordered, in addition to being untimely, by their sheer number created delay and disruption to the work.

29. Clause 16.1.

30. See, e.g., the ENAA—Contract GC 10.2 and 10.3.

31. See, e.g., FIDIC E & M Clause 12.1 and ENAA—Contract GC 18.2.

32. See, e.g., ENAA—Contract GC 22.4.

33. For example, the main contractor in one case co-ordinated his work with other main contractors in regular meetings under the direction of the engineer. The adjustments agreed there affected the work of the subcontractor who claimed compensation for access difficulties resulting from interferences to which the main contractor had agreed in the co-ordination meetings.

34. If these contractors form part of a consortium or are retained as subcontractors, the same type of interface problems arise within these contractual relationships.

35. See in particular Christian Wiegand, "Allocation of the Soil Risk in Construction Contracts: A Legal Comparison" [1984] ICLR 282 and a series of papers on Subsurface Ground Conditions—Risks and Pitfalls for Project Participants, delivered in a Committee T presentation at the IBA/SBL 1989, Strasbourg Conference by Gregory U Hummel, Richard A Schadbolt and R Raj Singam published in the *International Business Lawyers*, 1990 (June), pp. 269–286 and by Glower W Jones, Donald Marston and Rudolf Meroni in [1990] ICLR 155–209.

36. Physical conditions sometimes are construed quite widely by contractors: in one case, a dredging contractor claimed for unexpected frequency of high waves and argued that the waves should be considered as a physical condition of the site since they were affected by the configuration of the sea bed.

37. In one case, the employer made available to the contractor a geological study on which the lump sum price for the civil works was based. When construction started, it was discovered that the study was based on information from another site. The actual site had a very different bearing capacity and required substantial additional work. In another case, the employer, after much of the design and procurement under a turn-key contract had been performed, substituted the original site for another which the contractor found unsuitable. The subsequent dispute led to the abandonment of the project.

38. This is the case in FIDIC Civil 12.2, FIDIC E & M 11.3, ENAA 9.2 and 35.1, EDF Works 21.1.

39. EDF Works 20.1.

40. See T H N Nicholson, "The New Engineering Contract", *The Civil Engineering Journal*, November 1992, pp. 146–148; after a trial period for some years with a consultation version, the NEC was published in its First Edition on 30 March 1993. It has been used already on a number of projects in the UK, in South Africa and Hong Kong.

41. P. 11 of the consultation version, p. 27 of the 1st edition.

42. Technical Committee on Contracting Practices of the Underground Technology Research Council: *Avoiding and Resolving Disputes During Construction, Successful Practices and Guidelines*, New York (American Society of Civil Engineers), 1991, p. 25.

43. *Ibid.* p. 27.

44. *Ibid.* p. 25.

45. *Ibid.* p. 29.

46. *Ibid.*

47. This is done for instance in the ENAA—Contract at GC 21.2.2. and 21.2.3.

48. In one case, the contract for a power-station specified the characteristics of the fuel which the employer guaranteed. However, from the available test results, also included in the contract, the contractor could see that the employer was likely to have difficulties in meeting some of the guaranteed characteristics. Since one of them was particularly critical for the design chosen by the contractor, the employer argued that the

contractor had an obligation to warn the employer and, having failed to do so, was at least partially responsible for the difficulties which arose when the fuel did not meet the guaranteed characteristics.

49. As an example, one may mention the case of a glass plant where the employer had to provide the glass and the cooling water. When the plant failed to produce the required quality of products, the contractor argued that the glass supplied was not sufficiently homogeneous and the cooling water too hard; the employer argued that the production process was defective and, irrespective of glass quality and cooling water, was unable to turn out the products of the required quality.

50. In the case of a galvanising plant, the electric current which the employer had to supply was irregular. When the performance tests failed, the contractor attributed the failure to the defective supply of the electric current.

51. *The Need*, *op. cit.* above (note 16), p. 13; *NEC Guidance Notes*, p. 14.

52. Unit rates are widely used also outside the UK and the USA; see for instance VOB, CCAG-Travaux, EDF.

53. In one case a dispute arose about the question whether the quantities of earthworks in a road construction was to be determined by measuring the volume of the void left in the excavation area after the removal of the material to be incorporated into the permanent works, as the contractor claimed, or by measuring the completed works. In the case considered, the difference in the two methods over the full length of the 80 km. motorway amounted to a claim in a substantial amount.

54. See the present author's article on International Construction Contracts in *Droit et Pratique du Commerce International*, 1983, p. 277 at 297 and Arbitration of Construction Disputes in ICLR, above note 6 at 318.

55. Institution of Civil Engineers, Guidance Note 2A: *Functions of the Engineer under the ICE Conditions of Contract*, London, 1977, § 2.2; see also FIDIC Civil Clause 2.6.

56. Howard Holtzmann, "Use of Impartial Technical Experts to Resolve Engineering and Other Technological Disputes before Arbitration," in *Commercial Arbitration, Essays in Memoriam Eugenio Minoli*, Turin, 1974, pp. 233-255.

57. See above note 6.

58. See above note 5.

59. In this respect, specialists differ in the "philosophy" to be applied in defining *force majeure*: by a list of events which can never be complete but risks to be construed exclusively or by a general formula.

60. Clause 65.5.

61. For example, disputes concerned the alleged relationship between the outbreak of war and costs resulting from longer or more expensive transport costs and resulting delays, shortages and price increases on the local market, shortage of manpower, disturbed communications. In one such claim, the contractor argued that, due to the war-related closure of a port in the country of the works, a foreign port, through which he had scheduled to ship his equipment, had to absorb all traffic and became congested. The contractor alleged that this required him to make shipments by land and claimed for higher costs as a "war damage".

62. NEC, *Schedule of Contract Data*, pp. 50-59. Clause 60.1 (13), and *Guidance Notes*, p. 59.

63. IChemE Reimbursable, Introduction, p. 4.

64. This is, for instance, the case in the NEC.

65. *Avoiding and Resolving Disputes*, *op. cit.* (see above note 43).

66. In one case, a pipe-laying contractor was delayed by inclement weather, flooding of the trenches, late permits and other events: nevertheless, he continued working to the original schedule and, with additional resources, completed the work in time. The employer had no use of the timely completion since the installations to which the pipeline was to be connected were late. He argued that the contractor should have adjusted the programme rather than the resources.

67. The ENAA-Contract contains such a requirement in GC 35.1.

68. See above section 1.4.

69. See, e.g., IChemE Reimbursable, Guide Note Q.

70. Clauses 16 and 60-63.

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