Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 53 (1986)

Artikel: Designer-contractor relationship
Autor: McLaughlin, Richard T.P. / Doran, David K.
DOI: https://doi.org/10.5169/seals-41120

Designer-Contractor Relationship

Relation entre projeteur et entrepreneur

Die Beziehung zwischen Konstrukteur und Unternehmer

Richard T.P. McLAUGHLIN
Group Techn. Dir.
G. Wimpey PLC.
London, UK

David K. DORAN
Consult. Civil
and Struct. Eng.
London, UK

SUMMARY

The Designer/Contractor relationship stems directly from the client's decision on how he organises arrangements to execute his project – from initial concept to final completion. The UK system permits of a wide range of method and some of these will be described in the paper. Differences exist between some of these methods and there is some overlap. Some observations are made concerning the liabilities of the various parties to these arrangements.

RÉSUMÉ

La relation projeteur/entrepreneur dépend directement de la décision du client concernant la réalisation de sa commande – de l'avant-projet à la mise en service –. Le système britannique autorise de nombreuses variantes d'organisation et certaines sont décrites dans cet article. Il y a des différences et des superpositions selon ces variantes. Quelques observations sont faites sur la responsabilité des diverses parties, en fonction des variantes appliquées.

ZUSAMMENFASSUNG

Die Beziehung zwischen den projektierenden und den ausführenden Unternehmen hängt direkt vom Entscheid des Bauherrn ab, wie er die Organisation für die Realisierung seines Bauvorhabens von der ersten Idee bis zur Abnahme festlegt. Das britische System erlaubt eine breite Palette von Möglichkeiten, wovon einige in diesem Beitrag beschrieben werden. Insbesondere werden die Unterschiede und Überlappungen der verschiedenen Organisationsformen und ihre Auswirkungen hinsichtlich der Verantwortlichkeit und der Haftung aufgezeigt.

1.SCOPE OF ARRANGEMENTS.

The spectrum of arrangement is very wide and ranges from project management to those more traditional methods in which a client appoints and perhaps co-ordinates a team of consultants and contractors. Some clearly identified arrangements are considered.

1.1.Project Management.

In this method the client will appoint a Project Manager either from his own organisation or (as inthe case study below) an external organisation to manage the whole project. At this stage the brief may be ill defined; if so the Project Manager will clarify and expand the brief in consultation with the client and other authorities. The professional discipline of the Project Manager may be engineering (Civil; Structural; Mechanical; Electrical; Chemical Petroleum etc.) or he may be an Architect; Builder; Quantity Surveyor or perhaps from a purely commercial background. For a major project he will require considerable personal qualities such as negotiating skills. Although personal qualities and experience are paramount it is more ideal if the background of the individual equates with the principal discipline of the job. Thus it may be appropriate for a mechanical engineer to head up a complex industrial plant contract.

In the UK there are a number of major organisations, some British, some of foreign origin who have Project Management capability including that of carrying out much of the multi-discipline design. Some of these organisations are essentially major contractors with skills in design, procurement as well as construction.

The Project Manager having adequately defined the brief,arranged topographical surveys, site investigation and obtained outline statutory approvals will then organise a task force of designers and support staff, usually in one office, to complete the conceptual design, then draw up contract details including tender documents. If the job is large he will break it down into convenient packages (geographic or groups of buildings) and seek competitive tenders. It is usual, although not exclusively so,that the organisation responsible for project management will not tender for the construction packages. This is to prevent a conflict of interest where the liabilities for construction non-performance on the package are of an order of magnitude higher than the potential returns on the project management service.

In schemes where project management assumes the widest responsibility,this may embrace project promotion, site investigation and acquisition, parliamentary procedures, financial assessment and funding, conceptual and detailed design, site engineering, tender preparation and bid evaluation, management of construction, quality assurance, commissioning, training of operational staff, and maintenance. Project management will usually be required to work within strictly defined cost, time, quality and safety parameters and will,by delegation, expect those who participate in all aspects of the project to submit to a similar discipline. An important role of project management will be to set up and operate control systems to meet these objectives.

This form of contract is used by some UK government agencies such as the Department of the Environment; it has the merit of keeping lines of communication short and responsibilities clearly defined. It is applied to a wide variety of work but frequently to energy and

process related work.

1.2. Turnkey.

This type of arrangement has all the design features of 1.1 above. It involves a most comprehensive treatment of a project. Whereas many methods will leave a client with a shell of a building the turnkey approach will usually include the fitting out, furnishing (including soft furnishings) and in some instances the provision (in the case of for example a hotel) bed and table linen, cutlery, crockery so that a client can start up his business at project handover.

Since the range of skills required is wide and also include construction it is normal for such contracts to be carried out by major contractors with strong technical back-up. It is not unusual for some skills to be brought in from external sources but these will be fully co-ordinated by the turnkey contractor.

Typical examples where this form has been used are hotels and hospitals.Contracts are usually negotiated, with the client perhaps seeking some commercial protection from an independent quantity surveyor. Initial appointment of contractor might be a somewhat lengthy business in which a client will interview a number of candidates for personnel, track record and require a written proposal which includes notional cost and detailed target dates for the execution of the work.

1.3.Design and Build.

This form of contract has been available in UK for many years; the author's organisation has provided this type of service since late 1940's. Alternative nomenclature includes 'Design & Construct' or 'Package Deal'.

The principal feature of this arrangement is the provision by a contractor of a single resource to a client for the completion of his project. In many instances a client will only have an approximate idea of his needs in which case this arrangement can work well in the negotiated mode. It is normal practice for the Design & Build Contractor (DBC) to appoint a co-ordinator to work closely with the client's representative to define the brief and then arrange conceptual and detailed design, procurement and construction The DBC would arrange all subcontract work but would usually carry out a high proportion of it himself.

If the brief is well defined then competitive tendering is possible with the DBC's carrying the tendering costs; only the sucessful team recovering these costs through the contract. On medium sized jobs it is normal to limit the tender lists to about three competitors. Most jobs using this form are relatively straight forward - Some examples being housing, light industrial plants/ warehousing; offices and multistorey car parks.

The design teams may be drawn from the DBC's own staff or they may be consultants employed by the DBC to carry out all or part of the design function. Either way the method represents a streamlined solution to getting a job done quickly, economically and efficiently.

Although not usual this form has been used for bridge contracts with conspicuous sucess. In the case of KESSOCK BRIDGE (1) a saving of 30% when compared with a traditional tender was achieved. Although market conditions differed at the times of the respective

tenders it was felt that a large measure of the price reduction was due to the design and build method. For a job in excess of £20M five competing teams were chosen to submit bids. The bid documents were so framed as to permit a wide variety of design. Designs involving both steel and concrete were prepared by British engineers supported in a number of cases by international specialists. Tendering costs were very high (Wimpey 150K) and only the successful could recover these. The job evoked much discussion calling for partial re-imbursement of these costs but no agreement was reached.

1.4. Management Contract.

This is sometimes referred to as a new form of contract although almost identical methods have been available for some years. In its simplest form the client will engage one organisation to carry out a complete project. That organisation will appoint a manager to directly interface with the client and downstream will employ subcontractors to carry out the site work. If the Management Contractor (MC) is a major organisation he may call on his in-house staff to carry out the design work or he may employ a team of consultants to do some or all of the work. These designers may produce both conceptual and detailed design or they may pass the detail work wholly or in part to the subcontractors.

As a variant the client may supervise the design team himself and limit the work of the MC to the selection and supervision of subcontractors.

Either way the MC will usually be responsible on site for Quality Assurance (QA); Common user services (cranes, working platforms etc) supervision and possibly design of Temporary Works; Safety policy and Construction program. He may have the authority to place orders with subcontractors or may make arrangements for the client to do this. The MC will not actually carry out physical work on site. He will be paid a fee for his pre-determined management services and in effect becomes an extension of the clients' organisation for the duration of the contract. The MC may have an adjustment clause built into his contract to reflect good or bad performance; his fee will be a percentage of the final contract sum adjusted to take account of agreed contract variations and his performance.

The case study quoted is the variant where the client co-ordinated both the professional design team and the MC. This form of contract is used for many fast track projects and covers such work as bank/ insurance offices; exhibition centres and leisure centres.

1.5. Conceptual Design (Consultant) Detail Design (Contractor).

In this form of arrangement a client's brief is taken by a consultant or team of consultants who produce a Conforming Conceptual design. This design will normally optimise a client's requirements in terms of area and volume of facility which may in fact lead to a layout differing from that origally envisaged. Drawings will be sufficiently detailed to indicate principal materials, foundation types, frame member sizes and schematics for services. The amount of detail provided will usually be sufficient for consultant or quantity surveyor to arrive at a budget price and prepare tender details for a competitive or negotiated bid. All basic, statutory outline approvals will be obtained from concept drawings.

The successful contractor will then be required to work up construction details and schedules from the concept. This he will do using

either his own staff or he may appoint consultants (perhaps even those who have prepared the conceptual scheme). It is normal for the concept consultants to approve or at least check the contractors details for compliance.

This method is not in common usage in UK although it has been employed on military contracts in the Middle East within the authors experience and also for marine and process plant work. The recent publication by the British Property Federation (BPF) of their Manual of the BPF System (2) has given the method new impetus. The manual sets out in great detail the duties of various members of the construction team under the following headings:-
-Concept.
-Preparing the Brief.
-Design Development.
-Tender Documents andTendering.
-Construction.

The interface between the last two points takes the job from the concept stage to that of detail design with the contractor being fully responsible for developing these details from the consultants concept. A strong case is made out for the client to appoint a representative with full powers of decision making so that approvals and delays are kept to a minimum.

1.6.Traditional Method.

Until World War 11 almost the only method available to a client was for him to appoint a series of consultants (architectural; civil/ structural; services; quantity surveyor) and brief them (and in many cases try to co-ordinate them) himself. Consultants would then produce the concept for approval after which tender documents would be drawn up by the QS and the job let either by negotiation or competitive tender. The task can be a difficult one for a client who can, as a variant appoint a lead consultant to co-ordinate the work and perhaps supervise construction. The sequential or end-on arrangement of tasks in the design and construct process tends to make this method somewhat inefficient by comparison with more streamlined arrangements now available.

Very many jobs have been carried out this way, some with great success others less so. Communication has often been a problem when teams of professionals are used that have offices distant from one another. Remoteness from one another and from the contractor often produce lack of buildability with attendant delays and cost over-runs. It must be emphasised however that this is not always true and there are many successful examples where consultants are either multidisciplinary or perhaps share the same suite of offices and work regularly with particular contractors. Lines of communication are then correspondingly shorter and work proceeds efficiently.

Some clients prefer this method because they feel protected by a fair measure of independence from the contractor; others are merely irritated by this di-chotomy, confused and frustrated by the range of individuals with which they have to deal. Virtually all types of work have been handled using this method of working; examples are so numerous that we have not provided a case history.

It is usual for consultants to work to somewhat differing forms of contract which reflect the views of an association representing their discipline. Thus most architects will work to the RIBA Conditions of Engagement(3); Consulting Engineers may work to those

Conditions drawn up by the Association of Consulting Engineers(4) and Quantity Surveyors to yet another set of conditions. The position is further complicated by the fact that not all the professionals are members of these Associations and may therefore seek to impose their own conditions on a bewildered client!

2.CASE STUDIES.

2.1.Project Management.

Project: Beatrice Field Development.
Location: Offshore-Beatrice Field N.Sea.
Onshore -Nigg Bay Cromarty. Scotland.
Contract Value: Offshore-Not Known.
Onshore -£30 Million.

2.1.1.Brief Description.

Design, procurement and construction of production platform, oil storage and marine handling facility for waxy crude oil from Beatrice Field.Following a rejection by Department of Energy of a proposal to load oil at sea, plans were drawn up for a submarine pipe line to pump oil ashore and thence by land based pipeline to storage facilities at Nigg. The case study concentrates on the onshore facility for which the author's firm was responsible.

2.1.2 Marine Facility.

Jetty, service area and 400m long approach trestle to provide mooring for tankers of 40,000-120,000dwt. Construction was in hollow tubular steel piles with precast reinforced concrete decking. Offshore construction techniques were used in the form of tubular steel jackets to provide horizontal bracing to the mooring/ berthing dolphins and to part of the jetty head structure.

2.1.3.Shorebased Facility.

Pre-loaded foundations and earth bund for 108m diameter, steel oil storage and 68m dia.ballast water tanks; pump and compressor house, twin 1.0 metre dia,insulated, trace heated pipe line. Steel framed buildings and concrete structures housed the complex control plant needed to regulate flow and viscosity of oil. Sophisticated fire fighting and pipe cleaning gear.

2.1.4. Project Team.

-Project Manager; Brown & Root. (Client appointed Project Manager for Storage & Marine Facility).
-Storage & Marine Facility.
-Architects & Engineers; Wimpey Group Services.
-Mechanical & Electrical Engineers; Wimpey ME & C.
-Site Investigation; Wimpey Laboratories.
-Main Contractor; Wimpey UK Construction (under Contract to George Wimpey International).

2.1.5 Design Audit Team.

-Marine Facility; Peter Frankael & Partners.
-Storage Facility; Halcrow & Partners.

2.1.6. Contractural Arrangements.

Under a general project management contract between client and Brown & Root, Wimpey carried out design and construction of the storage facility.

As design progressed teams of professionals who had previously worked in dispersed locations were brought together as an integrated task force in one office. Design was packaged into Onshore and Marine facilities and carried out within those packages by multi-disciplined teams.

The site is one of outstanding natural beauty and considerable effort was required to overcome local objectors. Negotiations took place with some eighteen different authorities before a successful outcome was achieved.

2.2. Turnkey Project - A Hospital.

Project: Royal Hospital of Oman.
Client: Omani Ministry of Health.
Completion Date: 1986.
Turnkey Contract Value: £160 Million.

2.2.1. Brief Description.

A 600 bed general hospital with wards, diagnostic and operating facilities. Also included 1160 residential units comprising 3/4 storey flats and 2 storey houses, a Mosque and recreational facilities. Under the terms of the contract Wimpey were responsible for design, construction, provision of all equipment including soft furnishing.

The hospital buildings are RC framed structures based on a 7.2m grid with 4.5m storey heights to allow for services. Floors are designed as wide beams with troughed slabs with an overall depth of 425mm. Ward blocks are 3 storeys high with roof top plant rooms; diagnostic blocks are 2 storeys high.

Extensive use was made of computer aided draughting for both architectural and structural drawings. The number of drawings so produced was approx. 5000.

2.2.2. Project Team.

-Architects. Percy Thomas Partnership.
-Structural Engineers: Wimpey Group Services.
-Services: Donald Smith Seymore & Rooley.
-Site Investigation; Wimpey Laboratories.
-Turnkey Contractor: George Wimpey International.

2.2.3. Contract Arrangements.

The architect who had previously made a feasibility study was then absorbed into the professional team by GWI Ltd. who became the principal link with the client. (The job was run concurrently with an £8 million extension to the existing Khoula hospital).

2.3. Design and Build.

Project: Computer Centre.
Client: Lloyds Bank PLC.
Location: Peterborough England.
Completion Date: 1985.
Contract Value: £5.7 Million.

2.3.1. Brief Description.

A 2 storey computer centre 54m X 48m together with a 2 storey electrical support building 44.5m X 12.5m. Buildings of steel frame construction supported on mass concrete footings founded in stiff

clay; floors of precast reinforced concrete. Cladding to both walls and roof was profiled metal sheeting. Platform floors at 1st. and 2nd. level provided easy access to services. For a fast construction program maximum use was made of dry construction and off site fabrication. Site investigation included tracing magnetic fields as a safeguard against computer malfunction.

2.3.2. Project Team.

-Design & Build Contractor: Wimpey Construction UK.
-Consultant Architect: Lloyds In-House Architect.
-Architects & Engineers: Wimpey Group Services.
-Services: Haden Young.
-Site Investigation: Wimpey Laboratories.

2.3.3. Contract Arrangements.

The job was in competition with two others. Most of the design carried out by DBC in-house staff; one exception was for services which were by a specialist subcontractor. The brief for the building was drawn upby client's in-house architect who also employed an independent QS to assist with initial interviews with tenderers,bid evaluation and contract valuations. The job had the advantage of a fully co-ordinated design and construction team who produced a design which was simple and easy to build.

2.4. Management Contract.

Project: A Bank.
Client: Hong Kong Shanghai Banking Corporation.
Location: 1 Queens Road Central Hong Kong.
Completion Date: 1985
Contract Value: £500 Million.

2.4.1. Brief Description.

Building comprises a 47 storey steel framed superstructure 180m high; a 4 storey basement up to 20m deep. Total floor area 100,000 sq.metres which is the maximum plot ratio allowed by planning regulations. Against the possibility of a relaxation the design allows for a 30% increase in floor area by vertical extension. Plan dimensions are 54m X 70m and two rows of four steel masts provide the main vertical structure. Each mast is composed of four tubular steel columns interconnected at floor levels by haunched rectangular beams.Concrete floors are composite with steel profiled sheeting. Foundations to each mast are groups of four concrete caissons of up to 3.5m shaft diameter with bell-outs into granite bedrock.

Although maximum use was made of modular prefabrication virtually every element was specially designed and fabricated.

2.4.2. Project Team.

-Management Contractor: John Lok / Wimpey. Joint Venture.
-Architects: Foster Associates.
-Civil & Structural Engineers: Ove Arup & Partners.
-Services Engineers: J.Roger Preston.
-Quantity Surveyors: Levett & Bailey With Northcott Neighbour & Nicholson.

2.4.3. Contract Arrangements.

The contract was set up so that both the Management Contractor and the Design Team reported to the client. Prior to the award of contract the design team had won a competition the brief for which

was'to design the best bank building in the world'. Whilst the contract achieved its objective the chosen method put considerable strains on the client organisation which might have been avoided if the MC had been given overall responsibility including the management of detailed design. As it was the MC was responsible for the control of all subcontract packages and for the satisfactory completion of the job, budgetary control, quality, time and safety restraints.

2.5. Conceptual Design.

Project: Potash Loading Facility.
Client: Jordan Ministry of Transport.
Location: Aqaba. Jordan.
Completion Date:1982.
Contract Value:

2.5.1. Brief Description.

Plant to receive, store and handle 1.2m tonnes of potash/ annum. Facility to weigh and receive potash from trucks via an intake structure and to store 150,000 tonnes in sheds allowing for subsequent retrieval and routing to an existing jetty. Contract for civil works comprised all construction below ground plus roads and buildings for controls, administration, canteen, first aid, ablutions substations and workshop. All work designed to UK standards together with minimal adjustments for low seismic risk.

2.5.2. Project Team.

-Main Contractor: Pohling Heckel & Bleichert.(FDR)
-Civils Sub Contractor. George Wimpey International.(UK)
-Civil Consultant: Parsons Brown & Newton.(UK)
-Mechanical/Electrical Consultant: Rendell Palmer & Tritton.(UK)
-Detailed Civils Design: Wimpey Group Services.

2.5.3. Contract Arrangements.

Different consultants were employed by Jordanian government for the civil work and the mechanical/electrical work. The main contractor employed a subcontractor for the civil construction who in turn used his in-house designers for detailed design. Their brief was the conceptual design produced by the consultants. The in-house designers had to work within laid down restraints such as structural materials and scantlings and then submit details and calculations to the consultants for approval. In 95% of cases the original profiles were satisfactory. In the main the procedure worked well but there were delays in approvals which exceeded contractural targets.

3. LIABILITY.

The following appears in the proceedings to a recent IABSE British Group Colloquium on Liability. (5).

"There are three things which seem particularly noteworthy. Firstly the Danes seem to have found solutions to the problems worrying the rest of us. Secondly each profession seeks solutions lying in the other's domain. Thirdly a lack of understanding by those outside the industry of what goes on in it, what is possible. The tolerance shown to barristers who must lose on average half their cases or to doctors who must in the end lose all their patients is not extended to designers and builders. 'fools build houses for wise men to live

in' used to refer to those who commissioned houses as fools, if it is used at all nowadays it is probably the contractors who are being refered to."

Liability in our industry has been defined by an engineer/lawyer as follows:-

"Liability arises when, usually upon the happening of some event, one person becomes obliged to compensate another for some loss or damage".

Construction liability is already a minefield in the USA and is rapidly becoming so in the UK where the cost of the identification of a culprit and apportionment of blame may considerably exceed that of repair. The law in UK is thought to be particularly onerous in two respects:-

-Period of limitation- once almost indefinite now to be limited to 15 years from defendants breach of duty. (Only 5 years from handover in Denmark.)

-Knock-on'effect or liability by association.

Sandberg (and we paraphrase) has defined 'knock-on' as follows:- "When a structure is found to be defective the owner or whoever may be financially involved is likely to sue all parties concerned. This may include the architect; engineers; main contractor; subcontractors and supervising authority. The law will apportion liability in the light of evidence. When any of the parties cannot meet their portion of the liability (eg. liquidation) the liability for such non-available sums passes to the surviving defendants to the extent that perhaps one party becomes responsible for a 100% payout".

In Denmark there is no such thing as 'knock-on'. France has better systems of project insurance so that fights between insurance companies are less prevalent whilst in Japan such litigation is in its infancy.

In housebuilding however there is a better system in UK where under the National House Building Council (NHBC) properties being built by registered builders are covered for 10 years by a structural defects policy. Poor performance can lead to a builder being struck off the NHBC register.

It is the author's experience that less litigation takes place in contracts organised in a comprehensive way such as Design & Build than in traditionally structured jobs. There may be many reasons for this but the most significant are likely to be :-

-Better understanding and communication between the participants to the contract.

-A smaller number of insurance companies involved (often only one) thus reducing the probability of disputes between insurers.

4. ACKNOWLEDGEMENTS.

The authors have drawn freely on their experience and thank their colleagues for assistance in preparation of the paper. They also thank Wimpey for permission to publish information contained in the paper.

5. REFERENCES.

(1)Kessock Bridge: ICE Papers 8742-8745.1984 Proc.Vol.76.
(2)British Property Federation: Manual of BFP Systems 1983.
(3) RIBA Conditions of Engagement.
(4) Association of Consulting Engineers: Conditions of Engagement 1984.
(5) IABSE British Group. Colloquium on Liability. Cambridge 1984.