

Design Risk in Construction Contracts: The FIDIC Contracts and Civil law perspective

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Abstract: Design Risk-sharing is a crucial element in the construction project contract. The Design responsibility is associated with liability for the errors, omissions, and deficiencies. The duration of the design liability varies from a short term of the project duration, the defect notification period, and up to the decennial liability for ten years starting from the Taking over of the work. Various design issues arise in the contract execution phase, requiring a consistent contract document to manage the design issues. It is not uncommon that significant numbers of construction claims and disputed projects are due to design issues .

This paper discusses the design risk in construction projects from the perspective of the FIDIC suite of Contracts and civil law. The paper provides a comprehensive overview of the aspects and risks inherent with the design risk and the proper risk-sharing approach.

The author provides a Design Risk Management Matrix that guides the practitioners during the contract drafting process to consider the criticality of the design risk-sharing requirements.

Keywords: Design Risk-sharing, crucial element, construction project.

1. INTRODUCTION

The design risk is the prospective for a design to fail to satisfy the project/facility requirements.

The subject of design risk in the construction industry includes various aspects and areas of study. The design risk may be generally classified under two types, including the following:

- a) The design deficiencies that result in the design deliverables fail to comply with the related facility requirement stated by the statutes, safety, environmental requirements, the applicable standards, and the law. The work done in this case may need to be rectified, and as it is common practice in the projects, such rework causes cost overrun and delays to the project date of completion.
- b) Design deficiencies produce a project that fails to fulfill and comply with requirements of the project's intended purpose. It may fall behind the contractual requirements or similar service standards, or it may need additional costs to operate and maintain the facility than the planned cost. These designs include flawed, inefficient, unsafe, and infeasible designs.

2. DESIGN OBLIGATIONS UNDER THE CONTRACT

Deferent standard forms of contracts allocate the design responsibility explicitly in the contract conditions.

2.1 Design obligation in the FIDIC Red Book 2017

The FIDIC forms of contracts take into account the allocation of the responsibility of Design Risk. It is notable the principles of balanced risk-sharing between the Employer and the contractor in projects in which the Employer designs the work. The design is developed by the Employer's personnel or a design company under a contract signed between the Employer and the design company. However, the developed design may lack some parts or facilities. The Employer may complete the remaining design during the construction phase. The works under a contract adopting FIDIC Red Book may include those deferred parts of the design to be developed by the potential contractor, including civil, mechanical, electrical, and/or construction works. The construction contractor will then be responsible for developing the deferred elements and held responsible for his design. Example of those deferred elements includes selected specialized designs like an Olympic swimming pool or Waste Water Treatment Plan in a construction mega-project as the specialized vendors and manufacturers acquire the privilege in such design .

Without prejudice to obligations under the laws, the responsibility of the design is considered to be on the contractor for the part on him. In contrast, the responsibility for the Employer developed design remains under the Employer.

The practice in the dispute resolution mechanisms, Arbitration, or Litigation is not as simple as the narrative mentioned above. Several "what about" and "what ifs" arise in such valid disputes. Some clarifications are provided in the following sections for Each Form of contract.

2.2 Design obligation in the FIDIC Yellow Book 2017

The Yellow Book or the FIDIC® Conditions of Contract for Plant and Design-Build for Electrical & Mechanical Plant, and For Building and Engineering Works, Designed By the Contractor Second Edition 2017.

It is one of the principles of balanced risk-sharing between the contract parties in projects when the Employer requests the contractor to carry out the project design and to build the works and may provide plant, in accordance with the Employer's Requirements, including any combination of civil, mechanical, electrical, plumbing (MEP) and construction works.

The common practice in this design and build contract is that the contractor is responsible for the design and all related deliverables to satisfy the purpose of building the project or facility. The design risk is deemed transferred to the contractor entirely while the Employer's is requested to provide the documents, including the Employer's Requirements and the concept design as applicable. We identify the parties' risk-sharing and responsibilities allocation in these two documents.

The dispute resolution body, either an Arbitration panel or the court, relies on the signed contract and the documents forming the contract to allocate the design risk as construed from the contract.

The parties' design risk responsibility in the design-build contract may be shared proportionally in a percentage varying from (0%) to (100%) depending on the contract documents' inclusion.

In Executing the contract Conditions for Plant and Design-Build 2017 (Yellow Book), the contractor begins with a comprehensive review of the Employer's Requirements and the Concept/pre-concept design. Such concept design would be binding to establish the feasibility of the project.

In the tendering stage, the tenderers shall base their proposal on the concept design if it is considered a requirement in the contract, while the tenderers have been allowed to provide alternatives if the concept design is merely an idea or a proposal by the Employer.

The criticality of the Employer's Requirements in the design and builds contracts and its effect on the risk-sharing strategy is the subject of fertile claims and has caused a significant number of disputed projects. Prudent Employers are liable for providing clear and consistent documents in the tendering stage.

The Employer's Requirements should only comprehend a reference design with schematic drawings. Therefore, the Employer needs to identify the input necessary for the contractor to perform his design obligations maintaining the project's requirements.

The Employer's Requirements should only comprehend a reference design with schematic drawings. Therefore, the Employer needs to identify the input necessary for the contractor to perform his design obligations while maintaining the project's requirements. This will define the boundaries between the Employer's and the contractor's design liabilities and ensure that design responsibility is not transferred back from the contractor to the Employer.

The Employer's Requirement may include the project information and documents, which vary from the high-level information to a detailed project document where the risk is gradually transferred back to the Employer. The Yellow Book or the FIDIC® Conditions of Contract Sub-Clause 1.1.33 of the General Condition of the Contract defines the "Employer's Requirements" as:

"It means the document entitled Employer's Requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document describes the purpose(s) for which the Works are intended, and specifies Key Personnel (if any), the scope, and/or design and/or other performance, technical and evaluation criteria, for the Works." They are also referred to as Performance Specifications (United States).

The disputes that may arise related to the design risk-sharing in this type of contract are discussed in this paper's successor sections.

2.3 Design obligation in the FIDIC Silver Book 2017 (EPC)

Under this type of Contract "Engineering Procurement and Construction" (EPC), the EPC Contractor is responsible for scrutinizing the Employer's Requirements (as stated under Sub-Clause 5.1 [General Design Obligations] of the General Conditions of Contract. "The Contractor shall be deemed to have scrutinized, prior to the Base Date, the Employer's Requirements (including design criteria and calculations, if any)."

The EPC Contractor is responsible for designing the Works under the Employer's Requirements and shall be responsible for reviewing these Requirements and for any errors and omissions that may exist in the Employer's Requirements.

The FIDIC recommends that if there is insufficient time or information for tenderers to scrutinize and check the Employer's Requirements or carry out their designs to be fit for purpose, this type of Contract would be not preferred.

In the EPC Contract it is deemed to be a vehicle of complete design risk transfer from the Employer to the EPC contractor, including errors in the information may be provided by the Employer, such as the data provided by the Employer under Sub-Clause 2.5 [Site Data and Items of Reference] of the General Conditions of Contract.

It is common practice to include fitness for purpose clause in the Particular Conditions of the Contract to ensure the Contractor's design responsibilities.

The fit for purpose clause may be as follows"

[When completed, the Works shall be fit for the purposes for which the Works are intended as defined in the Contract].

Or we can tailor as per FIDIC Silver Book 2017 (EPC) Sub-Clause 4.1-e of the General Conditions of Contract:

(e) the Contractor shall be responsible for this part, and it shall, when the Works are completed, be fit for such purpose(s) for which the part is intended as are specified in the Contract (or, where no purpose(s) are so defined and described, fit for their ordinary purpose(s);

Fitness for purpose obligation is to enforce a duty of result. Consequently, a commitment that the works, service, or design will be fit for the intended purpose holds the committed (EPC Contractor) to that obligation. A question like why the works or design does not meet its intended purpose is common but does not support the obligor.

Such Clause is more obligations on the design and build contractor where the obligations are beyond the standard obligation to exercise reasonable skill and care in the carrying out of the design.

It is always recommended to seek legal advice to maintain such clause enforceability in addition to the limitation of liability under the Contract.

The Administration process of the EPC Contract is dependent on the Employer's Requirements consistency, either for the design process or for the review and acceptance of the project deliverables, which are intended to be fit for purpose.

3. DESIGN RISK MANAGEMENT UNDER THE CONTRACT.

The Contract parties agree to the form of Contract that allocates the design risks in the accepted risk-sharing strategy, while every party shall accept the design risk as allocated in the signed contract documents. Different levels of risk-sharing and the obligations put on the party are demonstrated in the following sections.

3.1 Design Risk management under the FIDIC Red Book 2017

Under Sub-Clause of the 1.2 [Interpretation] paragraph (j) General Condition of the Contract “*execute the Works*” or “*execution of the Works*” means the construction and completion of the Works and the remedying of any defects (and shall be deemed to include design to the extent, if any, specified in the Contract.

If the Contract specifies that the Contractor shall design any part of the Permanent Works, *then unless otherwise stated in the Particular Conditions:*

- (a) The Contractor shall submit to the Engineer the Contractor’s Documents for this part in accordance with the procedures specified in the Contract;
- (b) These Documents shall be in accordance with the Specification and Drawings,....

In such a traditional Contract strategy, the design risk is shared as follows:

- i. The project Design is prepared by the Employer probably through a design consultant; therefor, the Contractor shall proceed with the work under the provided design.

The contractor shall maintain his obligation to apply the due reasonable practice and care in the bidding and execution phases. The reasonableness here is the challenge as it requires an interpretation for every case as the projects are not atypical.

If the contract includes some elements to be designed by the contractor, these element/s shall be under the Contractor complete responsibility.

As decided in different court cases and Arbitration awards the reasonable practice and care are as follows:

i.1 Bidding stage

The Contractor shall check in reasonable time and cost the design provided in the bid documents by the Employer. The check means the contractor has to raise his concerns on the design like omissions, apparent errors, and inapplicability, which can be easily found while applying his checks. An example of a structure design check is applying a quick review (probably visual) by an experienced structural engineer with 20 years of experience in the same structural systems. The checker may raise concerns as a request for clarification to be replied to by the Employer in the pretender conference. The level of these concerns may include examples of:

- Under our responsibility to apply a quick check of the bid document, we found that the 40-story building did not include a shear wall or concrete shafts. Or;
- We noticed that the reinforcement of some square concrete structure columns includes three (03) vertical bars on the corners while the fourth corner is empty.

i.2 Execution stage

The contractor shall notify the Employer officially of any errors and omissions in the design he may find during the execution stage. The contractor is not obliged to apply for a design review or prepare a model for the hydraulic flaw or electrical design and or the structural stability of the building.

The Employer may elect to instruct the Contractor to:

- Prepare a proposal for the necessary rectification at the Employers cost, and accordingly, the contractor shall submit his proposal.

- The Employer may instruct the contractor to continue with the contractual design as received in the Contract documents. At this stage, the prudent contractor needs to reconfirm the issue with the Employer and identify all consequences of proceeding with the faulty Design. He considers it will be at the Employer's cost and risk
- Consequently the Contractor released the responsibility to the Employer and may be innocent/inculpable should any negative consequences occur.

I.2.1 Effect of the Employer's Maturity Level

The Court takes into consideration the Employers maturity level while making its decision as the mature Employer is considered to have the knowledge and experience to advise the contractor in such critical and safety decisions; here, we have two cases:

- The first case is when the Employer is considered to have the necessary experience in such projects, like the Employer's utilizing an Engineering company or the Employer may be employing a technical department under the Employer's organization, and they carry out such projects regularly. In this case the courts held Employer responsible for the design errors and omission risks.
- The second case is when the Employer is an entity that does not carry out such projects regularly. The court may proportion the responsibilities between the Contractor and the Employer due to the Employer's lack of experience.

If the Contract language includes that the contractor shall review the Design and the Design will be considered prepared by the contractor. Then the Employer accepts the cost of a complete design for the project. The contractor will be responsible for the design, and the court will hold the contractor responsible for any errors and omissions.

The Employer acknowledges that the original designer may insert the condition "Prior commencement of executing this project, the contractor shall review the design at the contractor cost and risk and the design will be considered prepared by the contractor. The Employer, in this case, pays for the design in two payments, firstly for the original design, secondly for the contractor, either in an explicit item or implied in the Contract Price.

3.2 Design Risk management under the FIDIC Yellow Book 2017

The Employer selects this type of contract when he desires not to accept the risk of design and transfer such risk to a competent Contractor/Design-Builder to avail from the contractor's similar experience. In this type of contract, the Employer assigns a Contractor/Design-Builder to carry out the project's design and construction .

The Contractor/Design Builder will utilize a preliminary input from the Employer to proceed with the design. The inputs may include but are not limited to:

- i. A concept design (may jut guidance design) as a part of the Employer's Requirements. (as defined under the FIDIC General Conditions of Contract).
- ii. Specifications guidance only
- iii. Applicable statutes and Regulations.

The Employer may provide a concept design or a pre-concept design either by his direct resources or through a design consultant and this concept design will be part of the Employer's Requirements. These Employer's Requirements are included in the bid documents and will form part of the contract with the awarded contractor.

The Employer's Requirements need to be the road map and the guide for the contractor to carry out the design and construction of the project, though it shall have the following features:

- i. Clear to enable the bidders to prepare the proposals.
- ii. Consistent and have no discrepancy in its sections
- iii. Complies with the Codes and Standards
- iv. Drafted in a summary level to allow for the Contractor's initiatives
- v. Accepts alternative solutions and proposals

- vi. Provide the base of the design, which should have been the base in the bidding stage.
- vii. The Employer's Requirements should avoid the approach of preparing additional proposals that may require marketing, economic studies which are not intended in the Contract with a Design-Builder and shall be completed and decided by the Employer in the early stage of the project initiation.

In the Design and Build FIDIC form of Contract, 2017, the question arises when analyzing the design liability, whether the obligations are to deliver under the Fit for Purpose rule or merely a reasonable care by the contractor?

These two types of obligations should be identified in the contract. Identifying the two different obligations may cause many complicated situations for the contract parties and the Engineer.

The contract shall explicitly demonstrate if it is intended to accomplish a result through the potential design, which is the interpretation of the 'fitness for purpose obligation. The contractor will be in breach if he fails to comply with the 'fitness for purpose obligation.

In the case of undefined results where the contract language can be understood that the design criteria and requirements are explicitly stated along with the Employer's Requirements, it can be the case of calling for reasonable duty of care and standard practice. The obligation is limited to providing a design under the level of similar work/services intended in the contract documents.

Sub-Clause 4.1 [*Contractor's General Obligations*] of the FIDIC Yellow Book requires the Contractor to deliver the work under fitness for purpose obligation:

'The Contractor shall execute the Works in accordance with the Contract. When completed, the Works (or Section or Part or major item of Plant, if any) shall be fit for the purpose(s) for which they are intended as defined and described in the Employer's Requirements.'

The contractor is considered in breach under Sub-Clause 4.1 if any part of the Works is not fit for the purposes which are defined in the Employer's Requirements document.

In a UK case related to a project for Offshore Wind Projects under the 'Fitness for Purpose' conflicting obligations, the parties signed a contract for the design, fabrication, and installation of the foundations for 60 wind turbine generators. The contract design obligation called for compliance with J101 for the international standard design of offshore wind turbines. The contractor's design was deficient, although it complied with the J10. The investigation showed that the J101 contained an error that the contractor was unaware of.

The contract included fit for purpose clause. Although the actor could prove that he demonstrated the due care and professional practice for similar work and produced the design under the Employer's Requirements and international standards J101, the contractor was held liable for the deficient foundations.

3.3 Design Risk in the FIDIC Silver Book 2017 (EPC)

In the EPC contracts, it is critical to deliver the project that complies with its intended deliverables and performance under the contract and maintain Fit for Purpose principles.

Clause 17 [Care of the Works and Indemnities] includes that the contractor remains responsible for any loss or damage to the Works until taking over except for damage caused by risks under the Employer's responsibility.

Pursuant to Sub-Clause 17.2 [Liability for Care of the Works] "*The Contractor shall be liable for any loss or damage caused by the Contractor to the Works, Goods or Contractor's Documents after the issue of a Taking-Over Certificate. The Contractor shall also be liable for any loss or damage, which occurs after the issue of a Taking-Over Certificate and which arose from an event which occurred before the issue of this Taking-Over Certificate, for which the Contractor was liable*".

The contractor's document includes the project design, which is under the EPC contractor's responsibility, and by virtue, it should retain the principles of the Fit for Purpose. A prudent EPC contractor usually shares the design risk inherent in interpreting of the Fit for Purpose obligations through an insurance policy.

The issue of Fit for Purpose was considered in the Greaves case ('Greaves & Co (Contractors) Lts v Baynham Meikle and Partners'.)

Lord Denning stated: '... now, as between the building owners and the contractors, it is plain that the owners made known to the contractors the *purpose for which the building was required*, to show that they relied on the contractors' skill and judgment. And Lord Denning adds that it was, therefore, the duty of the contractors to see that the finished work was reasonably fit for the purpose for which they knew it was required. It was not merely an obligation to use reasonable care. The contractors were obliged to ensure that the finished work was reasonably fit for the purpose.

3.3.1 Fitness for Purpose and Insurance

Pursuant to Sub-Clause 19.2.3 [Liability for breach of professional duty], the [contractor is requested that "To the extent, if any, that the Contractor is responsible for the design of part of the Permanent Works under Sub-Clause 4.1 [Contractor's General Obligations], and/or any other design under the Contract, and consistent with the indemnities specified in Clause 17 [Care of the Works and Indemnities]" and under paragraph (b) "*if stated in the Contract Data, such professional indemnity insurance shall also indemnify the Contractor against liability arising out of any act, error or omission by the Contractor in carrying out the Contractor's design obligations under the Contract that results in the Works (or Section or Part or major item of Plant, if any), when completed, not being fit for the purpose(s) for which they are intended under Sub-Clause 4.1 [Contractor's General Obligations].*"

The Author has been involved in several construction claims and disputes under the EPC contract. It may be a valuable recommendation to ensure that the contractor shall enter into a specific insurance policy that incorporates the requirement in the contract data to transfer the design risk to the insurance company. The Employer should acknowledge that it is complicated to prove that the contractor has fallen into a negligence situation due to the contractor's action or inaction i.e., has committed professional negligence. On the contrary, the Employer finds the approach and evidence to demonstrate that the contractor's deliverables do not comply with the Fit for Purpose requirements. The Employer has the entitlement to seek any reimbursement for a loss or damages due to the contractor's defaults under a Tort claim. It is always not unattainable for the Employer to recover its losses that fall under an uninsured claim under the Tort liability either in the common law or civil law jurisdiction.

3.4 Design Risk under the United Arab Emirates Law

The UAE law does not include implied terms that enforce an obligation on the contractor in *muqawala* contracts to carry out its obligation with reasonable skill and care.

Article 383(1) of the UAE Civil Code provides the following:

'If that which is required of an obligor is the preservation of a thing, or the management thereof, or the exercise of care in the performance of his obligation, he shall have discharged that obligation if, in the performance thereof, he exercises all such care as the reasonable man would exercise, notwithstanding that the intended object is not achieved, unless there is an agreement or a provision of law to the contrary.'

Consequently, as stated above in the UAE law, when the work is executed with reasonable skill and care, we may consider that the contractor may have fulfilled his obligations under the contract and the law. The law does not consider the results of the contractor's performance but considers the reasonable skill and care exerted, despite the possibility that the project's intended purpose was not realized. The Employer may negotiate with the potential contractor to impose a strict fitness-for-purpose obligation within the agreement.

The UAE courts have decided in different cases that, although the contract may be silent as to the Engineer's/consultant's/contract administrator's obligation to perform the services, it is considered an obligation to achieve a result and preserved by way of fitness for purpose obligation.

Regarding the decennial liability in the UAE Civil Codes, Article 880 of the provides that the Contractor and Consultant ".....they shall be jointly liable for a period of ten years to make compensation to the Employer for any total or partial collapse of the building they have constructed or installation they have erected, and for any defect which threatens the stability or safety of the building, unless the contract specifies a longer period. The above shall apply unless the parties intend that such installations should remain in place for a period of less than ten years." This applies if the building suffers (a) total, or (b) partial collapse, or (c) there is a defect that threatens the stability and safety of the building.

4. DESIGN RISK MATRIX

The author has summarized the cumulative experience in contract administration and several disputes resolution cases, which can guide the practitioners to the critical aspects that should be considered while drafting the construction contract sections related to the design risk-sharing process. The management of the critical design-risk aspects may be processed under the following matrix guidance in table 1:

Table 1: Design Risk Management Matrix

Contract /Law	Design Risk Responsibility	Drafting not in the particular conditions	Remarks
FIDIC RED Book 2017	The Employer's Responsibility	The Parties shall not add any obligation on the Contractor such as in-depth review and verification of the design.	The Employer may request the Contractor to provide a design for part of the work.
FIDIC Yellow Book 2017	The Design & Build Contractor's Responsibility	Construction claims/ disputes mitigation depends on the consistency of the Employer's Requirements and the Engineer's review process.	The Employer should keep the Requirements at the high level information and illustrative drawings to avoid retransferring the design risk back to the Employer.
FIDIC Silver Book 2017	The EPC Contractor's Responsibility	The Employer should provide clear and definitive requirements with high level information. The Employer Confirmation of the fit for purpose principles are a must regardless any deficiencies in the Employer's Requirement.	The Professional indemnity insurance requirements is a concern in the FIDIC form, the Employer may request to include the risk inherent under the fit for purpose obligation.
Civil Law	The Contract language to satisfy the law and Article 383 applies for the Contractor's performance to be under the reasonable duty of care.	The Contract conditions shall identify the level of responsibility on the Contractor/consultant, either to be inclusive up to the fit for purpose or to be limited to the reasonable duty of care.	Disputes are complicated of how to prove that the contractor has provided the reasonable duty of care.

5. CONCLUSION

Design risks are pertinent to construction projects. The contract parties share the design risk under the contract conditions. The FIDIC suite of contracts provides different approaches and levels of design risk allocation. This paper analyzed the design obligation and risks under the FIDIC Red, Yellow, and Silver form of contracts. Under the contract and the law,

the contractor's design obligations were addressed and analyzed to provide the required mechanism to ensure successful project delivery under consistent contract conditions that enable the designer and the design reviewer to work under a stipulated process. Prudent contract parties identify the responsibilities associated with the design requirements under a consistent Employer's Requirements. The Employer's requirements' quality is the Employer's responsibility, and it should only include a reference design with high level design, illustrative drawings. The Employer should identify the input necessary for the contractor to perform his design duties that satisfy the project needs. The Employer's Requirements also delineate the sharing limitations between the Employer's and the contractor's and ensure the level of information details provided by the Employer that we not cause the retransferring of the design risk back to the Employer. The paper also discussed the importance of the design responsibility level shouldered by the contractor. The responsibility level may be to perform under the reasonable duty of care or to ensure the project is delivered and fit for the intended purpose.

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