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From

President's Desk

Contracting is a prevalent practice since time immemorial in different industries, sectors and jobs without having to maintain a construction team on a permanent basis. Not only does this build up a variety of experiences, it is also ideal for those who enjoy venturing with fresh projects and challenges.

Construction contract management is an increasingly common practice worldwide where a contract is in place to maintain the relationship of the parties throughout a project. It aids in communicating the negotiated agreements between project stakeholders and ensures each gets the desired outcome.

The primary goal of contract management is to efficiently manage contractual processes and obligations. This way, one can bargain and conclude the deals quickly while ensuring to achieve the desired end results.

Through contract, the contractor controls the cost involved in the contract for labor, material, other fixed expenses, etc. Through contract, it is also easier to maintain control over the defects arising out of quality deficiency.

Through Contract Management we aim to ensure timely completion of a project by adhering to the agreed specifications. Variations in the quality, quantity and other parameters, closing of contract in an orderly manner along with claims and disputes, if any, are also controlled through Contract.

There are various types of Construction Contract prevalent in the construction industry. However, keeping in view the present scenario of EPC construction contracts where major thrust is to allow the contractor to adopt his own technology for meeting the Employer's Requirement for the Project, the Papers on 'EPC Contracts in Building Industry' have been invited from the experts having experience in the area of handling of contracts.

I hope the eight papers submitted by the expert authors in this publication will be immensely useful to the stakeholders in the construction industry.

(Vijay Singh Verma)

IBC Journal - June 2023

FOCUS ON

EPC CONTRACTS IN BUILDING INDUSTRY

Contents

From

Editor-in-Chief's Desk

The construction sector heavily depends upon contracting system in which many stakeholders are involved like employers or owners, contractors, sub-contractors, professional consultants, vendors and workers. A wide range of activities are covered in construction contracts like planning, designing, engineering, management, execution, supervision, and Operation & Maintenance, independent of the type of project to be delivered at the end.

Contracts have always been important in construction projects as they lay down the obligations, rights and responsibilities of the parties entering into the contract as contract is an agreement between parties, creating mutual obligations that are enforceable by law. Setting out the reciprocal obligations, rights and responsibilities of both the parties in the complex chain for construction of a project is absolutely essential to avoid any confusion throughout the process and clear routes to resolve any potential dispute. Therefore, a contract document has to fulfil these conditions and has to be prepared accordingly.

There is a wide range of legal structures and standard forms available to construction businesses. Choosing the most appropriate structure and format to the size and characteristics of a project, and managing it efficiently is the key to the success of the project. Each structure allocates activities, remuneration and risks to the parties in a construction contract differently so the parties have to understand very well before entering into the contract. The most important aspects of a construction contract and from where most of disputes arise are:

- The definition of the scope, i.e. what exactly has to be done, and what happens if the changes are required or desired during progress of work;
- When the work has to be concluded: what happens if it is concluded before time, on time or delayed;
- When payments are due but not paid timely;
- Technical specifications, quality and performance requirements and what happens if the agreed standards are not adhered to;

There are various types of construction contracts like fixed price contract, Percentage Rate Contract, Item Rate Contract, BOT (Build, Operate, Transfer) contract, EPC (Engineering, Procurement and Construction) Contract, HAM i.e. hybrid – a mix of the EPC and BOTmodels, prevalent in the industry. Each type of contracting has its own advantages and limitations. Therefore, one has to adopt appropriate contracting model depending upon various ground conditions within existing internal and external environment like site conditions, knowledge and skill available among engineers, contractors and professional experts. The skill, knowledge and experience required to handle each type of contract are decidedly different however the end requirement of an EPC contract is to create an asset with minimum hassle for the project owner by transferring the risks to the contractor.

In the present age, there is thrust for use of modern and innovative technologies in the construction sector which also requires liberty to be given to the contractors for deciding their own technology and innovation though meeting the owners' requirement of timely completion with required specifications and quality, optimum life cycle cost of the project and within the cost agreed upon. Therefore, more and more EPC mode of contracting is being adopted in major and technology driven projects.

Thus a need was felt to disseminate the idea of EPC contracting among stakeholders in the construction industry particularly for larger, technology driven and complex projects. Accordingly, experts in the field were requested to give their papers covering various issues involved in EPC contracts of buildings and the problems faced by them during their adoption. It is heartening to note that eight papers relevant to the topic have been received which have been included in this issue of IBC Journal. I am sure, these would be very useful to the professionals dealing with EPC contracts.

I am obliged and thankful to all the authors for their valuable contributions and Shri Vijay Singh Verma, President IBC and Shri V.R. Bansal, Hony. Secretary IBC for their useful suggestions and Shri M.C. Bansal, Advisor (Technical), IBC and his team in bringing out this publication timely.

(Dr. K. M. Soni)
Editor-in-Chief

Making EPC Contracts Successful

Amit Kathpalia
Brig. (Retd.) MES, MoD

Prologue

Indian construction industry is slowly shifting to EPC mode of project delivery in order to have single point responsibility and better value for money. However, while EPC mode does provide better value, it is also fraught with risks. The consequences of default are greater, and management of tendering, procurement and contract administration requires specific knowledge, skills, training and experience. Some of the critical things that need to be considered very carefully to make EPC contracts successful in construction industry are – selection of appropriate contractor, early contractor involvement in the project, appropriate risk sharing, clear enunciation of employer's requirements and giving adequate freedom to the selected contractor in design and execution. Since EPC mode is still relatively new in Indian construction industry, hence it will take few more years to correctly ascertain the success of EPC mode vis-à-vis standard methods of project delivery. However, internationally, there is enough literature available on issues related to EPC contracts in construction industry and the results have been largely mixed in terms of success and failures.

-Editor-

Introduction

EPC (Engineering, Procurement and Construction) contracts, also loosely called lumpsum turnkey contracts, make the contractor responsible for both design and construction. These types of contracts gained prominence due to adoption by power industry of USA in 1970s. In 1978, the Public Utility Regulatory Policies Act (PURPA), in an attempt to reduce USA's dependence on oil and improve efficiency in electric supply industry, encouraged development of "Independent Power Producers"(IPPs) by requiring utilities (Electricity Depts.) to purchase electricity from independently owned generating stations (called Qualifying Facilities or QFs) rather than construct their own power generation plants, if these QFs met certain criteria for efficiency or used certain types of "Green Fuels". This led to an industry of private developers who decided to build power plants and sell electricity. In order to

get access to capital from lenders, developers had to demonstrate that they could build plants on budget, on schedule and at proper efficiency and output levels. These developers, however, did not have the experience and technical expertise to deal with these risks. Therefore, they turned to large construction companies to deal with their job and take the risks. These companies were willing to do so but sought a hefty premium in return for taking these risks. These companies came to be known as "Turnkey EPC Contractors" because they would handle all aspects of Engineering, Procurement and Construction for a fixed price. EPC projects were contractually bound to a schedule, fixed final cost and performance levels. In 1980s and 1990s, this led to commissioning of many successful power projects in USA. However, as competition and requirements increased, inexperienced EPC came into the fray, forced everyone to lower prices, which led to huge numbers of ill-conceived and abandoned projects and bad debts.

Contracting Strategy

Contracting strategy is one of the outputs of pre-project planning. Contracting strategy is not simply "Item Rate contract/Lump Sum contract/EPC contract." Figs. 1 and 2 below depict the development process and components of contracting strategy.

Fig. 1: Contracting Strategy Development Process

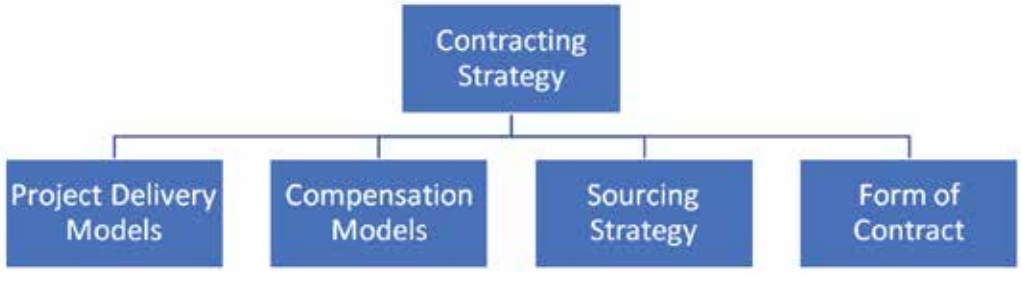

Fig. 2: Components of Contracting Strategy

Components of contracting strategy are further subdivided in Fig. 3 as below

Fig. 3: Contracting Strategy Sub-Components

Contracting strategy, thus, depends upon number of factors such as :

- Level of Scope Definition.
- Time Available.
- Capability of Owner and PIA-(Project Implementing Agency).
- Capability of Contractor.
- Project Complexity.
- Requirement of Price Certainty.

Traditionally, in India, Public Sector Agencies had been taking the following contracting strategy:

- Project Delivery – Design – Bid – Build (Design by the PIA-in house or through a consultant).
- Compensation methodology – Item Rate /Lump Sum.
- Sourcing Strategy- Open Tendering.
- Form of Contract – Bespoke contract (Each PIA having its own Form of contract)

While this strategy provided greater control to the PIA/Client to decide on design, specifications etc. it left little scope for Value Engineering. The PIA also took on most of the risks (design, quantities reflected in BoQs, site conditions, accuracy of drawings etc). Due to increasing number of projects, lack of staff and reliability of design consultants, there were increasing errors in design, drawings and BOQs. No constructability review was feasible since the contractor got involved only in construction stage. Since the responsibilities of design and execution was with differing agencies, this often led to major disputes especially in case latent defects discovered after few years.

Case Study 1 – Convention Centre

A prestigious convention centre was developed by a Central Govt PIA in 2010-11. After 10 years, the convention centre started showing structural cracks. Blame game started between the contractor and the consultant hired by the PIA. At this juncture, it became very difficult for any Technical Investigating Agency to apportion the responsibility between the contractor and the consultant (Design flaw vs Execution flaw , since there was presence of both). To obviate such disputes in future, the PIA is now exploring shifting to EPC mode for all high value projects, so that there is single point of responsibility.

Is EPC just Design-Build

Most PIAs in India identify EPC with just one aspect- giving design responsibilities to the contractor. FIDIC Yellow Book (Plant and Design-Build) and Silver Book (EPC/ Turnkey projects) deal with Design – Build projects. The major difference between the two is in risk sharing as illustrated at Table 1.

Table-1: Risk Sharing- FIDIC Silver vs Yellow Book

Risk	Silver book	Yellow book
Unforeseen physical conditions	No EOT/additional payment	EOT and additional payment
Operations of forces of nature	Not defined as employer's risk event	Defined employer's risk event. Additional time and payment.
Design responsibility	Yes	Yes
Errors in employer's requirements	No additional time or payment	Additional time and payment

Advantages/ Limitations of EPC Mode

Some of the major advantages of EPC mode to Client/PIA are:

Advantages	Limitations
Single point responsibility	Less control over the project by the client/PIA
Greater scope of innovation and value engineering	Greater tendering time (since contractor needs to be given adequate time to do site investigations and work out tentative rough design before quoting)
Faster project delivery since design and construction is by one agency	Difficult to compare varying designs submitted by the contractors
Fewer claims (since most risks are allocated to the contractor)	Increased risk allowance/contingency included by the bidder in his tender
Less risks for client	Disputes are more complex
Greater certainty of final price	Limited pool of well qualified bidders
	Management of risks is more complex
	Consequences of default are more drastic

FIDIC lays down following guidelines under which EPC contracts are not suitable:

- If there is insufficient time or info for tenderers to scrutinize and check employer's requirements or for them to carry out their designs, risk assessment and estimating.
- If construction will involve substantial underground work or work in other areas which tenderers cannot inspect, unless special provisions are provided for unforeseen conditions.
- If the employer intends to supervise closely or control the work or to review most of construction drawings.
- When there is anticipation of more scope changes/variations.

Circumstances and Factors to be analysed

A number of circumstances and factors should be carefully considered and analysed to assess the suitability of a project for EPC mode. Some important ones are:

- **Capability of the Client/PIA/Consultant -** If the Employer/PIA/his consultant is not in possession of know-how and suitable resources (human and material) or the Employer is inexperienced in this field.
- **Capability of the Contractor -** Does the contractor have an in-house Engineering team or a strategic tie- up with a well-qualified design consultant? Does the contractor have better know-how and resources than the PIA?
- **Risk Appetite of the PIA and Contractor -** Who has a better capability of taking on risks of changes in quantity, differing site conditions etc.
- **Costs -** Generally having a number of split contracts in design-Bid-Build mode, proves to be cheaper than EPC contracts in which the contractor may include in-built premium for taking on additional risks. However, there is more certainty of final price in EPC contracts which is more important to the Client.
- **Value Engineering -** Can the contractor provide better Value Engineering in the project?

- **Nature of the Project -** Is the project too complex and beyond the capability of the Client/PIA to design or even fully understand the technical aspects while there are experienced contractors available in the field?
- **Control of the Project -** Does the client/PIA wish to retain tight control over the project design and execution or is he satisfied with end result of "Fit for Purpose"?

An indicative matrix of factors to be considered for appropriate contract strategy is given in Table 2 below and Fig. 4 gives the FIDIC template of selecting the right type of contract.

Table-2: Contracting Strategy Matrix

Type of Contract	Scope Definition	Client's Risk	Con-tractor's Risk	Supervision/ Control by Client	Ease in implemen-ting changes	Design Respon-sibility
Unit rate	Defined for each unit	Quantity of units	Pricing of unit	High	High	Client
Reimbursable/ Cost Plus	Partially defined	High	Low	High	High	Client
Lumpsum	Fully defined	Medium	High -Price and Quantity	Moderate	Low	Client
Progressive Lumpsum	Flexible in initial stages, Fully defined in later stages	Moderate	Moderate	Moderate	Moderate	Client
EPC	Owner's Requirements fully defined	Low	High	Low	Low	Contractor
Alliance Contracting	Initially low Progressively High	Moderate	Moderate	Moderate	Moderate	Combined

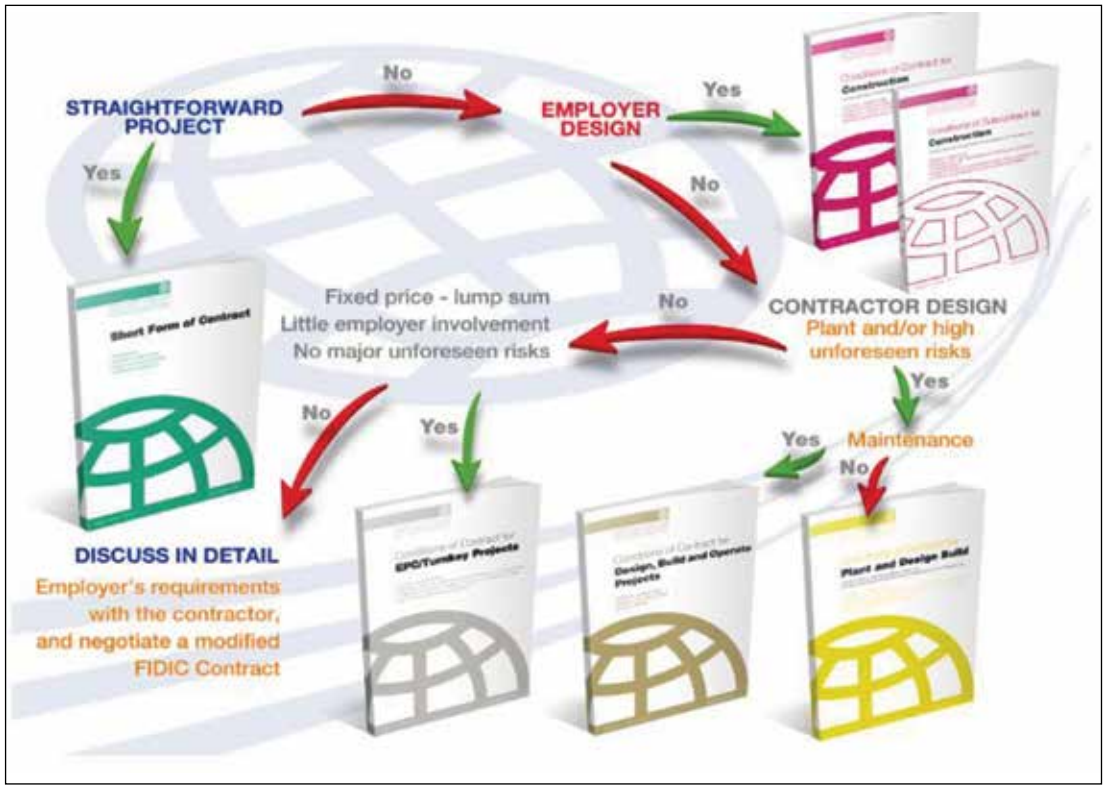

Fig. 4: FIDIC Template for Selection of Appropriate FIDIC Guide

Case Study 2 – First EPC Contract of Indian Railways-Doubling Work between Phulera and Degana - Rs 477.50 crores

In Aug 2017, North Western railways awarded the first EPC contract of railways for doubling work between Phulera and Degana, after a lot of deliberations. Perceived advantages of EPC mode were:

- No time and cost overruns due to delays in Designs and Drawings.
- Project risk (financial & technical) due to drawing and design lie with contractor.
- Single window monitoring by Railway's Authority Engineer.
- Flexibility in efficient designs without compromising on quality and the safety.

This project was considered fit for EPC mode due to following factors:

- Concept plans of yards were already approved.
- Proper Connectivity by road and rail was existing.
- Terrain and topography was mostly plain.
- Proper working season was available throughout the year.
- There was easy availability of local labour , material and resources.
- There were no law and order issues in this area.
- NOC for LHSs was already available.

Railways made special efforts to ensure success of this first EPC project by taking the numerous steps such as:

- Making more than 90% of the land available at the time of contract acceptance.
- Providing time bound decisions, assistance, guidance.
- Ensuring close co-ordination with state govt.
- Bidders were taken on a site tour for better appreciation of work.
- Queries were responded promptly.
- Soft copies of all drawings and documents were provided to six shortlisted bidders for examination by different departments of tenderer(s).
- Two pre bid meetings were held with selected top 6 bidders to clarify all doubts and instil confidence.
- DPR was prepared departmentally.
- Foot to foot Survey of section was done.
- All GAD & Drawings of major and minor bridges collected.
- All land plans, land details, index plan, index section etc were collected.
- Concept plan were prepared & got approved.
- Right of way in full or partial width was assessed.
- Railways provided 93% land within 15 days of LOA.
- Railways appointed Authority's Engineer - Within 15 days of Appointed date.

- Railways appointed Authority's Engineer - Within 15 days of Appointed date.
- Railways provided NOCs of all LHSs (Limited Height Subways) – within 60days of appointed date
- All trees (as per RFP) were again listed and handed over within 15 days of LoA.
- Mobilization advance was released- within 30 days of application.
- Railway land was made available for RMC, labs, store, offices.
- All the structures which were identified for dismantling/ replacement were handed over to the contractor within 15 days of LoA.
- Balance 7 % land was provided before 6 months of appointed date.

During Execution, all work was coordinated and monitored well:

- Insurance as applicable was provided.
- Railways provided project facilities as per RFP- within 3 months.
- Works were awarded to Sub-contractors as per RFP.
- Contractor established labs, mobilised machineries, RMCs etc. in time.
- Video-Recording 3 hrs. for each quarter and drone recording also done during execution
- Monthly meetings were held with all concerned.
- Monthly progress reports were submitted in time.

However, despite all this, the contract had to be terminated in one year due to non-performance of the contractor. In subsequent analysis, some of the reasons analysed by railways for failure of the contract were:

- Tenderers were inexperienced and not able to make a realistic assessment of challenges involved in Railway Work and costs associated.
- Railways is used to assessing cost of project through updation of last accepted rates, which may not be true cost and can misguide inexperienced tenderers.
- EPC contracts are fixed contracts requiring very detailed planning. Despite best planning, there are changes demanded during execution, which are difficult to incorporate.

- No detailed survey or assessment for utilities is done initially by the tenderer. Removal of same and its effect on progress of work, time and again is cause of disputes.
- The shifting of utilities owned by outside department like PHED, BSNL, VPNL etc become the responsibility of contractor, which is huge & time taking task.
- Stage Payments as per laid down schedule are involved which usually lead to locking of funds and financial failures.
- Detailed planning of yards, bridges and major structures are not done by the tenderer initially, so, the bid is based on rough assessments.
- Tenderers are not able to assess time and effort involved in preparation & approval of ESP, (Engineering Scale Plan), SIP (Signal Interlocking Plan), L Sections and GADs of bridges.
- EPC Contracts are inflexible and cannot accommodate changes in policy or later on requirements.
- Contractor intentionally hires subcontractor for each work less than 5% mostly through reverse auction, so not chosen as per any financial or technical criteria, so poor performances by them.
- Limited Engineering (in the spirit of EPC) is involved in doubling/ multiple line projects (alignment is parallel, standard/RDSO (Research Design & Standard Organisation) drawings are preferred etc.).
- Approvals of almost all drawings and GADs lies with open line division and HQ authorities, which is very cumbersome and time consuming.
- EPC is more suitable for green field projects, where 90% land is available.

It is interesting to note that most Data centres are designed and constructed in USA in CM at Risk mode, In Europe as Cost Reimbursable and Lumps Sum contracts and in China as EPC contracts.

Selection of EPC Contractor – Since the EPC contractor is given the onerous responsibility of design plus construction and all foreseeable and unforeseeable risks including risk of discovering and correcting Client's Requirements, hence selection of EPC contractor needs careful consideration. Some models adopted across the world are:

RFP Approach (based on QCBS/MEAT/QBS/Best Value Plan) - In this methodology, after prequalification, shortlisted contractors are selected on the basis of Quality-cum-Cost criteria with Technical (Quality) scoring including factors such as reliability of Supply chain of the EPC contractor, in-house design team, past record of value engineering and innovation, dispute history etc. Technical bids are opened separately before hand by a separate committee to avoid any bias due to commercial bid. In QBS system, the top contractor(s) are selected purely based on Technical/ Quality criteria and final price is then negotiated with them. Best Value Plan is a variation of QCBS wherein a notional positive or negative monetary value is allocated to a Technical score based on its percentage weightage and the expected project budget.

ECI (Early Contractor Involvement) Approach - ECI methodology has been highly successful in Highway England and High Speed (HS2) rail project in UK. In this methodology, one to maximum three contractors are selected based on only Q-Bid (Past record of Value Engineering, Successful projects, Partnership etc). These are then involved in the project right from conceptual stage. They work alongside with consultant during initial stages and provide their inputs on design, value engineering and constructability. This is done on cost reimbursable basis (decided beforehand). The contractor who provides the best value for the cost is then selected for further negotiations. The detailed design is developed by the selected contractor. The final contract has provisions for pain-gain sharing.

Single Source, Open Bid Negotiations - This can be done by Private Sector or by the concessionaire in PPP projects. In this, the sponsor interviews the EPC contractor, scrutinizes his past records and selects one whom he believes can perform the work best, for further negotiations. The sponsor will share all functional and relevant technical information of the project with the selected EPC contractor who will then "open its books" to the sponsor to reveal cost of all components of the work. Once the sponsor and the EPC contractor agree on the pricing of major components of work, contingencies, profit and overheads are added to these costs and Final EPC price set. The advantage of this methodology is that the sponsor can view all costs and risks involved in the project form the EPC contractor's perspective. Disadvantage is that the sponsor does not get the benefit of taking inputs from different EPC contractors.

The main point to note is that world over, complex mechanisms have been evolved for appropriate selection of EPC contractor, which are different from normal tender strategies done in case of Design-Bid-Build contracts.

Case Study 3 –

ECI in HS2

HS2 is the biggest rail investment ever made in the North of England, with over 250 miles of new high-speed line planned across the country.

Early contractor involvement (ECI) is an approach to contracting that supports improved team working, innovation and planning to deliver value for money. It involves an integrated contractor and designer team, appointed under an incentivised, two-stage contract.

Key stages

Stage 1 involves design development and construction planning, which is aimed at meeting our objectives and which leads to the agreement of a target price. Stage 2 covers the period of detailed design and construction.

How does ECI improve value for money?

It integrates design development and construction planning at an early stage. This allows the contractor, designer and key supply chain to develop innovative solution. It provides more time for planning and the preparation of the construction programme. For example, Stage 1 allows time to understand and plan for critical events, such as rail possessions and utilities diversions. It enables companies to plan for the recruitment, training and retention of personnel needed during the construction stage; appoint key supply chain partners; and source long-lead items. It provides greater opportunities for the integrated team to support stakeholder management, and to improve the management of risk and health and safety planning during the planning stage.

How does it work?

Before the ECI contract award

Prior to issuing invitations to tender, the client will prepare the specification and develop the design sufficiently to clearly set out the contract requirements and establish the contract budget. Tenderers will be required to submit their delivery

proposals, but the tender process will not require any design development. The competition stage will focus on technical and commercial criteria – the main aim is to award the contract to the best team with the necessary skills and appropriate collaborative culture to deliver value for money. Innovation, including innovation in collaboration with the supply chain will be a major criterion. The commercial submission should establish the Stage 1 price and the fees and pricing mechanism for Stage 2.

During Stage 1, Client will pay for the design and construction methodology to be developed by the ECI contractor's team. During Stage 2, the ECI contractor will be paid actual costs for the construction works.

After the ECI contract award

Stage 1: design development and construction planning

The ECI contractor team's role in Stage 1 is to:

- Provide the expertise to take ownership of, develop and optimise the design, aligned with our objectives (including build ability); plus, a fee, and will be incentivised against the agreed target price.
- Commence construction planning, including identifying opportunities for off-site manufacturing and supply chain engagement (as appropriate); and

Stage 1 will normally last 8 to 12 months – enough time to develop innovative solutions and efficiency ideas. Progression to ECI Stage 2 will depend on satisfactory performance during Stage 1, including the development of a cost-effective solution, the agreement of a construction programme and an affordable target price for construction. We will develop a mechanism whereby, if a contractor is not performing in Stage 1, we will be able tore-procure quickly and effectively.

Stage 2: detailed design and construction

The ECI contractor's role in Stage 2 is to take responsibility for and complete the detailed design; and construct the works.

EPC Contract

Employer's Requirements

One of the most important inclusions in an EPC contract is the Employer's Requirements, which guides the EPC contractor towards development of design, performance criteria etc. The Employer's Requirement is often in the form of FEED (Front End Engineering Design) or BEP(Basic Engineering package). Most Employers develop a DPR for EPC projects, which is made available to the bidders with a disclaimer of accuracy in its entirety. Following guidelines given below list the correct approach for giving Employer's Requirements:

- The specifications should give only functional requirements. The Employer should only describe what is expected as outcome after successful completion.
- The specifications should not be too prescriptive.
- Employer should not interpose his design or interfere in design development in a deliberate manner.
- Performance criteria must be laid down and met.
- The purpose of the project should be clear.

Tentative list that may form part of Employer's Requirements is:

- Documents to be maintained by the contractor.
- Any particular requirement with respect to compliance with laws and regulations.
- Time and manner of access to site.
- Survey control points.
- Details of Employer supplied material.
- Intended purpose of the construction.
- Any specific specification.
- Details of nominated subcontractors.
- HSE (Health and Safety of Employees) Requirements.
- Quality compliance /verification system.

- Specific emission/discharge limitations.
- Format and frequency of progress reports.
- Design criteria.
- Review period of the schedule.
- As-Built Records.
- Requirement of O&M manuals.
- Technical standards to be followed.
- Training of Employer's personnel.
- Key personnel of the contractor.
- Testing requirements.
- Employer's use of works prior to taking over.
- Test after completion.
- Warranties.
- Provision of spare parts.

Employer's requirement should contain only illustrative design with schematic drawings. This generally is equivalent to 10-30% of total design effort.

Case Study 4 – EPC tender of a Desalination Plant

A PIA floated an EPC tender for a desalination plant as single stage two envelope bid. He received offers which were based on different technologies. How should he evaluate the bids? Should he have specified the technology in the tender documents?

One of the mistakes PIAs do in an EPC tender is making the tender such that they get all "Apples" and have to compare "Apples with Apples" rather than do a complex evaluation of cost plus performance plus construction period plus O&M plus other technical factors. AS per EPC philosophy, the contractors should be free to choose their technology as long as it fulfils Employer's Requirements(which should be functional). Hence, in case of a desalination plant, the PIA should give only functional requirements such as output, energy consumption, Expected life, O&M costs, Environmental constraints on site constraints etc and then allow the bidders to offer their own solutions and prices.

Reliance data in EPC Contracts

In all EPC contracts in India, entire data provided by the Employer and Employer's requirements given to the contractor, is given with a disclaimer of accuracy.

In practice, not taking responsibility for any data/ requirement, is mostly counterproductive because:

- It makes it more difficult for EPC contractor to quote with reasonable accuracy, since in normal time pressures of tendering, it is not practical for the EPC contractor to carry out detailed geotechnical investigation or do detailed design before quoting.
- The Employer/his Consultant pays less attention to planning. This may be one reason for poor accuracy of data and mistakes in DPR made by NHAI consultants.

As per FIDIC Silver Book, the Employer is not responsible for any errors, inaccuracy or omission of any kind in Employer's Requirement except:

- Date which is stated to be immutable /responsibility of the Employer.
- Definition of intended purpose of works /parts of works.
- Criteria for testing and performance of completed works.
- Portions, data and information which cannot be verified by the contractor.

It is a good practice to have some baseline data which the contractor can rely upon. An analogy can be taken with the "Black Box" concept:-

- Project to be executed is the "Black Box".
- Works to be executed are within the Black Box. These are defined by functional basis and not detailed prescriptive specifications. There is no Reliance data within the Black Box.
- The Black Box is , however, interacting with the external environment and receiving inflows from it. The inflows form external environment which substantially impact the Black Box can and should become Reliance data.

As an example, in a Hydroelectric power plant, following can be part of Reliance data:-

- Geotechnical baseline- Reference characteristics of subsurface conditions like Rock classes.
- Water Quality – Chemical composition of water for which the plant is to be designed, hydrological data, maximum and minimum water temperature.
- Grid connection information – Data related to transmission lines and Grid characteristics.
- Maximum wind speed, seismic zone and any other design requirements the Black Box will have to withstand.

It should also be remembered that if the Employer lays disclaimer to accuracy of complete data and the actual site conditions prove to be more favourable to the contractor, the contractor is well-within his rights to take advantage of these.

Case Study 5 – Advantage of having Reliance data

In an EPC contract for a prestigious educational institute, the design made by the Employer's consultant for the purpose of obtaining tender price, was based on SBC of 8T/sqm. When the EPC contractor did his detailed investigations after winning the bid, he found the SBC in most places to the tune of 16-18T/sqm. This enabled the contractor to finalize a "lighter" design resulting in substantial cost savings. The Employer, being a Public Sector agency, did not allow this (due to implications of audit etc) and instructed the contractor to base his design on the SBC mentioned in the DPR (which was issued to the contractor with full disclaimer of accuracy). The matter went into arbitration wherein the contractor won the case.

Engineer's Supervision in EPC Contracts

FIDIC Silver Book does not envisage an Engineer to carry out contract administration for EPC contracts. World over, most EPC contracts are managed by an "Engineer." However, the role of Engineer in EPC contracts needs to be limited to only ensure that the contractor is executing the project as per the scope of the contract. The Engineer should refrain from interference in work meetings, design etc. The Engineer should not instruct the contractor, he should only apprise the contractor of what he perceives as issues of concern. Most EPC contracts ask for the contractor to submit critical working drawings to the Engineer. The Engineer should only review and comment upon the

drawings and documents submitted by the contractor rather than reject or approve as this may lead to legal issue of taking responsibility irrespective of what is written in the contract.

Payment Mode

The payment mode in EPC contract may be Fixed price, milestone payments, periodic payments, Target price with pain - gain sharing. Since there is no contractual BoQ, pricing of variations (star rates) is difficult. It may be worthwhile to have a mutually accepted BoQ for the purpose to pricing variations. In case of long gestation projects, the BoQ rates may be updated periodically.

Risk Allocation

Basic principles of risk allocation in EPC contracts are the same as for other types of construction contracts. The principles of risk allocation have been well illustrated by Max Abrahamson as follows:

A risk should be allocated to a party if:

- The risk is within the party's control.
- The party can transfer the risk, for example, through insurance, and it is economically beneficial to do so.
- The economic benefit of controlling the risk lies with the party in question.
- To place the risk upon the party in question, is in the interest of efficiency.
- If the risk eventuates, the loss falls on that party first and it is not practical to transfer the loss to another.

Nael Bunni has proposed following four principles for allocating risks in construction contracts:

- Which party can best control the risk and its associated consequences?
- Which party can best foresee that risk?
- Which party can best bear that risk?
- Which party can ultimately benefits or suffers the most when the risk eventuates?

Contractually, all risks can be allocated to the contractor –"pacta sunt servanda' – the contract is binding. However, it must be remembered that at the time of tendering, there is an information asymmetry between the Employer and the contractor. The Employer has had time to investigate, research and evaluate options for his requirements. It almost always ends up in disaster when the Employer overestimates the effectiveness of the contractor to manage the risks or underestimates the impact of the risks.

A specific issue of EPC contracts is that there is temptation for Employer's to say – "This is a complex risk for me to manage, let the contractor take care of it." It must be remembered that no contractor will execute a project if tit leads to financial loss. Hence this type of "wishful risk allocation" needs to be avoided. Thus, before deciding whether to do a project in EPC mode, the risk allocation aspect has to be clearly discussed and brainstormed. Risk allocation due to exception events (Force Majeure) also needs to be considered as per the basic principles enunciated in previous paragraphs.

LNTP (Limited Notice to Proceed)

Sometimes there may be a need to start some preliminary works such as site survey, protective works, placing important supply orders for long lead items even while the EPC agreement is being finalized. In such case a LNTP (Limited Notice to Proceed) agreement may be signed as a prelude to EPC contract. LNTP may also be utilised when the Employer wants to delay execution of a specific part of a project due to, say, delay in getting approval. In such a case the EPC contractor may be given Notice to Proceed with all works except certain works. Under LNTP, the Employer bears all the risks since the provisions of EPC contracts are not in vogue.

Subcontracting

EPC contractors invariably employ subcontractors. Most Indian EPC contracts require the EPC contractor to take permission of the Engineer for getting any work above 5% of total of value of EPC contract, through a subcontractor. However, that is not sufficient. The Employer also needs to scrutinize conditions of contract of the subcontract. For example, NEC ECC lays down that the PM will approve GCC of subcontract, unless the subcontract is also based on NEC. Another aspect that needs to monitored is timely payments to subcontractors, since as we go down in the contracting chain, the payment keeps getting delayed and the parties are less capable of sustaining delayed payments.

Some mechanisms which have been successful world over for ensuring payments to subcontractors are:

- **Project Bank Account-** This is one of the form of an Escrow account. The contractor submits details of payments to all his subcontractors, suppliers etc in his application for IPC. Payment is made simultaneously to all parties through the Project bank Account.
- **Banning of "Pay if Paid and Pay when paid"** clauses in construction contracts.
- **Submission of Payment Bonds** by the main contractor, which may be utilized for making any balance payments to subcontractors on completion of the project or in case of insolvency of the main contractor.

Sadly, none of these measures are in vogue in India thereby making the subcontractor the most vulnerable player in construction industry.

Some EPC contracts also have clauses of assignment of subcontractors to the Employer in case of termination of the EPC contract/insolvency of EPC contractor. However, these may not prove effective since it is likely that the subcontractors may have left the project before termination/insolvency.

JICA Observations on EPC Contracts

It may be worthwhile to have a look at JICA observations on D-B EPC projects (Design-Build). The observations listed by JICA are:-

"Most bidding documents submitted to JICA have been found not drafted on thoughtful and well-balanced risk allocation for example:

- No detailed site survey is incorporated in bidding documents whereas bidders are required to make preliminary design for setting their bid prices. Client recklessly thinks that the EPC contractor has to perform everything including detailed site survey and soil investigation during the bid period, but it never considers that the bidders will not be able to analyse accurate project costs during the project process.
- A detailed design has been practically completed by the client, but it is issued with disclaimer thereby forcing the bidder to take ownership of client's design , which is a malicious practice.

- Although the contractor is carrying out only part of design, but he is required to take entire turnkey like Fit for Purpose obligations.

JICA Recommendations

JICA recommends use of EPC contracts if following conditions are met:

- Nature of project is suitable for EPC contract, for example, Power plant project will generally be suitable, but underground works, roads and railways are generally not suitable since they are highly influenced by unforeseen risks.
- Seeking innovative technologies owned by private companies is beneficial to the project.
- Risks are fairly allocated to the party which is capable of taking on such risks. For example, suitability of site is a risk of the client.
- Detailed site survey has been made by the client and supplied to the bidders.
- Client's requirements are precisely defined.

Recommendations for Indian Public Sector Infrastructure Projects

Certain recommendations for Indian public sector projects are:

- Have an interdisciplinary committee to decide whether a particular high value project is suitable for EPC mode. This should be done on project-by-project basis.
- Have advanced mechanisms (Best value Plan/ Early Contractor Involvement) for selection of suitable and capable EPC contractor.
- Have Early contractor involvement wherever feasible.
- EPC contractor must have a reasonable level of in-house design capability.
- Incorporate basic Reliance /Immutable data in the tender and the contract which is the responsibility of the Employer, and which will form basis for design.
- Employer should not give finished /near completed design to the contractor.
- Monitor conditions of contract and payments to subcontractors.

- Have a simple mechanism for quick valuation of variations and scope changes.
- Curb the tendency to allocate all risks to EPC contractor. Carry out deliberate risk allocation exercise based on principle enunciated by Max Abrahamson and Nael Bunni.

Conclusion

To sum it up, EPC contracts can provide value for money provided they are done for the correct project, appropriate contractor selection is carried out, risks are allocated fairly, the Employer/Engineer spells out his requirements clearly and adequate freedom is given to contractor for design and execution.

Hence, to conclude, to ensure success of EPC project following issues needs to be deliberated:

- Suitability of EPC mode for the project.
- Methodology of Tendering and selection of EPC contractor.
- Risk sharing.
- Subcontractor management.
- Employer's requirements.
- Taking responsibility of data/information.
- Level of Engineer's supervision.
- Requirement of having LNTP.

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EPC Contract from Design Perspective

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Prologue

Engineering, Procurement and Con-struction Contract or EPC contract is a type of construction contract between contractor and employer / owner where the contractor is responsible for all the engineering, procurement, and construction activities to deliver the completed project to the employer or owner within a predefined time and agreed cost. To complete work in given time and cost, EPC agency has full liberty in selection of specialised agencies/ consultants and producst to be used and owner deals with only one construction agency. Tender document needs to be planned very carefully ,clearly defining the scope of the contract, specifications etc. CPWD has started using EPC contracts for last few years in 3 modes, based on the importance of project, client's requirementsand decisions of the competent authority.

This paper will study the advantages and disadvantages experienced through case studies of some of the projects taken by CPWD in EPC mode with aim of completing the projects in given time and cost, from design perspective.

-Editor-

Introduction

The most important purpose /advantage of EPC Contracts is that almost total assignment of design, approvals and construction risk goes to the EPC contractor and the owner/ employer deals with only one contractor, who in turn manages all the relationships with other specialised agencies making management of the project considerably easier for the owner/employer. While owner gets benefit from the single point of responsibility for the delivery of the project, they do lose involvement with the design process, adding potential risk if the project's design is crucial. Another advantage is that execution of the work can be started by the contractor even before entire design is completed to gain time for timely/early completion

The advantage to contractor is that he has more control over the design, selection of products and specialized agencies, vendors and suppliers. So, more risk with the coordination of the design gets compensated by great deal of control to efficiently lower construction costs as EPC contract severely limits the scope and circumstances under which EPC Agency/contractor can make claims for additional time and money.

Owner needs to ensure that specifications and tender document are very carefully planned and drafted before bidding, covering all the scope, terms and conditions so that contractor is not able to take undue advantage. He also needs to ensure that he carefully marks out the project's milestones to avoid lifecycle costs and changes in scope being easily overlooked as the usual checks and balances during such projects do not exist for the owner.

Design Perspective

In general, it is seen that Government Architects / designers of Government buildings pay more attention to function than aesthetics making full utilization of scarce funds available unlike private Architects / designers of private buildings which pay more attention to appearance (internal and external) using richer specifications and less to functional aspects leading to lower efficiency. Hence EPC agency is likely to follow the path of private Architects / designers, minimization of efforts in design as well as materials and richer specifications for finishing works to pay attention to aesthetics and better profitability.

Essential Features of a Good EPC Contract

A good contract must have the following features for successful completion of a project:

- Legal validity
- True reflection of the agreement
- Clear scope of work
- Clear and coherent conditions
- Contain all essential conditions of contract
- Detailed definitions to avoid ambiguity
- Consistent in structures
- Fair and Equitable

- Risk to be allocated to the party best placed to control it, bear it and deal with it.
- Complete and Flexible
- Contract to cover most of the needs and be readily adaptable to fit the requirements.
- Recognition – Identifying the contract with the customer.
- The contract should be acceptable by all, tested and have no ambiguous clauses.
- Provision for recourse for settlement of disputes.
- Clear banking, payments and insurance provisions.
- Offer a fair deal.
- Be written in a simple language.

Fundamental Principles for Drafting the Scope of the Contract

- The contract should be drafted keeping in consideration the entire scope / activities.
- The scope of the contract should not be ambiguous.
- The scope of the contract should be diligently drafted, including all the references and timelines of all the major activities to be performed by the parties.
- Scope of the project should be specific and clear in the contract, including but not limited to the following:
  - Scope of design and engineering.
  - Scope of supply of all equipment, machines, materials, tools, tackles, civil, spares, commissioning spares, etc., required to be supplied for completion of the project.
  - Scope of all services and utilities, transportation, storage, port clearance, customs duty payment, handling, insurances, testing, erection, pre-commissioning, commissioning, defect liabilities, training, supervision, dismantling, demolition of plant, equipment & building, etc.
  - All the scope activities which are unique to a particular project should be elaborated in clear terms.

Sub-Contracting with Specialised Agencies and other Vendors

Contractor has to invest more as such EPC contractor may need to subcontract considerable part of the contract to specialized agencies / vendors for smooth execution of the work,so only large companies can take up EPC contracts. Only few contractors having large capacity can take entire EPC contract .However small and medium size contractors lack financial resources and unable to take risk of large projects on EPC basis resulting in the elimination of small and medium size contractors thereby stopping their growth to increase their capacity and upgrade themselves with the new technology .In case, entire work is subcontracted, it tantamounts to subletting and the owner should not allow the total scope to be sub-contracted. Timely payment if not made to specialized agencies / vendors may also lead to delays.

Change in the Contract Element

Changes in large projects are necessitated due to the following reasons:

- To curb ambiguity in the scope of the project which might have crept in the original contract.
- In case of additional requests emerging in the project due to various reasons.
- Change in technology relating to process and equipment.
- For any afterthought requirements/improvements concerning the existing project.

To deal with situations mentioned above, in general contractual practice, the employer has the right to propose and subsequently order the contractor, from time to time during the performance of the contract, to make any changes, modifications, additions or deletions in the facilities, provided that such changes fall within the general scope, related to the work and are practicable i.e. the employer has the right to issue the change order provided that the change order is (i) part of the project, (ii) is complimentary to the project and (iii) is mutually agreed by the parties.

In fact, change order is a mini contract with its own scope, specifications, completion schedule, and price. Such change orders are usually a source of conflict and disputebetween employer and contractor, thus the owner and the contractor, should agree with the revised price and time with reference to the change order else the matter is referred for dispute resolution to arbitration/conciliation.

In EPC contract to maintain the essence of completing the project in given time and cost, it may not be feasible to carry out the necessitated changes arriving due to any of above reasons without raising time / cost thereby devoiding the basic concept of EPC.

Termination of Contract

It is very difficult to terminate the EPC contract as it doesn't specify any means of making payment of incomplete work and determine the reasonable value of the partially completed stages of works on the date of termination. Moreover, payment can be made by owner only if such works conform with the Specifications and Standards. It is even more difficult to re-award such work to some other agency.

Even if something is worked out in conditions of contract, termination can be of total contract not a part leading to extensive delays as time is needed to re-invite the tenders and award it to some other agency who in turn has to hire other specialized agencies also to complete the incomplete work of standard not matching their standard of work thereby increasing completion time and cost devoiding the essence of EPC.

Scope of Work of Contractor

Scope of work in EPC contract generally includes the following;

- Architectural design and Structural design as per the general parameters and proposed drawings given in the NIT.
- Topographic survey, subsoil investigation, traffic impact Assessment and all ancillary works.
- Planning, designing and execution of all Civil, Electrical & Mechanical and Horticulture services such as Internal electrical, HVAC, Sanitary, Water supply, Drainage system etc. complete for the buildings planned including all its fittings, fixtures, testing etc. and External services like Water supply, Rain water harvesting systems, Sewerage, STP, Drainage system, Roads, Paths and all connected Sub-structure and Superstructure, their integration, installation and commissioning.
- Obtaining mandatory approvals from local bodies/ authorities required for commencing the work such as: Environment Clearance, Clearance from Fire, Delhi Urban Arts Commission, Metro rails, Airport Authority, Tree authority and ASI etc.
- Development of area, Boundary Wall, Gates, Internal roads, Street lighting, Parks, Cycle track and all other amenities required.

Scope of Work of CPWD

Scope of work in a works contract of any government organization is similar. Broad scope of work of CPWD is given in the following;

- Overall Monitoring and Control of the project
- Co-ordination in getting Approvals required to start the work
- Day to day interaction with contractor to monitor the time schedule and quality requirements including assessment of monthly progress reports
- Review of all designs and other documents w.r.t their conformity to CPWD standards & specifications defined in bid document.
- Appointing TPQA and structural consultant for vetting structural drawings
- Fixing milestones with time limits for releasing payments along with penalties in case of non-achievement of Milestones defined in bid document.

CPWD – Architectural Design and EPC Contract

CPWD is an organization having one of the most talented, brilliant and experienced professionals in the field of Architecture, Civil, Electrical and Horticulture and for most of the buildings till now, architectural planning, structural designing, civil and electrical services including air –conditioning was being carried out in-house. CPWD officers are well versed with the technicalities of planning, design and maintenance issues of the projects including rules / bye-laws applicable for obtaining approvals from various authorities. They are fully responsible for everything planned / designed and executed by them. For large projects where there is pre-occupation of the experts, consultants are engaged with scrutiny done by technically sound professionals of CPWD.

Architectural design is the soul of the building design. If it is good, then the building is bound to be good. In EPC contracts, main emphasis being on time and cost, planning / design may take a little back seat. In EPC contract, the main contractor is neither an architect nor an engineer, who hires professionals like architects and engineers and is dependent upon them for planning and design of the project as well as services including reviewing the specialized works like structural design and HVAC etc. at an optimum cost.

The basic difference between CPWD working and EPC contract working is same like work being done by an expert professional v/s expert appointed by non-professional. There is also limitation in architectural design due to constraint of time and cost. Contractor may follow concept of minimization in every aspect to take care of his profit and completion within given time and cost. It appears that EPC can prove to be advantageous for those organizations who don't have technical expertise / professionals like architects or engineers but may not be advantageous for organization having expertise themselves like CPWD. Moreover, limiting time and cost is bound to impact the quality of work. However, in case of urgency / time bound projects, CPWD has completed many projects before time and same can also be made possible in most of the projects and on the other hand projects are bound to get delayed even in EPC due to many reasons including the ones mentioned above.

CPWD has started EPC contracts for last few years. CPWD uses 3 modes for EPC contracts.

Mode I – Where EPC contractor has to do everything and is responsible for all the engineering, procurement, and construction activities to deliver the completed project to the employer or owner within a predefined time and cost with concept drawings provided by CPWD.

Mode II – Where architectural drawings are provided by CPWD and EPC contractor has to get the structural and services drawings developed on the basis of these drawings and all other activities.

Mode III – Where all drawings and local body / authority approvals are provided to the EPC contractor and procurement, and construction activities are to be carried out by him.

Advantages of EPC

- Results in faster project execution due to reduction in the number of decision making levels compared to conventional methods.
- The costs/risks associated with delays due to indirect factors such as environmental factors, change in local building bye laws etc. are transferred from the department to the contractor.
- Saving of department's resources associated with preparation of detailed estimate, bills, detailed measurements etc. as there is stage payment in EPC mode.

Disadvantages of EPC

- In the absence of a clearly defined schedule of quantities in the agreement, there may be disagreement between the owner & the contractor resulting in cost issues.
- EPC contracts are inflexible because it is difficult to incorporate extra items/deviations necessitated by site conditions or client requirements.
- May cause delays due to late identification of technical issues caused by reduced involvement of the department in detailed project planning & design.

A study of the advantages and disadvantages experienced in some of the projects is given in the following;

1. Office and Residential for Custom & Excise at Wadala, Mumbai

Agency: Yet to be awarded

Sanctioned amount: 975 Crore

Type of Architectural Consultancy

Architectural consultancy was the first step as the client wanted to finalize the design before start of construction. Selection of Architectural firm (M/s Sikka & Associates) was through competition at the cost of 6.5 cr. It was initiated in Feb 2021. Scope of work included preparation of Architectural, detailed, Structural, preparation Civil, E&M services drawings and detailed estimates along with obtaining local body and statutory approvals, intermittent inputs during construction, obtaining completion and occupation certificate. All activities are to be completed by June 2025.

EPC Contract

As all the drawings were ready, tenders were invited in EPC Mode III with monolithic construction but it was found that the offer of the lowest bidder was on higher side, it was decided to go for mode II instead of III and making it technology neutral and redoing of structural drawings by EPC agency as per technology proposed by them to economize the project.

Hence tenders have been called in EPC Mode II- but work is yet to be awarded which is expected by Oct 2022 with 32 months of time for completion i.e. by June 2025.

Specific Observations

- Specifications provided were moderated by CPWD to some extent for making them maintenance free.
- Drawings are not yet approved by Local authority, only approved in principle by the local body as Fire approval could not be obtained.
- Tendered amount by first lowest bidder was 1132 crores against available amount of 860 crores as the preliminary estimate was prepared without any drawing and the actual area increased by about 50,000 sqm compared to the drawings used for tendering. Further, tendering was done with richer specifications with some additional items not covered in the preliminary estimate resulting into additional cost in tender, needing re-invitation of tenders.

For successful tendering CPWD suggested three alternates for inviting tenders in EPC mode ;- With reduced scope of work and technology neutral from EPC and class I - CPWD registered agencies, OR inviting item rate tenders OR inviting tenders in EPC mode with same scope of work from EPC agencies with separate rate for each tower and podium for negotiating for temporary deletion of a particular tower / podium to adjust cost.

Finally, tenders are invited in EPC Mode II as technology neutral after moderating the specifications and limiting the scope of work as per PE but allowing additional area of 50000 sqm as per the requirement of local bodies.

Learnings

- Cost escalation, maintenance free services, structural design etc. would have been taken care, if the project was dealt in-house.
- Structural drawings prepared by consultant had to be redone due to making the tender technology neutral.
- Richer specifications used by consultant had to be moderated to reduce the cost of the project.
- Consultant has not been able to obtain Local authority approval before start of construction against expected speed, one main reason making CPWD think to go for EPC.

The option of preparing all drawings by CPWD would have resolved most of the hurdles.

2. Office Building for Income tax at Nariman Point, Mumbai

Proposed Building **Present Status of Building**

Date / amount of sanction:	13.05.19 / 99.92 Crore
Actual date of start / completion:	20.10.2020 / 30.09.2023
Name of agency:	SPG Infraprojects Pvt. Ltd.

Office Building having B+ G+ 13 Floor (Basement 4.2m height for 3tier parking which may not be permissible now) with Building ht. – 51.9 MTR.

Although submission drawings were prepared by CPWD and submitted to Local authority and other statutory bodies for approvals but in the mean time it was decided to invite Tenders in EPC Mode -1. Also, changes were made in design, structure and aesthetics of building by the EPC agency for economizing cost of building and increasing profit.

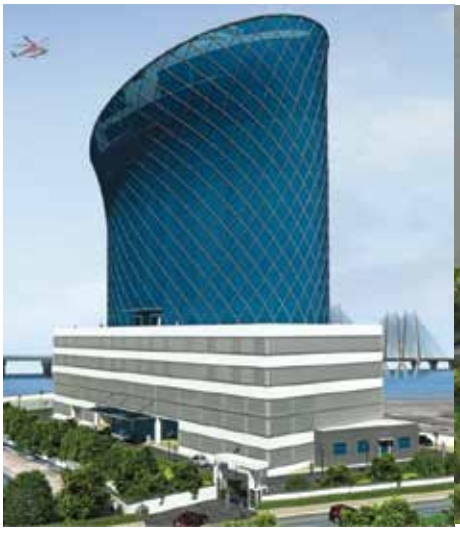
Drawings have been submitted for complete permissible FSI of 3.5. Set backs in plot are also left accordingly for height of 51.9 m. Parking has also been planned for FSI of 3.5. Permission for construction is available for 1.33 FSI though FSI of

3.5 is permissible on payment of 52 crores which needs to be deposited by the client for using additional permissible FSI. Construction of main structure (1.33 FSI) was started in Oct 20 which has been completed and finishing works are being taken up. Price for additional FSI was recalculated b BMC and 49 crores was deposited for building upto 7 floors, structure for which has been completed. Additional pament for complete 3.5 FSI is yet to be made by the client and additional construction work can be taken up only after approval of 3.5 FSI.

Observations

- Submission Drawings already submitted to Local authority could not be used as before approval could be obtained, tenders were invited in Mode-I.
- As informed by the Architect, good amount of Changes were made in design, structure and aesthetics of building compromised by the EPC agency for economizing cost of building and increasing profit.
- In case approval of additional FSI is not received in time, it may lead to contractual complications and litigation.

3. OTM infrastructure for Indian Coast Guard at Worli, Mumbai.



Designed by CPWD

Designed by EPC Agency

Date / amount of sanction:	29.10.2020 / 118.7 Crore
Date of start / Completion:	15.04.21 / 30.06.23

Present Status: Plans approved by MCGM on 1.12.21 with demand of 350 crores for issuance of LOA.

The project work has been awarded in EPC Mode I and the concept drawings were prepared by CPWD. EPC agency had to develop concept drawings and obtain Local body approvals. The project was awarded as best building design by CPWD, which has been changed by EPC agency to a great extent for simplification of structural design and external facade design making huge compromise on aesthetics of the building thereby converting an iconic structure into a simple glass structure retaining only the basic shape of the building that also in 2D/plan, not in 3D.

Inspite of getting approval of Local authority which is a very difficult task in Mumbai, execution / construction could not be started even almost a year after obtaining Local body approval for want of payment of premium to be made by Client for using higher FSI, which may lead to contractual complications if the same is further delayed.

Observations

- Structural design and external facade design have been changed by EPC agency making huge compromise on structure and aesthetics of the building thereby downscaling the structural design as well as aesthetics of the building which is clearly visible in pictures above. Left side one showing original concept and right one showing the simplified and designed by EPC agency for profit making.
- Construction could not be started even after one year of obtaining Local body approval (a very big task in Mumbai) which may lead to contractual complications / arbitration.

Conclusion

- Profit making appears to be the soul of EPC contract by compromising aesthetics, structure and functionality.
- There is no guaranty for adhering to the timelines of project.
- EPC contract compromises on quality of design, structure and aesthetics.
- Local body approval may get delayed in EPC contract also.
- In spite of Local body approval, construction can be delayed due to some other reasons, which may lead to contractual complications.

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Suitability of EPC Contracts for Buildings

Dr. K. M. Soni
Former Addl. D.G., CPWD

Prologue

EPC (Engineering, Procurement and Construction) differs from item rate and percentage rate contracts in terms of "Engineering" only which is a part of EPC contracts and are being adopted now particularly in major projects due to higher risks transferred to EPC contractor.

Even though EPC contracts are said to have single point responsibility, fixed time and fixed cost, practically they are not found to qualify these criteria in the present EPC contracts hence provisions of EPC contracts need to be reviewed and to be designed as turnkey contracts.

Dealing with variations and determination of EPC contracts becomes difficult compared to item rate/percentage rate contracts. As such, they lead to fait accompli condition in getting the work completed through EPC contractor only even after time and cost overrun, thus, requiring modification in existing conditions of EPC contracts.

-Editor-

Introduction

Item rate and percentage rate tenders have been traditionally adopted for construction of buildings but now discussion is going on to switch over to EPC (Engineering, Procurement and Construction) contracts particularly for high rise and costly buildings. Though India is witnessing construction of high rise buildings almost in all metropolitan cities and in their satellite towns due to constraints of land and its high cost (Soni, 2022), low rise buildings are also being adopted widely. However, additional infrastructure required in high rise buildings like vertical transportation system, parking, safety, fire detection and fire-fighting measures, pumping, air-conditioning and energy efficiency (Soni, 2019) makes the buildings further intricate, costly, and time consuming. Therefore, for high rise structures, EPC contracts are being adopted (Soni, 2019).

The clients are sensitive to get their buildings completed in time without cost overrun therefore engineers have a challenge to construct buildings in time without cost overrun simultaneously ensuring good quality. As such monitoring, coordination, decisions, availability of drawings and adoption of new technologies have become the necessity of successful project management, EPC mode of execution is considered suitable in such endeavour.

In item rate and percentage rate contracts, employer has to specify the materials and techniques to be adopted for execution of the projects through drawings, contract conditions and bill of quantities (BoQ). BoQ is generally prepared based on Schedule of Rates. Schedule of Rates includes the materials and techniques which are well proved and widely accepted hence patented and innovative technologies normally do not find place in it. As such, item rate and percentage rate tenders lack adoption of such technologies though quantity surveyors try to include few new materials and technologies, analysis of which is prepared based on the market rates. In item/ percentage rate contracts "Engineering" is the responsibility of the employer hence employer has to issue drawings, give decisions and co-ordinate with architects and designers thus risk remains with employer.

EPC Contracts

EPC contract includes "Engineering" in addition to procurement and construction which are the part of other type of contracts also like item rate and percentage rate contracts. Therefore, basic difference between EPC contract and item/percentage rate contract is "Engineering".

In item and percentage rate contracts, "Engineering" is the responsibility of the employer and as such design, drawings and BoQ are prepared by the employer or by the architect/consultants appointed by the employer. In EPC contracts, "Engineering' is the responsibility of the contractor however the contractor comes on board only after the work is awarded to him as such drawings, designs and detailed BoQ are not generally the part of EPC contracts. EPC contract generally includes BoQ having only stage or milestone based payment provisions. EPC tenders either do not include any drawing or only conceptual drawings. Detailed or GFC (Good for Construction) drawings are prepared during the currency of the contract. Thus, EPC contractor has to share most of the risks.

EPC contracts require engagement of architects, designers, engineers and many sub-contractors for execution of work hence it does not remain quality assured, cost effective requiring less co-ordination. Therefore, close monitoring is required from

the employer also. It is therefore recommended that EPC contracts may be adopted initially for intricate and technology driven structures till a suitable culture for EPC contracts is developed in the work place.

Complexity of Structures and EPC Contracts

High rise structures have complex civil and MEP services which require close coordination between architects, designers, engineers and contractors hence EPC contracts are said to be better suited for them. It is assumed that EPC contractor can engage the experts across the table or within a short time compared to the employer leading to time saving and even cost saving due to time saving. However, complex engineering structures may not necessarily be high rise structures and as such EPC contracts may be suitable for such structures also. As far as architectural complexity is concerned, most of complex structures might have been executed through item rate or percentage rate contracts. An EPC contractor may not design complex architectural structures in case conceptual drawing is not made part of the tender document or design selection is not made prior to finalisation of EPC contract. Therefore, employer has to take decision of adopting the type of contract document based on complexity of the structure and accordingly provisions are to be made in EPC tender document. However, it is beyond doubt that responsibility of sharing the risks is higher on the part of the EPC contractor compared to item rate/percentage rate contractor.

EPC and Turnkey Contracts

Though both the terms appear to be same, there can be a minute difference between the two. As already described, EPC contract is a contract in which "Engineering", "Procurement" and "Construction" (E, P and C) is done by the contractor as per the contractual provision while turnkey, as the name describes, is a contract in which contractor has to handover the complete project in a manner the employer is able to use and operate or turn the key once handed over. Thus, turnkey contract is essentially a contract of the work from concept to completion and handing over thus an EPC contract of a project becomes a turnkey contract if it includes scope from concept to completion.

EPC contract may be defined as a contract in which eEngineering, Procurement and Construction are included in the entire project or part of the project with or without approvals of the local bodies.

Suppose, there are 10,000 houses in a project to be constructed having eight towers. One way to prepare the contract is to construct 10,000 houses with all development services all together with complete E, P and C even taking all required clearances from

the local bodies from time to time. This becomes a turnkey contract and may also be an EPC contract. Suppose, the project is divided into two contracts having 5000 houses in each with their respective E, P and C still being part of respective contracts, both the contracts will qualify to be called as EPC contracts.

EPC Contracts and in house Design Capability

In many organisations, sanction of the work is required also known as Administrative Approval & Expenditure Sanction in government organisations. For getting the sanction, preliminary estimate is prepared based on plinth area rates for which conceptual/preliminary drawings are required. Plinth area rates have been derived based on the buildings constructed on item rate/percentage rate tenders. A detailed analysis is therefore required to derive plinth area rates based on completion cost of the buildings on EPC mode also so that a comparison can be made on the cost.

For inviting the tenders, tender documents are required to be prepared for which also conceptual/preliminary drawings are required along with the specifications. Further, tendered cost put to tender is found out based on BoQ which is generally lower than the preliminary cost as the completion cost of the building becomes more than the estimated cost put to tender particularly due to price escalation and variations. However, in EPC contracts, estimated cost put to tender is adopted as the tendered cost put to tender and in absence of detailed BoQ, EPC contractor generally quotes above or around the estimated cost put to tender. Hence, a methodology needs to be determined to work out the estimated cost put to tender for EPC contracts.

In major government organisations and major PMCs (Project Management Consultants) in India, in house architects and designers are available. This has its own advantages as they become specialised in their field. Architectural and structural drawings are prepared by them for the works they undertake however in case of EPC contracts, their utility is getting compromised and curtailed to checking which may lead to diminish their expertise gradually. In case conceptual drawings are prepared by in house architects, there is a possibility of copy right or proprietorship of the drawings as the detailed drawings are to be prepared by the architect appointed by EPC contractor. To overcome such situation, CPWD has classified EPC contracts into three modes. Mode – I, is described in which “Engineering, Procurement and Construction” is the responsibilities of EPC contractor however conceptual plans are to be prepared by the departmental architects. In Mode – II, architectural drawings are to be prepared by departmental architects/consultants and balance engineering being the responsibility of EPC contractor. Mode – III is in which “Engineering” is not part of EPC contract however other provisions of EPC contract included in the contract.

Provisions of EPC Contracts

Main features of EPC contract are said to be single point responsibility, better management, better coordination, fixed cost, fixed time, stage wise payments, and enhanced defect liability period. It sounds good but practically it is not so easy to manage.

Single point responsibility means EPC main contractor is responsible for E, P and C meaning thereby timely delivery of the project. But single point responsibility is with respect to the employer related to the project with EPC contractor. An employer selects EPC contractor based on his eligibility for past performance, quality, financial resources, personnel and timely completion of works etc. however, EPC contractor may engage architects, structural designers, and contractors dealing with other services like MEP, HVAC, security, AV services. Capability of such sub-contractors might have not been assessed either by the employer or EPC contractor. EPC contractor may not even disclose his agreements with his sub-contractors to the employer. In such situations, purpose of single point responsibility gets diluted even if provided in EPC contract. Few EPC contracts have provision of even 40% to 60% sub-contracting in EPC bid documents. In case of deficiency in the services by the sub-contractors, EPC contractor generally defends them.

Advantage of EPC contract is said to have better coordination. Earlier, coordination was owner's responsibility which is shifted on the contractor in an EPC contract. EPC contractor has to coordinate with client, architects, designers, associate contractors and sub-contractors, and as such EPC contractor have large coordination problems. Shifting the responsibility from an owner to contractor does not necessarily mean that coordination problem has been resolved as it has only been shifted to the EPC contractor from the employer. Even EPC contractor may have large fleet of staff as such single point responsibility may not actually mean a single person's responsibility. When EPC contractor fails to coordinate with his own staff and sub-contractors, sometimes he tends to discover the excuses by finding faults with the employer. An EPC contractor having maximum in house capabilities may have less coordination problems.

EPC contracts are considered to be fixed price contracts if they do not have escalation clause. Generally, in item rate or percentage rate tenders, escalation is paid separately hence the contractor does not need to load his tender for the escalation; however EPC contractor has to load it. When the escalation is more than the estimated loading by the EPC contractor, either he tends to slow down the progress leading to delay the work or demands for additional items leading to disputes. Therefore, key to success of the EPC contract is timely completion of the project.

Dealing variations in item rate/percentage rate tenders is easy as the process to derive the rates is well documented in the bid document and the items which are not included in BoQ or conditions of contract becomes additional items however EPC contracts are generally performance based as such all items required for performing the contract are assumed to have been included in the contract price. Therefore, employer finds difficult to take decision on the admissibility of variation leading to delay for which EPC contractor may claim additional cost and extension of time both. If variation clause is included in EPC contract, EPC contract does not remain a fixed cost contract.

EPC contract is also considered a fixed time contract but it does not mean that all EPC contracts are completed within the scheduled time. Though it is considered that entire responsibility of "Engineering" is with the contractor hence delay due to late issue of drawings is with the contractor, practically EPC contractor may claim delay due to delay in approval of the drawings as the drawings are approved by the employer. Further, any delay in making payment and approval of additional items is also considered on the part of the employer for which the contractor claims extension of time and as such the contract does not remain fixed time contract.

In case, an employer wants to determine the contract, he has to finalise the payment for the work done and also work out the cost of balance work, details of which are not available as neither total quantities and rates of items are available in the contract nor the quantities are measured during payment made hence determination of EPC contract becomes very difficult. In case of technology driven contracts where patented technology is adopted, it becomes further difficult to determine the EPC contract. Hence, it is advantageous for both employer and EPC contractor to complete the work within the time scheduled.

Main difference between item rate/percentage rate contracts and EPC contracts can therefore be summarised as given in Table 1.

Table 1: Item Rate/Percentage Rate Contracts Vs EPC Contracts

Sl. No.	Step	Item rate/percentage rate contract	EPC Contract
1	Preparation of Conceptual drawings	Essential part of such contracts	May be prepared by employer's architect or may be part of EPC contract
2	Preparation of preliminary estimate	Based on standard plinth area rates, conceptual drawings and specifications	No method prescribed as details of materials and technique not available hence prepared based on plinth are a basis

3	Preparation of Detailed drawings and detailed estimate	Required for preparation of tender documents	Since detailed drawings are generally prepared by the contractor, detailed estimate cannot be prepared.
4	Tender document	Tender document is prepared based on known and pre-decided details and specifications hence contractor is aware of the scope of work	Tender document is prepared without details and exact specifications hence each contractor may have different specifications and drawings to offer to the employer hence scope is broadly described
5	Bill of Quantities (BoQ)	Describes all the items to be executed along with the quantities required for the work	Neither items are described nor the quantities
6	Basis of contract	Based on the scope described in the tender document	Performance based
7	Risk of time overrun and Cost overrun	Risk is shared by the employer and the contractor	Theoretically, risk is on the contractor
8	Payment	Payment is made based on quoted rates by the contractor for each item	Payment is made generally based on stage payment as items and quoted rates of the items are not available in the contract
9	Variations	Easy to be decided as the contractor is paid for the same based on described procedure	Difficult to arrive at the admissibility as the contract is generally performance based
10	Coordination responsibility	Employer as well as contractor	Single point responsibility i.e. with the contractor
11	Contract price	Variable due to variations and actual execution	Said to be fixed price contract though difficult if not a turnkey project
12	Time	Theoretically time may be the essence of contract still extension of time clause is included	Even though it is said to be fixed time contract but practically extension may be required
13	Determination and foreclosure	Easy as the rates of each item executed are available in the contract	Difficult to find out the cost of balance work. It becomes almost fate accompli to get the work completed from the EPC contractor if the work is in advanced stage

Case Studies for EPC Contracts for Innovative Technologies

For technology driven structures, EPC contracts are well suited and the tender documents can be prepared which are technology neutral to suit such construction. To get familiarise to the proven and innovative technologies around the world, Ministry of Housing and Urban Affairs (MoHUA) organised a global conference named Construction Technology 2019 in March 2019 and invited innovative but proven technology providers from overseas. In all 54 technology providers attended the conference and also showcased the technologies in the exhibition arranged along with the conference in Vigyan Bhawan, New Delhi. These technologies were grouped in six broad categories as given in the following:

1. Monolithic construction technology
2. Pre-cast concrete construction technology
3. 3D modular pre-cast concrete construction technology
4. Light Gauge Framing System (LGFS) technology
5. Stay in place formwork technology
6. Sandwich panel system technology

To assess the performance, live projects were planned for taking up construction with each technology at six different places to work as live laboratories for construction of about 1000 houses at each place in a multi storeyed project. Monolithic construction technology was used in Rajkot (Fig.5), Pre-cast concrete construction in Chennai (Fig.2), 3 D modular construction in Ranchi (Fig.6), LGFS in Agartala (Fig.1), Stay in place formwork in Lucknow (Fig.4) and Sandwich panel system in Indore (Fig.3).

Fig. 1: LGFS Construction with Pre-engineered Structure at Agartala

Fig. 2: Pre-cast Concrete Construction at Chennai

Fig. 3: Sandwich Panel System Construction at Indore

Fig. 4: Stay in place Formwork Construction at Lucknow

Fig. 5: Monolithic Concrete Construction at Rajkot

Fig. 6: 3 D Modular Construction at Ranchi

After a lot of deliberations, it was decided to invite the tenders on EPC mode as EPC contracts were considered to be more suited to such innovative technologies. These projects are termed as light house projects (LHP), some of which are completed and some in progress. This shows that EPC projects though best suited for innovative technologies, do not mean that they always lead to timely completion of the projects even if the technologies provide chance for faster construction.

Conclusion

Even though EPC contract means contractor sharing of higher risks but is not the guarantee of the project getting completed without time overrun, cost overrun, quality product and disputes. Time overrun depends upon many other parameters like cash flow, approvals, timely decisions, hindrances and availability of resources with the EPC contractor and his sub-contractors. However, delay

in EPC contract may have higher financial implications, disputes and blame game between the employer and the contractor. Therefore, a time limit needs to be prescribed in the tender document for the activities required between the employer and contractor like time limit of submission of drawings for approval by EPC contractor and approval thereof from the employer.

Since, main aim of a works contract is to construct a building aesthetically pleasing, structurally sound, with quality and without time and cost overrun, a work culture needs to be developed among EPC contractors due to large responsibility on them.

Performance of EPC contractor depends upon his architects, designers, engineers, supervisors, vendors and sub-contractors engaged by him. An eligibility criterion needs to be developed for their selection and made part of the tender documents.

Determination of EPC contract becomes more and more difficult as the contract progresses. Therefore, a process of determining the cost of work done needs to be included in the tender documents.

Even with the constraints of EPC contract, it is a better alternate to item rate or percentage rate contract for complex, high rise and technology driven projects hence more and more awareness needs to be generated among architects, engineers and contractors.

Further, there is a need to adopt EPC contracts having scope of work from concept to completion i.e. turnkey contracts and a standard document needs to be prepared based on the experience to overcome the difficulties faced by the employers as well as contractors in the operation of EPC contracts in present form. The document also needs to be modified frequently on getting more and more experience.

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EPC Model of Contracting
Reality & Suggestions

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Prologue

Adopting EPC model of contracting got a thrust vide Niti Aayog OM No-1470/14/2016-PPPAU dt Sep 05, 2016. In this OM Niti Aayog has categorically stated that "Item rate contracts may be substituted by EPC contract, wherever appropriate". "Wherever appropriate" was left to be interpreted by Project Executing Agencies. Over the period, different project executing agencies have interpreted the same as per their own convenience with thrust to call tenders immediately after receipt of sanction, sometimes even at the cost of compromising broad objectives of EPC mode. Some of the organisations are treating EPC as a panacea for every type of work and have started calling tenders in EPC mode for almost each kind of work.

-Editor-

Introduction

Construction sector has been facing many problems and few of the biggest problems identified are quality, cost and time overrun. In traditional model of Design-Bid-Build models it is difficult to fix responsibility of a single party for quality of work and delays in execution. To address these issues, Engineering, Procurement and Construction (EPC) model of contracting was adopted by few Project executing agencies (PEA's) in India in Roads and Railways projects where not much fine details are required to be specified.

Objectives of EPC Model of Contract:

- Start project at the earliest after sanction of project (PEA's not required to do detail design preparation and obtain approvals from statutory bodies)
- Minimize efforts of Project Executing Agencies (PEA's to have hands off approach)

- Complete projects in time (No delays due to design and approvals by department, Extension of time is granted primarily due to Force Majeure)
- Reducing overall cost of project (Optimization of design and execution by EPC contractor)
- Keep the cost of project fixed (No extra items, variations allowed in EPC contracts, cost increase is due to Price Adjustment clause only) i.e. no requirements of revised sanctions etc
- Single point of responsibility (Make EPC contractors liable for design, construction defects and Operation Maintenance for longer periods)
- Confidence building among all stake holders (involvement of 3rd party Design vetting and 3rd party inspection)
- Reduce litigation (Grounds of litigation are reduced in EPC contract)

Existing Scenario

EPC model was devised for simple/repetitive kinds of like: railway tracks, railway traction work, roads, housing etc, ordinary/typical office buildings. The idea of switching over to EPC contract was to call tenders at the earliest without department getting involved into difficulty of detailed designs, which is supposed to be done by EPC contractor. Hence the works requiring fine details or the works where fine details can be properly developed as part of design development (like patient movement and logistic movements in hospitals and hotels, layout of highly technical equipments requiring 3D views in case of Data Centres) are certainly not suitable to be executed in EPC mode.

In case of non-repetitive or specialized works unless full details are specified in agreement, EPC contractor will not be able to account for proper costing of the same and find difficulty in meeting the expectations of PEA which leads to disputes. We need not forget that contractor participates in tendering process with his lowest quote for the scope of work as understood by him to earn profit. Once the scope of work carries without corresponding variation in cost (which is mostly not possible for the PEA to agree in EPC contracts) relations between PEA and contractor become sour and not only work suffers but also the image of PEA becomes darker.

To address above issues, some departments have devised new format of EPC mode where Architectural and/or service drawings are being issued to contractor at the

time of tender and/or subsequently. This format is short sighted and is against all the objectives of EPC tenders:

- Requires considerable time by department in preparing tenders
- Issue of drawings after award of work in EPC tender is legally wrong.
- Responsibility of design shifts with department (irrespective of whatsoever is mentioned as tender condition)
- Increase in disputes and arbitration cases.

Decision makers feel that EPC tenders can be called in no time as it does not require detailing. However, the fact remains that defining scope of work, clear cut requirements and specifications are more important in EPC tenders compared to traditional design-bid-built tenders as tender is practically on Lump sum basis. Decision making bodies must understand that requirements of a project must be clearly spelt out leaving no ambiguity. Each project has a specific feature. Although past experiences of similar projects help in specifying what we want in the current project but it always requires considerable time for making proper specifications.

In order to comply the directions and wishes of decision makers, PEA's are mostly in a hurry to invite EPC tender (mostly without properly specifying their requirements). In such cases we may save some time in starting the work but tend to spend more time in resolving problems after award of work. Even after lot of brain storming to solve these issues, many issues remain a knot between contractor and PEA which leads to disputes.

Conducting pre-bid meeting is also one issue which need to be relooked. Stakes are high in EPC tenders. Pre-bid meetings is an opportunity to remove defects in tender. It helps in improving quality of final tender document, minimizing doubts, reducing administrative and vigilance cases as many serious defects in tenders are set right as minutes of meeting /corrigendum. Bidder need time to read voluminous bid document, understand the same and prepare for pre-bid meeting. I feel minimum 21 days (to be linked with cost and complexity of the work) is required for the purpose. Time for submission of tenders should be counted after issue of minutes of pre-bid meeting.

Another issue which is ailing the EPC system is time allowed to bidders for submission of EPC tender. PEA's are using old yardstick of traditional design-bid-built system for time allowed for submission of tender. In case of EPC tenders, in order to submit a serious bid, contractor and his team must understand complete project involving

various disciplines, tie up with architect and consultant suitable for the work, develop working design, make Bill of Quantities, work out costing, assess various risks involved, and then submit tender. If sufficient time for bid preparation is not given, the bidder/bidders are left with no option but to quote without proper working. In such bids either lowest/accepted quote is on the higher or lower side. In both cases purchaser suffers. If the accepted bid is on high side, it is a financial loss to purchaser. If the lowest accepted bid is on lower side, contractor may not be able to complete the work or compromise on quality because of poor rates. Sometimes PEA's are extending the submission dates at the request of bidders, but extending the dates does not help much in preparing serious bid. Because the bidder has already half prepared their bids based upon his experience but without detailed working assuming that bid was to be submitted as per original schedule and extended period of submission is not enough to allow a bidder to do detail working for serious bid. Such extensions only help those who were still making up their mind whether to submit bid or not.

Engagement of 3rd party for proof checking and quality control plays an important role in ascertaining quality of work in EPC contracts. In general, 3rd party is being appointed and/or paid either by PEA or by contractor which makes 3rd party loyal to his pay master. My suggestion is to appoint and pay 3rd party just like the appointment and payment to Arbitrator is done. This will make 3rd part responsible and independent to both PEA and contractor.

Some departments keep defect liability period (DLP) like that in traditional contracts and that too without operation and maintenance (O&M), sometimes due to funds constraints for O&M. This arrangement is neither as per spirit of EPC system nor in the interest of project and tarnishes image of both the contractor and the PEA.

DLP can be honoured by EPC contractor without dispute provided operation and maintenance (O&M) of all mechanical, electrical, and plumbing services is also done by them during the DLP to avoid any buck passing/fault finding by PEA and/or contractor. I suggest to always keep DLP along with O&M of all services for 10 years so that any design and construction fault can be noticed by PEA and rectified by the EPC contractor during the DLP. Suitable clause may be provided for meeting the O&M cost of 10 years after completion of main construction work in the EPC contract. Budget shall be provided from the maintenance grant of respective years and in case non availability of the same O&M may be suspended. This arrangement shall guarantee better quality and performance from the EPC contractor.

The recent trend of increase in arbitration cases even in EPC contracts is a fallout of the issues listed above. Increase in arbitration cases is an indicator of dissatisfaction between PEAs and contractors and the same is not good for any stakeholder.

Experience Gained

Experience of EPC contracting in India is mixed. In many of the cases where EPC model of contracting has been adopted, neither Builder nor Procuring entity is happier after EPC mode of contracting. Builder is feeling that too much is being expected from him as specifications and standards mentioned in the contract are being read/ interpreted by PEA in a theoretical/narrow-minded/robot like manner, sometimes even against the interest of the project. PEAs are unhappy as their hands are tight and if they think of any improvement with respect to design or execution after award of work, contractor not only makes huge claims but delays the work as well. The problem is more acute in case of specialized works (hospitals, hotels, data centres, scientific buildings etc) in EPC mode.

Conclusion

Theoretically EPC model should have been able to fulfil the wishes of all stakeholders (Financers, PEAs, Contractors) but the reality is different. It is the implementation of EPC model which needs to be relooked. EPC contracting is required to be used in "appropriate cases" and the RFQ's/Tenders for EPC works need to be prepared with abundant caution by specialists having good experience in preparation of EPC tenders. EPC tenders should have long DLP and O&M during DLP. Sufficient time be allowed to bidders at first instance itself for submission of bid so that EPC bidders can prepare proper bid and submit the same with confidence. These measures are required so that objectives of EPC tenders are met and EPC model of contracting is not discarded due to poor implementation.

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Engineering, Procurement and Construction (EPC) Contracts in Building & Road Infrastructure Industry

Rajeev Singhal
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Prologue

Till recently, the engineering departments have been adopting the item rate or percentage rate contracts where many necessary items were left out either due to ignorance or inadvertently. The construction projects have become more and more complex with technological advancements and the project owners desire to reduce the risks on their part. As a result, EPC contracts are being increasingly adopted. In EPC Contracts the project owner transfers the risk in the entire process of construction to the contractor to a large extent. In compliance of Niti Aayog instructions, many departments have introduced EPC contracts in place of item/ percentage rate contracts. Model bidding document for EPC contract was also circulated by Niti Aayog. Many government departments like CPWD and NHAI have introduced their own bidding document for such contracts.

-Editor-

Introduction

EPC Contracts are the latest mode of contracting for all the large building and infrastructure projects. Need was felt to move on from the traditional Item rate or Percentage Rate contracts to a different form of the contract where the government agencies could call the tenders quickly without going into the nitty gritty of doing a detailed design, deciding the quantities of thousands of items forming part of the project, worrying about the procurement of materials and getting the statutory approvals from various agencies. EPC contracts have been adopted in CPWD for works costing more than Rs 100 Crores and a bidding document has been developed exclusively for EPC contracts.

What are EPC Contracts

EPC is short form for Engineering, Procurement and Construction. These are a sort of "Turnkey" contracts and most of the large-scale projects for creating infrastructure involving several complexities are taken up by adopting this form of contracts.

The EPC contractor is responsible for all the designs, procurement of materials, construction as well as performance of the project after construction.

Worldwide Adoption of EPC Contracts

The EPC contracts have become popular as the project owners transfer the risk in the entire process of construction to the contractor to a large extent as the contractor becomes responsible for the all the activities of the project like design, procurement of materials, testing, execution, getting the statutory approvals and commissioning of the project.The role and responsibilities of the project owner and the contractor are clearly defined. These are sort of "fixed price" contracts where additional costs become payable under the circumstances mentioned in the contract like change of scope or increase in price of materials and labour etc.

Need of EPC Contracts, Merits and Demerits from Perspective of the Owner

NEED:- The need for EPC contracts was felt as all the project owners did not have the required expertise and experience to execute the projects. This became more apparent as large projects have several complexities with more and more innovations in technology with each passing day. Lack of knowledge of the complexities of a project means that there would be a greater risk of time and cost overrun. In such a scenario, the financial institutions would not come forward to provide finance for the project. Need was therefore felt to transfer the responsibilities of execution to an agency who had sufficient experience and expertise to execute the complex projects so as to save the owners from risks of time and cost overrun.

EPC contracts act as a risk transfer tool which transfers the risks associated with the execution from the owner to the contractor to a large extent.

MERITS:- The entire responsibility of design, procurement of materials, construction and getting statutory approval lies with the contractor. The project owner can chalk out the specifications and performance criteria as per the requirement without going into the nitty gritty of working out items of work and their quantities which saves a lot of

time and energy on part of the owner. The right to modify the specifications or scope of work is reserved by the owner, so modifications can always be made by the owner after entering into the contract with commensurate cost adjustments.

DEMERITS:- EPC contracts are likely to be more costly in the shorter term as the project owners transfer their risk to the contractor. Also, as the entire responsibility of design, procurement, construction, commissioning, getting the requisite statutory approvals and handing over lies with the contractor, the owner or the government department owning the construction experts have less role and control over the project.

Also, many of the private construction agencies or the contractors lack the requisite expertise to plan and design the complex projects on their own. They rely on outside consultants for this important aspect of the EPC contracts. There is a tendency to cut costs while selecting the consultant resulting into poor planning and design and ultimately higher costs or a poorly designed project.

EPC Contracts in India

NITI Aayog had examined the problems being faced by the Construction Industry in India and held detailed consultations with the representatives of the construction industry, concerned government Departments and Ministries, PSUs and Banks which provided finance for the contractors. Based upon these deliberations it was decided to adopt a different format for contracts. The NITI Aayog issued instructions in September 2016 that all the Ministries and Departments should adopt EPC contracts in place of the Item Rate Contracts as adopted traditionally. As a follow up, the Ministry of Urban Development issued directions that contracts for all the works costing more than Rs 100 Crores may be called in EPC mode only and that outside design or structural consultants may not be engaged as it would also be a part of the EPC Contract. CPWD adopted the EPC mode of contracts for all the works costing more than Rs. 100 Crores unless a specific waiver is given for not adopting EPC format due to peculiar circumstances.

Bid Document for EPC Contracts

The Railways and Highways sector had already adopted EPC model of contracts and the erstwhile Planning Commission had developed a Model Contract Document for EPC works. NHAI had also adopted this document for their contracts. Model bidding document for EPC contracts was also circulated by NITI Aayog for guidance of various stakeholders.

There was no separate format for EPC contracts in CPWD. The tenders were invited by adopting the General Conditions of Contract available for Item Rate contracts after making modifications to make them suitable for EPC format. CPWD developed their own model document and issued it in the year 2019. The document was revised based on feedback received from the field formations and issued in the next year, i.e., 2020.

In spite of these modifications, a need was felt to have a detailed review of the bidding document and issue a fresh one after considering the feedback received from field officers and also looking into the model bidding document of NITI Aayog and format adopted by NHAI.

The revised bidding document was issued by CPWD in 2022. This is now being adopted by CPWD in all works costing more than Rs. 100 Crores. The bidding document of CPWD for Item Rate Contracts is widely used outside CPWD by PSUs, State PWDs etc. for execution of their works and the new bidding document for EPC contracts is also expected to be widely used by other departments and PSUs. It is important to understand the changes that have been brought in the new bidding document.

Important Provisions in EPC Contracts of CPWD

(I) Concept of different "Modes" for EPC contracts has been brought in

a. Three modes of EPC contracts have been specified.

Mode I: The conceptual architectural drawings are attached with the tender document and the contractor has to carry out the architectural, structural and services design and prepare the drawings followed by procurement of materials and construction.

Mode II: The preliminary architectural drawings are provided by the owner, i.e., the department along with the tender document and detailed architectural drawings are provided during execution stages. The contractor has to carry out the structural design followed by procurement of materials and construction.

Mode III: The responsibility of providing the architectural, structural and services design and drawings rests with the project owner, i.e., the department. The contractor is responsible for procurement and construction.

b. Provision of permitting the contractor to choose any of the approved construction technologies for tenders invited in Mode I and Mode II has been made. The list of approved technologies has been issued by CPWD.

(II) Modified Clauses of Contract in GCC-2022 EPC Projects

- **Clause 10C, 10CA and 10CC**

These are important clauses dealing with price adjustments after receipt of tenders on account of variations in wages and/or prices of materials. Clause 10C deals with price adjustments due to variation of wages of workmen due to statutory orders, Clause 10CA deals with price adjustments due to variations in prices of important materials like cement, steel reinforcement, structural steel etc and clause 10CC deals with price adjustments due to variations in prices of materials not covered in clause 10 CA. In the item rate contracts, escalation for materials covered in clause 10CA is paid based on actual consumption of materials and escalation on remaining materials/ labour is paid in clause 10 CC.

This has been modified for EPC contracts and a single clause 10 CC has been kept. The percentages of labour and all the materials like cement, reinforcement, structural steel, POL etc are defined by the NIT approving authority in the tender document. This is an important modification as measurement of materials consumed in a work need not be done in works executed in EPC mode.

- **Clause 12**

This clause deals with cost adjustments due to variations in scope of work or specifications. As in traditional item rate contracts, provision has been kept in EPC contracts for executing any additional work. Concept of "change in scope" has been brought in instead of specific items of work. However, it has been specified in the EPC contracts under clause 12.2 that in case there are any changes in the scope defined in the contract as per decision of the project owner leading to additional cost, nothing shall be payable to the contractor if the amount is up to 0.25% of the accepted tendered amount. There was no such provision in the traditional CPWD contracts where cost of each item not specifically mentioned in the contract had to be paid to the contractor, however minor the item may be.

- **Clause 14**

A new clause has been added regarding soil investigation and other preconstruction activities by the contractor. No such provision existed in earlier bidding documents of CPWD.

- **Clause 17**

A defect liability period of Three years after actual date of completion has been specified for works in EPC contracts instead of the traditional provision of One

year. The contractor has been made liable for defects due to improper planning and design also wherever these are within the scope of the EPC contractor.

Since the defect liability period is three years after completion of the work, provision has been made under clause 17.6 that fifty percent of the security deposit shall be released after eighteen months and remaining fifty percent after completion of defect liability period.

The concept of "Structural Soundness" of constructed work has been brought in and it has been stipulated that the contractor shall be liable for structural soundness of work owing to execution of work in the scope of contract for a period of ten years after completion of the work.

- **Clause 22**

A new clause for quality assurance and supervision for execution part of the work has been added. The EPC contractor has been made responsible for-

- Quality of materials and workmanship. The contractor is made responsible for carrying out work as per specifications and standards set out in the contract with reference to both materials and workmanship.
- Developing a quality assurance plan, identifying specific persons for quality assurance and developing a plan of action to assure quality and document the entire process.
- Testing of all the materials, preparation of "Method Statements" for all the important activities and ensure implementation.

The project owner has reserved the right to inspect all components of work, records and carry out a third-party quality audit. He has the right to reject or take remedial measures for any work if it is not as per the contractual terms. This clause is important as the control of the project in EPC contracts lies with the contractor to a greater extent.

(III) Operation of EPC contracts by CPWD and Government Departments

Officers in CPWD and similar State PWDs and PSUs work under the instructions/ provisions or rules of their respective departments which are binding on them for operation of contracts. As we move away from traditional item rate contracts to EPC contracts and with growing complexities of the works, such rules and "Works Manual" provisions governing the contract operation also need to change.

CPWD has made modification in the "Works Manual" to make it more amenable to operation of EPC contracts.

- Technical Sanction: In traditional item rate contracts, a detailed estimate listing all the items and their specifications was prepared by the engineer in charge (project owner) after a detailed design and a "Technical Sanction" was granted to such a proposal to certify that it was technically sound. In case of EPC contracts where responsibility of design rests with the contractor, there is no need to accord Technical Sanction of the detailed estimate of the work before invitation of tenders. This modification has been done in para 3.1.1.6 of the CPWD Works Manual 2022.
- Justification of Tenders: The procedure of preparing justification before acceptance of the tender by the competent authority has been made simple in CPWD. The justification can be simply prepared by enhancing the Plinth Area Rates for the work covered in the scope of the tender by the current cost index.

(IV) Provisions regarding maintenance

Maintenance component is added along with the construction component in the EPC contracts. In CPWD, a maintenance period of 3 years after the completion of project is normally specified to coincide with the defect liability period of 3 years after completion of the project.

The standard bidding document of MoRTH has specific provisions regarding maintenance during construction and after completion of construction of the project. The contractor has also to submit a "Maintenance Manual" to the project owner for regular and preventive maintenance of the project highways. After completion of the project, the contractor has to maintain the project for a period of five/ten years corresponding to the Defect Liability period. The document prescribes 5 years maintenance period for flexible pavements and 10 years maintenance period for rigid pavements and all concrete works.

Case Study

"Providing connectivity between northern Mahipalpur Bypass Road, NH-8 and Northern Access Road from Airport by construction of flyovers/ underpass".

This was a road infrastructure work to improve the connectivity of the Indira Gandhi International Airport (IGIA) with Mahipalpur Bypass Road and NH-8.

This work was entrusted to CPWD by MoH&UA on 05/10/2017. The sanction amounting Rs. 188 Crores received from DDA on 11/12/2017. Clearance of Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre, i.e., UTTIPEC was received on 11/01/2018.

It was decided to take up the project in EPC mode. Standard bidding document of CPWD for EPC works was not available at that time. It was decided to adopt the model bidding document of NITI Aayog with some modifications for the work.

Major components of the project were-

(a) 2 × 3 Lane Vehicular Underpass below NH-8 along with ramps and Loops for right turn movement

(b) Unidirectional Bridge in front of existing Tunnels in Airport area

(c) Unidirectional Flyover near Pocket E-2 Vasant Kunj

(d) Widening of existing roads in influence area along with construction of Drains and Footpaths

The tenders were invited and work was awarded in January 2018 with contractual date of start as 30.01.2018. A tight time schedule of 400 days was specified for the contract and the work was to be completed by 5th of March 2019.

The difficult component of the project was the underpass below NH-8. The underpass was constructed by adopting the box pushing technique which was specified in the contract. The challenges were:-

- The boxes were heavy. Each box weighed around 900 MT. The clear size of box was 11m × 5.9 m, length of 10m and uniform thickness of 1m. Two boxes were placed side by side for the traffic moving in two directions.

Fig.1: Construction of Boxes for Underpass

- Traffic on NH-8 could not be stopped even for a moment while box pushing was done below, so pushing was mainly done in the night when traffic intensity was low.
- Part of the strata was rocky and that made the pushing difficult.

Fig.2: Rocks being excavated and brought out of Underpass

The above complexities of the project have been explained to show that EPC format of contracting can be successfully adopted for challenging projects with uncertainties and the work can be completed on schedule. The project was not only completed within contractual time but also with savings vis-a-vis the sanctioned cost.

Fig.3: Layout Plan of the Project

Photographs of the Completed Work

Fig.4: View of the underpass below NH-8

Fig.5: View of the flyover at Vasant Kunj

Fig.6: View of the ramps of the underpass

Fig.7: Bird's eye-view of the flyover at Vasant Kunj

Fig.8: Bridge in front of existing tunnels of Airport

Fig.9: Birds eye-view of the underpass and slip roads

Conclusion

EPC mode of tendering is the way forward for execution of large-scale projects in private as well as government sector. Since, the government sector has been traditionally executing projects in the Item Rate or Percentage Rate mode, it may take some time for the departments (project owners) and the contractors to adjust to the new mode of contracting. The standard bidding document evolved by CPWD for EPC contracts takes care of the concerns of the contracting parties and may be further refined with passage of time based on feedback received from the departmental officers as well as the contractors.

The project owners have to be very clear about their requirements and they should spell them out clearly in an unambiguous manner. The contracting agencies should not shy away from engaging competent consultants to get a well-planned and designed project.

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Execution of Projects on EPC Contracts in Construction Sector

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Prologue

The EPC contract stands for the Engineering, Procurement and construction contract which is one of most popular contract methods in large infrastructure construction projects. The other types of contracts popular in India are Cost plus contract, Item Rate contract, Turnkey contract, Lumpsum contract, HAM (Hybrid annuity contract), DBOT (Design Build operate and Transfer) contract, TOT (Toll operated and transfer) etc. From Department like NHAI point of view, the cost-plus contract has maximum risk because the customer needs to arrange finance and pay for all variations occurred during the execution while the DBOT has minimum risk where the executing agency needs to design, construct, and mobilize fund. In EPC contract, the contractor is considered as the single point of responsibility and is solely responsible for the execution of the work till completion. The contractor is responsible for rectification of defects till the completion of the Defect Liability Period (DLP). Since, the contractor's scope includes the designing of structure in EPC contract, so they are responsible for the quantity variation, but the contractor can claim the price variation for scope change wherever it takes place escalation clause. However, the EPC contract may have the fixed contract price in which the contractor shall be responsible for the price and quantity variation.

-Editor-

Introduction

India will become the third largest economy in the world very soon and the focus of the Government has now been shifted to the implementation and execution of long pending infrastructure projects to meet the growing need of the Indian economy. The capital expenditure by Government in infrastructure segment provides a platform for the growth of the private investment as well as business.

"According to the Ministry of Statistics and Programme Implementation, which monitors infrastructure projects of Rs 150 crore and above, out of 1,521 projects, 380 reported cost overruns and as many as 642 projects were delayed."

There is a cost overrun of more than 4.58 lakh crores from 380 projects having value more than 150 crore and the average time overrun in these projects is 42 months. Ensuring the timely completion within the planned budget is one of the major challenges for the departments. Several departments like DMRC, NCRTC, state PWDs etc are executing the big project under conventional item rate contract in which all risks pertaining to the execution of work, timely approval of drawings and cost overrun come under their scope. The item rate contract is beneficial when the size of the contract is small and the capacity of the contractor is limited. In item rate contract, the department does the detail drawing as well as estimates for each BOQ items which may results in deviation in quantity, introduction of extra item, introduction of the non-scheduled items or substitute item due to minor changes. All these things create dispute with contractor while execution and deriving the mutually agreed market rate. Hence, EPC contract proves to be cost and time effective for the client as detailed design and deviation of BOQ items come under the scope of contractor.

Distribution of Scope of Work in EPC Contract

In EPC contract, the scope of work for the Departments/Clients includes the DPR preparation, land acquisition, utility shifting, arrangement of finance required for construction work, selection of the executing agencies, operational work, and its maintenance. After getting all approvals from the concerned authorities, the client department issues NIT (Notice Inviting Tender) with details of technical and functional specifications required for the construction of project. Based on the technical and financial evaluation, the customer selects the executing agency/agencies.

In EPC construction contract, the contractor holds the responsibility of detail designing of the structure and its approval from customer, execution of work and procurement including mobilization of labour, machinery, and material. After the completion of the project, the site shall be handed over to the Client Department for operational and maintenance work.

Advantages of Implementation of EPC Contract for Employer

- **Single Point Responsibility:** There is a single point responsibility of the contractor under EPC contract which includes the Design, Procurement, Resource mobilization, Execution work and he is solely responsible till

the completion of the project. The EPC contractor shall be liable for any defect or construction faulty till the DLP period and need to rectify the defects. Since the design, procurement, and actual execution on site of different work packages are being done by the same agency, the employer needs to deal with single agency. Hence, controlling and monitoring of work becomes easy. The issues of managing and instructing multiple agencies get reduced and hence, lacunas and delays arise due to multiple point responsibility get reduced. As the contractor carries the complete project solely, hence can execute the work with large freedom and design innovation.

- **Design Risk Minimization:** In EPC contract, the contractor is responsible for the designing the structure and hence cannot claim the extension of time and financial loss for delay or change in designing work.
- **Inventory Holding Cost:** The contractor needs to procure the materials required for the construction of project and the Client Department shall pay only for the completed activities. Hence, the Client Department doesn't require store/warehouse and stock optimum quantity of material and this way the Client Department mitigated the inventory holding cost. Further, the stock out costs due to non-availability of the material shall be borne by the contractor.
- **Saving in Capital Expenditure:** The contractor shall be responsible for the mobilization of the project specific resources like gantry crane, barge, multi-axle trailer etc which will help in reduction of the fixed assets cost and its maintenance. This way the Client Department will become asset light entity and can focus on its core business which is operational work.
- **Compliance of the Labour Related Law:** The EPC contractor needs to get the licence and approval from the labour commissioner as per Labour Act. Further, the compliance of wages, PF, ESI etc shall be done by the contractor and the approval copy needs to be submitted to the Client Department for reference purpose. The contractor shall be responsible for the preparation and reimbursement of the wages of workers.
- **Documentation as per QMS:** The contractor needs to prepare the quality management system for the project execution work as per the technical and functional specifications provided during the NIT and get it approved from the Client Department. The contractor shall be responsible

for the cost of implementation of Quality Management System (QMS) like Destructive or NDT testing, report preparation, work methodology preparation etc.

- **Contractor's all Responsibility for Insurance:** The EPC contractor needs to get the insurance for the execution of the work and shall be responsible till the completion of all execution work.
- **Overhead Saving:** By implementing the EPC contract with the executing agency, the Client Department may reduce the overheads as the execution as per Quality Management System (QMS), Environment, Health & Safety (EHS) plan comes under the contractor's responsibility.
- **Quantity Variation Cost:** Since, the design comes under the contractor's scope, increase in the project value variation due to the quantity shall be borne by the contractor.
- **Stage Payment:** In EPC contract the payment is linked with the completion of construction stage which encourages the contractor to focus on physical process not financial progress only.
- **Security:** After issuing the LOI (Letter of Intent), the contractor needs to submit the PBG till the completion of the project and customer also holds security deposit for the executed work till Defect Liability Period (DLP).

Limitations of Implementation of EPC Contract for Employer

- **Loosing Core Competency due to Design Outsourcing:** By sub-contracting the design part to the EPC contractor, the Client Department may lose its design core competency. Further, the scope of the implementation of the employer's innovating and creative ideas will be limited.
- **Limited Construction related exposure for the Client Department:** Since the contractor is solely responsible for the complete execution of the project, the exposure of the engineers in the department in the execution of the project is very limited as they are not directly involved in the finalization of enabling structure, method statement, procurement, machinery finalization etc.
- **Finance Cost:** In EPC contract, the Client Department needs to arrange the fund required for completion of the project hence the interest

cost incurred till operation of the project shall be borne by the Client Department.

- **Cartel Formation:** Due to limited inhouse research and design capabilities, many companies are not eligible to technically qualify hence sometimes construction companies may form cartel and maximize profit from this.

Conclusion

The main reason for the cost overrun and delay in the large infrastructure project is the poor initial planning and large risks associated with the Client Department. The implementation of the EPC contract will make easy for the Client Departments to shift focus to the monitoring and controlling of the projects. The statutory approval, designing of the structure, and finalization of the work manual and methodology will require limited involvement of the Client and the contractor can execute the work with large freedom and design innovation. The EPC contract provides the certainty of the execution within the quality and time because the design comes under the scope of contractor and hence will results in timely completion of the large projects within agreed cost. The EPC contract improves and modernises the execution capabilities of the Client's engineer at faster rate.

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Engineering, Procurement and Construction: Case Studies of Different Modes in Different Situations and Different Stations

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Prologue

Engineering, Procurement & Construction Contract (EPC) is a type of construction contract between contractor and employer/owner where the contractor is responsible for all the engineering, procurement, and construction activities to deliver the completed project to the employer or owner within a pre-defined time and agreed cost.

Item rate and percentage rate tenders have been traditionally adopted for construction of buildings but now switching over to EPC contracts is being considered particularly for high valued projects. Buildings are getting more and more complex, costly and prone to delays due to complex civil and MEP services, additional infrastructure required in high rise buildings like vertical transportation system, huge requirement of parking, safety, fire-safety measures, air-conditioning and energy efficiency etc.. The clients are hypersensitive to get their buildings completed without time and cost overrun thus engineers have a challenge to construct the buildings without time and cost overrun and without compromising quality. Therefore timely availability of drawings, coordination, timely decisions, monitoring, & adoption of new technologies has become the necessity for successful and timely completion of project. In such situation EPC contracts are being considered a better option especially for complex engineering structures, technology driven structures and high rise structures. For technology driven structures, EPC contracts are well suited and the tender documents can be prepared which are technology neutral to suit such construction as in such projects technology to be adopted is left to be decided by the contractor..

-Editor-

Introduction

Whenever a project is conceived, it must undergo several stages from inception till handing over to the client. Such stages may be listed as topographic surveying, soil investigation, assessing the requirements of client, preparation of conceptual drawings for initial approval of client, preparation of detailed architectural drawings, their approvals from the client, approval from various local bodies like local municipalities, archeological department, traffic, fire, airport authority, environmental and many more department depending upon the location of the project and statutory requirements of the particular location. Thereafter, it requires appointment of structural consultant, finalisation of structural drawings, proof checking of structural drawings, appointment of construction agency, appointment of specialised agencies, appointment of 3rd Party Quality Assurance, sometimes Project Management consultants etc. Many of these stages, are essentially to be completed by the owner department. Just see the scenario, if the owner department continues their involvements in taking all these approvals, how much resources in terms of time, finance and manpower are required? Certainly, it requires lot of resources in all manners. It is observed that there is acute shortage of staff at various levels, due to which it is becoming more and more difficult to get timely approvals resulting in the abnormal delay in starting the construction work at site. At this stage, delay causes increases in cost of construction which inturn causes lot of bitterness/unpleasantness to the client. The solution is to adopt EPC mode of tendering, where most of the activities are resolved under one umbrella. Ministry of Housing and Urban Affairs (MoHUA) took the initiative and decided to promote EPC mode of contract. In the recent past, CPWD has started taking up the construction of the high valued projects (Projects costing more than ₹ 100 Crore) in EPC mode.

Different Modes of EPC Contracts:

In CPWD, there are 3 modes of EPC in force as below:

- **EPC Mode 1:** In this mode, the department prepares only the conceptual drawings before bids are invited. It is the responsibility of the contractor to get the detailed architectural drawings prepared as per the requirements of the client, taking their approval from client and from various local bodies. The responsibility of structural design and vetting from proof consultants is done by the construction agency itself. The construction work is taken up by same agency under EPC mode 1 contract.

- **EPC Mode 2:** In this mode, the detailed architectural drawings are prepared by the department either in house or through the appointment of architectural consultant. The responsibility of approval from the local body may vest with the architectural consultant or the owner of the project. In the later case, generally the local body clearances are added in the scope of the construction agency.

- **EPC Mode 3:** In this mode all the architectural as well as structural drawings, after getting them finalised from the separately appointed consultants, are made part of the EPC contract and the construction agency is required to just execute the work as per the specifications and scope defined in the contract.

Since all technical responsibilities in EPC contracts vest with the construction agency, the department is relived of even sanctioning the job technically. The payment to the agency is released as per the pre-defined payment schedule in the contract. This saves lot of resources in making detailed BOQ, making lengthy bills involving lot of calculations and thus lot of man hours are saved. There are merits and demerits in both the systems i.e. EPC mode or the earlier practice of contracts with detailed BOQ.

Case Studies

EPC contracts were undertaken/ dealt by the 1st author (Shri Shishir Bansal) at Ladakh, Awantipora (Kashmir) and Mumbai. The geographical conditions, weather situation and availability of resources varies a lot amongst these 3 locations in India.

As per the weather conditions, Ladakh faces abnormally low temperature up to -30°C and is disconnected from other areas of Himachal, J&K by the road network for 6 months in a year. Kashmir is certainly better as far as ambient temperature is concerned. The temperature generally drops up to -10°C, while Mumbai being a coastal area does not have such freezing temperature issues. There is scarcity of all kinds of Engineering resources in Ladakh whereas Kashmir is little better, but not fully equipped with desired resources and Mumbai does not face such issues. Thus, all these 3 locations are different.

Various Works in UT of Ladakh

Ladakh region was declared as UT of Ladakh in August 2019. Immediately thereafter, CPWD opened O/o CE cum ED at Leh in Dec-2019. CPWD met all the challenges and established not only Zone, but started the construction work for various departments in the UT of Ladakh such as Police, Rural development, Public works, Technical Education, Higher education, Health, Ayush, Social Welfare, Industry & Commerce etc. Due to prevalent geographical and weather conditions, outside agencies were not much inclined to set up their establishment for taking any assignment in Ladakh, thus limiting the resources in this valley. Existing construction agencies were not capable of taking contracts of high value. Attempt to make a panel of local Architect consultants was also not successful. In the absence of local support, it was felt essential that the works are carried out in the EPC mode irrespective of their cost.

During the initial one year, bids were invited for office accommodation of Hon'ble Lt. Governor of Leh, Police works, Office complexes for Rural Development Complex and Resource Centre at Leh and Kurbathang-district Kargil, Health department (AYUSH) and 6 small span bridges at Hipti, Thiksay, Agling, Udmaroo, Bogdang and Deskit in district Lehin, Ladakh. Due to limitation of resources in finalising the drawings and preparing the BOQ, building works were conceived as Pre-Engineered buildings and in EPC mode 1.

Fig.1: Office Accommodation for Hon'ble LG of Ladakh at Leh

Limitations in Ladakh region need to be appreciated. The staff posted at Ladakh are not willing to join in such tough conditions. Due to scarcity of staff, it becomes extremely difficult for CPWD to even prepare BOQ. Despite all such limitations, preparation of conceptual drawings with local architects and framing of preliminary estimates were completed promptly and

administrative approval was also conveyed on fast track. The biggest challenge was the detailed working drawings for which CPWD had to rely on the construction agencies.

Thus under these circumstances, EPC mode 1 was the best option. The works were carried out successfully in this mode except for the main project at Ladakh i.e. Capital Complex and some other buildings like Raj Bhawan, Secretariat, Ceremonial Block, State Guest House, Police HQ, Housing, etc. For this mega-project costing more than ₹ 1500 Cr., the conceptual drawings were finalised in-house by CPWD office at Chandigarh. But, due to various administrative reasons, land for the capital complex was not finalised by local Government and Hill Council and so the building plans could not be finalised. Once the land and building plans are finalised, work shall be carried out in EPC Mode 1, the best available option in this region.

AIIMS Project at Awantipora, UT of Jammu & Kashmir

With the separation of Ladakh, J&K was also declared as a separate Union Territory. The geographical and weather conditions of valley of Kashmir is not as challenging as Ladakh, but it has other type of challenges. Due to unrest in this area for nearly 3 decades, dense existence of Army is observed, which is essential for restoration of peace in the valley. After J & K was declared as UT, the biggest and most challenging project of J&K region taken up by CPWD was the Construction of AIIMS at Awantipora, Distt. Pulwama. With the best efforts and assessment, CPWD decided to take up this work in EPC Mode 3. Hence, EPC appointed M/s ARCOP as the consultant for carrying out the detailed architectural drawings as well as structural drawings and invited the bids in EPC mode 3. All the drawings were prepared by the Consultant, but the tendering process was not successful in first attempt. In 2nd call, M/s NCC was the successful bidder with the contract value of Rs. 1649.37 Crore in EPC Mode 3. The efforts in making detailed BOQ was saved. The project started satisfactorily with best efforts on track on a steep hilly terrain, on the land measuring 184 Acres. All the approvals were got from the local body, well in time but still the project suffered because of unknown reason as the site was sharing land with common boundary wall with an adjoining Army campus. As per their protocol, no building above 4 storey is allowed to be constructed within 500m of their garrison. In the instant case, the hospital building was 9-storeyed at just 200m from common boundary wall. When the construction started, objections were raised by the Department of Defence. By that time, CPWD had already started the foundation work, but had to stop the construction to resolve the issue. The matter was taken up by Health and Defense Ministry and finally the decision was taken to revise master plan as per their protocol.

As per the revised master plan, the hospital building was shifted.

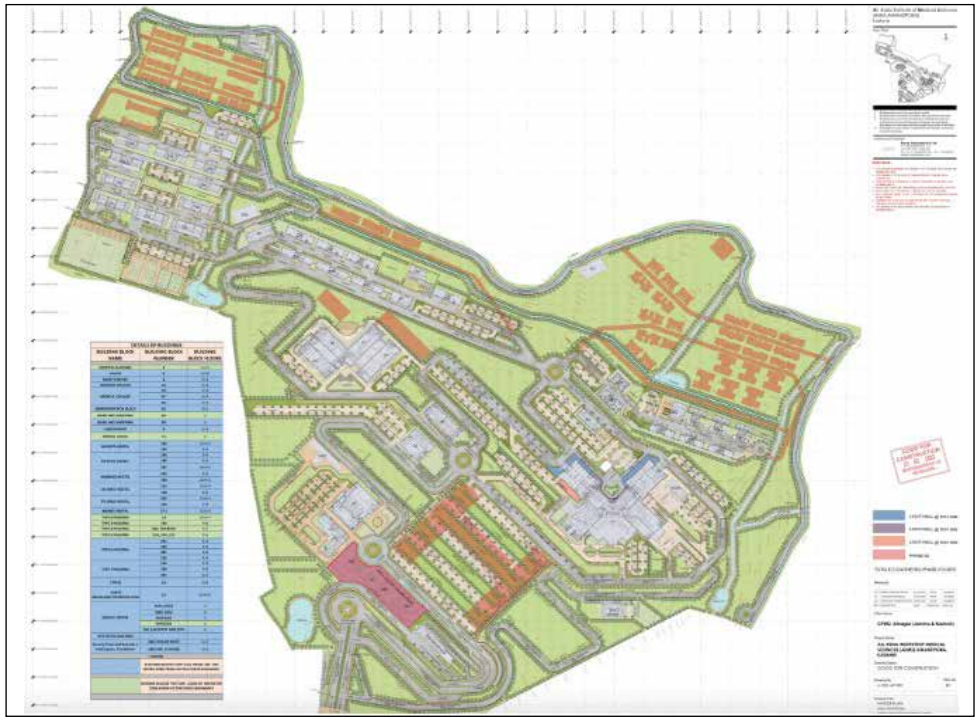


Fig. 2: Revised Layout of AIIMS Awantipora, Kashmir

Fig. 3: An Aerial View of the Works in Progress at Awantipora

The construction agency as well as consultants were to be compensated for the work already executed. It required detailed calculations to work out the amount of compensation. So, the advantage of not framing BOQ was lost and the basic purpose of taking the work in EPC mode 3 was partially defeated.

So, where uncertainty exists on security aspects, it is better to avoid Mode 3. If EPC mode is essentially to be adopted, it may be taken up in EPC Mode 1 or otherwise adopt the traditional system of preparing detailed BOQ.

Accommodation for Customs at Wadala, Mumbai

Construction of Office cum Residential Complex for Customs Department at Wadala, Mumbai with the project cost of ₹1,000 Crore was initiated by CPWD in November 2019. Like the previous work of AIIMS Kashmir, the decision was taken up to call the bids in EPC Mode 3. M/s. Sikka Associates was appointed as consultants of the project. The project was also hit by the Covid and therefore delay occurred in inviting the bids. Bids were invited in January 2022 in EPC Mode 3 with monolithic construction technology. The first call was not successful due to very high bid amount of L1 contractor. In the mean time, CPWD started promoting technology neutral bids. This has an inherent advantage that the bidder will propose a cost-effective technology and bid price is likely to be slashed down. In the instant case, the 1st call had resulted in substantially high price, hence it was a welcome move to invite bids as

Fig. 4: A Pictorial View of Wadala Project

technology neutral. Since different technologies will have different structural design, it is essential that tenders are invited without binding on any structural design of project. Hence in the instant case, the EPC mode was modified from mode 3 in 1st call to mode 2 in 2nd call on technology neutral basis. Bids received were very cost effective and successfully the work was assigned to M/s B G Shirke in November 2022. Presently, the work is progressing well.Hence if the project is a complex structure, a technology neutral bids in EPC Mode 2 is the best option.

Conclusion

- With the different EPC modes of CPWD, it is essential to choose a mode after observing the circumstances. Different modes have different merits and demerits. A conscious decision is required to be made in choosing the EPC mode depending upon all factors prevalent in that area.
- In Ladakh region, where the resources are insufficient, EPC Mode 1 is the best option to meet the challenge of construction of not just the mega projects but even small-valued projects lesser than ₹10 Crore.
- In regions like valley of Kashmir, where the security is prime concern, some uncertainty will always occur. EPC mode may not be successful in delivery of project in given time and cost. Hence, it is better to avoid high valued packages. Works may be split up in smaller packages with traditional system of framing BOQ. But, if at all decision is to adopt EPC mode, EPC Mode 1 is a better option.
- In Mumbai project, EPC mode was to be shifted from Mode 3 to Mode 2 and proved to be very successful.Thus, if the project is very complex like high rise building, it is better that technology neutral bids are invited in EPC mode 2.

EPC Contracts in Building Industry

Ajit Kumar Jha
Executive Director, Civil Engineering (G), Railway Board

Prologue

A robust infrastructure is the key driving factor of the economy of any country. To achieve the target of $5 trillion economy by 2025, and meet the aspirations of the citizens of India, creating new and upgrading existing infrastructure will be the key to raise India's competitiveness. Building Industry is one of the important components of the infrastructure. Works like housing, water supply, sustainable and smart cities are some of the examples of this building industry.

Various Government, public sector units as well as private sectors traditionally follow item rate contracts. In these contracts the client provides design, drawings, bill of quantities etc. There are cost and time overruns due to delay in giving design/ drawings, variations, new items etc. These are basically nothing but the drawbacks of item rate contracts.

On the contrary, Engineering Procurement and Construction (EPC) contracts are being used worldwide and have proved to be the most successful mode of contract for timely & cost-effective completion of the project.

On the recommendations of National Institution for Transforming India (NITI Aayog), the Cabinet Committee on Economic Affairs (CCEA) has recommended that Item Rate contracts may be substituted by EPC contracts wherever it is appropriate.

-Editor-

Introduction

In any type of construction project, the success of project is based on triple constraints – time, cost and scope which are also called as project management triangle.

As per the Quarterly Project Implementation Status Report (QPISR) on Central Sector Projects (costing Rs.150 crore and above) for the 3rd quarter of 2022-23 (October-December 2022) of the Infrastructure & Project Monitoring Division (IPMD) of

Ministry of Statistics and Programme Implementation, Government of India – Out of 1575 projects (costing above Rs. 150 Cr) 10 projects were ahead of schedule, 261 projects were on schedule, 893 projects were delayed with respect to the original schedule of completion. Further, for 411 projects, either original or the anticipated date of completion was not reported. The cost overrun of these projects is @ 21.42% with respect to original estimates.

Traditionally the construction industry has been using item rate contracts for project execution. Almost all item rate contracts are prone to delays due to various risks as well as improper planning, execution and monitoring of the project. This results in distortion of project management triangle hence repercussions like cost overrun or time overrun or scope overrun occur. It is a fact that trading between these triple constraints is not easy always and most of the time impossible. The risk of these constraints can be minimized by adopting suitable mode of procurement by the client.

Reasons for delay in Project Completion and Responsibility

- Inadequate planning
- Delay in Design and drawing
- Land acquisition
- Utility shifting
- Time taken for fixing multiple contracts
- Interdependency of multiple contractors
- Improper geotechnical investigation
- Improper cost estimation
- Improper quantity estimation – Variations & new items
- Improper specifications – change of scope
- Non adoption of new technology
- Non availability of milestone based payments
- Delay in decision making
- Unavailability of fund
- Claims and dispute

Above stated reasons are dependent on the type of contract adopted by the owner. Thus, selection of the type of contract is the key of successful project completion.

Various types of Contracts used in Construction Industry

There are different types of contract like item rate contract (schedule contract), percentage rate contract, piece work contract, EPC contract etc. As per manual for procurement of works, 2019, the choice of the contract should be based on the Value for money. Each of such type of contracts have inbuilt risk and mitigation measures.

Traditionally, in building industry, for repair and maintenance works, piece work contracts are used whereas for construction projects item rate (schedule) contracts are used. These item rate contracts have badly affected the project execution/completion to the great extent. Hence, there is a great need for considering the alternatives to this model of contracting.

Limitations of Item Rate Contracts

- Conventional item-rate contracts are prone to time & cost overrun due to:
  - Involvement of multiple agencies
  - Failure of even one contract delays the project
  - Lack of flexibility in replacing failed agency on real time basis
- In item-rate contract, construction risks are largely with Client & it leads to delays on account of :
  - Delays in design and drawings by the Client
  - Variation in items and quantities
- In item rate contract, considerable time of Project Engineers is consumed in processing of:
  - Variation in quantity of items , Introduction of new items

If we see above reasons, many people may not readily agree to these reasons. The fact remains that we keep setting right these short comings and still use the item rate contract. Client side need to have proper manpower throughout the - feasibility study, procurement, engineering (issuing design & drawings), supervision and monitoring of the project. It is a matter of fact that all Govt. & Public Sector units are having bare minimum work force despite the tremendous stress to increase the output. Also, all the private organizations work on the principles of having lean organisation from long term sustainability. Thus, due to shortage of manpower, certain kind of risk will always be on the project. Therefore, to avoid these manpower & risk issues, we have to get rid of item rate contract and adopt a type of contract which will minimize owner's (Employer's) manpower requirement & transfer risk from client to Contractor.

Working of Engineering, Procurement and Construction (EPC) Contract

Components of EPC Contract	
Engineering	Preparation of design, plans & technical specifications, Co- ordinated design, Design change/optimization etc.
Procurement	Equipment/Material Procurement, Bidding Management, Subcontract Management, Contract Management etc.
Construction	Managing construction site - Resources, Quality, execution. SHE management etc.
EPC Model basic	
Scope of Work	● Owner to bring out the detail scope of work in Bid document. ● All possible information about project shall be made available to Contractor. ● No detailed design & drawing to be given (Only conceptual design & drawings). **Note:** Requirement shall be very clear, there should not be scope for ambiguity otherwise it will lead to disputes/delays.
Technical Requirements	● Authority gives functional requirement of required output. ● Authority is interested in timely output with specified technical requirement. ● Fulfilling technical requirement in terms of design, quality is to be completely decided by Contractor Best Techno-economical practices can be followed as win-win situation for both parties.
Financial Benefit	● Authority has an idea of lump sum expenditure (less likely variation). Risk of unforeseeable items got transferred to Contractor.

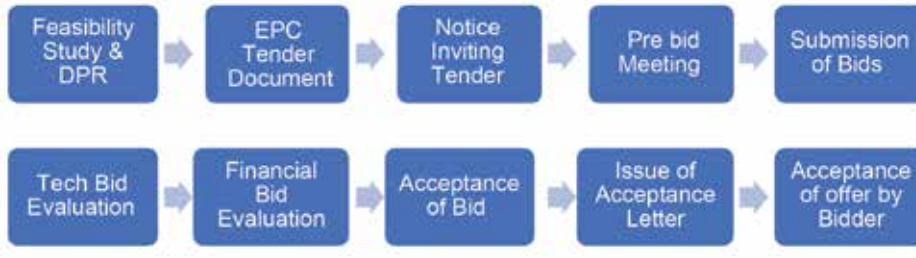
Objective of EPC Model

- Awarding contract for a Lump Sum (LS) price ensures predictability and financial discipline both for Government & Contractor
- Well defined system of obligation associated with damages both for Client & Contractor
- Assigning risk to the party who is in a better position to mitigate it

- Land, statutory clearances assigned to Client
- Design, site uncertainty, sub-contracting are assigned to contractor
- Single point responsibility with Contractor
- Milestone based pro-rata payments
- Reduction in time and cost overruns due to delays in issue of design and drawings
- Promotion of Value engineering and best practices

Adoption of EPC contracts in Railway Station Re-development Project

- **EPC Contract Bidding process:** For Station Re-development works in Railways (Single stage two packet system):



- **Scope of Owner:** Conduct the feasibility study for redevelopment of Railway Station. During feasibility study maximum stake holders shall be taken into confidence and their requirements shall be considered and same shall be spelt out with clarity in the tender document.

- **Standard Tender Documents:** EPC Tender document for Railway Stations is issued by Ministry of Railway. The standard document consists of Request for proposal (RFP -basically instructions to tenderer) and draft EPC agreement (basically conditions of contract) :–

i. RFP shall cover qualifying criteria – Technical as well as Financial. Documents to be submitted along with tender (bid) – online / physical format. Criteria of evaluation of Technical as well as financial bids. Bid security considerations, pre-bid meetings, bidding process etc.

ii. Draft EPC agreement shall cover following items with clarity:
   - Site of Project
   - Scope of Work

- Project facilities
- Specifications
- Permits/clearances
- Obligations of owner & Contractor
- Performance security
- Right of Way
- Utility shifting and tree cutting
- Design and drawings
- Quality management
- Safety at worksite
- Mandatory green building implementation
- Time schedule
- Change of scope
- Mobilization advance
- Stage payment
- Weightage and cost center details
- Sub-contracting rules
- Damages/penalties
- Insurances
- Extension of time
- Termination of contract
- Dispute resolution mechanism

Having above stipulations in the tender conditions will not guarantee that the contract management will be dispute or claim free, rather it will depend on how clearly the contract conditions are framed.

iii. Detailed Project Report (DPR):

DPR including the design based report. However, this DPR will be only for the guidance of the contractor.

Scope of Contractor for Station development work:

For example, the scope of work includes following –

- Construction of Station Building, Air concourse, FOBs, New service buildings, Rest houses, Utility Buildings (Operational Building, Parcel Building, Driver's room), Construction of OH/UG Tanks, Platform up gradation works, Canopy (Covered driveway, pick-up and drop-off area).
- All necessary services and utilities like Water Supply, Sanitary, ELV(Data, Voice, Wi-Fi, Networking of systems, Public Address systems, Train and Passenger Information Systems, Digital coach position indication systems, Signage etc), HVAC, Fire Protection Works, BMS, Lifts, Escalators, Security Scanners (Gate, Hand and Baggage), Surveillance system including CCTV cameras etc.
- External development works such as internal roads, compound wall, parking area development, storm water drains, HT works & Cabling, Sewage Treatment Plan, water storage structures, high mast lighting, street lighting, landscaping, covered pedestrian walkway etc.

The above scope shall be defined in various schedules under EPC draft agreement without any ambiguity and with clear specification.

Role of Contractor in Engineering, Procurement and Construction:

- **Engineering:**
  - Detailed site/geotechnical survey to be carried out.
  - Based on the conceptual architectural drawings detailed architectural drawings to be prepared, proof checked & get it approved from owner/his Engineer.
  - Based on approved architectural drawings detailed structural design, MEPF, HVAC drawings are to be prepared, proof checked & get it approved from owner/his Engineer.
  - The proof check is being done through top premier engineering institutes like IITs, IISC, NITs. Hence, more confidence in the designs/technology adopted by contactor.

Here the entire risk of drawing and design is shifted to the contractor & thus contractor has no excuse for slow progress. There is freedom for the contractor to adopt best engineering practice and achieve economy for him duly giving technical benefit to the owner. Traditionally it is observed that the government departments have lots of hesitation in adopting new design/technologies because there are many procedural things which are cumbersome & fear of failure or fixing of responsibilities for failure.

However, with EPC contracts the complete risk is with contractor & hence there is less hesitation in adopting the newer practices. Thus there is win-win situation for both parties.

- **Procurement:**
  - Contractor to engage sub-contractor for various works.
  - 50% work to be carried out by Contractor on its own.
  - Plant & equipment to be procured by contractor.

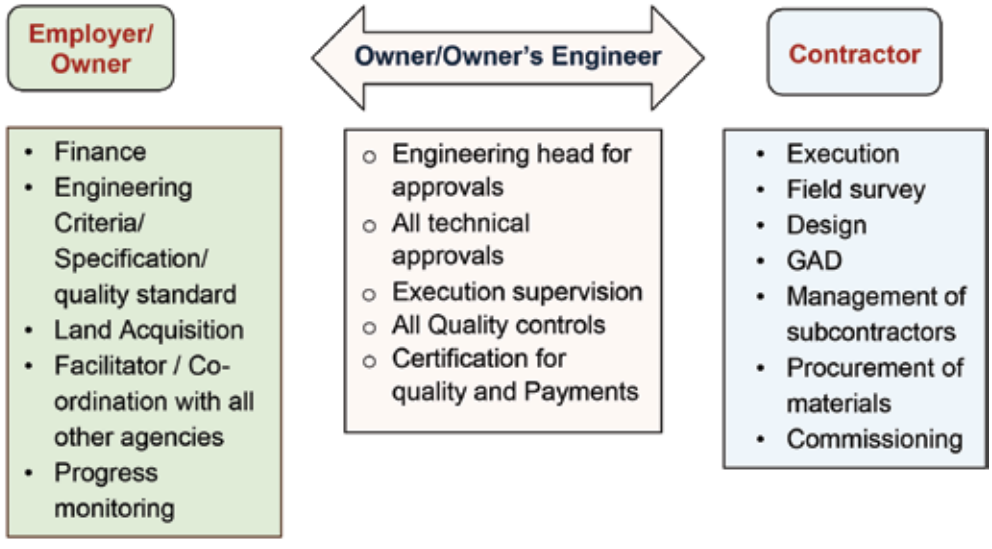
In a station development work, number of specialised agencies are involved e.g. Architectural, structural & MEP consultant, design proof check consultant, traffic management consultant, Vibration analysis consultant, Green building consultant, firefighting consultant, specialist in other assets creation.

If we go for routine item rate contract and with multiple contractors, the project will become more complex project due to interdependencies of consultants/ contractors, different timelines in output delivery. By adopting EPC contract all kind of risks are transferred to the contractor which will enable timely project delivery. Here the entire risk of drawing and design is shifted to the contractor & thus contractor has no excuse for slow progress.

- **Construction:**
  - The execution of actual works as per approved design & drawings
  - Materials, plants, equipment shall be of specified quality
  - Execution shall be with proper quality
  - Insurance of all labour, plant & machineries shall be available during the work execution
  - Each work is to be executed & tests to be witnessed by owner or it's representative
  - Work executed will have pre-decided defect liability period

Thus, owner need not worry about any kind of risk of quality, accident, defects.

The working of EPC Contracts for present Station Re-development Project is as under:



The EPC Contract takes care of following essential factors and risks:

- **Technical requirements:** The required standard of design is specified in the tender document, it allows contractor to adopt the best global engineering design and execution practice to achieve economical design, speedy construction, design which will require less maintenance, best quality as compared to routine item rate contract.
- **Essential permits:** In EPC contracts statutory permits like forest, environment are obtained by owner whereas other permits like quarrying permit, pollution control board permission for crusher, batching plant installation etc. are to be obtained by contractor. Hence, more liability on part of EPC contractor.
- **Scope of work:** The scope of work is frozen at the beginning and there is hardly any scope for change of scope unless very essential. In this project of Station re- development work:

  i) There is provision of change of scope @ 10% of contract price

- **Contract Price:** The contract price is almost fixed at the time of award. There is hardly any change in this price except for inevitable change of scope. Thus, more financial stability & discipline.

- **Contract period:** The contract period decided based on the nature and volume of work. There are clauses in the EPC contract under which contractor is liable to pay damages at pre-decided rates. These damages are not penalty, rather these damages clauses keeps contractor on their toes to achieve the progress and complete the project in time. Also, there is provision of bonus for early completion of project by contractor. In this project of Station re-development work:

  i) Delay damages are @ 0.05% of contract price per day if the completion of project delayed beyond 30days

  ii) Bonus for early completion @ 0.03% of contract price per day if the project is completed at least 30 days before completion period.

  Thus, there is equal treatment for either party.

- **Risk allocation:** Projects risks such as unforeseeable conditions like soil conditions and weather or commercial and technical risks relating to design and construction is assigned to the Contractor. The risk of delay in handing over of right of way, is assigned with the owner by way of paying damages to the Contractor. Shifting of utilities identified is termed as charted utilities and responsibility shifting of same lies with Contactor. However, owner assists in shifting of utilities which are property of owner. In this project of Station re-development work:

  i) Damages for delay in handing over of right of way @ 0.001% of contract price per day.

- **Survey, design, construction & monitoring and supervision:** The contractor is responsible for detailed site/geo-technical survey. The risk of any deficiency in data given by owner is with contractor only. Entire design, drawings to be prepared and got approved from owner or their representatives before starting any construction activity. The construction shall be as per specifications. Monitoring and supervisions can be done either by owner or through it's representative engineer.

- **Subcontracting/multiple agency handling:** The EPC contract has single point responsibility. Owner shall not waste time in finalizing multiple contracts & monitoring them as well struggle to resolve the disputes among various agencies working on the project. Contractor takes all the risk of having multiple agencies in the form of sub-contractors and manage them to deliver the project in time and in fixed cost.

- **Milestone/stage payment:** Payments are made based on achieving specific stages of physical progress. Also, there is provision for damages to be paid by contractor for non-achievement of pre-decided milestones. In this project of Station re-development work stage payment are defined: –

  i) On submission on account (running account) bill, 80% payment to be released within 15 days. Balance 20% payment to be made within next 15 days.

  ii) In case of delay beyond 30 days, damages to be paid by the owner at the rate of @ bank rate + 3% on the outstanding bill amount.

  This, fast payment of bills ensures the contractor has sufficient cash flow to ensure the timely execution of work. At the same time, non-achievement of milestones is like a sword hanging over the contractor. Hence, the contractor has to perform. Thus, this is a win-win situation for both parties.

- **Defect Liability Period:**

  Normally a defects liability period of one year is specified in most contracts, a defects liability period of two years has been specified in this project contract agreement in order to provide additional comfort to the Authority.

- **Dispute Resolution Mechanism:**

  In case of any kind of dispute between the parties there are various in-built mechanisms for fast track resolving the disputes. In this project of Station re-development work, there are provisions of:

i. Resolving disputes and claims through conciliators as first stage

ii. If not resolved in first stage then, Dispute Adjudication Board (DAB) – through standing DAB, as second stage.

iii. If not resolved in second stage then, Arbitration– through standing arbitration panel, as Third stage.

iv. After third stage, any party can go to Court.

Project Financers View

Till now, the aspect of EPC contract from the perspective of successful completion

of the project has been discussed. However, there is definite need to investigate/study whether the mode of contract also influence the funding for the project. With this perspective following points are brought out:

Any project financer while studying the project case, gives more weightage to projects where there are less risk on the fund seeker side. What project financer would like to have surety of:

- Timely completion of project
- Fixed project cost
- Transparency in Contracting system
- Less disputes in the contracts
- Single point responsibility
- Mechanism to have protection for funded money

All above requirements are fulfilled by EPC contracts hence project financers are willing to finance the EPC contracts compared to other modes of contract.

Way forward in adoption of EPC Contracts

With the above discussion, it is established that EPC contract are far superior to the traditional item rate contracts especially for Green Field Projects. Projects of Indian Railways are mostly Brown Field with movement of traffic at full capacity ensuring train and passenger safety. However, there are certain challenges and same need to be accepted when the organisation is in transition phase of adoption of item rate contract to EPC contract. To make EPC contract successful owner, contractor and owner's engineer have to take care of following items:

- **Owner/Employer side:**
  - Handing over of Right of Way (ROW) is the biggest issue.
  - Design approval activities taking longer time, hence delay in project.
  - Lack of clarity in contract document.
  - Timely clearance for Environmental issues.
  - Utility identification & removal of utilities - Live cables, structures
  - Forest clearance needed in advance.
  - Assured funding required during construction period to avoid outstanding bills.

- Movement of trains with passenger's safety.

➢ **Contractor's side:**

- Cash Flow problem with Infrastructure companies
  - ❖ Main Contractor may divert their money to other projects.
- Contractor's failure to study the site before bid.
  - ❖ This results in very low rate quoting.
- Poor mobilization of manpower, materials & machines.
  - ❖ Management of sub-contractors.
  - ❖ Sub-Contractor's mobilization may be poor quality performance.
  - ❖ Attitude of Contractor – litigant/earning from claim only attitude

➢ **Owner's Engineer side:**

- Delay in design /drawing approvals – interpretation issues/lack of knowledge
- Competency of site Engineers may be an issue sometimes
- Deficient staffing (less resource mobilization)
- Non-monitoring of project schedule
- Slackness in implementing QC, QAP

If above stated or more issues are taken care by concerned stakeholder (owner, contractor and contractor's engineer), there is every likelihood that the EPC contract will be successful mode of contracting.

Governments View on traditional Contracts

Loading contracts with difficult conditions, both financial and non-financial, have led to unnecessary burden leading to financial stress and potential insolvency amongst developers. Hence, adoption of international contract standards (such as FIDIC standards) by all infrastructure departments with clear procedures for change of scope, termination payments and safe exits for parties shall be done. [Report of the Task force to draw up the National Infrastructure Pipeline (NIP), Department of Economic Affairs, Ministry of Finance, GOI, 2020]

Conclusion

- Adoption of EPC contracts in building industry for all infrastructure projects, with clear scope of work, specifications, stage payments, defect liability period, procedures for change of scope, termination payments and safe exits for parties will be the key for successful completion of the project.
- Owner has to deal with one single entity, which will help in proper monitoring of project.
- In EPC Contracts, Contractor has complete control over the design, selection of sub contractors, development and construction. Thus, instead of transfer of risk to contractor, owner in fact transfers full control of project to contractor which enables him complete the project in time and cost.
- Lenders will be more willing to finance the projects which will be executed under EPC mode since lender will like to have surety about fixed project price and fixed contract period & lesser risk on owner side.

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Brief about the Authors

Dr. K. M. Soni, BE (Civil), M. Tech, MBA, PhD is former Additional Director General of CPWD having rich experience of 36 years in planning, construction and maintenance of Buildings. Dr. Soni has presented and published many technical papers and received many awards including DG, CPWD medals, CIDC Public Officer trophy, CIDC Technologist award, CPWD, IBC & CIDC best project trophies, IBC best paper medals and many commendation certificates from other organisations. Dr. Soni has been member of Leadership Excellence of Harvard Square, Senior Professional Engineer of ECI, FIE (I), Chartered Engineer, MIBC, MIGS, MISTE, MIRC, FIITArb, Expert Member of Engineers Excellence. At present he is Expert advisor for BRSA and International Buddhist Confederation, DRB member for NHAI and Arbitrator for CPWD.

In his paper he has brought out necessity of resorting to EPC system of contracting looking into the complexity of structures and large number of disciplines involved. He has brought out the advantages and limitations of EPC contracts in construction besides difference in Item rate/ Percentage Rate and EPC Contract. He has also given case studies for EPC contracts of projects involving innovative technologies.

Brigadier (Retd.) Amit Kathpalia, FIE, MRICS, FICCP, SCL (UK), Member AACE is having a rich experience of 38 years in Corps of Engineers of Indian Army, Military Engineering Service, Ministry of Defence, Public Works Dept. and Corporate. He held the post of Chief Engineer in MES. He has expertise in all Indian construction contracts, FIDIC, NEC and PPP contracts. He has also corporate experience as VP of a $ 2Bn turn over company and Head of Training and Products Development of RICS. He is presently working as consultant trainer and Adjunct Professor with RICS School of Built Environment, Amity University for training mid-level executives and MBA students, with L&T IPM for training on Contract Management, Delay and Disruption protocol, claim and cost management and administration of FIDIC contracts, with QCI for developing training modules and accreditation tests for in BoK (Niti Aayog led project on capacity development of Infrastructure Project managers).

In his paper he has discussed contracting strategies, circumstances and factors to be analysed like capability of stake holders, risk appetite, Cost, Value Engg. Nature & control of project, Contracting strategy matrix besides five case studies.

Mrs. Usha Batra, a graduate in B.Arch. from Chandigarh College of Architecture is former Special Director General, CPWD. She was the First lady Architect who worked in field as Special DG of CPWD and Additional DG of CPWD. She delivered expert talks at many forums and organized seminars. Authored many articles, presented papers and chaired sessions of BIS and IRADe. She is recipient of 'Smt. Satya Goel Memorial Award, 2017 for valuable services and outstanding contribution in the Building Profession and IBC Medals 2014, 2015 and 2016 for Best papers presented during mid-term and Annual convention & seminars. Her Research article on "Optimum level of insulation for energy efficient envelope of office buildings" was internationally acknowledged in Nov 2017. She has also authored "Compendium for design of central govt. Housing"; "A walk through the central Vista"; "Architectural footprints of CPWD", "Western region-Browser"- A coffee table book and has also Co-authored "Green Rating Manual" and "Accessibility Manual" for CPWD.

In her paper, she has discussed the EPC contract from design perspective, essential features and fundamental principles for drafting good contract, Sub contracting with specialized agencies and other vendors, change of scope, termination of contract and learning from the case studies in CPWD.

Shri Chandra Shekher Mital, B. Tech (E) from IIT BHU and MBA from IGNOU is a former Chief Engineer (Elect.), CPWD. He has rich experience of 38 years in design and execution of mega Projects. He worked in various capacities and immensely contributed on important projects e.g., LBS Academy MUSSORIE, Trauma Centre BHU Varanasi, Supreme Court Extension Project New Delhi, PNB Head office Dwarka, New Delhi to name a few. He has also worked as Quality Assurance Engineer for Bharat Heavy Electrical Limited before joining CPWD. Presently he is Advisor Contracts and lead Electrical Engineer for various construction projects. He delivers lectures as guest faculty at National Institute of Financial Management and National CPWD Academy on works, contract management, Fire & Life safety and E&M services. He is an arbitrator as well. He is a life member of IBC & ISLE, fellow member of Institution of Engineers and member of ISHRAE.

In his paper, he has discussed objectives of EPC model of contract, existing scenario, responsibility of 3rd party for proof checking, Defect Liability period and experience gained.

Shri Rajeev Singhal, a graduate in Civil Engineering from Punjab Engineering College in 1987 is having experience of more than 30 years in planning and construction of flyovers, residential buildings, offices, quality assurance and contract management. He is presently serving as Chief Engineer in CPWD. At present he is looking after the construction of multi-storied flats for Hon'ble MPs at Baba Kharak Singh Marg and planning of an elevated corridor for decongestion of traffic in Delhi. He has extensive experience in construction of multi-storied buildings, office complexes, underpass, flyovers etc. He is a member of Indian Buildings Congress and Chairman of the New Delhi Centre of Indian Concrete Institute.

In his paper he has dealt with the case study of the Project "Providing connectivity between Northern Mahipalpur Bypass Road, NH-8 and Northern Access Road from Airport by construction of flyovers/ underpass" which was executed by him on EPC Mode of Contracting.

Sh. Pradeep Kumar Parmar, a graduate in Civil engineering and ME (Geotechnical Engineering) from MBM Engineering College, Jodhpur, presently serving as Chief Engineer & Executive Director at AIIMS project Jammu, in Central Public Works Department. He has rich experience of more than 35 years for working on variety of infrastructure projects, across the length and breadth of the country in different geographical locations under varied temperature conditions.

Major infrastructure projects recently executed by him includes Elevated corridor of Barapullah phase-II & III, 3 nos. bridges Barapullah; Improvement of corridor in and around Pragati Maidan - tunnel from Purana Qilla Road to Ring Road and five nos. of under passes; Six Lane flyover at Shastri Park and three lane flyover at seelampur, Delhi and elevated road from DND to Ashram flyover.

In his paper he has dealt with the advantages & disadvantages of implementation of EPC Contract in the present scenario.

Dr. Shishir Bansal, Graduate in Civil Engineering, Master in Highways Engineering from Punjab Engineering College, Chandigarh, LL.B from Delhi University and Ph.D in Environmental Engineering from Delhi Technological University is Chief Engineer Cum Executive Director, CPWD, Mumbai. During his carrier spanning over 33 years in CPWD, he has worked

on the design and construction of various buildings as well as many infrastructure projects like Clover Leaves, Flyovers, Underpass, Elevated Corridors and River Bridge Projects. He successfully completed construction of Signature Bridge (an iconic structure over River Yamuna in Delhi) in the capacity of Chief Project Manager. He has also written more than 30 technical papers that have been published in various prestigious journals/ presented in various conferences in India and abroad.

Shri Venkatesh Doosa, a Graduate in civil engineering from IIT Bombay is currently working as Executive Engineer in CPWD, Mumbai. He has experience in planning, construction and has been instrumental in execution of prestigious projects of IIM, IIIT and other Central Govt projects.

In their paper Dr. Shishir Bansal and Shri Venkatesh Doosa has discussed the case studies on EPC contracts for the projects at 3 different locations in (i) Ladakh which is resource deficient and abnormally low temperature (-30°C) region disconnected by road for 6 months in a year (ii) Awantipora in UT of J & K where working was challenging due to security concerns & (iii) Mumbai in humid and temperate region where there is no scarcity of resources and working is comparatively easy.

Shri Ajit Kumar Jha did M.Tech., from IIT Delhi. He is an officer of Indian Railway Service of Engineers (IRSE, 1996 UPSC Exam batch). Presently he is Executive Director, Civil Engineering (G), Railway Board, Ministry of Railways, New Delhi. He has a rich diversified and challenging experience of over 25 years in various capacities in Railway. He executed many mega projects of national importance, maintenance of assets & is closely associated in General Administration & policy making like tenders & contracts, opening of passenger traffic, certification maximum permissible speed of rolling stocks (Loco, Coach, Wagon) etc. He is proud and privileged to issue introduction certificate of Vande Bharat Train set. He also got various Awards at different stages including highest level 'Minister of Railways (MR) Award' to recognise his excellent work done & outstanding contribution.

In his paper he has dealt with the necessity of implementing the EPC contracting system, the required parameter to be taken care of while drafting the tender document and the Government view on adoption of the EPC contracting.

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