

# IDENTIFICATION OF MOST WIDELY ACCEPTED CONTRACT TYPE IN PUBLIC SECTOR PROJECTS IN INDIA

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## ABSTRACT:

The accomplishment of financial and developmental targets is inevitable for survival of construction industry. The new contracting organizations may suffer in making decisions related to bid selection. The wrong decision during bid selection may lead to inefficient project management, which in turn results in huge loss in terms of finance and reputation. The main objective of the study is to identify the types of contracts generally considered in infrastructure and building construction industry. The study was conducted through telephonic interviews and Right to Information (RTI) with National Highway Authority of India (NHAI) and Central Public Works Department (CPWD) to understand the most widely operated type of contract in infrastructure projects and building sector respectively. The descriptive text analysis of NHAI identified the South and West region with Build Operate Transfer (BOT) -Toll and North and East region with the Engineering Procurement Construction (EPC) as the popular type of contract among the 9 types of contracts in infrastructure sector. The respondents also mentioned that the Hybrid Annuity type of contract is gaining popularity over other types of contract as this contract reduces the financial burden on the contracting organization. 'The financial facility available from the Government, cost of the project and revenues present' and the 'Government policies and terms of payment' were found to be the most important factors deciding the type of contract. Similarly, the study conducted on CPWD discovered 5 types of contracts. Among them, the majorly operated contract in all the regions was 'item rate' contract. The next popular contract types were 'percentage rate' and 'lump sum' contracts. The 'department's norms and policy' was the most significant factor influencing the selection of contract type in the CPWD.

**KEY WORDS:** Contract types, Infrastructure Projects, Hybrid Annuity, building and construction

## 1. INTRODUCTION

Construction work is one of the most important basic inputs for socio-economic development of any country. Infrastructure and building projects from public sector significantly contribute to growth of development process of both developed and developing countries. This industry provides employment to large number of people in India and affects the economy of a country/region. Hence, the contracting organization's vision shall be to involve into the discipline of construction and contribute into nation's economic development.

The selection of most suitable contract for a contracting organization is important considering the specific risk factors associated with the projects. While there are different types of contracts such as 'item rate', Engineering Procurement Contract (EPC), Build Operate Transfer (BOT) and so on. The associated risks with these type of contracts vary and are also different. Hence, the selection of most suitable contract plays an important role in decision making process of a contracting organization.

This study provides facts about the popularity, adaptability and comparison of various types of contracts operated in Indian public sector of building construction and infrastructure projects. This also includes discussion on the reasons for deploying a specific type of contract for a particular project type.

## 2. LITERATURE REVIEW:

**A. Merna and N. Smith**[1] described about the adoption of the 'Turnkey Contract' in major construction works of numerous projects. The advantages of this type of contract, in clients viewpoint, was that the responsibility for the contract lies with a single source and client will have less responsibility for the equipment and performance. Here, the work can be done faster since the design and construction can be done concurrently. Disadvantages such as lack of client control and participation in the project will be present, the overall cost may be higher compared to traditional contract type, and the flexibility to bring or associate changes in project is limited. Further, **R. L. K. Tieng, K. T. Yeo, and S. C. McCarthy**[2] explained the constraints mainly involved in winning a BOT projects. The study identifies constraints on winning the BOT projects such as high front-end costs, lengthy and extensive negotiations, opposition to project and project development risks. Finally, it was found that, in the selection of contract type, negotiation and auctioning were the two types of processes. **P. Bajari, R. McMillan, and S. Tadelis** [3] explained about the use of negotiation or auction in procurement of a private or public contracts and found that most of the negotiated contracts were cost-plus contracts and auctioned contracts were fixed-price contract. Later on, the study by **D. W. Chan et al.**[4] identified the risk factors and potential difficulties with the prevailing practices of GMP/TCC. The empirical survey findings reflected that the top three risk factors inherent with the GMP/TCC contractual arrangements were involvement of any inexperienced or claim-conscious contracting organizations in the project delivery process, disputes arising from changes in the scope of work, and unforeseen design development risks. **A. Hasan and K. N. Jha** [5] study identified various attributes affecting the successful use of Incentive/Disincentive (I/D) clauses in achieving their intended purpose in the Indian construction industry. The result shows that five important reasons for the low preference of Incentive/ Disincentive contracts were the difficulty in contract management, additional effort by project participants, adverse effect on the working relationship of client and contracting organization, increased responsibility of client, and client's unwilling top management. Later on, the study by **Q. Chen et al.**[6] discussed the comparison of project performance between Lump Sum and GMP contract. The results showed that Lump Sum contract type was still the most frequently used contract method for Design-Build (DB) projects, particularly in the public sector. However, compared to Lump Sum projects, using GMP contracts were more likely to have less schedule postponement and cost overrun. It revealed that project type, owner type, and procurement method affect the selection of contract types significantly. Civil infrastructure projects use Lump Sum more frequently compared to the industrial projects.

## 3. METHODOLOGY:

The research area related to selection of contract type and identification of bid decision strategies requires research philosophy of 'phenomenology' since it is subjective in nature. Hence, the data collection techniques such as structured questionnaire, opinion survey, telephonic interview, and Right to Information (RTI) have been selected.

Methodology for identification of most widely used contract type

- Framing the questionnaire and pilot study
- Computation of sample size
- Data collection through telephonic interview and RTI
- Analysis of data using descriptive text analysis
- Comparison of various popular contract types with reference to their applicability.

### 3.1 Identification of Most Widely Used Contract Type

With the intention of identifying the most widely accepted contract type in Indian construction industry, and to understand the rationale of its selection, the study was conducted on public sector of Indian construction industry.

Considering the complexity and the confidentiality of getting the data from the private sector, this study focused on public sector alone. Public sector of construction works under the public authority which in turn was administered by the government. This sector generally consists of public service agency to carry out the work. The public sector of construction undertakes various types of major projects and uses different contract types. This study focused on the building and infrastructure projects, a sub sector of public sector projects.

### 3.1.1 Framing the Questions

The questions were intended to collect the qualitative responses to identify the most widely operated contract type and the basis for the selection of a particular type of contract. Since, these questions were used in the telephonic interview, the complexity, time and the number of questions was kept to minimum. Only the relevant and direct questions such as the type of the project the respondents operated, the type of contract they used, and their opinion about the factors influencing the selection of contract type were finalized.

### 3.1.2 Computation of Sample Size

Since, the area of study was the public sector construction in India, the population size can be calculated. For collecting the sample from the respondents, simple random sampling technique was used. Hence, for the known population size, and random sampling using the Z-score test, was conducted to compute the sample size. The respondents chosen for the study were the Project Directors from National Highways Authority of India (NHAI) and Executive Engineers of Central Public Works Department (CPWD) from various parts of India.

The sample size was calculated by Z-test using following formula,

$$\text{Sample Size} = \frac{[(Z\text{-Score})^2 \times (S.D)^2 \times (1-S.D)]}{E^2} + \frac{[(Z\text{-score})^2 \times S.D \times (1-S.D)]}{(E^2 \times N)}$$

Where, Z-Score is value obtained from the Z-score table for assumed confidence interval; S.D is assumed Standard Deviation; E is Margin of Error; N is the population size.

### 3.1.3 Collection of Data from Telephonic Interview / Through Right to Information

The computed number of samples were collected from both CPWD and NHAI projects executed in all the four regions of India (namely North, South, East and West) in last three years to gather information pertaining to building and infrastructure project respectively. The Superintending Engineers (SE) or Public Information Officers (PIO) from CPWD and Project Directors (PD) from NHAI were interviewed by telephonic conversation with a prior appointment. Indian construction projects from all regions like North, South, East and West were collected to understand the diversity if any in selection of contract type. The telephonic conversation was noted for the further analysis. In the case of non-approachability of the respondents, the request was sent through RTI and the response was received in the form of letter. The collected data were compiled for the descriptive text analysis.

### 3.1.4 Descriptive Text Analysis of Data

The obtained responses the descriptive text analysis was carried out to identify the similarity, difference, and the uniqueness in the data from various regions of India. The same exercise was carried out for analysis of both building sector (CPWD data) and infrastructure projects (NHAI data). The frequency of operated contracts in the various regions were compiled to understand the most widely used contract types in last three years in each sector. The total number of reasons or basis for selection of a particular contract type was also compiled and listed in ascending order of its frequency from various regions. The results were then tabulated for the interpretation.

### 3.1.5 Interpretations, Inferences and Implications

The interpretation of the result was done through the frequency tables from both building and infrastructure sectors from all the four regions. Three contract types with the highest frequency in last three years was implied as the 'most widely used contract types' in the said region. The overall highest frequency for all the four region was also noted. The verification of basis for adoption was interpreted again on the basis of frequency of the spelled responses from the respondents. Finally, the inferences from the study on identification of most widely used contract type and the basis for its selection were drawn to provide the knowledge to the contracting organizations. It aimed help these organizations to note and adapt themselves to be proficient for competing with these type of contracts by improving their competitiveness and to strengthen their existence.

## 4. RESULTS AND DISCUSSIONS

### 4.1 Analysis on Most Widely Used Contract Type

The results of the study conducted to identify the most widely operated contract type in construction of building as well as infrastructure in public sector for the last three years are discussed as follows.

#### 4.1.1 Framed Questions for conducting Telephonic Interview /applying Right to Information (RTI)

The questionnaire framed for the telephonic interview of the respondents from the Indian Public sector of construction were as follows: Three questions were asked to all respondents to attain the research objective. The first question was framed to understand the type of the projects executed and the second question was framed to know the type of contract used to operate a particular type of project. This was to verify the correlation between the type of project and the type of contract. The third question was framed to ensure that the motives to select a type of contract for executing a particular type of project were properly covered. The respondent was asked to answer these questions with reference to the projects executed by them in last three years. Hence, the three questions formulated for the telephonic interview as well as for the RTI are as follows.

- 1) What are the various type of projects you have executed in your region?
- 2) What are the various types of contract used for the same project?
- 3) What are the reasons to select that type of contract or what made you to select the present contract type over the others?

These questions were asked to the randomly selected group of respondents from Central Public Works Department (CPWD) and National Highway Authority of India (NHAI).

#### 4.1.2 Sample size for Identification of Most Widely used Contract Type

The results of the Z-Score test for computing the sample size for the survey is given below. Since the target group was Project Directors (PD) from NHAI and Superintending Engineers (SE)/ Public Information Officers (PIO) from CPWD, the actual population was found to be 112 and 88 respectively.

The sample size is calculated by Z-test using following formula,

$$\text{Sample Size} = \frac{[(Z\text{-Score})^2 \times (S.D)^2 \times (1-S.D)]}{E^2} + \frac{[(Z\text{-score})^2 \times S.D \times (1-S.D)]}{(E^2 \times N)}$$

Where, Confidence Interval=90%;

E= Margin of Error=10%;

S.D = Standard Deviation = 20%

Z-Score for 90% confidence interval=1.645;

N= Total Population of Project Directors of NHAI (88) and Superintending Engineer/ Executive Engineer of CPWD (112)

Hence, Sample Size for NHAI = 29.01  $\approx$  say 29 respondents.

Hence, Sample Size for CPWD = 31.23  $\approx$  say 32 respondents.

#### 4.1.3 Data collection from various parts of India

For region wise data collection and analysis, the states of middle part of India i.e., Madhya Pradesh and Chhattisgarh state were considered along with the West Zone. Similarly, the responses from the North Eastern states are considered along with the East Zone. The details of the consideration of regions for data collection is shown in Figure 4.1.



Figure 4.1 Details of Geo-geographical Regions for data collection

The details of the data collected for NHAI and CPWD are tabulated below. In NHAI, majorly the telephonic interview method was used to collect the data from the Project Directors from various regions of India. Nine responses from North, eleven from the South, seven from the East and eight from the West region were collected adding up to a total of 35 responses against minimum sample size of 29. The statistics of the responses of different region of NHAI department and details of contracts operated under various region are shown in the Figure 4.2. and 4.3 respectively. Each respondent provided the information about the project type, contract used and factors influencing the selection of the contract type which was prevailing in their region. Then, response was noted and compiled to ease the analysis.



Figure 4.2. Responses Obtained for Study on NHAI

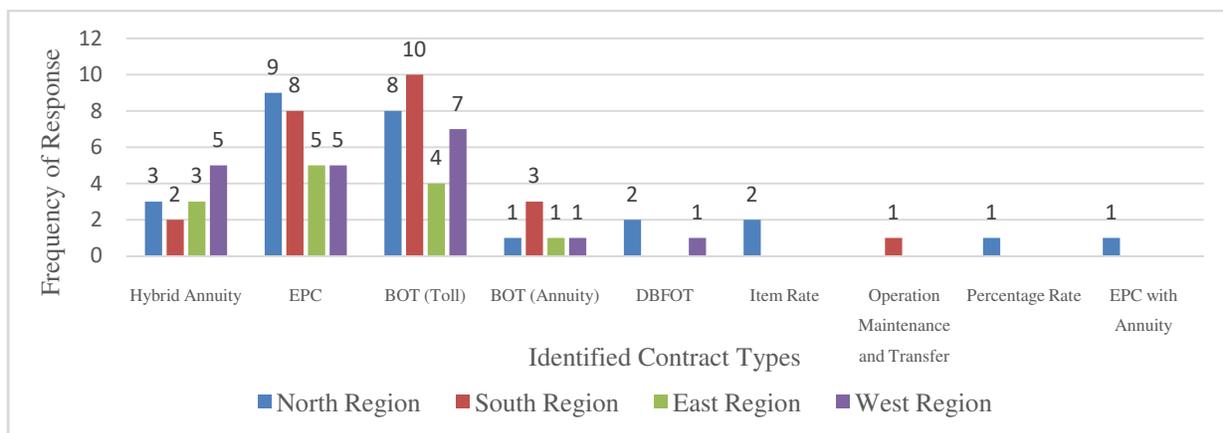


Figure 4.3. Types of Contracts Operated in NHAI

In CPWD, the collection of data was majorly done through application of RTI form to the CPWD, Delhi. Online application was filed to the RTI, Delhi. The application consisted of the same questions which were used for NHAI data collection: highlighting the type of projects executed by the department, type of contract used and factors influencing in selection of that contract type. The department has forwarded this RTI application to various zones in India. Thus, the Superintendent Engineers and the Public Information Officer (PIO) have responded for the letter via post, e-mail. However, a few responses were obtained also through telephonic interview. 30 responses from North, 15 from the South, 08 from the East and 10 from the West region contributed a total of 63 responses. The statistics of the frequency of responses obtained for the CPWD and the type of contracts operated in various regions are shown in Fig 4.4 and 4.5 respectively.

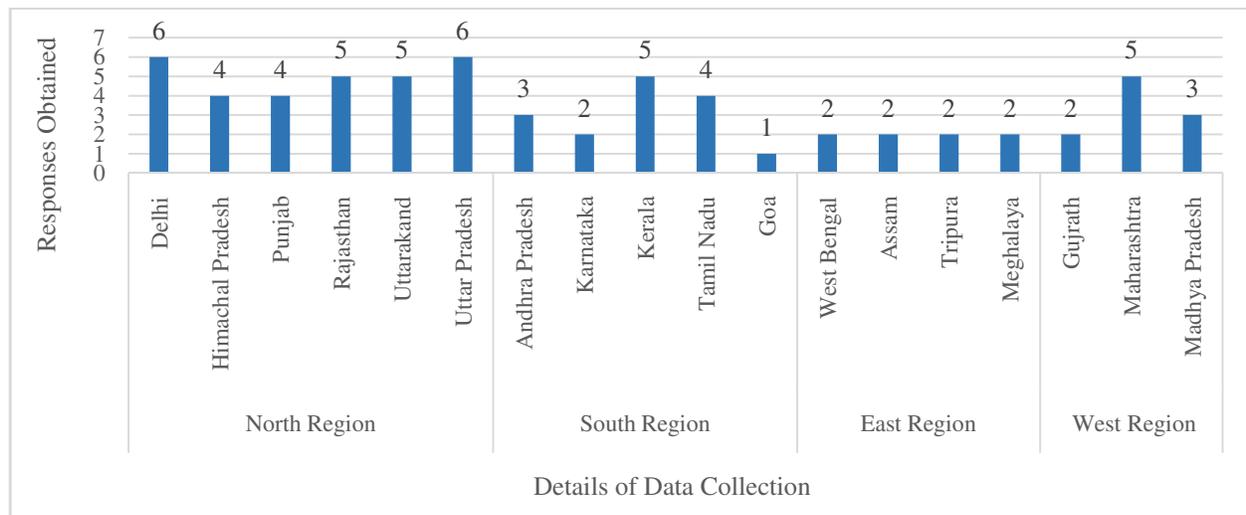


Figure 4.4. Responses Obtained for Study on CPW

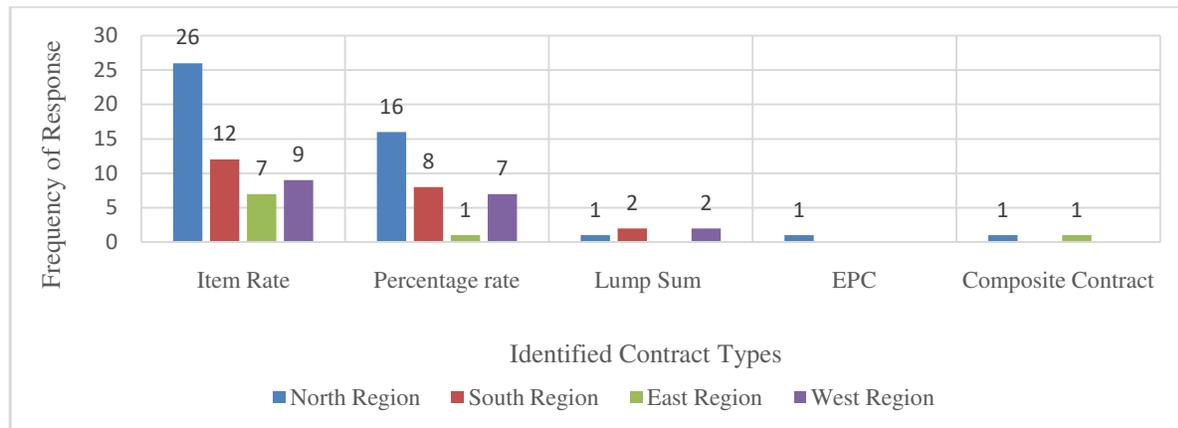


Figure 4.5. Types of Contracts Operated in CPWD

**4.2 Discussion on Data Analysis of NHAI Projects**

The responses received from the infrastructure sector (NHAI department) of all regions was shown in the form of frequency distribution chart in Figure 4.3. The chart depicts the majorly operated contract type in the North, South, East and West regions. In the North region, Engineering Procurement and Construction (EPC) contract was most operated type with 9 projects executed in last three years. The Build Operate Transfer - Toll (BOT - Toll) and Hybrid Annuity type of contract acquired second and third position respectively with 8 projects of BOT (Toll) and 3 projects of Hybrid Annuity. In South region, BOT (Toll) was the most widely operated contract with 10 projects executed in last three years. EPC contract was implemented in 8 projects and BOT (Annuity) type of contract in 3 projects.

Hybrid Annuity contract also had established its existence in 2 projects. Similar to North region, East region showed EPC contract as the most operated type with 5 projects. Also, BOT (Toll) and Hybrid Annuity attained subsequent positions. The West region showed similar results to that of South region. BOT (Toll), EPC and Hybrid Annuity contract type were found to be the most operated contract type.

To summarize, the BOT (Toll) and EPC were found to be the most widely operated contract type among the 9 types of contracts identified in the study. However, the respondents mentioned that, the Hybrid Annuity type of contract is gaining popularity over other types of contract, since this contract reduces the financial burden on the contracting organization. The Government is responsible for funding 40% to 50% of the cost of project to make sure no blockage of cash flow in the initial stages of the projects. This in turn contributes to the progress of the project. The respondents also hinted that, because of the stated reasons, Hybrid Annuity is likely to be the most accepted type of contract in the near future.

#### 4.3 Discussion on Data Analysis of CPWD projects

The responses received from the CPWD in the form of reply to the RTI application were compiled to identify the most widely operated contract type in the building sector in various regions of India as showed in Figure 4.5. The 63 responses obtained from the survey showed that, there were application of five major types of contracts in the building sector namely, item rate, percentage rate, lump sum, EPC and composite contract. The primarily operated contract in all the region was found to be 'item rate' contract in building sector. The next popular contract type was 'percentage rate' and 'lump sum' contracts.

The results of the study identified twelve major factors influencing the selection of contract type in building sector namely, the market rate with reference to Schedule of Rate (SOR) of the department, mode of award of contract, norms laid by the department, past experience in similar projects, viability of project, contracting organization's willingness, technical aspects, required design flexibility, site condition, nature of work, scope of work, and the need for project. The details of the responses obtained for each factor are shown in the Figure 4.7. The North region emphasized 'department norms, importance of market rate and SOR, mode of award of contract and the nature of work' as significant factors for selection of contract type. These factors were same for the East region. In addition to these factors from the North region, in the South region, the technical aspects involved in the project were considered. The West region highlighted 'the market rate conditions, quoting the lowest rate, SOR' as the most significant factors.

Based on the result of CPWD projects, the 'item rate' contract is evidently the most widely used type of contract throughout India. Among 63 responses, frequency of 54 projects operated by this type of contract in last three years clearly show its popularity and acceptance. 'Percentage rate' contract with 32 projects being executed stands second widely operated contract type. Also, the 'lump sum' contract, 'Single bid, double bid, three bid' and 'composite contract and EPC' are the other three contracts, which show their existence in various special or specific cases in CPWD projects.

### 5. CONCLUSIONS

This study concludes that the most widely used contract type in Indian civil engineering construction is item rate. The key factors for selection of the contract types are 'client department's norms and policies', 'technical aspects involved in the project' and 'nature of work'. In the infrastructure sector, the most widely used contract type in North and East region is EPC and in South and West region is BOT (Toll). The Hybrid Annuity figured in both the cases as the third preferred contract type. However, of late there is an increased tendency to prefer Hybrid Annuity in this sector due to its relative advantages in terms of funding. The key factors for selection of contract type are financial facility available from the government, cost of the project, and magnitude of revenue generation.

The identified factors for selection of contract type needs to be taken into account while choosing from various alternative contract types. This would ensure the management of contracts systematically within cost, time, and quality parameters. The most widely operated contract types identified and their pros and cons in building as well as infrastructural sector exhibit their specificity of application to projects. The contracting organization have to note and adapt themselves to be proficient for competing with the selected type of contract by improving their competitiveness and for strengthening their business.

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