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# Reliability Issues and Improvement of Preliminaries Cost Related Items For Civil Engineering Conventional Contracts

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## Abstract

Civil engineering is a professional discipline that deals with built environment which involves physical construction of man-made structures such as roads, rails, bridges, drains, water supply, geotechnical systems, and services. It also deals with soft skills such as maintenance, research and investigation, conservation, and planning. In Malaysia, it is a prerogative that civil engineers administer civil engineering contracts. The preliminaries are an integral part of the bill of quantities and difficult to price due to their nature. However, the contractor is expected to price all items fully. The engineer prepares the preliminaries but the risk and liabilities are ultimately transferred to the contractor notwithstanding the reliability of the bill itself. As such, the reliability of preliminaries is of the utmost concern. The research focused on the improvement of the reliability of the preliminaries. The aim is to improve the effectiveness of present preliminaries in Civil Engineering conventional contracts. The objectives are, (1) To investigate the existing cost of item consideration and strategic approaches, (2) To improve the criteria of cost-related item components and expand their potential strategies. This paper considered previous research findings and highlighted the issues and problems related to the fallacy of the subject. Based on the preliminary survey (N=18), it was obvious that the issues concerning the reliability of preliminaries do exist. The research proceeded with a mass survey (N=270) of stratified data sampling involving Malaysian civil engineering contractors belonging to G7 CE21 class, as well as civil engineering consultants and developers. The survey used Likert scales, which ranged from 1 for “Strongly Disagree” to 5 for “Strongly Agree”. The analysis predominantly used SPSS statistics. The results conspicuously exposed the issues and the weaknesses of present practices. The improvement in the criteria of the present practices’ is expected to increase the reliability of preliminaries. As a way forward, the improved criteria provide better clarity, accuracy, and transparency to engineers and contractors as well as other construction players in general. Reliable preliminary items improve price accuracy for the betterment of the construction industry.

**Keywords:** conventional contract, civil engineering contract, preliminaries, tender accuracy

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## INTRODUCTION

Civil Engineering is a professional discipline that deals with the physical and naturally built environment with an emphasis on design and construction of the infrastructure work but not limited to roads, bridges, and dams (Columbia University, 2016; Lucas, 2014; Vera, 2013). To a wider extent, it also deals with nature which potentially exposes it to enormous challenges. Preliminaries are an integral part of the Bills of Quantities (BQ) (Abas et al., 2017; Gebreab, 2016; Turner & Townsend, 2018; Vera, 2013). Despite that, preliminaries are subjective and difficult to price (Abas et al., 2018; Adnan et al., 2011; Gebreab, 2016; Jimoh et al., 2011; Kammer, 2012; Keng, 2016; Yi, 2010).

Abas et al. (2017b) found that the cost of preliminaries for civil work in the Malaysian construction industry is between 3.26% and 6.38% the amount of the construction cost. However, in the International Market Survey 2018, Turner & Townsend (2018) reported that the cost of materials has increased, and expected the preliminaries between 11% and 15% respectively for Kuala Lumpur, Malaysia. In this respect, the range of 3.26% and 6.38% of the preliminaries are deemed to be grossly low. The cause for this is interesting and needs to be investigated and one of the issues may be due to the reliability of the bill itself. The Civil Engineering contracts are usually prepared and administered by civil engineers (Columbia University, 2016; Jimoh et al., 2011; Lucas, 2014; Vera, 2013). Malaysia is no exception. In conventional contracts of Civil Engineering works, it is a common practice that the engineers establish tender documents that include preliminaries (Chan, 2016). The contractors then price cost items accordingly, and bear all responsibilities (Adnan et al., 2011; Gebreab, 2016;

Gunathilaka et al., 2013; Yi, 2010). Truly, a comprehensive description of preliminary items is extremely important for correct pricing (Nahel, 2014).

### Reliability of Preliminaries in Conventional Contracts

The reliability of preliminaries to provide an accurate bill is always the subject matter due to its complexities (Abas et al., 2017; Abas et al., 2018; Cunningham, 2016; Gebreab, 2016; Ghani, 2006; Gunathilaka et al., 2013; Jimoh et al., 2011; Turner & Townsend, 2018). Two factors construed as imperative are the reliability of the bill and the price. However, most of the past researches were concerned about the accuracy of the price. Refer to (Adnan et al., 2011; Ghani, 2006; Jimoh et al., 2011; Keng, 2016). The preliminaries mainly deal with the "method related charges" items alongside other mandatory enabling costs such as insurance. "Method-related charges" items are important and should be diligently attended to ensure correct pricing (Adnan et al., 2011). The contractor is obliged to describe in detail its intended tasks (MyCESMM2, 2018). The sum unit requires the contractor to be meticulous as the lack of consideration is fatal.

The preliminaries are frequently exposed to cost manipulation with the inclusion of instructions, information, and obligations intermixed with cost-related items (Abas et al., 2017). Taking into consideration that preliminaries are the contractor's overhead costs (Hesami et al., 2014; Tak et al., 2002), it could be interpreted in many ways (Hesami et al., 2014). What is in the engineer's mind may not always be clearly understood by the contractor. The misunderstanding of certain items may result in unnecessary costs that cause higher bid prices (Adnan et al., 2011).

It is common that the engineers establish preliminaries based on non-standard methods such as bespoke based on past projects due to familiarity and experience. In Malaysia, the application of the standard method is not compulsory. However, by the year 2020, the Malaysian Civil Engineering Standard Methods of Measurement (MYCESMM2) will act as a single standard and necessary document (MyCESMM2, 2018; The Malaysian Reserve [TMR], 2017). The Class A of MYCESMM2 for general items pertains to the preliminaries. Even though the importance of preliminaries is clear, it constitutes a fraction of the contract obligation which incurs a substantial financial commitment to the contractor (Aderinto, 2010; Hesami et al., 2014; Yi, 2010).

## LITERATURE REVIEW

### Underlying Issues

In the conventional civil engineering contract, it is a usual practice that the civil engineer provides preliminaries and trade bills to form part of the tender document (Abas et al., 2017; Abas et al., 2018; Entrusty Group, 2009). The engineer adopts various approaches and formats to establish the preliminaries from the simplest to the most extensive (Cunningham, 2016). Among others, the bills of past projects are usually referred to in the pretext of uncertainties and complexities of the work (Haruna et al., 2017). To a certain extent, deliberate modification by engineers is based on best application and experience to suit project needs (Adnan et al., 2011). The action is to be cautiously administered with the intention to avoid discrepancies in the description of items (Yanqiu et al., 2016). Deficiency of information would cause missing items to be considered, thus sustain unnecessary additional costs due to variations (Entrusty Group, 2009; Haruna et al., 2017; Keng, 2016).

The risk of the accuracy is implicitly transferred to the contractor with the passing of the tender exercise. Undoubtedly, contractors use their own understanding when pricing the bills (Haruna et al., 2017; Keng, 2016). Truly, the reliability of an item is important and the effort to ensure its accuracy in terms of pricing is paramount. The action is urgent as the preliminary cost is the most difficult to price and arbitrary in nature (Keng, 2016). In Malaysia, Abas et al., (2017b) found that the contractors are willing to bid for civil engineering contracts at preliminaries ranging between 3.26% and 6.38% of the construction cost. Ironically, this is far from the actual statistic of 10% in the year 2016 and 2017 or the latest 11% in 2018 as reported by the International Construction Market Survey (Turner & Townsend, 2016, 2017, 2018). The lack of accuracy of the bill of preliminaries provided by the engineer or aggressive competition of tender prices among the contractors may lead to such occurrences. Due to competition, it is not unexpected that the contractors are taking risks by reducing the profit margin to secure a contract (Ji et al., 2014).

The contractors are obliged to price all items despite the complexities and uncertainties (Ghani, 2006). The site information attained during the site visit(s) either organised by the engineer or

contractor's own initiative is imperative (Ji et al., 2014). The information provides three-dimensional views of the site, its surroundings and in-situ constraints to be anticipated in the preliminaries. Contractors chiefly price the preliminaries based on thoughts and anticipation (Haruna et al., 2017; Keng, 2016). Not to mention that the accurate description of items prepared by the engineer is extremely important. The contractors minimise the risks by jacking up the prices of other items (Adnan et al., 2011), or reduce the profit margin to secure a contract (Ji et al., 2014).

The present approach reveals that the engineers and contractors are two separate entities during the preparation of the tender document. The engineer needs to establish the preliminaries and trade bills using his or her own approach and experience. The contractor only gets acquainted with the tender document during the tender exercise. The engineers and contractors have distinct approaches in the preparation and interpretation of the bills (Abas, 2016; Abas et al., 2017; Abas et al., 2018). This is understood as they have different types of experiences based on respective trades. To note that the description of items is susceptible to discrepancies, insufficient deliberation, repetitiveness, manipulation, and arbitration (Adnan et al., 2011; Bandi, 2016; Keng, 2016; Yanqiu et al., 2016). Moreover, the preparation of the bills is not required to adhere to any specific Standard Methods of Measurement (SMMs) and the preparation is based on the originator's preference and familiarity (Nizam Akbar et al. 2015).

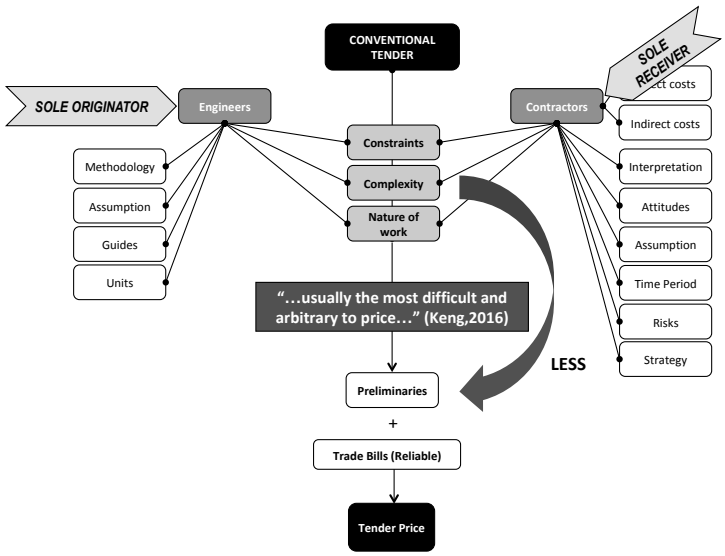


Figure 1: Existing Situation in Conventional Contract

Figure 1 depicts the traditional approaches by the engineer and the contractor in dealing with the preliminaries. The engineer as the originator establishes the bill based on certain methodologies, guides, and assumptions. The contractor as a receiver complies with the tender's requirements based on his or her own interpretations. The only shared knowledge about the site is its constraint, complexity, and nature of work that are obtained during the site visit. At this juncture, the reliability of preliminaries is uncertain but generally accepted for the tender exercise.

## AIM AND OBJECTIVES

The aim of the research was to improve the effectiveness of present preliminaries in Civil Engineering conventional contracts. The objectives were (1) To investigate the existing cost of items to be considered and the strategic approaches, (2) To improve the criteria of the cost related item components and expand its potential strategies.

### Conceptual Plan

The conceptual plan to improve the effectiveness of preliminaries is depicted in Figure 2. It shows that a clear justification of items would lead to a reliable bill. Certain issues such as unrealistic requirements or construction period (Memon et al., 2011), is normally not revealed by the Engineer. Clear justification increases clarity, eliminates ambiguities, and transparent that leads to easy

comprehension of items. Although the engineer established the bill separately, the contractor would understand the engineer's approach and the critical items would not be neglected. The avoidance of risks becoming the advantage of reliable preliminaries, therefore, expected to optimize the outcome that leads to smooth operation. The present preliminaries were verified through a quantitative survey against their reliability of cost related items and sought for best approaches to optimize the performance and avoidance of risks. Upon the release of the tender, the contractor should be able to inspect the items promptly using the improved criteria and raise concerns or counter proposals within the tender query period.

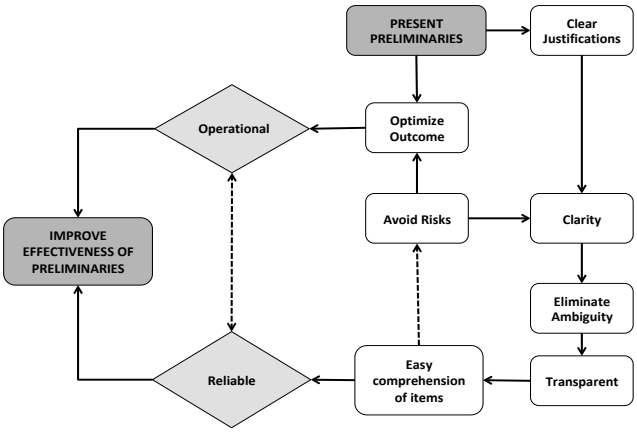


Figure 2: Conceptual Plan to Improve Effectiveness of Present Preliminaries

## PRELIMINARY SURVEY

The research started with literature review and followed by a preliminary survey on the construction industry players using simple random sampling. A preliminary survey was carried out in December 2016 among the civil engineering construction proponents in the Klang Valley. The purpose was to verify that reliability issues of the preliminaries in the conventional contracts do exist. A group of consultants and contractors was the unit of measurement. There were nine (9) consultants (50.0%), and nine (9) contractors (50.0%) participated in the survey. The respondents' experiences were between 5.1 and 10 years (17.0%), and above 10.1 years (83.0%). It was acknowledged that the experience above five to eight years of experience is considered fully competent professional and at the lead level. Eight years and above of experience are considered an expert in their own fields (University of Virginia, 2017). Table 1 depicts the distribution of respondents.

Six variables, where each of the "issues" and "problems" associated with preliminaries which were highlighted by previous researchers such as Aderinto (2010); Adnan et al. (2011); Atkinson et al. (2006); Austroads (2014); Azman et al. (2013); Cunningham (2014); Frazer (2012); Ghani (2006); Jimoh et al. (2011); Tower et al. (2012) were tested. The Likert scales where one (1) was "Strongly Disagree" to five (5) meant "Strongly Agree" were used to measure the strengths (Bertram, 2006). The results are graphically presented in Figure 3 and Figure 4 respectively. They indicate the extent to which the respondents agree that there are issues and problems which exist when dealing with preliminaries.

The Normality Test revealed that the ratio of skewness and kurtosis against their standard errors (SE) i.e. Z skewness and Z kurtosis, were within the limits of ±3.0 (Croarkin et al., 2013; Rindskopf et al., 2010). As such, the dataset approaching normality. However, the Shapiro-Wilk's coefficient (p) for all variables < 0.05, as such reject the null hypothesis as the dataset has significance difference and not normally distributed, therefore, non-parametric. Based on Spearman Rho ($\Upsilon s$) correlation analysis using SPSS Statistics, 33.3% of the variables were correlated. Among others, the "Standard Protocol" was seen to strongly influence the pricing ($\Upsilon s$=0.556), and reliability ($\Upsilon s$=0.408), and also risk due to uncertainty ($\Upsilon s$=0.614) as well as challenges to create reliable preliminaries ($\Upsilon s$=0.590). To note that 0.5 accept as a large correlation, 0.3 denote medium and 0.1 is small (Cohen, 1988). This concludes that the issue and corresponding problems do exist.

Table.1: Demography of Respondents of Preliminary Survey

| Nature of Business | Position | Experience (Years) | | | | Respondent | Total Respondent |
|---|---|---|---|---|---|---|---|
| | | 1-5 | 5.1-10 | 10.1-15 | >15 | | |
| Consultants | Director | - | - | - | 4 | 4 | 9 |
| | Engineer | - | 2 | 2 | 1 | 5 | |
| Contractors | Director | - | - | 1 | 3 | 4 | 9 |
| | Manager | - | - | 2 | 1 | 3 | |
| | Q.S. | - | - | 1 | - | 1 | |
| | Engineer | - | 1 | - | - | 1 | |
| | | | | | | Total | 18 |

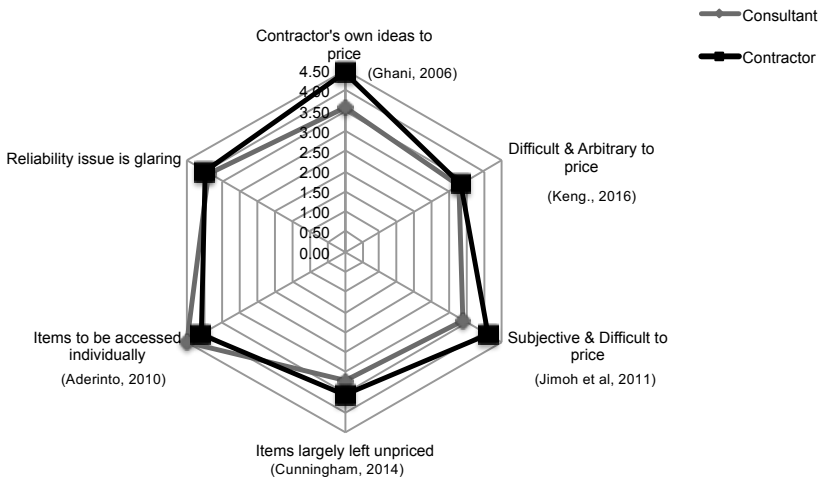


Figure 3: Issues in Preliminaries

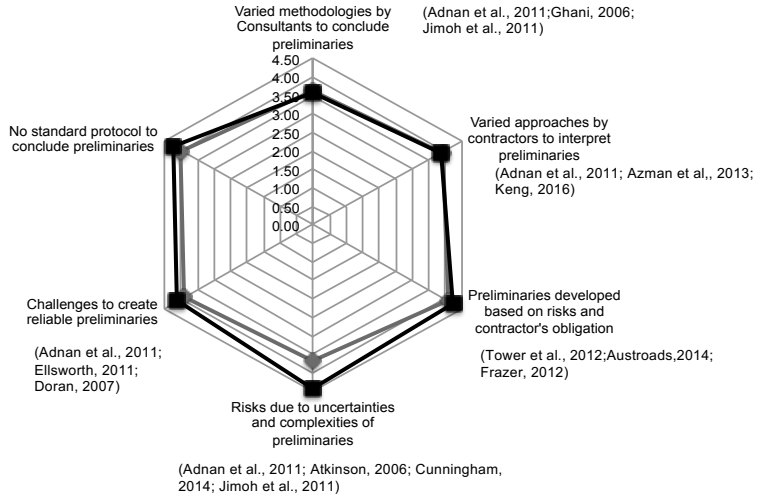


Figure 4: Problems Associated with Preliminaries

## RESEARCH METHODOLOGY

The preliminary survey dataset collected from 18 respondents was analysed using SPSS Statistics. Based on the initial result, a larger group (N=270) was subsequently considered to obtain a more accurate perception. This was carried out by means of a quantitative survey on the stratified construction proponents namely G7 CE21 contractors, civil engineering consultants and developers within Kuala Lumpur and the state of Selangor. The use of web applications such as Survey Monkey and emails were necessitated. The data analysis was carried out using SPSS Statistics.

## QUANTITATIVE SURVEY

The exploratory survey confirmed the existence of the issues in the preliminaries of conventional contracts. As such, a larger sample to investigate the issues further was necessary. The data was collected by means of the quantitative survey. The stratified group is presented in Table 2. Taro Yamane formula in Equation 1 prevailed the sampling size. Refer (Ajay et al., 2014, p.15; Israel, 1992) with confidence level of 95% and p = 0.05.

Table 2: Probability Sampling of Construction Proponents in Selangor and Kuala Lumpur

| State | Strata of Construction Proponent | | | Total |
|---|---|---|---|---|
| | Contractors* | Consultants** | Developers*** | |
| K.Lumpur | 1910 | 129 | 107 | 2146 |
| Selangor | 1818 | 267 | 153 | 2238 |
| **Total** | **3728** | **396** | **260** | **4384** |
| **Ratio** | **85%** | **9%** | **6%** | **100%** |

*CIDB, (February, 2018)

**Treasury, (June, 2018)

*** Master Builders Association of Malaysia, (2016)

The formula;

$$n = \frac{N}{1 + N\,(e)^2} \qquad \text{(Equation 1)}$$

Where: n = required sample size
N = 4384
e = Tolerance for error level 0.05
1 = Constant

Therefore,
Sample size, n = 367

### The validity of the Sampling Data

The total collected data at the cut-off date was 346 i.e. 6.0% < calculated sample size. Notwithstanding that, the response from the contractors was poor. Thus, the confidence level was adjusted from 95.0% to 94.1% to avoid disproportion of the stratum. The recommended frequencies of confidence level are 90.0%, 95.0% and 99.0% whereby the increased confidence level shows a true representation of the population somewhere in the interval (Bulpitt, 1987; Israel, 1992) As such, the confidence level of 94.1% was within the ambit. The generalized sample size of N=270 showed Consultants 24/270 (9.0%), Contractors 230/270 (85.0%), and Developers 16/270 (6.0%). Refer to Table 3.

Table 3: Proportionate Stratified Sampling at Cut-off Date of Quantitative Survey

| Strata | Proportion | Calculated Proportioned Sampling Size @ 95% | Completed Respond @ Cut-off Date | Revised Proportioned Sampling Size @ 94.1% | Clean up of Respond |
|---|---|---|---|---|---|
| Contractors | 85% | 312 | 231 | 230 | -1 |
| Consultants | 9% | 33 | 66 | 24 | -42 |
| Developers | 6% | 22 | 48 | 16 | -32 |
| | TOTAL | **367** | **346** | **270** | **-75** |

## DATA ANALYSIS

### Rankings

The dataset was ranked based on the Standard Deviation (SD) on the basis that the higher the value of SD the wider the data dispersed, thus less reliable. The lower the SD values gave the opposite meanings (Gordon, 2006; Rindskopf et al., 2010). The accuracy measured by the dispersion was more reliable (Rindskopf et al., 2010). Using a descriptive statistics analysis in SPSS, mean (M) and standard deviation (SD) were analysed for the dataset (N=270). The result was ranked to determine their strengths.

The researcher adopted an approach using SD as the scoring parameter due to its advantage over the mean. The closer SD to zero is most significant as the data concentration at the median and the higher values show wider dispersal from the median (Gordon, 2006; Rindskopf et al., 2010). The ranking using SD is more precise (Rindskopf et al., 2010).

Table 4 depicts the results of quantitative survey. Variables with SD ≥ 1.0 showed a wide dispersal of opinions, and 1.0 ≤ M ≤ 3.5 indicated the indecision or disagreement, and M > 3.5 denoted the agreement. Such variables represented existing issues of preliminaries that may be arbitrary, vague, or ambiguous and to be either removed or conceded with improved criteria (Table 5). Variables with SD < 1.0 are generally accepted (Table 6).

Table 4: Ranking of existing cost items consideration and strategic approaches

| Descriptive Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | Variables | N | Minimum | Maximum | Mean | SD | Ranking |
| 1 | O1_COCReg | 270 | 1 | 5 | 4.33 | 0.677 | Most reliable |
| 2 | O1_COCDer | 270 | 1 | 5 | 3.98 | 0.705 | |
| 3 | O1_Duplicate | 270 | 1 | 5 | 3.80 | 0.755 | |
| 4 | O1_Deliberate | 270 | 1 | 5 | 3.56 | 0.763 | |
| 5 | O1_Unprice | 270 | 1 | 5 | 3.96 | 0.785 | |
| 6 | O1_Familiar | 270 | 1 | 5 | 3.70 | 0.797 | |
| 7 | O1_Sparce | 270 | 1 | 5 | 3.69 | 0.821 | |
| 8 | O1_Sure_Dup | 270 | 1 | 5 | 3.72 | 0.850 | |
| 9 | O1_Absorb | 270 | 1 | 5 | 3.74 | 0.863 | |
| 10 | O1_Mistaken | 270 | 1 | 5 | 3.66 | 0.906 | |
| 11 | O1_VO | 270 | 1 | 5 | 3.90 | 0.929 | |
| 12 | O1_Understand | 270 | 1 | 5 | 3.66 | 0.958 | |
| 13 | O1_Unrelate | 270 | 1 | 5 | 3.47 | 0.962 | |
| 14 | O1_Contents | 270 | 1 | 5 | 3.69 | 0.979 | |
| 15 | O1_Allow | 270 | 1 | 5 | 3.00 | 1.009 | |
| 16 | O1_Unclear | 270 | 1 | 5 | 3.39 | 1.039 | |
| 17 | O1_CutPaste | 270 | 1 | 5 | 3.28 | 1.039 | |
| 18 | O1_EOT | 270 | 1 | 5 | 3.40 | 1.075 | |
| 19 | O1_Markup | 270 | 1 | 5 | 3.24 | 1.090 | |
| 20 | O1_Clarity | 270 | 1 | 5 | 3.09 | 1.132 | |
| 21 | O1_Indirect | 270 | 1 | 5 | 3.04 | 1.145 | |
| 22 | O1_Criteria | 270 | 1 | 5 | 3.12 | 1.257 | Less reliable |

Table 5: Improved Criteria with Standard Deviation (SD) ≥ 1.00

| Variables | Mean, SD | Concern of Existing Preliminaries | Improved Criteria |
|---|---|---|---|
| 01_Allow | 3.00,1.009 | Allow contingency to reduce cost risk for unclear item | Applied with caution. Contingency at Max of 10.0% (83.0% of respondents agreed) |
| 01_Unclear | 3.39,1.039 | Unclear items not to be priced | Applied with caution. |
| 01_CutPaste | 3.28,1.039 | Cut and paste items from previous project not practiced by Engineer | Conceded with caution. Independent Checker to be able to arrest abnormality. |
| 01_EOT | 3.40,1.075 | Extension of Time granted without incidental cost | Contractor to be cautious on the provision of contract prior to signing of an agreement. |
| 01_Markup | 3.24,1.090 | Mark-up higher price as safety buffer impractical | Not conceded. However suspected being practiced in the industry. |
| 01_Clarity | 3.09,1.132 | Lack of clarity does not lead to disputes | Lack of clarity leads to dispute. Independent Checker to be able to arrest abnormality. |
| 01_Indirect | 3.04,1.145 | Indirect costs not a major problem | Significant if involved higher cost and security issues. To handle with due diligent. |
| 01_Criteria | 3.12,1.257 | "Lower price wins" as a criterion for tender award | Not encouraged. The minimum standards to be specified for equal opportunities. |

Table 6: Improved Criteria with Standard Deviation (SD) ≤ 1.00

| Variables | Mean, SD | Concern of Existing Preliminaries | Improved Criteria |
|---|---|---|---|
| 01_COCReg | 4.33, 0.677 | COC regulates work | Conceded. Caution about bespoke COC as it may not provide a comprehensive reference and therefore exposed to missing items. |
| 01_COCDer | 3.98, 0.705 | Preliminaries derived from COC | Conceded but observe other requirements not stated in COC i.e. client's and site-specific requirements. |
| 01_Duplicate | 3.80, 0.755 | Duplicate items due to manipulation | Extreme caution required, as it would incur double payments. Independent Checker should be able to arrest abnormality. |
| 01_Deliberate | 3.56, 0.763 | Adequately deliberated | Conceded with caution. Be alert of insufficient deliberation that may cause misinterpretation. |
| 01_Unprice | 3.96, 0.785 | Unpriced item caused confusion | Conceded. Compulsory to make as clear as possible if not pricing by inserting the words "Nil" in the pricing columns. |
| 01_Familiar | 3.70, 0.797 | Contractors familiar with MYCESMM | Imperative as MYCESMM is compulsory by year 2020 for the Construction industry. |
| 01_Sparce | 3.69, 0.821 | Preliminaries prepared by Engineer is sparse | To be prepared by experienced persons ≥ 10 years with exposures in similar project's nature. |
| 01_Sure_Dup | 3.72, 0.850 | Price "sure" duplicate items to avoid vagueness | Contractors may opt not to price the duplicate items but must be by their robust experiences. Independent Checker should be able to arrest abnormality. |
| 01_Absorb | 3.74, 0.863 | Contractors absorb Preliminaries cost of additional work | Conceded with caution. The limit of tolerance not to exceed 10% or else consider Variation Order. |
| 01_Mistaken | 3.66, 0.906 | Non-cost related item not mistakenly priced by the Contractor | The non-cost related item must not be included in the Preliminaries to avoid misinterpretation. |
| 01_VO | 3.90, 0.929 | Variation order difficult to get paid. | The provision must be clearly stated in the binding contract between the Contractors and the Clients to avoid loss of expense. |
| 01_Understand | 3.66, 0.958 | Engineer and Contractor have different understanding | Conceded with caution. Tender briefings, tender visits, and tender queries would provide a certain degree of understandings. |
| 01_Unrelate | 3.47, 0.962 | Unrelated items not found in the bill | The unrelated items must be avoided and thorough review of the draft Preliminaries bills is required prior to the tender. |
| 01_Contents | 3.69, 0.979 | Contains not only cost related items | The non-cost related items could be specified in the preambles to avoid confusion. |

## FINDINGS AND DISCUSSIONS

The findings stipulate the existing situation in the Civil Engineering conventional contracts in Malaysia. The discussions encompassed the research objectives:

**Objective One:** "To investigate the existing cost of items to be considered and the strategic approaches". The findings in Table 5 show that the respondents disagreed with the "concern of existing preliminaries" (M<3.5) but with (SD>1.0) showed the dispersal of opinions were too wide. The respondent's opinions were interpreted that (1) the contingency is not mean to reduce the cost risk of the unclear item. (2) the unclear items still need to be priced. (3) the perception that cut and paste items from the previous project still being practiced by the engineer. (4) the respondent did not agree for the "extension of time" without disbursement of the incidental cost. (5) the perception that higher mark-up price is still practical as "cost" safety buffer. (6) they anticipated lack of clarity would lead to disputes, i.e. either construction or financial. (7) indirect cost is a major problem, and (8) "lower price wins" attitude is not preferred as the criteria for the tender award.

On the other hand, the findings in Table 6 show the respondents agreed to the statements with concentration of opinions (M>3.5, SD<1.0). It was pertinent that the respondents acknowledged that the Conditions of Contract (COC) is the origin of the preliminaries. The research confirmed that the existing flaws inherited from the past decades as discussed in the "underlying issues" section. The main issue prevailed that the engineer and contractor are having different approaches and anticipations in dealing with preliminaries. Secondly, the documentation issues such as "duplicate items", "sparseness" of preliminaries established by engineer, "variation order" difficult to get paid, contractor to "absorb" the preliminaries cost of additional work, and preliminaries contain non-cost related items are still occurring in the present day. The issues were cost-related and their propositions to improve were addressed in Objective Two.

**Objective Two:** "To improve the criteria of the cost related item components and expand its potential strategies". Based on the findings of Objective One, the "improve criteria" was proposed based on the "ranking" analysis in Table 5 and Table 6. The propositions for variables with lower values of "M", but higher values of "SD" need to be improved with caution to avoid wrong interpretations. Sufficient data need to be provided if necessary.

The research revealed that the current practices need to be realigned to meet the present and future challenges of the construction industry. The reliability of preliminaries is important to ensure reliable price. Based on the preliminary survey as depicted in Figure 3 and Figure 4, it shows that the concern of previous researchers as discussed in the Literature Review was justified, and ironically are still being practiced today. The findings of the quantitative survey on a larger sample size confirmed the assertion. The practice such as cut and paste, duplicate items, ambiguous statements i.e. due to sparseness, variation order without incidental cost, and other flaws need to be apprehended. The preparation of accurate preliminaries is a serious challenge. The approach must be transparent and exhaustive. It could be a prerequisite to align the preliminary items, thus bringing about the understanding of what transpired and what is expected in the contracts. The improved criteria would provide reliable preliminaries that lead to a respectable tender price.

## CONCLUSIONS

The improvement of the effectiveness of present preliminaries in Civil Engineering conventional contracts is achievable by a prudent review and continuous enhancement of the improved criteria. The improved criteria would provide an additional reference to the construction proponents such as to provide a cursory check against the preliminaries' items prepared by others or as a reference to develop a new bill. The preliminaries are usually established based on the Conditions of Contract (COC) used with the addition of specific items such as client's requirement. The transparency and reliability of preliminaries are imperative for the betterment of the construction industry.

Engineers and contractors differently conclude the preliminaries. Expectation and anticipation are distinctive. The engineer provides the bill of preliminaries and the contractor is expected to price them accordingly. The contractual and financial risks are ultimately transferred to the contractor albeit the accuracy of the bill is not certain at the time of tender. The effectiveness remains the subject matter, as redundant items such as repetition, and non-cost related are arbitrarily part of the bill of preliminaries. The research disclosed that many activities need to be improved due to vagueness and weaknesses.

The cost item components that underpin the preliminaries are identified and will need to improve their functions. The important issues such as the fallacy of the items are recognized as the main items that influence the reliability of preliminaries. Stressing on the prudent review and checking of the preliminaries bill and conditions of contract is envisioned to be important.

The overall performance of existing preliminaries (M=3.579, SD=0.927) is proven to have a substantial lack of reliability. The improved criteria presented in Tables 5 and 6 are expected to provide better clarity, accuracy, and transparency to engineers and contractors as well as other construction proponents in general. Reliable preliminaries ensure better price accuracy for the betterment of the construction industry.

## Recommendation for Future Research

Similar research is recommended for other construction disciplines such as buildings, refurbishment, safety, health and environment (SHE), and mechanical and electrical fields due to their different nature of work. The scope of the research may not be limited to conventional, design and build, hybrid, management, and miscellaneous contracts.

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