

# A COMPARATIVE STUDY OF USER PERCEPTIONS ON PRESCRIPTIVE SPECIFICATIONS VERSUS PERFORMANCE-BASED SPECIFICATIONS

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Nearly every construction project has its specifications written in either the prescriptive format or the performance-based format, or a mixture of both. The recent proliferation of specialist works and the popularity of the Design and Build procurement method have given rise to an increased use of performance specifications. Whilst prescriptive specifications are characterised by detailed descriptions of material and workmanship requirements, performance specifications lay down the desired end results and verification methods. It is often said that the latter allows flexibility and encourages innovations in the use of materials, systems and methods. Yet, performance specifications are not without their problems. Commonly cited complaints raise questions on the practicality of some targets, as well as the lack of objective criteria for testing certain results. Substantiating the achievement of desired results becomes problematic for many contractors. A recent survey carried out in both Hong Kong and Singapore explored the perceptions of users on both types of specifications. Clients, consultants and contractors have given their ratings and opinions on the attributes, usefulness and limitations of performance specifications. The types of work currently being specified by performance in the two cities were also surveyed. Some interesting comparisons on the use of prescriptive and performance specifications have been made between the two cities and they are correlated with the respective contextual backgrounds, which are largely similar yet with distinguishable features.

Keywords: prescriptive specifications, performance-based specifications, Hong Kong, Singapore.

## INTRODUCTION

Construction projects have traditionally been executed based on design information in the form of drawings and specifications prepared by the design teams. Whilst the drawings depict the graphical configuration of various components, the specifications are used to convey directions on the prescribed material and workmanship required to realise the design for the projects. The contractual responsibilities of contractors are to complete the construction in compliance with the drawings and specifications (hereinafter shortened as 'specs') under the supervision of the design team. As such, the traditional specifications are said to be *prescriptive* and the liability of their suitability for the intended use of the building rests on the design team.

With the increasing complexity and sophistication of construction projects in recent years, specialist contractors have developed new technology and building systems.

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They are often called upon to provide or contribute to designs based on the required performance of the facilities to be built. The client's requirements are expressed in the form of *performance specifications*, which state the end results and parameters to be achieved, either qualitatively or quantitatively, or both. This is coupled to a 'verification' approach.

The use of performance specifications in procuring construction works has been spurred by the increasing adoption of Design & Build and the Private Finance Initiatives. In order to encourage innovations in the construction industry, many countries, such as Australia, Canada, The Netherlands, New Zealand and the United States, have been re-molding their prescriptive building codes into performance-based standards (Hattis, 1999). The CIB also launched a networking program on Performance-Based Buildings in 2000 under the funding of the European Commission (Bakens, 2001). All these initiatives will gradually lead to the increased use of performance-based specifications (hereinafter shortened as PBS) worldwide.

### **PRESCRIPTIVE SPECIFICATIONS (PS) VS. PERFORMANCE-BASED SPECIFICATIONS (PBS)**

When the specifier wishes to dictate the required properties of a product, material or equipment, as well as the workmanship required for its proper installation, prescriptive specifications (hereinafter shortened as PS) would be written. In doing so, the specifier can achieve certainty by monitoring the suppliers and contractors to ensure compliance. Knowing the detailed requirements, the suppliers and contractors will also be able to price and plan for the works with certainty. If changes are made to the original requirements during progress of the works, both the clients and the contractors can ascertain the costs of variations based on the explicit price structure without great difficulty. As long as the contractors can demonstrate that the required materials and workmanship are installed into the delivered works, the burden of achieving the required performance is borne by the specifier. For example, a concrete mix specified to have four-part coarse aggregates, two-part fine aggregates and one-part cement with a 0.5 water-cement ratio is prescriptive.

As for PBS, the specifier states the required results (say concrete of 30MPa compressive strength at 28 days), the criteria by which performance will be judged and the methods of verification (say by trial mixes and compression tests). The contractor is free to choose materials, proportions, methods and systems to produce the required results. As such, innovative designs by specialists are encouraged. Evaluation, however, is more difficult due to different competing designs and prices. Specifiers may also encounter difficulties in laying down criteria of performance since there is still a lack of published performance data for all types of application (JCT 2001). When changes in the client's requirements are necessary after the design and pricing are fixed, it would be a painstaking task to ascertain the costs of variation and disputes on these aspects are therefore common. Usually, for field construction, maintenance and operation purpose, the specialist has to prepare detailed PS for the workforce and for use by operation and maintenance staff. Hence, specifying efforts may be duplicated.

### **THE SURVEYS IN HONG KONG AND SINGAPORE**

With an aim to understand the existing usage of PS and PBS, their relative strengths and user perceptions, two linked questionnaire surveys were carried out in Hong Kong

and Singapore. These two cities have undergone similar stages of infrastructure development and the capacities of their construction industry are comparable. In terms of the traditional procurement approach, Hong Kong and Singapore have both inherited the British model and share some common contract practices (such as in documentation) and institutional frameworks (such as statutory approvals). Yet, in recent years, there have been developments in the two cities, which have brought about subtle differences. An example of such difference is the more favourable reception of Design and Build by both the public and private sectors in Singapore when compared with Hong Kong.

The questionnaire survey was conducted in 2002 in the two cities by mail. Samples of building clients, consultants and contractors were chosen at random from the respective building directories and a linked questionnaire was mailed to each target respondent. The linked questionnaires were structured in such a way that clients, consultants and contractors would find the questions specifically worded for them by recognizing the different roles that they play, whilst the subject matter was essentially the same across different groups to allow direct comparison to be made between them (see Appendices A and B). For example, when requesting respondents to compare the usefulness of PS versus PBS in respect of pricing, client and consultant respondents were asked about estimating, whereas contractors were asked about pricing tenders and pre-contract planning. Satisfactory response rates were achieved after follow-up contacts with potential respondents. Table 1 shows the response statistics of the two surveys, broken down by the groupings:

**Table 1:** Response statistics of the questionnaire surveys in Hong Kong and Singapore

<b>Hong Kong</b>	<b>No. of questionnaires sent by mail</b>	<b>No. of valid replies received via fax</b>	<b>Response rate</b>
Clients	90	44	48%
Consultants	121	44	36%
Contractors	118	47	39%
Total	329	135	41%
<b>Singapore</b>	<b>No. of questionnaires sent by mail</b>	<b>No. of valid replies received via stamped envelopes provided</b>	<b>Response rate</b>
Clients	52	23	44%
Consultants	87	36	41%
Contractors	75	20	26%
Total	214	79	36%

## DESCRIPTION OF THE SAMPLES

In Hong Kong, the respondents were predominantly of management grade or were senior personnel with 6 to 15 years of experience. The distribution of firm sizes varies from small (with less than 20 technical personnel) to medium size (with between 21 to 100 technical personnel). Clients and consultants were more or less spread equally between the private and public/quasi-public sectors. 66% of contractor respondents worked for public/quasi-public projects whilst 28% worked for the private sector. The majority of all respondents worked on new building projects, whilst minor portions worked on alteration and addition works. Most of the projects were worth

HK\$50 million and above. Most clients (66%) engaged design consultants, but they still used in-house standard specifications to a significant extent.

For Singapore, the profile of experience and distribution of project types of respondents were comparable to those of Hong Kong. Clients were mostly from the public/quasi-public sector (78%), whereas more consultants and contractors were from the private sector. Contract values were mostly above S\$10 million (around HK\$50 million). Since these public sector clients had in-house design staff, only 44% of clients engaged consultants.

## METHOD OF ANALYSIS

In both Hong Kong and Singapore, the different groups of client, consultant and contractor respondents were first analysed separately to distill the group characteristics. Then cross comparisons were made between the three respondent groups to identify any significant difference due to the different roles they played in the projects. Eventually, each pair of respective groups (e.g., clients) in the two cities was compared in turn to identify any significant difference due to institutional factors.

For questions which invited scaled answers (based on a Likert Scale of 1 to 5 corresponding to “most disagree” and “most agree” respectively), Discriminant Analysis (DA) was employed to discern the existence of any difference amongst groups with roughly similar sample sizes. In the case of groups having significantly different sample sizes (e.g., during the comparison between Hong Kong and Singapore), the Mann-Whitney (MW) test (which is more accurate for larger samples) and the Kolmogorov-Smirnov (KS) test were used to identify any association between the data sets.

For questions that yielded categorical answers (such as “yes” or “no”, or choosing between prescriptive specifications and performance specifications), the Cramer Coefficient (or better known as Cramer’s *V* in statistical software) was calculated to identify any correlation between data sets.

Since all the mentioned techniques are well documented in statistical literature (e.g., Siegel and Castellan, 1988), it is not the intention of this paper to dwell on detailed explanations of their mechanics of calculation but to give the results or findings. The statistical software SPSS was employed to carry out all computations.

## RESULTS OF ANALYSIS

For the purpose of this paper, the relevant questions are extracted from a questionnaire with a larger scope and re-arranged in Appendices A and B. The sub-headings in the following paragraphs represent the focal issues of the respective questions.

### Existing Usage of Different Types of Specifications

The respondents were requested to indicate the approximate percentage of use of different types of specifications in their recently completed projects. Table 2 depicts a summary of the answers given by the 3 groups in Hong Kong and Singapore (all figures are mean values in percentage term):

**Table 2:** Comparison of the Use of Specs in Hong Kong and Singapore

Specs Type/City	Client Group		Consultant Group		Contractor Group	
	HK	Singapore	HK	Singapore	HK	Singapore

Prescriptive only	44.29	36.43	57.70	51.25	52.28	50.56
Performance-based only	27.38	25.95	26.49	20.66	27.05	30.00
Mixed	28.33	37.62	15.81	28.09	20.92	18.89
Total	100.00	100.00	100.00	100.00	100.25*	99.45*

(\*Deviation from 100 due to minor arithmetic inaccuracy)

It is interesting to note that the pure form of PS were used around half of the time by consultants and contractors in Singapore and Hong Kong, although clients in both cities reported slightly lower percentages of encountering PS. As for the pure form of PBS, usage was very consistent at around 26 to 27% in Hong Kong. Singapore shows a wider percentage variation of usage amongst the different respondent groups (from 20.66% to 30%).

The mixed use of PS and PBS within the same project was reported by all respondents at the extent of around 16 to 38% of the cases.

Due to limitation of space, only the mean values of usage percentages are shown in Table 2. Standard deviations are also calculated to be within the bounds of 13 to 33 (in most cases around 22).

Respondents in both cities mostly cited builder's work (such as brickwork, finishings, metalwork, etc.) as the items specified in a prescriptive way. Ready mix concrete and curtain walling was the commonly cited performance-based works. Although there is a traditional tendency for the basic builder's work trades to be specified by prescriptive means and specialist works to be specified by performance, there is no clear-cut division, as was seen in this survey. The respondents have demonstrated that some apparent specialist works (such as adventure climbing walls, GFRC rock wall, UPVC windows, etc.) were specified by prescriptive means, whereas seemingly basic items (such as interior decoration, window, louvers, etc.) were specified in terms of performance requirements. Most likely, the specialist works currently being specified by the consultants in a prescriptive manner were designed and developed by the specialist contractors, who have since laid down unequivocal specifications for the works based on their trusted systems. On the contrary, some traditional items have been opened up for more innovations when the consultant designers want to try out something new and unconventional. Hence, windows and louvers are increasingly specified by performance, given now that new materials, section profiles and coating systems (such as powder-coating and fluorocarbon) have proliferated in recent years.

### **Strengths of PS versus PBS at different project stages**

Respondents were requested to choose between PS and PBS as being suitable for a number of tasks at different stages of a project. The tasks were worded differently in the questionnaire for clients and consultants (Appendix A) from that for contractors (Appendix B) to reflect their respective roles during the design stage under the traditional procurement approach.

From Table 3, it can be observed that clients and consultants agreed that PS was more useful for estimating, both in Hong Kong and Singapore. Their opinions differed in the case of confirming client's requirements. Yet, they all reached consensus as to the usefulness of performance specs over prescriptive specs for other tasks during design and contractor selection.

**Table 3:** Usefulness of Prescriptive Specs vs Performance-based Specs as viewed by Client and Consultant groups for tasks during design and contractor selection

Use by Hong Kong respondents	Client Group		Consultant Group		Is consensus reached on which type is more useful?
	PS	PBS	PS	PBS	
For estimating by cost consultants	81.8	15.9	84.1	13.6	Yes, PS
For confirming client's requirements	45.5	52.3	65.9	31.8	No
For gaining time advantage in overall design	31.8	65.9	40.9	56.8	Yes, PBS
For saving construction cost	45.5	52.3	38.6	59.1	Yes, PBS
For soliciting innovative solutions	6.8	90.9	34.1	63.6	Yes, PBS
For sharing design liability amongst consultants and contractors	25.0	72.7	34.1	63.6	Yes, PBS
For selecting the more capable contractors	29.5	68.2	45.5	52.3	Yes, PBS
<b>Use by Singapore respondents</b>					
For estimating by cost consultants	87.0	13.0	83.3	11.1	Yes, PS
For confirming client's requirements	47.8	52.2	38.9	58.3	Yes, PBS
For gaining time advantage in overall design	47.8	52.2	38.9	52.8	Yes, PBS
For saving construction cost	39.1	60.9	41.7	55.6	Yes, PBS
For soliciting innovative solutions	13.0	87.0	13.9	83.3	Yes, PBS
For sharing design liability amongst consultants and contractors	13.0	87.0	25.0	72.2	Yes, PBS
For selecting the more capable contractors	13.0	87.0	22.2	72.2	Yes, PBS

Notes: Figures are in percentage of samples.

Cramer's *V* test indicates that Singapore consultants showed a bigger preference for PBS than Hong Kong consultants. This could be due to the more favourable reception of Design and Build in Singapore as mentioned earlier.

Around 70% of contractor respondents in both Hong Kong and Singapore considered PS to be more useful for estimating/pricing tenders and pre-contract planning. Their opinions were more or less equally split between PS and PBS as regards their usefulness in obtaining specialists' quotations. Hong Kong contractors opined that PBS was better for proposing innovative solutions (78.7%).

During the construction stage, client respondents in both Hong Kong and Singapore preferred PS for ensuring quality, assessing variation claims and comparing alternatives submitted by contractors. Consultant respondents also preferred PS for monitoring contractors' quality, for checking compliance with design requirements and as instructions to site supervisory staff. Contractor respondents found PS to be more useful for material ordering and for site planning. They, however, thought that PBS would be more useful for accepting/rejecting work done by sub-contractors. This is perhaps true for specialist sub-contractors who could be given performance targets to fulfil.

After construction, unlike their Singapore counterparts, Hong Kong clients seem to be less certain about their preference when using PS for property management and PBS for providing feedback for the design of future projects. Singapore clients should have got it right since maintenance and repairs entail detailed records of how items

were fixed together whereas feedback can be related to the appropriateness of design parameters adopted for present projects.

Consultants in both cities preferred PS over PBS for assessing time and cost claims from contractors and for assessing set-off against contractors for breach of contract requirements.

Hong Kong and Singapore contractors preferred PBS for testing and commissioning, presumably due to the greater flexibility in materials and workmanship as long as the specified targets were achieved. Singapore contractors, however, reversed their choice for making good defects; for compiling maintenance manuals; for preparing time/cost claims against employers and for preparing set-off claims against sub-contractors.

## **PERCEIVED ATTRIBUTES OF PBS**

Respondents' opinions were solicited on various attributes of PBS (which include positive and negative aspects) based on a Likert Scale of agreement and disagreement.

All respondents agreed most with the attribute that PBS facilitated innovation by specialist contractors.

Discriminant Analysis identifies that the attribute "Expensive re-work if end results are not satisfactory" is significantly different between Hong Kong and Singapore consultant respondents (Wilks' Lambda at 0.828 at  $p < 0.001$ ). This is confirmed by the Mann Whitney test ( $p < 0.001$ ) and the Kolmogorov-Smirnov test ( $p = 0.008$ ). Singapore consultants were more wary of this negative attribute of PBS than their Hong Kong counterparts. In close connection, Singapore contractors were more worried about vague requirements and expensive re-work arising from the use of PBS than Hong Kong contractors (Wilks' Lambda at 0.666 with  $p < 0.001$ ).

## **PREDICTED PROJECT OUTCOMES**

Respondents were asked to choose between PS and PBS against 4 sets of desirable project outcomes. They were reminded that project performance is affected by many factors other than specification types and that they should indicate their choice assuming "other things being equal".

Most respondents in the two cities preferred PS for achieving better quality construction, whilst they preferred PBS for achieving value for money and timely completion. The pendulum swung in favour of PS again when they aimed at reduction of disputes.

A subtle difference arose when the answers given by Hong Kong and Singapore groups were subjected to further tests. In terms of achieving better value for money, Singapore clients favoured PBS more so than Hong Kong clients. This is perhaps due to their perception that contractors' design can help to keep costs down. That again explains the increasing use of Design and Build, at least during the last building boom.

## **FUTURE USAGE OF PBS**

Respondents were asked whether they would like to see an increased use of PBS in the construction industry. The majority of respondents in Hong Kong (clients: 79.5%; consultants: 63.6%; contractors: 68.1%) and Singapore (clients: 73.9%; consultants: 66.7%; contractors: 77.3%) answered affirmatively. They liked the flexibility and

possibility of having innovations brought about by the move. Those who objected cited the uncertainties of interpretation and verifying results. Contractors were worried about the difficulty in cost estimation and the increased design liability.

Hong Kong contractors welcome more PBS for M & E works whereas their clients would like to see PBS being used even for builder's works. This seems natural since clients are more concerned with end-results, even for more traditional works. Singapore respondents did not manifest clear patterns in this regard.

## CONCLUSION

This survey has resulted in some meaningful comparison of the use of PS and PBS in two Asian cities with similar construction backgrounds. The perceptions of project participants on the attributes of these two types of specs have been explored. In general terms, PS is useful for quality assurance and contract administration whereas PBS can encourage innovation and enhance flexibility. The survey also leads to a conclusion that project participants in Hong Kong and Singapore by and large welcome the increased use of PBS due to predicted better outcomes in time and cost.

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## APPENDIX A

### Questionnaire for Clients and Consultants

1. Please fill in the approximate percentages of the Specifications (Specs) of your recently completed project as prescriptive and performance-based (including all M & E and specialist works)?

- |  |                     |
|--|---------------------|
| a. <b>Prescriptive ONLY</b>                              | [    ]%             |
| Pls. give examples of trades/sections: _____             |                     |
| b. <b>Performance-based ONLY</b>                         | [    ]%             |
| Pls. give examples of trades/sections: _____             |                     |
| c. <b>Mixture</b> of the above in the same trade/section | [    ]%             |
| Pls. give examples of trades/sections: _____             |                     |
| <b>Total:</b>  | <b><u>100 %</u></b> |

2. How would you compare the usefulness of Prescriptive Specs vs Performance Specs in the following situations (please put a tick to represent "More Useful")

- |  |  |   |
|--|--|---|
| (A) <u><b>During design and contractor selection</b></u> | <u>Prescriptive</u><br><u>Specifications</u> | <u>Performance</u><br><u>Specifications</u> |
|--|--|---|

- |   |                          |                          |
|---|--------------------------|--------------------------|
| a. For estimating by cost consultant            | <input type="checkbox"/> | <input type="checkbox"/> |
| b. For confirming client's requirements         | <input type="checkbox"/> | <input type="checkbox"/> |
| c. For gaining time advantage in overall design | <input type="checkbox"/> | <input type="checkbox"/> |
| d. For saving construction cost                 | <input type="checkbox"/> | <input type="checkbox"/> |
| e. For soliciting innovative solutions          | <input type="checkbox"/> | <input type="checkbox"/> |
| f. For sharing of design liability              | <input type="checkbox"/> | <input type="checkbox"/> |
| g. For selecting the more capable contractors   | <input type="checkbox"/> | <input type="checkbox"/> |

**(B) DURING CONSTRUCTION**

- |   |                          |                          |
|---|--------------------------|--------------------------|
| a. For monitoring contractors' quality performance  | <input type="checkbox"/> | <input type="checkbox"/> |
| b. For checking compliance with design requirements | <input type="checkbox"/> | <input type="checkbox"/> |
| c. As instructions to site supervisory staff        | <input type="checkbox"/> | <input type="checkbox"/> |
| d. For accepting/rejecting work done by contractors | <input type="checkbox"/> | <input type="checkbox"/> |
| e. For checking submittals prepared by contractors  | <input type="checkbox"/> | <input type="checkbox"/> |
| f. For effecting changes in design where necessary  | <input type="checkbox"/> | <input type="checkbox"/> |

**(C) AFTER CONSTRUCTION**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| a. For testing and commissioning                               | <input type="checkbox"/> | <input type="checkbox"/> |
| b. For supervising the making good of defects                  | <input type="checkbox"/> | <input type="checkbox"/> |
| c. For assessing time/cost claims from contractors             | <input type="checkbox"/> | <input type="checkbox"/> |
| d. For assessing set-off claims against contractors for breach | <input type="checkbox"/> | <input type="checkbox"/> |

3. Please give your opinions on the following attributes of performance specifications:

- |  | Most Disagree            |                          |                          |                          |                          | Most Agree               |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|  | 1                        | 2                        | 3                        | 4                        | 5                        | 1                        | 2                        | 3                        | 4                        | 5                        |
| a. Facilitate innovation by specialist contractors               | <input type="checkbox"/> |
| b. Buildability can be enhanced                                  | <input type="checkbox"/> |
| c. Tenders can be made more competitive                          | <input type="checkbox"/> |
| d. Specialist contractors can contribute to design               | <input type="checkbox"/> |
| e. More flexibility allowed                                      | <input type="checkbox"/> |
| f. End results can be validated by tests                         | <input type="checkbox"/> |
| g. Less subjectivity on acceptance/rejection                     | <input type="checkbox"/> |
| h. Vague requirements lead to different interpretations          | <input type="checkbox"/> |
| i. Not useful unless testing means and criteria are established  | <input type="checkbox"/> |
| j. Transfer part of the design liability to contractors          | <input type="checkbox"/> |
| k. Less supervision necessary for specialist contractors         | <input type="checkbox"/> |
| l. Expensive re-work if end results are not satisfactory         | <input type="checkbox"/> |
| m. Joint & several warranties extend Main Contractors' liability | <input type="checkbox"/> |

4. How do you compare the likely project results of the 2 types of specs, assuming other things being equal? (please tick the "better" choice for each attribute)

- |   | <u>Prescriptive Specifications</u> | <u>Performance Specifications</u> |
|---|------------------------------------|-----------------------------------|
| a. Clients can obtain better quality construction | <input type="checkbox"/>           | <input type="checkbox"/>          |
| b. Clients can obtain better value for money      | <input type="checkbox"/>           | <input type="checkbox"/>          |
| c. Time targets are more likely to be met         | <input type="checkbox"/>           | <input type="checkbox"/>          |
| d. Less likely to give rise to disputes           | <input type="checkbox"/>           | <input type="checkbox"/>          |

5. Would you like to see the increased use of performance specifications in the industry?

Yes  No  Reason(s): \_\_\_\_\_

If your answer is yes, which type (s) of work are more suitable?

Builder's work  Specialist works (e.g. waterproofing/curtain walls)  M & E  All

## APPENDIX B

### Relevant Question in Questionnaire for Contractors

NB: The following is the only different question for contractors, whereas Question 1, 3, 4, and 5 are the same as those for Clients and Consultants.

### 2. How would you compare the usefulness of *Prescriptive Specs* versus *Performance Specs* in the following situations (please put a tick to represent "More Useful")

		Prescriptive Specifications	Performance Specifications
<b>(A) During tender preparation</b>			
a.	For estimating/pricing	<input type="checkbox"/>	<input type="checkbox"/>
b.	For pre-contract planning, e.g., plant deployment	<input type="checkbox"/>	<input type="checkbox"/>
c.	For obtaining specialists' quotations	<input type="checkbox"/>	<input type="checkbox"/>
d.	For proposing innovative solutions	<input type="checkbox"/>	<input type="checkbox"/>
<b>(B) During construction</b>			
a.	For material ordering	<input type="checkbox"/>	<input type="checkbox"/>
b.	For post-contract planning of site works	<input type="checkbox"/>	<input type="checkbox"/>
c.	As instructions to foremen and sub-contractors	<input type="checkbox"/>	<input type="checkbox"/>
d.	For accepting/rejecting work done by sub-contractors	<input type="checkbox"/>	<input type="checkbox"/>
e.	For checking shop drawings prepared by specialists	<input type="checkbox"/>	<input type="checkbox"/>
f.	For securing variation entitlements from employers	<input type="checkbox"/>	<input type="checkbox"/>
<b>(C) After construction</b>			
a.	For testing and commissioning	<input type="checkbox"/>	<input type="checkbox"/>
b.	For making good defects	<input type="checkbox"/>	<input type="checkbox"/>
c.	For compiling maintenance manuals	<input type="checkbox"/>	<input type="checkbox"/>
d.	For preparing time/cost claims against employers	<input type="checkbox"/>	<input type="checkbox"/>
e.	For preparing set-off claims against sub-contractors & suppliers	<input type="checkbox"/>	<input type="checkbox"/>