



CONTRACT DOCUMENTS DISCREPANCY IN THE ROYAL COMMISSION BUILDING PROJECTS AT JUBAIL

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Term Paper

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ABSTRACT

This report represents results of a study performed on the causes, effects, and controls of contract documents discrepancies in the Royal Commission building projects. A survey questionnaire was distributed to the Royal Commission building contractors in Jubail Industrial City. The questionnaire lists the possible causes and effects of discrepancies. The study concluded that the main cause of discrepancy is changing one contract document and failing to do so to the other. It also concluded that the major effect of discrepancy is delaying the completion of the contract schedule. The study found that providing adequate budget for drafting the specification can minimize or eliminate the discrepancy in the contract documents.

CHAPTER ONE

1. INTRODUCTION

1.1. Background

The construction industry is one of the most important industries in all over the world. Construction industry in Saudi Arabia has in the last 30 years.

The construction industry products (projects) in Saudi Arabian are affected by some factors: Environment, Cultural/Social life, Materials & Equipment, Manpower and Codes & Standards Applications.

As Jubail Industrial City lies along the Arabian Gulf coast, the relative humidity is generally high especially in the summer. As a result, most of the contractors try to work in the cool hours of the early morning or evening, especially when pouring concrete, in order to slow the rate of water evaporation and avoid cracking in concrete.

Normally, workers are brought for a certain project and leave upon completion. This means that every time workers start from zero or close to zero on the learning curve.

The Royal Commission for Jubail & Yanbu follows the international codes and standards. Also, it developed its own guideline specifications that each construction contractor shall follow during construction projects.

In this research, the aim is to study this construction issue in the Building Projects of the Royal Commission for Jubail & Yanbu at Jubail Industrial City and to find out the causes and the effects of the discrepancies in the contract documents on the construction process.

1.2. Statement of the Problem

1. Discrepancies in the contract documents are to be expected in the construction work.
2. There are many causes for the discrepancies; all of which will lead the contractor, once the discrepancy discovered, to claim and may ask for a change order.

1.3. Objective of the Study

The main objectives of this research study are to:

1. Limit the causes of discrepancies in the contract documents in the Royal Commission.
2. Rank the effects of discrepancies in the contract documents in the Royal Commission.
3. Rank the most common procedures utilized in the Royal Commission to control or eliminate the discrepancies.

1.4. Research Methodology

Literature review was conducted to identify the common causes and the major effects of the contract documents discrepancy and the procedures being utilized to minimize or eliminate the discrepancies.

A research questionnaire was designed and distributed to the Royal Commission building contractors to determine, from their experience, the prevalence of each cause, effect and control procedure. At the end, the causes, effects, and controls were ranked on the basis of their importance.

CHAPTER TWO

2. LITERATURE REVIEW

This chapter describes the components of construction contracts. Then, it explains the specifications and its purposes. Finally, it describes different types of contracts.

2.1. Components of Contracts

1. Bid Form
2. Special Provisions
3. Agreement Form
4. General Conditions or Standard Specifications
5. Special Provisions
6. Plans (Drawings)
7. Addend.

2.2. Drawings

The drawings consist of plan views, elevations or side views, and cross sections. These drawings are drawn to show the details of various parts of the structure.

2.3. Specifications

The specifications are the part of the contract documents that define the qualitative requirements of the project that is to be built.

Purpose of Specification

There are two main purposes of specifications

1. To clarify the ideas of the designers and their vision of a complete project to the people who will assist in constructing the project.
2. To provide a specific document on which a legal contract can be based and executed.

Content of the Specifications

The specifications usually consist of general conditions, standard construction provisions, and special provisions.

1. General conditions refer to the basic legal and operating rules under which the contractor and agency will work.
2. Standard construction provisions (Standard Specifications) set forth the requirements for items commonly used in construction such as asphalt, concrete, fencing, pipe, and so on.

3. Special provisions are used to state modifications, additions, or deletions since the general conditions or standard construction provisions seldom cover all the details or items needed for a given project.

CSI Specification Format

The Construction Specifications Institute (CSI) developed a standard format of writing construction specifications. 16 standardized divisions which were supposed to work for everything:

1. General Requirements
2. Site Work and Utilities (includes civil work)
3. Concrete
4. Masonry
5. Metals
6. Wood and Plastics
7. Thermal and Moisture Protection
8. Doors and Windows
9. Finishes
10. Specialties
11. Equipment
12. Furnishings
13. Special Construction
14. Conveying Systems
15. Mechanical
16. Electrical.

As an example the searcher should automatically turn to Division 3 if he is looking for concrete or Division 16 if he is looking for electrical work.

2.4. Causes, Effects, and Controls of Contract Documents Discrepancies

Many architectural and engineering firms prefer not to repeat data on both documents. Some items will appear only in the specifications and not on the drawings; others will appear only on the drawings and not be mentioned in the specifications. This is done to prevent conflicts due to the late changes that may be made to one document alone and not to the other (CII, 1990).

Conflicts between the various clauses in the specifications are the cause of much trouble: in construction work. Confusion may result from typographical errors, mistakes and from the lack of coordination between the drawings and the specifications. These can be corrected usually by carefully checking before the specifications and other documents are issued.

As a result of a conflict, it would be possible for a contractor to claim to miss the conflict so as to furnish or perform the cheaper. Also, knowing well that if the design firm wants it changed after the contractor has already built it in accordance with the specifications, in all likelihood, contractor will be able to claim successfully compensation for such additional work.

Discrepancies

2.4.1. Discrepancies Causes

These parts examine the potential the following causes of discrepancies in contract documents.

1. Change one document & fail to change the others:

In some cases, the same data, covered in both the drawings and the specifications, are not in agreement. This is because frequently one document is changed during design and the other is overlooked.

2. Repetition of information in more than one document:

Repeating the same information or data in two or more places causes conflict between contract documents. Some details or specifications are shown in the drawings and are also shown in the specification.

3. Lack of specifics in specification and sufficient details in drawings:

Another frequent cause of the discrepancy and work dispute is the lack of detail in drawings or lack of specifics in specifications. The problem with drawings is most common on small projects where design costs, and therefore the number of drawings, are held to a minimum. If the drawings lack sufficient detail, the contractor will have to rely on what it understands is expected.

4. Specifications are not well prepared:

Specifications should be written in short, concise sentences, in the simplest style possible. The style and tense should be the same throughout. Unfamiliar words, words having more than one meaning, and unusual technical and trade expressions should be avoided.

5. Lack of specification writer experience:

The qualifications of a competent specification writer are a full knowledge and understanding

of the work to be accomplished, definite ideas as to the materials and which should be used, and the ability to express these ideas in the specifications and drawings in a manner readily understandable by those which are responsible for the execution of the work.

6. Human errors.

7. Typographical errors:

Incorrect spelling and punctuation marks and typographical errors in the specifications may have serious consequences. Mistakes of this sort may completely change the meaning of a sentence and cause disputes or extra cost.

8. Lack of Coordination:

It is quite important in a multi-player environment like a construction project to keep strong and continuous coordination. The owner should avoid giving direct orders to the contractor without the involvement of the party who is acting on his behalf. The consultant has to update the contractor of any concern he might have with the scheduled work.

2.4.2. Discrepancies Effects

There are numerous effects of discrepancy in contract documents. This section examines some of these effects which are commonly encountered.

1. Initiation of a change order:

One of the effects if any discrepancy in contract documents is discovered is issuing a change order. A change order is as “the formal document that alters some conditions of the contract documents”.

2. Decrease in Productivity:

Labor will slow or stop constructing the discrepancy related work activities. This degradation of productivity may cost extra days or weeks of expensive labor.

3. Delay in Completion Schedule:

Additional time means additional money. Delays incompletion can be quite costly.

4. Dispute between Owner and Contractor:

If these disputes are not settled peacefully through direct negotiations and arbitration they end up in court and legal procedures may suspend the whole project.

5. Decrease in Quality:

Sometimes discrepancies lead to a lower level of workmanship. The low morale of the crew after many discrepancies are made is also expected to affect the quality of their performance

6. Increase in Project Cost:

This is very evident result of discrepancy especially if a change order is required to be issued.

7. Delay of Material and Tools:

Discrepancies bring about problems with materials and tools required carrying out a certain activity.

8. Work on Hold:

This happens when activities are interdependent. This action may freeze a certain craft crew or shift the schedule of its schedule.

9. Increase in Overhead Expenses:

They may requires holds on funds that otherwise will be used for other activities. The charge normally goes on the contractor's overhead account.

10. Delay in Payment.

11. Demolition and Re-work:

This may cause some parts of the work done to be demolished and to be done again.

2.4.3. Discrepancy Controls

1. Providing adequate budget for specification drafting:

Specialized specification's writers shall be used. Adequate budget shall be allocated for drafting and reviewing the contract specifications.

2. Work only with a set of carefully prepared & coordinated front-end document:

The longer the period between recognition and implementation, the more costly the change is. Because of the dynamics of construction projects, work impacted by changes increases as the project progresses to a more detailed phase. This control is quite important in large organizations or large projects and a multiplayer environment.

3. Qualified specification engineers shall control the sets of project specifications:

Not every engineer can revise, update or mark the specifications set.

4. Master specification document shall be used to create a set of job specifications:

Only a copy of master specification documents shall be used to create a set of job specification.

5. Update the master specification at least annually:

The master specifications shall be subject to the update at least once a year. This is to bring the specification documents up-to-date with the latest standard practices and technology advancement.

6. Changes to documents shall be reviewed by legal and construction management personnel:

Changes to specification documents should be subject to review of both legal and construction management personnel.

CHAPTER THREE

3. SURVEY QUESTIONNAIRE

3.1. Questionnaire Design

The questionnaire design took into confirmation the objectives of the study with the aim to answer the research questions. Questions required were identified and presented in a clear format.

3.1.1. Content of the Questionnaire

The questionnaire is divided into five sections.

1. The first section includes instructions to respondents defining the key terms in the study and providing respondents with instructions on completing the questionnaire.
2. The second section contains general information about the respondents such as contact address, company size, type, etc.
3. The third section addresses causes of discrepancy.
4. The fourth section addresses the possible effects of discrepancies.
5. The last section in the questionnaire addresses the normally adopted controls of discrepancies in the construction industry and the administrative procedures set to minimize their impact.

3.1.2. The Statistical Sample

Two restrictions were imposed on the selection process of respondents:

1. Restricted to Royal Commission, Jubail.
2. Restricted to building projects (excluding industrial, highway, and other types of construction).

Sample size was determined as follow:

$$n_0 = (p*q)/V^2 \quad (1)$$

$$n = n_0/[1+(n_0/N)] \quad (2)$$

Where:

n_0 : First estimate of sample size

P : The proportion of the characteristic being measured in the target population

q : Complement of 'p' or 1-p

V : The maximum standard error allowed

N : The population size

n : The sample size.

To maximize n , p is set at 0.5. The target population N is 16 for contractors. To Account for more error in qualitative answers of this questionnaire, maximum standard Error V is set at 10% or 0.1. Substituting in Equations 1 and 2 above, minimum required Sample is calculated to be 9.76. This means that minimum sample size is 10.

3.1.3. Gathering of Data

Forms were given to project managers, construction managers or quality managers to complete. Completed forms were collected later. Over a period of a month after mailing the questionnaire and making contact with the contractors, the researcher collected the twelve responses.

3.1.4. Scoring

The main sections of the questionnaire on causes, effects, and controls use basically an ordinal scale. This offline scale does not offer in its qualitative 5 point scales a direct quantitative comparison between its intervals. This scale will be transformed into an interval scale by assigning a weight to each interval. Therefore if we think of intervals from 'never' to 'very often' as an interval scale from zero to 100, we can achieve this transformation which will enable us to carry the required parametric statistics. As long as we keep alert of the "possibility of gross inequality of intervals" we can proceed with treating our 5-point scale as an interval scale and use parametric statistics. We can use the arithmetic mean as the measure of central tendency and standard deviation as the measure of dispersion. The questions in Section II of the questionnaire are either in ordinal scale, nominal or ratio scale. Ordinal scale questions will be transformed into interval scale as above. Ratio and interval scale questions will be used directly in the analysis.

No scoring will be used for questions in Section II of the questionnaire, since this section contains general information and characteristics of the market.

Section III, IV, and V on causes, effects, and controls respectively will be scored as follows to come up with an Index to indicate its prevalence:

CHAPTER FOUR

‘VERY OFTEN’ equals to one hundred (100)

‘OFTEN’ equals to seventy five (75)

‘SOMETIMES’ equals to fifty (50)

‘SELDOM’ equals to twenty five (25)

‘NEVER’ equals to zero (0).

Prevalence Index of each causes, effects or controls will be calculated as follows:

$$\Pi_{ci} = 100x_1 + 75x_2 + 50x_3 + 25x_4 + 0x_5 / (x_1 + x_2 + x_3 + x_4 + x_5)$$

Where:

Π_{ci} : Importance Index

(C1 denotes cause 1 in this case)

x_1 : Number of respondents answering (VERY OFTEN)

x_2 : Number of respondents answering (OFTEN)

x_3 : Number of respondents answering (SOMETIMES)

x_4 : Number of respondents answering (SELDOM)

x_5 : Number of respondents answering (NEVER).

Causes, effects, and controls will be ranked on the basis of their indexes with the first rank assigned to the highest index.

4. RESULTS AND FINDINGS

In, the analysis of obtained data, the same order used in the questionnaire **will** be followed. The first section will discuss the results on general information and the prevailing industry characteristics. These include size of companies working in this industry and their level of experience. These features are thought to have bearing on the discrepancy’s magnitude and consequences.

In the second section, data on causes of discrepancies will be analyzed. Minimum and maximum values, standard deviation, and Prevalence Indexes of causes will be reported and will be ranked on the basis of their importance.

In the third section, data on the effects of discrepancy will be analyzed. The effects will be ranked according to their Prevalence Indexes.

In the fourth section, data on controls of discrepancy will be analyzed. We will look at the distribution of data and examine the basic statistics of controls. Prevalence Indexes of the common controls will be calculated and ranked on the basis of their utilization.

4.1. General Information and Industry Characteristics

The distributions of size and level of experience for contractors are shown on: Tables 4.1.1 and 4.1.2. Sizes of companies are categorized according to the number of employees as follow:

1. Very Large (more than 1000 employees)
2. Large (between 500 and 1000 employees)
3. Medium (between 200 and 500 employees)
4. Small (less than 200 employees).

Table 4.1.1: Size of Contractors

No. of Employees	No. of Contractors
< 200	0
200 – 500	2
500 – 1000	6
> 1000	4

The level of experience among participating contractors and consultants are classified as follows:

1. Very Long (more than 15 years)
2. Long (between 10 and 15 years)
3. Short (between 5 and 10 years)
4. Very short (less than 5 years).

Table 4.1.2: Contractors Years of Experience

Years of Experience	No of Contractors
< 5	0
5 – 10	0
10 – 15	4
> 15	8

4.2. Causes of Discrepancy

The responses on the causes of discrepancy data provided by contractors will be reported by stating the minimum and maximum values and the standard deviation for each cause to see the dispersion of data. The Importance Index will be calculated as outlined in chapter four above. Finally, causes will be ranked and categorized based on the importance index calculated.

The results in Table 4.2.1.

It is apparent that contractors rank cause no. 1 “Changing one document & fail to change the other” as the prime cause of discrepancy in the building construction.

The ranking of the discrepancy causes is as follows:

1. Changing one document & failing to change the other.
2. Lack of specifics in specifications & sufficient details in drawings.
3. Repetition of information in more than one document/drawing.
4. Specifications are not well prepared.
5. The lack of coordination between contractor and consultant or other contractors.
6. Human errors.
7. Typographical errors.
8. The lack of specification writer experience.

Table 4.2.1: Prevalence Index (PI) of Causes

Causes of Discrepancy	No. of Respondent					PI
	Very Often	Often	Some Times	Seldom	Never	
1. Changing one document & fail to change the other	0	5	6	1	0	58.33
2. Repetition of information in more than one document/drawing	0	4	6	2	0	54.17
3. Lack of specifics in specifications & sufficient details in drawing	1	2	8	1	0	56.25
4. Specification are not well-prepared	0	0	12	0	0	50.00
5. Lack of specification writer experience	0	0	4	8	0	33.33
6. Human errors	0	0	8	4	0	41.67
7. Typographical errors	0	0	8	4	0	41.76
8. The lack of coordination between contractor and consultant or other contractors	2	1	2	7	0	45.83

4.3. Effects of Discrepancy

Table 4.3.1 below summarizes the results of responses of the contractors participated in the survey on the effects of discrepancy on the building projects.

The ranking of the discrepancy effects in the building projects listed in descending order is:

1. Delay in completion schedule.
2. Increase in overhead expenses.
3. Delay of materials and tools.
4. Increase in cost of the project.
5. Delays in payment.
6. Hold on work in other areas.
7. Disputes between owner and contractor.
8. Decrease in productivity of workers.
9. Initiate a change order.
10. Demolition and re-work.
11. Decrease in quality of the work.

Table 4.3.1: Prevalence Index (PI) of Effects

Effects of Discrepancy	No. of Respondent					PI
	Very Often	Often	Some Times	Seldom	Never	
1. Initiate change order	0	2	4	6	0	41.67
2. Decrease in productivity of workers	0	1	7	4	0	43.75
3. Delay in completion schedule	2	4	4	2	0	62.50
4. Disputes between owner and contractor	0	3	4	5	0	45.83
5. Decrease in quality of work	0	0	6	2	4	29.17
6. Increase in cost of the Project	2	0	8	2	0	54.17
7. Delay of materials and tools	4	1	1	6	0	56.25
8. Hold on work in other areas	2	2	2	6	0	50.00
9. Increase in overhead expenses	2	2	6	2	0	58.33
10. Delays in payment	2	2	6	0	2	54.17
11. Demolition and re-work	0	2	4	4	2	37.50

Table 4.4.1: Prevalence Index (PI) of Controls

Controls of Discrepancy	No. of Respondent					PI
	Very Often	Often	Some Times	Seldom	Never	
1. Provide adequate budget for drafting specifications	8	2	2	0	0	87.50
2. Work only with a set of carefully prepared & coordinated front-end document	6	4	2	0	0	83.33
3. Place the control of each set of project specification in the hands of a single qualified specification engineer	6	2	4	0	0	79.17
4. Use only a copy of master specification documents to create a set of job specification. Don't use a previous job specification documents.	6	4	2	0	0	83.33
5. Update the master specification at least annually.	4	2	4	2	0	66.67
6. Project engineers should not edit the front-end documents.	6	2	2	2	0	75.00

4.4. Controls of Discrepancy

Table 4.4.1 shows the summary of the results of the survey's responses from the contractor participated in the survey.

The ranking of the controls utilized by contractors to safeguard against occurrence of discrepancy or to minimize their impacts if they occur is:

1. Provide adequate budget for drafting specifications.
2. Work only with a set of carefully prepared & coordinated front-end document.
3. Use only a copy of master specification documents to create a set of job specification. Don't use a previous job specification documents.
4. Place the control of each set of project specification in the hands of a single qualified specification engineer.
5. Project engineers should not edit the front-end documents.
6. Update the master specification at least annually.

4.5. Comments from Respondent

The following comments are made by contractors on the questionnaire forms and documented for reference.

1. Asking for materials that are not in the specification.
2. As an effect of discrepancy, contractor is forced to bear the additional correction effort of the discrepancy.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

Based on the field survey conducted and the results presented in chapter four, the following can be concluded:

1. The general industry information collected indicates the following facts: contractors involved in the Royal Commission building construction are large in size and most of them reported over 15 years of experience.
2. Failing to change other documents when one is changed and the lack of specifics & sufficient details in the specifications and drawings are the two main causes of contract documents discrepancy. Lack of specification writer experience is the least important cause of discrepancy in the contractor point of view.
3. Delay in completion the project schedule and the increase in overhead expenses are the two main effects being noted for discrepancy. Decrease in quality of work and demolition & re-work scored lower and are less prevalent.
4. Providing adequate budget for drafting specifications ranked the first among controls adopted.
5. Updating the master specification at least annually by building construction department.
6. Avoid the repetition of information. Similarly, a crosscheck shall be conducted once there are revisions made in the drawings.

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