

Causes of Discrepancies between Design and Construction Stage in the Construction Projects

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Abstract

Before the designs are transferred into the practical reality during the actual construction work, there might occur some unwanted mistakes, errors or variations such as design errors. Thus, discrepancies do occur between the designs and actual construction work. This may cause losses for the particular project such as delay of time, compromise on quality, cost overrun and also bad reputation for the project and parties involved in the problem. The objectives of this study were to identify the causes of discrepancy and identify the methods to reduce the discrepancy between design and construction work. The study was

carried out through questionnaire. Responses of each 4 consultants and contractors were analyzed. All data analysis of the research was done by using Microsoft Excel 2007.

The methods to reduce discrepancies were good supervision, coordination, standardization and control of flow of information. Arranging for periodical professional meetings, accrediting body, neutral participant and Project construction management team can also reduce the discrepancies.

Keywords – design complexity, design-construction interface.

I INTRODUCTION

A. Importance of Design Construction Interface

The design construction interface is especially important since the quality of construction facility many times is a function of the quality of the information generated during the planning and design phases, and especially of the degree of construction input to the design process.

II REVIEW OF LITERATURE.

Sui Pheng Low and Wai Kiong Chong (2006) conducted a research study on design and construction interface dissonances in large building projects. The results indicate that lack of coordination, insufficient working drawing details, involvement of designer as consultant, involvement of contractor as consultant & participants' honest wrong beliefs are considered as

most important origins of professional dissonances on project design and construction interfaces. Whereas the project management as individual professional service, nationality of professional firms & involvement of contractor in design phases are interestingly revealed as least important origins of dissonances between professionals on project design and construction interfaces in large building projects.

Mohammad Mryyian and Patricia Tzortzopoulos (2013) conducted a study to develop a framework to support designers to identify sources of errors and reduce waste through different design phases. Results demonstrate perceptions that the main causes of errors and waste are related to (a) client changes; (b) design drawing and detail issues; and (c) problems with following regulations and building codes.

III INTERFACE MANAGEMENT

Interface Management is defined as the management of communication, coordination, and responsibility across a common boundary between two organizations, phases, or physical entities which are independent. It is

managing the problems that often occur among people, departments, and disciplines rather than within the project team itself.

IV PILOT STUDY

Table 1 Details of Projects Used for Pilot Study

Project Location	Type of Project	Project Participant (Designer)	Project Participant (Contractor)
Star Constructions, Coimbatore	Commercial	Saravanan	Prabakaran
Shalom Constructions, Palani	Commercial	Vignesh	Boopathi
Chettinadu Constructions, Coimbatore	Industrial	Ramya	Kumaran
RG Construction, Coimbatore	Residential	Ashok	Murugan

affecting the design construction interface.

V DATA COLLECTION

Interviews and surveys with design and construction professionals were also carried out in order to identify the most common problems

VI MAJOR CAUSES OF DISCREPANCIES

A. Common Causes of Discrepancies from both Design

Consultants and Contractors Point of View

- a) Lack of Data
- b) Lack of Human Resources in Design Firm
- c) Change Order
- d) Lack of Mutual Respect between Constructor and Designer
- e) Obstinate Nature of Participants
- f) Lack of Coordination
- g) Influence of Buildability
- h) Involvement of Contractor in Design Development Phase
- i) Lack of Accuracy in Specification and Working Drawings
- j) Nationality of Both Construction and Design Firms

B. Causes of Discrepancies from Design Consultants Point of View

- a) Time Limitation in Design Phase

- b) Contractor's Lack of Comprehension of Drawing Details and Specifications
- c) Design Complexity
- d) Lack of Designer Knowledge about Available Materials
- e) Involvement of Contractor in Design Conceptual Phase

C. Causes of Discrepancies from Contractors Point of View

- a) Procurement Delays
- b) Design Errors
- c) Unforeseen Problems at Site
- d) Participant's Honest Wrong Belief
- e) Lack of Professional Experience and Judgment
- f) Material Changes during the Construction Phase
- g) Construction Error

VII SURVEY QUESTIONNAIRE

The questionnaire design was developed while considering the vital

objective of the study. Pilot study and meetings with professionals of the construction industry were carried out to identify the appropriate questionnaire stipulated and to convey them in unambiguous format.

VIII RESULTS AND DISCUSSION

A. Analysis of Responses

a) Five Point Scaled rating

Responses in 5-point scaled starting with VERY OFTEN and end with NEVER are analyzed.

b) Three Point Scaled Rating

Responses in this section are given on a three-point scale starting with SEVERE and ending with NIL.

c) Two Point Scaled Rating

Some of the Response is given as yes or no type in both contractors and design consultants questionnaire.

B. Method of Data Analysis

The relative importance index method used to determine the relative importance of the various factors that affect design-construction interface. The five-point scaled rating as 1 (never), 2 (seldom), 3 (sometimes), 4 (often), 5 (very often) were adopted. The three-point scaled rating as 1 (nil), 2 (mild), 3 (severe) were adopted. The two-point scaled rating as 1 (no), 2 (yes) were adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \sum W / (A * N)$$

Where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in five-point scaled rating, 3 in three-point scaled rating and 2 in two-point scaled rating), and N is the total number of respondents. The RII value had a range from 0 to 1 (0 not inclusive), higher the value of RII, more important was the cause or effect.

The RII was used to rank the different factors.

C. Results of Data Analysis

Table 2 RII value and rank of each cause from consultants view

Causes of Discrepancies	RII	Rank
Five Point Scaled Rating		
Time limitation in design phase	0.8	5
Obstinate participants	0.7	7
Lack of data	0.85	4
Contractor's lack of comprehension of drawing details and specifications	0.95	1
Lack of human resources in the firm	0.7	7
Design complexity	0.9	2
Lack of accuracy in specification and working drawings	0.85	4
Lack of mutual respect between design consultant and	0.45	9

contractor		
Lack of designer knowledge about available material	0.8	5
Three Point Scaled Rating		
Effect of incomplete plans and specifications	0.75	6
Involvement of contractor in design conceptual phase	0.66	8
Involvement of contractor in design development phase	0.75	6
Nationality of the firms	0.66	8
Two Point Scaled Rating		
Lack of data	0.875	3
Lack of coordination	0.875	3
Influence of buildability	0.75	6
Change order affect design construction interface	0.75	6

Table 3 RII value and rank of each cause from contractors view

Causes of Discrepancies	RII	Rank
Five Point Scaled Rating		
Obstinate participants	0.7	6
Lack of data	0.65	8
Participant's honest wrong belief	0.65	8
Lack of human resources in the firm	0.85	3
Lack of accuracy in specification and working details	0.65	8
Lack of mutual respect between design consultant and contractor	0.75	5
Unforeseen problems at site	0.85	3
Involvement of contractor at design development phase	0.8	4
Nationality of the firms	0.55	11
Lack of professional experience and judgments	0.65	8
Material change during construction	0.6	10

phase		
Design errors	0.85	3
Procurement delays	0.75	5
Three Point Scaled Rating		
Effect of incomplete plans and specifications	0.66	7
Two Point Scaled Rating		
Change order	1	1
Lack of data	0.875	2
Lack of coordination	1	1
Influence of buildability	0.875	2
Construction error	0.0625	9

IX ELIMINATING DISCREPANCIES AND IMPROVING DESIGN CONSTRUCTION INTERFACE

A. Methodology to Improve Design Quality

These problems the can be solved acting through four different actions:

- Supervision of the design process

- Coordination of the different specialties
- Standardization of design information
- Control of the flow of information

B. Common Measures to Improve Design Construction Interface

- Implementation of project centre
- Contractors should provide their input in design phase
- Periodical professional meetings
- Accrediting body
- Neutral participant who intends to act as a mediator
- Project construction management as individual professional service

X CONCLUSIONS

The main objective of the thesis was to determine the factors affecting design-construction interface, to know their causes on construction works and to identify ways of preventing or solving these problems. For collecting

the data for this project, 4 companies were selected. The 4 companies responded to the direct interviews and on-line surveys. Then, through the interview 22 major causes of discrepancies are shortlisted. Method used for analysis of data is relative importance index. From the analysis and results 22 factors are ranked according to their Relative Importance Index value.

These problems produce a series of impacts in the construction works such as: delays in construction, rework, conflicts between professionals etc.

By conducting frequent professional meetings during the various, Regular safety meetings and preconstruction exercise, project construction management team should also work hard for reducing these problems. They should be strictly professional in maintaining the stipulated time schedule of the client.

APPENDIX 1 SURVEY QUESTIONNAIRE

QUESTIONNAIRE (DESIGN CONSULTANT)

I am a Post Graduate student from Ratnavel Subramaniam College of Engineering and Technology, Dindigul. I thank you for spending your valuable time on filling this questionnaire. The information you provide will help me in my academic research.

(Your information will be kept confidential and will be used only for the assessment purpose in this thesis work)

SECTION A

Name: _____

Organization / Company: _____

Role: _____

SECTION B

Some of the causes for discrepancy in design construction interface are formed as questions for your response to evaluate their effects and severity.

Q_1) Do time limitation in design phase affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_2) What is the effect of incomplete and inadequate plans and specification in design construction interface?

Severe []

Mild []

Nil []

Q_3) Do you encounter obstinate nature of participants?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_4a) Do loss of data affect?

a. Yes b. No

Q_4b) If yes, Mention it's inference in your past projects.

Very Often []

Often []

Sometimes []

Seldom []

Never []

Seldom []

Never []

Q_5a) Do you think lack of coordination between design team and construction team affect the interface between design and construction?

a. Yes b. No

Q_5b) If yes, mention suitable technique to improve coordination between construction team.

- Web based project management
 - Implementation of project centre
 - Other
-

Q_7) Do influence of buildability affect interface?

a. Yes b. No

Q_8) Do lack of human resources in design firm affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_9) Do design complexity exist?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_6) Do you encounter contractor's lack of comprehension of drawings details and specifications?

Very Often []

Often []

Sometimes []

Q_10) Do lack of accuracy in specification and working details affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Mild []

Nil []

Q_11) Do lack of mutual respect

between designer and contractor affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_15) Do lack of designer knowledge

of available materials affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_12) Do involvement of contractor in

design conceptual phase affect?

Severe []

Mild []

Nil []

Q_16) Your view on project

construction management team in

promoting design construction

interface

Q_13) Do involvement of contractor in

design development phase affect?

Severe []

Mild []

Nil []

Q_17a) Do you think change order

affects design construction interface?

a) Yes b) No

Q_14) Do nationality of both

construction and design firms affect?

Severe []

Q_17b) If yes rank the causes for

change order

Causes for Change Order	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Change in design by client					

Value engineering					
Errors and omissions in design					
The scope of work for the contractor is not well defined					
lack of coordination					

Rank the following according to your preference from 1-5 with

(1-highest preference 2, 3, 4-next preferences and 5-lowest preference)

Q_18a) What are the effects of discrepancies in design and construction interface?

- Construction delays []
- Decrease in productivity []
- Increase in project cost []
- Decrease in quality of work[]
- Dispute between owner and contractor []

Q_18b) Please mention any other effects that you have experienced in past projects (if any) _____

QUESTIONNAIRE (CONTRACTOR)

I am a Post Graduate student from Ratnavel Subramaniam College of Engineering and Technology, Dindigul. I thank you for spending your valuable time on filling this questionnaire. The information you provide will help me in my academic research.

(Your information will be kept confidential and will be used only for the assessment purpose in this thesis work)

SECTION A

Name: _____

Organization / Company: _____

Role: _____

formed as questions for your response to evaluate their effects and severity.

Q_1a) Do change order affect the construction phase?

a. Yes b. No

SECTION B

Some of the causes for discrepancy in design construction interface are

Q_1b) If yes rank the causes for change order

Causes for Change Order	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Change in design by client					
Value Engineering					
Errors and omissions in design					
The scope of work for the contractor is not well defined					
lack of coordination					

Q_2) What is the effect of incomplete and inadequate plans and specification?

Severe []

Mild []

Nil []

Q_3) Do obstinate nature of participants encounter?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_4a) Do loss of data affect?

- a. Yes b. No

Q_4b) If yes, Mention it's inference in your past projects.

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_5a) Do you think lack of coordination between contractor and designer affect the interface between design and construction?

- a. Yes b. No

Q_5b) If yes, mention suitable technique to improve coordination between construction team

- a. Web based project management
b. Implementation of project centre
c. Other

Q_6) Do participant's honest wrong belief affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_7) Do influence of buildability affect?

- a. Yes b. No

Q_8) Do lack of human resources in design firm affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_9) Do lack of accuracy in specification and working details affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_10) Do lack of mutual respect
between designer and contractor affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Sometimes []

Seldom []

Never []

Q_11) Is there unforeseen problems at
site?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_14) Do lack of professional
experience and judgments affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_12) Do involvement of contractor
team in design development phase
affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_15) Is there effect of material
changes during construction phase?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_13) Do nationality of both
construction and design firms affect?

Very Often []

Often []

Q_16) Do design error affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Q_17) Do procurement delays during
construction phase affect?

Very Often []

Often []

Sometimes []

Seldom []

Never []

Construction delays []

Decrease in productivity []

Increase in project cost []

Decrease in quality of work[]

Dispute between owner and contractor []

Q_18a) Does construction error at job site cause discrepancy in design and construction interface?

a. Yes b. No

Q_19b) Please mention any other effects that you have experienced in past projects (if any) _____

Q_18b) If yes please specify the type of construction errors which may affect design and construction interface

Rank the following according to your preference from 1-5 with

(1-highest preference 2, 3, 4-next preferences and 5-lowest preference)

Q_19a) What are the effects of discrepancies in design and construction interface?

REFERENCES

1. Carlos T. Formoso, Patrícia Tzotzopoulos, Margaret S. S. Jobim and Renata Liedtke (1998) "Developing a Protocol for Managing the Design Process In the Building Industry", *Proceedings IGLC '98*
2. Luis F. Alarcon and Daniel A. Mardones (1998) "Improving the Design- construction interface", *Proceedings IGLC '98*

3. Pavitt T.C. and A. G. F. Gibb
(2003) “Interface Management
within Construction: In
Particular, Building Facade”,
*Journal of Construction
Engineering and Management*,
Vol. 129, pp. 8 to 15
4. Twomey. T. R. (1989)
“Understanding the Legal
Aspects of Design-Build” R.
S. Means Co., Kingston, Mass.
5. Zipf, Peter J. (1998) “An
Integrated Project
Management System” *Journal
of Management in
Engineering*, pp. 38-41.