Identifying Causes of Variation in Construction Industry Based on Questionnaire

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Abstract. The aim of this study is to diagnose problems of quality in ready mixed concrete industry. A field survey includes open and close questionnaire have been done which aimed to get data and required information for achieving this research. The results of the questionnaire have identified the most factors of quality deviation in Iraqi concrete industry.

Keywords: Field Survey, Questionnaire, Concrete Mixture, Construction Management.

1. Introduction

Concrete is the most popular construction material, with more than 11.4 billion tons of concrete consumed annually worldwide [1].

A questionnaire is a means of communication with people. The questions have to be brief and concise, yet not too simple so as to lose the interest of the person in answering/filling out questions [2].

Accordingly, questionnaire process would be used through this research to investigate the most common causes of variation in concrete production under the circumstance and conditions of Iraq.

2. Field Survey

For the purpose of achieving the goal of this research, it is necessary to work in the open and close questionnaire methods as follows:

2.1. Open Questionnaire

This step is considered the following processes which are: literature survey, field visits and personal interviews to help designing the questionnaire form. The literature survey of the research helped much in the preparation of the questionnaire form. In addition, information was obtained from surveying various literatures and researchers in the field of quality systems. Some sites, for manufacturing concrete, have been visited in order to know the basic stages of producing concrete on the site. Interviews were also made with a selected number of well-experienced personnel in the field of construction to know the most common current problems related to quality failure during the processes of producing concrete.

2.2. Close Questionnaire

The formulations of the questionnaire form were directed to accomplish the objectives of the research and it was formed with two axes:

- Axis One which named 'General Information' which covers the personal information about the engineers who participate in the questionnaire, such as: the name of organization or firm they work for, the academic degree, specialization, the current position and years of experience.
- Axis Two which shows the most common causes of deviations in the quality of concrete mixtures.

3. Close Questionnaire Sample

The questionnaire sample represents the tool that tells the information that is needed from the field of engineering work.

3.1. Questionnaire Form Distribution and Replies Collection

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Specific steps have been adopted, through distribution and replies collection of the questionnaire forms, which are:

- The researcher has personally distributed the questionnaire forms to the engineers and gives a brief idea prior to its distribution.
- A convenient period of time was allowed for each individual from receiving till reply.
- Questionnaire replies were gathered later through direct meeting to solve any misunderstanding and answer any question could be put forward by the respondents to the questionnaire.

3.2. Size of the Sample

The design of any questionnaire should address the following issues: time, cost and data quality. It should be kept as short as possible while at the same time maintaining the ability to cover all the required variables. Most statisticians accept a sample size (N) of 30 in random samples as large enough for data analysis purposes [3].

Fifty questionnaire forms have been distributed among different places of construction factories but only 36 forms were received which will be enough to achieve the confidence level according to the last paragraph.

3.3. Respondent Academic Degree

It is found that the majority of the respondents were engineers with B.Sc. degrees while the engineers with M.Sc. were two, and one for both Ph.D. degree and Diploma.

3.4. Respondent's Specialization

Close questionnaire samples consisted of four fields, all of them are engineering, but the majority of the respondents were civil engineers about thirty while two engineers for each of electrical, mechanical and surveying engineering.

3.5. Respondents Experience

It is found that twenty two engineers of the total respondents have more than fifteen years of experience, while the remaining, which are fourteen respondents, have less than ten years of experience.

4. Causes of Variation

According to the responses of respondents of questionnaire form (axis two), the most common causes of deviation in the quality of ready mixed concrete industry are indicated in Table 1 where the second column refers to the standard weights that have been given by questionnaire sample.

TABLE 1: Causes of deviation in the quality of concrete mixtures

Rank	Causes of Deviation in the Quality	Standard Weight	Influence	Cumulative
1	*w/c* ratio	140	*9.9%*	*9.9 %*
2	Mix proportion	139	*9.8%*	*19.7 %*
3	Raw materials	133	*9.4%*	*29.1%*
4	Truck mixer delay (traffic jam)	129	*9.1%*	*38.2%*
5	Temperature (weather condition)	123	*8.7%*	*46.9%*
6	Efficiency of labors (no training)	120	*8.5%*	*55.4%*
7	Type or/and method of mixing	117	*8.2%*	*63.6%*
8	Curing and compacting	115	*8.2%*	*71.8%*
9	Handling or/and storing	113	*7.9%*	*79.7%*
10	Lack of motivation	100	*7.1%*	*86.8%*
11	Machines aging	96	*6.8%*	*93.6%*
12	Diversity of provision sources	91	*6.4%*	*100.0%*
	Total	*1416*		

Fishbone diagram (also called Ishikawa diagram or cause-and-effect diagram) is a causal diagram which shows that there are many other causes of deviation in the quality of concrete mixtures based on questionnaire forms, field visits and interviews as shown in Figure 1.
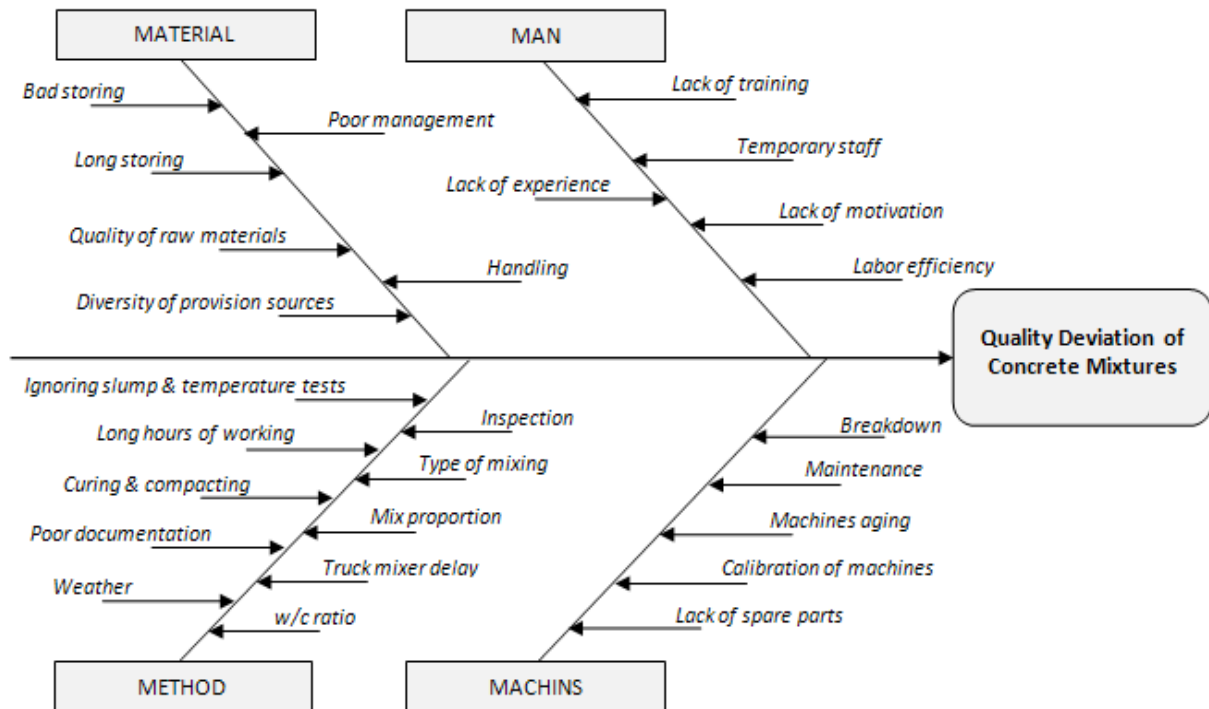

Fig. 1. Fishbone diagram for causes of deviation in quality of concrete mixtures

5. Conclusion

Based on research findings and questionnaire form, it can be found that the information obtained from axis one has proved that the questionnaire sample are well-experienced in diversity engineering fields of construction works. Also, it can be noticed that responses does not have enough knowledge about quality tools even the basics one like the seven basic quality tools!

While axis two shows that the major causes of deviations in the quality of concrete mixture are: w/c ratio; then, mix proportion; next, raw materials; next, delay; after that, weather condition; next, labors efficiency beside mix problems, protection troubles, handling-and-storing, lack of motivation, machines aging, and instability of provision sources.

6. References

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