

Prioritization of Problems Impacted to Construction Delay by Consultant Engineers Attitude

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Abstract

Thailand construction business is more competition. Construction operators have to build customers satisfaction. Several problems affected to customers unreliable, particular the problems impacted to the delay of construction work. This research objectives study the impacted to the delay of construction work and prioritize these problems. Researcher collected secondary data by reviewing the problems impacted to the delay of construction work as website, books and journals. The second data will be considered by expert. Thirteen problems impacted to the delay of construction work are generated questionnaire by pairwise comparisons, in order to correct primary data. The questioners are seventy eight questions, they will be answered by seventeen construction consultants. Their answers are calculated and analyzed with matric method, applied analysis hierarchy process. Labors lack problem is most important weight which impacted to the delay of construction work, it is 0.16 eigenvectors weight. The results showed to this research are just data of happening on current. These data may have discrepancy in the future, because; technology, economy, environment and regulation of government will be changed.

Keywords: The delay of construction work/ Consultant engineers/ Problems

Introduction

Thailand joined to ASEAN Economic Community (AEC) therefore, many foreign investors are interested to invest in Thailand. Construction works are one of important business obtained to investment such as, the parts of residential construction, industrial factory, large utility and other communications systems. The construction in various types was affected not meet the customers' needs consists of; construction is not completed on time, received quality, etc.

Thailand construction business is more competition. Construction operators have to build customers satisfaction. Several problems affected to customers unreliable, particular the problems impacted to the delay of construction work. This issue is the cause of investor's incomes lack they have to keep the time for making money. The labors and construction equipment lacks, labors ability, complicated design and others are directly problems impacted to delay of construction. These factors occurred both domestic and international. Therefore, researcher need to know more these problems impacted to construction delay. This research will gather data with real experience of construction consultant's engineers.

Research Objectives

Many problems impacted to the delay of construction work will be more studied and prioritized in various issues by metric method.

Scope of Research

Bangkok and metropolitans provinces are the areas for gathering data with 17 construction consultant engineers. They are respondents who work in private companies. This research uses 17 questionnaires for studying problems impacted to construction delay. The answers are from attitudes of consultant engineers. The research uses discrepancy value of 0.50-0.48 which is decreased to 0.2. In various issues will be calculated and ranked by metric method.

Relevant literature review

In order to know more details of relevant research, this part represented to guiltiness and suggestion about research content. Researcher review all data from websites, books, journals, and others. It helps research receive more knowledge for conducting. This research objective is to study many problems impacted to the delay of construction work and prioritize it in various issues by metric method. Therefore, researcher has started to review what is involved. They are as follows; 1) Construction industry overview, 2) the problems impacted to construction delay, and 3) analytic hierarchy process.

Construction industry overview

Thailand Construction in 2018 is expected to grow 5% to 10% from 2017 at 1.2 hundred million baht, while 2016 was 1.22 hundred million baht. It is similar the years 2016 – 2017. Particularly, since 2560 was considered to be the base adjustment, starting to see more private construction. The result of the wakefulness of people whose fallow land, they have to use these land for utilization. Otherwise, it will pay a high rate of tax under the new government legislation. This regulation stimulate people need to construct more home and others. Resulting, the market for home construction is expanded. Overview of the home market throughout the country for second half of year 2018 has trended improving. Especially, middle-income consumers are the large base.

In the present, home business or home builder groups have 200 small and large operators. First six month on year 2018 operators are shared by the market around 6,800-7,000 million bath but it is lower than the forecast target. Factor affected to value of houses per unit decreased because of the competition is undercut. Especially, entrepreneurs in the provinces focused on home market price less than 2 million. In addition, labor shortage is still a major obstacle. Number of foreign workers are decreased because of someone got out of time to apply for a work permit registration. The state agency responsible for this matter has the procedure and manage of delayed time. The operator was directly affected by this problem.

However, home construction association evaluated to positive factors encouraged consumers to build a home in 2018, consist of: 1) consumers are more confident about future economic and political directions, 2) stimulation from bank with low interest for building home, 3) Consumers who have their own land already, start daring to invest and spend about home building, 4) The result of the wakefulness of people whose fallow land, they have to use these land for utilization. Otherwise, it will pay a high rate of tax under the new government legislation, and 5) the result of higher single-detached house prices and central cost of housing projects. Therefore, group of consumers change their minds to buy land and build their own homes.

The problem impacted to construction delay

The constructions work received many problems impacted to construction delay. These problems lead to construction operator profits are decreased. Several companies are obtained punishment from the delay. In order to prevent it from happening again, they have to know the cause that let company loss the money. These factors are directly affect to the delay of constructions consists of; 1) the problem of purpose changing of work plan (Sutep Bootko et al., 2014), 2) erroneous design (Boris construction pro, 2016), 3) lack of experiences and working skills of the workers (Nitithon, 2011), 4) lack of construction equipment (Wuttipong aonsrisombat, 2013), 5) labors lack (Worapol jantanasin , 2010), 6) construction machines lack (Nitithon, 2011), 7) Contractor finance received from the employer (Boris construction pro, 2016), 8) applying for permission from government agencies, 9) Environmental conditions such as rain, hot weather and social factors (Sutep Bootko, 2014), 10) Conflicts between contractors and consultant engineers (Worapol jantasin , 2010), 11) Coordination and internal communication are mistaken (Worapol jantasin , 2010), 12) lack of equipment and machinery maintenance, 13) Transportation of materials and tools (Sutep Bootko, 2014), 14) material price fluctuations based on economic conditions (Sutep Bootko, 2014), 15) inadequate infrastructure system such as electricity, water supply, telephone, etc (Sutep Bootko, 2014), 16) complicated construction model, 17) stop working condition, and 18) Security control (Boris construction pro, 2016).

Analytic Hierarchy Process (AHP)

Analysis Hierarchy Process (AHP) is a decision-making process to use for diagnosis, in order to find reasonable. AHP was invented around 1970 by Thomas Saaty. This method is the only process that can be used with the 6-step decision consist of; right quality, quantity, time, source, price and place. It was widely used to business and management aspects. Analysis Hierarchy Process helps to make decisions on complex issues is easier, which it learn to human nature. The method divides elements of the problem to concrete and abstract parts, then reorganize it into a hierarchical chart. Subsequently, define the numbers from diagnosis, compare the significance of each criterion and synthetic these number, it will be calculated which criteria or alternatives have the highest priority value, and how to influence the outcome of the solution. In addition, AHP helps to enhance decision-making as a group, because of this method support to organize group thinking process. Determining the number of each problem element will be invariably consistency with reasonable. Moreover, this technique is process to support group referendum in order to help diagnosis obtained more reasonable consistency. Therefore, Analysis Hierarchy Process (AHP) is performance decision-making process and receive reliable in all kinds of decisions with reasonable (Saaty, 2008).

Hana microelectronic company in Thailand applied Analysis Hierarchy Process (AHP) with its manager decision. The research used questioners for data collection. The result showed to important criteria for selection of logistics service providers (Nareerat Potikulom, 1993). In 2003, Pranadda Yentrakul from Thailand used Analysis Hierarchy Process (AHP) with alternative to find suitable warehouse location. Simultaneously, they bring this technique analyzed to suitable industrial estate for investigators as well (Pranadda Yentrakul, 2003).

Research methodology

The research is to study and priorities problems impacted to construction delay. This section will describe research procedure in various steps. In order to achieve these objectives, researcher has 11 procedures for conducting. It is showed to figure1 as follow;

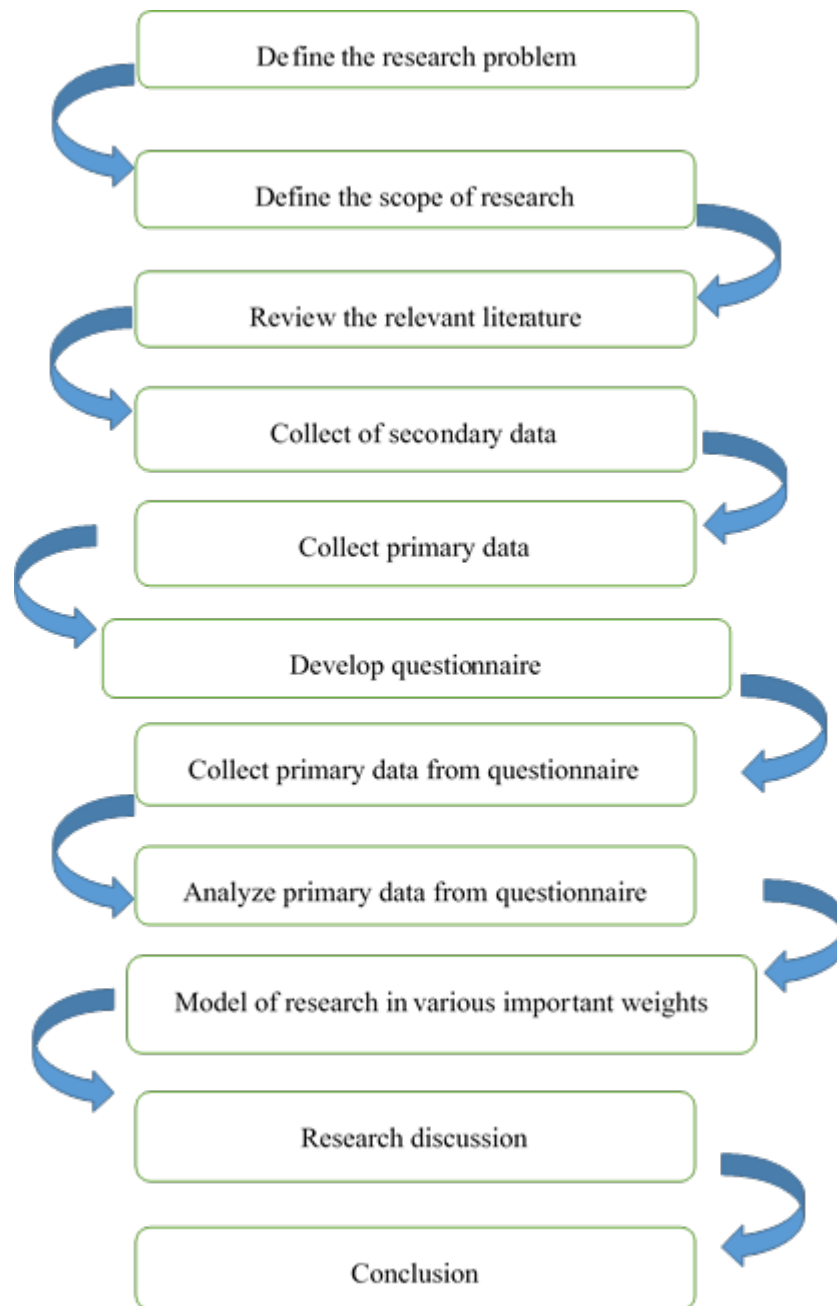


Figure 1 Research procedures

1) Define the research problem, many companies obtained problem impacted to construction delay. Therefore, the research need to study these problems and calculate rank important weight by matric method.

2) Define the research scope, Bangkok and metropolitan's provinces are the areas for gathering data with 17 construction consultant engineers. They are respondents who work in

private companies. This research uses 17 questionnaires for studying problems impacted to construction delay. The answers are from attitudes of consultant engineers. The research uses discrepancy value of 0.50-0.48 which is decreased to 0.2. In various issues will be calculated and ranked by metric method.

3) Review the relevant literature, in order to know more details of relevant research, this part represented to guiltiness and suggestion about research content. It helps research receive more knowledge for conducting. Researcher has started to review what is involved to problems impacted to construction delay, its prioritization and metric calculation method.

4) Collect of secondary data, this research obtains 18 problems impacted to construction delay. It is the main factors that often received complaining by construction workers. These data are reviewed from academic articles, books, journals, websites, and other database related.

5) Collect of primary data, 18 problems impacted to construction delay will be suggested by expert. The most suitable problems affected to real work will be added to the list. Some problems are overlapped definition and impacted to work are very few, specialist must put some issues together and out. 13 problems are main factors selected by expert, they are consists of; 1) the problem of purpose changing of work plan, 2) the design is insufficient detail, 3) lack of experiences and working skills of the workers, 4) Materials delivery is wrong required, 5) labors lack, 6) Mechanical is not obtained maintenance, 7) Contractor finance received from the employer, 8) Environmental conditions such as rain, hot weather and social factors, 9) lack of coordination between contractors and consultant engineers, 10) Transportation of materials from production sites to construction sites is not catch up, 11) material price fluctuations based on economic conditions, 12) the construction site is not space enough to accommodate the utilities, and 13) Security control is not standard.

6) Develop questionnaire, this research designs questionnaire covered 13 problems impacted to construction delay which it was suggested by expert. These problems will be received pairwise comparisons, they have 78 couples for the question. In various pairs earn 9 scales for providing the important weights, it shows on figure 2. Respondents must answer to all questions.

Intensity of importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgement slightly favour one over the other.
5	Much more important	Experience and judgement strongly favour one over the other.
7	Very much more important	Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice.
9	Absolutely more important.	The evidence favouring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed

Figure 2 Importance score in various pairwise comparisons

Source: Thomas saaty (1980)

7) Collect primary data by questionnaire, 78 questions will be questionnaires of this research. It is given out to 17 respondents, consultants engineer in construction site. The suitable respondent's number for data collection shows on table 1 which is from California Junior Colleges Association (CJCA) published on 1971. The range of discrepancies are in the range of 0.05 – 0.48, because of its discrepancies value are started to 0.02, it is minimum values.

Table 1 Suitable respondents number for data collection

Respondents number	Range of discrepancies	Discrepancies
1 – 5	1.02 – 0.70	0.05
5 – 9	0.70 – 0.58	0.12
9 – 13	0.58 – 0.54	0.04
13 – 17	0.54 – 0.50	0.04
17 – 21	0.50 – 0.48	0.02
21 - 25	0.48 - 0.46	0.02
25 - 28	0.46 - 0.44	0.02

Source: Macmillan (1971)

8) Analysis primary data from questionnaire, the data is from collected will be calculate and analyzed by metric method. In each pairs earn important weight scores in each scale. Researcher must compute geometric mean in various answers of 17 respondents. These problems impacted to construction delay will be checked consistency ratio with 1.56 random index value, in order to know the reasonable of responding. Random index value shows in table 2. The consistency ratio should be not over 0.1 as well.

Table 2 Random Index (RI) values in various respondents' number

N	1	2	3	4	5	6	7	8	9	10	11	12	13
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56

Source: Thomas saaty (1980)

9) The research results each important weight, the steps are finished by the way. This research acquire priority in various factors. The problems are most important weight will be ranked to number 1, 2 and so on respectively. The outcomes of the research support construction operators ready to prepare themselves with issues impacted to construction delay.

10) Research discussion

11) Research conclusion

Results and discussions

This part explains about results and discussions of research. The research objectives will be answered in various procedures. The problems impacted to construction delay are obtained to calculation and analysis by matric method. It is compared to pairwise. Research give out 17 questioners to respondents, include 78 questions per set, and consultants engineers are the samples group shows in figure 3.

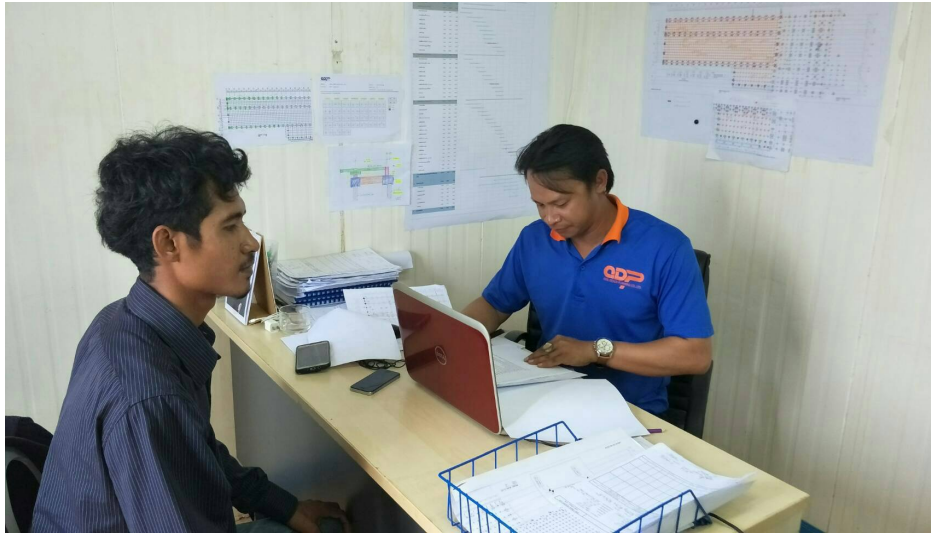


Figure 3 Respondent is answering to the questionnaire

These answers from questionnaires will be calculated to geometric mean. Consultants engineer will be thoroughly educated with responding. The right side answer is fraction of scoring, and left side is integer respectively. After finished to compute geometric mean, the data will be calculated by metric method, in order to analyze the priority each problem. Researcher have to define abbreviation in various problems for metric method calculation. It help the reader are not confused for understanding and easy to remember for calculating and analyzing, are as follows;

P1 = the problem of purpose changing of work plan

P2 = the design is insufficient detail

P3 = lack of experiences and working skills of the workers

P4 = Materials delivery is wrong required

P5 = labors lack

P6 = Mechanical is not obtained maintenance

P7 = Contractor finance received from the employer

P8 = Environmental conditions such as rain, hot weather and social factors

P9 = lack of coordination between contractors and consultant engineers

P10 = Transportation of materials from production sites to construction sites is not catch up

P11 = material price fluctuations based on economic conditions

P12 = the construction site is not space enough to accommodate the utilities

P13 = Security control is not standard

Various problems from geometric mean calculation will be computed to column total values, shows in figure 4. The example represent to its column total of P1 such as $1.00 + 0.77 + 1.66 + 0.52 + 2.50 + 0.77 + 2.50 + 0.83 + 0.91 + 1.00 + 0.91 + 0.91 + 1.67 = 15.95$. Researcher must calculate weight for ranking. It is eigenvectors value represent to important weight of various problems, which is showed in figure 5. The matrix will be calculated in each couple such as, pairwise P1 and P1 is $1.00/15.95 = 0.06$. The column total will be simple weight with 1.00. Row total of problems should be as equal as the number of problems, it is 13 factors. The eigenvectors value are from row total divide by number of these factors, such as eigenvector of P1 is $0.84/13 = 0.06$. The data from questioners have to be checked to reasonable. First step, researcher must compute average value of quotient (λ_{max}), we shows in figure 6. Various problem columns are multiplied by eigenvectors value as $0.06 \times 0.84 = 0.05$. The row total earns new value in various problems, which it is divided by each eigenvector such as $0.83/0.06 = 13.83$, it is quotient value. Quotient value in various problems will be calculated to average (λ_{max}) which, is 13.10. Last step, research computes consistency index (CI) = $\frac{(\lambda_{max}-N)}{(N-1)} = \frac{(13.1-13)}{(13-1)} = 0.0083$, and consistency ratio (CR) = $\frac{CI}{RI} = 0.0083/1.56 = 0.0053$. The data from questionnaire answers will be reasonable if consistency ratio is not over 0.1. Resulting, the data of this research calculated to be reasonable, shows in figure 7.

Factors	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
P1	1.00	1.29	0.60	1.93	0.39	1.33	0.39	1.20	1.12	0.96	1.14	1.08	0.59
P2	0.77	1.00	0.58	1.33	0.31	0.87	0.38	1.00	1.12	1.08	0.97	1.34	0.79
P3	1.66	1.67	1.00	0.73	0.37	1.79	0.39	1.01	2.02	1.86	2.51	2.03	2.10
P4	0.52	0.77	1.43	1.00	0.52	1.76	0.39	2.08	2.16	1.24	1.10	2.21	0.84
P5	2.50	3.30	2.50	2.00	1.00	3.46	1.10	2.14	2.62	2.43	2.53	3.42	2.98
P6	0.77	1.15	0.56	0.56	0.29	1.00	0.68	2.67	0.75	0.61	1.08	2.30	0.66
P7	2.50	2.50	2.50	2.50	0.91	1.43	1.00	3.55	2.90	3.03	2.59	3.46	2.33
P8	0.83	1.00	1.00	0.48	0.48	0.37	0.28	1.00	0.59	0.88	1.27	1.60	0.86
P9	0.91	0.91	0.50	0.46	0.38	1.25	0.34	1.67	1.00	1.10	1.91	1.75	1.14
P10	1.00	0.91	0.53	0.83	0.42	1.67	0.33	1.11	0.91	1.00	2.39	1.41	1.23
P11	0.91	1.00	0.40	0.91	0.40	0.91	0.38	0.77	0.53	0.42	1.00	1.37	1.02
P12	0.91	0.77	0.50	0.45	0.29	0.43	0.29	0.63	0.56	0.71	0.71	1.00	0.00
P13	1.67	1.25	0.48	1.25	0.33	1.43	1.43	1.11	0.91	0.83	1.00	0.00	1.00
Columns total	15.95	17.52	12.58	14.42	6.08	17.70	7.38	19.96	17.19	16.16	20.21	22.97	15.54

Figure 4 The compute column total values in various problems

Factors	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	Rows total	Eigenvectors	Priority ranking
P1	0.06	0.07	0.05	0.13	0.06	0.08	0.05	0.06	0.06	0.06	0.06	0.05	0.04	0.84	0.06	6
P2	0.05	0.06	0.05	0.09	0.05	0.05	0.05	0.05	0.06	0.07	0.05	0.06	0.05	0.73	0.06	6
P3	0.10	0.10	0.08	0.05	0.06	0.10	0.05	0.05	0.12	0.12	0.09	0.13	0.13	1.17	0.09	3
P4	0.03	0.04	0.11	0.07	0.09	0.10	0.05	0.10	0.13	0.08	0.05	0.10	0.05	1.01	0.08	4
P5	0.16	0.19	0.20	0.14	0.16	0.20	0.15	0.11	0.15	0.15	0.13	0.15	0.19	2.07	0.16	1
P6	0.05	0.07	0.04	0.04	0.05	0.06	0.09	0.13	0.04	0.04	0.05	0.10	0.04	0.81	0.06	6
P7	0.16	0.14	0.20	0.17	0.15	0.08	0.14	0.18	0.17	0.19	0.13	0.15	0.15	2.00	0.15	2
P8	0.05	0.06	0.08	0.03	0.08	0.02	0.04	0.05	0.03	0.05	0.06	0.07	0.06	0.69	0.05	7
P9	0.06	0.05	0.04	0.03	0.06	0.07	0.05	0.08	0.06	0.07	0.09	0.08	0.07	0.81	0.06	6
P10	0.06	0.05	0.04	0.06	0.07	0.09	0.04	0.06	0.05	0.06	0.12	0.06	0.08	0.85	0.07	5
P11	0.06	0.06	0.03	0.06	0.07	0.05	0.05	0.04	0.03	0.03	0.05	0.06	0.07	0.65	0.05	7
P12	0.06	0.04	0.04	0.03	0.05	0.02	0.04	0.03	0.03	0.04	0.04	0.04	0.00	0.47	0.04	8
P13	0.10	0.07	0.04	0.09	0.05	0.08	0.19	0.06	0.05	0.05	0.05	0.00	0.06	0.90	0.07	5
Columns total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	13.00	1.00	

Figure 5 The calculate weight of problem (Eigenvectors)

Figure 6 The calculate average value of quotient (λ_{max})

Factors	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	Rows total	Eigenvectors	Quotients
P1	0.05	0.05	0.06	0.13	0.13	0.06	0.10	0.04	0.05	0.05	0.04	0.02	0.03	0.83	0.06	13.83
P2	0.04	0.04	0.05	0.09	0.11	0.04	0.10	0.03	0.05	0.06	0.03	0.03	0.05	0.73	0.06	12.16
P3	0.09	0.07	0.09	0.05	0.12	0.08	0.11	0.04	0.10	0.10	0.08	0.04	0.12	1.09	0.08	13.62
P4	0.03	0.03	0.13	0.07	0.18	0.08	0.11	0.07	0.10	0.07	0.04	0.05	0.05	0.99	0.08	12.37
P5	0.13	0.14	0.23	0.14	0.34	0.16	0.30	0.07	0.12	0.13	0.08	0.07	0.17	2.09	0.16	13.06
P6	0.04	0.05	0.05	0.04	0.10	0.05	0.19	0.09	0.04	0.03	0.03	0.05	0.04	0.79	0.06	13.16
P7	0.13	0.10	0.23	0.17	0.31	0.07	0.27	0.12	0.14	0.16	0.08	0.07	0.14	2.00	0.15	13.33
P8	0.04	0.04	0.09	0.03	0.16	0.02	0.08	0.03	0.03	0.05	0.04	0.03	0.05	0.70	0.05	14.00
P9	0.05	0.04	0.05	0.03	0.13	0.06	0.09	0.06	0.05	0.06	0.06	0.04	0.07	0.77	0.06	12.83
P10	0.05	0.04	0.05	0.06	0.14	0.08	0.09	0.04	0.04	0.05	0.08	0.03	0.07	0.82	0.06	13.66
P11	0.05	0.04	0.04	0.06	0.14	0.04	0.10	0.03	0.03	0.02	0.03	0.03	0.06	0.66	0.05	13.20
P12	0.05	0.03	0.05	0.03	0.10	0.02	0.08	0.02	0.03	0.04	0.02	0.02	0.00	0.48	0.04	12.00
P13	0.09	0.05	0.04	0.09	0.11	0.07	0.39	0.04	0.04	0.04	0.03	0.00	0.06	1.05	0.08	13.12
															λ_{max}	13.10

Consistency Index (CI)	0.0083
Random Index (RI)	1.5600
Consistency Ratio (CR)	0.0053
0.0053 < 0.1 is reasonable	

Figure 7 Reasonable calculation

All data from questioners are answered by 17 consultant engineers. They are calculated and analyzed by matrix method. 13 problems impacted to construction delay are obtained prioritization. It can be summarized on this paragraph, with eight priority as follow; number one, two, three, and four are labor lack (eigenvector = 0.16), contractor finance received from the employer (eigenvector = 0.15), lack of experiences and working skills of the workers (eigenvector = 0.09), materials delivery is wrong required (eigenvector = 0.08). Number five are transportation of materials from production sites to construction sites is not catch up, and security control is not standard (eigenvector = 0.07). Number six are the problem of purpose changing of work plan, the design is insufficient detail, mechanical is not obtained maintenance, and lack of coordination between contractors and consultant engineers (eigenvector = 0.06). Number seven are environmental conditions such as rain, hot weather and social factors, and material price fluctuations based on economic conditions (eigenvector = 0.05). Number eight is the last of this priority, it is the construction site is not space enough to accommodate the utilities (eigenvector = 0.04).

Conclusions

The results of this research represented to important problems impacted to construction delay in various sequences. 13 problems are directly the main factors affected to construction operators particularly labor lack is most significant with them. In the past, many foreigners labor worked in Thailand. Presently, these labors were already came back to its countries. Someone must be stopped its works because out of time extend with immigration office, and operation delay of government. Moreover, Thailand regulation is quite limited number of foreign workers. Mostly, Thai people need to be the labor on other countries, it depend on income is higher. Therefore, we lack many construction labors. This problem lead to the delay of construction. However, it just be result in Thailand that was received. Overseas

may not be the same which is based on its labor legislation, and higher incomes. Others problems are obtained few important weight which will be its majors issues. It depend on changing technology, economy, environment and regulation of government respectively.

The results is only from construction engineer's attitude, it should be other groups perspective in construction work as well. The outcomes will be more compared, in order to be earned diversity in problem ratings. The data calculation tool should be more diversity for analysis as well. Matric method is not sufficient for computation. Several methods have to compare matric technique. These problems impacted to construction delay will be received answer is more resolution and closer to the truth. However, the results from prioritizing each problem in this research will be beneficial to future. It is basis and guidelines for improving the working system in construction industry. It is important thing to remind the operator cautious before these problems happen to themselves.

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