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Factors Affecting Cost Overrun of RC-PIER Jabodebek LRT Project : A Case Study of Cawang, Indonesia

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ABSTRACT

Light Rail Transit Development in Indonesia is progressing quite rapidly. Light Rail Transit is one of the modes of transportation solutions in the capital. The reason for the construction LRT because it more easily integrated with MRT and KRL. Due to the shortage of land in the capital, Jakarta. The system will use the system structure model structure elevated structure (cross-over structure), where pier structure is the structure of reinforced concrete columns (RC-Pier). At the time of execution occurs because the cost overrun earlier methods used inefficiently. Therefore, researchers will discuss the factors that affect the cost of crusting of 16:25% of the budget plan at work implementation RC-Pier in the LRT Jabodebek. Researchers using SPSS as the tool to get the factors that affect the cost of the implementation of the work crusting RC-Pier in LRT Jabodebek Project location of Cawang-Dukuh Atas. The results of this study the factors that affect the efficiency gain is planning inadequate project, management, control and structure a bad project, project funding is inadequate, does not account for unexpected costs, inaccurate estimates/cost estimates are too low, collect information complete, resource constraints, the cost of construction of the LRT, the lack of experience of consultants, contractors and project managers and changes in design specifications.

Key Words: Key Success Factors, Cross-over structure, Cost Overrun, RC-Pier.

1. INTRODUCTION

Traffic jams in Indonesia, especially in the city as a center of government and economy become one of the serious problems that must be overcome and resolved. One solution is to increase the number of public transport modes. Implementation of Railway Light / Light Rail Transit one of the solutions taken by the government through the Indonesian Presidential Regulation No. 98 Year 2015 on the Acceleration of the Implementation of Railway Light / Light Rail Transit integrated in Jakarta, Bogor, Depok, and Bekasi.

The LRT Jabodebek development is divided into two stages. At present the Jabodebek LRT project currently underway is phase 1 which is expected to be completed by 2019. The first phase of Jabodebek LRT consists of 3 services, namely Cross Service 1 Cawang - Cibubur (14.3 kilometers), Lintas Layanan 2 Cawang - Kuningan - Dukuh Atas (10.5 kilometers), and Lintas Layanan 3 Cawang - Bekasi Timur (18 , 5 kilometers). This research was carried out at the Cross Service location 2.

2. JABODEBEK LRT STRUCTURE SYSTEM

The LRT structure system used in this study is a system of upper cross structures (elevated structures) with two railroad lines that are transported using prestressed U-Shape Girder supported on reinforced concrete pier (RC-Pier).

In planning this LRT structure, both for loading and for the design of structural elements use the following rules:

- ACI 343 1R-12 "Guide for Analysis and Design of Reinforced and Prestressed Concrete Guideway Structures"
- AASHTO 2012 LRFD Bridge "Design Specifications"
- Regulation of the Minister of Transportation PM. 60 of 2012 "Technical Railroad Requirements"
- SNI 2833-2016 "Designing bridges against earthquake loads"
- SNI 1726-2012 "Indonesian earthquake regulations"
- SNI 2847-2013 "Indonesian concrete regulations"

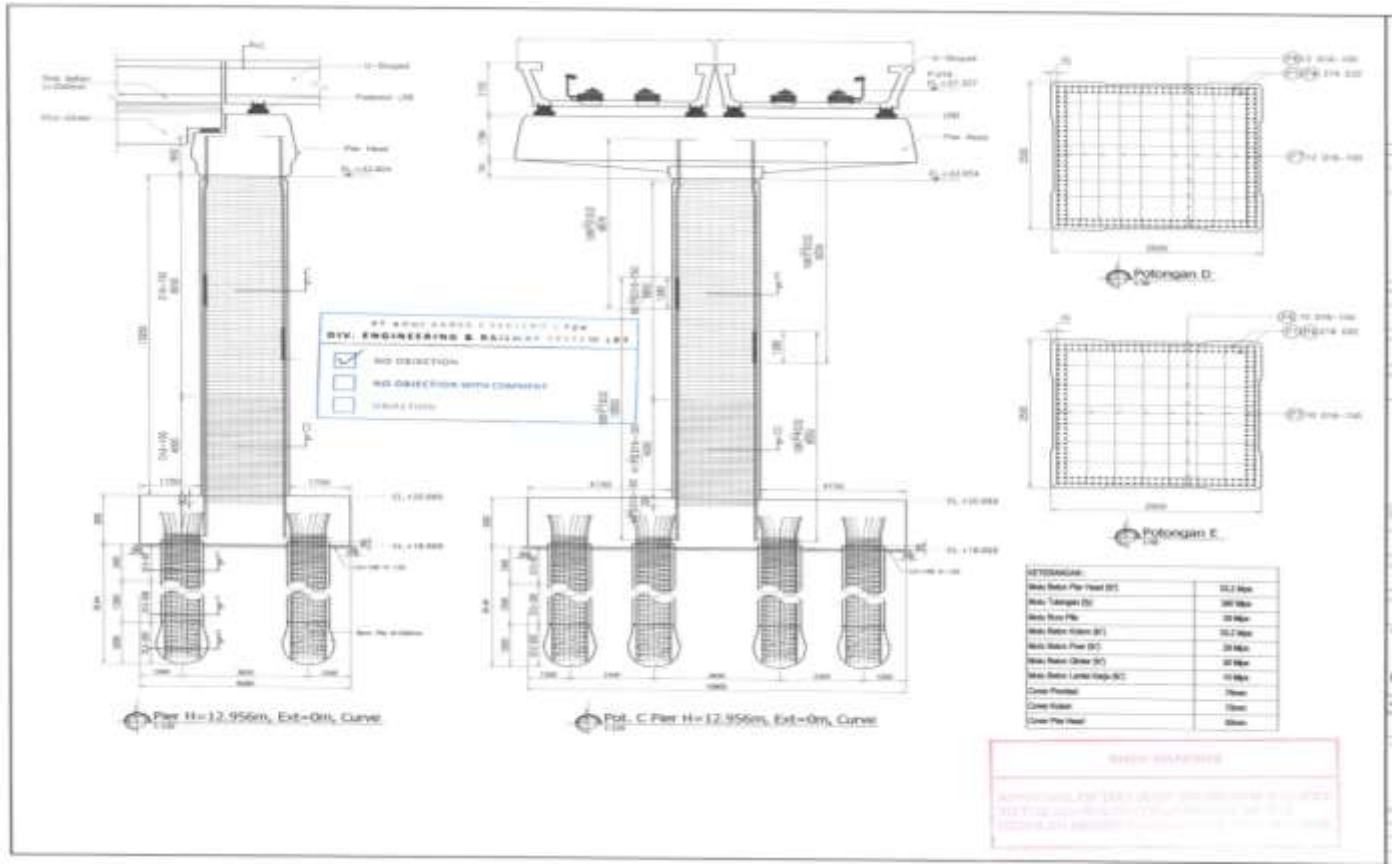

Figure 1. Jabodebek LRT Structure

Figure 2. Implementation Of RC-Pier Work

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3. COST OVERRUN

Cost overrun is the cost of construction of a project during the implementation phase, exceeds (budget) of the project budget is set early stages (estimated costs), resulting in a significant loss for the contractor [1]. Cost overruns were occurring at a construction project can be caused by factors both internal and external factors of the construction project itself. With the good project management starting from initial estimate to the final stage of the project, the cost overrun on the project can be prevented or avoided. [2]

3.1 ESTIMATED COST

Estimates in the broad sense is essentially an attempt to assess or estimate a value through the analysis of calculation and based on experience. The cost estimate is the calculation of the cost requirements necessary to complete an activity or occupation in accordance with the requirements or contract [3]. According to [4] said that, the estimated cost of the project divided into several phases as follows: a. Preliminary estimates, made at an early stage in the project, the purpose to estimate the cost of economic approach, b. Detailed estimation, made on the basis of a count of the volume of work, costs, and unit price and c. Estimation of needs, an overview of financing and accountability for a project to be completed with only a small chance of an error.

3.2 COST EFFICIENCY

The cost efficiency is the selection strategy used by many companies, especially companies engaged in the construction field. When the client is more concerned with what they want, and when a lot of rules and regulations guiding, either by the buyer or the seller, the price competition to be very decisive.

4. RESEARCH METHODS

This research process contains lines of inquiry from the beginning to the discovery hypothesis to answer the formulation of the problem by conducting scientific research, which in its process there are stages / customized order by a research framework that had been developed in the form of a flowchart. Flowchart is based on the formulation and research objectives to be achieved by referring to the project feasibility study [5]:

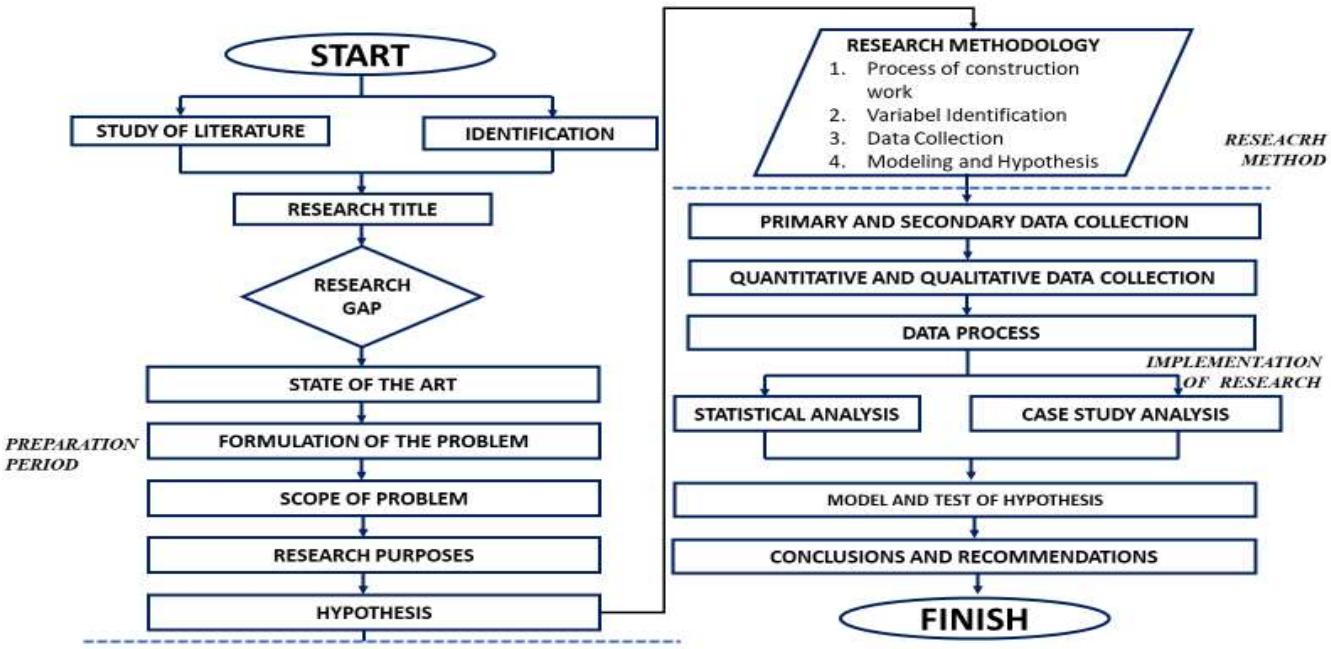

Figure 3. Research Flow

Data gathered data followed by processing and analyzing the data to get the results of the initial data. From the findings of the preliminary data analysis processing is then performed for the discussion can draw conclusions about the cost-efficiency and understanding can improve project cost performance. [6]

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4.1 IDENTIFICATION OF VARIABLE

This study has 3 (three) main variable to obtain and get a result of factors - factors that affect the cost of the job crusting RC-Pier in the LRT Jabodebek. The variables in this study there are two types of variables, namely the independent variable and the dependent variable. Here's the explanation:

Variables: X1 = Cost Efficiency
X2 = Construction of LRT
X3 = Work Implementation RC-Pier
Variable Bound : Performance Cost

Identification of sub variables related to the performance of the project cost consists of four variables: cost efficiency, construction of the LRT, Work Implementation RC-Pier and Cost. Respondents were used in this study amounted to 52 respondents obtained from slovin method. Here are the factors that affect the cost overrun:

Table 1. Influencing Factors

NO	VARIABLE		Main factors	sub factor
1	**X1**	X1-1	**COST EFFICIENCY**	Identification of problem experienced crusting costs
2		X1-2		Assign Scope and Targets to be achieved
3		X1-3		Establish study team that will control costs crusting
4		X1-4		Collecting information is complete
5		X1-5		Informing the highest functions in high-rise building projects
6		X1-6		Determine the lowest cost
7		X1-7		Doing Analysis with FAST Diagram
8		X1-8		Appearances encourage creative ideas
9		X1-9		Establish rules that guarantee conditions that are conducive to creativity
10		X1-10		List of Advantages and Disadvantages of Each idea to parameter
11		X1-11		Determining the best alternative ideas and their feasibility
12		X1-12		Doing Life Cycle Cost Analysis
13		X1-13		Ensuring Cost Benefit Analysis
14		X1-14		Cost Analysis report
15		X1-15		Cost Efficiency report
16		X1-16		Prepare presentation and supporting documentation
17	**X2**	X2-1	**LRT CONSTRUCTION**	Cost of construction of LRT
18		X2-2		Improving transit and transit mobilization
19		X2-3		Improving economic vitality and environmental
20		X2-4		Encourage intermodal transport
21		X2-5		Skill of operator equipment

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22		X2-6		Lack of equipment
23		X2-7		Material shortage in the market
24		X2-8		Damage to equipment
25		X2-9		The low quality of the material
26		X2-10		Shortage of labor
27	**X3**	X3-1	**WORK IMPLEMENTATION RC-PIER**	Fast assembly and Productivity
28		X3-2		innovative Materials
29		X3-3		Construction Process Management
30		X3-4		Innovative design and product
31		X3-5		image Design
32		X3-6		Expertise and Experience at Work
33		X3-7		Conformity and Clarity Specifications
34	**Y1**	Y1-1	**COST**	Inadequate project funding
35		Y1-2		Does not account for unexpected expenses
36		Y1-3		owner make design changes when construction is already running
37		Y1-4		Increase in interest rates
38		Y1-5		Miscommunication in the planning design

4.2 STAGE DATA PROCESSING

In a test of the validity of his own [7] a measure that can indicate the validity or the validity of the instrument. So in testing the validity of the reference to an instrument in carrying out its functions. Variables obtained from journals, articles, and e-books that can be published. [8] The process of validity and reliability are performed using the SPSS following Tools is a flowchart of data processing:

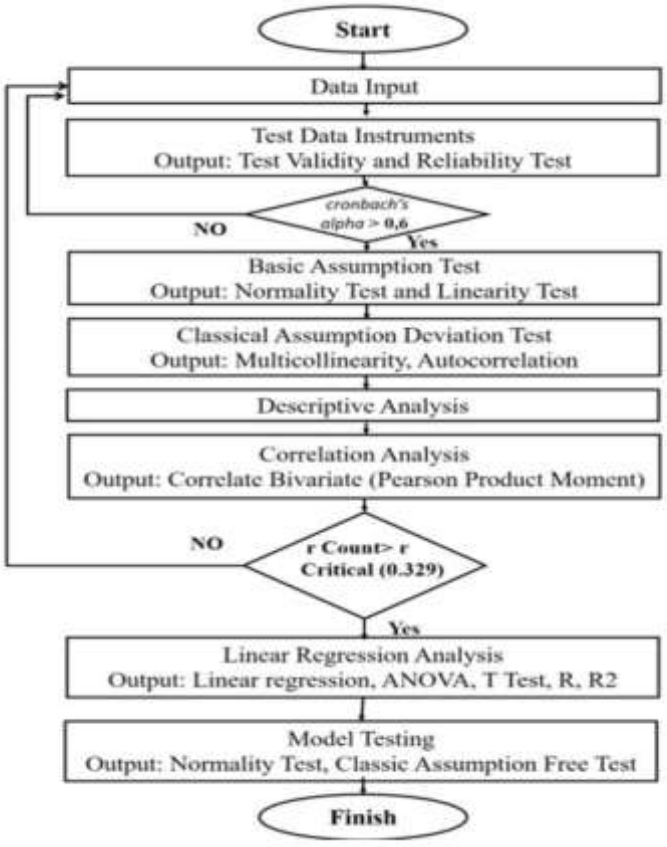

Figure 4. Data Processing Flowchart

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4.3 DETERMINATION OF TOTAL RESPONDENTS

This study uses a type of target population, where the questionnaire will be distributed to those who were directly involved in the construction of the RC-Pier. Determination of the number of respondents using the formula slovin with a population target of N = 60. [9] Here the number of samples using methods slovin:

n = N / (N x e ^ 2 + 1) ---------- (1)

n = 60 / (60 x 0,05^ 2 + 1)

= 52.17 ~ 52 respondents. Thus, in this study there were obtained 52 respondents.

4.4 TEST VALIDITY AND RELIABILITY

Of each - each variable will be tested using tools SPSS namely the value corrected item total correlation (Validity count) when his value is more than 0.300, it can be stated Valid and value of Cronbach's Alpha (reliability Compute) . When his value is more than 0,600, it can be stated reliable, the following results are reliable and valid data grouping. [10]

Table 2. Validity and reliability test X1

Questionnaire	Validity Count	Validity Standard	Valid / Non Valid	The Reliability Count	The Reliability Standard	Reliable / Non Reliable
X1-1	0.916	0,600	Valid	0.583	0,300	Reliable
X1-2	**0,517**	**0,600**	**Non Valid**	**.580**	**0,300**	**Relibel**
X1-3	0.918	0,600	Valid	.516	0,300	Reliable
X1-4	0.919	0,600	Valid	0.469	0,300	Reliable
X1-5	0,921	0,600	Valid	0.416	0,300	Reliable
X1-6	0,921	0,600	Valid	0,397	0,300	Reliable
X1-7	0,920	0,600	Valid	0,438	0,300	Reliable
X1-8	0.911	0,600	Valid	.766	0,300	Reliable
X1-9	0,913	0,600	Valid	.706	0,300	Reliable
X1-10	**0,913**	**0,600**	**Valid**	**0.205**	**0,300**	**Non Reliable**
X1-11	0.915	0,600	Valid	0,624	0,300	Reliable
X1-12	0.908	0,600	Valid	.839	0,300	Reliable
X1-13	0,913	0,600	Valid	0,711	0,300	Reliable
X1-14	0.916	0,600	Valid	.609	0,300	Reliable
X1-15	0.912	0,600	Valid	0.725	0,300	Reliable
X1-16	0.910	0,600	Valid	0.822	0,300	Reliable

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Table 3. Validity and reliability test X2

Questionnaire	Reliability Count	Reliability Standard	Reliable / Non Reliable	Validity Count	Validity Standard	Valid / Non Valid
X2-1	0.919	0,300	Reliable	.982	0,600	Valid
X2-2	0.931	0,300	Reliable	0,981	0,600	Valid
X2-3	0.931	0,300	Reliable	0,981	0,600	Valid
X2-4	0.931	0,300	Reliable	0,981	0,600	Valid
X2-5	0.931	0,300	Reliable	0,981	0,600	Valid
X2-6	0.942	0,300	Reliable	0,981	0,600	Valid
X2-7	0,906	0,300	Reliable	.982	0,600	Valid
X2-8	0.891	0,300	Reliable	.982	0,600	Valid
X2-9	0.936	0,300	Reliable	0,981	0,600	Valid
X2-10	0.895	0,300	Reliable	.983	0,600	Valid

Table 4. Validity and reliability test X3

Questionnaire	Reliability Count	Reliability Standard	Reliable / Non Reliable	Validity Count	Validity Standard	Valid / Non Valid
X3-1	0,962	0,300	Reliable	0.976	0,600	Valid
X3-2	0.873	0,300	Reliable	0.982	0,600	Valid
X3-3	0.938	0,300	Reliable	0.978	0,600	Valid
X3-4	0.888	0,300	Reliable	0,981	0,600	Valid
X3-5	0.957	0,300	Reliable	0.977	0,600	Valid
X3-6	0.943	0,300	Reliable	0.978	0,600	Valid
X3-7	0.956	0,300	Reliable	0.977	0,600	Valid

Table 5. Validity and reliability test Y1

Questionnaire	Reliability Count	Reliability Standard	Reliable / Non Reliable	Validity Count	Validity Standard	Valid / Non Valid
Y1-1	0.536	0,300	Reliable	0.838	0,600	Valid
Y1-2	0.501	0,300	Reliable	0.845	0,600	Valid
Y1-3	0.518	0,300	Reliable	0.841	0,600	Valid
Y1-4	0,877	0,300	Reliable	0.735	0,600	Valid
Y1-5	0,877	0,300	Reliable	0.735	0,600	Valid

Having obtained realiabel and variable declared invalid then the variable will continue to rank each variable by using the tool RII. From the results of this RII will take the top 10 :

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Rank	Main Factor	Sub Factor	Name	Recapitulation of Questionnaire Results					Number of Respondent	W	A	N	Index RII
				1	2	3	4	5					
1	I	X1-1	Identification of problem experienced crusting costs	0	0	0	11	41	52,00	249	5	52	0,958
2	I	X1-2	Assign Scope and Targets to be achieved	0	0	0	12	40	52,00	248	5	52	0,954
3	IV	Y1-1	Inadequate project funding	0	0	0	13	39	52,00	247	5	52	0,950
4	IV	Y1-2	Does not account for unexpected expenses	0	0	0	14	38	52,00	246	5	52	0,946
5	I	X1-3	Establish study team that will control costs crusting	0	0	0	15	37	52,00	245	5	52	0,942
6	I	X1-4	Collecting information is complete	0	0	0	16	36	52,00	244	5	52	0,938
7	III	X3-2	innovative Materials	0	0	0	17	35	52,00	243	5	52	0,935
8	II	X2-1	Cost of construction of LRT	0	0	0	18	34	52,00	242	5	52	0,931
9	I	X1-5	Informing the highest functions in high-rise building projects	0	0	2	15	35	52,00	241	5	52	0,927
10	IV	Y1-3	owner make design changes when construction is already running	0	0	2	16	34	52,00	240	5	52	0,923
11	I	X1-6	Determine the lowest cost	0	0	3	15	34	52,00	239	5	52	0,919
12	II	X2-7	Material shortage in the market	0	0	3	16	33	52,00	238	5	52	0,915
13	II	X2-9	The low quality of the material	0	0	3	17	32	52,00	237	5	52	0,912
14	I	X1-7	Doing Analysis with FAST Diagram	0	0	4	16	32	52,00	236	5	52	0,908
15	III	X3-6	Expertise and Experience at Work	0	0	4	17	31	52,00	235	5	52	0,904
16	II	X2-10	Shortage of labor	0	0	4	18	30	52,00	234	5	52	0,900
17	I	X1-8	Appearances encourage creative ideas	0	0	4	19	29	52,00	233	5	52	0,896
18	I	X1-11	Determining the best alternative ideas and their feasibility	0	0	4	20	28	52,00	232	5	52	0,892
19	II	X2-5	Skill of operator equipment	0	0	5	19	28	52,00	231	5	52	0,888
20	II	X2-6	Lack of equipment	0	0	5	20	27	52,00	230	5	52	0,885
21	III	X3-1	Fast assembly and Productivity	0	0	5	21	26	52,00	229	5	52	0,881
22	III	X3-5	image Design	0	0	5	22	25	52,00	228	5	52	0,877
23	III	X3-7	Conformity and Clarity Specifications	0	0	5	23	24	52,00	227	5	52	0,873
24	I	X1-12	Doing Life Cycle Cost Analysis	0	0	5	24	23	52,00	226	5	52	0,869
25	II	X2-2	Improving transit and transit mobilization	0	0	6	23	23	52,00	225	5	52	0,865
26	II	X2-4	Encourage intermodal transport	0	0	6	24	22	52,00	224	5	52	0,862
27	I	X1-13	Ensuring Cost Benefit Analysis	0	0	6	25	21	52,00	223	5	52	0,858
28	I	X1-14	Cost Analysis report	0	0	6	26	20	52,00	222	5	52	0,854
29	III	X3-4	Innovative design and product	0	0	6	27	19	52,00	221	5	52	0,850
30	II	X2-8	Damage to equipment	0	0	6	28	18	52,00	220	5	52	0,846
31	I	X1-15	Cost Efficiency report	0	0	6	29	17	52,00	219	5	52	0,842
32	III	X3-3	Construction Process Management	0	0	6	30	16	52,00	218	5	52	0,838
33	II	X2-3	Improving economic vitality and environmental	0	0	7	29	16	52,00	217	5	52	0,835

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Rank	Main Factor	Sub Factor	Name	Recapitulation of Questionnaire Results					Number of Respondent	W	A	N	Index RII
				1	2	3	4	5					
34	IV	Y1-5	Miscommunication in the planning design	0	0	7	30	15	52,00	216	5	52	0,831
35	IV	Y1-4	Increase in interest rates	0	0	8	29	15	52,00	215	5	52	0,827
36	I	X1-16	Prepare presentation and supporting documentation	0	0	8	30	14	52,00	214	5	52	0,823
37	I	X1-9	Establish rules that guarantee conditions that are conducive to creativity	0	0	8	31	13	52,00	213	5	52	0,819
38	I	X1-10	List of Advantages and Disadvantages of Each idea to parameter	0	0	8	32	12	52,00	212	5	52	0,815

5. CONCLUSIONS

Factors affecting cost overrun in carrying out the RC-Pier work of the Jabodebek LRT Project are:

1. Inadequate project planning
2. Management, control and structure a bad project
3. Inadequate project funding
4. Does not account for unexpected expenses
5. Inaccurate estimates / cost estimates are too low
6. Collect complete information
7. Resource constraints
8. Cost of construction of LRT
9. The lack of experience of consultants, contractors, project managers
10. Changes in design specifications

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