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The Influence of the Final Engineering Plan (RTA) Design and Labor on the Completion of the Jakarta - Cikampek Toll Road Capacity Increase Project

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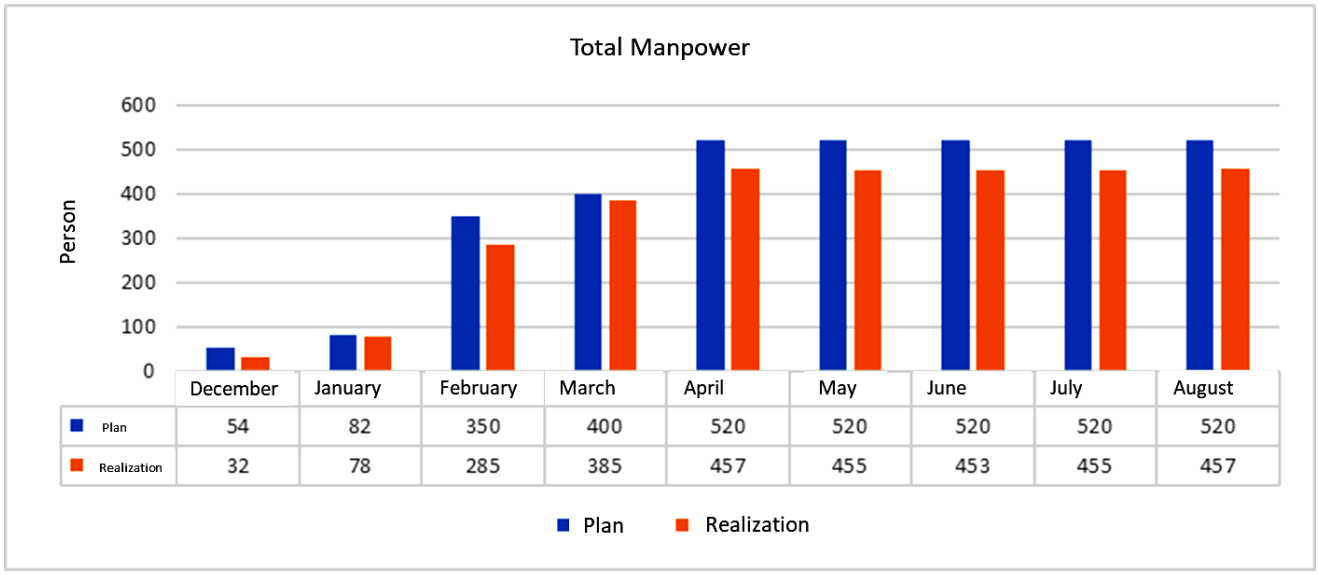
***Abstract*— In 2022, there will be congestion due to the highest spike in traffic volume from the East of 170 thousand vehicles or an increase of 159.6% compared to the average traffic volume under normal conditions in November 2021, which will cause a degree of saturation in the volume capacity ratio (VCR) reached 1.46 in the KM 47 to KM 66 Jakarta – Cikampek Toll Road (if no traffic engineering is carried out). So PT Jasa Marga (Persero) Tbk together with related agencies carried out several traffic engineering such as one-way and contraflow arrangements. So by considering these calculations, the construction of additional lanes needs to be carried out properly and taking into account technical studies so that the work can be completed on time. This research was conducted with the aim of looking at several influences on the certainty of completion of the Jakarta Cikampek Toll Road Capacity Increase Project. The method used in this research is quantitative with hypothesis testing. Furthermore, the population of this research is the actors in the Jakarta Cikampek Toll Widening construction project. The research sample will be taken from employees who are actively working on the project to represent the population studied. The data analysis technique used in the research uses Structural Equation Modeling (SEM) with Smart PLS 3.0 (Partial Least Square) software. Based on the results of research that has been carried out, the Final Engineering Plan Design (RTA) has a positive and significant effect on Project Completion. Likewise, labor was found to have a positive and significant effect on project completion.**

***Index Terms*- Final Engineering Plan Design, Manpower, Project Completion, Structural Equation Modeling (SEM)**

I. INTRODUCTION



Source: (Japek Widening Project, 2022)

Figure 1. Total number of workers for the Jakarta Cikampek Toll Road Widening Project

The number of workers for the work is less than planned, especially at critical times when the work must be completed quickly.

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So the number of workers who must be prepared increases so that the work can be completed on time. In this project, there is still a monthly shortage of workers compared to the planned number of workers as in Figure 1.10 above. This shortage of workers can cause work achievements not to go according to plan, resulting in the need for additional work time. However, the number of workers is only one of the things that will be studied. The capabilities and skills of existing personnel/workforce are also determining factors

for decision makers both at the managerial level and the skills of workers in the field.

In the successful completion of a project, another thing that will influence how quickly or slowly the project is completed is the Design Drawing (Final Engineering Plan). In toll road projects, whether new toll roads or widening of existing toll roads, the official design which must be approved by the government is an important factor. However, by considering several conditions, construction work can sometimes be carried out simultaneously with design completion by the government, in this case Bina Marga through BPJT (Toll Road Regulatory Agency) as the Toll Road regulator in Indonesia. However, to what extent will the impact of work carried out simultaneously be on the completion of projects that already have schedules and completion targets, especially for toll road widening / capacity building projects considering that toll road operations and services to road users must be prioritized. The Jakarta-Cikampek Toll Road is a toll road that connects the city of Jakarta with Cikampek and is a very important piece of infrastructure and a transportation artery that plays a role in the flow of transportation to and from Jakarta.

During its journey, the Jakarta – Cikampek toll road section has undergone several stages of increasing lane capacity (widening). This is done because the number of vehicles increases which directly affects the capacity of existing roads. Several technical problems arise, of course, not only internally, but also how to coordinate with third parties outside of toll road interests. Many assets are affected by toll road construction, especially in toll widening projects where existing assets during the operation of existing toll roads result in disruption of the operations and functions of the assets in question, such as PLN poles, optical network cables, gas pipelines and river flows. Of course, all these assets must be discussed with the asset owner regarding relocation, re-functioning and protection techniques for the assets so that during the widening project the assets are still functioning or operating as they should.

To date, PT Jasa Marga (Persero) Tbk has added lanes due to the current toll road capacity no longer being able to accommodate vehicles, especially during traffic on weekend holidays and other major holidays. So increasing capacity by widening lanes is absolutely necessary so that traffic can continue normally without congestion and congestion. However, the dense traffic and demands from the Ministry of Public Works that toll road services are not disrupted during the widening construction process are challenges for Jasa Marga amidst the need to provide good service for road users. Therefore, it is necessary to make several efforts to accelerate the implementation of widening construction both in terms of design, readiness of tools, materials and human resources.

In 2022, there will be congestion due to the highest spike in traffic volume from the East of 170 thousand vehicles or an increase of 159.6% compared to the average traffic volume under normal conditions in November 2021, which will cause a degree of saturation in the volume capacity ratio (VCR) reached 1.46 in the KM 47 to KM 66 Jakarta – Cikampek Toll Road (if no traffic engineering is carried out). So PT Jasa Marga (Persero) Tbk together with related agencies carried out several traffic engineering such as one-way and contraflow arrangements. So by considering these calculations, the construction of additional lanes needs to be carried out properly and taking into account technical studies so that the work can be completed on time.

I. Literature Review

A. *Definition of Toll Roads*

Toll roads are public roads which are part of the road network system and as national roads whose users are required to pay tolls. With this road network, it is hoped that the existence of toll roads will enable equitable development to achieve balanced regional development while still paying attention to economic development and equality. Toll road construction is closely related to physical and non-physical aspects of people's lives. The physical aspect is related to environmental problems, while the non-physical aspect is related to social problems that tend to exist in society. Those affected by toll road construction experience both aspects directly.

B. *Final Engineering Plan*

The Final Technical Plan (RTA) is a document developed from the technical planning carried out by the Toll Road Business Entity (BUJT) as one of the obligations in the Toll Road Concession Agreement (PPJT). This document must be submitted by BUJT within the specified time period from the start of engineering planning as stated in each BUJT's Toll Road Business Plan. RTA documents are a collection of documents created from engineering plans consisting of work schedules/plans to complete RTA documents, design criteria related to PPJT business plans, survey results, planning analysis results, RTA drawings, general and special specifications, Bill of quantities/BoQ and/or budget plan (RAB). The RTA document is submitted at the time specified in the PPJT by fulfilling all toll road technical requirements in accordance with applicable technical regulations and specification standards and having received recommendation for approval from BPJT and approval from the Directorate of Highways. The RTA drawing becomes the planning drawing that is the basis for carrying out construction work in the field.

C. *Definition of Project*

A project is an endeavor that is undertaken with restricted time and resources in order to accomplish a predetermined goal. The triple constraint—budget, schedule, and quality—limits project activities and ultimately determines the outcomes that may be achieved (Hafnidar A. Raji, 2016). According to the PMBOK Guide (2017), project management is defined as the use of knowledge, skills, tools, and strategies in project activities to meet or exceed stakeholder demands and expectations. The purpose of project management is to fulfill predetermined goals and outcomes by efficiently planning, organizing, directing, and managing corporate resources in a limited amount of time. Project success is not just determined by the project's duration, budget, scope, or quality. According to recent statements made by engineers and practitioners, meeting project goals is a new way to gauge a project's success

(Kaelan, Bintoro, and Nugroho 2020).

D. Project Planning

Planning is very important in project implementation. Inappropriate planning will result in difficulties in implementation. Therefore, project planning must be in accordance with existing constraints (cost, schedule, performance) and the goals to be achieved (Nurhayati Sembiring, 2020). Some of the functions of project planning include being a means of communication for all related parties, a basis for allocating resources, and a benchmark for control.

E. Project Management

The process of arranging, guiding, and managing a company's resources in order to accomplish predefined short-term objectives is known as project management. Project management is the application of knowledge, skills, tools, and procedures to project operations in order to achieve project requirements, according to Komaruddin & Nugroho (2022). Today's businesses operate in a more dynamic business climate and confront more fierce competition than in the past. Due to this situation, there is a higher emphasis on and need for operational effectiveness and efficiency in both the public and commercial sectors. This has heightened the requirement for organizational responsibility. The use of optimal organizational resource management best practices can promote effectiveness and efficiency. It has been demonstrated that projects and operations are not the same thing since they require distinct management strategies. Consequently, in a project setting, project management may help stakeholders feel more confident that resources are being managed well while also assisting in the accomplishment of organizational and project goals. It should be underlined that project management techniques may be used to address the reasons for delays in delivering work within budget, on schedule, and with the anticipated level of performance. Additionally, a project is not always a failure if it is not completed on schedule, within budget, or with the desired level of performance. Not whether a project succeeds or fails, but rather the efficacy and efficiency of project implementation are being examined at this point.

F. Project Human Resource Management

The method required to utilize the people engaged in a project effectively is known as human resource management, or HR. This covers all parties involved in the project, such as sponsors, partners, customers, individual contributors, and others. The following are the primary procedures in Human Resource Management: 1) Organizational planning include determining, recording, and allocating project roles, responsibilities, and reporting lines. 3) Team Development, which is the enhancement of individual and group capabilities to enhance project performance, and 2) Staff Acquisition, which is the process of acquiring the human resources required to be allocated and work on the project. These procedures communicate with one another and with procedures in other domains. Depending on what the project demands, each step may entail the work of one or more persons, or groups of individuals. In actuality, the processes may overlap even though they are shown above as distinct pieces.

G. Hypothesis Development

A temporary solution to a research issue formulation, where the problem formulation is expressed as a question phrase, is called a hypothesis. It is considered provisional as the response is predicated on pertinent theory rather than empirical facts currently gathered through data collecting. Thus, a theoretical response to the framing of a research topic can also be expressed as a hypothesis (Sugiyono, 2017).

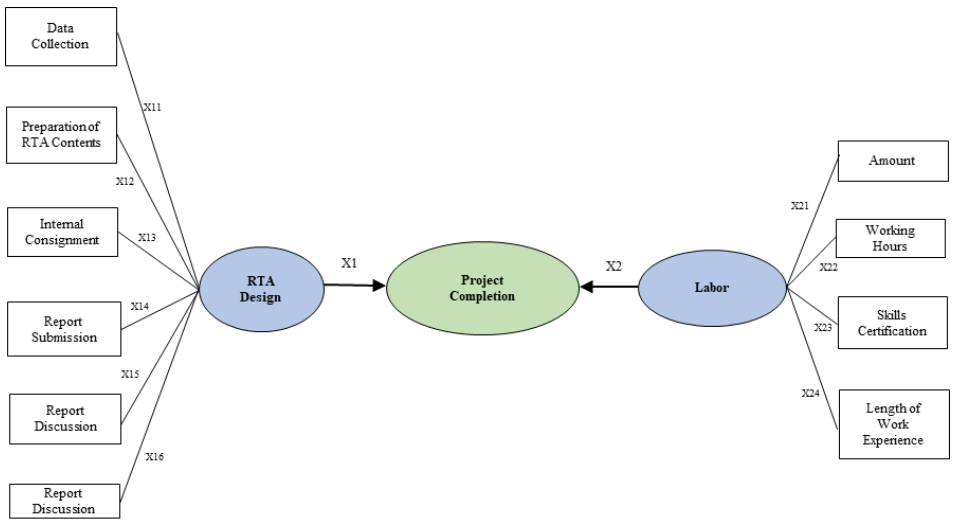


Figure 2. Hypothesis Flow

So several hypotheses were set, namely:
Hypothesis 1 : It is suspected that there is a positive and significant influence between the Final Engineering Plan Design (RTA) variables on Project Completion
Hypothesis 2 : It is suspected that there is a positive and significant influence between the Labor variable on Project Completion

I. RESEARCH METHODS

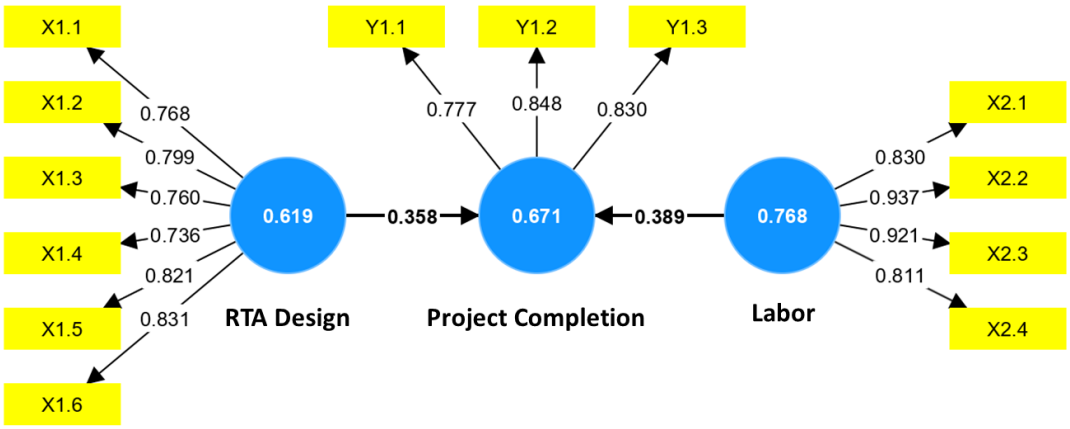
This research was conducted with the aim of looking at several influences on the certainty of completion of the Jakarta Cikampek Toll Road Capacity Increase Project. The research design used is casual research with a survey approach to test the influence of the independent variable on

the dependent variable. Data was obtained by means of a survey by giving questionnaires to the construction actors involved. The questions given are fixed (static) or standard. The method used in this research is quantitative with hypothesis testing. Furthermore, the population of this research is the actors in the Jakarta Cikampek Toll Widening construction project. All personnel involved in this project have the same understanding regarding the completion of this project within the specified time. The research sample will be taken from employees who are actively working on the project to represent the population studied. The sample in question uses simple random sampling statistical techniques. According to Hair et al. (2014), one way to determine the sample size for SEM is 5 to 10 times the number of parameters (indicator variables) in the model. Because this research involves 16 dimensions, 80 respondents are needed to be the sample in the research. The data analysis technique used in the research uses Structural Equation Modeling (SEM) with Smart PLS 3.0 (Partial Least Square) software.

II. RESULTS AND DISCUSSION

A. Outer Model Evaluation

The goal of outer model testing is to determine a model's dependability and validity. There are two tests in the measurement validity set: the discriminant validity test and the convergent validity test. In order to assess the validity of indicators, loading factor parameters are used to quantify convergent validity. Path coefficients known as loading factors are what link a hidden variable to its indicators. All of the SEM's components come together to provide a comprehensive measurement and structural model, as seen in the flow diagram (Path Diagram) in the image that follows.



Source: Processed data (2023)

Figure 3. Path Diagram Based on Factor Loading

With values ranging from 0.736 to 0.937, Figure 3 above demonstrates that all Factor Loading values are > 0.7, indicating that either all 13 indicators have satisfied the validity standards or there is a strong association between them and the construct. The Average Variance Extracted (AVE) Value Test is performed following the Factor Loading value test. Table 1 below displays the model's AVE values:

Table 1. Average Variance Extracted (AVE) Value

Variable	Average Variance Extracted (AVE)
Final Engineering Plan Design	0.619
Project Completion	0.671
Labor	0.768

Source: Processed data (2023)

In the table above, it can be seen that the AVE value ranges from 0.619 to 0.768. Thus, all indicators used for variables are declared to meet validity requirements because the AVE value is > 0.5.

Next comes discriminant validity, which involves evaluating each construct's square root of average variance extracted (AVE) value against the model's other constructs' correlation. Table 2 below displays the model's cross loading values.

Table 2. Cross Loading Values

Indicator	Cross Loading		
	RTA Design	Project Completion	Labor
X1.1	**0.768**	0.374	0.190
X1.2	**0.799**	0.409	0.203
X1.3	**0.760**	0.479	0.399
X1.4	**0.736**	0.408	0.371
X1.5	**0.821**	0.290	0.246
X1.6	**0.831**	0.309	0.228
X2.1	0.353	0.361	**0.830**
X2.2	0.350	0.508	**0.937**
X2.3	0.324	0.466	**0.921**
X2.4	0.243	0.461	**0.811**
Y1.1	0.426	**0.777**	0.397
Y1.2	0.458	**0.848**	0.436
Y1.3	0.330	**0.830**	0.440

Source: Processed data (2023)

Table 2 shows that, when compared to the values for other variables with cross loading values > 0.7, specifically ranging from 0.736 to 0.937, the cross loading values in bold had the greatest values for the variables generated.

These numbers suggest that all indicators have satisfied the requirements and are deemed to be satisfactory, allowing for more investigation. In addition to examining the Cross Loading value, the Fornell-Larcker criteria value may also be used to perform the discriminant validity test. Table 3 below displays the Fornell-Larcker criterion findings.

Table 3. Fornell-Larcker Criteria Values

Variable	RTA Design	Project Completion	Labor
RTA Design	**0.787**		
Project Completion	0.498	**0.819**	
Labor	0.360	0.518	**0.876**

Source: Processed data (2023)

With respect to each latent variable, the square root of AVE is bigger than the correlation value with respect to other latent variables. Therefore, it may be said that the variable satisfies the criteria for discriminant validity. Next, a Variance Inflation Factor (VIF) method test of the multicollinearity assumption is offered. The Variance Inflator Factor (VIF) can be used to assess the collenarity of indicators.

Table 4. Multicollinearity Testing based on Variance Inflation Factor (VIF)

	Project Completion
Final Engineering Plan Design	1.149
Labor	1.149

Source: Processed data (2023)

Moreover, the dependability value of the indicators that make up a variable is tested using Composite dependability testing. Table 5 below displays the model's Composite Reliability value:

Table 5. Reliability Testing based on Composite Reliability

	Composite Reliability
Final Engineering Plan Design	0.907
Project Completion	0.859
Labor	0.930

Source: Processed data (2023)

Referring to Table 5 above, it is known that the values of all variables, namely Final Engineering Plan Design, Labor and Project Completion, have composite reliability values above 0.7. So it can be stated that each indicator has met the requirements of being reliable, accurate, consistent and precise for measuring variables. Then test the next reliability by looking at the Cronbach's alpha value. The Cronbach's alpha value can be seen in table 6 below:

Table 6. Cronbach's Alpha Value

	Cronbach's Alpha
Final Engineering Plan Design	0.878
Project Completion	0.754
Labor	0.898

Source: Processed data (2023)

Every study variable has a known Cronbach's alpha value of greater than 0.7. This demonstrates that every study variable has either satisfied the reliability value or the Cronbach's alpha value standards.

A. Evaluation of the Inner Model

Predicting causal linkages or direct and indirect impacts between variables is done through the examination of the inner model. First, to demonstrate the degree of impact or effect the independent variable has on the dependent variable, the Coefficient of Determination (R^2) is evaluated. Table 7 below displays the model R-Square value.

Table 7. R Square Value

Variable	R Square	R Square Adjusted
Project Completion	0.380	0.364

Source: Processed data (2023)

Project Completion (Y), the dependent variable, will display the R Square value. Table 7 indicates that the R Square value for project completion is 0.380, indicating a 38% explanation of project completion by the Final Engineering Plan Design (RTA and Labor). However, other factors not covered in the research account for the remaining 62% of the effect.

Finding the Q^2 value is an additional method of evaluating the PLS path model's prediction accuracy. There are other general structural model criteria in addition to the assessment criteria mentioned above. This criterion, the GoF index, is used to compare the structural model and overall measurement to the generated model predictions. The following table displays the Q^2 value and GoF index value.

Table 8. Q^2 Value and Goodness of Fit Value

	Q^2 (=1-SSE/SSO)	Estimated Model
Project Completion	0.283	
SRMR		0.086

Source: Processed data (2023)

It is known that the Project Completion variable's Q2 value is 0.283, a value larger than 0. This indicates that the variables related to manpower and the Final Engineering Plan Design (RTA) have strong model prediction relevance. The model is then found to be FIT based on the findings of the SRMR goodness of fit test, with a value of SRMR = 0.086 < 0.1.

B. Hypothesis Testing

After all tests have been carried out and have met the criteria for measurement requirements, the bootstrapping method is then carried out on the smartPLS application. Based on the t-statistical coefficient (T value), the route diagram that results from bootstrapping using the smartPLS program is as follows.

Table 9. Hypothesis Test Results

Hypothesis	Original Sample	T statistic	P values	Information
RTA Design → Project Completion	0.358	5.060	0.000	Significant Positive Effect
Labor → Project Completion	0.389	4.868	0.000	Significant Positive Effect

Source: Processed data (2023)

I. DISCUSSION

A. Influence of the Final Engineering Plan Design on Project Completion

It is known that the Final Engineering Plan Design (RTA) has a favorable and substantial influence on project completion based on the findings of the hypothesis testing in Table 9 above. The Final Engineering Plan design serves as a guide for project implementers during its implementation, ensuring that work is completed in compliance with designs and drawings that satisfy the standards of excellent design. The design that has been prepared and approved by the Ministry of Public Works, in this case Highways and the Toll Road Regulatory Agency (BPJT), is the basis for implementation in the field so that all existing design criteria can be implemented. Completion of the approved Final Engineering Plan Design will affect the completion of work in the field. When there are design changes or designs that have not been completed, it causes work in the field to be hampered so that the project completion time can be hampered so that the project becomes late. This is in accordance with research conducted by (Agritama, Huda and Rini 2018) which explains that incomplete provision of detailed drawings, design errors by planners, lack of clarity in planning engineering designs have an impact on construction project delays.

B. Influence of Labor on Project Completion

Based on the results of hypothesis testing in Table 9 above, it is known that the hypothesis can be accepted. The workforce for this toll widening work consists of various backgrounds. Starting from daily workers in the field to managerial level both in the project office and head office. The implementing contractor as the service provider who is responsible for carrying out work in accordance with the design and specifications that have been determined, has personnel who will be placed in work areas and locations spread across all project areas. This toll road widening work is work that has a predetermined completion target. Considering that the road capacity is already congested, the government requests that the completion target be achieved well. So that workers in the field are asked to be professional in terms of working hours, skills and numbers must be in accordance with the calculation of needs for each work item. This toll road widening work is work that has a predetermined completion target. Considering that the road capacity is already congested, the government requests that the completion target be achieved well. So that workers in the field are asked to be professional in terms of working hours, skills and numbers must be in accordance with the calculation of needs for each work item.

II. CONCLUSION

We may infer that the Final Engineering Plan Design (RTA) has a good and significant impact on project completion based on the researched outcomes. This clarifies how the RTA design's preparation and approval process affects how long the project takes to finish. Finally, this study discovered that labor significantly and favorably impacted project completion. This shows that workers who have skills or certification and who have work experience will influence the project completion time.

Company management can pay more attention to ensuring design approval from the Ministry of Public Works so that changes that occur during the preparation of the RTA design can be minimized which will impact changes in implementation in the field which will of course affect the completion time of the work. Furthermore, further research can develop other factors that can influence project completion, especially for projects carried out on toll roads that are already operating, such as road user comfort factors and toll road investment business factors.

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