SICEST2016

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PROCEEDINGS

SRIWIJAYA INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE & TECHNOLOGY [SICEST 2016]

Bangka Island Indonesia, 8-10 November 2016

A Conference by
Faculty of Engineering
Sriwijaya University

SICEST2016
Bangka Island-Indonesia, 8-10 November 2016

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OVERVIEW

SICEST (Sriwijaya International Conference on Engineering, Science and Technology) is the firsrt regular conference organized by The Faculty of Engineering Sriwijaya University focuses on engineering, science and technology in innovation and development.

The objectives of the conference are:
☑To bring together experts active in engineering, science and technology
☑To explore research findings in the field of engineering, science and technology
☑To discuss current development in innovation of Engineering, science and technology issues
☑To enhance collaboration and networking among experts in the field on engineering, science and technology

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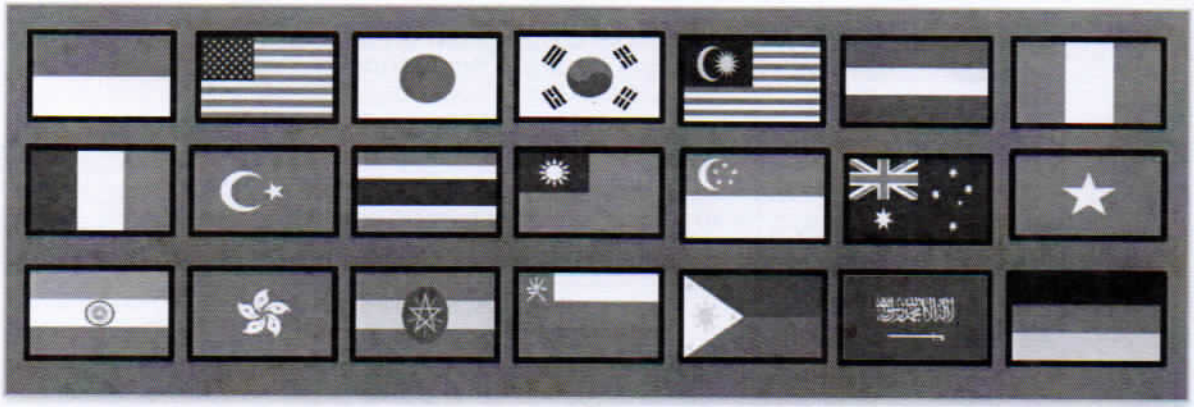

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WELCOME NOTE

FROM THE RECTOR OF SRIWIJAYA UNIVERSITY

On behalf of Sriwijaya University, I am very much privileged to congratulate all participants of The First Sriwijaya International Conference on Engineering, Science and Technology 2016 (SICEST 2016). This conference is part of the activities to mark the 56th year anniversary of Sriwijaya University.

Today our world is facing the engineering, science and technology problems. Research and development in Engineering, Science and Technology are one of a few sectors that can move forward and expected to be a share for regional and global economic recovery. I hope this international conference on engineering, science and technology can partially respond to the above issues.

World class universities and academic institutions are acknowledged by the high quality of researches produced and large number of high impact research publications. Therefore, high quality of researches and publications become the primary mission for an academic institution to achieve. Sriwijaya University as one of Indonesia's leading universities has determined to support the enhancement of researches and publications by providing platforms such as international conferences.

Finaly, I am very grateful fo the dedicated efforts of all the committee members who have involved in preparation, organization and administration of this event. I hope this conference will provide opportunities to all of participants to exchange ideas and result of their work and also to discuss future cooperation plans in engineering, science and technology development.

Thank you very much for your kind participation and I wish you all the best of luck.

Rector of Sriwijaya University
Prof. Dr. Ir. Anis Saggaff, MSCE

WELCOME NOTE

FROM DEAN OF FACULTY OF ENGINEERING SRIWIJAYA UNIVERSITY

Welcome to the 1st Sriwijaya International Conference on Engineering, Science, and Technology (SICEST) 2016. This conference is a regular program organized by Faculty of Engineering Sriwijaya University. In accordance with the rising demand for global harmonization of education, there will be increasing needs for international stages as the media for international community to meet, exchange ideas, cultures, and create collaborations. SICEST is created as a partial effort to accelerate international collaboration and dissemination of researches in the field of Science, Engineering, and Technology.

In order to make SICEST2016 gives more benefit for scientific communities, this conference is not only served as a media for research dissemination via presentation. SICEST2016 develops publication cooperation with four SCOPUS indexed publications to ensure the papers from this conference are well recorded in international database and recognized worldwide.

It is our great wishes and expectation that all distinguished guests and participants will get the benefits from this conference in order to make this event accomplishes its missions.

May all participants will have memorable experiences in Bangka Island Indonesia and enjoy the conference.

Best Regards

Dean
Prof. Subriyer Nasir, MS., PhD

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SICEST2016

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Honored Guest, Distinguished Scientists and Researchers
Ladies and Gentlemen

On behalf of The Organizing Committee, I would like to extend a warm welcome to all distinguished participants who are attending the First Sriwijaya International Conference on Engineering, Science and Technology 2016 (SICEST 2016), with the theme : "Building a better future through innovation in engineering, science and technology" This conference is the first international conference organized by the Faculty of Engineering, Sriwijaya University.

SICEST2016 received 650 submissions, that were sent to review process by SICEST reviewers. After a thorough consideration based on the quality of paper submitted. SICEST Scientific Committee selected 220 papers for SCOPUS Publication by SICEST Publication Partners. There are four SICEST2016 publication partners i.e. Jurnal Teknologi, IJASEIT, MATEC, and IAES Journals. SICEST Scientific Committee also selected 180 papers for participation in SICEST2016 in Non Scopus Publication. There are 60 participants registered as listener.

The papers in this conference are contributed by scientists, researchers, engineers, students, professional stakeholders, plant builders, consultants, government officials, marketers and professional users/buyers of energy etc., coming from 20 countries and 137 affiliations.

We do hope that by organizing this conference will bring the most exciting development on Engineering, Science and Technology for our better future. This activity will provide a forum, where all concerned, may change ideas, information and knowledge to enhance the development of engineering, science and technology.

I hope that fruitful discussions during the conference will lead to the next steps in expanding engineering, science and technology cooperation, and once again my cordial welcome, my best wishes and a memorable stay in Bangka Island. Through this occasion, we would like to apologize for any unfavorable situations that may cause inconvenience during the SICEST 2016.

Chairman
Dr. Muhammad Faizal

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PROGRAM AT A GLANCE

Day 1 (Tuesday, November 8, 2016)

08.00-07.30	Participants Arrival
13.00-18.30	Registration (batch 1)
19.00-21.00	Opening Ceremony (Welcome Party)

Day 2 (Wednesday November 9, 2016)

07.00-08.00	Registration (batch 2)
08.00-08.15	Symposium Opening Remarks
08.15-10.00	Plenary Session
10.00-10.15	Coffee Break
10.15-12.30	**Symposium Session I** Poster Presentation Session I
12.30-13.30	Lunch Break & Shalat
13.30-15.30	**Symposium Session II** Poster Presentation Session II
15.30-15.45	Coffee Break
15.45-17.45	**Symposium Session III** Poster Presentation Session II
17.45-17.50	Symposium Closing

Day 3 (Thursday, November 10, 2016)

07.30-15.30	SICEST Sightseeing (Tour) Program
15.30-17.30	Awarding & Closing Ceremony

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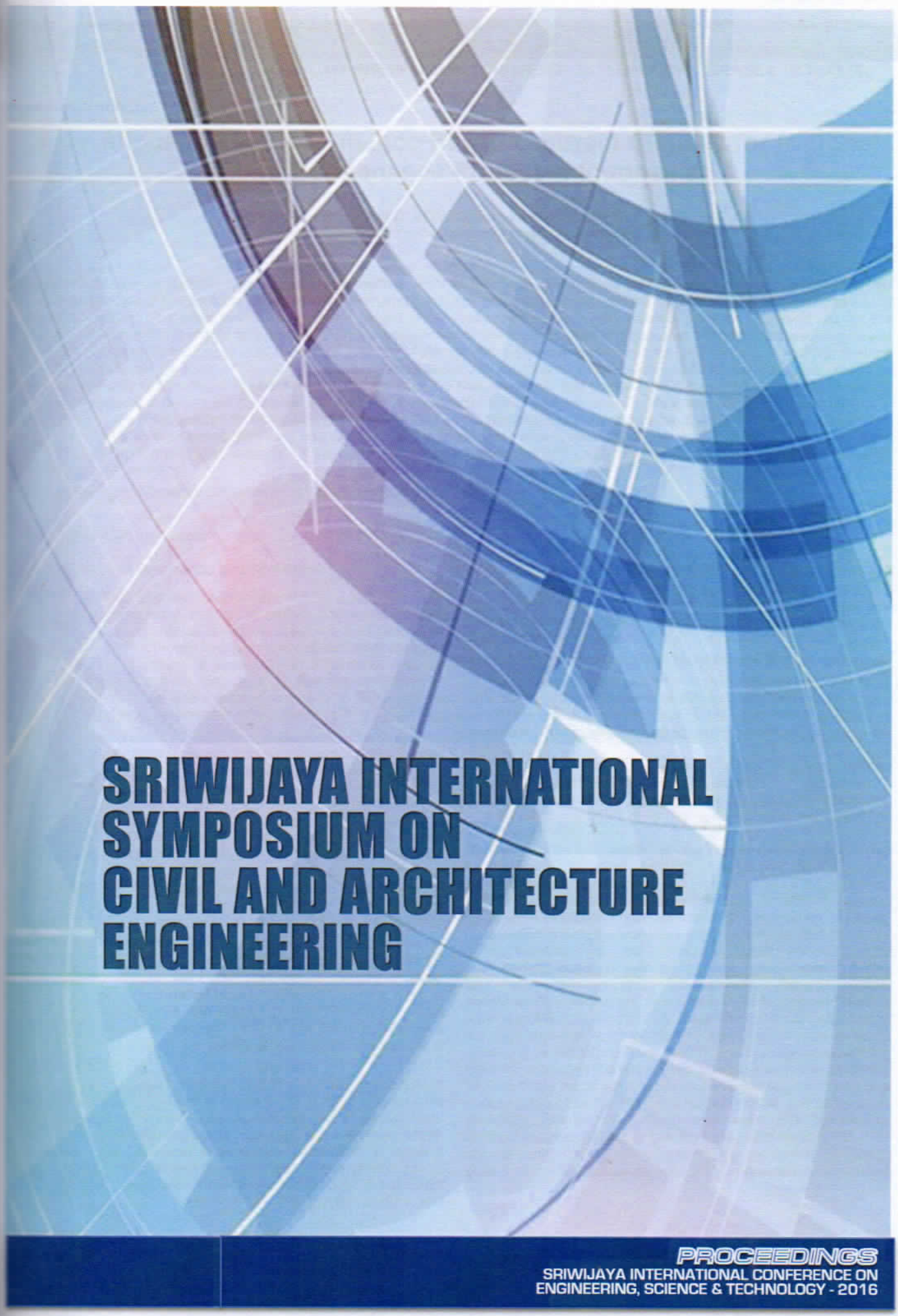

SRIWIJAYA INTERNATIONAL SYMPOSIUM ON CIVIL AND ARCHITECTURE ENGINEERING

PROCEEDINGS
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SICEST PROCEEDINGS

SRIWIJAYA INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE & TECHNOLOGY

Risk Allocation in Performance Based Contract Clauses for National Road Maintenance Project in Indonesia

Deni Setiawan*, Reini D. Wirahadikusumah, Krishna S. Pribadi
Civil Engineering, Institut Teknologi Bandung, Indonesia

Abstract: As a new contract type for road maintenance work in Indonesia, PBC offers potential improvements in road service performance at lower project costs. However, its implementation is still facing challenges, with risk allocation between parties as one of the critical issues. The allocation of risk between project owner and contractor in a PBC contract plays an important role for the success of the project. It should be based on a proper assessment of the involved risks and choosing the party best able to manage them. The purpose of this paper is to review the practice of risk allocation between project owners and contractors in PBC contract clauses. Specifically the focus of this study is to review the clauses in the Standard Bidding Documents for the PBC work issued by Ministry of Public Works, Republic of Indonesia. The result of the analysis shows that contract clauses in PBC contract in Indonesia tend to allocate more risks to the contractor. For example the contractor has to bear the risk of inflation and exchange rate fluctuations, which have to be compensated by increasing the bid price. The contractor also has to bear risks beyond his or her capability to deal with, such as traffic overloading, bad road user behavior and improper road side activities such as informal markets using part of the right of way including drainage channels. If the owner can assume these risks with much lower costs, then the risk should be better allocated to the owner.

Keywords: Risk, allocation, performance, contract, roads, maintenance.

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1. Overview of Risk on Consruction Porject

All construction projects are unique and have their own risks. Such projects involve a number of parties concerned, starting with the owner, contractor, designer, suppliers, and others. All parties involved in a project inevitably carry certain risks. Risk can be defined as a hazard, a probability of it to occur and the potential of losses and resulting gains [7]. Risk can be defined as a difference of actual and expected results [11]. Risks can be managed, reduced, transferred or accepted, but it cannot be ignored [7].

Risk management process usually consists of four stages: risk identification, risk analysis, selection and monitoring of risk management techniques to the consequences of risk. The implementation phase of construction started after the owner and the contractor sign a construction contract. The purpose of construction contract agreement is to allocate the rights, responsibilities and risks between the parties. Construction business is a business with high risks, such as financial risks, political risk, security risk and risk at the time of execution which to be managed and handled by contractors. From the moment that the decision to begin design is taken until the new facility is in use, the owner is uncertain about the outcome of the project.

Risks are usually considered as uncertain future events, which, if they happen, will cause significant extra cost or delay. Generally, the project owner usually prefers to allocate most of the risk to the contractor. The impact of " must" bear a lot of risks , the contractor will perform a " trade off " to the offer price as a consequence to accept the risks that are beyond the control of the contractor [13].

Performance Based Contracts (PBC) is defined as the type of contract in which payment is made if the contractor meets the performance indicators that have been agreed in the contract. Performance Based Contracts focused on outcome (what), compared to how the work is done (how). Therefore, in terms of risk allocation, PBC is a contract that allocates a greater risk to the contractor. [5,6]. The provisions contained in the contract should clearly define "new role" of the project owners and contractors. The parties involved would have to clearly identify all potential risks and allocate it to the party best able to manage it, for example: how to allocate risk in predicting traffic growth and how to allocate the risk of unexpected costs that are beyond the control of the contractor.

2. Introducing PBC in Road Maintenance Work in Indonesia

Road management authority in accordance with Indonesia Law No. 38, (2004) implements the activities (that include cycles of activities and the realization of the road which consists of regulation, development, construction and monitoring) are described as follows :

1. Regulation is the formulation of policy planning, general planning, and the preparation of legislation.
2. Development is drafting guidelines and technical standards, service, empowerment of human resources, research and development.
3. Construction of roads is the activity of programming, budgeting, technical planning, construction, operation and maintenance of roads .
4. Monitoring is the activities undertaken to aim of realizing orderly regulation, development and construction of roads. Monitoring include evaluation, assessment and control.

In handling the road condition, DGH conducts road management activities such as: periodic maintenance activities and increased structure (betterment). Basically, road maintenance activities are to maintain the condition and level of service of the road, so that they obtain the minimum total costs of transport and has a longer service age. Maintenance of roads according to the World Bank (1998) is a process for optimizing the performance of the road network throughout the year, aiming to keep these roads still function to serve the economic needs of society throughout the year and reduce vehicle operating costs. Generally, national road maintenance work uses a traditional contract with the method of delivery Design-Bid-Build (DBB). The characteristics of DBB delivery method are the contract for design work and construction work separately conducted, while routine

maintenance work is usually done by inhouse management. Other characteristics, are traditional contract using unit price, and requires technical specifications that have been set by the owner.

PBC is an approach that holds contracts with delivery methods Design-Build-Operate-Maintain (DBOM). At the PBC, design work, construction, through maintenance contracts are integrated into a single package and only to one contractor. PBC does not set the job specifications, but contractors are limited by the outcome. PBC uses lump sum fixed price and applies incentives and disincentives in the payment mechanism. With the mechanism as mentioned above, PCB diverts a significant risk to the contractor, **FIGURE 1** shows the allocation of risks in various contract strategies for the project road maintenance work.

Issue	Client to manage risk	←		→	Contractor to manage risk
Type of contract	Hourly rates	Single activity	Grouped activity	Performance based (short term)	Performance based (long term)
Payment method	Cost reimbursable	Target cost	Price based (schedule of rates)	Price based (admeasure)	Price based (Lump sum)
Term of contract	Short term	←		→	Long term
Packaging	Many small contracts	←		→	Few large contracts

Note: No comparison of relative risk can be made from the table between different issues

Source: [2]

FIGURE 1. Contracting Strategies and Allocation of Risk

3. Risk Allocation In Indonesia's Standard Bidding Documents For PBC Road Maintenance Project

In this study, the risk of road maintenance work projects under PBC scheme is defined as uncertain events or conditions which have a negative impact on project objectives, that is increased cost of the project. List of the risks obtained through literature study of various references. Some previous researchers have conducted a study on risk identification on Performance Based Contracts [3], [4], [8], [9], [10], [14], [15], [16]. **TABLE 1** shows a list of the various risks that could potentially occur at PBC road work projects.

TABLE 1 Risk Identification On Performance Based Contract

No	Risk Event	Code
1	The project stalled due to changes in policy and politics	R1
2	Increasing cost of material and equipment due to inflation	R2
3	Losses due to natural disasters (floods , landslides , etc.)	R3
4	Increased cost caused by design changes by geography and topography	R4
5	Increased costs due to design errors	R5
6	Increased rework to meet the performance standards	R6
7	Increased costs due to the scope and amount of work can not be predicted	R7
8	Delays in the construction process due to incomplete specification	R8
9	Losses due to unavailability of materials, equipment , and labor	R9
10	Increased costs due to fluctuations in currency exchange rates	R1
11	Disputes due to the weak ability of supervisors	R1
12	Schedule delayed due to weather conditions	R1
13	Losses due to work accident	R1
14	The dispute caused by lack of understanding of the contractual agreement	R1
15	Late payments to contractors	R1
16	The increasing volume of traffic and overloading	R1
17	The delay in the project due to the strife caused by the unclear legal framework	R1
18	Cessation of the project due to conflicts related to the legality	R1
19	Losses due to price estimation error	R1
20	Late payments due to work packages that are not included in the priority handling	R2
21	Late payments due to the budget that are not available or is available but less	R2
22	Contractor's Financial failure	R2
24	Disputes with contractors that have an impact on the delay in the construction process	R2
25	Changes in working methods caused by the lack of environmental documents	R2
26	Costs for security payment	R2
27	Blockage of drainage channels due to market	R2
28	Losses due to price escalation	R2
29	Theft of materials and equipment	R2
30	Cessation of schedule due to strike	R2
31	Rework activities due to the weak ability of subcontractors	R3
32	Disputes due to performance measurement that does not reflect the performance requirements	R3
33	Cessation project occurred due to force majeure	R3

It is important for the parties involved in the contract understand the risks of what might happen. Contract docume is a tool for allocate risk, there is a clause in the contents of wh party bears the risks and how to mitigate those risks. A revie the Indonesia's Strandard Bidding Documents for PBC Natio Road Maintenance Project provides information on how ris allocated show in **TABLE 2.**

TABLE 2 RISK ALLOCATION THROUGH CONTRACT CLAUSES

No	Risk Event	Code	Risk Ba
1	The project stalled due to changes in policy and politics	R1	Owne
2	Increasing cost of material and equipment due to inflation	R2	Contrac and ow
3	Losses due to natural disasters (floods , landslides , etc.)	R3	Contrac and ow

No	Risk Event	Code	Risk Barier
4	Increased cost caused by design changes by geography and topography	R4	Contractor
5	Increased costs due to design errors	R5	Contractor
6	Increased rework to meet the performance standards	R6	Contractor
7	Increased costs due to the scope and amount of work can not be predicted	R7	Contractor
8	Delays in the construction process due to incomplete specification	R8	Contractor
9	Losses due to unavailability of materials, equipment , and labor	R9	Contractor
10	Increased costs due to fluctuations in currency exchange rates	R10	Contractor
11	Disputes due to the weak ability of supervisors	R11	
12	Schedule delayed due to weather conditions	R12	Contractor
13	Losses due to work accident	R13	Contractor
14	The dispute caused by lack of understanding of the contractual agreement	R14	Contractor
15	Late payments to contractors	R15	Contractor
16	The increasing volume of traffic and overloading	R16	Contractor
17	The delay in the project due to the strife caused by the unclear legal framework	R17	Contractor and owner
18	Cessation of the project due to conflicts related to the legality	R18	Contractor and owner
19	Losses due to price estimation error	R19	Contractor
20	Late payments due to work packages that are not included in the priority handling	R20	Contractor
21	Late payments due to the budget that is not available or available but less	R21	Contractor
22	Contractor's Financial failure	R22	Contractor
24	Disputes with contractors that have an impact on the delay in the construction process	R23	Contractor and owner
25	Changes in working methods caused by the lack of environmental documents	R24	Contractor
26	Costs for security payment	R25	Contractor
27	Bad road user behavior and improper road side activities such as informal markets	R26	Contractor
28	Losses due to price escalation	R27	Contractor
29	Theft of materials and equipment	R28	Contractor
30	Schedule delay due to strike	R29	Contractor
31	Rework activities due to the weak ability of subcontractors	R30	Contractor
32	Disputes due to performance measurement that does not reflect the performance requirements	R31	Contractor
33	Project termination due to force majeure	R32	Contractor and owner

The result of the analysis shows that contract clauses in PBC contract in Indonesia tend to allocate more risks to contractor. For example contractor has to bear the risk of inflation and exchange rate fluctuations, which have to be compensated by increasing the bid price. Contractor also has to bear risks beyond his or hers capability to deal with, such as traffic overloading, bad road user behavior and improper road side activities such as informal markets using part of the right of way including drainage channels.

4. CONCLUSION

PBC projects in Indonesia allocates more risk that a significantly affects on the increase in the project cost to the contractor party. For example the contractor has to bear the risk of inflation and exchange rate fluctuations, which have to be compensated by increasing the bid price. The contractor also has to bear risks beyond his or hers capability to deal with, such as traffic overloading, bad road user behavior and improper road side activities such as informal markets using part of the right of way including drainage channels.The road manager doesn't bear much risk that a significantly impacts on increase the project cost, because the payment mechanism used in PBC is lump sum fixed price.

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