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Engineering Ethics In The Case Of the Kutai Kartanegara Bridge Collapse

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ABSTRACT

The collapse of the Kutai Kartanegara Bridge in 2011 was a national tragedy. This case highlighted the failure of engineering practices and violations of engineering ethics and codes of conduct in Indonesia. The Kutai Kartanegara Bridge study aims to analyze engineering ethics in the case of the bridge collapse. The methodology used was qualitative analysis by collecting various information from the perspective of engineering professional ethics as stipulated in the regulations of the Indonesian Engineers Association. The results of the analysis showed several systematic violations of the PII code of ethics as stipulated in the Sapta Marga and Catur Karsa. The most prominent thing in the violation of the code of ethics is on the principle of public safety, professional integrity, morals and engineering ethics. The results of this study also produced: 1) Causes of the collapse of the bridge Bridge planning that does not comply with design standards, materials, structures, area contours, changes to several materials, the absence of analysis of unexpected loads and the bridge structure is weakened due to loose knots or connections, 2) Violation of the Indonesian Engineers Code of Ethics (PII) against Sapta Dharma (Guidelines for Attitudes) 1, 2, and 3 and Catur Karsa (Basic Principles) 3, 3) Forms of Violations that occur Professional negligence, Integrity and Honesty, Professional competence, 4) Analysis of ethical evaluation based on Deontology (Ethics of Obligation) Teleology (Ethics of Consequences/Utilitarianism) and Virtue Ethics

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INTRODUCTION

Infrastructure development is one of the most important sectors in supporting economic growth, equitable development, and improving community welfare. Urban infrastructure is closely related to construction activities, which encompass the development, operation, maintenance, and demolition of buildings and infrastructure facilities (Hayati, 2022; Schwartz, 2025). Construction work is a systematic process planned from the initial stage to the utilization stage, including project site planning, feasibility studies, Environmental Impact Assessment

(EIA) studies, design, physical construction, and post-construction maintenance (Malik, 2024; Sari, 2025).

Ideally, every construction project is expected to be completed successfully in accordance with established standards regarding quality, cost, schedule, and safety. However, in practice, various problems such as workplace accidents, construction failures, and other negative impacts frequently occur during project implementation. Workplace accidents are often associated with failures in complying with safety standards and violations of professional ethics in construction activities (Wibawa, 2024). Such violations may result in risks ranging from minor and moderate to severe consequences. In some cases, failure to uphold professional ethics has led to fatalities (Marwiyah, 2002). Furthermore, ethical violations may cause significant financial losses and reduce public trust in construction service providers (Imas Toha, 2023).

In this context, engineering ethics plays a crucial role as a foundation for maintaining integrity, professionalism, and accountability in engineering practice (Mukhlisin, 2025). Professional ethics in construction requires engineers and construction practitioners to perform their duties according to their competencies, prioritize safety, and maintain the quality of work while adhering to applicable regulations and ethical standards (Sri Wahyuning, 2018). In structural engineering projects, the application of engineering ethics is not only intended to meet safety requirements but also to ensure that structures are sufficiently strong, capable of achieving their design life, and able to provide safety and comfort for users and owners (Awang, 2023). Conversely, neglecting technical standards and professional ethics may result in structural vulnerabilities, increase the risk of structural failure, and endanger public safety. Therefore, a comprehensive understanding of the implementation and violation of engineering ethics in construction projects is essential.

One of the most significant construction failure cases in Indonesia was the collapse of the Kutai Kartanegara Bridge in Kutai Kartanegara Regency, East Kalimantan Province. The bridge is a suspension bridge spanning the Mahakam River with a total length of approximately 710 meters and a main free span of about 270 meters without intermediate supports. The Kutai Kartanegara Bridge serves as a vital transportation link connecting Tenggarong District and surrounding areas, playing an important role in supporting regional mobility and economic activities. Construction of the bridge began in 1995 with a project value of approximately IDR 110 billion and was carried out by PT Hutama Karya as the main contractor. Upon its completion in 2001, the bridge became one of the most prominent infrastructure landmarks in East Kalimantan.

However, on November 26, 2011, the Kutai Kartanegara Bridge collapsed while maintenance work involving bolt tightening was being performed on the structure. The incident resulted in the deaths of at least 20 people and caused substantial economic and social losses to the communities of East Kalimantan. This tragedy became one of the largest construction failures in Indonesia and raised serious concerns regarding both the technical and ethical aspects of construction implementation and infrastructure maintenance. Therefore, a comprehensive study of engineering ethics in relation to the collapse of the Kutai Kartanegara Bridge is necessary. This study focuses on analyzing the engineering ethical principles applicable at the time of the incident, with the aim of providing valuable lessons and recommendations to prevent similar construction failures in the future.

METHODS

Violations of the code of ethics in construction work, particularly building structures, must be analyzed based on literature reviews and related sources. Field observations and literature collection on real-life cases serve as a reference for analyzing cases of code of ethics violations (Pratama, E., F., 2025). The violations analyzed in this study are real-life cases occurring in the construction industry that resulted in violations of security, safety, and building quality (Banerademorin, 2024). Investigations of violations are drawn from various reliable sources, such as media reports, literature studies related to the violated code of ethics, and so on.

This data is then analyzed to identify the ethical violations that occurred, the consequences experienced, and preventative measures to be implemented if similar incidents occur in the future. The analysis is conducted qualitatively based on the data collection, analysis, and interpretation (Marwa, 2021). The results will provide understanding for construction practitioners and readers in cases of code of ethics violations in building construction work.

RESULTS AND DISCUSSION

General Description of the Kutai Kertanegara Bridge

The collapse of the Kutai Kertanegara Bridge was caused by several engineering factors. The team's investigation determined that the bridge's collapse was due to structural failures, such as faults in the connections between several hanger rods and the main cable, which had accumulated since the initial planning stage. Specifically, the structural failures that caused the collapse of the Kutai Kertanegara Bridge were:

a. Bridge planning that does not comply with standardization of design, materials, structure, area contours
b. Changes to some materials
c. There is no analysis of unexpected expenses
d. he bridge structure is weakened due to the presence of glue or loose connections

Figure 1. Broken clamp connection **Figure 2**. Lower clamp collapse
(Source: Ilham, 2021)

Identification of the Kutai Kartanegara Bridge

Based on the investigation and literature study that was analyzed, several things can be taken regarding violations of the code of ethics on the Kutai Kertanegara Bridge (Table 3.)

Table 3. Description and Impact of Ethical Violations on the Kutai Kertanegara Bridge

No	Code of Ethics Violation	Description and Impact of Ethical Violations
1	Safety Risk	Ignoring safety standards can lead to workplace accidents, ranging from minor injuries to severe cases (including death) among construction workers and building users.
2	Structural Damage	Failure to meet quality standards may result in structural damage such as cracks or building collapse.
3	Additional Costs	Reconstruction of buildings due to structural failure leads to increased costs for both owners and project contractors.
4	Reputation Damage	Construction failures related to safety or poor quality can damage the reputation of contractors, reduce public trust, and negatively affect the company's future business prospects.
5	Legal Consequences	Violations that result in loss of life may trigger legal actions, fines, or even criminal penalties for the responsible parties.
6	Environmental Impact	Environmental damage, such as contamination or ecosystem disruption, may occur due to structural failure or poor construction practices.
7	Financial Loss	Not only repair costs arise from construction failure, but also financial overruns affecting all stakeholders involved (project owners, contractors, and related institutions).
8	Loss of Public Trust	Such incidents can reduce public confidence in the construction industry as a whole.

Analysis of the Indonesian Engineers Code of Ethics (PII)

The Kutai Kertanegara Bridge code of ethics violation case has totally violated the basic principles and behavioral guidelines set out in the Catur Karsa and Sapta Dharma of the Indonesian Engineers' Code of Ethics (PII). The articles violated on the Kutai Kertanegara Bridge can be identified in detail (Table 4).

Table 4. Identification of Violations of the PII Code of Ethics Articles

No	Code of Ethics Component	IPI Code of Ethics Violation	Form of Violation
1	Sapta Dharma 1	Prioritizing the safety, health, and welfare of the public	Structural safety failure during the maintenance process, resulting in fatalities.
2	Catur Karsa 3	Working earnestly for the benefit of society in accordance with duties and responsibilities	Construction/maintenance technical standards (by project implementers and supervisors) are not properly fulfilled.
3	Sapta Dharma 2	Working within one's area of competence	Engineers acting as designers, constructors, or maintenance personnel are unable to demonstrate adequate engineering competence.
4	Sapta Dharma 3	Only expressing opinions that can be accounted for	Flawed procedures in design change approval or implementation indicate that engineers fail to uphold professional responsibility and engineering accountability.

Technical Causal Factors and Negligence

Technical investigations indicated that the primary causes of the Kutai Kertanegara Bridge failure were planning errors, construction failures, and a lack of attention during maintenance. The identified factors, including engineer negligence and the elements involved, were as follows:

a. Initial Design Changes: Indications of changes made to the original design without verification with a competent structural analysis team.
b. Material and Workmanship Quality: The use of materials suspected of being of substandard quality, as well as poor construction/maintenance workmanship.
c. Maintenance Procedures: The procedural implementation of changes to bridge components, such as bolt tightening, did not meet established safety and loading standards. This indicates a lack of competence on the part of the supervising engineers and the work implementers.

Standard Operating Procedure (SOP) for Whistleblowing Engineers' Code of Ethics

Whistleblowing is a way to reveal information about unrecorded (illegal) activities, non-standard activities, or fraud committed by individuals or groups that can harm an organization, company, both internally and externally. Therefore, a safe channel is needed for construction actors (engineers) to report fraudulent practices that do not meet standards. The draft SOP for Whistleblowing for Engineers' Code of Ethics designed by PII is in Table 7.

Table 7. Draft SOP for Whistleblowing

No	Stage	SOP Design	PIC (Person in Charge)
1	Violation Identification	Engineers identify practices, designs, or procedures that violate the PII Code of Ethics or pose a high risk to public safety.	Project Engineer/Supervisor
2	Confidential Reporting	Reports are submitted confidentially and anonymously to the organization's Internal Ethics Committee (IEC) or directly to the PII Honor Council.	Reporting Engineer
3	Rapid Investigation	The IEC/PII promptly establishes an independent investigation team that must complete the inquiry within 14 working days.	Internal Ethics Committee/PII
4	Whistleblower Protection	The organization is required to ensure full protection of the whistleblower's career and safety against any form of retaliation.	Organization Management/HRD

CONCLUSION

The Kutai Kartanegara Bridge collapse represents a failure of engineering ethics in acting and practicing engineering. The Kutai Kartanegara Bridge collapse not only caused financial losses but also claimed victims and compromised public safety and health. The analysis revealed several systematic violations of the Indonesian Engineers' Code of Ethics (PII) as outlined in the Sapta Marga (Guidelines for Attitudes) and Catur Karsa (Four Principles). The most prominent

violations of the code of ethics concern the principles of public safety, professional integrity, and engineering morals and ethics. The research concludes:

a. The causes of the bridge collapse were: Bridge design that did not comply with design standards, materials, structures, and area contours, changes to several materials, the lack of analysis for unexpected loads, and the weakening of the bridge structure due to loose joints and joints.
b. Violations of the Indonesian Engineers' Code of Ethics (PII) against Sapta Dharma (Guidance for Attitudes) 1, 2, and 3 and Catur Karsa (Basic Principles) 3.
c. Types of Violations that Occur: Professional Negligence, Integrity and Honesty, Professional Competence
d. Analysis of Ethical Evaluation Based on Deontology (Ethics of Obligation), Teleology (Ethics of Consequences/Utilitarianism), and Virtue Ethics

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