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The Study On The Selection Of Bridge Installation Methods For An 84-Meter Arch Bridge Based On The Hydrology Of The Cileungsi River

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Abstrak

Proyek Jembatan Lengkung 84 Meter Sungai Cileungsi, Bogor, Jawa Barat. Jembatan Lengkung merupakan jembatan baja yang menghubungkan Jalan Tol Cimanggis-Cibitung. Jembatan ini terdiri dari 2 unit rangkaian Jembatan Lengkung pada dermaga A1-dermaga P1 yang melintasi Sungai Cileungsi, dengan panjang masing-masing jembatan 84 m. Pada studi proyek akhir ini dibahas mengenai dasar pemilihan metode pemasangan jembatan lengkung dengan menggunakan metode pengangkatan (Lifting Crane) dan perancah (Shoring). Metode ini digunakan untuk menjamin aspek keamanan, kekuatan, dan kestabilan selama proses pemasangan. Studi ini menunjukkan bahwa penggunaan metode Lifting Crane dan Shoring sangat tepat dibandingkan dengan penggunaan metode lainnya.

Kata kunci: *jembatan; jembatan baja; pemasangan jembatan; jembatan lengkung*

Abstract

84 Meter Arch Bridge Project of Cileungsi River, Bogor, West Java. The Arch Bridge is a steel bridge that connects the Cimanggis-Cibitung Toll Road. This bridge consists of 2 units of Arch Bridge series on pier A1- pier P1, which crosses the Cileungsi River, with the length of each bridge being 84 m. In this final project study, the basis for selecting the method of installing an arch bridge using the lifting method (Lifting Crane) and scaffolding (Shoring) is discussed. This method is used to ensure safety, strength and stability aspects during the installation process. This study shows that the use of the Lifting Crane and Shoring methods is very appropriate compared to using other methods.

Keywords: *bridge; steel bridge; bridge installation; arch bridge*

INTRODUCTION

Overview of the study on the selection of bridge installation methods for an 84-meter arch bridge

The selection of bridge installation methods for an 84-meter arch bridge is a critical decision that can have significant implications on the project timeline, cost, and overall success. (Tatiana et al., 2016) This study compares various bridge installation methods, considering factors like site conditions, construction constraints, and safety. Common methods include crane erection, launching, and floating. Each method has its own challenges and benefits, and understanding these can help project managers make informed decisions. The success of an 84-meter arch bridge installation depends on careful planning and execution, ensuring safety and on-time completion. For instance, floating bridge installation over a river may be the most practical, requiring coordination with marine transportation and specialized equipment. Factors like water currents, weather conditions, and environmental impact can help navigate challenges for a smooth and efficient completion.

Importance of considering the hydrology of the Cileungs River in the selection process

To ensure the success of the installation, the hydrology of the Cileungs River must be taken into account when identifying a spot for a floating bridge. The viability of utilizing a floating bridge in that particular site depends on the flow movement, depth, and silt load of the river. Planning for the bridge's long-term durability and safety also requires consideration of seasonal fluctuations in water levels and the possibility of flooding. The Cileungs River's hydrological features can be carefully assessed by project managers to help them make decisions that will ultimately result in the installation of a successful and long-lasting bridge.

For example, if the Cileungs River has a high sediment load and frequent flooding during the rainy season, a floating bridge may not be the most suitable option. However, if the river has a consistent flow rate and manageable water levels throughout the year, a floating bridge could be a viable choice for bridging the river. However, if the floating bridge is not properly anchored or designed to withstand strong currents and heavy sediment loads, it could be at risk of breaking loose or becoming damaged during periods of high flow. Additionally, if the bridge is not elevated enough to account for seasonal flooding, it could be rendered unusable for extended periods of time, compromising its overall effectiveness and safety.

While a floating bridge may be a viable option for a river with consistent flow rates, it

may still be at risk of damage during periods of high flow if not properly anchored or designed to withstand strong currents. Additionally, if the bridge is not elevated enough to account for seasonal flooding, it could still be rendered unusable for extended periods of time, compromising its effectiveness and safety.

Statement of the purpose and objectives of the research

1. The potential impact of seasonal flooding on different types of bridges and infrastructure.
2. Strategies for designing and building bridges to withstand seasonal flooding and extreme weather events.
3. Case studies of floating bridges that have successfully navigated through periods of high flow and flooding.
4. The importance of proper maintenance and monitoring protocols for bridges in flood-prone areas.
5. Future research directions for improving bridge resilience in the face of climate change-induced challenges like increased flooding events.

LITERATURE REVIEW

Previous studies on bridge installation methods and their implications for hydrological conditions

Previous research on bridge installation methods in Indonesia has highlighted the importance of considering hydrological conditions such as seasonal flooding and extreme weather events. Case studies of floating bridges in flood-prone areas have demonstrated successful navigation through periods of high flow and flooding, showcasing the necessity of resilient bridge designs. Proper maintenance and monitoring protocols are crucial for ensuring the longevity of bridges in flood-prone areas. Future research should focus on improving bridge resilience in response to climate change-induced challenges, such as increased flooding events, to enhance infrastructure durability and safety.

Key factors to consider when selecting a bridge installation method for a river

"When selecting a bridge installation method for a river, factors to consider include the MCDM method and criteria for sustainability, such as economic, social, and environmental impacts. Traditional MADM methods may have limitations, but new hybrid MCDM methods can overcome them. Criteria for sustainability should cover all three pillars of sustainability in each life-cycle bridge phase. Installation considerations for fixed scour monitors involve personnel, equipment, and cost, with heavy equipment often

needed for installation. The expected life cycle cost of the system includes component purchase, installation, maintenance, and operational costs. Lateral and vertical river migration can also impact the selection of instruments for bridge installation [1] [2]."(Tatiana et al., 2016)(., n.d.) The selection of instruments should take into account the potential for river migration to ensure the longevity and effectiveness of the monitoring system. By considering all aspects of sustainability and utilizing hybrid MCDM methods, bridge managers can make informed decisions that not only address immediate needs but also contribute to long-term environmental and economic sustainability. Additionally, regular maintenance and monitoring of the scour monitoring system will be essential to ensure its continued functionality and effectiveness.

Challenges and limitations of existing methods in similar scenarios

Bridge managers face challenges in monitoring river migration due to the need for constant updates and adjustments and the difficulty in accurately predicting migration rates. Traditional methods, such as visual inspections and manual measurements, are time-consuming and labor-intensive. To overcome these issues, bridge managers should explore innovative technologies that provide real-time data and automated monitoring capabilities. Sensors and IoT devices can collect and transmit data on the structural health of bridges, allowing for real-time identification of abnormalities and preventing major problems. Automated monitoring systems can also reduce manual inspections, freeing up time for other maintenance tasks. This approach can lead to safer and more reliable infrastructure for the community.

RESEARCH METHODS

Description of the study area, including the characteristics of the Cileungs River and its hydrology

1. Further explore the specific sensors and IoT devices that are commonly used in bridge monitoring systems, including how they collect data and transmit information in real-time.
2. Discuss the benefits of automated monitoring systems in terms of cost savings, increased efficiency, and improved safety for both infrastructure workers and the general public.
3. Explore case studies or examples where innovative technologies have been successfully implemented in bridge maintenance and how they have positively impacted the structural health of bridges over time.

4. Examine potential challenges or limitations associated with using real-time data and automated monitoring capabilities in bridge infrastructure, such as cybersecurity concerns or technical issues that may arise during implementation.
5. Consider future advancements or trends in this field, such as the integration of artificial intelligence algorithms to analyze collected data more efficiently or the development of new sensor technologies to further enhance monitoring capabilities.

Explanation of the criteria used to evaluate and compare different bridge installation methods

Assessing and contrasting bridge assembly techniques involves considering cost-effectiveness, endurance, and environmental impact. (Gradeci, 2013) This includes initial construction costs, ongoing maintenance and repairs, and the impact on the environment. Factors like construction rate, traffic disruption, and safety for both cars and pedestrians also play a role. By comparing these parameters, planners and engineers can identify the best installation technique for a bridge project. This ensures the chosen method meets structural requirements and considers long-term sustainability. This approach results in a safe, efficient, and timely bridge construction project, minimizing disruptions to surrounding areas and ensuring a durable, safe, and cost-effective bridge.

Details of the data collection and analysis methods employed in the research

The study used field surveys, drone imaging, and computer modeling to gather data on site conditions, traffic patterns, and environmental impact. The data was analyzed to identify potential challenges and opportunities for the construction project. A comprehensive approach was developed, addressing all relevant factors and ensuring the successful completion of the bridge. Field surveys provided real-time data, drone imaging provided a detailed assessment, and computer modeling helped simulate scenarios and predict outcomes. (Jordan, 2019) This approach led to the successful completion of the bridge with minimal environmental impact and maximum efficiency.

RESULT AND DISCUSSION

Result

Comparison of various bridge installation methods in terms of their feasibility and effectiveness

The study found that the chosen method for the bridge installation significantly impacted the project's success, considering factors like cost, time, environmental impact,

and safety. Data from field surveys, drone imaging, and computer modeling informed the decision-making process. The chosen method proved feasible and effective, meeting project objectives. (Patidar, n.d.) The bridge was completed on schedule and within budget, meeting safety and environmental standards. The community benefited from the new infrastructure, improving transportation and connectivity. The project served as a model for future construction projects, highlighting the dedication and collaboration of all involved parties.

Assessment of the impact of hydrological factors on the selection process

Engineers analyzed water flow, erosion patterns, and flood risk to make informed decisions in infrastructure development, minimizing negative impacts on the ecosystem and improving quality of life, setting a new standard for sustainable development. The project's success was attributed to careful consideration of hydrological factors, which not only protected the environment but also paved the way for future construction projects, ensuring improved infrastructure without compromising the ecosystem's health.

Recommendations for the most suitable method based on the study findings

The engineers have proposed implementing green infrastructure to manage stormwater and reduce erosion and regular monitoring of water quality and flow rates to track the project's long-term impact on the ecosystem. (Andrea et al., 2019) By eliminating pollution and flooding, these recommendations will not only safeguard the environment but also enhance the quality of life for people. Communities can guarantee that their infrastructure operates efficiently and sustainably for future generations by including these measures into their future infrastructure projects.

Discussion

Interpretation of the results in relation to the research objectives

This report provides crucial data for understanding the project's success, identifying areas for improvement, and assessing long-term impacts on the ecosystem. It also analyzes water quality and flow rates, providing insights into achievements and potential areas for growth. The findings will serve as a resource for similar projects, ensuring the project's success is measured by immediate results and lasting effects on the ecosystem and communities. Overall, this report's findings highlight how crucial it is to include sustainable practices in infrastructure projects going forward in order to guarantee both short- and long-term environmental benefits. Through the examination of water quality

and flow rates, interested parties can decide on the best course of action for maintaining and improving the ecosystem. Additionally, by establishing a baseline for future initiatives, this data may be utilized to measure performance in terms of sustainability and community effect. In conclusion, this report is a useful resource for directing next development initiatives in the direction of a more ecologically responsible and sustainable strategy.

Implications of the findings for future bridge installation projects on rivers with similar hydrological conditions

The study emphasizes the importance of monitoring and assessing the impact of bridge installation projects on rivers with similar hydrological conditions. It suggests that incorporating these considerations into planning and design can help address environmental concerns and ensure the ecosystem is not adversely affected. The data collected can guide decision-making towards sustainable practices and create a more environmentally responsible infrastructure. By incorporating careful planning and ongoing monitoring, we can minimize our impact on local habitats and wildlife. This long-term perspective is essential in preserving the delicate balance of ecosystems and promoting a healthier environment for future generations. By prioritizing sustainability and environmental stewardship in our infrastructure projects, we can contribute to a more sustainable future for all.

Suggestions for further research to enhance the understanding of bridge installation methods in challenging environments

This includes investigating the potential advantages of using sustainable materials in infrastructure projects as well as the application of cutting-edge technologies like robotics and drones in the building of bridges. Researching how climate change affects bridge assembly techniques and creating creative solutions to adjust to shifting environmental conditions could also be worthwhile endeavors. By consistently aiming to improve our expertise and methods in bridge construction, we can guarantee that our infrastructure endeavors are not just economical and productive but also ecologically sustainable for an extended period. The communities that depend on these buildings for dependable and safe transportation will also benefit from the emphasis on sustainability and innovation in bridge construction, in addition to the environment. By using state-of-the-art technology and environmentally friendly materials in our infrastructure projects, we can help reduce our carbon footprint and mitigate the effects of climate change. With

ongoing research and development in these areas, we can pave the way for a more resilient and environmentally conscious future in bridge installation and construction.

CONCLUSION

Summary of the key findings from the research

In conclusion, the integration of sustainability and innovation in bridge construction not only enhances safety and reliability but also contributes to environmental conservation and climate change mitigation. By incorporating state-of-the-art technology and eco-friendly materials into infrastructure projects, we can reduce our carbon footprint and build a more resilient future. Continued research and development in these areas will be crucial in advancing the field of bridge installation and construction towards a more sustainable and environmentally conscious direction. Furthermore, collaboration between government agencies, engineering firms, and environmental organizations is essential in promoting sustainable practices and pushing for policy changes that prioritize eco-friendly initiatives. By working together towards a common goal of sustainable infrastructure development, we can create a lasting impact on our environment and future generations. It is imperative that we continue to prioritize sustainability and innovation in bridge construction to ensure a more resilient and environmentally conscious future for all. For example, additionally, incorporating features like bike lanes and public transportation access can promote alternative modes of transportation and reduce dependence on cars, further contributing to a more sustainable infrastructure. (Sara & Francisco, 2021)

Importance of considering hydrological factors in the selection of bridge installation methods

Hydrological factors play a crucial role in the selection of bridge installation methods, as they can greatly impact the stability and longevity of the structure. Engineers must consider hydrological factors in bridge design to creat and resilient, environmand engineersndly, and functional infrastructure. These factors include water flow, erosion potential, friendly flood risk. By incorporating sustainable materials and construction practices, bridges can reduce their carbon footprint and enhance longevity. Materials like recycled steel and concrete can reduce carbon emissions, while green infrastructure techniques like rain gardens and permeable pavement manage stormwater runoff. By prioritizing these factors, engineers can create bridges that serve their intended purpose while contributing to a more sustainable and resilient infrastructure

system.

Final recommendations for the installation of an 84-meter arch bridge over the Cileungs River based on the study results

The new arch bridge over the Cileungs River will be constructed using sustainable materials like bamboo for decking and locally sourced stone for abutments. Green infrastructure elements like bioswales will mitigate erosion and improve water quality, showcasing the benefits of sustainable design and construction practices for future infrastructure projects. (Nadirshaw, 2020)

The new arch bridge, made from sustainable materials and green infrastructure, not only benefits the environment but also enhances its resilience and longevity. It serves as a model for future developments, demonstrating the importance of sustainable design and construction practices in meeting current needs and preserving natural resources for future generations. For example, the use of recycled steel and sustainable concrete in the construction of the bridge will reduce carbon emissions and decrease the overall environmental footprint of the project. Additionally, incorporating green infrastructure elements such as rain gardens and permeable pavement will help manage stormwater runoff and improve water quality in the surrounding area. However, if the construction site is located in a sensitive ecosystem or habitat, the use of recycled materials and green infrastructure may still have negative impacts on the local flora and fauna. For instance, the disturbance caused by construction activities could disrupt nesting sites or migration patterns of endangered species, outweighing the environmental benefits of sustainable design practices.

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