Journal of Social Research
P-ISSN: 2827-9832
E-ISSN: 2828-335x
http://ijsr.internationaljournallabs.com/index.php/ijsr

Analysis of Pavement Condition Using The International Roughness Index (IRI) Method With The Roadroid Application on The Genengan–Lembeyan Road Section In Magetan District

Adi Purwanto, Hanie Teki Tjendani, Budi Witjaksana
Universitas 17 Agustus 1945 Surabaya, Indonesia
adi.architecture95@gmail.com, hanie@untag-sby.ac.id, budiwitjaksana@untag-sby.ac.id

ABSTRACT

The Genengan–Lembeyan road in Magetan Regency serves as a vital transportation route, connecting Magetan and Ponorogo Regencies. As a primary collector road, it facilitates the distribution of goods and community mobility but experiences significant surface deterioration due to high traffic volumes and heavy vehicle loads. This study evaluates the pavement condition using the International Roughness Index (IRI) method, supported by the Roadroid application, a smartphone-based tool for assessing road unevenness. The research identifies an average IRI value of 4.24, which suggests that the overall road condition is moderate to good. However, critical segments, particularly between STA 5+000 and STA 8+660, exhibit moderate to severe damage, including cracks, potholes, and surface deformations, necessitating immediate repair. The estimated repair costs, calculated using the Bina Marga 2024 guidelines, amount to IDR 4,069,031,000. This study emphasizes the effectiveness of the Roadroid application in providing accurate, real-time road condition data, offering a cost-efficient and practical alternative to conventional methods. The findings underline the importance of timely maintenance to prevent further deterioration, enhance road safety, and sustain transportation efficiency. Furthermore, the study advocates for regular evaluations using innovative tools like Roadroid and improved drainage systems to mitigate damage caused by environmental factors. The insights from this research contribute to better infrastructure management in Magetan Regency, demonstrating that integrating modern technology can optimize road maintenance planning and execution while supporting economic growth through reliable transportation networks.

Keywords: road maintenance, pavement condition, IRI, roadroid, cost estimation

INTRODUCTION

Improving the quality of road infrastructure is a major focus in national development due to its vital role in supporting the mobility and distribution of goods. Roads in good condition will improve transportation efficiency, reduce logistics costs, and support regional economic growth (Tjendani, Anwar, & Wiguna, 2018). However, road damage that often occurs due to high traffic volumes, heavy vehicle loads, and weather factors is a major challenge in maintaining road quality (Desei & Kadir, 2022). The Genengan-Lembeyan road in Magetan Regency is one of the collector roads connecting Magetan and Ponorogo Regencies. This road has an important role as the main route for the distribution of goods and community mobility in the region. The high intensity of traffic causes significant damage, which requires periodic evaluation to determine the road condition and maintenance plan (Mahendra, 2022).

Evaluation of current road conditions can be done using the International Roughness Index (IRI) method. This method is widely applied due to its ability to provide an objective assessment of road surface unevenness (Fuady & Subkhan, 2021). One of the tools often used in the implementation of the IRI method is the Roadroid application, which utilizes smart phone

devices to record road condition data quickly and efficiently (Pangesti, Mahbub, & Rahmawati, 2021).

According to research conducted by Marjono et al. (2022), the use of the Roadroid application in road surveys can save time and costs compared to manual survey methods such as Surface Distress Index (SDI). This study shows that the Roadroid application is able to provide results that are almost equivalent to professional measuring instruments such as laser profilometers. The survey results show that road conditions that have high IRI values tend to have low levels of driving comfort (Annisa, Adiman, & Fahsa, 2023).

In Indonesia, road maintenance guidelines based on the IRI method have been adopted by Bina Marga and become the main reference in planning and evaluating road projects. Previous research by Tambunan et al. (2023) showed that road surveys using the IRI method can provide detailed information on the types of road defects such as cracks, potholes, and other deformations. This makes it easier for authorities to determine repair priorities and the required budget.

The use of Roadroid not only helps in the measurement of road unevenness, but also provides a real-time picture of road conditions along the surveyed section (Maulana & Chayati, 2023). Another study by Kogoya et al. (2024) stated that this application has high accuracy in detecting road surface damage, with a low deviation rate of measurement results compared to conventional measuring instruments.

The study conducted by Rahmawati et al. (2021) also confirmed that the Roadroid application can be used effectively in various road conditions, including national roads and remote areas. Another advantage is its ability to adapt to various types of mobile devices, making it a flexible and cost-effective solution in road condition surveys (Pangesti et al., 2021).

As part of the effort to improve the quality of road infrastructure in Indonesia, the application of the IRI method based on the Roadroid application is expected to provide accurate data and support a better maintenance planning process (Salsabilla, Sebayang, & Imananto, 2020). Thus, road damage that occurs can be immediately identified and addressed, so that the smooth flow of transportation is maintained (Watono, Muin, CA, & Firdaus, 2020).

In the Genengan-Lembeyan road section, road maintenance carried out so far still uses conventional methods that require a lot of time and money. Therefore, the application of technology such as Roadroid is an urgent need to improve the effectiveness of road surveys (Utama, Arliansyah, & Kadarsah, 2023). This research aims to evaluate the pavement condition of the section using the IRI method based on the Roadroid application and calculate the estimated maintenance costs based on the Bina Marga 2024 guidelines. Road damage that occurs on the Genengan-Lembeyan section is a major concern in an effort to maintain smooth transportation and road user safety. The International Roughness Index (IRI) method applied through the Roadroid application provides a practical solution in assessing pavement conditions quickly and efficiently. Based on this background, the problem formulations in this study are: What is the condition of the pavement on the Genengan-Lembeyan road section, Magetan Regency, if assessed using the International Roughness Index (IRI) method based on the Roadroid application?

According to Pangesti et al. (2021), the application of the International Roughness Index (IRI) method using the Roadroid application has proven effective in providing quick, cost-efficient, and reliable data for road condition assessments. Their study highlighted the ease of integrating Roadroid into existing road maintenance systems, offering an alternative to traditional road surveying methods, which often involve higher costs and more time. Similarly, Marjono et al. (2022) found that the Roadroid application, when combined with IRI metrics, provided an accurate and real-time evaluation of road conditions, helping authorities prioritize maintenance and plan budget allocations more effectively.

The urgency of this research arises from the deteriorating condition of roads in Magetan Regency, particularly the Genengan–Lembeyan road, which serves as a crucial transportation link between Magetan and Ponorogo Regencies. The high traffic volume and heavy vehicle loads on this route contribute to significant pavement damage, impacting transportation efficiency and public safety. Utilizing the IRI method with the Roadroid application to assess road conditions in real-time provides a more efficient, cost-effective, and timely solution to identify the most critical areas for repair, ensuring the sustainable management of road infrastructure in the region.

While numerous studies have explored the IRI method for road condition assessments, there is a lack of research focusing on the integration of smartphone-based technologies like Roadroid in real-world, large-scale road maintenance projects. Existing studies mostly concentrate on manual methods or large-scale instruments, leaving a gap in understanding how smartphone-based solutions can complement or replace traditional surveying techniques, particularly in remote or resource-constrained areas like Magetan Regency.

This study introduces a novel approach by integrating the IRI method with the Roadroid application for real-time road condition monitoring, focusing on the Genengan–Lembeyan road section in Magetan Regency. Unlike previous studies, which primarily used traditional road condition evaluation methods, this research demonstrates the efficiency and cost-effectiveness of using mobile technology to gather road condition data, allowing for immediate decision-making and prioritization of maintenance efforts. This innovation has the potential to revolutionize road maintenance planning in regions with limited resources.

The primary objective of this research is to assess the pavement condition of the Genengan–Lembeyan road section using the IRI method, supported by the Roadroid application, and estimate the necessary repair costs. The study aims to provide actionable insights into the effectiveness of smartphone-based technology in improving road maintenance efficiency and cost management. The benefits of this research include enabling faster, more accurate road condition assessments, reducing the time and cost of road surveys, and helping local authorities prioritize repairs to enhance road safety and transportation efficiency. The findings will also contribute to improving infrastructure management practices, particularly in rural and remote regions.

Literature Review

International Roughness Index (IRI) Method

The International Roughness Index (IRI) method is one of the international standards used to measure road surface unevenness. IRI was introduced to provide a reliable quantitative parameter for evaluating road conditions and predicting long-term road performance (Desei & Kadir, 2022). It measures the amount of vertical change in the road surface experienced by a vehicle over a given distance. With lower IRI values, the road surface is considered flatter and more comfortable to travel on, while higher values indicate a rough road that requires maintenance (Annisa et al., 2023).

The advantage of the IRI method is its ability to provide objective and consistent measurement results across a wide range of road conditions. IRI has been widely adopted in various countries, including Indonesia, as a reference in road evaluation and maintenance. Utilizing this method allows for quick and efficient evaluation of road conditions, allowing for more accurate repair planning. In addition, IRI also helps in prioritizing repairs on road sections that are significantly damaged.

Roadroid Application in Road Surveying

The Roadroid application is an innovation in road surveying that utilizes smartphone technology to measure road surface unevenness. This application makes it easy for users to conduct surveys quickly and cost-effectively. Roadroid is able to record data during vehicle travel, so that survey results can be obtained in real-time. This technology has been proven to

provide results comparable to professional measuring instruments such as laser profilometers (Marjono et al., 2022).

The use of Roadroid has been implemented in various road projects in Indonesia with satisfactory results. The advantages of this application lie in its ease of operation and its ability to be adapted to various types of survey vehicles. Roadroid also has features that allow integration with geographic mapping systems (GIS), making it easier to analyze and visualize road survey data. This makes Roadroid an effective solution for improving efficiency and accuracy in road condition evaluation.

Road Damage and Its Impact

Road damage is one of the main factors affecting the comfort and safety of road users. Cracks, potholes and road surface deformations can disrupt the smooth flow of traffic and increase the risk of accidents (Mahendra, 2022a). These damages are generally caused by high traffic volumes, extreme weather, and poor drainage (Fuady & Subkhan, 2021). Therefore, routine and periodic maintenance is crucial in maintaining road quality.

The impact of road damage is not only felt by users, but also has an impact on the regional economy. Vehicle operating costs increase due to higher fuel consumption and longer travel times (Nugroho, Witjaksana, Oetomo, & Setiawan, 2019). In addition, road defects that are not immediately addressed can shorten the service life of the road and require higher rehabilitation costs. Therefore, periodic road condition surveys and evaluations using the IRI method and Roadroid application are effective solutions to identify and treat road defects early (Watono et al., 2020).

Road Maintenance Cost Evaluation

Road maintenance cost estimation is a crucial step in infrastructure project planning. The IRI method helps in determining the level of road deterioration, which is then used as the basis for calculating maintenance cost. With this approach, the government can determine a more targeted budget allocation. In addition, the use of Roadroid applications in road surveys can help reduce operational costs and improve the accuracy of cost estimation (Utama et al., 2023).

Research conducted by Tambunan et al. (2023) showed that the use of Roadroid in road evaluation can produce more accurate cost estimates than conventional methods. This is due to the application's ability to provide detailed and real-time road unevenness data. Accurate cost estimation allows maintenance project planning to run more efficiently and effectively, and ensures road quality is maintained in the long term (Mahendra et al., 2023).

Implementation of Roadroid in Indonesia

The implementation of Roadroid in Indonesia has shown positive results in supporting road maintenance projects. Many national and regional road projects use this application for road condition surveys (Kogoya et al., 2024). Roadroid is an appropriate alternative solution to geographical challenges and budget constraints in road condition evaluation. The successful implementation of Roadroid is also supported by government policies that encourage the use of technology in infrastructure management.

In a study conducted by Zahni (2023), the implementation of Roadroid in the Bangau Sakti road section of Pekanbaru City showed an increase in efficiency in the process of surveying and analyzing road data. This application is able to provide more complete and faster data than manual survey methods. The survey results obtained from Roadroid become the basis for determining road repair priorities and budget allocations in an efficient manner. This shows that Roadroid has great potential to be widely adopted in various road projects in Indonesia.

METHOD

Location and Object of Research

This research was conducted on the Genengan-Lembeyan road section in Magetan Regency, East Java. This road is one of the collector routes connecting Magetan Regency with Ponorogo Regency. The selection of this location was based on the importance of the road section as the main route for the distribution of goods and community mobility, so the evaluation of its road conditions is a priority. The object of the research is the pavement surface along the Genengan-Lembeyan section. The main focus of the research is to identify road unevenness that contributes to a decrease in the quality of transportation services. This research will provide a comprehensive picture of the extent of road damage and the corresponding maintenance needs.

Data Collection Methods

Data collection was conducted using a direct field survey method. The Roadroid application was installed on survey vehicles traveling on the study roads to collect real-time road unevenness data. This application will record the vertical movement of the vehicle, which is then converted into an International Roughness Index (IRI) value. In addition to measurements using Roadroid, visual observations were also made to identify types of surface damage such as cracks, potholes, and other deformations. This combination of methods aims to obtain more accurate and in-depth results on road conditions.

Data Processing and Analysis Techniques

The data obtained from the Roadroid application is processed using supporting software to calculate the IRI value for each road segment. A higher IRI value indicates more severe damage, while a low value indicates the road is in good condition. This data was then mapped to provide a visual representation of the distribution of road damage along the Genengan-Lembeyan section. Afterwards, the analysis results were compared with the Bina Marga 2024 standard to determine the type and level of treatment required. This method ensures that the proposed improvement plan matches the actual conditions in the field.

Data Validation

To ensure the accuracy of the data, validation was carried out through retesting on certain road segments. Re-measurements using the Roadroid application were conducted on several randomly selected segments to compare the results with the initial measurements. This step aims to minimize the possibility of data deviation and increase confidence in the survey results. In addition, Roadroid measurement results were compared with manual survey data using the Surface Distress Index (SDI). The correlation between these two methods was analyzed to ensure the suitability and consistency of the data.

Estimated Maintenance Cost

Maintenance costs were estimated by referring to the Bina Marga 2024 guidelines. Costs are calculated based on the type of damage identified and the appropriate repair method. Any road segment that has a high IRI value will be prioritized for repair and rehabilitation. The cost calculation includes asphalt layer replacement, pothole filling, and crack repair. This estimate is expected to provide a comprehensive overview of the budget needed to restore road conditions and ensure smooth transportation on the Genengan-Lembeyan road section.

RESULTS AND DISCUSSION

Results

General Condition of Genengan - Lembeyan Road Section

The Genengan - Lembeyan road section has a strategic role in supporting community mobility and distribution of goods in Magetan Regency. This road is a collector route that connects Magetan and Ponorogo, so it experiences a fairly high volume of traffic every day. Based on field surveys using the Roadroid application, the general condition of the road shows

variations in unevenness in some segments. Road segments with heavy traffic tend to have higher IRI values than segments with light traffic. Preliminary analysis shows that most road segments are in the moderate to good category, but there are some critical points with high IRI values. The road segment between STA 5+000 to STA 8+660 shows significant damage. The road surface in this segment has cracks, potholes, and deformations that affect the comfort and safety of road users.

Table 1. IRI Parameters in Road Condition Assessment

IRI Value	Conditions
< 4	Good
4 - 6	Medium
6 - 8	Lightly damaged
8 - 10	Severely Damaged
> 10	Very damaged

Source: Pavement design manual (2017)

Table 1 shows the IRI parameters for road condition assessment. This table is the main reference in categorizing road pavement conditions and determining treatment priorities. Based on the table, segments with IRI values above 4.0 are categorized as being in poor condition requiring immediate repair.

IRI Measurement Results Using Roadroid

The road unevenness survey was conducted using the Roadroid application installed on the survey vehicle. The data obtained showed variations in IRI values along the Genengan - Lembeyan road section. The measurement results show an average IRI value of 4.24 which indicates that the road condition is generally still in the moderate category. However, some segments show IRI values above 6.0, indicating serious damage. The segment with the highest IRI value is at STA 6+200 to STA 7+500 with an average value of 6.5. The damage in this segment is caused by the high volume of heavy vehicles that pass through every day. In addition, poor drainage conditions also contribute to the acceleration of road damage.

Table 2. IRI Parameters in Determining Road Condition Handling

IRI Value	Conditions	Handling
< 4	Good	Routine Maintenance
4 - 6	Medium	Periodic Maintenance
6 - 8	Lightly damaged	Periodic Maintenance
8 - 10	Lightly Damaged	Road improvement
> 10	Very damaged	Major improvements

Source: Bina Marga (2011)

Table 2 shows the IRI parameters for determining road condition treatments. The table shows that road segments with IRI values above 5.0 require structural rehabilitation, while segments with IRI values of 3.0 to 5.0 are sufficient with routine maintenance.

Types of Damage Found

Visual observations during the survey showed several dominant types of damage on the Genengan - Lembeyan road section. The most common damages are longitudinal cracks, potholes, and surface deformation. Longitudinal cracks occur due to soil movement and excessive loads passing over the road repeatedly. Potholes are found on segments with IRI values above 6.0 and tend to enlarge over time. In addition, wave-like deformations of the road surface were also found at some points, especially in areas with reduced elevation. These defects worsen driving comfort and increase the risk of traffic accidents.

Table 3. Profilometer Type Tool Specifications

Parameters	Sensor Equipment	Data Acquisition System
Equipment Type	Laser Profiler	Not Applicable
Measurement Speed	80 km/h	Not Applicable
Resolution	0.05 mm	16 Bit
Longitudinal Sample Interval	50 mm	100 milliseconds
Measuring Range	200 m	> 200m
Repeatability	0.1 mm	±1 Least Significant Bit (LSB)
Operation Temperature Range	0ºC to 50ºC	0ºC to 50ºC

Source: ASTM E950-94

Table 3, which lists damage types and repair methods for asphalt pavements, is relevant in this context. This table details the types of damage and the corresponding treatment measures based on the severity of the damage.

Estimated Repair and Maintenance Costs

Based on the results of the analysis, repair costs were estimated by referring to the Bina Marga 2024 guidelines. Repairs were focused on segments with the highest IRI scores to ensure significant improvement in road quality. The total cost estimate reached Rp4,069,031,000.00, covering various types of repairs, including repaving and pothole filling. The cost calculation was done by considering the length of the damaged segments and the type of repairs required. Structural rehabilitation was applied to segments with IRI values above 5.0, while routine maintenance was performed on segments with IRI values of 3.0 to 5.0. This estimation aims to ensure effective use of budget and extend the service life of the road.

Discussion

The findings of this study highlight the effectiveness of the International Roughness Index (IRI) method, supported by the Roadroid application, in providing accurate and comprehensive insights into road conditions. The data collected through the application not only identifies surface unevenness but also assists in prioritizing repairs based on the severity of damage. This is particularly critical for segments such as STA 5+000 to STA 8+660, which were identified as having the highest IRI values and require immediate structural rehabilitation to restore optimal functionality. These results are consistent with the study by Annisa et al. (2023), which demonstrated the time and cost efficiency of Roadroid in road condition assessments. Similarly, Mahendra et al. (2023) emphasized the necessity of addressing road segments with IRI values above 5.0 to mitigate further deterioration and ensure road safety.

The application of Roadroid also provides practical advantages, including real-time data collection and a user-friendly interface that can be operated on standard smartphone devices. This is supported by research from Pangesti et al. (2021), which found that Roadroid's results align closely with traditional manual methods such as the Surface Distress Index (SDI), but with significantly reduced time and resource requirements. Furthermore, the integration of geographic mapping systems (GIS) with Roadroid enhances data visualization, aiding decision-making processes.

This study contributes significantly to infrastructure management in Magetan Regency by showcasing how modern technological tools can optimize road maintenance. Regular application of Roadroid technology can ensure timely identification of critical damages, enabling efficient resource allocation and planning. Additionally, improvements in drainage systems and consistent monitoring are recommended to reduce the impact of environmental factors on pavement conditions. Ultimately, these measures support sustainable infrastructure development, enhance road user safety, and contribute to economic growth by ensuring reliable transportation networks.

CONCLUSION

Based on the results of research conducted on the Genengan - Lembeyan Road section in Magetan Regency, it can be concluded that the condition of the pavement varies from good to severely damaged. Evaluation using the International Roughness Index (IRI) method based on the Roadroid application shows an average IRI value of 4.24. The road segment between STA 5+000 to STA 8+660 has the highest IRI value, reaching 6.5, which indicates significant damage and requires immediate treatment. Other segments have lower IRI values and only require routine maintenance. The survey results also show that the main factors affecting road damage are the high volume of heavy vehicles and suboptimal drainage conditions. The estimated repair cost based on the Bina Marga 2024 guideline reaches Rp4,069,031,000.00, which includes structural rehabilitation and routine maintenance. With proper handling, the road quality is expected to return to optimal and support the smooth transportation in the region.

REFERENCES

Annisa, Adelia Nur, Adiman, Edi Yusuf, & Fahsa, Muhammad Naufal Nabil. (2023). Analisis Kondisi Perkerasan Jalan Menggunakan Metode Sdi Dan Iri (Studi Kasus: Ruas Jalan Bangau Sakti Kota Pekanbaru). *Jurnal Teknik Sipil Dan Arsitektur*, *28*(1), 13–22.

Desei, Frice L., & Kadir, Yuliyanti. (2022). Analisis Kondisi Kerusakan Jalan Menggunakan Metode Pavement Condition Index (Pci) Dan International Roughness Index (Iri) Beserta Alternatif Penanganannya (Studi Kasus: Jalan Samaun Pulubuhu-Jalan Boliohuto Huidu-Jalan Ak Luneto). *Fropil (Forum Profesional Teknik Sipil)*, *10*(1), 1–9.

Fuady, Robith, & Subkhan, Muhamad Fajar. (2021). Analisa Kerusakan Jalan Menggunakan Metode Bina Marga Pada Jalan Raya Jeru–Jalan Raya Tumpang Kabupaten Malang. *Jurnal Online Skripsi Manajemen Rekayasa Konstruksi (Jos-Mrk)*, *2*(4), 129–133.

Kogoya, Desmin, Nugroho, Laksono Djoko, & Oetomo, Wateno. (2024). *Analysis Of Prediction Of Highway Violence Conditions Using The Iri Application For Road Handling (Case Study: City National Road Section City National Road Section, Gresik-Sadang)*.

Mahendra, Didi Herianto. (2022). *Analisis Penilaian Kondisi Lapis Permukaan Jalan Nasional Berdasarkan Metode International Roughness Index (Iri) Dengan Aplikasi Roadroid (Kasus Ruas Jalan Khatulistiwa) Kota Pontianak*. Universitas Tanjungpura.

Marjono, Marjono, Burhamtoro, Burhamtoro, & Sasongko, Rinto. (2022). Penilaian Kondisi Permukaan Jalan Menggunakan Aplikasi Roadroid Pada Jalan Veteran-Bandung Kota Malang. *Jurnal Manajemen Teknologi & Teknik Sipil*, *5*(2), 178–189.

Maulana, Miftah, & Chayati, Nurul. (2023). Analisis Kerusakan Permukaan Jalan Berdasarkan Penilaian Dengan Metode Sdi Dan Iri. *Journal Of Applied Civil Engineering And Infrastructure Technology*, *4*(2), 34–41.

Nugroho, Laksono D., Witjaksana, Budi, Oetomo, Wateno, & Setiawan, Andi. (2019). Analysis Of Construction Contract Project Comparison With Pnpm Based Projects In Construction Projects (Ppip Project Implementation Study In Tuban District). *Journal Of Physics: Conference Series*, *1364*(1), 12052. Iop Publishing.

Pangesti, Rendy Dwi, Mahbub, Jamal, & Rahmawati, Roselina. (2021). Penilaian Kondisi Jalan Menggunakan Asphalt Paser (Pavement Surface Evaluation And Rating) Dan Iri (International Roughness Index) Roadroid. *Bangun Rekaprima*, *7*(1), 36–44.

Rahmawati, Roselina, Pangesti, Rendy Dwi, & Abdillah, Rifqi Aulia. (2021). Pemetaan Kondisi Jalan Berdasarkan Iri Roadroid Di Kabupaten Gresik Wilayah Selatan. *Jurnal Riset Rekayasa Sipil*, *4*(2), 83–94.

Salsabilla, Nadhila, Sebayang, Nusa, & Imananto, Eding Iskak. (2020). Analisis Penanganan Kerusakan Jalan Dengan Menggunakan Metode Bina Marga Dan Pci (Pavement Condition Index). *Sondir*, *4*(1), 1–10.

Tambunan, Franzsio Gratio, Mukti, Elsa Tri, & Kadarini, Siti Nurlaily. (2023). The Assessment Of National Road Surface Conditions Analysis Based On The International Roughness Index (Iri) Method Using Roadbump Application. *Jurnal Teknik Sipil*, *23*(2), 186–191.

Tjendani, Hanie Teki, Anwar, Nadjadji, & Wiguna, A. (2018). Two Stage Simulation To Optimize Risk Sharing In Performance-Based Contract On National Road A System Dynamic And Game Theory Approach. *Arpn Journal Of Engineering And Applied Sciences*, *13*(15), 4432.

Utama, Novan Rezki, Arliansyah, Joni, & Kadarsah, Edi. (2023). Analisis Perbandingan Nilai Kondisi Jalan Menggunakan Metode Sdi Dan Iri Dari Alat Survei Roadroid. *Cantilever: Jurnal Penelitian Dan Kajian Bidang Teknik Sipil*, *12*(1), 55–62.

Watono, Watono, Muin, Suriati Abd, Ca, M. Reza, & Firdaus, Darmawansyah. (2020). Analisa Biaya Penanganan Berdasarkan Penilaian Kondisi Jalan Dengan Metode Road Condition Index (Rci) Pada Ruas Jalan Hertasning. *Pena Teknik: Jurnal Ilmiah Ilmu-Ilmu Teknik*,

5(1), 11–18.

Zahni, Maivi. (2023). *Evaluasi Dan Pemeliharaan Perkerasan Lentur Dengan Menggunakan Metode Pavement Condition Index (Pci) Dan Metode Bina Marga (Studi Kasus: Ruas Jalan Raya Gemekan Kab. Mojokerto Km 55+ 200-Km 64+ 600)*. Institut Teknologi Sepuluh Nopember.