ANALYSIS OF SAFETY ISSUE OF POTHOLES AND LIGHTING: CASE A JALAN BEBER – JATIWANGI, MAJALENGKA

Yoga Setyawan[1], Yusra Aulia Sari[2]

[1]Civil Engineering Study Program, Faculty of Engineering, University Majalengka
[2]Faculty Of Civil Engineering and Planning, Fakultas, University Internasional Batam, Indonesia
Emai korespondensil: yogasetyawan112@gmail.com

ARTICLE INFO	ABSTRACT
Keywords: *Driver Safety, Potholes, Street Lighting*	*Autonomous driving is a major trend in the automotive industry. As the technical implementation of automated driving approaches, the focus is shifting from feasibility to the acceptability and comfort of driving styles. A pressing global issue is travel safety, as good road conditions significantly impact daily activities and regional connections. Poor road conditions, such as inadequate lighting and increasing potholes, especially in developed Asian countries, pose significant safety risks. In Malaysia, pavement cracking is a common problem due to heavy traffic and climate changes. In Indonesia, government efforts to improve road infrastructure and lighting are crucial to reducing accidents. Studies show that street lighting and road surface improvements can reduce traffic fatalities and injuries by 4.2% and 3.4%, respectively. However, minimal lighting hampers drivers' ability to react to changing road conditions. This study aims to provide concrete recommendations for future road infrastructure and lighting technology development, focusing on Majalengka. Proper street lighting is essential to prevent accidents, reduce crime, and provide adequate illumination. Data analysis from 15 countries indicates that street lighting can reduce accidents by an average of 30%. The case in Beber Jatiwangi Village, Majalengka, highlights the negative impact of poor road conditions on logistics vehicles and the increased risk of accidents.*

1. Introduction

Automated driving is currently one of the main trends in the automotive industry. As technical realization of highly automated driving or automation on SAE level draws closer, attention is now being shifted from the sheer feasibility to the question of how an acceptable driving style and thus comfort can be implemented [1].One global issue that requires urgent and careful consideration is the issue of travel safety. Roads are infrastructure that have a major impact on people's daily lives and represent important connections between regions. Not only does it show routes to guide drivers, but it also has the ability to remove obstacles. Therefore, healthy road conditions play an important role in encouraging various aspects of communication, making visual observations more comfortable, and increasing the efficiency and effectiveness of activities. Because with good road conditions, all activities on the road become easier, drivers are more comfortable, and activities become more effective and efficient.

The two biggest problems facing developed countries in Asia are the lack of adequate lighting and the increase in potholes. This horrific scenario has far-reaching impacts, especially on the safety and well-being of drivers. In addition, this has a negative impact on the driver's reaction, making it more difficult to identify potholes and increasing the possibility of a collision. This will destroy the road physically and internally, and it may also risk the safety of road users. In recent years, highway engineering has seen significant growth, necessitating good condition of pavement during the pavement facing the load of traffic heavy loaded vehicles and climate change we will see the change of behavior and condition of pavement Cracks are the common distresses that develop in pavement sector in Malaysia [2].To understand and address this problem, studies of how drivers react to potholes and inadequate road lighting in Asia are essential.

The Indonesian government is also faced with considerable difficulties in this regard. Poor infrastructure has a negative impact on the economy.In the context of a developing country like Indonesia, we hypothesize that the government can minimize the severity of road accidents by providing street lighting and road repairs. surface. By using road accident data from the Republic of Indonesia Police Traffic Control Center Indonesia and the negative binomial regression method, we found that street lighting and road surface improvements were associated with a reduction in road accident casualties of 4.2% and 3.4%, respectively [3].But it will be difficult for drivers to react to changes in road conditions when lighting is minimal. To overcome the problem of potholes and inadequate lighting on Majalengka's roads, this research is intended to produce specific recommendations that will guide the development of road infrastructure and lighting technology in the future.Street lighting and road surface improvements also have an impact on lowering the number of road deaths.

Street lighting is very important for drivers, especially to prevent accidents, reduce crime rates, and provide lighting that resembles everyday objects. Apart from that, street lighting also functions as a navigation aid for drivers at night. The number of accidents is reduced with street lighting. It can be concluded that street lighting reduces accidents by an average of 30% based on an examination of 62 street lighting and accident data from 15 different countries. All roads, highways, intersections, and interchanges fall under this [4]. Beber—Jatiwangi is a village in the Ligung region, Majalengka. In the middle of the Ligung factory area, Majalengka, this is a problem that is often discussed by the community because it has an impact on industrial activities. The resulting effects, such as damage to the logistics fleet and increased risk of accidents, will be very relevant to support efforts to improve infrastructure and ensure smooth operations.

The causes of traffic accidents are human error, vehicles and the environment [5]. Therefore,The aim of this research is to see how drivers react to areas with poor lighting and potholes, especially around the Ligung Majalengka industrial area. This research attempts to provide better knowledge of the difficulties experienced by drivers and businesses in the region by fully understanding the impact of these infrastructure problems. Additionally, creating a foundation for improving road infrastructure is another goal, with an emphasis on improving mobility and safety in the Ligung industrial area. Therefore, it is hoped that this article can have a positive impact on Majalengka's efforts to improve traffic management and infrastructure.

2. Literature Review

2.1 Driver Safety

Driver training is more likely to be an independent variable. The variable values in this study are not able to represent the majority of self-control in driving safety [6]. This means that there are factors that have the potential to influence self-regulation in driving safety outside of this research. Driver safety aims to prevent accidents and protect them from potential injuries and losses while driving on the road. To achieve this safety, drivers take actions such as obeying traffic rules and increasing awareness of the driving environment. Responsible drivers not only obey speed limits and follow traffic signs, but also avoid driving behavior that can increase the risk of accidents. For example, driving while in good mental health can affect concentration levels and responsiveness on the road. Maintaining your vehicle to ensure it is always in good condition also plays a role in maintaining travel safety, so that all vehicle systems function optimally.Therefore, understanding the influence of driver behavior on crash risk is of utmost importance for reducing road crashes [7].

Driving requires multiple levels of scene understanding and decision making, ranging from road user detection and tracking, localization, scene recognition, risk assessment based on prediction and causal inference, and interaction [8]. Driver behavior is at the heart of road safety, involving a number of decisions and actions that have an impact on the collective welfare. Awareness of traffic rules, including obeying speed limits and traffic signals, is the basis of safe driver behavior. Rapid response to road and traffic conditions, such as potholes, traffic jams, bad weather is also an important component of responsible behavior. Drivers who understand the risks, take preventive measures, and prioritize the safety of themselves and fellow road users, plays a key role in creating a safe and efficient driving environment. Encouraging this positive behavior involves ongoing education and an emphasis on individual responsibility for overall safety on the road.

Roads are infrastructure that have a major impact on people's daily lives and represent important connections between regions. Not only does it show routes to guide the driver, but it also has the ability to remove obstacles. Factors such as inexperience, lack of skills, and risky behavior are associated with accidents among young drivers. In contrast, impairments in visual, cognitive, and motor skills are thought to be associated with accidents among older drivers [9]. Therefore, healthy road conditions play an important role in encouraging various aspects of communication, making visual observations more comfortable, and increasing the efficiency and effectiveness of activities . Accident prevention is an important aspect of road safety, and various measures have been proposed in the literature to reduce accidents without redundancy.

2.2 Potholes

Various defects that often appear on the road surface can be easily observed while driving. These typically include potholes, road damage, explosions, debris, and cracks. Among these defects, motorists may consider potholes to be the most common defect. Therefore, these things generally cause the most anxiety [10]. Several approaches have been proposed for automatic monitoring of road surface conditions to assess road roughness and detect potholes [11]. Potholes are different from the definition of damaged roads, namely uneven road surfaces with deep depressions of irregular depth and diameter. Many roads have potholes with very large diameters and depths. Due to this, the risk of a motorbike losing balance when riding is very high. If the rider does not have sufficient skills to control the situation, the bicycle could change direction and fall.Therefore,It is important to note that these safety impacts are

not limited to motorcyclists, but pose safety hazards for pedestrians and cyclists. Efforts to improve pothole detection and repair can directly support road safety measures.

In recent years, the death toll has been fueled by traffic accidents increase accompanied by enormous direct property loss. Therefore, gotraffic safety status has attracted widespread social attention [12]. This is a problem that has many negative impacts not only on road users, but also on society as a whole. Especially from a safety perspective, potholes can cause serious traffic accidents. Drivers may not be able to detect potholes quickly enough, potentially causing accidents, especially at night or in bad weather conditions that reduce visibility. Apart from the risk of accidents, potholes on the road can also damage vehicles, increase maintenance costs, and disrupt people's daily movements.

A number of conclusions and recommendations were made. Potholes are mainly caused by the delayed response to timely fixing common pavement distresses [13]. To overcome the problem of potholes, steps to improve road infrastructure are crucial. The government and related institutions need to increase budgets and attention to road maintenance, with a focus on routine repairs and maintenance. The application of innovative technology in the use of durable road materials can also be an effective solution. In addition, strengthening reporting mechanisms and quick responses to public reports regarding potholes can help detect and respond to these problems more efficiently. With collaboration between government, society and the private sector, holistic solutions can be created to improve road quality and overall driving safety.

2.3 Street Lighting

ith inadequate street lighting. The synthesis of these studies provides a comprehensive framework for the present research, contributing to the broader discourse on enhancing road infrastructure and ensuStreet lighting refers to the utilization of strategically placed artificial lights, such as street lamps or lighting fixtures, to provide visibility and enhance safety on roads, sidewalks, and outdoor areas during the night. Its primary function is to ensure clear visibility, reduce the risk of accidents, prevent criminal activities, and create a safer and more navigable urban environment after dark. This can be explained by the idea that improved street lighting increases community cohesion, which in turn counteracts criminal behaviour [14]. With well-lit roads, drivers can more easily identify obstacles, signs, and other road users, creating a more organized and secure driving environment. Moreover, effective lighting can reduce the potential for criminal activities around road areas, providing a sense of security for those in the vicinity. Therefore, investments and attention to road lighting safety are not only to ensure efficient mobility but also to safeguard the overall safety and well-being of the community.

Street lighting standards are required to ensure proper installation and form the basis of tenders [15]. Illuminating the streets has a considerable influence on daily life and the safety of communities. Primarily, it improves visibility during nighttime, aiding both drivers and pedestrians in navigating, and simultaneously reducing the likelihood of accidents. Additionally, proper lighting fosters a feeling of safety and security, diminishing the potential for criminal activities around road areas. These effects are experienced not only by individuals on the roads but also resonate throughout the entire community. In an indirect sense, street lighting promotes economic growth by encouraging nocturnal commercial activities and enhancing the overall quality of life. Hence, investing in street lighting serves not only as

a means to heighten safety but also as a step towards establishing a lively, secure, and empowered urban setting.

In the modern era where energy is a major concern throughout the world, we have a primary responsibility and responsibility to save energy effectively. With the development of technology, automation systems play an important role in daily life and are also preferred over traditional manual systems today. The main aim of this research is to ensure comfort in driving through street lighting [16]. The community's perception of the impact of street lighting plays a crucial role in shaping their views of the surrounding environment. Studies reveal that the level of illumination can influence how people feel safe and comfortable, especially in street areas during the night. Adequate lighting not only provides visual clarity but also enhances a sense of security, reduces discomfort, and improves overall daily life quality. Furthermore, a positive perception of street lighting can motivate community participation in efforts to maintain safety and care for public facilities. Therefore, a profound understanding of how the community perceives the effects of street lighting can serve as a foundation for better planning in creating an urban environment that is supportive and comfortable for everyone. In conclusion, the literature review establishes a foundation for understanding the multifaceted implications of road conditions, encompassing both the physical impact of potholes and the safety concerns associated wring optimal safety for drivers.

3. Method

Structured questionnaires and semi-structured interviews are often used in mixed method studies to generate confirmatory results despite differences in methods of data collection, analysis, and interpretation [17]. This research adopted a questionnaire method involving 20 respondents to analyze the impacts and responses of drivers on Jalan Beber – Jatiwangi, especially regarding potholes and the lack of road lighting. This case study focuses on Majalengka. All scales have adequate psychometric characteristics and are theoretically meaningfully related to the criterion variables examined [18]. The results are expected to provide in-depth insight into the challenges and potential solutions related to road infrastructure and driver safety in the region. Using the questionnaire method can be an effective tool in collecting data related to Impact Analysis and Driver Response on Jalan Beber – Jatiwangi, Majalengka. First, questionnaires can be designed to identify drivers' perceptions of road conditions, such as the extent to which they are aware of the presence of potholes and the lack of lighting. Second, through a questionnaire, we can measure the extent of the impact of road conditions on driver behavior. For example, how often drivers have to avoid potholes or whether they feel increased discomfort during the journey. This data can provide deep insight into the driver's response to identified problems. Furthermore, the questionnaire can include questions about the driver's suggestions and expectations regarding improving road conditions. Do they hope for a quicker fix, or do they have concrete ideas about workable solutions?. it is important to ensure that the questions are clearly worded and structured, so that the results can be interpreted appropriately. The use of rating scales or open-ended questions can provide depth to the data collected. In addition, distribution of questionnaires can be done through various channels, including online and conventional, to ensure representative participation. Finally, statistical analysis can be applied to questionnaire data to identify trends and patterns that may emerge from driver responses, providing a strong foundation for more effective policy recommendations.

Figure 1. Research location.
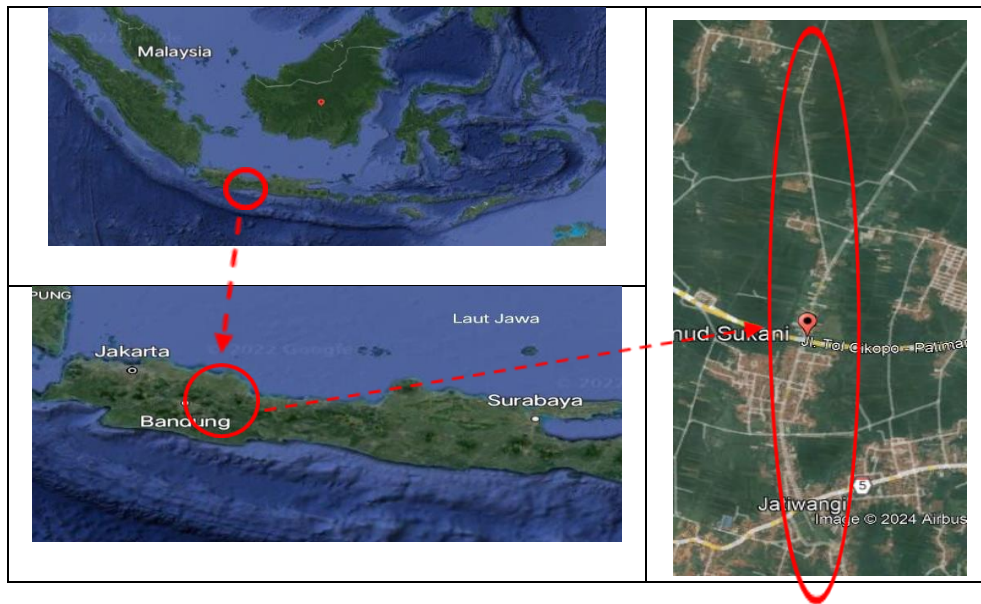
4. Result and Discussion

4.1 Responden Information

The data collection process in survey research is very important. DuringThis researcher or surveyor collects data manually, namely by printing [19]. questionnaire and distribute it by visiting respondents one by one. Data was collected from 20 respondents based on age, gender, and vehicle used when crossing the road beber-lanud sukani. From the results of the survey, it is clear that the majority of genders who choose beber-lanud sukani are men.

Table 1. Respondent's information.

| Variabel	Category	Frequency	Persent
Gender	Male	13	65%
	Female	7	35%
Age	≤20	10	50%
	21 - 30	4	20%
	31 - 40	3	15%
	41 - 50	2	10%
	51 - 60	1	5%
Vehicles Used	Car	6	30%
	Motorcycle	14	70%

4.2 Performance Level Of Road Lighting

The performance of lighting can be assessed based on several factors, including brightness level, light distribution, energy efficiency, and its impact on visual comfort. In-depth research and discussions on lighting performance aim to identify the best methods and technologies that meet safety standards and enhance the comfort of road users. The objective is to ensure that lighting systems not only provide adequate visibility but also contribute to an overall sense of safety and well-being for those navigating the streets. This comprehensive examination of lighting performance is crucial in selecting and

implementing methods that align with safety and comfort standards for road users. The data indicates that the security and safety factor for potholed roads and street lighting has the highest value at 9.88, while the satisfaction level is low at 4.48. This suggests that, despite the security and safety factor being rated high, the satisfaction level related to these aspects is relatively low. This might indicate a discrepancy between the perceived security and safety and the actual conditions, or there could be other factors influencing the satisfaction level in the context of potholed roads and street lighting. Further evaluation is needed to understand the reasons for the low satisfaction level and identify potential improvements that can be implemented.

Table 2. The importance and performance level of road lighting.

NO	Indicator	I	P	G
1	potholes on safety	9.45	5.66	-3.79
2	Road conditions	9.75	5.1	-4.65
3	Security and Safety Factors	9.88	4.48	-5.4
4	Road lighting on driving navigation	9.9	2.55	-7.35
5	Road lighting to vehicles in the same direction	8.75	2.47	-6.28
6	Comfort factor when driving	9.7	2.52	-7.18
7	damage to the vehicle	9.77	4.55	-5.22
8	Safety factor for pedestrians	7.9	4.2	-3.7
9	Road lighting to the turn	9.2	3.58	-5.62
10	Road lighting in avoid the risk of damage	7.33	4.17	-3.16
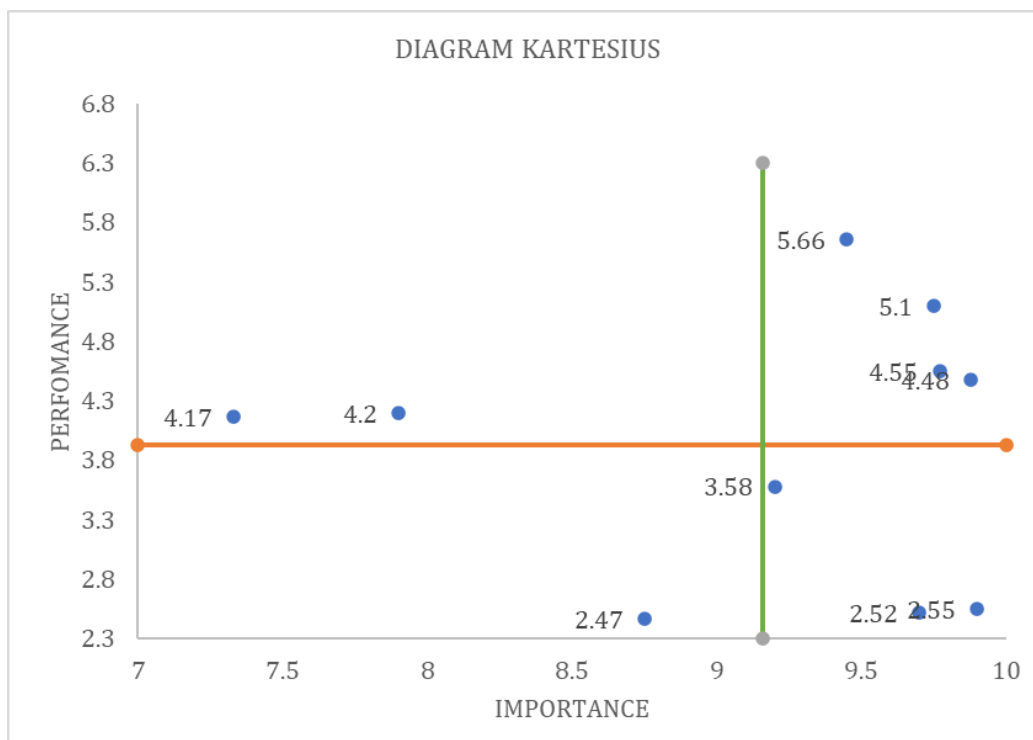
5. Conclusion

To provide relevant recommendations for policymakers, studies that estimate future trends in energy demand and GHG emissions in the road transport sector are needed [20]. *In conclusion, the case study of Impact Analysis and Driver Response on Jalan Beber – Jatiwangi, Majalengka, highlights the urgency*

of dealing with potholes on the road and the lack of lighting to improve driving safety and comfort. Potholes in the road not only threaten the integrity of the vehicle, but can also cause serious accidents. Drivers are expected to respond more carefully, but limited road infrastructure and lack of lighting can hinder an effective response. The driver's response not only includes caution, but also relates to travel time and driving experience. Therefore, measures to improve road infrastructure, including repairing potholes and improving lighting, are very important. Collaboration between local governments, road authorities and communities is needed to achieve comprehensive solutions. Through responsive road maintenance and improving adequate road lighting, it can be hoped that traffic safety will increase, the risk of accidents will decrease, and the driving experience will become more comfortable. The policy recommendations resulting from this study can be the basis for better infrastructure improvements, creating a safe and efficient driving environment for the people of Majalengka.

References

[1] H. Bellem, B. Thiel, M. Schrauf and J. F. Krems, "Comfort in automated driving: An analysis of preferences for different automated driving styles and their dependence on personality traits," *Transportation research part F: traffic psychology and behaviour,* vol. 55, pp. 90-100, 2018.

[2] N. R. Bukhari and M. Y. Aman, "Review Study of Identify Main Factor That Causes the Cracking and Potholes on Asphalt Pavement in Malaysia," *Recent Trends in Civil Engineering and Built Environment,* vol. 4, p. 2, 2023.

[3] Y. Sari and M. H. Yudhistira, "Cahaya buruk, jalan buruk, atau nasib buruk? Hubungan penerangan jalan dan kualitas permukaan jalan terhadap tingkat keparahan kecelakaan jalan di Indonesia," *Studi kasus tentang kebijakan transportasi,* vol. 9, no. 3, 2021.

[4] E. Setyaningsih, L. S. Putranto, S. F. N. Soelami, M. I. Setiawan and D. Abdullah, "Persepsi Visual Pengendara Mobil Menghadapi Fasilitas Penunjang Jalan, Median Jalan, Jalan Berlubang, Dan Mobil Lain Di Jalan Tol Dengan Dan Tanpa Penerangan," *Journal of Physics: Conference Series,* vol. 1114, pp. 1742-6596, 2018.

[5] P. Jecson, D. V. Doda and O. R. Pinontoan, "Analisis Kondisi Jalan dan Cuaca yang Berhubungan dengan Kecelakaan Kerja pada Pengemudi Ojek di Kota Bitung," *Indonesian Journal of Public Health and Community Medicine,* vol. 1, pp. 70-77, 2020.

[6] N. M. S. Arnawa and L. . S. Putranto, "The influence of driver training on self-regulated and safe driving behavior. case study: bus driver in Indonesia," *Materials Science and Engineering ,* vol. 508, no. 1, p. 1, 2019.

[7]   H. Singh and A. Kathuria, "Analyzing driver behavior under naturalistic driving conditions: A review," *Accident Analysis & Prevention,* vol. 150, p. 105908, 2021.

[8]   V. Ramanishka, Y.-T. Chen, T. Misu and K. Saenko, "Toward Driving Scene Understanding: A Dataset for Learning Driver Behavior and Causal Reasoning," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition,* pp. 7699-7707, 2018.

[9]   J. J. Rolison, S. Regev, S. Moutari and A. Feeney, "What are the factors that contribute to road accidents? An assessment of law enforcement views, ordinary drivers' opinions, and road accident records," *Accident Analysis & Prevention,* vol. 115, pp. 11-24, 2018.

[10] J. G. Kim and S. P. Shin, "Road Hazard Assessment Using Pothole and Traffic Data in South Korea," *Journal of advanced transportation,* vol. 2021, pp. 1-10, 2021.

[11] B. Varona, A. Monteserin and A. Teyseyre, "A deep learning approach to automatic road surface monitoring and pothole detection," *Personal and Ubiquitous Computing,* vol. 24, p. 519–534, 2020.

[12] H. JING, Q. LIU, M. GAO, J. ZHANG and X. MU, "Analysis on Drivers' Vision-psychology under the Influence of Color Difference after," *Tehnički vjesnik,* vol. 28, pp. 1894-1903, 2021.

[13] D. Ghosh, M. Turos, M. Hartman, R. Milavitz, J.-L. Le and M. Marasteanu, "Pothole Prevention and Innovative Repair," *Minnesota Department of Transportation,* no. 04, 2018.

[14] T. Lawson, R. Rogerson and M. Barnacle, "A comparison between the cost effectiveness of CCTV and improved street," *Computers, Environment and Urban Systems,* vol. 68, pp. 17-25, 2018.

[15] S. F. ,PhD and . R. . G. PhD, "Road lighting research for drivers and pedestrians: The basis of luminance and illuminance recommendations," *Lighting Research & Technology,* vol. 50, no. 1, pp. 154-186, 2018.

[16] M. Saifuzzaman, N. N. Moon and F. N. Nur, "IoT based street lighting and traffic management system," *EEE region 10 humanitarian technology conference (R10-HTC),* pp. 121-124, 2017.

[17] L. . R. Harris and G. T. Brown, "Mixing interview and questionnaire methods: Practical issues in harmonizing data.," *Practical Assessment, Research, and Evaluation,* vol. 15, p. 1, 2019.

[18] I. Buric, I. Macuka and A. Sliskovic, "A mixed-method approach to the assessment of teachers' emotions: development and validation of the Teacher Emotion Questionnaire," *An International Journal of Experimental Educational Psychology,* vol. 38, no. 3, pp. 325-349, 2018.

[19] V. . H. Pranatawijaya, W. R. Priskila and P. B. A. A. Putra, "Pengembangan Aplikasi Kuesioner Survey Berbasis Web," *Jurnal Sains dan Informatika,* vol. 5, p. 2, 2019.

[20] T. Peng, X. Ou, Z. . Y. Yuan, X. Yan and X. Zhang, "Development and application of China provincial road transport energy demand and GHG emissions analysis model," *Applied Energy,* vol. 222, pp. 313-328, 2018.