JURNAL UPI

Dedicated:
Journal of Community Services (Pengabdian kepada Masyarakat)
https://ejournal.upi.edu/index.php/dedicated/

HIPKIN

Use of convex glass to improve driving safety in Sukahurip Village

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ABSTRACT

Driving safety is a severe challenge experienced by Sukahurip Village. In 2021, 306 accidents were recorded, especially on roads with sharp bends. The Sukahurip Village 2023 UPI KKN Student Team took the initiative through this service program to install convex mirrors on roads with sharp bends. The installation of this convex mirror as a 2023 UPI KKN student service program in Sukhurip Village is an effort to reduce the number of accidents and improve driving safety in Sukahurip Village. Another objective is to evaluate the impact of convex mirrors on improving traffic safety in rural areas. This service method is carried out through a direct approach in the area where the service is carried out by installing convex mirrors with a focus on broadening the driver's view and increasing awareness of road conditions. The results show a reduction in traffic accidents in the area because the convex mirror increases the viewing angle for the driver and allows a quicker response to road situations. This can certainly be a solution and a significant contribution for village communities to reduce the risk of accidents. The mirror installation involved collaboration between UPI 2023 KKN students and Sukahurip Village residents, providing concrete benefits for road safety in the village. It is hoped that one of the programs in this service activity can become the basis for similar programs regarding the importance of simple innovations such as convex mirrors in driving safety in rural areas.

ARTICLE INFO

Article History:
Received: 6 Sep 2023
Revised: 29 Jan 2024
Accepted: 14 Feb 2024
Available online: 17 Feb 2024
Publish: 21 Jun 2024

Keyword:
Convex mirror; driving safety; roads with sharp bends

Open access
Dedicated: Journal of Community Services (Pengabdian kepada Masyarakat) is a peer-reviewed open-access journal

ABSTRAK

Keselamatan berkendara merupakan tantangan yang cukup serius dialami oleh Desa Sukahurip. Tercatat 306 kasus pada tahun 2021 kecelakaan terjadi, terutama di jalan dengan tikungan tajam. Tim Mahasiswa KKN UPI 2023 Desa Sukahurip berinisiatif melalui program pengabdian ini memasang cermin cembung di jalan dengan tikungan tajam. Pemasangan cermin cembung ini sebagai program pengabdian mahasiswa KKN UPI 2023 di Desa Sukhurip menjadi salah satu upaya untuk mengurangi angka kecelakaan yang terjadi serta meningkatkan keselamatan berkendara di Desa Sukahurip. Tujuan lainnya yaitu untuk mengevaluasi dampak penerapan cermin cembung terhadap peningkatan keselamatan lalu lintas di wilayah pedesaan. Metode pengabdian ini dilakukan melalui pendekatan secara langsung di daerah pelaksanaan pengabdian dengan memasang cermin cembung dengan fokus pada perluasan pandangan pengemudi dan peningkatan kesadaran terhadap kondisi jalan. Hasil menunjukkan pengurangan kecelakaan lalu lintas di daerah tersebut karena dengan cermin cembung meningkatkan sudut pandang bagi pengemudi dan memungkinkan respons yang lebih cepat terhadap situasi jalan. Hal ini tentunya bisa menjadi solusi dan kontribusi besar bagi masyarakat desa untuk mengurangi risiko terjadinya kecelakaan. Pemasangan cermin melibatkan kolaborasi antara mahasiswa KKN UPI 2023 dan warga Desa Sukahurip, memberikan manfaat konkret bagi keselamatan jalan di Desa tersebut. Diharapkan salah satu program pada kegiatan pengabdian ini dapat menjadi dasar bagi program lain yang sejenis mengenai pentingnya inovasi sederhana seperti cermin cembung dalam konteks keselamatan berkendara di daerah pedesaan.

Kata Kunci: Cermin cembung; jalan dengan tikungan tajam; keselamatan berkendara

How to cite (APA 7)
Karim, M. A. N., Akbarulah, B, A., & Katiah, K. (2024). Use of convex glass to improve driving safety in Sukahurip Village. Dedicated: Journal of Community Services (Pengabdian kepada Masyarakat), 2(1), 45-54.

Peer review
This article has been peer-reviewed through the journal's standard double-blind peer review, where both the reviewers and authors are anonymised during review.

https://doi.org/10.17509/dedicated.v2i1.62250

INTRODUCTION

Transportation is a vital modern necessity, driven by individuals' increasing mobility needs. Its importance is closely linked to the growing number of motor vehicles. According to data from the Indonesian National Police Traffic Corps, the number of vehicles in Indonesia reached 159.9 million units in 2023. This undeniable surge in vehicle numbers directly correlates with an increase in traffic accidents.

The World Health Organization (WHO) reported in 2012 that traffic accidents ranked as the ninth leading cause of global deaths, claiming 1.3 million lives, equivalent to 2.2% of total fatalities. This translates to approximately 3,500 lives lost on roads daily. The Global Status Report on Road Safety revealed that 59% of traffic accident deaths involved individuals aged 15 to 44 years. WHO estimates that traffic accidents will become the fifth largest cause of death globally, following heart disease, stroke, respiratory diseases, and respiratory tract infections (Kusdarwati & Hartono, 2016).

The problem of road accidents remains a serious concern, especially in Indonesia, with the National Police recording 11,750 traffic accidents in October 2023. An average of 60 people lose their lives daily due to traffic accidents across Indonesia (see https://pusiknas.polri.go.id/detail_artikel/ribuan_orang_meregang_nyawa_di_jalan_raya_pada_oktober_2023) The increasing number of private vehicles, particularly motorcycles, has significantly contributed to the high rate of traffic accidents in the country. The severe adverse effects, in terms of both human lives and material losses, stemming from these accidents are immense.

The impacts of traffic accidents, which range in severity from minor injuries, serious injuries, permanent disabilities, to fatalities, indicate that road safety is not merely an individual issue but also affects the entire surrounding community (Kepel & Mallo, 2019). In Sukahurip Village, road safety is a primary focus because Jalan Sukahurip serves as a crucial route connecting various hamlets in the area. Given the significant traffic challenges, the risk of accidents can have a substantial impact cts the entire surrounding community (Kepel & Mallo, 2019). In Sukahurip Village, road safety is a primary focus because Jalan Sukahurip serves as a crucial route connecting various hamlets in the area. Given the significant traffic challenges, the risk of accidents can have a substantial impact on the villagers, both physically and socio-economically.

This situation underscores the urgency of addressing traffic safety issues on Jalan Sukahurip. In an effort to create a safer driving environment, the utilization of convex mirrors is considered an effective solution for reducing accident risks (Antin et al., 2020; Williamson. 2021). This proactive measure aims not only to mitigate physical harm to victims but also to prevent the social and economic losses that can arise from such tragic incidents. Therefore, understanding the serious impacts that accident victims can endure, Sukahurip Village needs to implement concrete steps to enhance driving safety, including the integration of convex mirrors as a form of protection for road users.

In recent years, traffic accidents in this area have become a major concern, particularly around sharp bends which often become accident hotspots. Factors such as limited visibility, especially on steep curves, and the presence of oncoming vehicles, are major causes of accidents (Hamim et al., 2020; Ortiz-Peregrina et al., 2020). Therefore, innovative approaches are needed to improve road safety in Sukahurip Village.

Through the UPI KKN 2023 program, students have the opportunity to contribute and provide assistance to the community of Sukahurip Village. KKN, as a mandatory program for university students, aims to connect students with society and provide practical experience in addressing social, economic, or cultural problems in a specific area (Asriati et al., 2021). This program serves as a concrete form of student dedication to the community, requiring good adaptability and active involvement in local community life.

https://doi.org/10.17509/dedicated.v2i1.62250

The program lasts for one month, during which students reside in the designated location and collaborate with local communities to identify, plan, and implement beneficial projects (Aliyyah et al., 2019).

One proposed program and solution to address these issues is the utilization of convex mirrors. Convex mirrors are known for providing a wider field of view and helping drivers see vehicles approaching from difficult-to-see directions. Previous studies, as reported by Suprianto dan William (2020), suggest that the use of convex mirrors can be effective in improving visibility, although they note that objects in the mirror appear smaller.

With the increasing number of vehicles and growing traffic density along Jalan Sukahurip, proactive measures such as the use of convex mirrors are considered an appropriate strategy for reducing accident risks. Furthermore, this approach aligns with the village's development vision focused on SDGs, where traffic safety and community welfare are given top priority. By understanding the traffic conditions and safety needs in Sukahurip Village, the implementation of convex mirrors is expected to be an effective solution that positively impacts road safety and the well-being of the local community.

Literature Review

Factors Contributing to Traffic Accidents and Prevention Strategies

Traffic accidents are a serious global issue affecting public safety. Various factors, including human, technical, and environmental elements, contribute to their occurrence. Numerous studies have identified several causes of traffic accidents.

One primary factor is human negligence, such as disorderly traffic behavior (Enggarsasi & Sa'diyah, 2017). Driver errors like traffic rule violations, fatigue, or the influence of illicit substances can lead to tragic incidents on the road. Additionally, psychological factors, such as lack of concentration and disregard for road conditions, play a significant role (Pawelec, 2021). Therefore, implementing more effective education strategies and traffic law enforcement can help mitigate human factors that trigger accidents. Moreover, other factors influencing the severity of accident casualties involve the use of personal protective equipment, the type of accident, and the types of vehicles involved (Jamal & Umer, 2020; Klinjun et al., 2021).

Technical and environmental factors also play crucial roles. Poor road conditions, inadequate lighting, and insufficient vehicle maintenance can increase accident risks. Developing good road infrastructure and ensuring regular vehicle maintenance are critical strategies for addressing technical and environmental factors that can trigger accidents. A holistic approach involving government, community, and the private sector can create a safer traffic environment that is responsive to transportation safety needs (Amyrulloh, 2024; Lin & Cui, 2021). In a study titled "Analisis Keselamatan Jalan Pada Tikungan Berdasarkan Jari-jari dan Kemiringan Melintang Tikungan," road geometric factors are also recognized as accident triggers. Road geometry, including road width, curves, longitudinal and transverse slopes, and sight distance, can contribute to the risk of traffic accidents (Widianty et al., 2019).

Road geometric design must meet safety and comfort standards for road users, aiming to reduce traffic accident rates. The length of transition curves is influenced by various factors such as driver characteristics, vehicle speed, curve radius, and road elevation (Abdollahzadeh-Nasiri et al., 2020). Therefore, a comprehensive understanding of road geometry, particularly on sharp curves, is crucial for safe road design and reducing the risk of traffic accidents (Pau & Aron, 2018).

Positive Impact of Convex Mirrors in Enhancing Alertness and Reducing Accident Risk

https://doi.org/10.17509/dedicated.v2i1.62250

One effective solution for sharp curves in roads is the use of convex mirrors. Convex mirrors serve a crucial function in enhancing road user alertness. Beyond promoting road safety, convex mirrors can also help reduce the likelihood of criminal acts (Ceccato et al., 2022). A convex mirror consistently reduces the size of reflected images, thereby providing a wider field of view compared to flat or concave mirrors of the same size (Nirsal, 2015).

Relying solely on flat mirrors in vehicles to observe surrounding conditions has a limitation: blind spots. A blind spot is an area that a driver cannot see through their mirrors. To overcome the blind spots caused by flat mirrors, convex mirrors are utilized to expand the mirror's field of view and reduce blind spots(Ozawa et al., 2023).

The use of convex mirrors presents an effective option for addressing this issue. By strategically installing convex mirrors, such as at intersections, drivers' fields of vision can be expanded, and blind spots—a potential cause of accidents—can be reduced. Convex mirrors provide a more comprehensive view of traffic situations, enabling drivers to make more informed and safer decisions (Marsyanda et al., 2022). Although external vehicle mirrors (side mirrors) can offer adequate visibility, they can still be obstructed by dirt or raindrops, which may diminish the quality of the image on the vehicle's glass. While larger side mirrors could be another option, they are not always effective in overcoming the limitations of conventional mirrors, as larger mirrors can lead to increased drag due to a larger vehicle surface area (Large, 2016).

Convex mirrors are designed to provide additional visibility to drivers entering or crossing intersections. They help reduce the potential for collisions and conflicts between vehicles, especially in areas with limited visibility. Furthermore, the use of convex mirrors can help drivers and pedestrians see each other more clearly, creating a safer and more efficient traffic environment at village road intersections (Wardani, 2022). Therefore, the installation of convex mirrors at village road intersections is an important step towards enhancing safety and reducing the risk of traffic accidents.

The implementation of convex mirrors at intersections has a positive effect by expanding drivers' visual fields, which can ultimately reduce the risk of accidents caused by limited visibility. With convex mirrors, drivers can see approaching vehicles from a wider angle, even in areas with restricted sightlines (Bernhard & Hecht, 2021; Lin et al., 2020). This is significantly important in preventing accidents that can occur due to drivers' inability to see vehicles approaching from unexpected directions. The installation of convex mirrors at intersections in Sukahurip Village is expected to reduce potential material losses and casualties from traffic accidents. By increasing awareness and visibility at these intersections, it is hoped that a safer traffic environment can be created, free from incidents that could potentially endanger road users.

METHODS

An optimal strategy for installing convex mirrors involves a series of carefully designed steps to maximize visibility benefits and enhance traffic safety at a given location. The method used involves the implementation of convex mirror installation at several points along Jalan Sukahurip in Sukahurip Village.

The method began with the selection of installation locations based on field surveys and measurements of Jalan Sukahurip. The UPI KKN (Community Service Program) team of 2023 reviewed points identified as accident-prone areas, particularly sharp bends. August 19, 2023, was chosen as the date for the convex mirror installation activity.

The UPI KKN 2023 team, comprising ten members and one Field Supervising Lecturer, participated in this activity, receiving support and participation from local residents and hamlet chiefs. The target groups included the community of Sukahurip Village and general road users traversing the area. The tools and materials used consisted of convex mirrors and iron poles. Installation was carried out at five strategic

https://doi.org/10.17509/dedicated.v2i1.62250

points, primarily on curves that posed potential blind spots for oncoming drivers. Through this method, it is hoped that these specific road points in Sukahurip Village can become a safer traffic environment, thereby reducing the risk of accidents (Khambali, et al., 2021).

Following the installation of the convex mirrors, the next step is to monitor their impact on the accident rate on Jalan Sukahurip. Evaluation will be conducted to measure the effectiveness of the convex mirrors in reducing accident risk, especially at the installed points. Post-installation accident data will serve as a benchmark for evaluating the program's success. Regular monitoring and continuous collaboration between the UPI KKN team and the local community are essential for obtaining accurate feedback, allowing for corrective actions if needed to enhance the sustainability and effectiveness of the convex mirror installation program in Sukahurip Village.

RESULTS AND DISCUSSION

Through field surveys and measurements, we identified that Jalan Sukahurip in Sukahurip Village features several sharp curves highly susceptible to traffic accidents. Statistical data indicates that 306 traffic accident cases (Lakalantas) occurred in Pangandaran and Ciamis Regencies in 2021. This figure reflects the accident rate in the region, leading us to address this issue by installing five convex mirrors at high-risk points along Jalan Sukahurip.

Figure 1. The process of digging a hole for a convex mirror pole
Source: Author Documentation 2023

Earth excavation was performed for the foundation of the convex mirror pole (see **Figure 1**), with digging reaching a depth of approximately ±30 cm. Subsequently, the iron pole, already fitted with the convex mirror, was inserted into the excavated hole. The pole's position was ensured to be perfectly perpendicular, and the convex mirror was adjusted for optimal visibility by road users. The hole was then filled completely with a cement mixture as a backfill material.

https://doi.org/10.17509/dedicated.v2i1.62250

Figure 2. Process of installing a convex mirror
Source: Author Documentation 2023

The installation of the convex mirrors involved the UPI KKN (Community Service Program) student team, local residents, and was overseen by the hamlet chief (see **Figure 2**). This program was aimed at the community of Sukahurip Village and general road users in the area. The activity focused on the deployment of convex mirrors, along with their installation and supporting equipment.

Figure 3. Installation of a convex mirror accompanied by the Head of Bengkekan Hamlet
Source: Author Documentation 2023

Before implementing the program, the UPI KKN team actively communicated with the local community through public meetings as part of their work plan. This KKN program offers an opportunity to enhance, expand, and strengthen collaboration with institutions, the community, and other departments through student-led KKN partnerships. Community support and participation are crucial for the program's success, and their positive response reinforces the perception that convex mirror installation is an accepted and necessary solution. Along with the installation of convex mirrors, additional prevention efforts include increasing warning signs around sharp turns. This initiative aligns with a holistic approach to traffic safety, ensuring that drivers are not only helped to see potential hazards but are also adequately informed to reduce speed at high-risk points.

The installation of convex mirrors at accident-prone locations on Jalan Sukahurip has significantly impacted traffic safety. With the presence of convex mirrors, drivers can more easily detect vehicles

https://doi.org/10.17509/dedicated.v2i1.62250

approaching from sharp turns that were previously difficult to see. This helps reduce blind spots and enhances drivers' ability to respond quickly to changing road conditions. After installation, the position of the convex mirrors was tested by driving a motorized vehicle through the installation points. This was done to ensure that the convex mirrors, when viewed by motorized vehicle users, were within their effective field of vision (Hendriyani et al., 2023).

The installation of convex mirrors at accident-prone locations on Jalan Sukahurip can serve as a solution to enhance traffic safety. With the presence of convex mirrors, drivers' ability to detect approaching vehicles from sharp turns becomes more efficient, which was previously difficult to observe. This contributes to reducing blind spot areas and increasing driver responsiveness to changing road conditions. After the installation process was complete, the position of the convex mirrors was tested by driving a vehicle through the points where they were installed. The objective was to ensure that the convex mirrors, when viewed by motorized vehicle users, were within the vehicle's field of vision (Hendriyani et al., 2023). The trial response indicated that the convex mirrors are quite effective in widening the field of view at turns, as they allow drivers to see other vehicles from the opposite direction.

Following these steps, a warning sign was placed to prevent approaching the convex mirror poles for 2x24 hours, allowing the cement filling the holes to dry optimally. The primary hope from this convex mirror installation is to reduce the potential risk of traffic accidents in Sukahurip. Furthermore, this activity also plays a role in strengthening the relationship between the university and the local community by providing tangible benefits, demonstrating that higher education can actively contribute to community progress and well-being.

Discussion

The installation of convex mirrors on Jalan Sukahurip, Sukahurip Village, marks a significant initiative with a substantial impact on traffic safety. The area was identified as having sharp turns prone to accidents. The selection of locations for convex mirror placement was based on this analysis, specifically targeting turns that could pose blind spots for drivers. Therefore, installing convex mirrors emerged as a concrete solution to enhance safety on Jalan Sukahurip. These mirrors widen the visual field for road users, increasing their awareness around sharp bends and potentially deterring criminal activity (Ozawa et al., 2023; Ceccato et al., 2022).

The process of installing the convex mirrors involved the active participation of the UPI KKN (Community Service Program) team of 2023, local residents, and the support of the hamlet chief. This undertaking was not merely a technical decision; it also prioritized the involvement and positive feedback from the community. Intensive communication before the program's implementation helped foster understanding and support from local residents. This cultivated a sense of ownership and shared awareness toward the desired improvements in traffic safety within their village.

Beyond the technical aspects, the impact of the convex mirror installation can also be assessed in terms of the relationship between the university and the community. KKN programs that engage students in tangible activities to improve the quality of life in local communities underscore the positive role of higher education in contributing to society (Purba et al., 2023). This initiative also serves as an example of how collaboration between universities and communities can create concrete and sustainable benefits, leading to a broader positive impact on traffic safety and the overall quality of life in Sukahurip Village.

CONCLUSION

https://doi.org/10.17509/dedicated.v2i1.62250

The implementation of convex mirrors as an innovative solution to enhance driving safety in Sukahurip Village has yielded positive results. These mirrors were installed with the aim of widening drivers' fields of view and increasing their awareness of road conditions, which in turn can reduce traffic accidents in the area. Convex mirrors offer a broader viewing angle, enabling drivers to respond more quickly and accurately to road situations.

The installation of these convex mirrors was a collaborative effort between the UPI KKN (Community Service Program) 2023 students and the residents of Sukahurip Village. This initiative not only brought tangible benefits to the village but also fostered a stronger bond and camaraderie between the students and the local community.

AUTHOR'S NOTE

The author declares that there is no conflict of interest regarding the publication of this article. The author confirms that the data and content of the article are free from plagiarism.

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