International Journal of Engagement and Empowerment
p-ISSN: 2798-0154 | e-ISSN: 2798-0146
Vol. 6, No. 2, August 2026
https://doi.org/10.53067/ije2.v6i2

OPTIMIZATION OF STREET LIGHTING TO IMPROVE PUBLIC SAFETY THROUGH THE MAKING OF ROAD REFLECTORS IN TAMANSARI VILLAGE, PULOMERAK DISTRICT, CILEGON CITY

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Abstract

This Community Service (PkM) activity was carried out as an effort to support road user safety through community empowerment in the manufacture and installation of road reflectors in Tamansari Village, Pulomerak District, Cilegon. The activity was motivated by the need for visibility support facilities at several points in the road environment, especially in low lighting conditions. The implementation of the activity took place for two days, namely 7–8 August 2026, with the target locations of RT 07 RW 06 Link Langon Indah and RT 02 RW 06 Jalan Kedalon Link Babakan Turi. The activity method used a participatory approach which included observation of location conditions, coordination with the community, identification of installation points, preparation and manufacture of reflectors, installation, and evaluation of activity results. The results of the implementation showed that the reflectors were successfully made and installed at predetermined points based on environmental conditions. The activity also resulted in active community involvement in the preparation process until the installation of safety facilities. The presence of reflectors provides additional visual signs for road users and is one form of safety support facilities in environments with limited lighting. In addition to the physical benefits, the activity encourages increased public awareness of environmental safety and the importance of sustainable facility maintenance. This initiative is expected to be the first step in developing a safer, more orderly, more comfortable, and more responsive road environment to public safety needs.

Keywords: Community Service; Community Empowerment; Road Safety; Road Reflectors; Visibility.

INTRODUCTION

Community Service (PkM) is a form of higher education contribution in applying academic knowledge, skills, and experience to provide real benefits to the community. PkM activities are not only oriented towards conveying information, but also directed at solving problems faced by the community through participatory and applicable activities. In the context of transportation safety, community involvement is crucial because creating a safe road environment requires concern, understanding, and participation from various parties. Siswanto et al. (2024) explain that community empowerment can be an approach to increasing understanding and concern for road transportation safety.

Road user safety is a crucial aspect in creating a comfortable and safe residential environment. Safety risks can increase when road conditions are limited by lighting or facilities that help users recognize directions, boundaries, and road locations, especially at night. Bhagavathula and Gibbons (2023) explain that improving visibility at night is a crucial aspect in supporting road user safety. Therefore, the use of reflectors can be a simple alternative that helps provide visual cues to drivers when ambient lighting conditions are limited.

This Community Service (PKM) activity was held in Tamansari Village, Pulomerak District, Cilegon, specifically at several points in RT 07 RW 06 and RT 02 RW 06. The location selection was

based on the need for supporting facilities for road safety and visibility in the community. These conditions became the basis for the implementation of the activity of making and installing road reflectors as a simple form of solution that can be implemented directly with community involvement.

The findings demonstrate that road safety support facilities in residential areas require collective attention. The installation of reflectors not only provides a visual function for road users but also serves as a means to raise public awareness of environmental safety. A community-based approach can strengthen community readiness to support sustainable road safety implementation (Elias et al., 2024).

Previous research has shown that simple, participatory approaches can support improved road safety. Siswanto et al. (2024) emphasize the importance of community empowerment in transportation safety, while Bhagavathula and Gibbons (2023) demonstrate that improving nighttime visibility contributes to road user safety. Black et al. (2023) demonstrate the benefits of reflective materials on nighttime visibility. Khabiri et al. (2025) emphasize the importance of visibility interventions, while Elias et al. (2024) highlight community readiness to support road safety.

The two-day implementation program, August 7–8, 2026, included material preparation, reflector fabrication, installation location determination, and community involvement in field implementation. These activities are expected to improve road user visibility while strengthening community participation in creating a safer road environment.

Figure 1. Group photo of the Community Service Team

The creation and installation of road reflectors have positive implications for creating a safer road environment in Tamansari Village. The presence of reflectors can help improve visibility at road points with limited lighting, making it easier for road users to recognize environmental conditions at night. In addition to these direct benefits, this activity encourages community involvement in maintaining safety facilities on an ongoing basis. Environmental and community-based approaches are also important because improved visibility is a component of pedestrian and road user safety (Boun et al., 2024; Khabiri et al., 2025).

LITERATURE REVIEW

Road Safety

Road safety considers environmental conditions and road facilities as crucial elements in creating a safe journey for road users. Roads with inadequate safety facilities can increase risks, especially when user visibility is reduced. Hamim and Ukkusuri (2024) explain that built environment characteristics are related to pedestrian safety perceptions. Ai et al. (2024) also emphasize the importance of maintaining safety facilities, signs, and equipment as part of improving road safety.

Visibility and Reflectivity

Visibility explains that the ability of road users to recognize environmental conditions, road boundaries, and surrounding objects is a crucial component of safety, especially at night. Reflectors function as passive safety features that reflect vehicle light, making the presence of points or road boundaries easier to recognize. Bhagavathula and Gibbons (2023) demonstrated that improving nighttime visibility can support road user safety, while Khabiri et al. (2025) emphasized the importance of visibility interventions in reducing risks to pedestrians.

Community empowerment

Community empowerment emphasizes community involvement as active actors in identifying needs, determining solutions, implementing activities, and maintaining the results. In road reflector installation activities, communities are not only beneficiaries but also play a role in identifying locations requiring safety facilities. This approach encourages a growing sense of shared concern and responsibility for the environment. Empowerment through direct involvement can also strengthen the sustainability of safety programs because communities gain experience and understanding of the benefits of available facilities.

METHOD AND PROCEDURES

The activity method was designed in a participatory manner, placing the community at a key stage in every stage of implementation. This approach was chosen so that the activity would not stop at facility installation but also foster awareness of road safety. Implementation included site condition observations, coordination, material preparation, reflector fabrication, installation at priority points, and evaluation of the results of the activity with the local community.

1. Observation and Location Identification

   The initial stage was carried out through direct observation in the Tamansari Subdistrict environment, specifically RT 07 RW 06 and RT 02 RW 06. Observations were directed to identify road conditions, lighting levels, characteristics of road points, and locations requiring additional visual signs. Activity points included RT 07 Link Langon Indah and RT 02 Jalan Kedalon Link

Babakan Turi. The observation results were used as a basis in determining the location of the reflector installation precisely and according to field needs.

2. Coordination with the Community

   Coordination was carried out with the sub-district, neighborhood association (RT/RW) heads, and the community surrounding the activity location. This stage aimed to convey the purpose of the activity, determine installation locations, schedule implementation, and build understanding regarding the importance of road safety support facilities. Community involvement from the outset aligns with an empowerment approach that positions the community as an active participant in road safety activities (Johnson et al., 2023).

3. Preparation and Making of Reflectors

   Once the location is determined, the materials and equipment needed to manufacture the reflectors are prepared. The manufacturing process is tailored to the installation location and aimed at producing reflectors that are easily visible when exposed to vehicle headlights. The principle of using simple and easy-to-implement facilities is relevant to road visibility improvement activities using reflectors in environments with limited lighting (Ramadhan et al., 2026).

Figure 2. Activity Planning and Sample Street Lighting Installation

4. Installation of Road Reflectors

   Installation was carried out at predetermined points based on observations and coordination. Reflectors were placed on sections of the road requiring additional visual markings, taking into account installation safety, visibility by road users, and the surrounding environmental conditions. The activity was carried out collaboratively, involving the implementation team and the local community. The installation of reflectors is expected to improve visibility of road boundaries or specific sections in low-light conditions.

5. Evaluation and Monitoring

   Evaluations were conducted after all reflectors were installed. The evaluation included checking the installation condition, reflector visibility when exposed to vehicle headlights, and community response to the results of the activity. Monitoring was also aimed at identifying future

facility maintenance needs. An evaluative approach is essential because community-based safety activities require ongoing engagement to maintain intervention results (Greer et al., 2025).

Table 1. Stages of Implementation of Making and Installing Road Reflectors

Activity Stages	Form of Implementation	Location/Time
Observation and identification	Observe road conditions and determine priority points	RT 07/RW 06 and RT 02/RW 06
Coordination	Coordination with environmental and community devices	Tamansari Village
Preparation	Prepare reflector materials and equipment	Before implementation
Reflector manufacturing	Assemble and prepare the reflector according to the installation point requirements.	August 7, 2026
Installation	Install the reflector at the specified point	August 7–8, 2026
Evaluation	Checking the installation results and visibility of the reflector	August 8, 2026

Source: Data on implementation of PkM activities, 2026.

Table 1 shows the series of activities implemented in stages, starting from needs identification to evaluation. The implementation period, which lasted from August 7–8, 2026, allowed each stage to be carried out in a focused manner with community involvement. This division of stages also demonstrates that reflector installation is not a stand-alone activity, but rather part of an empowerment process that begins with an understanding of environmental conditions and ends with monitoring the results.

6. Community Participation

Community participation is a crucial element in implementing these activities. The community is involved in the coordination process, determining installation points, preparing the site, and installing the reflectors. This involvement is expected to foster a sense of ownership of the installed facilities, encouraging them to maintain and care for them. A participatory approach to road safety activities can also strengthen the community's understanding of safety issues in their environment (Siswanto et al., 2024).

7. Implementation Procedure

The activity procedure is carried out in sequence***observation → coordination → preparation of materials → manufacture of reflectors → determination of installation points → installation → checking results → evaluation and monitoring***This sequence is used to ensure activities are systematic and appropriate to field conditions. The phased approach also provides space for community participation, from the planning process to the maintenance of the activity results.

Figure 3. Implementation of the Manufacture and Installation of Road Reflectors

IMPLEMENTATION RESULTS AND DISCUSSION

Activity Results

The road reflector manufacturing and installation project in Tamansari Village was carried out over two days, August 7–8, 2026. The project focused on providing road visibility support facilities while encouraging community involvement in maintaining environmental safety. The project's outcomes included location identification, reflector manufacturing, installation at priority points, and increased public awareness of road user safety.

Identify Conditions and Installation Points

The initial phase of the activity involved observing environmental conditions at two target locations: RT 07/RW 06, Tamansari Village, and RT 02/RW 06, Tamansari Village. Specifically, the target locations were RT 07 Link Langon Indah and RT 02 Jalan Kedalon Link Babakan Turi. The observations focused on road conditions and identifying areas requiring additional visual signs.

The identification results indicate that the need for reflectors is primarily related to providing visual markers on roads used by the public. Locations were determined by considering road location, lighting conditions, and user needs. This process resulted in more targeted installation points, allowing the facility to be placed in locations deemed to provide the greatest benefit.

Table 2. Results of Activity Location Identification

Location	Conditions/Needs	Follow-up
RT 07 RW 06, Link Langon Indah	Requires additional visual markers on the road environment	Determining the reflector installation point
RT 02 RW 06, Jalan Kedalon Link Babakan Turi	Requires supporting facilities for road visibility	Determining the reflector installation point

Source: Data on implementation of PkM activities, 2026.

The table above shows that the activities were directed at two target neighborhoods. Identification served as the basis for determining installation points to ensure reflectors were not installed haphazardly. The determination of locations based on field conditions also demonstrates that the activities utilized a community-based approach. Therefore, the resulting facilities are expected to provide direct benefits to road users and the surrounding environment.

Road Reflector Manufacturing

Once the installation location is determined, the process continues with the manufacture and preparation of the reflectors. This is done with the reflector's primary function in mind, as it provides a visual signal when exposed to vehicle light. This process is crucial because the quality and position of the reflector determine its visibility to road users.

The construction was carried out collaboratively by the implementation team, involving the community. This involvement provided the public with the opportunity to directly observe the process of providing road safety facilities. In addition to producing physical facilities, the construction process also served as a practical educational tool regarding the importance of visibility and road safety.

This activity is relevant to Khabiri et al. (2025), who explained that visibility is a crucial factor in road user safety, particularly when drivers' ability to recognize road users or objects in their surroundings is impaired. Various forms of visibility-enhancing interventions can help strengthen detection and recognition capabilities under certain conditions.

Table 3. Stages of Reflector Manufacturing and Preparation

Stages	Activity	Results
Preparation	Prepare materials and equipment	Ready to use materials
Making	Assembling and preparing the reflector	Reflector ready to be installed
Inspection	Checking the condition of the reflector	Reflector is suitable to be installed

Source: Data on implementation of PkM activities, 2026.

Table 3 shows that reflector manufacturing follows simple and systematic steps. Material preparation is the foundation for the manufacturing process to proceed as needed. Once the reflectors are complete, they are inspected before installation. This step is necessary to ensure that the installed equipment is in good condition and can function as a visual marker for road users, especially in low-light conditions.

Installation of Road Reflectors

Reflectors were installed at points predetermined through prior observations. The project took place on August 7–8, 2026, and involved the implementation team and the surrounding community. The activity took place directly in neighborhood units (RT 07/RW 06) and neighborhood units (RT 02/RW 06).

The installation results indicate that reflectors have been placed in locations deemed to require visual support. The presence of reflectors provides additional markings on the road surface, allowing users to obtain additional visual information when passing. Reflectors are not a substitute for street lighting, but rather a supporting facility that can complement environmental safety conditions.

This activity aligns with Hamim and Ukkusuri (2024), who showed that physical environmental characteristics and road environment elements are related to road users' perceptions of safety.

Therefore, attention to the physical condition of the environment is an important part of creating a road space that is perceived as safer.

Table 4. Results of Reflector Installation Implementation

Location	Execution time	Activity Results
RT 07 RW 06, Link Langon Indah	August 7–8, 2026	The reflector is installed at a predetermined point.
RT 02 RW 06, Jalan Kedalon Link Babakan Turi	August 7–8, 2026	The reflector is installed at a predetermined point.

Source: Documentation and data on the implementation of PkM activities, 2026.

Table 4 shows that the reflector installation was carried out at both target locations according to the activity schedule. The two-day implementation provided the team with the opportunity to perform installation and inspect the facility's condition. These results indicate the achievement of the activity's immediate objective, which was to provide facilities to support road visibility. In addition to the physical benefits, the collaborative implementation also strengthened community involvement in environmental safety activities.

Public Participation and Response

One important outcome of the activity was community involvement throughout the implementation process. The community participated in coordination, site preparation, installation, and supervision of the installed facilities. This involvement demonstrates that the activity is not solely focused on providing physical facilities but also on fostering community awareness of road safety.

Community participation is increasingly important because the sustainability of safety facilities requires attention after the project is completed. People who understand the installation process and purpose are expected to help maintain the reflectors and report any damage or changes in site conditions.

These findings align with Greer et al. (2025), who demonstrated that community and multi-stakeholder engagement is a critical element in developing road safety programs. Community involvement can broaden program acceptance and help ensure that safety interventions are aligned with community needs.

Activity Achievements

The activity yielded several achievements, including the completion of priority point identification, the availability of reflectors, the successful installation in two target areas, and increased community involvement. These achievements demonstrate that the activity can connect simple solutions with real community needs.

The activity provided the community with practical experience in understanding the importance of road safety support facilities. The community not only received the results of the installation but also gained an understanding that environmental safety is a shared responsibility. This principle aligns

with the Safe System approach, which places safety as a shared responsibility among various parties. Greer et al. (2025) also found that the involvement of various groups and communities is a crucial part of developing road safety programs.

Discussion

The discussion focused on interpreting the results of the reflector construction and installation based on the project's objectives and comparing them with previous projects. The focus of the discussion included the reflectors' contribution to visibility, the facility's suitability to environmental conditions, the role of community participation, and the sustainability of road safety activities in Tamansari Village.

1. Reflectors as a Support for Road User Visibility

   The installation of reflectors in Tamansari Village demonstrates that simple facilities can be used to support road user visibility. Reflectors work by utilizing vehicle light to create visual cues that make certain parts of the road environment easier to recognize. This benefit is particularly relevant at night or in environments with limited lighting. In their study, Khabiri et al. (2025) emphasized that improving visibility is a crucial part of preventing road user safety risks. Interventions that improve drivers' ability to detect and recognize objects can contribute to safety. The results of the Tamansari activity reinforce this idea through a simpler, environmentally-based approach. Reflectors are not intended as the sole safety solution, but rather as an additional facility that can complement lighting and other road equipment.

2. Suitability of Interventions to Environmental Conditions

   The results of the activity demonstrate the importance of tailoring safety interventions to site characteristics. Determination of reflector points was based on direct observation, ensuring that facilities were placed in areas of the environment requiring visual markers. This approach aligns with Hamim and Ukkusuri (2024), who found that built environment characteristics can influence pedestrian safety perceptions. This means that safety is determined not only by user behavior but also by the physical condition of the road space. The Tamansari activity implemented this principle through site identification prior to installation. This advantage is that the available facilities are tailored to field needs, rather than simply being installed without considering environmental conditions. The location-based approach also allows the public to provide information on points deemed in need of attention, making the activity results more relevant to the daily experiences of road users.

3. Community Participation in Road Safety

   Community involvement is a crucial aspect of the project's success. The Tamansari community was involved in the coordination, preparation, installation, and oversight of the

facilities. This model demonstrates that road safety can be built through shared responsibility, not solely through government or individual intervention. Greer et al. (2025) demonstrated that community involvement is a crucial component of various Vision Zero road safety plans. They found that community involvement strategies were used in most of the plans reviewed, including community engagement and mechanisms for obtaining community input. These results align with the Tamansari project, despite its smaller scale. Direct community involvement helped the community understand the purpose of the installed facilities and increased the likelihood of post-project maintenance.

4. Sustainability and Strengthening of Safety Programs

   The installation of reflectors should be seen as an initial step in building an environment that is more concerned with road user safety. Sustainability is determined not only by the availability of these facilities, but also by their monitoring, maintenance, and the potential development of other safety facilities. Elias et al. (2024) demonstrated that community readiness is related to the implementation stages of road safety initiatives, so strengthening community knowledge and support is necessary to sustain the program. Abebe et al. (2024) emphasized the importance of involving various community groups in determining and implementing road safety interventions. The results of these activities can serve as a basis for developing follow-up activities such as regular reflector inspections, mapping vulnerable areas, improving lighting, and providing safety education to the community. Thus, simple activities can develop into sustainable environmental safety movements.

CONCLUSION

Community Service activities through the manufacture and installation of road reflectors in Tamansari Village, Pulomerak District, Cilegon, have been carried out for two days, namely August 7–8, 2026. The activities were carried out at RT 07 RW 06 Link Langon Indah and RT 02 RW 06 Jalan Kedalon Link Babakan Turi. The implementation of activities includes observing environmental conditions, identifying installation points, preparing and manufacturing reflectors, installing them at predetermined points, and checking the results of the activities. The presence of reflectors is a supporting facility that can help improve visual signs in the road environment, especially when lighting conditions are low at night.

This activity provides benefits in the form of increased community involvement and awareness of environmental safety. Public participation in the preparation, installation, and supervision processes demonstrates a shared responsibility in supporting road user safety. This activity also serves as an initial step to encourage the ongoing maintenance of safety facilities. Therefore, the presence of reflectors needs to be accompanied by regular condition monitoring and the development of other supporting facilities according to environmental needs. With a participatory approach, this simple

activity is expected to be part of a sustainable effort to build a safer, more orderly, and more comfortable road environment for the residents of Tamansari Village.

ACKNOWLEDGMENTS

Thank you to the Tamansari Village Government, the RT 07 and RT 02 administrators, the local community, and all parties who provided support, assistance, and participation during the activity. Appreciation is expressed for their cooperation in the manufacture and installation of road reflectors, which ensured the successful implementation of the activity and provided benefits to road user safety.

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