JFE TECHNICAL REPORT
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New Guardrail with Retroreflecting Bolts as Standard Equipment†

1. Introduction

White-painted guardrails are the most-frequently used safety barrier for vehicles. However, these facilities were mentioned as a factor that obstructs the highway landscape during daytime in the guidelines for construction of safety barriers considering landscape, which was published under the editorial supervision of the Regional Road and Environment Division, Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism in 2004[1]. Dark brown and similar landscape colors were recommended, and as a result, diffusion of guardrails with landscape colors instead of white has progressed in recent years.

On the other hand, however, because landscape colors are difficult to see at night, reduced visibility by drivers is a problem. At present, visibility is secured by attaching a larger number of reflectors or reflecting tapes to guardrails than in the past.

This report introduces a new type of guardrail which does not depend on attaching reflective materials as described above, but rather, is provided with retroreflecting bolts as standard equipment. The visibility of this new guardrail is improved by painting its component parts with retroreflecting paint. (Retroreflection means reflection back to the light source.) The principle of retroflection and the structure of the retroreflecting paint film developed for the new guardrail are shown in **Fig. 1**.

2. Features

2.1 Retroreflecting Bolts (Paint Specification)

In this work, retroreflecting bolts were developed jointly with the paint maker, Komatsu Process Co., Ltd. As shown in **Photo 1**, considering the highway landscape, the surface appearance of the bolts is a gray-colored paint similar to the color of standard bolts (hot-dip galvanized finish), which are inconspicuous during daytime. A painting technology which secures an appropriate uniform arrangement of glass beads in the surface layer on the bolt head was also established, as shown in **Photo 2**, realizing reflected brightness approximately 6 times higher than that of ordinary white-painted guardrails.

The reflecting paint film have passed all paint film material property tests, including the salt spray test, accelerated weathering test, etc. provided in the “Paint Standard for Safety Barriers” (Paint: Polyester powder coating) of JFE Metal Products and Engineering and possesses long-term durability equal to that of other guardrail members.

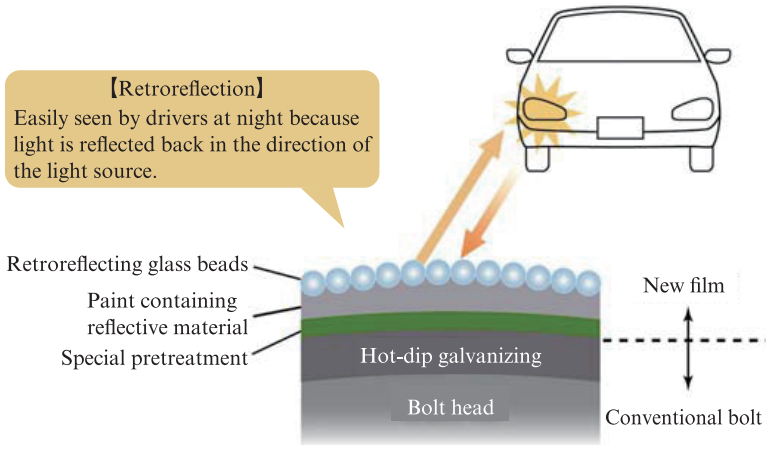

Fig. 1 Principle of retroreflection and structure of developed paint film

†Originally published in *JFE GIHO* No. 31 (Jan. 2013), p. 84–85

Standard bolt (Galvanized)

Retroreflecting bolt

Photo 1 Surface view

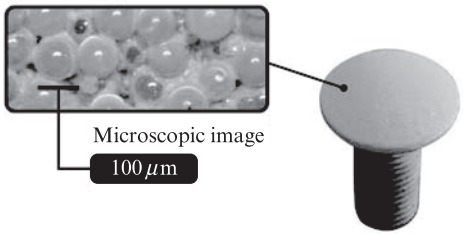

Photo 2 Enlarged view of bolt head surface

2.2 New Guardrail

As shown in **Photo 3**, these retroreflecting bolts are installed on guardrails in the two middle rows of beam-connecting bolts (G. L. +600 mm) which are easily visible by drivers, and receive the light of automobile headlights as a light source with good efficiency.

This makes it possible for night-time drivers to be aware of the presence of the guardrails in advance and continuously recognize the road alignment, as illustrated in **Photo 4**, giving drivers a sense of security.

Regarding construction, because the reflective function is added to component parts of the guardrail, the new guardrail will contribute to reducing construction costs related to the installation of reflective materials, which is currently handled separately from guardrail construction itself.

3. Conclusion

Considering the orientation toward conservation of electricity which is foreseen in the future, the newly-developed guardrail with retroreflecting bolts as standard equipment is expected to contribute to traffic safety, while also saving energy and reducing costs in highway sections which are poorly lighted due to selective reductions in highway lighting. Further efforts will be made to expand sales, particularly from this viewpoint.

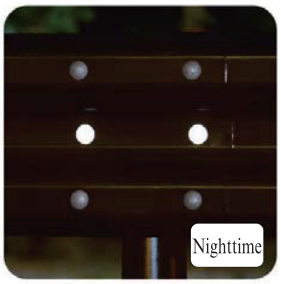

Photo 3 Comparison of guardrail appearance during day and night

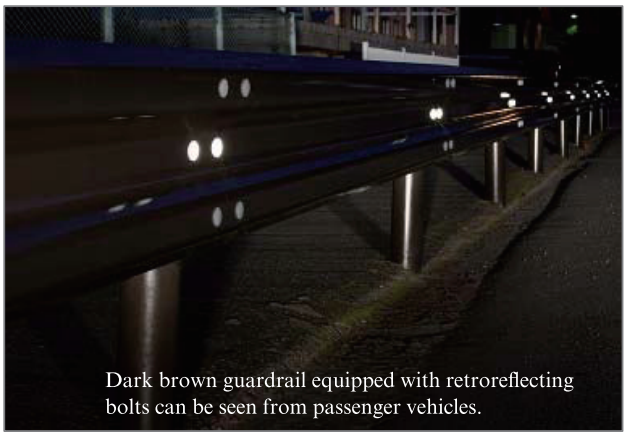

Photo 4 Appearance of actual highway guardrail at night

The paint film composition, painting technology, and aesthetic value of the surface of the guardrail developed in this work have been highly evaluated and were recognized by the award of the 2011 Otani Memorial Art Museum Prize. In the future, JFE Metal Products and Engineering will enhance this technology and will continue research and development responding to the needs expressed by customers, for example, for expansion of applications to other parts, etc.

Reference

1) Regional Road and Environment Div., Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism. Keikan-ni Hairyoshita Bogosaku-no Seibi Guideline. 2004, p. 35.

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