Seven Years of Illumination at Railroad-Highway Crossings

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The results of 34 crossings that were installed during the first 7 years of illumination of railroad-highway grade crossings in Oregon are discussed here. The specifications, along with the orientation of the lights to the road and railroad track, are discussed. The dates of installation for each crossing, number of tracks, orientation of the lights at the crossing, and results of the various light readings are presented. Installation costs are discussed, and the method used to attain the goal of $2,000 per installation is described. Some of the problems encountered and the accident history during the 7 years are analyzed. It is concluded that illumination has provided an effective low-cost alternative for improving crossing safety at night.

In the early 1980s, officials of the Oregon Public Utility Commission (OPUC), recognizing that the majority of grade crossings do not qualify for installation of expensive automatic warning signals, began searching for low-cost alternatives for safety improvements. At that time, the agency began studying illumination for crossings that had regular nighttime (4 p.m. to 7 a.m.) train movements and were too low on the statewide crossing priority list (low train or vehicle traffic volumes) to qualify for automatic warning devices.

OPUC staff was aware that research on the use of conventional street light luminaires in the vicinity of grade crossings was being done at Kansas State University and in the city of Lincoln, Nebraska. OPUC, interested railroads, and public road authorities conducted three demonstration projects in Oregon: at the 5th and 6th Street crossings in Ontario and at 170th Avenue in Washington County. Results from the projects were presented at a formal hearing conducted by OPUC in 1977. After the hearing, OPUC formed a crossing illumination advisory committee and initiated additional research at crossings in three different settings: metropolitan area, small city, and rural area.

After a second formal hearing on crossing illumination, OPUC staff was directed to take the following actions.

1. Establish a list of eligible grade crossings. (The two criteria for eligibility were mentioned previously.)
2. Circulate the list for review and comment to appropriate public road authorities and railroads, the State Highway Division, and the County Engineers' Technical Advisory Committee.
3. Invite applications for illumination.
4. On receipt of an application for illumination, the following steps were taken:
   a. Serve it on all interested parties, including any advisory group established by the County Engineers' Technical Advisory Committee.
   b. Request that the highway division provide accident data for a distance of 200 ft on each side of the crossing.
   c. Conduct an on-site meeting at the crossing.
   d. Draft and circulate to all parties a memorandum summarizing the action requested in the application along with any data and arrangement of luminaire developed at the on-site meeting.
   e. Institute a formal investigation along with circulation of a staff-proposed final order.
   f. Issue a final order after expiration of the comment period (assuming all parties agree on what should be done).

Funding for installation of the illumination devices was provided by the following sources: State Grade Crossing Protection Account (GCPA), 90 percent; railroad, 5 percent; and road authority, 5 percent. The cost of electrical power for illumination devices is normally shared equally by the railroad and road authority.

INSTALLATION SPECIFICATIONS

1. At least one luminaire shall be mounted on each side of the track at the crossing. Luminaires should be located so that protective devices at the crossing will be directly illuminated.
2. Luminaires shall be oriented toward the railroad track to provide at least 1 ft-c of illumination on the vertical plane 5 ft from the centerline of the track. Maximum permissible level of illumination and exact orientation of the luminaire will be determined case by case. Factors at the site, including the ambient level of nighttime illumination, need to be considered. The maximum level of illumination is related to the level of lighting on the roadway approaches. The level of illumination should be sufficient to alert drivers to the crossing ahead and to any railroad equipment occupying the crossing, but should not be so bright as to create a blinding effect for motorists in the area immediately beyond the crossing. Cutoffs will normally be used on luminaires to minimize this blinding effect.
3. Luminaires should illuminate an area along the track that is 50 percent wider than the traveled width of the road. The illumination should cover a distance equal to the normal height of rail equipment (at least 15 ft above the top of the rail).
4. Poles holding luminaires should be located so that they can be maintained from the highway right-of-way.

Figure 1 shows an example of an installation.

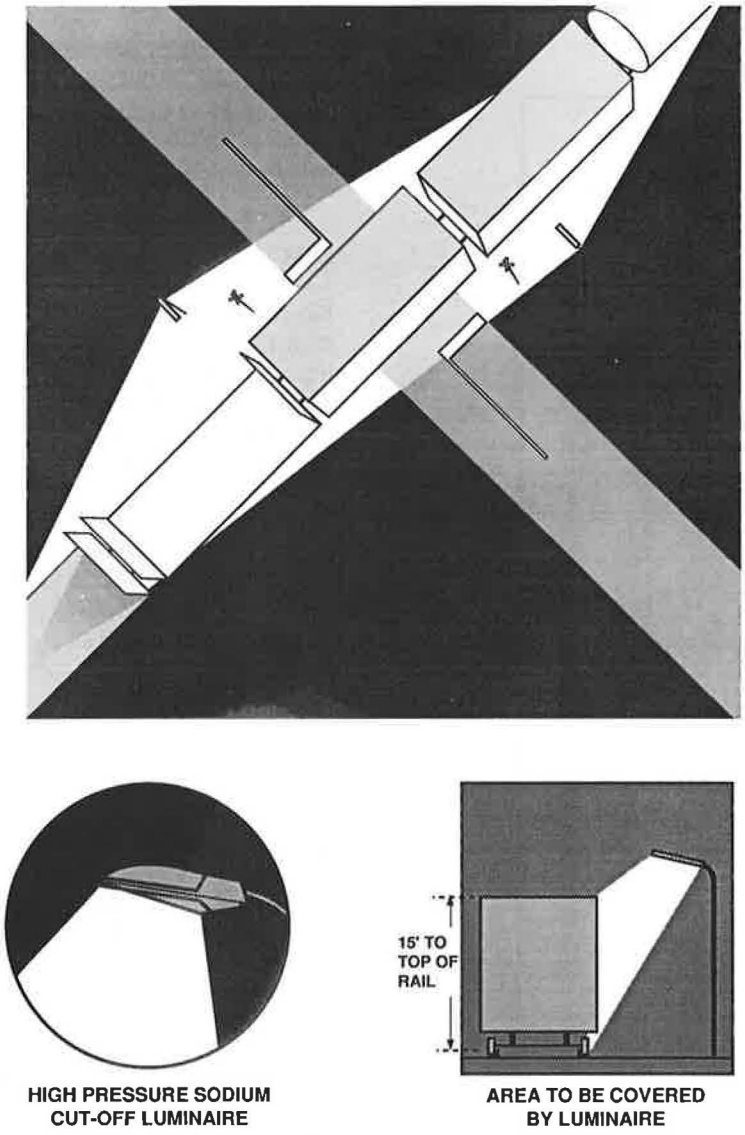

FIGURE 1 Example of installation of luminaires.

NUMBER OF CROSSINGS ILLUMINATED

Before undertaking the crossing illumination investigation, OPUC staff members ordered some type of crossing illumination at nine grade crossings in Oregon. At 18 crossings, local road authorities paid the entire cost of installation and maintenance of the illumination devices. (Findings from OPUC's studies were used as a guide in some of these crossing illumination projects.) A railroad constructed and fully funded one illumination project, including electrical power and maintenance costs.

Illumination has been installed at 34 crossings to date; criteria developed by OPUC were used. GCPA was the major source of funding (75 to 90 percent) for all but one of these projects. The road authority paid 5 percent, and the railroad paid the remaining 20 or 5 percent. One project was funded 90 percent by federal Section 130 funds and 10 percent by GCPA. Maintenance costs were divided equally by the road authority and the railroad. In most cases, the road authority pays the monthly bill to the supplier of electrical power, and bills the railroad for its share annually. A few crossings are maintained by an electrical contractor. Table 1 lists the 34 crossing illumination projects by year of completion.

ORIENTATION OF LIGHTS

At first, it was difficult to convince road authorities and electrical companies that luminaires should be aligned toward the railroad tracks instead of the roadway. Several meetings were held to demonstrate that aligning the luminaires toward the railroad tracks increased the effectiveness of the illumination. Eventually, all parties agreed that the luminaires were more effective if they were aligned toward the track. As shown in Table 1, a higher percentage of the installations complied with the 1-ft-c standard for illumination when the luminaire faced the railroad tracks.

TABLE 1 CROSSING ILLUMINATION PROJECTS BY YEAR OF COMPLETION

Year	No. Tracks	Luminaires Facing Railroad	Luminaires Facing Road	Readings Taken To Date	Av % of the 1 Ft-Candle Requirement
1984	1	4		1	100
1985	1		2	4	85
1985	1	1	1	3	70
1985	1		2	3	51
1985	2		2	3	93
1985	1		2	3	97
1986	1	2		3	100
1986	3	2		3	89
1986	2	2		3	87
1986	1	2		3	93
1986	2	2		3	77
1986	2	1	1	3	53
1986	1		2	3	48
1986	1		2	2	93
1986	2		2	2	80
1986	1		2	2	100
1987	1		2	3	99
1987	1	1	1	4	98
1987	1	2		2	94
1987	1	2		3	96
1987	1	2		1	100
1988	1	2		2	100
1988	1	2		2	100
1988	1	2		2	100
1988	1	2		1	100
1988	1	2		1	100
1988	1	2		1	100
1988	1	2		1	100
1988	1	2		1	100
1988	1	2		1	100
1988	1	2		1	100
1989	1	2		1	100
1989	1	2		1	100
1989	1	2		1	100

Twenty-five light readings were taken at nine crossings at which the luminaires faced the road. The readings showed a 48 to 100 percent compliance rate with the 1-ft-c requirement. The average compliance rate was 82 percent.

Ten readings were taken at three crossings at which one luminaire was directed toward the track and the second one was directed toward the road. These readings showed a 53 to 98 percent compliance rate, with an average rate of 73 percent.

Thirty-six readings were taken at 20 crossings at which the luminaires were directed toward the railroad. The readings showed a 77 to 100 percent compliance rate, with an average rate of 96 percent.

PROBLEMS ENCOUNTERED

Where possible, the luminaires were mounted on existing utility poles. Occasionally, railroad pole lines or heavy power lines or both interfered with the preferred location for luminaire poles. If the existing poles were not long enough, luminaires were installed in each crossing quadrant to provide adequate illumination.

Two crossings were vandalized. The problem was resolved at one crossing by education and increased police patrols.

"Light-out" problems (luminaires not working properly) were encountered at approximately 2 to 3 percent of the crossings. They were found primarily during OPUC staff routine field testing of the illumination devices.

SPECIFICATIONS

For single-track crossings, poles were located approximately 25 ft from both the road and the centerline of the railroad track. Two-hundred-watt high-pressure sodium luminaires were placed at least 30 ft above the top of the rail on 6- to 16-ft-long arms. If a railroad signal system was involved, full cutoff luminaires were used.

For multiple-track crossings, 400-watt high-pressure sodium luminaires were placed at least 40 ft above the top of the rail. If a considerable distance separated the tracks, it was desirable to install a luminaire between the tracks. Semicutoff luminaires were used because they spread the light over a larger area of the crossing. This treatment was needed particularly at crossings of three or more tracks and those with severe angles of intersection.

COSTS

Initially, OPUC staff estimated the installation cost of illumination to be about $2,000 per crossing. (This included the two wooden poles with two 200 = watt high-pressure sodium luminaires on arms 6 to 16 ft long.) The average installation cost for the 34 crossings was $1,931. The most expensive installation was $9,384, and the least expensive one was $386. The most expensive project involved digging a ditch approximately 1 mi long to provide electrical power to the site. Monthly maintenance costs averaged about $15 per luminaire/pole. Maintenance costs for publicly owned utilities were slightly less.

FUTURE PROJECTS

OPUC staff prepared and distributed two lists of crossings that met the minimum criteria for illumination. The lists were provided to various public road authorities for their consideration. Without their input and cooperation, additional illumination devices may not be installed at other grade crossings in Oregon.

ACCIDENT HISTORY

Does using illumination at crossings reduce train-vehicle accidents? Based on the OPUC experience, the answer is yes. Before 1985, 18 train-vehicle accidents occurred at 13 crossings during the hours of darkness. Since the illumination program began, three train-vehicle accidents have occurred at two crossings during the hours of darkness.

Because the sample is small, it is statistically invalid to draw many definite conclusions. However, on the surface, it ap-

pears that safety at grade crossings can be improved by using illumination devices that meet the minimum criteria described here. Illumination is another tool that can be used to help reduce train-vehicle accidents at grade crossings that meet specific criteria.

CONCLUSIONS

Crossing illumination has been accepted with enthusiasm by local citizens and some public road authorities. Illumination provides an opportunity to improve safety at crossings that might otherwise not be addressed. The cost of installing automatic protective devices at grade crossings is prohibitive at many locations. Illumination has provided an effective low-cost alternative for improving crossing safety. Such medium-to-low-level priority crossings might not qualify for current dedicated funding programs.

Through experimentation and study, OPUC staff have found an acceptable standard for crossing illumination. Illumination is not appropriate for all crossings (e.g., those without regular nighttime train movements). It should only be applied in cases in which specific criteria have been met.

The information gathered about crossing illumination is a result of the cooperation of local road authorities, railroads, utility companies, and OPUC staff. The staff has been fortunate to work with parties who were willing to experiment in finding an answer.