Alaska Department of Transportation & Public Facilities
Alaska University Transportation Center

Evaluation of the Overheight Detection System Effectiveness at Eklutna Bridge

Final Report

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The Eklutna River/Glenn Highway bridge has sustained repeated impacts from overheight trucks. In 2006, ADOT&PF installed an overheight vehicle warning system. The system includes laser detectors, alarms, and message boards. Since installation, personnel have seen no new damage, and no sign that the alarm system has been triggered. Although this is good news, the particulars are a mystery: Is the system working? Is the presence of the equipment enough to deter drivers from gambling with a vehicle that might be over the height limit? Is it worth installing similar systems at other overpasses? This project is examining the bridge for any evidence of damage, and is fitting the system with a datalogger to record and video any events that trigger the warning system. Finally, just to be sure, researchers will test the system with (officially) overheight vehicles. Project results will help ADOT&PF determine if this system is functioning, and if a similar system installed at other bridges would be cost-effective.

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Executive Summary

The Eklutna Village Road bridge is located adjacent to the Native Village of Eklutna, northerly of the community of Chugiak. The bridge overcrosses the Glenn Highway at milepost 26.5 (.e., measured from the end in downtown Anchorage) with a clearance of 16 feet and 1 inch from the Highway. In the past, the bridge had sustained occasional collisions with overheight vehicles. A vehicle overheight detection and warning system was installed at a distance before the bridge on both the northbound and southbound directions of the Glenn Highway in 2006. However, since the completion of the system, collisions to the bridge by overheight vehicles still occurred and the system has had many technical issues (e.g., false alarms). To validate the effectiveness of the overheight detection and warning system at the bridge, the system at the southbound direction was upgraded with a new signal controller (iSINC), detector loops, two video cameras and a video recorder. The purpose of the new controller and the loops is to reduce the occurrences of false alarm while the added cameras and recorder provide data for the AKDOT&PF to determine if the system is effective.

After reviewing video images collected by the added monitoring system from August 2011 to June 2012, we conclude that the system is indeed functioning according to the design as the videos show that the system was triggered and issued warnings to the overheight vehicles. A few issues and limitations with the system are identified.

1. The system sometimes fails to activate Camera#1. The distance between the detector and the blankout sign may be too short to allow processing of higher speed vehicles of significant length. This design shortcoming can lead to failure of camera#1 activation when the triggering vehicles travel too fast to give the system sufficient time to process information.
2. Camera#2 can become out of focus to the level that manual on-site adjustment is needed to restore the focus. Without a means of remote communication to the controller, the camera can be out of focus for a long period of time without being noticed.
3. The recording time of Camera#2 needs to be long enough to make sure the videos follow the trucks all the way past the bridge. In addition, if the purpose of system is to gather evidence for bridge impacts, the resolution of camera#2 needs to be increased.

To address the issues identified, we make the following recommendations for the system at the Eklutna site:

I. Relocate the blank-out sign for an additional 100 feet downstream from its current location away from the sensor array. Relocation of the sign will provide adequate processing time, which in turn will allow the fail safe and fault detection functions of the iSINC controller to work for vehicles at all speeds. It will also allow the existing camera array to capture the slower target vehicles all the way to the bridge structure. The resolution of the video image will also be improved as the relocated camera #2 will be closer to the bridge.

II. Add a cellular radio modem for the system to be reached via a hardwire phone line or wireless connection supplied by an ISP. Addition of a cellular radio modem to the system will bridge the

existing communication gap between the cabinet and the closest connection points of the hardwire or wireless connection. Real-time connection to the iSINC controller and the DVR can thus be established for data download, real-time status checks and manipulation of controller configurations.

III. Restore controller cabinet grounding. Signal triggering irregularities such as signal not turning off correctly are more likely to occur if the system is not grounded.

The recorded data also help us identify situations when the system can be prone to false alarms. 65% of the false alarms in our data occurred in extreme winter weather events. We found that the system is often triggered for false alarms by freezing fog from the trucks' exhaust pipes when air temperature is below -10^0 F. In addition, false alarms also tend to occur during heavy snow events. Thus, the false alarm rate of the system strongly depends on particular winter weather events. In addition, if a similar system is installed at another location in Alaska with a lower average winter temperature or more snow precipitation, the false alarm of the system is going to be higher than what observed in our study.

To conclude this study, we generalize and extend our findings and experience with the Eklutna system to make the a set of recommendations of design specifications and site consideration for future overheight detection systems to be installed in the State of Alaska. To make sure that the shortcomings of the Eklutna system are not repeated in the future, it is important to make sure that adequate distance be established between the overheight sensor and the blankout sign. The distance is critical for correct functioning of the system. It also gives the drivers sufficient amount of time to see and process the warning message.

The appendices of this report include documents created to help AKDOT&PF maintenance staff operate, troubleshoot, and maintain the system components added for this project (e.g., iSINC controller and cameras). Technical details of the recommendations can also be found in the appendices.