System of automated warning messages to creatures moving on railway tracks about the approach of rolling stock

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Abstract. Incidents of train collisions with creatures on railway tracks are one of the major problems for railway transport today. The scientific article presents the results of the analysis of cases of trains hitting people and creatures on railway sections. Taking this into account, the aim of the scientific work is to develop a system of automated warning messages to creatures on railway tracks of approaching trains. In the creation of the system, the notification of the approaching trains to the creatures was selected based on the frequency of hearing of the creatures that gather a lot on the railway sections. In the article, the working algorithm of the system for notifying creatures of the noise generator of the approach of trains, as well as the types of auto-blocking systems on railway sections, to start the noise generator that transmits the message of the approach of trains, if the railway tracks are equipped with the auto-blocking system, the rail chains or the railway tracks are equipped with a semi-auto-blocking system connecting the road sensors that notify when the train is approaching to the contacts of the road relays, and recommendations on the selection of frequencies for the noise generator of the train approach warning system based on the hearing frequency of the creatures that gather in large numbers around the railway sections.

1 Introduction

These days, automated systems are especially important for guaranteeing train safety. On the other hand, incidents of animals being struck by trains on international railway tracks are becoming increasingly frequent. The results of the analyses that were done indicate that the following are the primary causes of these situations: animals moving along railway sections; creatures walking between railway tracks; and the absence of special crossings on railway sections for the passage of creatures.

For instance, between 2021 and the seventh month of 2023, “Uzbekistan Railways” JSC’s railway sections have incidents of trains colliding with people and animals (Fig. 1).

In order to prevent trains from hitting creatures, we will consider using noise generators to warn trains of approaching railway tracks [1-4].

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Identifying the place of installation of noise generators to transmit the warning signal of the approaching trains to the creatures

Based on the frequency of the signal within the range of noises that creatures can hear, the warning system for trains approaching stage sections where creatures congregate is activated (Table 1). Animals on railway tracks are alerted by means of a noise generator. The kind of animals that congregate in big numbers close to the railway section determines the noise generator’s operating frequency and the speaker’s power. Making sure that the railway automation and telemechanics systems are coupled with the creature warning system at the railway sections would easily fix the current issue [5-7].

A system for controlling train movement on a part of railway is built depending on the train’s speed in order to organize train movement on the railway sections. On high-speed sections, railway tracks are equipped with an auto-blocking system (Fig. 2, a). If the railway sections with single train activity have semi auto-blocking systems installed (Fig. 2, b) [8–14].

Fig. 1. Analysis of trains hitting people and creatures at JSC “Uzbekistan Railways”.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hitting creatures</th>
<th>Hitting people</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021y</td>
<td>95</td>
<td>61</td>
</tr>
<tr>
<td>2022y</td>
<td>71</td>
<td>40</td>
</tr>
<tr>
<td>07.2023y</td>
<td>45</td>
<td>36</td>
</tr>
</tbody>
</table>
Fig. 2. The method of giving a warning message to creatures moving on railway sections about approaching trains: a – if the stage is equipped with an auto-blocking system; b – if the stage is equipped with a semi auto-blocking system. R – road relay.

<table>
<thead>
<tr>
<th>#</th>
<th>Animal name</th>
<th>Hearing frequency level, [Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mouse</td>
<td>45-64000</td>
</tr>
<tr>
<td>2</td>
<td>Dog</td>
<td>67-45000</td>
</tr>
<tr>
<td>3</td>
<td>Cow</td>
<td>23-35000</td>
</tr>
<tr>
<td>4</td>
<td>Horse</td>
<td>55-33500</td>
</tr>
<tr>
<td>5</td>
<td>Sheep</td>
<td>100-30000</td>
</tr>
<tr>
<td>6</td>
<td>Deer</td>
<td>16-12000</td>
</tr>
<tr>
<td>7</td>
<td>Bear</td>
<td>300-70000</td>
</tr>
</tbody>
</table>
3 Algorithm of operation of the system of transmission of a warning signal from the approach of trains to creatures

Because the railway sections are equipped with an auto-blocking system, the operating algorithm of the system for providing a warning signal to creatures as trains approach (Fig. 4) is built as follows.

If the railway section approaching the train is equipped with an auto-blocking system, the gathering point of creatures that gather in large numbers near the railway section is studied. After that, the noise generator is activated through the back contacts of the road relays of the railway section where the system of warning of approaching trains is located.

If the railway sections approaching the trains are equipped with a semi-autoblocking system, in this case, the system that transmits the message about the approaching trains to the creatures, the noise generator is activated at the contact of the track relay of the rail chain or track sensors at the same distance from the point where the creatures gather in the even and odd directions [15-24].

The train’s occupancy of the section in the direction it is approaching must be verified, as must the activation of the noise generator via the section’s track relay’s rear contact, for the system to function. It is verified that, in the event that the noise generator is turned on, the animals are receiving an auditory alert about the impending trains.

Fig. 3. The scheme of connecting the noise generator to the railway track circuit or the sensors to the road relay.
Fig. 4. Algorithm for the operation of the system for transmitting a warning signal to creatures from the approach of trains.

4 Conclusion

When providing a warning to creatures about the approach of trains, the railway section is examined and the frequency of the voice warning message to warn creatures is determined. Based on the frequency of hearing, creatures are given a warning message about the approach of trains in the form of a warning message, ensuring that creatures are provided with a timely warning message about trains approaching this section. This is done in accordance with the automated system of notifying creatures about the approach of trains to creatures moving on railway sections. This technique warns critters of impending trains while reducing the chance that they may be struck by them.
References


