DESIGN OF ASL (ADVANCED SPACE LOCALISATOR) DEVICE

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Summary: Coupling of railway vehicles is an integral part of the railway traffic. Is a risk of incorrect approach of drive vehicle to standing towing vehicles and the possibilities of creation of large shocks leading to greater wear of bumpers or the occurrence of accident. Another dangerous situation arises in connection with a limited view of train driver from vehicle. There is a risk of personal injury or death for people, which is located in this area. This risk has been exacerbated in the case of using the remote control vehicle e.g. for shunting on the siding. ASL device developed at VSB - Technical University of Ostrava, Institute of Transport in cooperation with MSV Electronics, Ltd., aforementioned risk significantly reduced or completely eliminated.

Key words: rail vehicles, safety, vehicle coupling.

INTRODUCTION

Aim of the project TA 03011271 „Active safety system for object spatial localization between railway vehicles and ahead of it front ends“ is not only the realization of measuring the distance between vehicles, but also locating people and barriers in area, without the train driver visual control. This distance is transmitted to the locomotive control system and the system automatically stop locomotive when contacting bumpers.

1. ANALYSIS OF TRAIN DRIVER VIEW

The different types of locomotive arrangement have been analyzed. The analysis comes from the directives on the interoperability of the rail system. On fig. 1 is shown driver view range analysis of locomotive series 742, on fig. 2 is shown driver view range analysis of locomotive series 744.

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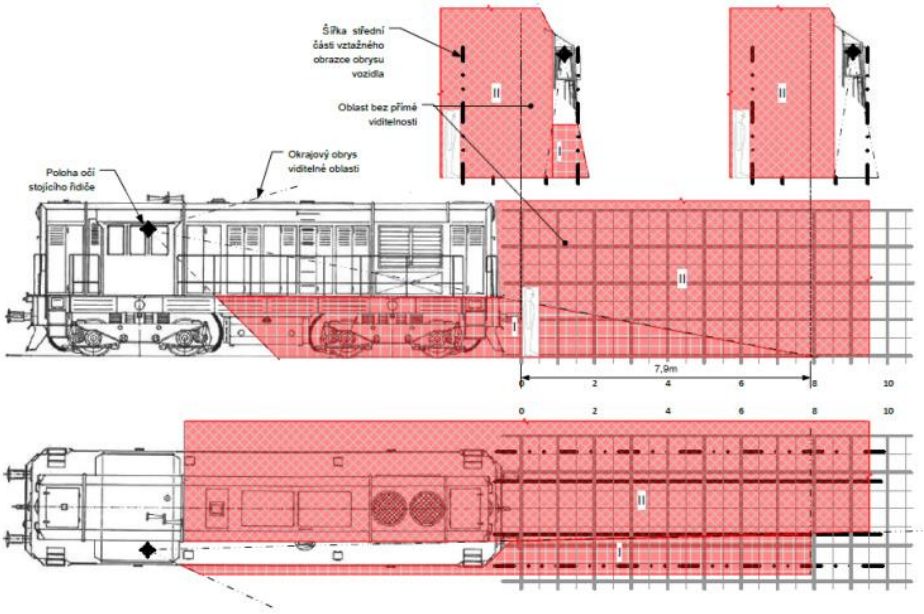

Source: Author

Fig. 1 - Range of view- locomotive series 742

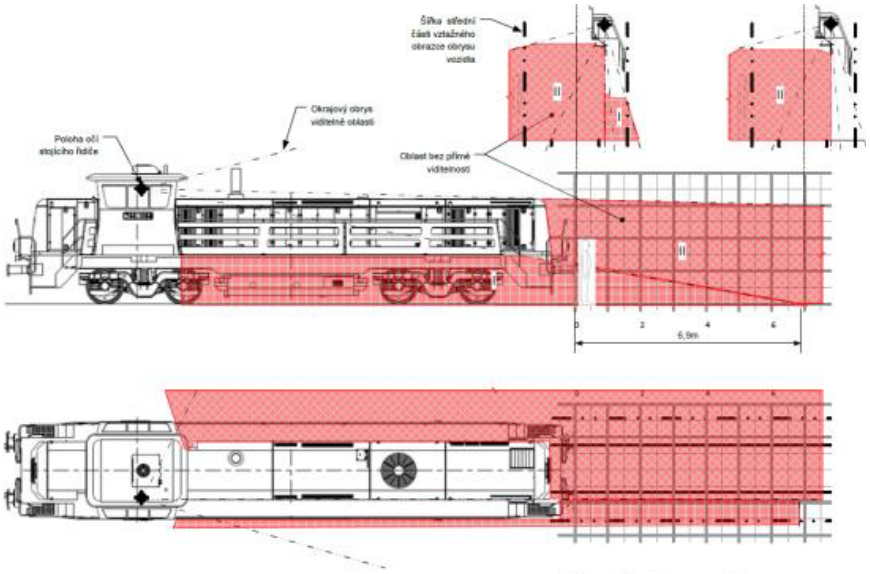

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Fig. 2 - Range of view- locomotive series 744

Comments to images - range of view

The worst situation is shown in fig. 1 when the area indicated as II. is not at all visual control of the driver, in the area I. drivers cannot see the bumper plate. Person about 170 cm tall standing in front of the bumper is visible for the standing driver, but person 130 cm tall (for example child) is visible at a distance of about 1 m from the bumper. Better situation is a locomotive series 744 where standing driver safely sees bumper plate and it is possible to

safely locate person with a height of 130 cm standing before the bumper. Even here in the area II. is not at all visual control. The analysis shows that the sensors monitoring the area in front of the locomotive must have a range at least 5 meters.

2. SENSORS SELECTION AND POSSITIONING

2.1 Sensors selection

Due to suitable properties for the detection of persons (barriers) in front of the vehicle and measuring the distance between the vehicles, will be chosen the ultrasonic sensor. With ultrasonic sensors we can measure distances from 30 mm to 10 m with accuracy of 1 mm. Some sensors have a resolution of 0.18 mm. Sensors measure in clean air and in color mist. Due to the requirements of the system were chosen two types of sensors with different characteristics.

Sensor for close detection

For people or barriers localization in front of the vehicle must be chosen ultrasonic sensor with a range of approximately 5 meters and a width of lobe max. 3 m, as follows from the analysis range of view of the train driver. In the case of wider lobe can be unwanted detections barriers outside the infrastructure gauge, for example from the platform etc. The selected sensor characteristic must be able to detect even very small reflective surface, typically a person dressed in soft confluent dress. After careful market survey were selected sensor with the characteristics given in fig. 3, the width of one piece of matrix is about 30 cm.

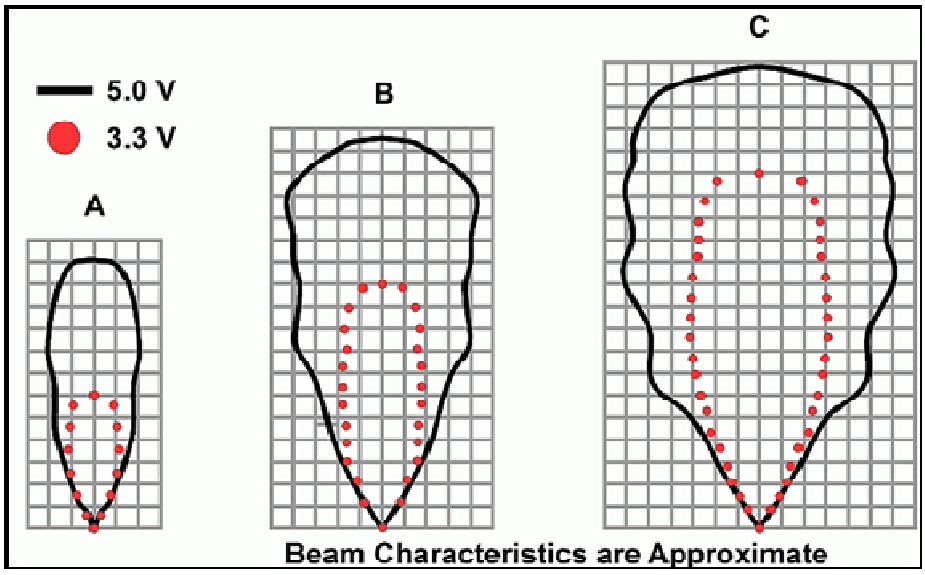

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Fig. 3 - Characteristics of sensor for close detection

Sensor for far detection

For automating coupling process of vehicles is in the first phase of approach, necessary detect frontal area of the stationary vehicle. Sensor of far detection must reach of 10 meters and very narrow shape of lobe. Reflection surface of frontal area of the stationary vehicle is relatively large, Reflection surface of frontal area of the stationary vehicle is relatively large, and so we can use the sensor with lower sensitivity than the sensors for close detection. After careful market survey were selected sensor with the characteristics given in fig. 4.

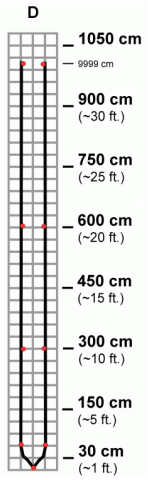

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Fig. 4 - Characteristics of sensor for far detection

2.2 Sensors positioning

Variants of sensors positioning and basic characteristics of sensors range are shown in fig. 5 and fig. 6. As a default solution was chosen table design locomotives with far detection sensor. The aim is to get a basic idea about the possible positions of the sensors. In terms of choice of the direction of radiation was desirable to eliminate, as much as possible, such undesirable reflections e.g. from sleepers.

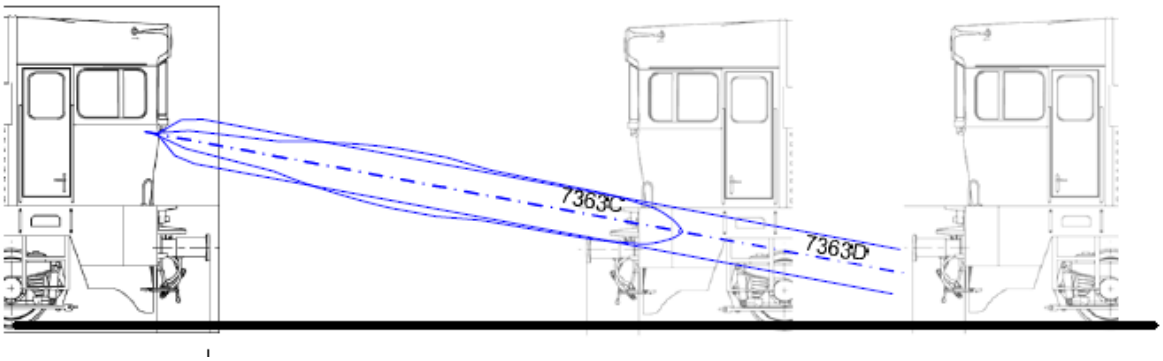

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Fig. 5 - The sensor in high position for far detection

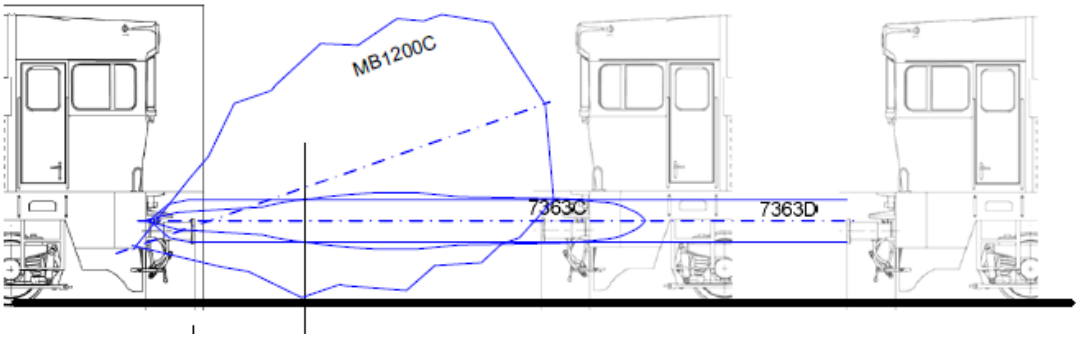

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Fig. 6 - The sensor in low position for far detection

3. CONCLUSIONS

This article processed the requirements for placement of ultrasonic sensors on the locomotive and sensor characteristics. Requirements were obtained by analysis of train driver range of view on different types of locomotives, table and tower configurations. The result of these analysis is using of two different types of sensors. First sensor for far detection will be used for automation and control of vehicle coupling process. Second sensor for close detection will be used for to barriers and people identification in front of the vehicle e.g. area without visual control of the train driver.

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