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Group of Experts on Improving Safety at Level Crossings

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Programme of Work:
Enforcement

Enforcement at Level Crossings

Submitted by the United Kingdom and France

This formal paper submitted by the subgroup comprised of Network Rail (United Kingdom) and SNCF (France) provides a report of analysis of the GE.1 survey regarding enforcement of regulations at level crossings.

1. Background

The programme of work for the United Nations GE1 working group on level crossing safety included a review into the effect that enforcement had on user behaviour and level crossing risk.

There is a broad range of incident types and causal factors relating to accidents at level crossings. These causes align with the different user groups such as; road vehicle users, equestrians, cyclists and pedestrians. At public road level crossings risks can include;

- Road vehicle driver deliberately ignores the road traffic lights and weaves around the barriers
- Late braking on the approach to a level crossing
- Vehicular traffic blocking back over the level crossing
- Pedestrian climes over/goes under barriers and crosses in front of train
- Pedestrian slip/trip/fall on the level crossing

Some of the causes relate an error on the part of the user and others relate to deliberate violations. The following Generic Error Model illustrates how switching occurs between the different types of information processing in tasks.

Figure 1

The degree of risk associated with the accident types also varies according to the protection at different level crossing types (see the tables in Appendix A). For example, in the UK there is a

different degree of risk for a road vehicle driver who weaves around lowering barriers at a full barrier crossing than there is for a road vehicle driver who weaves around lowering barriers at an automatic half barrier crossing. The full barrier level crossing would have over two minutes of warning time before the train arrives as well as signal protection requiring positive confirmation that there are no obstructions before the train is allowed to proceed over the crossing. At an automatic crossing there would only be around 27 seconds of warning time before the train arrives and there would be no signal protection, no positive confirmation of lack of obstruction and the train will proceed over the crossing regardless of whether an obstruction is present. At private level crossings, the risk is different again. There is unlikely to be any warning of approaching trains and the crossing is likely to be lightly used, however heavy agricultural vehicles may use the crossing – perhaps intensively over a short period of time.

The violation human failure modes are especially relevant regarding enforcement. Descriptions and examples of the four modes are;

- Routine violations – where a road vehicle driver regularly disregards red road traffic lights at level crossings as a normal pattern of behaviour
- Situational violations – where a normally compliant driver disregards a red road traffic light due to their situation, for example they are late for an important appointment
- Exceptional violations – where a person deliberately disregards the red road traffic lights due to exceptional circumstances, for example to 'shunt' a stationary vehicle off the level crossing to prevent a collision
- Optimising violations – where a road vehicle driver purposefully disregards red road traffic lights for [perceived] personal gain, for example the thrill of deliberate risk taking

Enforcement is likely to have the greatest effect on 'routine' violations followed by 'situational' and 'optimising' violations. It is also possible that enforcement could reduce human error if highly visual enforcement equipment raised people's situational awareness. However, it is not clear how much effect enforcement has in member states.

The UN Group wanted to evaluate the effect enforcement has on level crossing user behaviour and how that affects risk. A questionnaire was produced and issued to member states in June 2014 (see Appendix B). The questionnaire covered a number of topics, including a section on

enforcement (see Appendix B Section E). The questions were aimed at gaining a basic understanding of whether countries used enforcement at level crossings, what techniques were used to detect violations, whether enforcement data was collected and what problems are encountered. The results of this section of the questionnaire were presented to the GE.1 group in October 2014. Twelve member countries responded. It was clear that further detail was needed.

A second questionnaire was issued in December 2014 to collect more detailed information about legislation, enforcement, technology and how data is used (see Appendix C). Responses were received from twelve member countries. Analysis of the results was carried out between March – May 2015 and the results were presented to the UN Group on 16th June 2015.

2. Results

2.1 Legislation

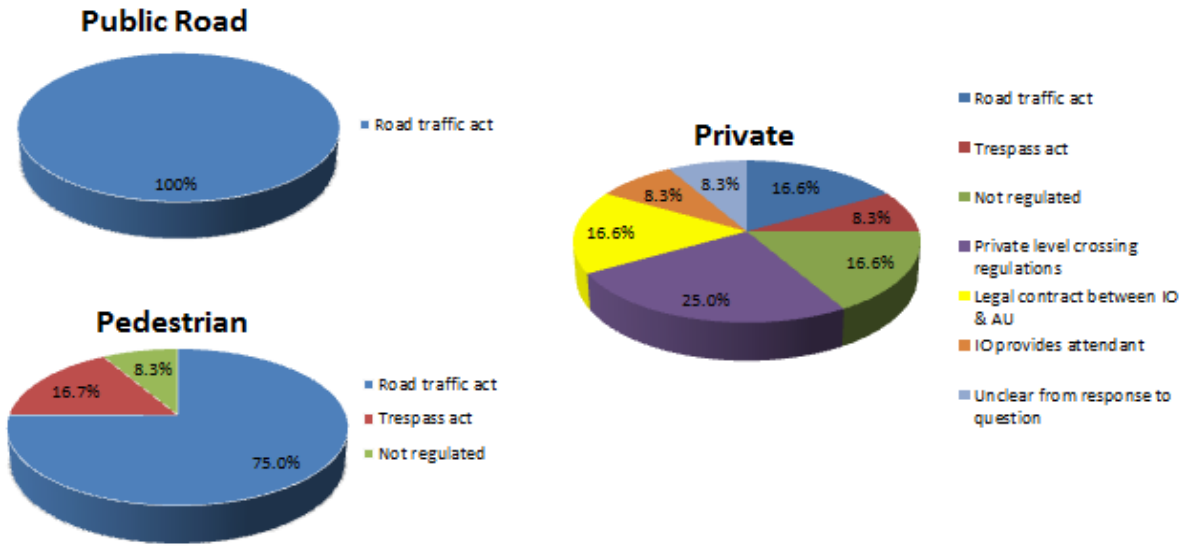
The first area explored by the questionnaire was the legislation in place within member countries and the types of enforcement used. The key elements to cover under 'legislation' were;

- Whether legislation covers the key areas of violation throughout member states, and
- Whether legislation gives the enforcement agencies the legal powers to enforce safe use

In terms of legislative provision, all respondents reported that they had legislation in place for road vehicle users on public roads. Also, 75% of respondents had the ability to use the legislation for public road users to enforce safe use by pedestrians. However, there is much less consistency around legislation for private level crossings (see Figure 2 below).

It was noted that in the UK legislation is weak around pedestrian use of public road level crossings. The police have limited powers with regard to pedestrian users who chose to ignore warnings of approaching trains. There is scope for the UNECE member states to optimise legislation and/or Infrastructure Manager's powers at private level crossings (see Recommendation 1).

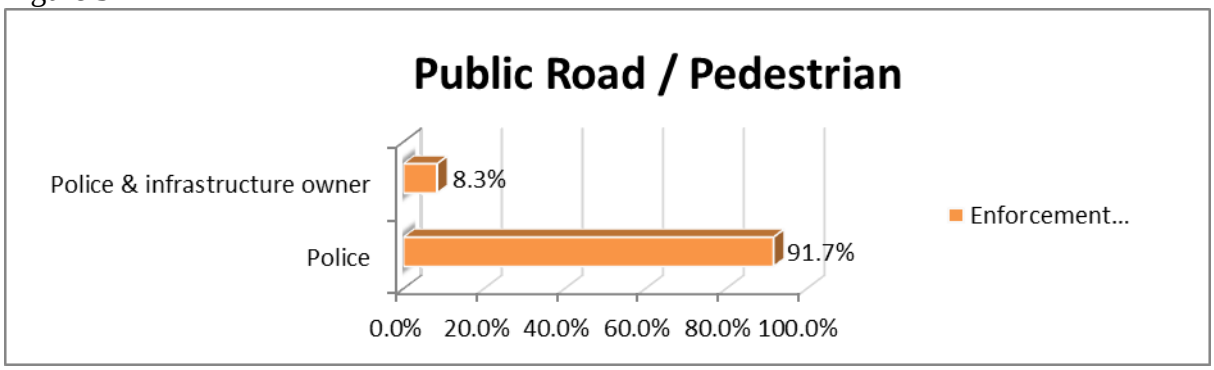
Figure
2



2.2 Enforcement Agencies

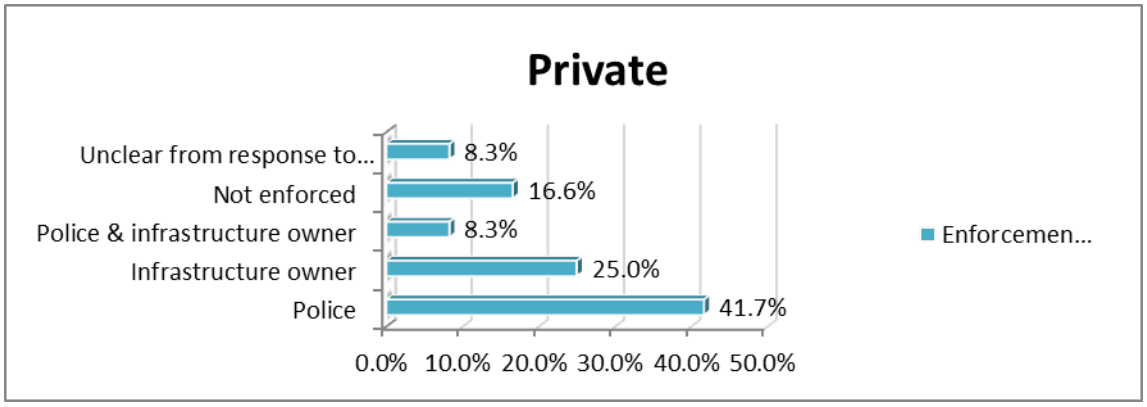
All respondents stated that the police were responsible for enforcement of public road crossings, with one country stating that the infrastructure owner also had some responsibility for enforcement on public road level crossings alongside the police. Note: the term 'police' included national, regional or railway police.

Figure 3



There is much more inconsistency with regard to enforcement at private level crossings. The infrastructure owner is expected to take a greater level of responsibility for enforcement at private level crossings compared to public road level crossings. This should be reflected in any work-stream to address Recommendation 1.

Figure 4



2.3 Detection Methods

Figure 5 below shows that, for public road level crossings, 50% of respondents rely solely on the police to detect road vehicle violations (as well as to prosecute or take other enforcement action). For pedestrian violations the figure is even higher with 75% relying solely on the police to detect infringements.

For private level crossings more onus is placed on rail staff and some member states have no method of detecting violations.

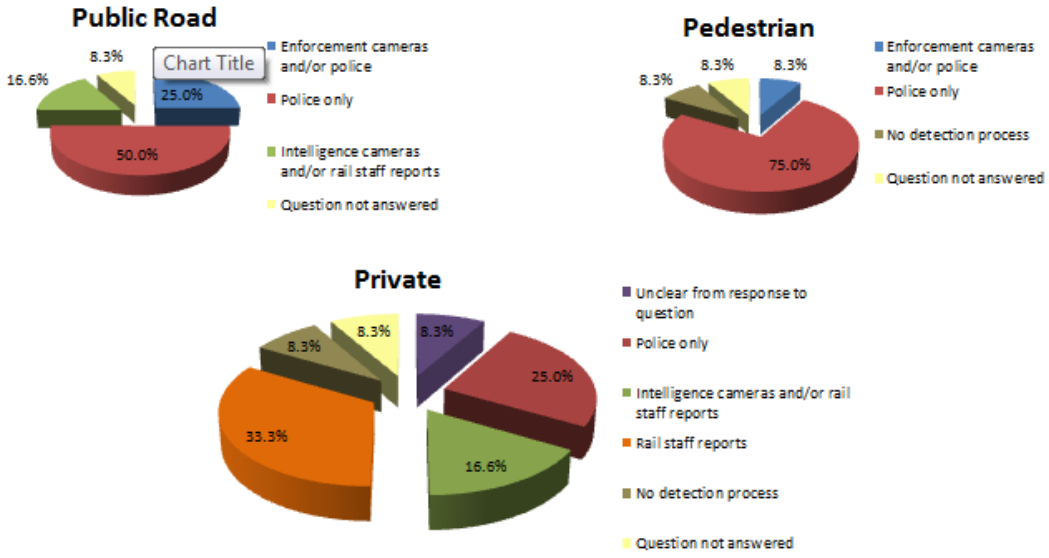


Figure 5

The police have limited resources and the use of police officers is inevitably labour intensive and expensive. Cost, resource constraints and other practicalities – including the safety and welfare of officers – means that 24 hour, 7 days per week detection could never be provided by the police. Detection of violations through police only is, therefore, sporadic and dependent on resources and tasking commitments. It is also largely out of the Infrastructure Manager's control.

Enforcement cameras are being introduced in some member countries. However, even in those countries, cameras are only in place at a tiny proportion of level crossings. For example, in the UK, there are currently 16 Mobile Safety Vehicles and 16 operational fixed enforcement cameras. This provides the potential to detect violations at 32 level crossings out of circa 1,500 public road crossings (2%).

These results highlight the fact that there is currently no comprehensive means of detecting violations at the vast majority of public road level crossings. There is even less capability for detecting violations at private level crossings.

2.4 Technology

The only enforcement technology in use is camera based.

Some of these camera systems provide intelligence only and are not used directly for enforcement. However, they may be used by Infrastructure Managers and police to identify problem locations prior to deploying police officers or dedicated enforcement cameras. Some use motion sensors to commence recording while some are on continuous recording loops.

Other camera systems, however, are dedicated enforcement cameras. Within this sub-set there are variations around how the various camera systems are operated with regard to;

a) The status of the level crossing [for red light enforcement cameras] i.e. 'arming' the cameras when the lights go to red. Some systems use video analytics, some use voltage readings etc.
b) Detecting road vehicles that violate the red lights/regulations. Some systems use radar [speed cameras], some use ground induction loops, some use video analytics and others use motion sensors.

One of the obvious benefits of camera systems is that they can provide still or moving images of the infringement making it unlikely that the enforcement action will be challenged by a third party. However, as stated in section 2.3 above, even in countries where cameras are used they are currently deployed at very few level crossings.

Detection cameras or intelligence gathering cameras are used in the following countries; UK, France, Republic of Ireland, Hungary and Lithuania.

		Status		Application		
Technology	**Country**	**Fixed**	**Mobile**	**Public Road**	**Pedestrian**	**Private**
Camera - video analytics	UK	✓	X	✓	X	X
Camera - no auto detection / continuous recording	UK	✓	✓	✓	X	X
	Rep. of Ireland	✓	X	✓	✓	✓
	Hungary	✓	X	✓	X	X
Speed camera (radar)	France	✓	X	✓	X	X
Ground induction loops (red light)	France	✓	X	✓	X	X
Motion sensors	Lithuania	✓	X	✓	X	X

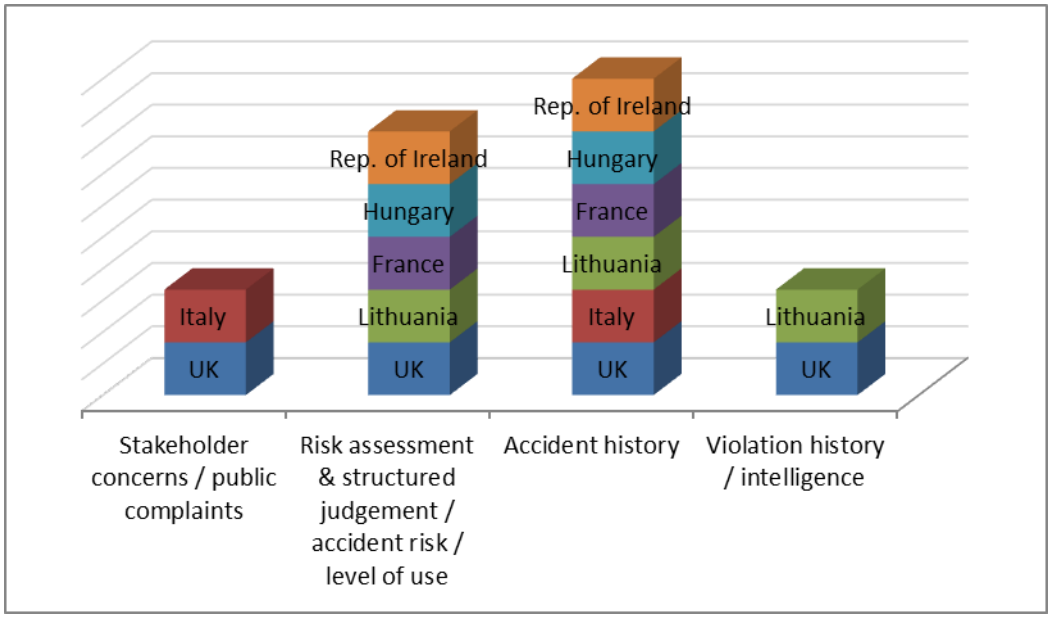
Note: Italy use CCTV, but this is not linked to the police authority

2.5 Technology Site Selection

Within the countries that utilise technology, site selection for deployment is based on a variety of criteria. As seen in Figure 6 below, accident history [reactive] and risk assessment/structured expert judgement [proactive] are the most widely used decision making criteria for site selection.

In addition, stakeholder concerns/public complaints and violation history/intelligence are used in some countries to select sites for deployment of technology.

Figure 6 – Technology Site Selection

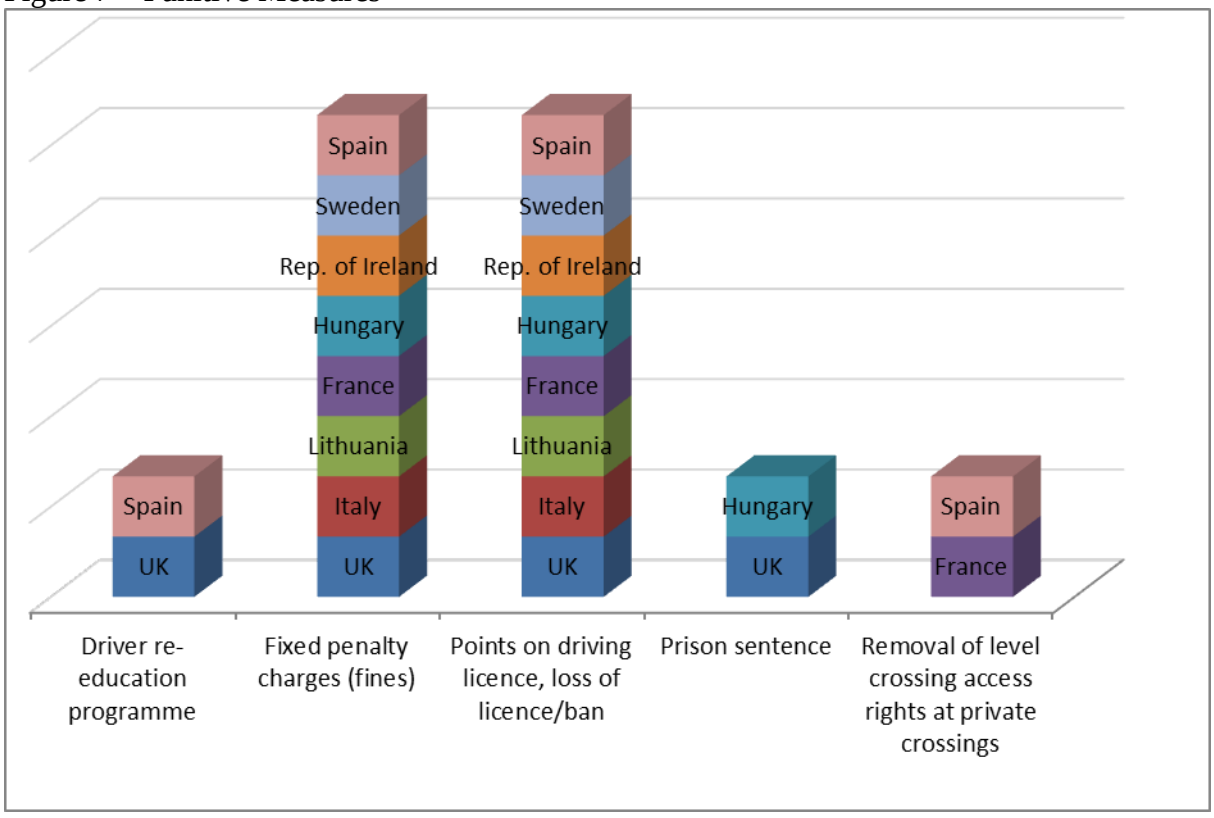


Site selection appears to be consistently based on an individual level crossing basis. No countries currently install detection technology as routine or standard at the time of renewal/installation. No countries have yet instigated a major fitment programme of camera technology.

2.6 Improving User Behaviour

Finally, the questionnaire and subsequent analysis looked into the punitive measures used in member countries. The most widely used punishments available are fixed penalty charges (fines) and points on licence through to loss of licence for road vehicle drivers. For the worst, most dangerous, offences this can lead to prison sentences in two countries. Two countries also use driver re-education programmes. Interestingly, at two countries abuse of safe protocols at private crossings can lead to removal of access rights.

Figure 7 – Punitive Measures



Some analysis has been carried out which suggests that re-education programmes have an effect of reducing re-offending rates. However the main purpose of detection technology [cameras] is to ultimately deter members of the public from violating laws to safeguard safe protocols. Prevention is far more preferable for Infrastructure Managers compared to simple detection and prosecution. It is only through prevention that detection cameras achieve risk reduction. There is very little analysis available to offer solid conclusions as to whether enforcement cameras affect user behaviour – or by how much (see Conclusion)

3. Conclusions

There is inconsistent legislative provision to support enforcement at private level crossings. The result of this is that some countries do not effectively enforce compliance with legislation and safe protocols at private level crossings (see Rec 1).

Most countries rely entirely on police for detection of violations at level crossings. Technology to support enforcement is new and emerging. It is not used extensively anywhere at this time. Even in countries with emerging detection technology, Infrastructure Managers still mainly rely on police for detection. Inevitably the police cannot provide extensive coverage, therefore, users know that violations at level crossings are unlikely to be detected and result in punishment. Technology offers a potential solution to this problem, it could provide wide-scale permanent and consistent detection coverage across the level crossing estate.

There has been very little analysis and evaluation carried out into the effect of enforcement on user behaviour. Such analysis is needed in order to define how much risk reduction enforcement can achieve and how it can be optimised. This is necessary in order to provide the basis for the safety case/business case for member countries investing in camera detection technology (see Rec 2). This will inform whether there is a true potential for a wider roll out of technology throughout member countries.

4. Recommendations

1)The UNECE Member States should consider ways to optimise legislation and/or Infrastructure Manager's powers at private level crossings.

2)A Project should be initiated to carry out detailed evaluation of the effect of enforcement on user behaviour. This should include before/after benchmarking exercises to quantify whether violations [and risk] reduces once detection technology has been installed at level crossings, if so by how much, and whether the beneficial effect is long term.