



Technical note

Noise and disturbance caused by vehicles crossing cattle grids: Comparison of installations



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ABSTRACT

Cattle grids are used on roads and tracks to prevent grazing animals from leaving an open space without fencing onto a more controlled area where access to the road from surrounded land is more limited. They are widely used in the UK at the entrances to common and moorland areas where animals are free to roam, but also on private drive entrances. Typically, they consist of a series of metal bars across the road that are spaced so that an animal's legs would fall through the gaps if it attempted to cross. Below the grid is a shallow pit that is intended to further deter livestock from using that particular crossing point. The sound produced as vehicles cross these devices is a characteristic low frequency “brrrr” where the dominant frequencies relates to the bar passage frequency under the tyres. The sound can be disturbing to riders and their horses and walkers and residents living close by as evidenced by press reports and the need to consider noise aspects in planning for new installations. For this reason and due to the lack of available information on the size and nature of the problem measurements and recordings have been made at a number of sites in Yorkshire in the UK. In addition, questionnaire surveys of residents living close by and façade measurements have also been used to gauge impact. Results show that there is a wide variation in the maximum noise level produced by cattle grids of apparently similar design. This can be related to impact noise produced by the movement of all or part of the grid as the frame comes under impulsive loading as the vehicle crosses. It was further established that some residents living close to the cattle grids were disturbed by the noise, and in some cases vibration, and wanted them removed or suitably modified.

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1. Introduction

Cattle grids are widely used to prevent grazing animals from leaving unfenced farmland or moorland onto more controlled spaces where access to the road is prevented by walls, fences or hedges. Typically, they consist of a grid of regularly spaced metal bars with a shallow pit beneath. They are designed so that an animal's leg would fall through the grid if attempts were made to cross. There is design guidance set out in BSI 4008 2006 [1]. This gives the range of spacing and widths of the individual bars. The gaps between bars should be in the range 130–150 mm and the running surface of the bars should be 30–40 mm wide if of rectangular section.

Fig. 1 shows an installation on the entrance to Baildon Moor (Site Baildon B) north of Bradford in West Yorkshire. It consists

of 11 rectangular topped steel bars of width 75 mm set at right angles to the road at 200 mm centres.

Noise associated with vehicles crossing these installations, which is typically a low frequency ‘brrrr’ is often the main reason why people living in the vicinity of cattle grids complain to the planning or highway authorities. Within the United Kingdom cattle grids are often located in areas of public amenity, such as the urban-rural fringe, National Parks, ancient commons and Areas of Outstanding Natural Beauty (AONB), all of which attract large numbers of visitors on a daily basis. The perceived degradation of environmental quality caused by vehicles continually crossing cattle grids in these areas was partially assessed in a controlled laboratory study carried out by the University of Bradford in 2013 [2]. The study examined the extent to which the introduction of congruent mechanical and natural soundscape components into video recordings of a range of natural environments, influenced the perception of tranquillity and wildness. It was found that the introduction of cattle grid noise reduced tranquillity ratings significantly.

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Fig. 1. Cattle grid installation on Baildon Moor (site Baildon B).

Disturbance to peace and quiet and to the overall tranquillity of a location by the installation of a cattle grid, is a concern that is regularly reported in the press and articulated to the UK Government's Department of Transport (DoT) inspectors [3–8].

The aims of this preliminary study were to investigate the size and nature of the problem and evaluate effects on residents living nearby. It was expected that the findings would be of use in further more detailed studies leading to solutions.

2. Method

2.1. Outline of approach

Roadside measurements of vehicle noise were carried out at 2 sites near Baildon, 3 sites in Ilkley (both groups near Bradford) and at 2 sites on the A684 east of Sedburgh in the Yorkshire Dales. Vehicles were selected from the traffic passing ensuring they were freely moving and not in close proximity to other vehicles. In addition, measurements were carried out using a test vehicle at these and further locations at a fixed speed for accurate comparison of noise produced across sites. Finally, façade measurements at homes where residents were affected by the noise from cattle grids were also taken.

The approach adopted included roadside measurements of the maximum noise produced by vehicles crossing the cattle grids in both directions, where safe and practical to do so, and recordings of the sound produced by a test vehicle for later analysis. L_{Amax} was the preferred measure as the nature of the sound was less than a second in duration. All sites were on minor single carriageway roads where average vehicle speeds were generally in the range 40–50 km/h. For the purpose of characterising the noise produced a Bruel and Kjaer sound level meter type 2250 was used for capturing maximum A weighted levels using fast averaging and additionally for recording a few seconds from a test vehicle cruise-by for post processing. Measurements were confined to light vehicles i.e. cars and vans as there were very few heavy vehicles on these minor single carriageway roads and it would have taken too long to obtain a valid sample.

2.2. Measurement of noise selected from passing traffic

The method employed was guided by the statistical pass-by standard of measurement method described in ISO 11819-1 [9]. Due to restricted level ground at the sites the distance to middle of the nearside lane was fixed at 5 m and not 7.5 m as given in this standard. At some sites far side measurements were also carried out and distance corrections made to enable comparisons with nearside measurements. The microphone height was 1.2 m which conforms with ISO 11819 – 1. The method involved sampling vehicles that were freely moving and widely separated from other

vehicles so that the noise of the selected vehicle was not contaminated by other vehicles on the road. The approach speed to the cattle grid was measured using a radar speed meter (Bushell Velocity speed gun) positioned close to the edge of the carriageway. A sample of between 60 and 110 vehicles were obtained on the higher flow roads but on roads carrying very little traffic it was only possible to sample between 10 and 40 vehicles and in some cases the samples were too small for statistical analysis. However, measurements with a test vehicle was made at all sites. All measurements were conducted with a wind speed less than 2 m/s and background noise levels at all sites were low <55 dB(A). Where possible measurements were also made on adjoining road surfaces (i.e. without cattle grid) with the test vehicle.

2.3. Measurements with a test vehicle

For the purpose of making detailed comparisons of the noise produced from different installations a test vehicle was used and driven over each cattle grid at a speed of 40 km/h. The test vehicle, a Toyota Yaris, was a front wheel drive compact and had a wheelbase of 2.44 m and a kerb weight of 830 kg. The crossing speed was chosen to be close to the average observed crossing speed across sites of vehicles in the traffic stream. Again the maximum A-weighted dB level on fast averaging was recorded on site and short recordings taken for post processing.

2.4. Measurement near homes of residents affected by noise

To determine the size and nature of any noise and vibration disturbance caused by vehicles crossing cattle grids, questionnaires were posted to homes within an approximate radius of 150 m from two cattle grids located near to residential areas i.e. sites Baildon A and Ilkley A. Each questionnaire was accompanied by a postage paid reply envelope and permission was sought to allow measurements at their home if it was thought appropriate. In all, measurements near the facades of four such homes were carried out. The distances from the cattle grids ranged from 7.7 m to 122 m. Fig. 2 show maps of the cattle grid sites situated close to dwellings with concentric circles centred on the cattle grids to indicate distance. The four measurement positions are indicated with asterisks.

3. Results and analysis

3.1. Passing traffic

Plots were made of the captured L_{Amax} against crossing speed for each installation. Measurements made to vehicles travelling in the far side lane were normalized to a distance of 5 m for comparison purposes. For this purpose, a simple correction based on

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