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# Appendix 1: Methods of speed data collection

### Methods involving timing

The increasing availability of electronic time and data recorders has meant that manual timing of vehicles using a stopwatch is now used only as a last resort. The passage time of a vehicle between two detectors, a measured distance apart, can easily be recorded. Detectors can include pairs of pneumatic tubes, tribo- and piezo-electric cables, switch tapes, inductive loops and photo-electric or electro-magnetic beams.

### Microwave radar gun

A microwave beam is sent to the target vehicle, which reflects back a signal to the receiver in the radar gun. The moving vehicle affects the frequency of the returned signal. By measuring the amount of frequency shift and the duration of the time interval, the speed of the targeted vehicle can be determined. A microwave radar gun has a wide cone of detection, which is about 70 m at a range of 300 m.

### Direct measurement using laser guns

The laser infrared gun has a small detection cone of about 1 m in diameter at a distance of 300 m between the laser gun and the targeted vehicle. The equipment relies on the measurement of the round-trip time of the infrared light beam to reach a vehicle and be reflected back.

### Methods involving video

Video can be used to determine vehicle speeds and is becoming increasingly cheaper to use and operate. The general method involves recording the distance moved by a vehicle in a short period (perhaps a couple of frames), then computing the speed.

Manual data extraction from a video recording is time consuming, tedious and expensive, making the technique not particularly useful for routine surveys. However, the continuing development of automatic data extraction procedures should make vehicle speed data collection from video a cost-effective alternative.

### Global positioning system

Vehicles can be fitted with receiver units that pick up signals from the Global Positioning System (GPS) satellite network.

The accuracy of code-based differential GPS (DGPS) accuracy is about 2–3 m with a baseline distance (i.e. range of coverage) of 100–200 km.

# Appendix 2:
# Speed enforcement – Victoria, Australia

In 2002, a Ministerial road safety forum identified the need for radical actions to be implemented and launched the *arrive alive! 2002–2007* strategy, with a strong focus on behavioural change programmes, such as speed enforcement. Key initiatives for the speed enforcement component of *arrive alive!* included:

- increased attention to 'lower level speeding' by reducing the threshold speed (i.e. the trigger speed at which the cameras are set or the enforcement level applied by on-road policing)
- intensifying enforcement efforts – more hours for the mobile camera programme and more fixed cameras
- making enforcement more unpredictable – including implementing 'flashless' mobile cameras and a mix of marked and unmarked police vehicles. Reviewing the sanctions for speeding.

The Victoria Auditor-General's 2006 review of the state's speed enforcement programme considered (among other things) whether the speed enforcement programme had been effective in reducing speed and road trauma.

The review concluded the programme had been very effective. In 2005, for the first time, average travel speeds in metropolitan Melbourne's 60, 70 and 80 km/h speed zones were below legal speed limits. However, in 100 and 110 km/h speed zones across the state, compliance with speed limits had not improved. In each of these zones, around 15% of drivers still travelled at speeds above the speed limit.

*arrive alive!* sets ambitious targets, aiming for a 20% reduction in deaths and serious injuries by 2007. During the first four years of the strategy (2002–2005), there was a reduction of around 16% in fatalities. In August 2006, Victoria reached its lowest fatality level over a 12 month rolling period.

Road crashes occur as a result of many causes; it is therefore difficult to conclude that the reduction in road trauma is solely because of improved compliance with speed limits. However, the greatest reductions in trauma have been in the lower speed zones, which are the most intensively enforced. There have also been significant reductions in pedestrian trauma and severity of serious injuries – two measures sensitive to changes in travel speeds. These factors suggest that improved compliance with speed limits has been a major contributor to trauma reductions.

Source: Australian Transport Council. *National Road Safety Action Plan, 2007–2008.*

# Appendix 3: Examples of suspension or withdrawal of driving licence and other non-monetary penalties applied to speed offences

| Country | Amount of speeding, km/h or other criteria (specified) | Duration of suspension or withdrawal | Other penalty |
|---|---|---|---|
| **Australia (Victoria)** | 25–34<br>35–44<br>45 + | 1 month<br>6 months<br>12 months | |
| **Canada** | **Demerit points**<br>10–15<br>(6 during new-driver probationary period) | First suspension: 1–3 months<br>Subsequent suspensions: 2–6 months | |
| **Denmark** | % above speed limit | **First offence:**<br>Conditional suspension of licence for 3–5 years. You still have the right to drive | **First and subsequent offences:**<br>Supervised driving test is required before reinstatement of licence |
| **For cars and light trucks without a trailer:** | > 60% | **Subsequent offences:**<br>Withdrawal of licence for 6 months to 10 years, or permanently | **First offence within 3 years of obtaining first driving licence:**<br>Special driver training and supervised driving test |
| **For HGV, buses, vehicles with a trailer etc:** | > 40% (> 60% in 30 km/h zones) | **First offence within 3 years of obtaining first driving licence:**<br>A general prohibition of driving will replace suspension of the driving licence | |
| **France** | > 50 | Withdrawal of licence for 3 years | **50 km/h with recidivism within 3 years:** Up to 3 months imprisonment |
| **Greece** | > 40 or exceeding a speed of 140 km on motorways, 130 km on highways, 120 km on other roads | Withdrawal of licence for 1 month | |
| **Korea** | **Demerit Points**<br>> 40<br>> 120<br>> 200<br>> 270 | <br>Suspension for 1 year<br>Withdrawal for 1 year<br>Withdrawal for 2 years<br>Withdrawal for 3 years | |
| **Poland** | **Demerit points**<br>20 or 24 | Not specified | **Upon withdrawal of licence:**<br>1. Drivers licensed for less than 1 year, with more than 20 demerit points: training and written and driving test for new driving licence<br>2. Drivers licensed for at least 1 year, with more than 24 points: written and driving test WITHOUT training |
| **Portugal** | > 30 ≤ 60<br>> 60 | 1 month to 1 year<br>2 months to 2 years | Compulsory training;<br>cooperation on road safety campaigns |

Source: 2008, Australian Transport Council. *National Road Safety Action Plan, 2007*

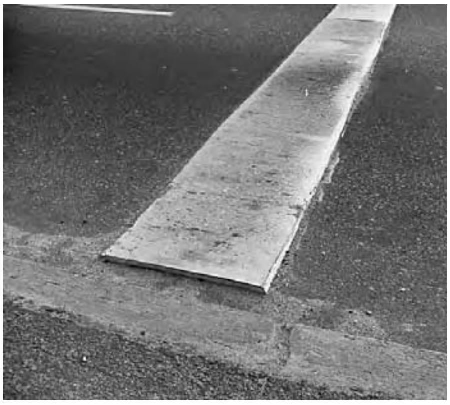
# Appendix 4: Traffic calming in Ghana – rumble strips and speed ramps

*Traffic calming* is the term given to self-enforcing engineering measures designed to reduce vehicle speeds – and sometimes vehicle flow – in the interests of safety. Engineers in the UK, Holland and Denmark have pioneered work on this. They used *rumble strips* to alert drivers to the need to slow down, and vertical and horizontal deflections to force them to slow down. These vertical deflections are better known as *speed ramps* – or *road humps.*

Rumble strips and humps were first introduced in Ghana about five years ago, and they have since become very widespread. They are often installed on newly built roads in response to complaints or concerns about high speeds. Sadly, however, almost no attempt has been made to check whether they do reduce speeds and road crashes, and by how much. Engineers are trying different designs, but they are doing this without evidence on what works and what doesn't. It cannot be assumed that the results of studies done in Europe will be valid for Ghana.

In order to evaluate these measures properly we need 'before and after' studies. In the absence of these all we can do is make an 'after assessment' based on speed surveys (for some measures) and observation.

## Assessment

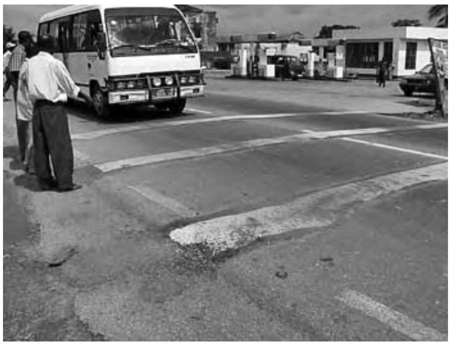


### Rumble strips

They are about 15–25 mm high and made of thermoplastic or concrete. They are usually laid in a pattern – typically 3 groups of 4 or 5 strips. Sometimes the width of the strip and the spacing (within the group and between groups) is varied in order to make the 'rumble' more noticeable if the driver does not slow down – but there is no evidence that this has any effect. The first rumble strips were installed at Suhum on the Accra – Kumasi road. A 'before and after' evaluation undertaken by BRRI concluded that accidents had reduced. They have been very widely used since. Cost: 650,000 Ghanaian Cedis per metre (2005).

Although rumble strips are designed only to alert drivers, the hope is that they will also slow them down. Observation shows that a minority of drivers do slow down – but most drivers quickly realize that the faster they cross them the less 'rumble' and discomfort they experience. The strips wear down gradually, so need to be reshaped every year or so.

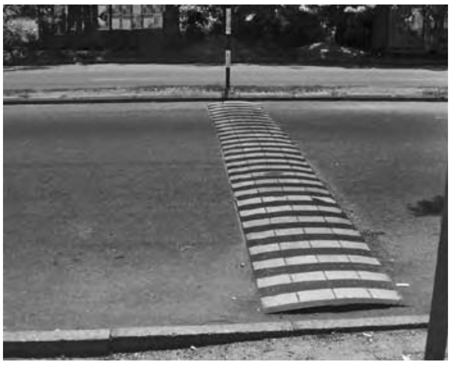
*Conclusion:* not very useful on their own, but helpful as a warning of speed ramps or other severe hazards.



**Mini-humps in asphalt**

They are typically about 35 mm high and 500 mm wide. They are made of asphalt, which is roughly formed into a round-topped hump. A white line marking is added to make them more visible. One of the first sites where they were tried was at Ejisu on the Accra – Kumasi road, and they were later used on the new Tema – Akosombo road. Observation suggests that they are perhaps too severe in the way they reduce speeds, because of the severe discomfort caused if drivers try to travel over them at anything greater than about 10 km/h. Long vehicles and articulated vehicles are particularly affected, and their suspension may suffer. On busy roads this type of speed ramp may cause traffic to queue back a long way. Cost: 1,200,000 Ghanaian Cedis per metre (2005).

*Conclusion:* excessively tough on drivers (and their vehicles) – better alternatives exist.



**Pre-fabricated mini-humps**

These round-topped mini-humps made from recycled tyres are about 40 mm high and 900 mm wide. They are nailed to the road. They have been used in Cape Coast and a few places in Accra. Observation shows that they are quite effective in reducing speeds. A survey at a site on a dual carriageway arterial road recorded the mean speed of vehicles crossing the mini-hump as 33 km/h (85th percentile: 42 km/h). Discomfort and vehicle wear does not seem to be excessive. Cost: 2,000,000 Ghanaian Cedis per metre (2005).

It is reported that sections of the mini-hump sometimes come loose, and cannot easily be re-fastened.

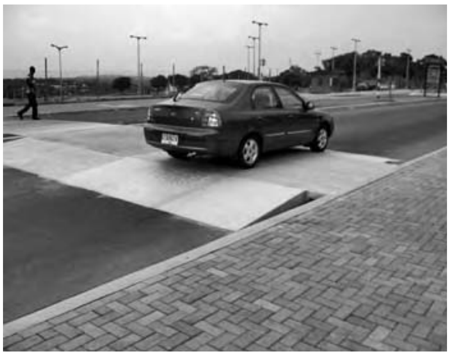
*Conclusion:* perform well but maintenance problems may preclude wider use.

**Standard 3.7 m speed ramp**

The standard ramp is round-topped, 100 mm high and 3.7m wide. This Ghanaian version, incorporating concrete block paving set in mass concrete haunches, works well and has been very widely used. Observation shows that it reduces vehicle speeds to about 15–20 km/h, and, when spaced at about 100 m intervals, it can control mean speeds to about 30 km/h. Cost: 1,450,000 Ghanaian Cedis per metre (2005).

The concrete haunches should be painted to make the ramp more visible.

*Conclusion:* this is the best choice of speed-reducing measure for local roads, especially where there are large numbers of pedestrians using the road. However, it is too severe for use on arterial roads.



**Flat-topped speed ramp**

In some countries flat-topped humps are used at zebra crossings – and are effective in slowing down vehicles sufficiently to enable pedestrians to use the crossing safely. The flat-topped platform should normally be 75–100 mm high and at least 6 m wide; the ramps should have a maximum slope of 1:13. The ramp can be constructed of reinforced concrete or asphalt. The ramp illustrated is at Kotoka International Airport, but the design is too severe for general use.

*Conclusion:* worth trying at zebra crossings on local roads where the volume of traffic is such that pedestrians have to wait too long before they can cross.

**9.5 m speed ramp**

This is a Danish design – it is a round-topped hump, 100 mm high and 9.5 m wide. It is made of asphalt. It has been used on the approach to villages and other potential hazards areas on the Takoradi – Agona road (see illustration). Rumble strips provide a warning. Observation shows that the ramps are effective in reducing speeds. A survey at one ramp recorded the mean speed of vehicles crossing the ramp as 45 km/h (85th percentile: 55 km/h). Discomfort and risk of vehicle wear seem to be minor.

Constructing these ramps may not be easy – some of those on the Agona road show deformations, possibly because of inadequate compaction.

*Conclusion:* good choice of traffic calming measure for villages on trunk roads; possible potential for speed reduction on urban arterials.