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How to assess the situation

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MODULE 1 explained why speed management is needed to reduce the large numbers of fatalities and injuries associated with unsafe speeds. However, before designing and implementing an effective speed management programme, it is important to assess the existing situation.

The sections in this module are structured as follows:

2.1 What do you need to know? An effective speed management programme will be based on an understanding of both the extent and nature of the problem in a country, as well as any key underlying factors contributing to it. Essential information in understanding the existing situation in relation to speed will include awareness of:

- existing road hierarchies by function
- activities occurring on the roads (particularly vulnerable road-user activity)
- data on crashes
- speed levels
- speed involvement in crashes
- the existing legal position for speed limits
- speed compliance
- attitudes to speed.

2.2 How to measure the problem: This section shows how to determine the prevailing travel speeds and how to determine the extent of speed related injury risk. It also considers why many people do not comply with speed limits and discusses the need for an appreciation of community attitudes towards potential speed management initiatives.

2.3 How are current speed limits set, advised and enforced? This section provides advice on assessing whether current speed limits are too high, resulting in unacceptable crash risk for a range of road environments and functions. It also considers the important roles of signage and enforcement.

2.4 Understanding management arrangements: This section describes the information needed about a country's existing management arrangements and policies with regard to speed control. A key question is who is responsible (i.e. which lead agency is responsible) for road safety and speed management? It also considers who the road safety stakeholders within and outside government are, the details of any previous speed management programmes and experience in the country, and the potential resources (financial, human, and institutional) that may be available for future speed management programmes.

2.1 What do you need to know?

First, it is necessary to build up knowledge of the situation to be addressed through speed management. Beginning with the roads and road environment, an examination of the infrastructure and its uses, laws and their enforcement, road-user behaviour and the inherent risks associated with speed should be carried out.

2.1.1 Road functions and setting speed limits

Reducing risk through speed management requires a good understanding of individual road functions. For example, a major arterial road carrying through traffic between cities may be able safely to accommodate maximum speeds of 70 km/h; whereas, roads through shopping and residential areas with high pedestrian activity may need to have a maximum limit of 30 km/h.

A road system is usually a hierarchy of roads based on each road's primary function. Ideally speeds of motor vehicles using each road will be appropriate to the type and quality of the road, the types and mix of road users, and the surrounding environment. Before one can determine how best to manage travel speeds, it is important to examine and classify the types of roads in the road system.

While a hierarchy of roads is necessary, it is only a starting point for consideration of more detailed speed limit and speed management arrangements. The issue of road hierarchy is more fully addressed in Module 3.

Awareness of any existing hierarchy that the road authority or municipalities have adopted is important. A review of any hierarchy and individual roads within it, based on road user mix and current travel speeds, will be an important part of an assessment of the appropriateness of the designated road function and existing speed limits. It is also important to recognize that road hierarchy can change, for example unpaved roads can be surfaced, which is likely to result in more traffic and higher speeds. This may have implications for the existing hierarchy.

Activities on roads and road environment

When determining whether speed limits are at the right level, it is especially important to take into account the presence of pedestrians, cyclists and other road users who are more vulnerable to injury in the event of a crash. In residential areas where children may be playing close to the road, for example, the speed limit should be set quite low. If motorized four-wheeled vehicles cannot be separated from two-wheeled road users (or three-wheeled vehicles used extensively in countries such as India and Bangladesh), again the maximum speed should reflect the risk to the more vulnerable road user.

A study of the road and its environment, including the behaviour of the people close to the road, should be undertaken to enable a full assessment of speed related injury risks. For example, is there extensive ribbon residential or commercial development in rural areas along arterial roads? Are people walking along the side of the road?



Assess whether there are any land-use plans which could lead to a road changing in function over time, e.g. the amount of traffic, the mix of traffic, the speed and the safety risk. It is then necessary to re-evaluate the safety provisions for the pedestrians and other vulnerable road users.

This study should have a particular focus on those road users that are more likely to be injured because of a lack of protection – pedestrians are as important to

plan for as drivers. Changing the traffic environment may require lower speed limits and/or additional infrastructure improvements, such as giving vulnerable road users priority at crossings or separating them from the fast-moving vehicles using barriers.

2.1.2 Speed and crash data

Good data are important in assessing the situation. This means data that are appropriate, accurate, complete and reliable. The information collected should include:

- numbers of fatal crashes where speed was a contributing factor
- number and type of road users killed as a result of speeding
- the age and sex of all involved in speed crashes
- type of road, traffic volume and speed limit of roads where speed crashes have occurred
- mean free flow travel speeds (see section 2.2.2)
- other measures of speed distribution, such as the 85th percentile speed (the speed below which 85% of vehicles travel)
- speed variance.

In order to be successful, a speed management programme needs the backing of both policy-makers and the public. Accurate data on speed related serious casualties and free flow speeds will help provide evidence about the potential scope for serious casualty reductions.

Methods for collecting data vary and the breadth of data obtained will depend on its source. Hospital data on crashes and injuries, for instance, will only take account of part of the problem because they only include cases that are brought to the hospital. Similarly, police data on crashes will only record cases the police investigate.

However, either of these two sources provides a good starting point. Ideally the information obtained by trauma rescue, medical facilities, police, press and road authority investigators will be integrated to give a fuller picture of circumstances and outcomes of speed related crashes.

Some of the desired data, such as free flow mean speeds, will not always be readily available. The lack of such data should not be used as an excuse for inaction or ignoring the problem of speed related serious casualties. Some country-level injury data, no matter how rudimentary, together with some simple measurement of free flow speeds, can be used as a starting point to develop a strategy for better managing speed.

2.1.3 Legislation and regulation

It is also important to know what laws and regulations about speed and speeding exist in the country or project area (see Box 2.1), and how these are periodically reviewed and updated. The issue of how they are implemented and enforced is also important.

Laws about speed management usually include setting limits, defining sanctions for people who break them (fines, suspension) and specifications of equipment used for enforcement by the police.

It should be clear who has the legal responsibility for setting speed limits on the road network in the country. It is usually the government road authority for the arterial routes, and municipalities for local roads and streets, either alone or with the approval of the roads authority. However, the setting of limits can be a police responsibility in some countries.

Some countries have extensive regulation and legislation regarding speed management. Compliance with these regulations depends in part on the understanding of road users about when, where and how to comply with them. While signage standards vary considerably between different countries, there is a need to examine whether speed limit signage is adequate, and whether signs are highly visible and well understood by the population.

It may be useful to begin by reviewing the current state of laws and regulations in relation to speeding as shown in the checklist in Box 2.2.

In many countries there is a lack of consistent enforcement of existing legislation – whether as a result of weak capacity or poor governance – that leads to corrupt practices. In assessing the country situation, an analysis of the existing enforcement regime should form part of the diagnosis. It would help reveal the state of the relationship between the intention of legislation/regulation and the way it is actually enforced.

BOX 2.1: Example of speed limit legislation, South Africa**Speed limit****59.**

- (1) The general speed limit in respect of –
- (a) every public road or section thereof, other than a freeway, situated within an urban area;
 - (b) every public road or section thereof, other than a freeway, situated outside an urban area; and
 - (c) every freeway, shall be as prescribed,
- (2) An appropriate road traffic sign may be displayed on any public road in accordance with section 57, indicating a speed limit other than the general speed limit which applies in respect of that road in terms of subsection (1): Provided that such other speed limit shall not be higher than the speed limit prescribed in terms of subsection (1)(c).
- (3) The Minister may, after consultation with the MECs [Members of the Executive Council of the provincial government], in respect of any particular class of vehicle, prescribe a speed limit which is lower or higher than the general speed limit prescribed in terms of subsection (1)(b) or (c): Provided that the speed limit so prescribed shall not replace a lower speed limit indicated in terms of subsection (2) by an appropriate road traffic sign.
- (4) No person shall drive a vehicle on a public road at a speed in excess of –
- (a) the general speed limit which in terms of subsection (1) applies in respect of that road;
 - (b) the speed limit indicated in terms of

subsection (2) by an appropriate road traffic sign in respect of that road; or

- (c) the speed limit prescribed by the Minister under subsection (3) in respect of the class of vehicle concerned.

Certain drivers may exceed general speed limit**60.**

Notwithstanding the provisions of section 59, the driver of a fire-fighting vehicle, a rescue vehicle or an ambulance who drives such vehicle in the carrying out of his or her duties, a traffic officer who drives a vehicle in the carrying out of his or her duties or any person driving a vehicle while engaged in civil protection as contemplated in an ordinance made in terms of section 3 of the Civil Protection Act, 1977 (Act No. 67 of 1977), may exceed the applicable general speed limit: Provided that –

- (a) he or she shall drive the vehicle concerned with due regard to the safety of other traffic; and
- (b) in the case of any such fire-fighting vehicle, rescue vehicle, ambulance or vehicle driven by a person while he or she is so engaged in civil protection, such vehicle shall be fitted with a device capable of emitting a prescribed sound and with an identification lamp, as prescribed, and such device shall be so sounded and such lamp shall be in operation while the vehicle is driven in excess of the applicable general speed limit.

Source: National Road Traffic Act (1996), available at www.transport.gov.za/library/index.html

BOX 2.2: A proposed checklist for determining the current legal framework

- What current laws and regulations relate to road safety generally? Is there a specific law on speed and speeding? If so, does it apply nationally or locally?
- Are there highway design standards that specify recommended speed limits?
- Are they up-to-date?
- To whom does the law apply? To all vehicle drivers, or are there specified variations – for example for learner and novice drivers, or for different vehicle types? How well understood are existing variations in speed limits for different vehicle types?
- Does the law apply to all types of road?
- Does the law specify any default speed limits for urban and rural areas?
- How are limits signed?
- What are the penalties for not complying with the law?
- Is the law enforced? Is it enforced everywhere, and among all types of vehicle-based road users?
- Which government agency is responsible for preparing/modifying laws in relation to speed?
- How is a variation on the law or a new law officially adopted by the government?

2.1.4 Speed risk profile and vulnerable road users

The crash risk varies for different classes of road user. Vulnerable road users are defined as those exposed directly to vehicle impacts (pedestrians, cyclists) as opposed to those protected within a vehicle (drivers, passengers). Pedestrians, cyclists and those using motorized two-wheeled and three-wheeled vehicles are much more vulnerable to injury than those using larger motor vehicles.

An examination of the risks of exposing vulnerable road users to heavier motorized traffic warrants particular attention. This examination should consider whether enough has been done to manage the speed of motorized vehicles so that collision and injury risks are minimized.

While the behaviour of vulnerable road users is often a contributory factor in injury crashes, it is often difficult to enforce laws governing the behaviour of these road users. It is difficult to apprehend cyclists in traffic. Even when offenders are apprehended, it is difficult to process a violation, especially when the road user is not required to carry a licence (e.g. pedestrians and cyclists).

It is essential that the risks faced by vulnerable road users on the network are well understood, and that the locations where they experience higher-than-average crash risk (based on crash data) are carefully studied in order that targeted risk reduction solutions can be developed.

In addition to understanding speed crash and injury data, it is useful to conduct further research about local behaviour patterns and cultural settings to determine which people are most at risk of having a speed related crash. Knowing more about the circumstances in which people drive or ride at dangerous speeds can inform speed management measures, for example public education, licensing policies or design of infrastructure.



2.2 How to measure the problem

Speed on roads is a major public safety and health issue, although the precise causal role of speed in road crashes is difficult to determine. Collecting and analysing data that can indicate prevalence of unsafe vehicle speeds on the road network helps to guide and measure the effectiveness of the speed management programme.



CASE STUDY: **Matatu magic, Kenya**

To celebrate the World Health Day in 2004, BBC World Service produced a radio show called *Matatu magic*. A tale of suspense and heroism, treachery and tragedy, *Matatu magic* transports you to the tarmac of the Kenyan capital, Nairobi. There, the drivers of minibus taxis – known as *matatus* – are kings of the road, and regularly play Russian roulette with the lives of their passengers. At least they did, until the government introduced strict new laws in 2004. This five-part drama series, written by Kenneth Gitari – himself a Kenyan matatu driver – explores the central role these vehicles play in the life of the city.

In 2004, road safety measures in Kenya were largely successfully imposed. All of the country's 40,000 matatu drivers were obliged to reduce the number of seats in each vehicle, to install seat belts for all passengers and a speed limiter which costs around \$300. The seat belts range between \$12 and \$20 each. These are expensive measures, but it

is generally accepted that the best way of improving road safety is to reduce the speed and volume of traffic.

The radio show created debate on the BBC website. Below some of the quotes from the web debate:

"From my observation the seat-belts have reduced overcrowding in public transport, the speed governors have installed a lot of discipline. This can be seen in Mombasa and other towns in Kenya."
—Mohamed Shariff, Kenya

"The use of seat-belts and speed governors to prevent the prevalent road carnage is like immunization against a deadly malady."
—George Kyalo Mutua, Kenya

Sources: www.bbc.co.uk/worldservice/specials/1225_deathontheroads/page4.shtml and <http://news.bbc.co.uk/2/hi/africa/3593905.stm>.

However, a definition for use by crash investigators must identify circumstances that can be used to determine the involvement of speeding as a contributing factor in a crash (see Box 2.3).

Unsafe driving speeds increase both the likelihood and severity of road crashes. So, for example, if an investigation indicates that a driver had fallen asleep and lost control as a result, driver fatigue rather than speeding is likely to be the primary contributing factor. But these types of crashes tend to be more severe because a sleeping driver does not react to the situation. In this example fatigue was the primary (road injury) contributing factor, and speed is a secondary factor.

BOX 2.3: A definition of speeding for police use in assessing its role in a crash and crash outcome

The identification of speeding (excessive speed for the prevailing limit or conditions) as a contributing factor in road traffic crashes cannot always be determined from police reports of those crashes. Crash investigators can look for other clues or circumstances surrounding the crash that would suggest speeding was involved.

A working definition could be:

Speeding is considered to have been a contributing factor to a road traffic accident crash if that accident involved at least one 'speeding' motor vehicle.

A motor vehicle is assessed as having been speeding if it satisfies the conditions described below in (a) or (b) or both:

a) The vehicle's controller (driver or rider) was charged with a speeding offence; or the vehicle was described by police as travelling at excessive speed; or the stated speed of the vehicle was in excess of the speed limit.

b) The vehicle was performing a manoeuvre characteristic of excessive speed, that is: while on a curve the vehicle jack-knifed, skidded, slid, or the controller lost control; or the vehicle ran off the road while negotiating a bend or turning a corner and the controller was not distracted by something; or disadvantaged by drowsiness or sudden illness; was not swerving to avoid another vehicle, animal or object; and the vehicle did not suffer equipment failure.

Source: (1)

Other important data to enable a comprehensive analysis of speed related behaviour include information such as:

- mean free flow speeds (the average speed of all vehicles that are unaffected by slower moving vehicles)
- 85th percentile speeds
- the proportions of drivers and riders at, below or above the speed limit
- speed variance (by what amounts and in what proportions are drivers above, near to, or below the speed limit?)
- public opinion about speed compliance
- attitudes towards police enforcement activity
- public opinion about appropriateness of current speed limits and penalties.

2.2.1 How big is the speed related injury problem?

Speed is always a contributory factor in the severity of a crash. The assessment of the speed related injury problem involves a number of separate elements. In order to gauge the extent of injury that relates to inappropriate speed it is necessary to look at a number of sources of data.

Some crashes will have been identified by police as having speed as a major contributing factor, perhaps on the basis described in Box 2.3, but the police in many countries do not provide such information on crash causes (2). In most crash situations, especially with mixed traffic, analysing to what extent speed contributed to the crash requires careful study.

Collecting data on road traffic crashes

Usually it is the role of police to investigate road crashes. In the case of serious crashes, specially trained investigators or accident reconstruction specialists may be able to find more clues about road environment, vehicle related and behavioural factors that might have contributed to the crash or crash severity.



CASE STUDY: Thailand Accident Research Centre (TARC)



The Thailand Accident Research Centre (TARC) was established in 2003 to provide a national centre for collecting data on the road crash problem in Thailand. The centre is run by the Asian Institute of Technology. TARC is focusing its efforts on on-site investigation, crash analysis and research, and has been working to develop a knowledge-base on crash investigation, analysis, technical know-how and local capacity building. Following detailed investigations at the crash scene, interviews with drivers and passengers and an inspection of all vehicles involved,

possible contributory factors are determined and reported. At the crash scenes, the impact of speed is determined from the damage profile and vehicle trajectory. The radius of the yaw marks and the friction co-efficient (μ) of the road surface are important factors too, in addition to crush measurements at certain intervals along the length of direct damage of the vehicle.

Crash reports can be downloaded from the TARC website: www.tarc.ait.ac.th

While most high-income countries have teams of crash experts, many lower income countries rely on traffic police conducting such investigations – often with limited training and experience.

Using the definition in Box 2.3, investigators can determine if speed was involved in a road crash by observations, interviews of witnesses, measurement and analysis of changed road-environment characteristics including skid marks. As far as possible, an estimation of impact speed and travel speed in the moments just prior to the crash should be made. Tachometers, if they are fitted to vehicles, will record these with greater accuracy. In addition, some of the latest global positioning system (GPS) technology installed in some freight carrying vehicles can also accurately monitor travel speeds if it is linked to a recorder.

Such information can be analyzed against vehicle damage and human injury. This data should be stored and analyzed on a regular basis.

In practice, extensive information on these factors is often not available in lower income countries because data may not be complete. Issues of under-reporting in police records (for example, compared to hospital-based data) also exist, even in those countries with a good road safety record. Other sources of data might be non-governmental organizations, universities and other research organizations. Insurance companies may also have such information since police accident reports are often required as part of any claim. However, such information may not be readily available (for commercial reasons) and also may only exist in 'hard' paper files rather than being available on a computer database.

To analyze these data the following questions should be asked:

- What is the scale of the problem of speed related crashes as identified in police records in terms of the number of crashes and the number of fatalities?
- What proportion of overall road traffic crashes does this comprise?
- What does the crash data indicate about the appropriateness of speed limits?
- Who are those most likely to be involved as drivers or riders in speed related crashes?
- Where are the locations where pedestrian and other vulnerable road-user crashes form a high proportion of total crash numbers?
- What are the characteristics of drivers involved in serious or fatal pedestrian crashes?

2.2.2 How to measure speed

Assessing free flow speeds on a representative sample of arterial and local roads in urban and rural areas will be an important activity to enable an assessment of the opportunities for a speed management programme to reduce serious injuries.

Regardless of what measurement of speed is used, it is vital to take account of the different types of vehicles using the roads (lorries typically move more slowly than cars), the traffic volume (higher volumes result in lower speeds) and variables such as time of day, day of week, holidays and weather conditions.

NOTE**What are ‘free speeds’?**

Free flow speeds are measurements of the speed of travel of vehicles that are not affected by other vehicles. Surveys are usually carried out using a radar detector (or ‘speed gun’), selecting those vehicles that have a substantial headway and are not impeded by other vehicles or other factors. It is usual to set a minimum headway between vehicles in the traffic flow of three seconds to measure free speed, but a time gap of at least four seconds is preferable.

It is important to conduct surveys under similar conditions each time, as any variation in collection procedures may result in differences in the speeds recorded. It is also important that the same location is used, as well as the same recording equipment, and preferably the same equipment operator. Recording equipment such as radar should be hidden, if possible, as road users who spot the equipment may change their speed and might even brake in fear of getting a fine.



Speed surveys can be conducted with fixed speed-measuring equipment, or with observational surveys involving researchers standing by the roadside with hand-held speed measuring devices. They can also be done by observing the types of drivers who are exceeding limits (male, female, young, old). Such observational speed surveys should be sufficiently large to identify any significant differences between men and women, motorcycle riders and vehicle drivers, speeds in cities and smaller towns, urban roads and highways, and different regions of the country. New Zealand guidelines suggest that for a simple ‘before/after’ or ‘change over time’ survey, a sample of 200 vehicles is required over a minimum of two hours. This number should be used for each vehicle type or road user type. A minimum of 300 vehicles is appropriate over a one-hour period (3).

The measurement of speeds should be collated and analyzed to find out the mean speed of traffic flow over a period of some hours. The 85th percentile speed should also be calculated from the free speed distributions as this speed is often used as the basis for road design and has also been used in some countries to provide guidance on appropriate limits. It should be noted that speed survey results are highly dependent on the way the survey is conducted. Box 2.4 gives useful advice.

The speed limit in these locations should be recorded and the measurements taken at a number of sample sites, if possible, over a few days and if practicable, repeated often, say every three months.

Surveying sample speeds on a regular basis will indicate trends in vehicle speeds and, importantly, provide an opportunity to monitor the impact of speed management programmes on driver behaviour (Boxes 2.5, 2.6 and 2.7).

If free flow speeds are in excess of the posted speed limit this will indicate an opportunity to reduce speeds to the speed limit by carefully targeted enforcement and public education, or to change the road layout using engineering measures. The lower speed will in turn lead to reductions in fatalities and serious injuries. If the free flow travel speeds are below the speed limit and there are still substantial crash risk problems along a length of road or at a particular site, it should be clear that travel speeds need to be reduced through lower speed limits and other measures.

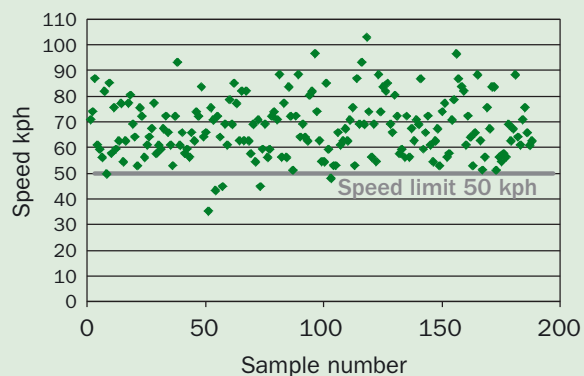
Further information about conduct of speed surveys is provided in (3).

CASE STUDY: **Speed survey in Ghana**

Speed surveys were conducted in rural and urban locations using a calibrated Muni Quip K-GP Radar speed gun, operating in the K-band frequency range (24.1Ghz). The equipment operates on the Doppler principle.

The Doppler principle states that if a transmission is made into a given area, striking a moving object, the reflected signal is a different frequency and the difference between the transmitted frequency and the received frequency is proportional to the target speed. Speed can be measured both approaching the measuring site as well as after the site. If drivers observe that their speed is being measured these speeds may be very different.

The survey data shows the high levels of speeding that are found in many developing countries where the perceived risk of enforcement is often very low. It was concluded that in urban areas the potential for crash reduction (per 1 mile/h reduction in average speed) is greatest on those roads with low average speeds. These are typically busy main roads in towns with high levels of pedestrian activity, wide variations in speeds, and high crash frequencies.



BOX 2.4: How to conduct spot-speed surveys: UK's DFID guidelines for low-income countries

Overseas Road Note 11 (ORN11) Urban road traffic surveys (DFID/TRL 1993) gives full details on how speed surveys can be conducted in 'developing and transitional' countries.

The guidance covers:

- a variety of reasons for conducting such surveys
- choice of location
- method suitable for different types of road and traffic conditions
- use of radar speed guns (spot speeds) or stop watches (average 'short-base' speeds)
- 'hiding' the observers
- which vehicles to sample
- when to carry out surveys (to obtain 'free flow' speeds)
- how to present the results.

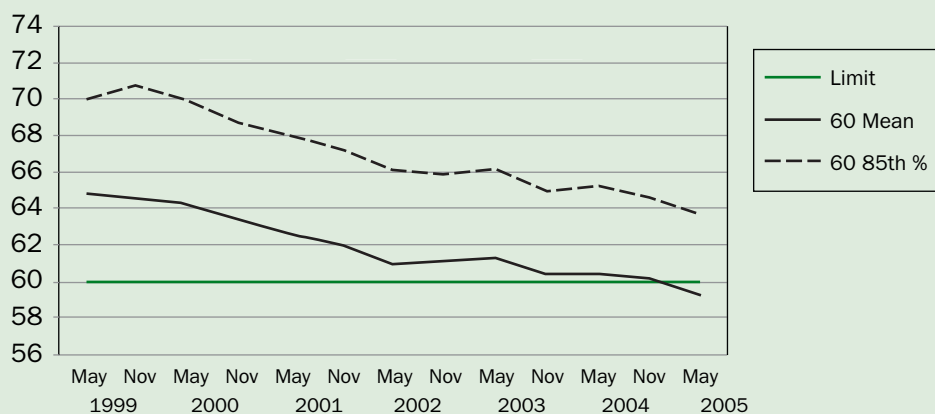
The guidelines make reference to the 85th percentile speed as a commonly used measure, since this 'excludes extremely fast drivers (and gross measuring errors) and gives an estimate of what the majority of drivers consider a top limit'.

Available at: www.transport-links.org (search ORN11)

BOX 2.5: Change in free speeds for a large metropolitan area (Melbourne) – 60 km/h zones

The effects of major speed reduction as a result of publicity and enforcement campaigns in a major city over the period from 1999 to 2005 are shown. Substantial reductions in fatalities and serious injuries occurred over this time. Monitoring of free travel

speeds enables any changes in speed levels to be detected, and is of considerable assistance as an intermediate and advance indicator of effectiveness in reducing road trauma resulting from speed.



Source: (4)

BOX 2.6: Developing core speed-monitoring sites

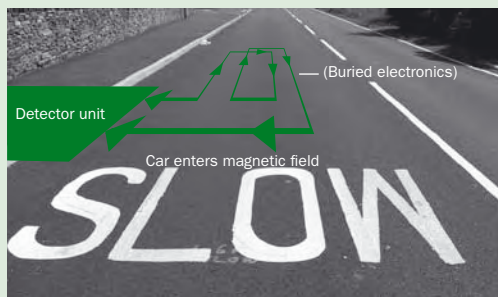
Speed management is an ongoing operation and consequently regular monitoring is essential. In order to do this, permanent measuring sites are desirable in the medium term. While there is a range of high technology equipment for monitoring traffic speed, inductive loops and pneumatic tubes still provide a durable, reliable and low-cost solution to the problem in appropriate environments. Loop and tube data loggers can be purchased for as little as US\$ 500. As the equipment has its own power supply it can be set up in remote locations.

Inductive loops are cables cut into the tarmac carriageway surface, sealed in, and connected to the data logger housed in a roadside cabinet.

As the measuring cables are buried they are not worn by traffic flows. Depending upon the flows and capacity of the logger, the equipment can be left unattended for weeks.

A pneumatic tube generates an air pulse when a vehicle compresses it. As the tubes are a known distance apart it is possible to calculate the time the vehicle takes between the pair of tubes and hence calculate the speed.

Although the tubes have a limited life (perhaps four weeks in continuous operation) they can be used in locations where it is not possible to install loops. Tubes can be pinned to gravel roads.



with their own download software and data management packages that create a range of data presentations at the touch of a button.

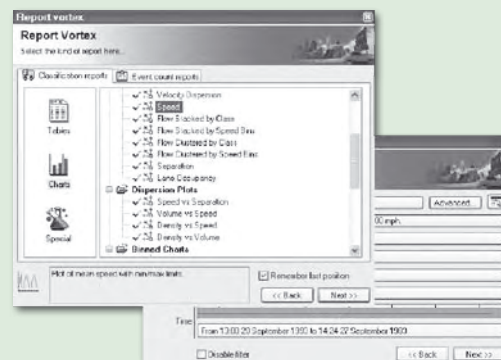
Speed data loggers will also provide vehicle classification and flow-volume data. Because of this, traffic monitoring in an urban network will also identify:

- traffic flow growth
- change in vehicle usage (e.g. increase in heavy goods vehicles)
- migration of traffic onto new routes
- highway wear rates

However, the use of such equipment will not be possible in certain countries and the use of hand-held laser equipment will be preferable.

Portable traffic analyzers are a third type of equipment. A plate with a sensor fitted to the pavement determines vehicle count, speed, and type using magnetic-imaging technology. The plate is placed directly in the traffic lane. It can be installed and removed quickly and easily using a drilling machine and can be left unattended for weeks.

Tubes, loop data loggers and removable plates come



BOX 2.7: Equipment options for speed survey data collection

Measurements of spot speeds are generally made from a specific location on the road. Various approaches may be used to collect spot-speed data:

- methods involving timing between two points or a known distance
- microwave radar using the Doppler effect
- direct measurement using laser gun
- methods involving video
- global positioning system (GPS) equipment.

These options are described in more detail in Appendix 1.

**CASE STUDY: Testing speed measurement equipment, Malaysia**

It is important to know and maybe test which equipment to choose for the specific purpose. In Malaysia, as part of a tendering process to find a contractor to do a speed measurement programme, six prospective contractors were asked to install, test and show the usage and ability of their equipment on a 1 km test stretch of the Guthrie Expressway.

Different scenarios relevant to Malaysia were tested, such as big groups of speeding motorcyclists. Some types of equipment failed to be able to measure the individual speeds. At same time the free flow speed was measured as a control to reflect the real situation and allow for evaluation of the different types of equipment in the different scenarios.

2.2.3 Speed variance

Often a distinction is made between those who drive a few km/h above the posted speed limits (low-level speeding) and those travelling at an extremely high speed (high-level speeding). Also, some countries informally accept a certain amount of low-level speeding by, for example, setting the 'tolerance' of speed enforcement (the speed resulting in prosecution) at a level above the posted limit. While such leniency goes some way towards maintaining public approval for speed enforcement, there is an impact in trauma terms which can be readily calculated, since even if the majority of drivers are driving only a *little* above the speed limit, this can result in a significant number of fatal and serious injury crashes (see Tables 1.1 and 1.2).

Driving at very high speeds in excess of the legal speed limit is dangerous. If the speed surveys find that there is a significant amount of driving well in excess of the speed limits, a range of legislative, enforcement, public education and engineering measures may be required to manage the problem. It is important to find out how often and where it is happening.

Even legal high-speed road travel such as the kind done by police and other emergency service drivers is dangerous, and can result in greater risk of injury crashes.

Awareness of the extent of these practices in a jurisdiction is useful. Such drivers should receive specialized training and be guided by specific procedures and protocols. The safety control adequacy of guidelines and protocols for emergency, e.g. high-speed police pursuits or emergency rescue driving, should be examined.

However, the majority of the injury crashes are likely to happen at lower speeds, and these should be the focus of speed management programmes, as they represent the most significant problem.

Very small increments of speed in excess of speed limits are a major factor in increasing crash risk on the network, especially if it is a behaviour that is widely practiced by the driving population. Over time, low-level speeding can become the accepted behaviour of drivers and they will expect to drive at a higher level until or unless they encounter some enforcement.

The extent of low-level speeding will be indicated in the free speed surveys. If low-level speeding is widespread and is more than 2 or 3 km/h above a posted speed limit, there may be the need to apply tougher standards to speed enforcement than those that currently exist. For example, some jurisdictions allow drivers to travel up to 15 km/h over the limit before being given an infringement notice. This results in the *de facto* speed limit becoming 15 km/h over the posted limit. The increase in crash risk as a consequence can be large.



2.2.4 Assessing community attitudes to speed management

It is necessary to know what the driving public is likely to favour and react unfavourably to when developing stronger speed management measures. Also, the balance between drivers, pedestrians and cyclists needs to be considered. Community surveys can indicate the level of public support for lower speed limits, more police enforcement, higher penalties for speeding and more engineering treatments (Box 2.8). This feedback is critical to programme design, which should also include comprehensive measures to inform the public of speed and crash risks.

However, societies have different levels of tolerance for change, and different approaches to the pace and extent of change. These constraints need to be understood and addressed in any speed management programme.

BOX 2.8: Community surveys about speed

There are a number of examples in various countries of community surveys about speed, usually conducted annually or more frequently to monitor changes in community attitudes to speed and speeding. In countries undertaking speed management programmes for the first time, the initial survey will be an important baseline record of the pre-programme attitudes.

It is important that sample sizes are adequate and the process of selection of interviewees is carefully planned to ensure the sample is representative of the population being studied.

Further details of the methodology used can be obtained from source (5). Specialist assistance will be needed to ensure that surveys elicit useful and accurate information.

2.3 How are speed limits set, communicated and enforced?

Speed limit setting has traditionally reflected attempts to achieve a balance between safety and mobility. However, countries that recognize their poor safety record and are committed to reducing road deaths and injury are shifting this balance in favour of safety. Some countries are now setting speed limits with reference to the limits of human injury tolerance, that is, to a level that will not usually result in death or serious injury to road users when crashes occur. This policy position is called the *Safe-system* approach (see Module 1).

Also, many countries now recognize that lower speeds have additional benefits over and above safety, in that they contribute to economic savings (less fuel used), smooth flow of traffic, and help alleviate air pollution and noise.

2.3.1 How are speed limits set?

It is important to understand who is responsible for setting the limits, and which criteria are used to set the speed limits. Are the limits based on expert analyses, politicians' judgements, analysis of data and injury risk, or cost-benefit assessments? The implications of the different methods need to be understood in order to develop any case for changing existing methods and criteria used.

It is also necessary to determine on what basis limits have been set in a jurisdiction for both urban and rural areas, and for different classes of road and vehicles. There will usually be an agreed general speed limit for good quality rural and urban roads. These are normally referred to as the default speed limits, and are therefore not normally signposted.

Sometimes different speed limits can be applied to different standards of roads or classes of vehicles, and, in some cases, even drivers – for example new drivers.

Other questions to be asked include: has there been a review to determine the appropriateness of speed limits, the nature of traffic/road users, the nature of the road and roadside (including neighbouring developments and control of access to them), the standard and type of vehicles and the levels of enforcement?



2.3.2 How are speed limits communicated?

Once speed limits are set, it is important to advise drivers about these limits. This is usually done with signs and road markings. A review of the speed limit signage and information should be done to find out whether drivers understand what is required by law, and a review of the sufficiency of advice to drivers should be undertaken in preparation for any speed management programme.

Consistency is important. If it appears to a driver that the same type of road has different limits in different places for no obvious reason, then they are more likely to abuse the limit.

A fuller discussion on signage and advice to road users about legal maximum speed limits is contained in Module 3.

2.3.3 How are speed limits enforced?

In the absence of infrastructure engineering treatments that force drivers to reduce their speed (such as humps), speed limits are often not respected by the driving and riding population unless there is a level of enforcement. It is important to recognize that it is the perceived level of enforcement that critically influences speed behaviour, rather than actual levels. This means that enforcement activity needs to be publicized (i.e. used to persuade rather than to catch); but drivers are seldom fooled by extravagant claims of more extensive enforcement activity for long. It is necessary to determine as a starting point how extensive enforcement currently is in terms of geographic distribution, number of vehicles screened, distribution of enforcement over a day and over a week, and the limit that is effectively enforced.

Police may be reluctant to enforce new speed limits, as the new limits may not be well accepted by road users – resulting in criticism of or ill feeling towards the police. Police experience and attitudes to speed enforcement should be assessed.

Enforcement is discussed more fully in Module 3.

NOTE**What is the existing 'real' speed limit?**

Often, police allow some tolerance for driving in excess of the legal maximum speed limit. When this occurs, road users come to believe that the limit, plus the added tolerance, is the actual speed limit. For example, many limits are only enforced when drivers are up to 10 km/h or more over that limit. Most drivers become aware of this practice and the new limit becomes the posted limit plus the enforcement tolerance. This is an example of an issue that needs to be carefully considered in designing any future programme.

2.4 Understanding management arrangements

For road safety management and speed management it is necessary to have a clear understanding of existing arrangements and responsibilities.

2.4.1 Who has responsibility for the regulation of speed on public roads?

The agency responsible for setting speed limits is likely to be a national or state/provincial one. But local authorities may also be able to set limits or establish speed zones in their cities or towns. There may be a separate agency with overall road safety responsibilities, which does not have the power to manage road regulations. It is normal for speed management roles to be shared by a range of organizations, such as road authorities, transport ministries, police, local government and others.

To implement a speed management programme it is necessary to establish what are the main government departments involved in road safety decision-making, what role each department plays and how they relate to each other. An assessment of their speed management capabilities can also be undertaken, to determine how well equipped the agencies are for carrying out necessary tasks.

2.4.2 Who are the road safety stakeholders?

A stakeholder analysis sheds light on the social and economic environment in which any new policy will be developed and implemented. Its primary function is to identify all possible partners who might have an interest in better management of speed, including those who might initially oppose efforts to reduce inappropriate speed through enforcement, lower limits or a range of engineering measures. Potential stakeholders include: government departments, non-government organizations and institutions that will be affected (positively or negatively) by the

new management arrangements or standards, local communities, formal or informal groups, as well as individuals. Stakeholders will also include motoring associations whose members might be affected by new management arrangements for speed, regulators, other industry bodies and associations, vehicle manufacturers and transport operators. The media plays an important role in airing the views of the different groups and the public at national, regional and local levels, and its influence should not be underestimated.

The second important function of the analysis is to examine the roles and activities of all of the stakeholders. It is important to distinguish between stakeholders within government and those beyond it. Those within government may have a management responsibility for their role in road safety, whereas those outside government (including lobbyists) will have a keen interest either for or against speed-regulating initiatives.

Their input, advice and support for the proposed programme should be sought and valued, but the management task of providing final recommendations to government, or exercising delegated authority to act, is the role of the directly accountable road safety agencies in government (transport, roads, police, justice, health and education), with consultation occurring separately with other government ministries, such as finance. This consultation will often create potential conflict of interest related to the costs and economic development, which is why it is very important to document the benefits of a speed management and the cost savings for society.

A careful analysis should be made of the influence, importance and interests of all major stakeholders beyond the road safety agencies, within and beyond government, as this will facilitate the design of appropriate approaches for involving them. It is especially important to identify both supporters and opponents, and to appreciate the reasons for their respective positions so as to be able to develop a package that satisfies all parties. With these comments in mind, the key objectives of the analysis of the stakeholders beyond government are:

- to identify these key stakeholders, define their characteristics and examine how they will be affected by speed management policy changes (e.g. their interests, likely expectations in terms of benefits, changes and adverse outcomes)
- to assess their potential influence on the development, approval and implementation of a speed management programme
- to understand the relationship between stakeholders and the possible conflicts of interest that may arise
- to assess the capacity of different stakeholders to participate in developing a speed management programme and the likelihood of their contributing positively to the process
- to decide how they should be involved in the process to ensure the best chance of success for the programme, in particular:

- ▷ the nature of their participation (e.g. as advisers or consultants, or as collaborating partners)
- ▷ the form of their participation (e.g. as a member of the working group or as an adviser)
- ▷ the mode of their participation, (e.g. as an individual participant or as a representative of a group).

For the other government stakeholders apart from the road safety agencies, a similar but less detailed process should be undertaken to ensure they are engaged at an early stage in a positive manner. A more in-depth discussion on conducting a stakeholder analysis can be found in (6).

2.4.3 What funding is there for speed management?

Without sufficient funding it will not be feasible to conduct a comprehensive speed management initiative. While the development of a case for funding will be part of the programme prepared (as described in Module 4), an understanding of current funding support is a required starting point.

What is the current budget for road safety? Are there priorities in the budget for future improvements in the field of road safety? Are there funds that might be accessed for a speed management programme? It is important to estimate the benefits of the proposed programme and to present the programme as an investment rather than a cost. It is generally the case in countries with high crash rates that the benefits to the economy from reducing death and injury on the road will far exceed the costs.

The stakeholder analysis (2.4.2) should also explore the possibility of funds being made available by stakeholders outside government.

It should also be recognized that any increase in speed enforcement activity is likely to generate funds from the penalties collected. However, in many countries that have introduced large numbers of cameras for enforcement purposes, there has often been a media response, allegedly on behalf of the public, that they are simply a way of raising revenue ('another tax on the motorist'). An examination of this problem and a proper understanding of public attitudes, or potential for this problem to arise and how to deal with it, should be made.

In a number of countries, the revenue from the penalties – for example from speed cameras – can be ring-fenced for road safety activities, rather than flowing into general government revenues. While there are many arguments about this approach, it can be used to generate wider public support on the argument that it is the speeding drivers who are paying for their 'sins', to the benefit of the community put at risk by their behaviour.

Summary

There are three main reasons for assessing the situation before starting to develop a speed management programme. First you need to identify the nature and scale of unsafe vehicle speeds. The assessment process will provide evidence for arguments as to why speed management is essential and why it should be supported. The documentation of the starting situation provides baseline indicators that can be used for monitoring and evaluating the programme. To get backing of both policy-makers and the public you need to:

- obtain an overall view of the road, its environment and use
- illustrate to what extent drivers comply with speed limits in various locations, the speed limits and the mean speeds in higher risk locations (such as where there are many pedestrians, cyclists or motorcyclists)
- understand why people speed in those locations and what proportion of serious casualty crashes have speed as a contributing factor
- measure the size of the injury risk caused by speeding, as well as the nature of the risk
- obtain accurate data on speed related serious casualties, mean free flow speeds and in comparison to current speed limits – this will help show the scope for serious casualty reductions through better speed compliance or lower limits, or both.

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