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Speed Detection Equipment Operators Manual


Calibration Services
Police National Headquarters

New Zealand POLICE
Nga Pirihimana O Aotearoa

2015 version 1

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INTRODUCTION

About this manual

This manual is designed to provide the theoretical basis for the safe and efficient operation of speed enforcement equipment. The manual focuses on the 'best practice' use of speed detection equipment. It provides an overview of the operating principles and policy guidelines governing the use of speed detection equipment. Evidential and administrative requirements are covered to ensure all operators are able to follow correct procedure.

This manual should be read in conjunction with the 'Speed Enforcement' and 'Traffic Patrol Techniques' chapters of the Police Manual.

This manual focuses on both radar and laser speed detection equipment. Radar and laser describe the scientific methodology used to detect vehicle speed. Although there are some similarities between the devices, there are also some fundamental differences. For this reason, this manual looks at each device separately. The first part of the manual deals with radar and the second with laser. It is important that you note the similarities and differences between the two types of device.

Manufacturer's manuals

The equipment manufacturer's operational manuals for radar and laser speed detection systems used by the NZ Police are inappropriate for the New Zealand environment. For this reason this manual is the only document detailing how to operate speed detection equipment in New Zealand.

Who may operate speed detection equipment

Except for the purposes of instruction, speed detection equipment is to be operated only by members of the NZ Police who have been certified as a Speed Enforcement Operator.

Requirements to be a certified operator

To become a certified speed enforcement operator you must have:

- ✓ Completed the e-learning training package.
- ✓ Achieved a minimum of 80% in the online Te Puna test.
- ✓ Undergone practical instruction with a qualified instructor and demonstrated competence.
- ✓ Been certified as a trained operator by the National Manager: Road Policing.

Practical training and experience

Once you have passed the Te Puna test you will need to gain practical experience operating the speed enforcement equipment. This will take at least 20 hours and needs to be completed with a qualified instructor. The suggested breakdown of hours is 16 hours for radar training and 4 hours for laser training. Your district Road Policing Manager has a list of approved instructors.

The practical training is vital and provides an opportunity for you to apply the theory in a practical setting. The qualified instructors have a training checklist they will use with you to guide your training and to assess your competence. A copy of this checklist is at the end of the manual.

Once you have successfully completed your practical training, your instructor will issue you with a temporary approval to operate speed detection equipment. This temporary approval is valid until you receive your certificate from PNHQ. They will then forward the necessary correspondence to your Road Policing Manager for certification. Your Road Policing Manager will make the arrangements for your Certificate of Approval to be issued (via Police Calibration Services). You will be issued a numbered certificate and your details will be recorded on a national database of trained operators.

Qualified instructors

To be appointed as a qualified instructor, staff must fulfil the following criteria:

- ✓ Be a certified Speed Enforcement Operator.
- ✓ Have spent two years consistently operating speed detection equipment.
- ✓ Operate speed detection equipment as part of their regular duties.
- ✓ Have the ability to train others.

District Road Policing Managers have the authority to appoint qualified instructors if they are satisfied the staff member fulfils the above criteria. Qualified instructors *must* be registered with Road Policing Support (Police National Headquarters) before taking up a qualified instructor role.

Code of Operations

In the interests of fairness, professionalism and accuracy, the Measurement Standards Laboratory New Zealand Limited and the NZ Police have agreed to a Code of Operations that governs the operation of all speed detection equipment used by NZ Police. A copy of the **Code of Operations 2015** is contained at the end of this manual.

RADAR SPEED DETECTION

Introduction

About radar

Radar is an acronym for **RA**dio **D**etection **A**nd **R**anging.

Radar is the transmission of radio waves to determine the range, altitude, direction or speed of objects.

History

The concept of radar was first discovered in 1904, but it was during the Second World War that significant progress was made in this area of research. New Zealand scientists who had worked in this field during the war returned to work for the Department of Science and Research and extended the technology. The world's first working traffic speed detection radar was developed in New Zealand in the late 1940s. In 1947 the first traffic speed radar was trialled in Wellington. From these humble beginnings radar devices have become an integral part of the New Zealand road safety strategy.

Although the models have changed and will continue to change, the operating principles of radar devices remain the same.

The use of radar as a speed enforcement tool is not restricted to New Zealand. Radar speed detection devices are widely used; each year over 50 million enforcement notices are issued to speeding drivers around the world.

Radar theory

The principle of radar can be explained simply. A beam of microwave electromagnetic energy is generated at super high frequency. If the energy strikes an object, part of the scattered energy is returned to the radar through the antenna. The unit processes the return signals then displays the speed and the distance the object was from the antenna.

Doppler shift effect

Speed detection radar uses the phenomenon of Doppler shift to calculate the speed of a target vehicle. This effect is the change in frequency of a wave, for an observer moving relative to its source. An example of this is a passing vehicle with a siren: as it passes the observer the pitch of the siren lowers.

To assist in target identification and tracking history, the speed detection unit produces an audio tone of the Doppler shift. The higher the tone, the faster the target vehicle.

Operators MUST NOT conduct speed enforcement with the audio tone turned down to zero. The tone is an essential part of the tracking history.

Radar components

There are three basic components to traffic radar:

1. Radar readout.
2. Antenna(s).
3. Remote control.

Radar readout

The radar readout is the microprocessor controller for the radar system; it transmits, receives and processes the radar signal. It then compares the frequency of the return signal with that of the transmitted one (Doppler shift) and displays the speed.

The microprocessor design gives it the ability to distinguish the direction of the vehicles and a number of other advanced features to aid the operator.

The antenna(s)

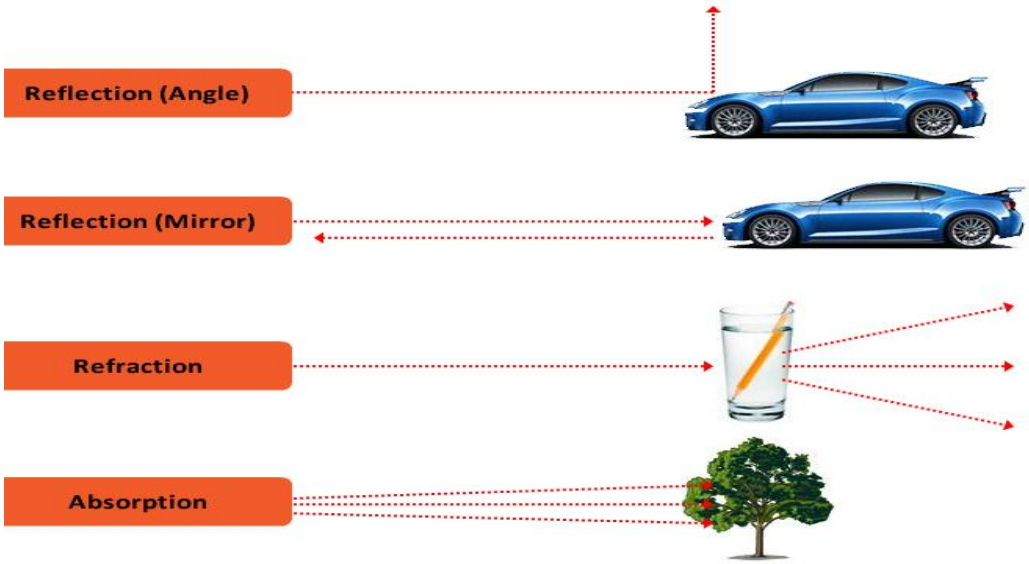
A narrow-beam, horn antenna is used to direct the microwave energy and collect the reflected signal. Most systems fitted to NZ patrol vehicles are operated with both a front and rear antenna.

Remote control

The remote controls all the functions of the traffic radar unit. The remote is split into an upper group of white buttons that control the operational functions and a lower blue set that control the functions and settings.

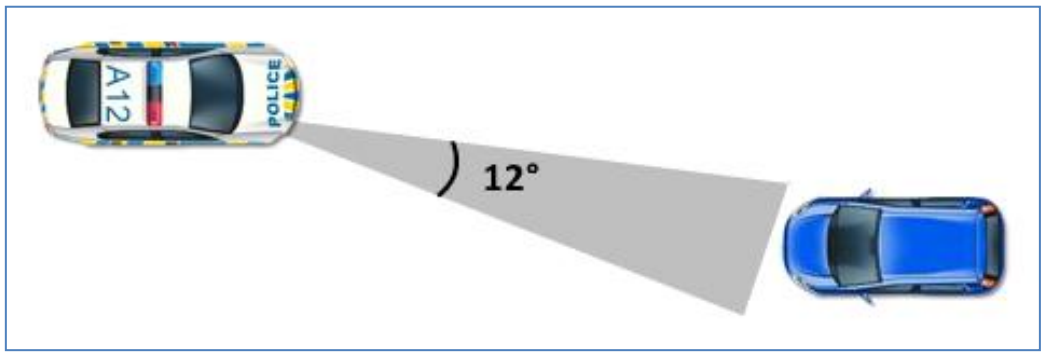
The radar beam

The energy transmitted from the radar antenna is similar in shape to that of a torch beam. The radar signal continues outward from the antenna until it is reflected, refracted (bent, like a pencil placed in a glass of water) or absorbed.



Radar beam angle

The beam of radio wave energy transmitted from the antenna is coned shaped with a 12° spread. Therefore the further the beam extends from the antenna the wider it becomes.



The radar beam could continue outward from the antenna for an indefinite distance. However, in reality the beam range is the distance that the radar signal can be reflected back from a target to the receiver. The range differs depending on the site.

The further the range the more difficult it becomes to complete a thorough tracking history of the vehicle.

Atmospheric conditions

Atmospheric conditions such as rain, mist and fog will affect the radar range and the return signal.

NZ Police-operated radar units have a sensitivity control that can be adjusted to control the level of received return signal. By adjusting the sensitivity operators can ensure the radar signals received are optimal for the current environment.

These conditions will not affect the accuracy of the displayed speed.

Factors affecting range

The size and shape of the target vehicle's surface will affect the reflected signal back to the radar unit for processing into speed readings. The bigger the target the better it will reflect the signal back to the radar unit.

A heavy motor vehicle with large flat sides offers a good reflective surface.

Conversely a target vehicle that is small and aerodynamically designed is a poor reflector of a radar signal. This means it will need to be closer to the unit to be picked up clearly.

Vehicles such as motorcycles and sports cars offer poor reflective surfaces.

Similarly, when a small vehicle is followed immediately by a large vehicle the radar may return the speed of the larger vehicle due to a stronger reflection. Operators must ensure their tracking history covers such situations (see tracking history later in this manual).

Tuning forks

A tuning fork is an example of a vibrating object that produces sound. The fork consists of a single piece of aluminium with two machined tines. When the tuning fork is hit, the tines begin to vibrate. This causes disturbances in the surrounding air molecules, which produces a ringing sound.

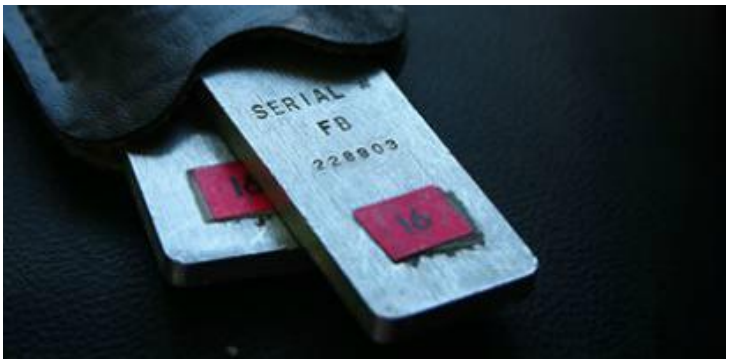
Tuning forks are precisely engineered and should not be hit against hard objects as the tines will bend out of shape and lose their ability to vibrate at the correct frequency. They should always be kept clean and stored within their protective pouch, to ensure their accuracy. The fork can be **lightly** struck against another fork to produce the required signal level to conduct daily testing.

Tuning forks are used as part of the calibration and daily testing of the radar unit. The noise they create simulates the Doppler shift for the particular speed reading stamped on the fork.

Note: Because the movement of air molecules from the fork goes from left to right, you should always present the side of the tine to the antenna.

The correct manner to hold the tuning forks.

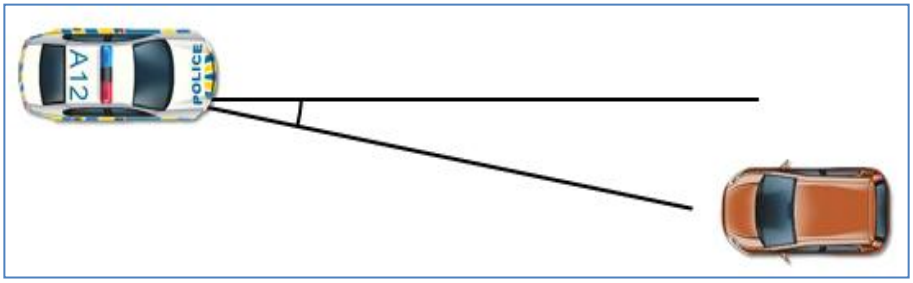
Each fork is stamped with a serial number, operating band (frequency) and speed the fork will produce at that frequency.



Note: It is important to confirm the tuning forks' serial numbers match those in the radar logbook.

Cosine effect

In both stationary and moving modes, a cosine effect occurs when vehicles pass at an angle through the beam rather than directly in line with it.



The cosine effect is dependent on the angle between the operator and the target vehicle. The greater the angle the larger the effect on the detected speed.

Actual Target Speed 100km/h	
Angle between Antenna and Target	**Speed Displayed on Radar Readout**
0	100km/h
10	98km/h
20	94km/h
30	87km/h
40	77km/h

As the table shows, for every degree the radar is off-set to the target vehicle the speed reading registers less than the true speed of the target vehicle.

Note: The outcome of this effect is that measured speed will always be less than actual speed of the target vehicle. The only time the two speeds will be equal is when there is no angle between the radar and target vehicle, i.e. directly behind or in front.

Radar site selection

Radar stationary mode

Site selection is extremely important when operating radar in a stationary mode. An operator must consider both operational and safety considerations when selecting a location.

Safety considerations

- ✓ **Patrol vehicle position.**
- ✓ **Ability to stop vehicles in a safe location, including performing a u-turn if required.**
- ✓ **Safety of yourself, target vehicle and other road users when conducting the stop.**
- ✓ **Driver interview position.**

Note: Depending on light conditions and your site selection you must have either your patrol vehicle's primary or secondary lights turned on.

Hi-visibility jackets maximise the operator's visibility to road users and enhance safety. Remember the sleeveless vest is for **daytime** use only and at **night,** you must wear the long-sleeve version or your raincoat.

Operational requirements

You must consider if your speed enforcement at the site also aligns with your local prevention strategies, e.g. outside schools and high crash areas. An ideal site is straight for at least 250 metres, with the road surface slightly rising away from the radar unit and free from undulations. Undulations will cause fading of the return signal.

You must ensure you consider the following:

- ✓ **Not within 250m of reduction in speed limit.**
- ✓ **If operating within road works site you must contact the STMS (site traffic management supervisor).**
- ✓ **Site does not significantly impact traffic flows.**
- ✓ **Site complies with parking regulations (e.g. broken yellow lines).**

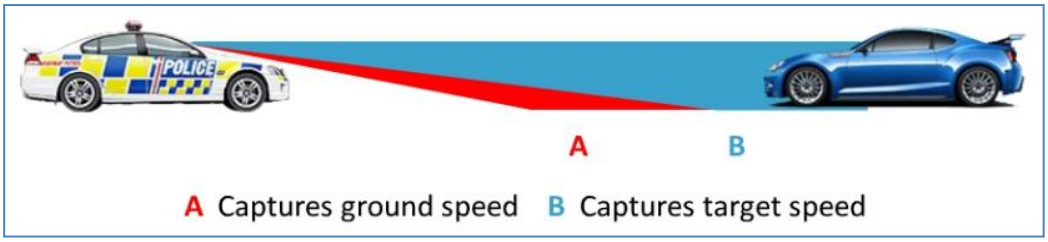
Treat the radar beam like a torch, ensuring you aim the antenna slightly towards the right-hand side of the road. The operator must listen to the Doppler tone to ensure any targets are free from the fading that results from a poorly aimed antenna or poor site selection. The aiming of the beam is important to minimise the cosine effect and to obtain a greater return signal.

Radar – moving mode

The basics of stationary radar apply to radar used in moving mode. However, there are some additional factors that must be considered.

When operated in moving mode, a single radar signal is transmitted from the antenna. A portion of this signal is reflected off the ground about 15 metres directly in front of patrol vehicle and returned to the antenna. This is called "**ground speed**" and is displayed in the patrol speed window.

As the ground speed is being measured directly in front of the patrol vehicle, there is negligible cosine effect and the displayed ground speed aligns with the true speedometer indicated speed.



For the radar to operate in moving mode it must be able to detect the ground speed of the patrol vehicle. There are times when the traffic radar is unable to process ground speed and when this happens the unit will show no speed readings.

Ground speed may be lost during heavy rain as the rain droplets may absorb the radar signal. In this case operation of the device should cease until the rain eases or stops.

Ground speed will be lost if:

1. The vehicle being detected is travelling at the same speed as the patrol vehicle (within 5km/h).
2. There is heavy rain.
3. The patrol vehicle is following a large vehicle, in which case the ground speed beam may not obtain a reflection off the road.
4. The sensitivity is turned down too low.

Radar – opposite lane mode

It is vital that ground speed is obtained before any target vehicle enters the beam. Without a ground speed reading the unit cannot produce an accurate target vehicle reading.

Example: A patrol vehicle travelling at 90 km/h and a target vehicle travelling at 130 km/h produce a combined speed of 220 km/h. However, the radar unit subtracts the patrol ground speed from the combined speed. This results in a target speed of 130 km/h.

Operators must constantly monitor the patrol vehicle's calibrated speedometer to ensure the radar unit is displaying the correct ground speed.

Radar same-lane mode

Same-lane mode is used for vehicles travelling ahead of and in the same direction as the patrol vehicle. This also applies when a rear antenna is fitted for vehicles behind the patrol. The unit calculates the difference between the ground speed of the patrol vehicle and the target vehicle and this is depicted on the speed readout.

Radar deployment

Tracking history

Obtaining a proper tracking history of the target will effectively eliminate errors. Tracking history is the ‘chain of evidence’ that provides the operator with the assurance the target vehicle speed is correctly captured by the radar equipment. Tracking history for all radar contains three main elements:

1. Visual observation.
2. Audio confirmation.
3. Radar verification.

Visual observation

There are three parts to visual observation. The operator must:

1. Identify the target vehicle and continue to monitor its travel.
2. Confirm the target vehicle is within the radar’s range.
3. Estimate the target vehicle’s speed.

Audio confirmation

There are three parts to audio confirmation. The operator must:

1. Listen for a clear Doppler tone.
2. Check the tone is consistent with the speed.
3. Check the level of the audio tone is strong and not fluctuating or warbling.

Radar verification

There are four parts to radar verification:

1. The initial reading is consistent with the operator's visual observation and operator-estimated speed.
2. A steady target reading.
3. Readings are consistent with visual observation and audio tone.
4. Ground speed readings are confirmed by patrol speedometer.

When the operator is satisfied the target vehicle is producing the correct reading, they should lock the reading and take the appropriate enforcement action. Although it is best practice to lock the speed and offer the driver the opportunity to view the readout, there are times when this is not possible.

Note: Failure to lock the speed will not prevent normal enforcement action being taken.

Possible sources of interference

Introduction

In the super high frequencies of the spectrum where traffic radar operates (24-38 GHz) the environment is relatively free of noise and other non-natural sources of interference.

Many articles have been written about the types of interference that will cause traffic radar to produce erroneous readings. Some examples of this are high tension power lines, air traffic control radar and airport navigation systems.

NZ Police and the Measurement Standards Laboratory of New Zealand (MSLNZ) conducted tests to determine if the potential interference sources had any effect on the traffic radar equipment used by the NZ Police. **No effects were found.**

Even though some conditions may cause occasional intermittent readings, most interference sources do not produce any Doppler tone.

Note: A clear Doppler tone is the operator's indication they have an accurate, interference free, target speed.

Radar jammers

The only effective devices that can jam radar speed detection equipment transmit at a power level that requires certification under radio communication regulations. As such they are prohibited.

Any equipment in a vehicle designed to interfere with a speed measuring device *Is an offence against the Land Transport Act 1998.*

Sufficiently high levels of radio energy detected by the traffic radar unit will blank off any target readings and display **RFI (**radio frequency interference). This is a likely indication a jammer is being used.

Radar detectors

Radar detectors rely on the detection of detected radio waves in the particular frequency that speed detection equipment operates in.

Operating the radar in hold mode means the transmitter is turned off until required by the operator. The motorist with a radar detector cannot be alerted to the radar when it is operating in hold mode.

The operator can take the unit out of hold mode to obtain a speed check and produce a valid speed-reading before the driver has time to react.

LASER SPEED DETECTION

Introduction

About laser detectors

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. A laser is a concentration of light energy into a narrow beam.

Principles of laser energy

To better understand how laser energy operates it helps to understand the principles of light. Light is defined in wavelengths similar to radio waves. The shorter the wavelength, the higher the frequency. Visible light falls into a fairly narrow section of the electromagnetic wave spectrum with infra-red light at one end with the longest wavelength, and ultraviolet light at the other end with the shortest wavelength.

As with radio waves, light waves can be reflected, refracted or absorbed. Reflection of light is commonly seen in day-to-day life. Refraction is when light is bent. Absorption is when light is incorporated into the surroundings.

Laser light is found only in technology, never in nature. The beam used is very narrow, much narrower than other light sources such as a torch. It is also monochromatic (a single wavelength and colour) and its narrow beam expands only slightly over distance.

Speed detection lasers

While the speed detection laser and traffic radar have much in common there are also many differences. Similarities and differences are highlighted throughout this section of the manual.

The infra-red invisible laser beam is emitted in coded pulses. When each laser pulse makes contact with the target vehicle the laser beam is reflected back to the laser unit. The internal computer calculates the time between each pulse and the change in distance between the unit and target vehicle. This enables the computer to accurately calculate the change in each pulse (time/distance) and provide a readout of the target vehicle's speed.

Safety Note: Even though the laser devices used for speed detection comply with relevant safety standards, do not point a device directly into a person's eyes at close range.

The traffic laser can be used to check the speed of vehicles approaching the laser and vehicles that are moving away from the laser. Where vehicles are moving away from the unit this is indicated by a minus sign (e.g. – 54kmh) in the display.

The use of coded pulse allows a much faster target acquisition time and other advanced features that are not available to radar-based systems.

The spread of the laser beam is **minimal** compared to that of radar. The laser speed detection devices used by NZ Police have an approximate spread of 0.17°. At a 100 metre range the laser beam is only 30cm wide. This allows the operator to aim the traffic laser at specific vehicles allowing individual speed measurement of vehicles in a line of traffic.

Components

Unlike the traffic radar, the traffic laser is one unit. This laser unit transmits the laser beam and receives it. The internal computer calculates the target vehicle's speed from the changing distance readings received.

How it works

The operator aims the laser at the target vehicle using the unit's optical site. Projected onto the lens of the site is an aiming circle that is placed over the target vehicle. When a speed and/or distance is obtained, this is also displayed to the operator.

Beam range

In theory the laser beam will continue outward for an indefinite distance. However, in reality the beam range is the distance that the laser beam can be reflected back from the target to the laser unit. The latest model speed detection laser operated by the NZ Police is capable of acquiring a target at approximately 1200 metres.

Note: Your ability to correctly identify the vehicle for your tracking history becomes difficult at extended ranges.

Atmospheric conditions

Weather conditions are an important consideration when operating the laser. Fog, snow and heavy rain have the potential to interfere with the laser's operation and limit its range.

Note: These conditions will not affect the accuracy of the displayed speed.

Laser speed detection should not to be used in fog, snow or heavy rain. This is for both operational and safety considerations.

Measurement of distance

Speed detection laser devices can be used to measure distance. The accuracy of this type of device is less or equal to 300mm, over all distances displayed. It may be used in this way at crash scenes and for engineering purposes.

Target reflectivity

Similar to using the radar, the range of the laser beam will depend on the target vehicle's size and shape. However in laser speed detection, the laser's range is more about the ability to aim and strike the target with the narrow beam it emits.

A large flat truck acts as a very good reflector of signals.

Although trucks reflect signals well, the large radiator grills on the front of commercial motor vehicles make poor targets. This is because the laser light is unable to reflect back out.

Small and aerodynamically designed vehicles, especially motorcycles are particularly difficult to hit due to their small frontal cross section

Laser site selection

Site selection

Site selection is extremely important when operating the laser. An operator must consider both operational and safety considerations when selecting a location. Unlike the radar, the **laser can only be used as a stationary device.**

Safety considerations

- ✓ Patrol vehicle position.
- ✓ Ability to stop vehicles in a safe location, including performing a u-turn if required.
- ✓ When operating the laser outside of the patrol vehicle it is easy to become overly target focused, so ensure you are constantly aware of your position and surroundings.
- ✓ Safety of yourself, target vehicle and other road users when conducting the stop.
- ✓ Driver interview position.

Note: When operating in the hours of darkness the patrol vehicle must either be illuminated by artificial light (i.e street lights) or have its park lights on.

When you have stopped a vehicle and depending on light conditions and your site selection you must have either your patrol vehicle's primary or secondary lights turned on.

Hi-visibility jackets maximise the operator's visibility to road users and enhance safety. Remember the sleeveless vest is for **daytime** use only and at **night** you must wear the long-sleeve version or your raincoat.

Operational requirements

You must consider if your speed enforcement at the site also aligns with your local prevention strategies, e.g. outside schools and high crash areas.

You must ensure you consider the following:

- ✓ Not within 250m of reduction in speed limit.
- ✓ If operating within a road works site you must contact the STMS (site traffic management supervisor).
- ✓ Site does not significantly impact traffic flows.
- ✓ Site complies with parking regulations (e.g. broken yellow lines).

Specific considerations

There are a number of things that need to be taken into account when selecting a laser operating site, including:

1. The cosine angle.
2. A clear line of sight.
3. Weather conditions.
4. Operation is from inside the patrol vehicle.
5. Movement of the unit.

Cosine effect

The cosine effect applies equally to laser as it does to radar. To minimise the cosine effect ensure your location accounts for this. You can achieve this by angling the patrol vehicle when you park or using the available roadside features to position yourself when outside of the vehicle.

Clear line of sight

Laser light cannot bend around or travel through solid objects. The operator **must** have a clear line of sight to the target vehicle. That means the operator must see the target vehicle clearly throughout the speed check. If the operator can see the object, the laser can see the object.

Operation from inside vehicles

The windscreen and side windows of the patrol vehicle can affect the maximum range of the laser. Windscreen laminations, tinting, infrared and ultraviolet protections can reduce the effective range of laser.

Note: While range is affected, the accuracy of the speed-reading is not. The best way to use the laser is through an open drivers or passenger window.

Movement of vehicle

Operator movement will affect the laser. Maintaining a firm stable hold with both hands will ensure a quick accurate reading is obtained. Think of the principles of accuracy you cover in firearms training.

Sweep effect

Occurs when an operator changes aiming points while conducting a vehicle speed check. When this happens, the unit will not display a steady reading. To prevent this operators must aim at a single point on the target vehicle for the entire check (the registration plate is ideal).

Night operation and headlights

Headlights may reduce the range of the laser at night; however, they will not affect the accuracy. The headlights of vehicles emit levels of infrared light, so may interfere with the laser's ability to detect the reflected laser pulse.

Note: To avoid this problem the operator should aim between the headlights at the number plate area on the target vehicle.

Laser speed deployment

Introduction

The traffic laser can only be operated as a stationary device. It may be used from inside or outside the patrol vehicle.

When selecting a site make an objective assessment of what the public will perceive of your location and actions. Does it contribute to prevention and the Safer Journeys strategy? Think of your professional appearance as well as the safety and operational considerations.

Operating procedures

To maximise the deterrent effect of speed detection through laser and ensure the safety of the public, the occupants of the target vehicle and police, the following guidelines have been developed.

Where traffic volumes are heavy, only vehicles travelling on the same side as the parked patrol vehicle are to be targeted.

On roads with low traffic volumes and speeds restricted to no more than 70 km/h, officers may target vehicles travelling in any direction provided the method employed to stop the offender is safe for all parties.

When operating the laser outside of the patrol vehicle it is easy to become overly target focused, so always ensure you are constantly aware of your position and surroundings.

Motorcycle use

Laser speed detection equipment may be operated from motorcycles subject to the requirements outlined in the Speed Enforcement chapter of Police Instructions.

Covert use

The daily operation of the laser is to be carried out in an overt manner. However, covert operation can be approved under strict circumstances with authorisation from your Road Policing Manager. These criteria are outlined in the Speed Enforcement chapter of Police Instructions.

Locking on speed

Wherever possible best practice is for the operator to lock on the speed reading and maintain it on the device until the driver has had the opportunity to view the reading. However this is not a requirement under the Land Transport Act 1998.

Remote operation

Officers may operate the device from any location such as an over-bridge or side of the road.

If operating remotely there must be a second patrol in radio contact, stationed on the road and responsible for stopping the vehicle. The operator must ensure that any locked speeds are retained for viewing by an alleged offender, and that details of speed, distance and vehicle description are recorded by the device operator.

Note: Using your mobility device is a good way to comply with the above requirements. By taking a photo of the locked speed, it allows the speed readout to be sent to the officer who has stopped the driver. It is good evidential proof as the photo is time/date stamped and also has a GPS location stored with it.

Tracking history

Like the radar, the traffic laser is only a tool used by the officer. To establish that the speed check is accurate the operator must establish a tracking history for the target vehicle.

Tracking history is obtained by three elements:

1. Visual estimation of speed.
2. Audio tone confirmation.
3. Comparison of the digital readout with the operator's estimate of speed.

The Stalker laser system employs a **Target Speed Tone**, much like the Doppler tone heard on radar. This tone is in direct proportion to the speed, i.e. the higher the speed, the higher the pitch of the audio.

The audio can be heard whenever you are tracking and displaying a speed. If the sweep effect occurs, the operator can hear an irregular tone for the vehicle being tracked, thus alerting the operator to the possible sweep effect.

The Stalker laser system also has a **Target Return Tone**. This helps the operator properly aim. No Target Return Tone is heard when the beam is off the target.

Recording speed readings

The speed and distance at which the vehicle was checked should be recorded on all offence notices, for example 130km/h at 400 metres.

Sources of interference

Unlike radar devices, interference sources such as radios and power lines do not have any effect on laser speed devices. However if smoke is blowing across the road and blocking the operator's view, the laser will be prevented from detecting a target through the smoke.

Laser jammers

Unlike radar jammers, there are cost-effective laser jammers in New Zealand. As speed detection lasers operate in the infrared frequency range, the jamming devices are compact and relatively cheap.

The Stalker lasers have built-in detection software and will display the error code 'E04', indicating they are being jammed. Newer models will operate through jamming.

Any equipment in a vehicle designed to interfere with a speed measuring device Is an offence against the Land Transport Act 1998.

Laser detectors

Most model radar detectors also have a laser detection function. However due to the narrow beam of the laser and very quick acquisition of the target vehicle speed, their ability to alert the driver in time is limited. Operating the laser with a firm hold and aiming precisely will reduce the time the detector has to identify a laser in operation.

OPERATING PRINCIPLES

Accuracy

All speed enforcement devices used by the NZ Police are required to have regular accuracy checks.

Certificate of accuracy

Section 146 of the Land Transport Act 1998 requires all operational speed detectors' certificates of accuracy be issued within 12 months of the date the device is to be used in the detection of offences. Only devices with current certificates of accuracy may be operated.

A series of electronic and road tests form the basis of the certificate of accuracy. The responsibility for testing and certification rests with Police Calibration Services, an International Standards Accredited Laboratory, based in Wellington.

All speed enforcement devices are calibrated annually on a district-by-district basis or when a device has been serviced. Whenever a device is serviced it must be re-calibrated before being placed back in service.

Speedometer certificate

All police vehicles being used in conjunction with radar speed detection equipment must have a current speedometer certificate of accuracy. This also applies to all vehicles used in the laser weekly run through test.

Note: The operator must complete the pre-deployment tests before using the device. Results of the tests must be recorded in the logbook at the completion of the test If the unit fails any checks it must not be used.

Testing

At the beginning of each shift operators must conduct the series of tests prescribed in the operational guidelines to ensure the device is operating correctly. This means before you start your enforcement patrol.

Pre-deployment tests include internal circuitry tests and other tests specified in the best practice guidelines for each device.

Note: The operator must complete the pre-deployment tests before using the device. Results of the tests must be recorded in the logbook at the completion of the tests If the unit fails any checks it must not be used.

Log books

Operators must complete the following information in the unit logbook before their enforcement patrol:

1. Member's name and QID.
2. Date and time of operations.
3. Test results.
4. Location.
5. Total hours of use.
6. Signature of operator.
7. Serial numbers of all components.

Note: The operator must fill in a separate log sheet for each day of operation. The sheets must remain in the logbook unless required to be removed for court.

Faulty units

If the device fails any tests it should not be used. The unit must be returned to Police Calibration Services.

When an instrument used in the testing of a speed enforcement device (for example, a tuning fork) malfunctions then both the unit and all testing equipment should be packaged together and sent to Police Calibration Services.

After servicing by the agent, the unit will be re-calibrated by Police Calibration Services before being returned to the district. All costs associated with repair (other than for normal wear and tear) will be charged to the district.

EVIDENTIAL REQUIREMENTS

Documentary evidence

To comply with evidential requirements the operator will need:

1. A copy of the speed detection device logbook relating to the day in question.
2. A copy of the certificate of accuracy for either the laser or radar device issued within a year of the date of the offence.
3. A copy of the certificate of accuracy for the patrol vehicle:
   - used in the operation of the radar device, or
   - used for the weekly check in the case of a laser device.
4. A copy of the operator's certificate of proficiency for radar and laser devices.

Evidence in Court

The operator must be able to give in evidence that:

1. They are a certified speed detection equipment operator.
2. They conducted the required tests for the unit and found it to be working correctly.
3. A tracking history was established for the target vehicle.
4. The code of operations was complied with.

OPERATING GUIDELINES – RADAR

Pre-deployment tests

These tests that must be carried out before you start a speed enforcement patrol.

1. **Serial Numbers**
   Confirm the serial numbers on the radar readout, antenna(s) and tuning forks match those in the logbook.

2. **Certified Device**
   Visually check the sticker on the unit to confirm the date for the next calibrations is in the future.

3. **Speedometer**
   Check the patrol vehicle has a certified speedometer and has the accompanying, current certificate of accuracy.

4. **Switch on Device**
   Ensure all segments of the display are operating and that it displays 'PASS' at the end of the device's self check.

5. **Tuning Forks**
   A tuning fork test must be completed for all antennas. The results are to be recorded in the logbook.

Deployment tests

These are the tests that are completed while the unit is being used in moving mode:
Confirm patrol vehicle speed is consistent with the speed readout on the unit within +/- 3 km/h. This is achieved by travelling at a consistent speed, appropriate to the speed limit being operated in (50km/h or 100km/h) and checking that the true speed (according to the certificate of accuracy) is the one displayed on the readout. Where the margin of error exceeds **+/- 3 km/h** the unit is to be withdrawn for servicing.

The results of the check must be recorded in the logbook.

Note: For the users of SMART devices and the upcoming mobility ticketing system: Ensure that before each shift you always confirm the serial numbers, vehicle registration and related speedometer certification match those stored in your device.

OPERATING GUIDELINES – LASER

Pre-deployment tests

These tests must be carried out before you start your speed enforcement patrol.

1. **Certified Device**
   Visually check the sticker on the unit to confirm the date for the next calibrations is in the future.

2. **Switch on Device**
   Ensure all segments of the display are operating and that it displays 'PASS' at the end of the device's self check.

3. **Sight Alignment Test**
   This is carried out every day the device is used.

   1.1 Select a pole or similar fixed point marker and aim the unit to the centre of the fixed object; record the distance.

   1.2 Move the aim of the laser to the left-hand side of the fixed point and check that the unit ceases the reading on the fixed point as soon as the aim is moved.

   1.3 Repeat this test but instead of moving the aim left, move to the right-hand side of the fixed point.

   1.4 Repeat twice more, moving the aim above and below the fixed point. The measurement displayed on the readout unit must be recorded in the logbook.

Note: Determine a fixed point and target for use for all pre-deployment checks. The distance between these two points must first be manually measured for use as a constant reference.

Note: For the users of SMART devices and the upcoming mobility ticketing system: Ensure that before each shift you always confirm the serial numbers, vehicle registration and related speedometer certification match those stored in your device.

Weekly testing

On a **WEEKLY BASIS,** the laser unit accuracy needs to be checked using a drive through by a patrol vehicle with a certified speedometer. This is carried out by having the driver of the vehicle drive at a steady speed towards the laser operation area. **The speed should be relevant to the area of operation**. (e.g. 50km/h if working in a 50km/h urban area)

The driver should flash their headlights or advise using the radio when the vehicle speed is steady and the laser operator will check the speed. The member using the laser will advise the vehicle driver of the results of the speed check. The driver will advise the speed they were travelling at after checking the certificate of accuracy to determine the true speed.

Where the margin of error exceeds **+/- 3 km/h** the unit is to be withdrawn for servicing. The results of the check must be recorded in the logbook (vehicle speed/checked speed), for example 64/65; 75/75; 100/102.

PRACTICAL TEST REQUIREMENTS – RADAR

Training

The code of operations requires members to receive 20 hours' practical training (16 hours of radar, 4 hours of laser) in the operation of speed enforcement equipment.

The following checklist describes the required competencies that must be demonstrated to achieve certification.

Pre-deployment tests

The operator must:

1. Serial numbers

1.1 Confirm the serial numbers on the radar readout, antenna(s) and tuning forks match those in the logbook.

2. Check certification sticker

2.1 Visually check the sticker on the unit to confirm the date for the next calibrations is in the future.

2.2 Explain that if the device is not current, it cannot be used and they should advise their supervisor immediately to have it sent to Police Calibrations Service.

3. Speedometer

3.1 Check the patrol vehicle has a certified speedometer.

3.2 Check the certificate of accuracy for the speedometer of the patrol vehicle and determine its status — the test date must be within 12 months from the date of operation.

3.3 Identify the difference, if any, between true vehicle speed and actual vehicle speed readings.

3.4 Explain that for speed enforcement the true speed as described in the certificate of accuracy is the speed used for testing the device.

4. Unit internal tests

4.1 Turn on device and ensure all segments of the display are operating and that it displays ‘PASS’ at the end of the device’s self check.

4.2 Explain how to recheck and retest device if the system does not turn on by:

- 4.2.1 rechecking cables
- 4.2.2 checking connections
- 4.2.3 confirming the power connection
- 4.2.4 turning the device off and restarting it
- 4.2.5 repeating the internal test.

5. Tuning forks

Tuning fork test must be completed for all antennas. The results are to be recorded in the logbook.

5.1 Remove the tuning forks from storage and confirm they are clean and free of significant defects.

5.2 Confirm the serial numbers on the tuning forks are the same as listed on the certificate of accuracy for the radar device.

5.3 Record the tuning fork’s serial numbers in the logbook.

5.4 Conduct the tuning forks test sequence (for both antennas if fitted).

5.5 Record the results of the tuning fork tests in the logbook.

Deployment test

6. Confirm patrol ground speed

6.1 Confirm the patrol vehicle speed is consistent with the speed readout on the device within +/-3 km/h. This is achieved by travelling at a consistent speed, appropriate to the speed limit of the area and checking that the true speed (according to the certificate of accuracy) is the one displayed on the readout.

6.2 Record the results in the logbook.

Log books

At the start of each shift the operator must complete the following information in the unit logbook. This must be completed before starting their patrol.

- Member's name and QID.
- Date and time of operations.
- Test results.
- Location.
- Total hours of use.
- Signature of operator.
- Serial numbers of all components.

Site set up

The site must:

1. Be straight enough to allow vehicles to be detected for at least 100 metres (250 metres is preferred).
2. Comply with both safety and operational requirements.
3. When operating in the hours of darkness the patrol vehicle must either be illuminated by artificial light (ie street lights) or have its park lights on.
4. Not be within 250m of a reduction in speed limit.
5. Allow for the unit antenna to be aimed and setup to detect vehicles and minimise the cosine effect.
6. Demonstrate using the antenna how the cosine angle affects the speed reading.

Unit set up

The operator must:

1. Ensure the antenna is aimed and setup to detect vehicles.
2. Ensure the antenna is aimed and setup to minimise the cosine angle.
3. Demonstrate, using the antenna, how the cosine angle affects the speed reading.

Stationary mode

The operator must demonstrate that they are able to establish a tracking history that:

1. Identifies the target vehicle and estimates speed.
2. Identifies which vehicle the readout relates to.
3. Ensures Doppler tone:
   3.1 is strong, clear and not fluctuating
   3.2 changes to indicate a decrease or increase in speed.

Moving mode

The operator must:

1. Identify ground speed on the readout.
2. Confirm the ground speed and speedometer readout are consistent (given the certificate of accuracy).
3. Place the unit in hold mode using the hold button.
4. Release the lock button for device operation.
5. Identify the target vehicle and its speed.
6. Establish a tracking history for the target vehicle using the three elements – visual, audio and readout.
7. Lock the target vehicle speed on the unit.
8. Indicate the difference between multiple and single vehicles in the beam.

Patrol stops

Same lane

The operator must:

1. Identify the target vehicle when it comes into the beam.
2. Identify a target vehicle where its speed exceeds the posted speed limit.
3. Establish a tracking history by telling the instructor how it meets audio, visual and readout requirements.
4. Lock on the target vehicle's speed.
5. Activate red and blue lights.
6. Pull out into the flow of traffic safely.
7. Indicate to the target vehicle to stop.
8. Park safely.
9. Wear an appropriate reflectorised jacket.
10. Exit the patrol vehicle after checking for traffic.
11. Assess and approach vehicle after considering driver interview position.
12. Keep passing traffic in line of sight when speaking with the driver.

Opposite lane

The operator must:

1. Identify a target vehicle where its speed exceeds the posted speed limit.
2. Establish the tracking history by telling the instructor how it meets audio, visual and readout requirements.
3. Lock on the target vehicle's speed.
4. Activate red and blue lights.
5. Complete a U-turn safely and with due consideration to minimise stress on the patrol vehicle (for example, speed is reduced before turning; the kerb is not mounted when turning).

6. Indicate to target vehicle to stop.
7. Park safely.
8. Wear an appropriate reflectorised jacket.
9. Exit the patrol vehicle after checking for traffic.
10. Assess and approach vehicle after considering driver interview position.
11. Keep passing traffic in line of sight when speaking with the driver.

Issuing notice

The operator must:

1. Record the driver's details on the notice.
2. Identify the appropriate offence.
3. Check the infringement fee is correct for the charge.
4. Record the appropriate precedent code.
5. Record the device serial numbers accurately on the notice.
6. Record a summary of the offence on the reverse of the notice, including tracking history.
7. Complete all relevant areas of the speed section.

PRACTICAL TEST REQUIREMENTS – LASER

Training

The following checklist describes the required competencies that must be demonstrated to achieve certification.

Pre-deployment tests

The operator must:

1. **Serial number**
   1.1 Confirm the serial number on the device matches that in the logbook.

2. **Check certification sticker**
   2.1 Visually check the sticker on the unit to confirm the date for next calibrations is in the future.

   2.2 Explain that if the device is not current, it cannot be used and they should advise their supervisor immediately to have it sent to Police Calibrations Service.

3. **Unit internal tests**
   3.1 Turn on the device and ensure all segments of the display are operating and that it displays 'PASS' at the end of the device's self check.

   3.2 Explain how to recheck and retest device if the system does not turn on by:

   3.2.1 confirming the battery is charged
   3.2.2 checking the battery is connected correctly
   3.2.3 turning off then on for retest.

4. **Sight alignment test**
   4.1 Select a pole or fixed post object.

   4.2 Aim the device at the object (using the heads up targeting display) to obtain a distance reading (the distance between the device and the fixed point as previously measured) and advise the instructor of that distance.

   4.3 Move the laser aim to either side of the fixed point and check the distance reading ceases on movement from the aimed point.

   4.4 Move the laser aim from the fixed point above the point, and check the distance reading ceases on movement from the aimed point.

4.5 Move the laser aim from the fixed point below the point, and check the distance reading ceases on movement from the aimed point.

4.6 Record the test results in the unit logbook.

Log books

At the start of each shift the operator must complete the following information in the unit logbook. This must be completed before starting their patrol.

1. Member's name and QID.
2. Date and time of operations.
3. Test results.
4. Location.
5. Total hours of use.
6. Signature of operator.
7. Serial numbers of laser.

The operator must fill in a separate log sheet for each day of operation.

If the weekly test was completed within 7 days then they enter the vehicle registration, date completed and officer QID in the 'Result of Road Test' section of the logbook.

Weekly testing

The operator must provide instructions to the driver of a patrol vehicle to conduct the weekly drive-through test. The operator must:

1. Establish that the vehicle has a current speedometer certificate of accuracy.
2. Instruct the driver to drive towards the unit at a constant speed.
3. Instruct the driver to flash their headlights or advise using the radio when they check their vehicle speed.
4. Lock on the speed of the target patrol vehicle.
5. View the readout and ask the driver of the target patrol vehicle for their true speed.
6. Confirm the target patrol vehicle speed and the readout on the unit is within +/- 3 km/h.
7. Record the test results in the logbook, including officer's QID who drove vehicle.

Tracking history

The operator must establish a tracking history of a vehicle. This means:

- Seeing the target vehicle and specifying what it looks like, for example a red Toyota.
- Ensuring the vehicle is within target icon of laser sight.
- Hearing the change in audio that indicates an increase or decrease in speed.

Site selection

The operator must select a site for operating the laser that:

- Complies with both safety and operational requirements.
- Is not within 250m of a reduction in speed limit.
- Provides for a U turn if required.

8. When operating in the hours of darkness the patrol vehicle must either be illuminated by artificial light (ie street lights) or have its park lights on.

-

Unit operation

The operator must:

- Ensure laser is operated with a firm grip.
- Ensure aim minimises cosine effect.
- Identify a target vehicle where its speed exceeds the posted speed limit.
- Establish a tracking history by telling the instructor how it meets audio, visual and readout requirements.
- Lock on the target vehicle's speed.
- Activate red and blue lights.
- Pull out into the flow of traffic safely.
- Indicate to the target vehicle to stop.
- Park safely.
- Wear an appropriate reflectorised jacket.
- Exit the patrol vehicle after checking for traffic.
- Assess and approach the vehicle after considering Driver Interview Position.
- Keep passing traffic in line of sight when speaking with the driver.

Issuing notice

The operator must:

- Record the driver's details on the notice.
- Identify the appropriate offence.
- Check the infringement fee is correct for the charge.
- Record the appropriate precedent code.
- Record the device serial number accurately on the notice.
- Record the summary of the offence on the reverse of the notice, including tracking history.
- Complete all relevant sections of the preformatted officers' notes field.

Explains that if operated remotely it is the operator's information to be entered in the speed section of the infringement not the issuers. It should also be annotated that it was operated remotely, including the officer's name and QID.

CODE OF OPERATIONS – SPEED DETECTION EQUIPMENT

This Code of Operations governs the operation of all speed detection equipment used by the New Zealand Police. It has been jointly prepared and agreed to by the Measurement Standards Laboratory of New Zealand (MSLNZ) and the New Zealand Police.

Operators

Trained Operators

Except for the purposes of instruction, speed detection equipment is to be operated only by members of the NZ Police who have:

1. completed the eLearning training package
2. achieved a minimum of 80% in the online Te Puna test
3. undergone 20 hours, practical instruction with a qualified instructor and demonstrated competence
4. been certified as a trained operator by the National Manager: Road Policing.

Former members of the Ministry of Transport Traffic Safety Service who completed training in the use of speed detection equipment prior to 1992 are deemed to be qualified operators. This covers members whose identification numbers begin E002 up to and including F116.

Qualified instructors

District Road Policing Managers have the authority to appoint qualified instructors. To be appointed as a qualified instructor, staff must have been certified as a trained operator and:

- have spent at least two years consistently operating speed detection equipment
- are currently using speed detection equipment as part of their regular duties
- have the ability to train others.

Qualified instructors *must* be registered with the Road Policing Support (Police National Headquarters) before taking up a qualified instructor role.

Equipment

Certificate of accuracy

Section 146 of the Land Transport Act 1998 requires all operational speed detection equipment certificates of accuracy to be issued within 12 months of the date used in the detection of offences. Only units with current certificates of accuracy may be operated.

A series of electronic and road tests form the basis of the issue of the certificate of accuracy. The responsibility for testing and certification rests with Police Calibration Services, an International Standards Accredited Laboratory, based in Wellington.

Speedometer certificate

All police vehicles being used in conjunction with radar speed detection and the field testing of laser speed detection equipment must have a current speedometer certificate of accuracy. Section 146 of the Land Transport Act 1998 requires all speedometer certificates of accuracy to be issued within 12 months of the date used in the detection of offences.

Servicing

Repairs and servicing are only to be carried out by authorised service agents. Details of authorised service agents are maintained by Police Calibration Services.

Pre-deployment testing

At the beginning of each deployment, operators must conduct the series of tests prescribed in the Speed Detection Equipment Operators Manual to ensure that the device is operating correctly. The operator must record test results in the device logbook. If the speed detection unit fails, any checks it is not to be used.

Tracking history

A tracking history of a vehicle must be established. Tracking history for all speed detection units contains three main elements:

1. Visual observation
2. Audio confirmation
3. Verification by a speed detector.

To eliminate errors effectively, all three elements must be present for each speed check.

For radar units operated in moving mode, the vehicle ground speed must be confirmed by certified speedometer.

Multiple vehicles in beam

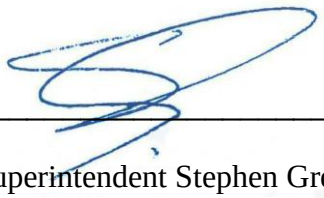
Where there is more than one vehicle in the beam, enforcement action may be taken, providing the operator can give evidence relating to the tracking history of other vehicles and the offender's speed.

Fairness

Operators must use their training and experience to ensure that there are no significant sources of reflection or interference in the vicinity of the offence. **If there is ever any doubt concerning the speed check or the operation of the speed detection unit, no action is to be taken.**

Dr Tim Armstrong
Director and Chief Metrologist
Measurement Standards Laboratory of New Zealand

Date: 26/11/2015



Superintendent Stephen Greally
National Manager: Road Policing
New Zealand Police

Date: 30/11/2015